STATE OF MAINE
DEPARTMENT OF AGRICULTURE, CONSERVATION & FORESTRY
BOARD OF PESTICIDES CONTROL
28 STATE HOUSE STATION
AUGUSTA, MAINE 04333

JANET T. MILLS
GOVERNOR

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COMMISSIONER

Memorandum

To: Board of Pesticides Control
From: Pamela J. Bryer, Ph.D., Toxicologist
Subject: EPA's Proposed Changes to Neonicotinoid Reregistration

May 12, 2020

Proposed changes to neonicotinoid uses resulting from the most recent EPA reregistration review.

This document was based on the Board Chair's request at the February 28th, 2020 meeting to include information on the changes to proposed changes in "neonic" reregistration in the next board packet. In January 2020, EPA released a group of Proposed Interim Decisions (PIDs) for almost every neonicotinoid. Specifically, there are new PIDs for acetamiprid, clothianidin, dinotefuran, imidacloprid, and thiamethoxam.

This document summarizes changes highlighted by EPA and provides links to the parent documents. Each of these PIDs, generally 30 to 80 pages, is supported by hundreds of pages of documentation, all of which is found in the EPA dockets. The dockets IDs are listed the table that follows. Because of the complexity of finding information amongst this volume of paperwork EPA has prepared "Reader's Guides" to most of the dockets. Links to the PIDs and Reader's Guides are provided in the table that follows and a guide on how to navigate to the docket is at the end of this document.

Highlights of the proposed changes include:

Acetamiprid:

- Increased PPE and PPE label language added
- New Best Management Practices for handling/mixing
- Seed handling label instructions
- Additional pollinator label language

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Highlights of the proposed changes include:

Acetamiprid (Continued…)

- Additional drift management guidance including buffers, inversion language, spray parameter changes: wind speed, displacement, direction of spray, droplet size, release height
- Resistance management labelling
- Voluntary stewardship actions
- Tolerance changes (lowered or eliminated -incl leafy vegetables and stone fruit)

Clothianidin:

- Cancellation of use on bulb vegetables
- Additional PPE -incl gloves & respirator
- Changes in poultry house requirements
- Changes in allowable rates
- Changes in timing of application associated with crop stage
- Seed handling label instructions
- Cautionary statement to residential users suggesting professional use only
- Additional drift management guidance, buffers, vegetative filter strips, inversion language, spray parameter changes: wind speed, displacement, direction of spray, droplet size, release height
- Resistance management labelling
- Voluntary stewardship actions
- Tolerance changes (new uses, lowered, regrouping, harmonizing, and formatting)

Dinotefuran:

- Cancellation of uses
- Changes in allowable rates
- Changes in timing of application associated with crop stage
- Cautionary statement to residential users suggesting professional use only
- Additional drift management guidance, buffers, vegetative filter strips, inversions, wind speed, and droplet size
- Resistance management labelling
- Voluntary stewardship actions
- Tolerance changes (regrouping, harmonizing, and formatting)

Imidacloprid:

- Cancellation of uses (turf and bulb vegetables)
- Prohibition on-farm seed treatment
- Increased PPE
- Changes in allowable rates
- Changes in timing of application associated with crop stage
- Cautionary statement to residential users suggesting professional use only
- Restriction specific to poultry house uses

Highlights of the proposed changes include:

Imidacloprid (Continued…)

- Additional drift management guidance, buffers, vegetative filter strips, inversion language, spray parameter changes: wind speed, displacement, direction of spray, droplet size, release height
- Resistance management labelling
- Voluntary stewardship actions
- Tolerance changes (revoked (apple, okra, watercress, legume grp 6, kohlrabi, soybean vegetable), regrouping, harmonizing, and formatting)

Thiamethoxam:

- Additional PPE -incl gloves & respirator
- Livestock use formulation limitations
- Changes in allowable rates
- Changes in timing of application associated with crop stage
- Corn seed treatment requires a closed system
- Seed handling label instructions
- Cautionary statement to residential users suggesting professional use only
- Additional drift management guidance, buffers, vegetative filter strips, inversion language, spray parameter changes: wind speed, displacement, direction of spray, droplet size, release height
- Resistance management labelling
- Voluntary stewardship actions
- Tolerance changes (new uses, lowered, regrouping, harmonizing, and formatting)

Electronic Document Locations Associated with Neonicotinoid Registration

	Docket Number	Links to: PIDs & Reader's Guides
Acetamiprid	EPA-HQ-OPP-2012-0329	PID: https://www.regulations.gov/document?D=EPA-HQ-OPP-2012-0329-0064 No Reader's Guide (smaller docket; only 36 supporting documents)
Clothianidin	EPA-HQ-OPP-2011-0865	PID: https://www.regulations.gov/document?D=EPA-HQ-OPP-2011-0865-1190 Reader's Guide: https://www.regulations.gov/document?D=EPA-HQ-OPP-2011-0865-1192
Dinotefuran	EPA-HQ-OPP-2011-0920	PID: https://www.regulations.gov/document?D=EPA-HQ-OPP-2011-0920-0765 Reader's Guide: https://www.regulations.gov/document?D=EPA-HQ-OPP-2011-0920-0764
Imidacloprid	EPA-HQ-OPP-2008-0844	PID: https://www.regulations.gov/document?D=EPA-HQ-OPP-2008-0844-1619 Reader's Guide: https://www.regulations.gov/document?D=EPA-HQ-OPP-2008-0844-1618
Thiamethoxam	EPA-HQ-OPP-2011-0581	PID: https://www.regulations.gov/document?D=EPA-HQ-OPP-2011-0865-1190 Reader's Guide: https://www.regulations.gov/document?D=EPA-HQ-OPP-2011-0581-0364

How to find files in “the docket”

1) Go to the federal government’s website: regulations.gov.

Enter the full docket number.

In the example below I used the docket number for acetamiprid: EPA-HQ-OPP-2012-0329

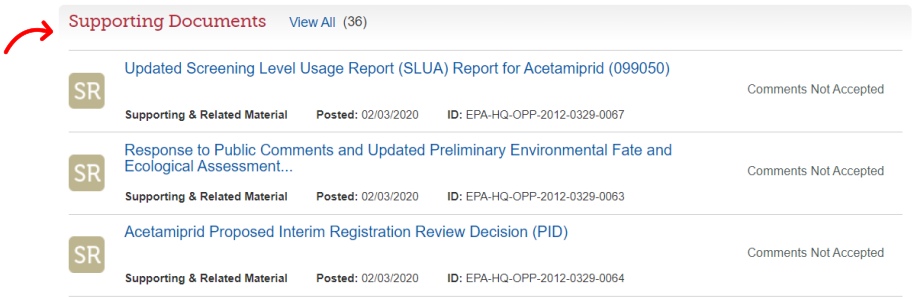
2) On the next page, on the right-hand side, click on the links that say: “Open Docket Folder” (any of them will work and take you to the right location).

3) Scroll down until you see the “Supporting Document” section. All supporting documentation can be found in this section of the docket.

1)

2)

3)



9b

Acetamiprid

Proposed Interim Registration Review Decision
Case Number 7617

January 2020

Approved by: _____

Elissa Reaves, Ph.D.
Acting Director
Pesticide Re-evaluation Division

Date: 1-22-2020

Table of Contents

I. INTRODUCTION

This document is the Environmental Protection Agency's (EPA or the agency) Proposed Interim Registration Review Decision (PID) for acetamiprid (PC Code 099050, case 7617), and is being issued pursuant to 40 CFR §§ 155.56 and 155.58. A registration review decision is the agency's determination whether a pesticide continues to meet, or does not meet, the standard for registration in the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA). The agency may issue, when it determines it to be appropriate, an interim registration review decision before completing a registration review. Among other things, the interim registration review decision may require new risk mitigation measures, impose interim risk mitigation measures, identify data or information required to complete the review, and include schedules for submitting the required data, conducting the new risk assessment and completing the registration review. Additional information on acetamiprid, can be found in EPA's public docket (EPA-HQ-OPP-2012-0329) at www.regulations.gov.

FIFRA, as amended by the Food Quality Protection Act (FQPA) of 1996, mandates the continuous review of existing pesticides. All pesticides distributed or sold in the United States must be registered by the EPA based on scientific data showing that they will not cause unreasonable risks to human health or to the environment when used as directed on product labeling. The registration review program is intended to make sure that, as the ability to assess and reduce risk evolves and as policies and practices change, all registered pesticides continue to meet the statutory standard of no unreasonable adverse effects. Changes in science, public policy, and pesticide use practices will occur over time. Through the registration review program, the agency periodically re-evaluates pesticides to make sure that as these changes occur, products in the marketplace can continue to be used safely. Information on this program is provided at http://www.epa.gov/pesticide-reevaluation. In 2006, the agency implemented the registration review program pursuant to FIFRA § 3(g) and will review each registered pesticide every 15 years to determine whether it continues to meet the FIFRA standard for registration.

EPA is issuing a PID for acetamiprid so that it can (1) move forward with aspects of the registration review that are complete and (2) implement interim risk mitigation (see Appendices A and B). The agency is currently working with the U.S. Fish and Wildlife Service and the National Marine Fisheries Service (together, the Services) to develop methodologies for conducting national threatened and endangered (listed) species assessments for pesticides. Therefore, although EPA has not yet fully evaluated risks to listed species, the agency will complete its listed species assessment and any necessary consultation with the Services for acetamiprid prior to completing the acetamiprid registration review. Likewise, the agency will complete endocrine screening for acetamiprid, pursuant to the Federal Food, Drug, and Cosmetic Act (FFDCA) § 408(p), before completing registration review. See Appendices C and D, respectively, for additional information on the listed species assessment and the endocrine screening for the acetamiprid registration review.

Acetamiprid is a neonicotinoid insecticide with products registered for use to control a variety of sucking and chewing insect pests. It is a chloropyridinyl neonicotinoid, distinct from the nitroguanidine neonicotinoids (imidacloprid, clothianidin, dinotefuran, and thiamethoxam),

which are subjects of separate PIDs. All neonicotinoids function by binding to nicotinic acetylcholine receptors in the post-synaptic neurons of an insect's central nervous system.

The first product containing acetamiprid was registered in 2002. Acetamiprid did not undergo reregistration, as the first product containing acetamiprid was registered after November 1984. Formulations include liquid, wettable powder (WP), wettable powder in soluble packets (WSP), soluble granule (SG) or dry flowable (DF) products, baits and sticky traps, impregnated materials, and ready-to-use products. Products containing acetamiprid are registered for use on a variety of agricultural crops and crop seeds, and in livestock premises. Acetamiprid products may also be used in residential, institutional, public, commercial, and industrial settings.

This document is organized in five sections: *Introduction*, which includes this summary and a summary of public comments and EPA's responses; *Use and Usage*, which describes how and why acetamiprid is used and summarizes data on its use; *Scientific Assessments*, which summarizes EPA's risk and benefits assessments, updates or revisions to previous risk assessments, and provides broader context with a discussion of risk characterization; *Proposed Interim Registration Review Decision*, which describes the mitigation measures proposed to address risks of concern and the regulatory rationale for EPA's proposed interim registration review decision; and, lastly, *Next Steps and Timeline* for completion of this registration review.

A. Summary of Acetamiprid Registration Review

Pursuant to 40 CFR § 155.50, EPA formally initiated registration review for acetamiprid with the opening of the registration review docket for the case. The following summary highlights the docket opening and other significant milestones that have occurred thus far during the registration review of acetamiprid.

- September 2012 - The *Acetamiprid Preliminary Work Plan* (PWP), *Acetamiprid. Human Health Assessment Scoping Document in Support of the Registration Review*, and *Problem Formulation for the Environmental Fate and Ecological Risk, Endangered Species, and Drinking Water Assessments in Support of the Registration Review of Acetamiprid* were posted to the docket for a 60-day public comment period.

- March 2013 - The *Final Work Plan* (FWP) for acetamiprid was issued. Stakeholders submitted five public comments on the PWP, none of which changed the schedule, risk assessment needs, or anticipated data needs for acetamiprid.

- May 2013 - A Generic Data Call-In (GDCI) for acetamiprid was issued for data needed to conduct the registration review risk assessments. All the requested data were submitted, and the GDCI is satisfied.

- February 2018 - The agency announced the availability of the *Acetamiprid. Draft Human Health Risk Assessment for Registration Review* and the *Registration Review: Preliminary Environmental Fate and Ecological Risk Assessment for Acetamiprid* for a 60-day public comment period. This comment period was later extended by an additional 30 days based on comments from technical registrants (see the Summary of Public

Comments on the Draft Risk Assessments and Agency Responses section, below, for more information). The EPA received ten public comments from nine sources, including the technical registrants, a crop council, public agencies, researchers, and environmental interest groups. These comments and the agency's responses are summarized below. Comments submitted by one of the technical registrants, Nippon Soda Co, Ltd, and supported by the other technical registrant, GeneraTec LLC, provided the agency with data to refine its human health risk assessment. These data changed the Margin of Exposure (MOE) for two application scenarios. See section III of this document for details.

- January 2020 - The agency is now announcing the availability of the PID in the docket for acetamiprid, for a 60-day public comment period. Along with the PID the following documents are also posted to the acetamiprid docket:

    - *Response to Public Comments on the Acetamiprid Draft Risk Assessment for Registration Review* (dated 12/4/19);
    - *Response to Public Comments and Update to the Preliminary Environmental Fate and Ecological Risk Assessment (PRA) for Acetamiprid* (dated 10/30/19); and
    - *Acetamiprid: BEAD Benefit Assessment and Response to Public Comments in Support of Registration Review* (dated 1/15/20)

B. Summary of Public Comments on the Draft Risk Assessments and Agency Responses

The public comment period for the *Acetamiprid. Draft Human Health Risk Assessment for Registration Review* and the *Registration Review: Preliminary Environmental Fate and Ecological Risk Assessment for Acetamiprid* was extended from the standard 60 days by an additional 30 days, to a total of 90 days after the agency received public comment from the technical registrants requesting the extension so that they might prepare additional data to support the acetamiprid registration review. During the public comment period, which opened on February 27, 2018 and closed on June 29, 2018, the agency received public comments from nine sources. Comments were submitted by the two technical registrants of acetamiprid, Nippon Soda Co., Ltd. and GeneraTec, LLC. The agency also received comments from The Northwest Horticultural Council, the California Specialty Crops Council, the National Cotton Council, the Central Valley Regional Water Quality Control Board, the US Department of Agriculture's (USDA) Office of Pest Management Policy, a researcher of the Michigan State University, and the Center for Biological Diversity (CBD). Substantive comments, comments of a broader regulatory nature, and the agency's responses to those comments are summarized below. The agency thanks all commenters for their comments and has considered them in developing this PID.

Comments Submitted by the Northwest Horticultural Council in EPA-HQ-OPP-2012-0329-0048, Michigan State University in EPA-HQ-OPP-2012-0329-0045, the California Specialty Crops Council in EPA-HQ-OPP-0329-0046, the USDA's Office of Pest Management Policy in EPA-HQ-OPP-2012-0329-0047, and the National Cotton Council in EPA-HQ-OPP-2010-0329-0049

Comment: These commenters highlighted the uses and benefits of acetamiprid and of all neonicotinoid pesticides. They stressed that acetamiprid is effective against a diversity of insect pests, including species which have been particularly damaging to crops. They also underscored the use of acetamiprid to control pests of specialty and high value crops. Commenters also stressed the relative safety of acetamiprid to workers and to beneficial insects and pollinator species, as compared to other pesticides, including in comparison to other neonicotinoid pesticides.

EPA Response: The agency thanks these groups and individuals for submitting comments. The agency considered these comments in the development of this PID. See *Acetamiprid: BEAD Benefit Assessment and Response to Public Comments in Support of Registration Review* for more information.

Comments Submitted by the Center for Biological Diversity in EPA-HQ-OPP-2012-0329-0031

Comment: CBD's comments focus on the EPA's duty to consult with the Services on the registration review of acetamiprid in accordance with the Endangered Species Act (ESA). The CBD comments mention various aspects of the risk assessment process, specifically use of the best available data, including all necessary data and studies, particularly to develop listed species risk assessments, and evaluation of effects on listed species and their designated critical habitat. CBD also expressed concern regarding the rigor of the agency's preliminary determinations regarding the effects of acetamiprid on listed species and their designated critical habitat for the acetamiprid registration review. In addition, CBD expressed concern about effects on pollinators and other beneficial insects, effects on human health or environmental safety concerning endocrine disruption, and any additive, cumulative or synergistic effects of the use of the pesticide.

EPA Response: The EPA has reviewed CBD's comments and plans to address many of the concerns regarding listed species as part of the implementation plan for assessing the risks of pesticides to listed species based on the recommendations of the April 2013 National Academy of Sciences (NAS) report. See *Endangered Species Assessment* in Appendix C of this document for more information. The EPA will address concerns specific to acetamiprid, particularly with regard to pollinators, ESA, and endocrine disruption, in connection with the development of its final registration review decision for this pesticide. See *Endocrine Disruptor Screening Program* in Appendix D of this document for more information regarding endocrine disruption. The EPA is currently developing an agency policy on how to consider claims of synergy being made by registrants in their patents. On September 9, 2019, the EPA released an interim process for public comment, available at regulations.gov in docket EPA-HQ-OPP-2017-0433. The comment period closed on October 24, 2019. After the agency has considered the public comments received on the proposed policy, and once the policy has been finalized, the EPA will consider its implications on the EPA's final decision for acetamiprid.

Comment Submitted by Nippon Soda Co., Ltd./Nisso America, Supported by GeneraTec LLC in EPA-HQ-OPP-2012-0329-0051

Comment: The two technical registrants of acetamiprid, Nippon Soda Co., Ltd. (or Nisso America) and GeneraTec LLC, submitted comments refuting assumptions and resulting conclusions in the agency's human health and ecological risks assessments for acetamiprid.

The registrants requested that the agency use data previously submitted to assess the risk to occupational handlers in greenhouses and revise the assessed risks to occupational handlers in landscape settings. The registrants stated that these data approximate landscape application scenarios better than the agency's default assumptions. The registrants also highlighted an error in a data summary table that appears in *Acetamiprid. Draft Human Health Risk Assessment for Registration Review*.

Additionally, the registrants questioned values presented in *Registration Review: Preliminary Environmental Fate and Ecological Risk Assessment for Acetamiprid*, such as biotic metabolism half-life values and others. Nisso America also presented new data from studies assessing acute toxicity to larval honey bees (*Apis mellifera*). While the registrants recognized that the larval bee toxicity data result in risks of concern for bees where before there were none, the registrants believe that typical use patterns of acetamiprid are unlikely to adversely impact bees.

EPA Response: After using the submitted data to revise its assumptions, the agency in turn revised its risk estimates for occupational handlers of acetamiprid using backpacks to make basal bark drench applications with liquids and wettable powders. Although the agency's baseline assumptions of this scenario yielded worker risks of concern, the submitted data yielded acceptable risk estimates. See *Response to Public Comments on the Acetamiprid Draft Risk Assessment for Registration Review*, available in the public docket, and Section III. Scientific Assessments below for more details. EPA also acknowledges there was a typographical error in Table 9.1.1 of the *Acetamiprid. Draft Human Health Risk Assessment for Registration Review* but concludes that the correct values were used in its calculations, even if the data summary was recorded incorrectly.

The agency also responded to each of the registrant's comments on the values and assumptions underlying its environmental fate and ecological risk conclusions in the *Response to Public Comments and Update to the Preliminary Environmental Fate and Ecological Risk Assessment (PRA) for Acetamiprid*, available in the public docket. The agency corrected an error in the calculation of one aerobic soil metabolism half-life reported in the PRA. In this same document, the agency presented new risk conclusions for larval honey bees, based on the new toxicity data. As noted by the registrant, in some cases, the new data produced risks of concern that were not identified in the original document. See the aforementioned response to public comments document for more details.

II. USE AND USAGE

Acetamiprid is a neonicotinoid insecticide that has contact and systemic activity used to control a variety of insects, primarily piercing sucking pests, but also select lepidopteran and coleopteran species. Acetamiprid is registered for use on many crops, including grapes, apples, cotton, beans, soybeans, corn, berries, nuts, stone fruits, and potatoes. Seed treatment uses of acetamiprid

include canola, mustard, and potato seed pieces. Registered non-agricultural sites include indoor and outdoor residential settings. It is also registered for use in institutional, public, commercial (including food handling establishments), industrial, and animal/livestock settings. In agricultural settings, acetamiprid products are applied to leaves, seeds, and soils, as well as directly to insect nests, such as ant nests. In the home they may be applied to surfaces or used in bait traps or dispensed as an aerosol, for treatment of household pests, such as bedbugs, for control of ticks and fleas on dogs, and in landscaping. Formulations include liquid, wettable powder, wettable powder in soluble packets, soluble granule or dry flowable products, baits and sticky traps, impregnated materials, and ready-to-use products. Acetamiprid may be applied by aircraft, groundboom, airblast equipment, backpack, and pressurized handwand.

Between 2014 and 2018, approximately 80,000 pounds (lbs) of acetamiprid were used to treat over 850,000 acres (A), with average annual application rates ranging from 0.04 lbs to 0.16 pounds active ingredient per acre (lbs a.i./A). During this period, crops with the highest usage in terms of average pounds applied were apple (25,000 lbs), walnut (15,000 lbs), and cotton (10,000 lbs). The greatest percent crop treated (PCT) values were reported for apple (40%), celery (40%), and strawberries (40%).

The agency has limited usage data on non-agricultural use sites. In 2016, over 10,000 lbs of acetamiprid were reported to have been used by pest management professionals (*i.e.*, applicators who typically apply pesticides to turf and ornamental plants, including in residential areas)[1]. Nursery and floriculture data from 2009 suggest that acetamiprid was used in 20% or more of businesses in this sector among surveyed states; the median application rate was 0.131 lb a.i./A. More recent data for this sector are unavailable. At the state-level, California reported that from 2013 to 2017, on average, less than 1,000 lbs. of acetamiprid were applied in nursery and greenhouse sites[1].

More details are available in *Acetamiprid: BEAD Benefit Assessment and Response to Public Comments in Support of Registration Review* and *Acetamiprid (099050) Screening Level Usage Analysis (SLUA), July 15, 2019*.

III. SCIENTIFIC ASSESSMENTS

A. Human Health Risks

A summary of the agency's human health risk assessment is presented below. The agency used the most current science policies and risk assessment methodologies to prepare a risk assessment in support of the registration review of acetamiprid. For additional details on the human health assessment for acetamiprid, see the *Acetamiprid. Draft Human Health Risk Assessment for Registration Review* (or DRA), which is available in the public docket.

[1] *Non-agricultural Market Research Data (NMRD), 2017. Data on consumer and professional pest control markets collected and sold by a private market research firm.*

1. Risk Summary and Characterization

Dietary, Residential, Aggregate, Bystander, and Occupational Post-Application Risks

No risks of concern were identified for dietary, residential, aggregate, bystander, or occupational post-application exposures. Both acute and chronic estimated dietary risks were below 100% of the population adjusted dose and thus not of concern. Acetamiprid is classified as "not likely to be carcinogenic in humans."

In all residential handler exposure scenarios, the combined estimates of the exposure and toxicity, or margin of exposure (MOE), was greater than the level of concern (LOC), so there are no residential handler exposure risks of concern. The same is true of all residential post-application exposure scenarios. An assessment of the exposure to acetamiprid via spray drift also did not identify any risks of concern. In accordance with the FQPA, the agency aggregated pesticide exposure and risk from three major categories (*i.e.*, food, drinking water, and residential exposure), and there are no aggregate risks of concern. Finally, there are no occupational post-application risks of concern. Based on the acute toxicity of acetamiprid, the restricted entry interval (REI) of 12 hours is adequate to protect agricultural workers from post-application risks.

Occupational Handler Risks

Nearly all the exposure scenarios for those working with acetamiprid yield risk estimates that are not of concern. Assuming baseline clothing (single layer of clothing, including long sleeves and pants, without chemical resistant gloves), the MOEs for combined dermal and inhalation exposure scenarios for occupational handlers ranged from 170 to 700,000. Occupational handlers applying pet spot-on treatments do not have dermal risks of concern (MOEs=120 to 1,200). In all scenarios, the LOC is 100.

In the human health DRA, there were two occupational exposure scenarios that resulted in risks of concern, assuming baseline attire (single layer clothing; *i.e.,* long pants, long sleeves, and socks and shoes):

- Mixing, loading, and applying liquid and wettable powder formulations to the basal bark of landscaping, trees/shrubs/bushes using backpacks, where the MOE was 20 (LOC=100); and,
- Mixing, loading, and applying liquid and wettable powder formulations to the basal bark of landscaping, trees/shrubs/bushes using manually-pressurized handwands. For this scenario, the MOE is 11 (LOC=100); however, with the addition of gloves, the MOE is 1,600.

Even with the addition of double layer and gloves, there were still risks of concern with the backpack scenarios (MOE=65; LOC=100). During the public comment period for *Acetamiprid. Draft Human Health Risk Assessment for Registration Review,* the registrant requested review of a monograph (MRID# 436232) produced by the Agricultural Handlers Exposure Task Force (AHETF) for backpack sprayer exposure from liquid formulation applications (BP-L) to foliage.

This monograph had previously been used to better model exposure to occupational handlers in greenhouse setting; however, the registrant argued that it is also applicable to modeling exposure to occupational handlers in landscape settings. The agency reviewed and incorporated the data into its assessment of landscape handler risks (see *Response to Public Comments on the Acetamiprid Draft Risk Assessment for Registration Review* for details). As a result, the MOE was updated to 150 (LOC=100) for occupational handlers making basal bark treatments with acetamiprid using backpacks, with double layer clothing and chemical resistant gloves.

While potential risks of concern were identified for the handwand scenarios, these risks are mitigated by gloves (MOE=1,600; LOC=100). All acetamiprid products registered for use on ornamental trees/shrubs/bushes, including in landscape settings, currently require the use of gloves; therefore, potential for risk is considered mitigated and these scenarios will not be explored further in this document.

2. Human Incidents and Epidemiology

The current Incident Data System (IDS) analysis from January 1, 2012 to April 28, 2017, shows 24 incidents reported in the Main IDS involving acetamiprid as a single active ingredient and 35 cases involving multiple active ingredients and 117 incidents reported to Aggregate IDS. A query of the Sentinel Event Notification System for Occupational Risk (SENSOR)-Pesticides Database over the period 1998-2013 showed that acetamiprid was involved in 43 cases, primarily agricultural in nature.

On September 19, 2019, an incident was reported that alleges that a bus traveling on a highway at 10:30 p.m. was exposed to drift from a nighttime airblast application of acetamiprid (product registration 8033-23-70506) to a citrus orchard. Twenty-nine persons were potentially exposed, with eight reporting itchy and watery eyes. This incident was reported after the search of the incident databases described above and so was not returned in the results of that search, nor was it reported in the *Acetamiprid: Tier I Update Review of Human Incidents and Epidemiology for Draft Risk Assessment* available in the public docket.

The agency will continue to monitor the incident reports. Additional analyses will be conducted if ongoing human incident monitoring indicates a concern.

3. Tolerances

The tolerances for residues of acetamiprid are listed in 40 CFR §180.578(a), 180.436 (b) and (c), including its metabolites and degradates, for plants and livestock commodities, and for residues resulting from applications made in food handling establishments. EPA is proposing tolerance actions to reflect changes to crop groups, as summarized in Table 1: Summary of Proposed Tolerance Actions below. The acetamiprid human health risk assessment recommended changes to various tolerance levels to conform with the agency's rounding practice (*i.e.*, adding a trailing zero) at that time. Since the risk assessment was issued, the agency has decided to follow the Organization for Economic Cooperation and Development (OECD) rounding class practice, which does not recommend adding a trailing zero. The agency anticipates the following changes

to the tolerances for acetamiprid. The agency intends to undertake these tolerance actions pursuant to its Federal Food, Drug Cosmetic Act (FFDCA) authority.

Table 1: Summary of Proposed Tolerance Actions

Acetamiprid 40 CFR § 180.578: Summary of Proposed Tolerance Actions			
Commodity	Established Tolerance (ppm)	Recommended Tolerance (ppm)	Comments
Brassica, head and stem, group 5-16	None	1.2	Update crop group tolerance
Brassica, leafy greens, subgroup 4-16B	None	15	Update crop group tolerance
Fruit, stone, group 12-12, except plum, prune	None	1.2	Update crop group tolerance
Leafy greens, subgroup 4-16A	None	3	Update crop group tolerance
Stalk, stem, and leaf petiole vegetable subgroup 22B	None	3	New crop subgroup tolerance
Nut, tree, group 14-12	None	0.1	Updated crop group tolerance
Celtuce	None	3	Now in subgroup 22A (no subgroup tolerance)
Fennel, Florence	None	3	Now in subgroup 22A (no subgroup tolerance)
Kohlrabi	None	1.2	Now in subgroup 22A (no subgroup tolerance)
Brassica head and stem, subgroup 5A	1.2	None	Revoke tolerance with update to crop group
Brassica, leafy greens, subgroup 5B	15	None	Revoke tolerance with update to crop group
Fruit, stone, group 12-12, except plum, prune	1.20	None	Revoke tolerance with update to crop group
Vegetable, leafy, except Brassica, group 4	3.00	None	Revoke tolerance with update to crop group
Nut, tree, group 14	0.10	None	Revoke tolerance with update to crop group
Pistachio	0.10	None	Revoke tolerance with update to crop group

4. Human Health Data Needs

The agency does not anticipate any further human health data needs for the acetamiprid registration review at this time.

B. Ecological Risks

A summary of the agency's ecological risk assessment is presented below. The agency used the most current science policies and risk assessment methodologies to prepare a risk assessment in support of the registration review of acetamiprid. For additional details on the ecological assessment for acetamiprid, see the *Preliminary Environmental Fate and Ecological Risk Assessment in Support of the Registration Review of Acetamiprid* (or RDA), which can be found in EPA's public docket (EPA-HQ-OPP-2012-0329) at www.regulations.gov.

EPA is currently working with its federal partners and other stakeholders to implement an interim approach for assessing potential risk to listed species and their designated critical habitats. Once the scientific methods necessary to complete risk assessments for listed species and their designated critical habitats are finalized, the agency will complete its endangered

species assessment for acetamiprid. See Appendix C for more details. As such, potential risks for non-listed species only are described below.

1. Risk Summary and Characterization

Terrestrial Risks

Mammals

Acetamiprid is highly toxic to mammals on an acute oral exposure basis, based on a 14-day LD_{50} (lethal dose to 50% of the test subjects) of 149 mg a.i./kg bw (where bw=bodyweight) in rats. The chronic toxicity endpoint (the no observed adverse effect concentration, or NOAEC=160 mg a.i./kg diet) is based on reduced body weight and reduced body weight gains.

While there are no acute (Level of Concern or LOC=0.5) or chronic (LOC=1.0) risks of concern from foliar applications of acetamiprid, there are both acute and chronic risks of concern from consumption of acetamiprid-treated seeds. The maximum acute seed treatment risk quotient (RQ) is 2.65 and the maximum chronic RQ is 48.31. (RQs greater than the established LOC represent potential risks of concern for a given exposure scenario). For context, a small mammal (weighing approximately 15 g) would receive an acutely lethal dose of acetamiprid after ingesting 214 treated canola seeds, or 30% of its diet over a foraging area of 2.53% of its home range. Similarly, a small mammal would reach the chronic LOC after consuming 107 acetamiprid-treated canola seeds, representing 15% of its diet.

Birds, Reptiles, and Terrestrial-Phase Amphibians

Acetamiprid is very highly toxic to passerine species—*e.g.*, zebra finch (*Taeniopygia guttata*)—and moderately toxic to larger birds—*e.g.*, mallard duck (*Anas platyrhynchos*)—on an acute oral exposure basis. The 14-day LD_{50} is 5.68 mg a.i./kg bw in zebra finches and 84.4 mg a.i./kg bw in mallard ducks. The chronic toxicity endpoint (NOEAC=99 mg a.i./kg diet) is based on reduced number of eggs laid and hatched.

There are both acute (LOC=0.5) and chronic (LOC=1.0) risks of concerns to birds from both foliar applications and seed treatments with acetamiprid. From foliar applications, the maximum acute RQ is 23.51 and the maximum chronic RQ is 1.26. For seed treatments, the maximum acute RQ is 167.83 and the maximum chronic RQ is 40.49. For context, a passerine bird would receive an acutely lethal dose of acetamiprid after ingesting as few as 5.4 acetamiprid-treated seeds, or 0.5% of its diet over a foraging area of 0.06% of its home range. Similarly, a passerine bird would reach the chronic LOC after consuming 88 acetamiprid-treated canola seeds, representing 7.8% of its diet and approximately 1% of its home range.

Terrestrial Invertebrates (honey bees)

Since the publication of the PRA, the agency has revised the toxicity estimates and resulting RQs for larval bees upwards by approximately an order of magnitude. For more information on revisions to the PRA, see the *Response to Public Comments and Update to the Preliminary*

Environmental Fate and Ecological Risk Assessment (PRA) for Acetamiprid available in the public docket. The information presented below reflects these updated estimates. The toxicity and resulting RQs for adult bees remain unchanged since the PRA.

Honey bees may be exposed to acetamiprid through ingestion of residues in nectar and pollen foraged from treated plants, contact with pesticide residues on plants treated with foliar applications, and direct contact via spray drift. Acetamiprid is classified as moderately toxic to adult bees and highly toxic to larvae on an acute exposure basis. For adult bees, the acute contact LD_{50} is 10.53 µg a.i./bee and the acute oral LD_{50} is 8.96 µg a.i./bee. For larvae, the acute oral LD_{50} was 1.16 µg a.i./larva. The chronic endpoint for bees (the no observed adverse effects level, or NOAEL=0.12 µg a.i./bee/day) is based on a decrease in larval survival.

There are acute (LOC=0.4) and chronic (LOC=1.0) risks of concern to adults and larvae from registered uses of acetamiprid. For adult bees, the maximum acute RQ is 1.86 and the maximum chronic RQ is 6.90. For larvae, the maximum acute RQ is 6.59 and the maximum chronic RQ is 63.7.

Measured residue data suggest that the actual residues of acetamiprid on treated plants may be up to 99% lower than the estimated environmental concentrations (EECs) used to generate RQs. Moreover, though there are risks of concern to individual honey bees, which serve as a surrogate for non-*Apis* bees, colony-level studies show that these risks are not likely to translate into long-term adverse effects on the colony. These studies indicate that adverse effects of acetamiprid are likely transitory and so will probably not pose long-term risks to colony health. However, there are 37 reported incidents associated with the use of acetamiprid involving honey bees, with the numbers of colonies affected per incident ranging from 9 to 12,000. The majority (76%) of the bee-related incidents occurred in Canada. Of the eight incidents that occurred inside of the U.S., six were classified as either "unlikely" or were the result of illegal use of acetamiprid.

Additional data may be necessary to fully evaluate risks to non-target terrestrial invertebrates, especially pollinators. Although the EPA identified the need for certain data to evaluate potential effects to pollinators when initially scoping the registration review for acetamiprid, the problem formulation and registration review DCI for acetamiprid were both issued prior to the EPA's issuance of the June 2014 *Guidance for Assessing Pesticide Risks to Bees*[2]. This 2014 guidance lists additional pollinator studies that were not included in the acetamiprid registration review DCI. Therefore, the EPA is currently determining whether additional pollinator data are needed for acetamiprid. If the agency determines that additional pollinator exposure and effects data are necessary, then the EPA will issue a DCI to obtain these data. The pollinator studies that could be required are listed in Table 1: Potential Pollinator Data Requirements below.

Table 1: Potential Pollinator Data Requirements

Guideline #	**Study**
Tier 1	
850.3020	Acute contact toxicity study with adult honey bees

[2] Available at https://www.epa.gov/sites/production/files/2014-06/documents/pollinator_risk_assessment_guidance_06_19_14.pdf

Guideline #	Study
850.3030	Honey bee toxicity of residues on foliage
Non-Guideline (OECD 213)	Honey bee adult acute oral toxicity
Non-Guideline (OECD 237)	Honey bee larvae acute oral toxicity
Non-Guideline	Honey bee adult chronic oral toxicity
Non-Guideline	Honey bee larvae chronic oral toxicity
Tier 2†	
Non-Guideline	Field trial of residues in pollen and nectar
Non-Guideline (OECD 75)	Semi-field testing for pollinators
Tier 3†	
850.3040	Full-Field testing for pollinators

† The need for higher tier tests for pollinators will be determined based upon the results of lower tiered tests and/or other lines of evidence and the need for a refined pollinator risk assessment.

Terrestrial Plants

Non-target terrestrial plants may be exposed to acetamiprid via runoff and drift from foliar application sites. Terrestrial plant toxicity studies with acetamiprid resulted in reductions in shoot length in both monocotyledonous (monocots) and dicotyledonous (dicots) plants and reductions in plant weight in monocots. The EC_{25} (the dose at which 25% of the test subjects show adverse effects) for monocot seedling emergence was 0.23 lb a.i./A. The EC_{25} for dicot seedling emergence was 0.16 lb a.i./A. The EC_{25} for monocot vegetative vigor was 0.46 lb a.i./A. The EC_{25} for dicot vegetative vigor was 0.0056 lb a.i./A. There are risks of concern (LOC=1.0) for monocots for both aerial (RQ values up to 1.24) and for ground applications (RQ values up to 1.15). For dicot, there are risks of concern following aerial (RQ values up to 4.64) and ground applications (RQ values up to 1.66).

Aquatic Risks

Freshwater and Estuarine/Marine Fish

Acetamiprid is practically non-toxic to freshwater (96-hr LC_{50}>100 mg a.i./L; 96-hr LC_{50} is the concentration of a.i. in which half of the test subject are immobilized after 96 hours) and slightly toxic to estuarine/marine fish (96-hr LC_{50}=100 mg a.i./L) on an acute exposure basis. The chronic toxicity endpoint for freshwater fish (NOAEC=19.2 mg a.i./L) is based on reduced growth. Chronic toxicity data are not available for estuarine/marine fish.

There are no acute risks of concern (LOC=0.5) for freshwater or estuarine/marine fish. Since freshwater fish serve as surrogates for aquatic-phase amphibians, there are no risks of concern for this taxon as well. There are no chronic risks (LOC=1.0) of concern for freshwater fish; however, chronic risks to estuarine/marine fish were not calculated due to the absence of data. Overall, the likelihood of adverse effects to aquatic vertebrates is considered low, given the available data; therefore, the agency is not requiring chronic toxicity data for estuarine/marine fish at this time.

Freshwater and Estuarine/Marine Invertebrates

Since the publication of the PRA, the agency has revised the toxicity estimates and resulting RQs for freshwater invertebrates upwards by approximately an order of magnitude. For more information on revisions to the PRA, see the *Response to Public Comments and Update to the Preliminary Environmental Fate and Ecological Risk Assessment (PRA) for Acetamiprid* available in the public docket. The information presented below reflects these updated estimates. The toxicity and resulting RQs for estuarine/marine invertebrates remain unchanged since the PRA.

Aquatic invertebrates may become exposed to acetamiprid through residues in runoff, flooding of treatment sites, and spray drift. Acetamiprid is very highly toxic to both freshwater and estuarine/marine invertebrates on an acute exposure basis. The 96-hr LC_{50} for freshwater invertebrates is 3.31 µg a.i./L. The 96-hr LC_{50} for estuarine/marine invertebrates is 66 µg a.i./L. The freshwater invertebrate chronic toxicity endpoint (NOAEC=0.36 µg a.i./L) is based on adult emergence and on the average number of days to emergence. The estuarine/marine invertebrate chronic toxicity endpoint (NOAEC=2.5 µg a.i./L) is based on reduced body weight in males.

There are both acute (LOC=0.5) and chronic (LOC=1.0) risks of concern to both freshwater and estuarine/marine invertebrates from registered uses of acetamiprid. For freshwater invertebrates, the maximum acute RQ is 10.2 and the maximum chronic RQ is 91.7. For estuarine/marine invertebrates, the maximum acute RQ is 0.57 and the maximum chronic RQ is 14.56.

Aquatic Vascular and Non-Vascular Plants

Toxicity studies showed no effects to the growth of both vascular and non-vascular aquatic plants up to the highest concentrations tested (1.1 mg a.i./L). The RQs for both vascular and non-vascular plants were lower than the LOC of 1.0; therefore, there are no risks of concern for aquatic plants from the currently registered uses of acetamiprid.

2. Ecological Incidents

A review of the Incident Data System (IDS) in October 2017 indicated 55 incidents involving adverse effects to terrestrial plants between 2004 and 2015. All 55 plant incidents were associated with the use of just two formulations of acetamiprid. The certainty code for all but two incidents was “possible”, while the certainty code for the remaining two was “unlikely”. These incidents suggest that there is potential for effects to occur to terrestrial plants from the current uses of acetamiprid.

Thirty-seven reported incidents in the IDS involved bees. Of these, six were assigned the “unlikely” certainty level, one was assigned “highly probable”, and the remaining majority were characterized as “probable”. Four incidents were not assigned a certainty level. Although bee kill incidents have been associated with the use of acetamiprid on cotton and apples, the incidents were listed as misuses.

One aquatic incident was reported after water used to extinguish a fire at an agrochemical warehouse later contaminated a river, killing 700 to 1,000 fish. A complete list of the chemicals present in the runoff is not known, but acetamiprid was present and the certainty level assigned was "possible".

The October 2017 IDS analysis of aggregated incident reports identified 78 aggregate incidents reported between October 1, 2004 and June 30, 2016. Seventy-four involved damage to plants, while four involved wildlife; however, the wildlife affected were not specified.

EPA will continue to monitor the incident information, and additional analysis will be conducted if ongoing ecological incident monitoring indicates a concern.

3. Ecological and Environmental Fate Data Needs

There are no data gaps related to the environmental fate database for the acetamiprid registration review at this time. The agency will consider calling in pollinator data as a separate action.

C. Benefits Assessment

Acetamiprid controls piercing/sucking insects, an assortment of lepidopterans, and some coleopterans pests in numerous agricultural crops. Such pests include aphids, whiteflies, oriental fruit moth, apple maggot, pear psylla, adelgid, borer and scale insects, flea beetle, certain flies, and wireworm. Acetamiprid reduces not only direct damage incurred by insect pests but also the spread of plant diseases by insect vectors. There are also applications of acetamiprid in residential pest control, such as for cockroaches and bedbugs.

Acetamiprid seed treatments in mustard and canola are primarily used to target flea beetles and wireworms. Flea beetle is a major economic concern in canola plantings with more than half of all canola acreage treated for this pest. Acetamiprid is a viable control method for these pests, but it is not the top option since most canola seed is preferentially treated with thiamethoxam.

In many crop systems (e.g., vegetables, fruits, and tree nuts), aphids, thrips, whiteflies, codling moth, and other insects targeted by acetamiprid not only cause direct yield loss but also vector important crop diseases (e.g., cucurbit yellow stunting disorder, mosaic viruses, yellow spot virus) that can result in high yield losses. Specifically, for vegetable crops like celery or leafy greens, insecticidal control is important because any visible scarring from insect feeding can result in downgrading or rejection of harvested crops.

In pome and stone fruits, acetamiprid functions as a broad-spectrum spray to control numerous pests simultaneously including codling moth, oriental fruit moth, apple maggot, pear psylla, aphids, and mealybugs. These insects can also cause yield loss via direct feeding or vectoring diseases, which may impact the quantity or quality of marketable fruit.

In strawberry production, acetamiprid is primarily used to target aphids, lygus bug, and thrips. These are some of the top insect pests targeted generally in strawberries because of the damage

they cause (e.g., direct feeding, vectoring diseases, etc.). Acetamiprid is one of the top two insecticide options, by acres treated, for aphids and thrips within strawberry production.

In walnut production, acetamiprid is primarily used to target walnut husk fly and codling moth, both of which attack the developing fruit on walnut trees which contains the nut within. These are the top two insect pests targeted in walnuts. In California (i.e., where almost all walnuts are produced), acetamiprid is the top recommended insecticide for control of walnut husk fly and the top choice for control of moderate populations of codling moth in walnut production. Based on usage data, acetamiprid is the second most used control option for walnut husk fly and a generally used option for codling moth.

For more information on the benefits of acetamiprid, see the *Acetamiprid: BEAD Benefit Assessment and Response to Public Comments in Support of Registration Review* available in the public docket.

IV. PROPOSED INTERIM REGISTRATION REVIEW DECISION

A. Proposed Risk Mitigation and Regulatory Rationale

EPA has identified risks of concern to occupational handlers applying liquids and wettable powders as basal bark treatments using backpacks. EPA has also identified risks to mammals and birds that consume treated seeds, to birds from foliar applications, to terrestrial invertebrates from foliar applications, to aquatic invertebrates from foliar applications, and to terrestrial plants. To mitigate the risks to occupational handlers, EPA proposes updating personnel protective equipment (PPE) standards for certain applications of acetamiprid. To mitigate risks to birds, invertebrates and terrestrial plants, EPA proposes spray drift mitigation and buffer zones to limit the movement of acetamiprid. To mitigate risks to birds and mammals, EPA proposes standards for handling acetamiprid-treated seeds. The agency is also proposing updated gloves statements, insecticide resistance management language, an environmental hazard statement for pollinators, and best practices language for water soluble packaging.

1. Proposed Addition of PPE for Basal Bark Treatments in Landscape Uses

As discussed in Section III of this document, EPA found risks of concern for occupational mixer/loader/applicators of liquid and wettable powder formulations as basal bark treatments using backpacks in landscaping. Requiring these occupational handlers to wear double layer clothing and chemical-resistant gloves mitigates these risks of concern to acceptable levels. Therefore, EPA proposes PPE standards of gloves and double layer clothing for occupational handlers using backpacks in landscaping (trees, shrubs, and bushes).

EPA expects that this mitigation will have low impacts on most current users of acetamiprid. Backpack sprayer basal bark treatments of acetamiprid in forestry or residential settings are likely a minor component of pest control in these sites. Additionally, professional applicators will likely have the required PPE readily available, so cost increases are not likely. Nevertheless,

for the users of acetamiprid as a basal bark treatment, the use of additional PPE (i.e., wearing double layers or respirators when applying pesticides) can reduce their productivity because of the physiological stress when working in high temperatures and/or humid conditions.

2. Updated Gloves Statement

The agency is proposing to update the glove statement currently on labels to be consistent with the Label Review Manual[3]. The proposed new glove language does not fundamentally change the personal protective equipment that workers need to use, and therefore should impose no impacts on users.

Specifically, all statements that refer to the chemical resistance category selection chart are proposed to be removed from acetamiprid labels, as they might cause confusion for users. These statements are proposed to be replaced with specific chemical-resistant glove types.

3. Proposed Addition of Best Management Practices Language for Handling and Adding Water-Soluble Packets to Spray Tanks

For products formulated in water-soluble packaging, the agency proposes to incorporate up-to-date instructions for proper mixing and loading of water-soluble packets to ensure that packets are allowed to dissolve in water via mechanical agitation as intended and to prevent rupturing, as well as an up-to-date engineering controls statement.

4. Advisory Statements for Acetamiprid Seed Treatment Uses

Acute and chronic dietary risks of concern have been identified for birds and mammals exposed to acetamiprid-treated seeds. The potential for risk depends on the size of the animal and the treated seed. However, the risk potential is also dependent on factors affecting exposure (*e.g.* application rates, timing, seed depth).

To help mitigate these risks, EPA is proposing that all pesticide products that contain acetamiprid and are registered for seed treatment uses include the following advisory statements:

- "Cover or collect treated seeds spilled during loading and planting in areas (such as in row ends)."
- "Dispose of all excess treated seed by burying seed away from bodies of water."
- "Do not contaminate bodies of water when disposing of planting equipment wash water."

The purpose of these required advisory statements is to encourage the adoption of best management practices when handling and planting acetamiprid-treated seeds that will reduce the exposure of birds and mammals to treated seeds. Covering or collecting spilled seed and burying excess seed are all measures that will reduce the likelihood that animals will find and consume treated seeds. Disposing of excess seeds and equipment wash water away from water bodies, which tend to be gathering points for birds and mammals, decreases the chance of contaminating

[3] https://www.epa.gov/pesticide-registration/label-review-manual

those water bodies with neonicotinoid residues and the chance that animals will discover and consume treated seeds while visiting a body of water.

5. Environmental Hazard Statement for Pollinators

As discussed in Section III of this document, registered uses of acetamiprid poses potential risks to bees. Therefore, the agency proposes the following pollinator advisory language for all products with outdoor uses:

- "This product is moderately toxic to bees and other pollinating insects exposed to direct treatment, or to residues in/on blooming crops or weeds. Protect pollinating insects by following label directions intended to minimize drift and to reduce risk to these organisms."

6. Spray Drift Management

The agency is proposing label changes to reduce off-target spray drift and establish a baseline level of protection against spray drift that is consistent across all acetamiprid products. Reducing spray drift will reduce the extent of environmental exposure and risk to non-target plants and animals. Although the agency is not making a complete endangered species finding at this time, these label changes are expected to reduce the extent of exposure and may reduce risk to listed species whose range and/or critical habitat co-occur with the use of acetamiprid.

The agency is proposing the following spray drift mitigation language be included on all acetamiprid product labels. The proposed spray drift language is intended to be mandatory, enforceable statements and supersede any existing language already on product labels (either advisory or mandatory) covering the same topics. The agency is providing recommendations which allow acetamiprid registrants to standardize all advisory language on acetamiprid product labels. Registrants must ensure that any existing advisory language left on labels does not contradict or modify the new mandatory spray drift statements proposed in this proposed interim decision once effective.

These mandatory spray drift mitigation measures are proposed for aerial applications for all products delivered via liquid spray:

- Applicators must not spray during temperature inversions.
- For aerial applications, do not apply when wind speeds exceed 15 mph at the application site. If the windspeed is greater than 10 mph, the boom length must be 65% or less of the wingspan for fixed wing aircraft and 75% or less of the rotor diameter for helicopters. Otherwise, the boom length must be 75% or less of the wingspan for fixed-wing aircraft and 90% or less of the rotor diameter for helicopters.
- For aerial applicators, if the windspeed is 10 miles per hour or less, applicators must use ½ swath displacement upwind at the downwind edge of the field. When the windspeed is between 11-15 miles per hour, applicators must use ¾ swath displacement upwind at the downwind edge of the field.
- For aerial applications, the release height must be no higher than 10 feet from the top of the crop canopy or ground, unless a greater application height is required for pilot safety.

- Specify spray droplet size of Medium or coarser (ASABE S572.1)

These mandatory spray drift mitigation measures are proposed for ground applications delivered via liquid spray:

- Applicators must not spray during temperature inversions.
- Do not apply when wind speeds exceed 15 mph at the application site.
- For air blast applications, nozzles directed out of the orchard must be turned off in the outer row.
- For air blast applications, applications must be directed into the canopy foliage.
- For ground boom applications, apply with the release height no more than 4 feet above the ground or crop canopy.
- Specify spray droplet size of Medium or coarser (ASABE S572.1)

In addition to including the following spray drift restrictions on acetamiprid labels, all references to volumetric mean diameter (VMD) information for spray droplets are proposed to be removed from all acetamiprid labels where such information currently appears. The proposed new language in below, which cites American Society of Agricultural & Biological Engineers (ASABE) S572.1, eliminates the need for VMD information.

Impacts of Spray Drift and Runoff Mitigation

Wind Speed, Boom Length/Swath Displacement, Release Height, and Temperature Inversions

Current requirements for aerial applications are:

- Do not apply acetamiprid when wind speeds exceed 10 mph at the application site. The boom length must be 75% or less of the wingspan or rotor diameter.
- The release height of 10 feet from the top of target, unless a greater application height is required for pilot safety is advisory.
- Mandatory language prohibiting applications during temperature inversions.
- There are no requirements for swath displacement on current labels.

For aerial applications, proposed changes will allow applications of acetamiprid at higher wind speed, which will provide growers with greater flexibility to make applications in a timely manner. Further, at wind speeds of 10 mph or less, the boom length for helicopter is increased to 90 percent of the rotor diameter, which may necessitate fewer passes to complete an application, likely decreasing application costs. There are no proposed changes for applications during inversions. The agency has not assessed the impacts of a ½ or ¾ swath displacement upwind at the downwind edge of the field or a 10-foot release height; however, the agency does not anticipate impacts as a result of a mandatory swath displacement or 10-foot release height as this corresponds to good application practices. The agency invites comments if this mitigation would impact growers.

Currently, there are no mandatory requirements for ground applications. Based on previous reviews of recommended release heights for optimal coverage across common nozzle types, a release height of 4 feet or less should not impact growers when making applications of

acetamiprid. The agency has been proposing wind speed restrictions and proposing prohibitions against applying during temperature inversions for several years in many decisions. Proposed mandatory windspeed requirements and prohibitions on applications during temperature inversions could result in delays to intended applications and, more generally, could reduce the amount of time users have to apply acetamiprid. Management of production activities may be more complex. Potentially, growers might switch to a different active ingredient that does not have this restriction, but that could be costly and potentially difficult in a short period of time. This could also lead to reduced yield and/or quality. Additionally, temperature inversions are more likely to occur a couple of hours before sunset and after sunrise, which is when applications may be timed to avoid spraying during windy hours of the day or when pollinators are active. This may complicate growers' ability to follow good stewardship programs.

Droplet Size

The agency is proposing a restriction on droplet size because coarser droplets have been demonstrated to decrease spray drift and therefore reduce potential risks to non-target species. Because chemical-specific data for the performance of droplet sizes is limited, the EPA was not able to evaluate the effects of Medium or coarser droplet sizes (as defined by ASABE S572.1) specifically for acetamiprid. Therefore, the EPA does not know the effect this requirement will have on the performance of acetamiprid across various use patterns. In general, the agency expects a droplet size requirement would not likely have a major impact in pest control scenarios where acetamiprid is valued for its systemicity in plants and residual control of target pest(s); however, acetamiprid also offers value to users for its contact activity which may be impacted by a droplet size requirement due to potential reductions in coverage and possibly efficacy in killing the target pest(s). In general, potential negative impacts to growers from requiring larger droplets could include reductions in efficacy, increased selection pressure for the evolution of insecticide resistance due to a decrease in lethal dose delivered to target insects, increased application rates used by growers, increased costs associated with reduced yield, more insecticide applications, purchase of alternative products, or an inability to use tank mix or premix products. The EPA encourages comments on any potential impacts to growers from specifying a mandatory minimum droplet size on product labels.

Requirements for Air Blast Sprayers

There are currently no specific label requirements for air blast applications. The agency does not expect impacts to the users of acetamiprid from requirements to direct spray into the canopy and to turn off nozzles that would treat the outer orchard rows as this corresponds to good application practices. The agency invites comments if this mitigation would impact applicators.

7. Proposed Spray Drift Buffers

In addition to the proposed spray drift mitigation measures above, the EPA is proposing buffers from waterbodies of 25 ft for ground application and 150 ft for aerial applications to limit the amount of spray drift that enters waterbodies. These proposed mitigation measures will establish a baseline level of protection for waterbodies against spray drift that is consistent across all

acetamiprid products. Reducing the overall amount of spray drift that reaches waterbodies will reduce the extent of environmental exposure and risk to aquatic organisms.

Currently, labels are silent on buffers to water bodies. Impacts could include yield losses in untreated portions of fields. If growing areas are adjacent to water bodies, buffers may require growers to leave a portion of the land dedicated to crops untreated, remove land from production, or apply another insecticide without this proposed requirement. The impact of this mitigation can be highly localized and may depend on the size and shape of a field. Leaving an area untreated in a field can harbor insects and vectored diseases and serve as a source of re-infestation and inoculum, requiring subsequent applications, thus increasing costs. Alternatively, a grower could switch to a different chemical that does not have a buffer requirement, at least along the edge of the field next to the water body. Potential alternatives are typically more expensive per acre than acetamiprid.

Aerial applications are common in crops such as cantaloupes, squash, lettuce, and cotton. The effect of buffers will be larger for crops that are typically grown in small fields, such as cucurbits, than on crops typically grown in larger fields, such as cotton. See *Acetamiprid: BEAD Benefit Assessment and Response to Public Comments in Support of Registration Review.*

8. Pesticide Resistance Management

Pesticide resistance occurs when genetic or behavioral changes enable a portion of a pest population to tolerate or survive what would otherwise be lethal doses of a given pesticide. The development of such resistance is influenced by a number of factors. One important factor is the repeated use of pesticides with the same mode (or mechanism) of action. This practice kills sensitive pest individuals but allows less susceptible ones in the targeted population to survive and reproduce, thus increasing in numbers. These individuals will eventually be unaffected by the repeated pesticide applications and may become a substantial portion of the pest population. An alternative approach, recommended by resistance management experts as part of integrated pest management (IPM) programs, is to use pesticides with different chemical modes (or mechanisms) of action against the same target pest population. This approach may delay and/or prevent the development of resistance to a particular mode (or mechanism) of action without resorting to increased rates and frequency of application, possibly prolonging the useful life of pesticides.

The EPA is proposing resistance-management labeling, as listed in Appendix B, for products containing acetamiprid, in order to provide pesticide users with easy access to important information to help maintain the effectiveness of useful pesticides. Additional information on the EPA's guidance for resistance management can be found at the following website: https://www.epa.gov/pesticide-registration/prn-2017-1-guidance-pesticide-registrants-pesticide-resistance-management.

B. Tolerance Actions

The agency is proposing several crop group conversions/revisions, as well as typographical corrections to be consistent with agency rounding procedures. Refer to Section III.A.3 for

details. The agency will use its FFDCA rulemaking authority to make the needed changes to the tolerances.

C. Proposed Interim Registration Review Decision

In accordance with 40 CFR §§ 155.56 and 155.58, the agency is issuing this PID. Except for the Endocrine Disruptor Screening Program (EDSP), and the Endangered Species Act (ESA), the agency has made the following Proposed Interim Registration Review Decision: (1) no additional data are required at this time; and (2) changes to the affected registrations and their labeling are needed at this time, as described in Sections IV. A and Appendices A and B.

In this PID, EPA is making no human health or environmental safety findings associated with the EDSP screening of acetamiprid, nor is it making a complete endangered species finding. Although the agency is not making a complete endangered species finding at this time, the proposed mitigation described in this document is expected to reduce the extent of environmental exposure and may reduce risk to listed species whose range and/or critical habitat co-occur with the use of acetamiprid. The agency's final registration review decision for acetamiprid will be dependent upon the result of the agency's ESA assessment and any needed § 7 consultation with the Services and an EDSP FFDCA § 408(p) determination.

D. Data Requirements

The agency does not anticipate calling in data for the acetamiprid registration review at this time. The EPA will consider requiring submission of pollinator data as a separate action.

V. NEXT STEPS AND TIMELINE

A. Proposed Interim Registration Review Decision

A Federal Register Notice will announce the availability of this PID for acetamiprid and will allow a 60-day comment period on the PID. If there are no significant comments or additional information submitted to the docket during the comment period that leads the agency to change its PID, the EPA may issue an interim registration review decision for acetamiprid. However, a final decision for acetamiprid may be issued without the agency having previously issued an interim decision. A final decision on the acetamiprid registration review case will occur after: (1) an EDSP FFDCA § 408(p) determination and (2) an endangered species determination under the ESA and any needed § 7 consultation with the Services.

B. Implementation of Mitigation Measures

Once the Interim Registration Review Decision is issued the acetamiprid registrants must submit amended labels that include the label changes described in Appendices A and B. The revised

labels must be submitted to the agency for review within 60 days following issuance of the Interim Registration Review Decision in the docket.

Appendix A: Summary of Proposed Actions for Acetamiprid

Registration Review Case #: 7468
PC Code: 099050
Chemical Type: Insecticide
Chemical Family: Neonicotinoid
Mode of Action: Group 4: Nicotinic Acetylcholine Receptor Competitive Modulators

Affected Population(s)	Source of Exposure	Route of Exposure	Duration of Exposure	Potential Risk(s) of Concern	Proposed Actions
Occupational Handlers	Backpacks for basal bark treatments	Dermal exposure	Short- and intermediate-term	Reproductive and neurotoxic effects	Addition of double layer clothing and gloves to PPE
Mammals and Birds, Reptiles, and Terrestrial-Phase Amphibians	Seed treatments	Dietary exposure	Acute and chronic	Acute toxicity and weight loss, behavioral changes, labored breathing, and reproductive effects	Require specific handling and management of treated seeds
Birds, Reptiles, and Terrestrial-Phase Amphibians	Foliar applications	Dietary and dermal exposures	Acute and chronic	Acute toxicity and reproductive effects	Spray drift and runoff mitigation language
Terrestrial Invertebrates (Pollinators)	Foliar treatments	Dietary exposure	Acute and chronic	Acute toxicity and increased mortality in adult and larval workers and drones	Environmental hazard statement on labels Spray drift and runoff mitigation language
Terrestrial Plants	Drift; runoff	Contact	Not applicable	Seedling emergence and vegetative vigor	Spray drift and runoff mitigation language
Aquatic Invertebrates	Foliar treatments; runoff	Dermal exposure	Acute and chronic	Acute toxicity and decreased size and reproductive effects	Spray drift and runoff mitigation language

Appendix B: Proposed Labeling Changes for Acetamiprid Products

Description	Proposed Label Language for Acetamiprid Products	Placement on Label
	End Use Products	
Mode of Action Group 4	**Note to registrant:** • Include the name of the **ACTIVE INGREDIENT** in the first column • Include the word "**GROUP**" in the second column • Include 4A in the third column (for herbicides this is the Mechanism of Action, for fungicides this is the FRAC Code, and for insecticides this is the Primary Site of Action) • Include the type of pesticide (*i.e.*, **HERBICIDE** or **FUNGICIDE** or **INSECTICIDE)** in the fourth column. **ACETAMIPRID** | **GROUP** | **4A** | **INSECTICIDE**	Front Panel, upper right quadrant. All text should be black, bold face and all caps on a white background, except the mode of action code, which should be white, bold face and all caps on a black background; all text and columns should be surrounded by a black rectangle.
Updated Gloves Statement	Update the gloves statements to be consistent with Chapter 10 of the Label Review Manual. In particular, remove reference to specific categories in EPA's chemical-resistance category selection chart and list the appropriate chemical-resistant glove types to use.	In the Personal Protective Equipment (PPE) within the Precautionary Statements and Agricultural Use Requirements, if applicable
For products with liquid or wettable powder formulations that allow basal bark application in landscape settings to trees, bushes, and shrubs by backpack	Update the gloves statements to be consistent with Chapter 10 of the Label Review Manual. In particular, remove reference to specific categories in EPA's chemical-resistance category selection chart and list the appropriate chemical-resistant glove types to use. "Coverall worn over short-sleeved shirt and short pants, socks, chemical-resistant footwear, and waterproof or chemical-resistant gloves*." *The gloves statement should be consistent with Chapter 10 of the Label Review Manual.	In the Personal Protective Equipment (PPE) within the Precautionary Statements

Description	Proposed Label Language for Acetamiprid Products	Placement on Label
Environmental Hazard Statement for Pollinators	"This product is moderately toxic to bees and other pollinating insects exposed to direct treatment, or to residues in/on blooming crops or weeds. Protect pollinating insects by following label directions intended to minimize drift and to reduce risk to these organisms."	Environmental Hazards
Resistance-management labeling statements for insecticides/acaricides	Include resistance management label language for insecticides/acaricides from PRN 2017-1 (https://www.epa.gov/pesticide-registration/pesticide-registration-notices-year)	Directions for Use
Additional Required Labelling Action	Remove information about volumetric mean diameter from all labels where such information currently appears.	Directions for Use
Directions for mixing/loading products packaged in water soluble bags	Instructions for Introducing Water Soluble Packages Directly into Spray tanks: "Water Soluble Packages (WSPs) are designed to dissolve in water. Agitation may be used, if necessary, to help dissolve the WSP. Failure to follow handling and mixing instructions can increase your exposure to the pesticide products in WSPs. WSPs, when used properly, qualify as a closed mixing/loading system under the Agricultural Worker Protection Standard [40 CFR 170.607(d)]. Handling Instructions Follow these steps when handling pesticide products in WSPs. 1. Mix in spray tank only. 2. Handle the WSP in a manner that protects package from breakage and/or unintended release of contents. If package is broken, put on PPE required for clean-up and then continue with mixing instructions. 3. Keep the WSP in outer packaging until just before use. 4. Keep the WSP dry prior to adding to the spray tank. 5. Handle with dry gloves and according to the label instructions for PPE. 6. Keep the WSP intact. Do not cut or puncture the WSP. 7. Reseal the WSP outer packaging to protect any unused WSP(s). Mixing Instructions Follow the steps below when mixing this product, including if it is tank-mixed with other pesticide products. If being tank-mixed, the mixing directions 1 through 9 below take precedence over the mixing directions of the other tank mix products. WSPs may, in some cases, be mixed with other pesticide products so long as the directions for use of all the pesticide product components do not conflict. Do not tank-mix this product with products that prohibit tank-mixing or have conflicting mixing directions. 1. If a basket or strainer is present in the tank hatch, remove prior to adding the WSP to the tank. 2. Fill tank with water to approximately one-third to one-half of the desired final volume of spray. 3. Stop adding water and stop any agitation. 4. Place intact/unopened WSP into the tank.	Directions for Use

Description	Proposed Label Language for Acetamiprid Products	Placement on Label
	5. Do not spray water from a hose or fill pipe to break or dissolve the WSP. 6. Start mechanical and recirculation agitation from the bottom of tank without using any overhead recirculation, if possible. If overhead recirculation cannot be turned off, close the hatch before starting agitation. 7. Dissolving the WSP may take up to 5 minutes or longer, depending on water temperature, water hardness and intensity of agitation. 8. Stop agitation before tank lid is opened. 9. Open the lid to the tank, exercising caution to avoid contact with dusts or spray mix, to verify that the WSP has fully dissolved and the contents have been thoroughly mixed into the solution. 10. Do not add other allowed products or complete filling the tank until the bags have fully dissolved and pesticide is thoroughly mixed. 11. Once the WSP has fully dissolved and any other products have been added to the tank, resume filling the tank with water to the desired level, close the tank lid, and resume agitation. 12. Use the spray solution when mixing is complete. 13. Maintain agitation of the diluted pesticide mix during transport and application. 14. It is unlawful to use any registered pesticide, including WSPs, in a manner inconsistent with its label. ENGINEERING CONTROLS STATEMENT Water soluble packets, when used correctly, qualify as a closed mixing/loading system under the Worker Protection Standard [40 CFR 170.607(d)]. Mixers and loaders handling this product while it is enclosed in intact water soluble packets may elect to wear reduced PPE of long-sleeved shirt, long pants, shoes, socks, a chemical-resistant apron, and chemical-resistant gloves. When reduced PPE is worn because a closed system is being used, handlers must be provided all PPE specified above for "applicators and other handlers" and have such PPE immediately available for use in an emergency, such as in case of a spill or equipment break-down.	
The following proposed label language applies to end-use products that have agricultural uses		
Mandatory Spray Drift Management Application Restrictions for all products delivered via liquid spray application and allow aerial application	**"MANDATORY SPRAY DRIFT MANAGEMENT** **Aerial Applications**: • Do not release spray at a height greater than 10 ft above the ground or vegetative canopy, unless a greater application height is necessary for pilot safety. • Applicators are required to use a Medium or coarser droplet size (ASABE S572.1). • If the windspeed is 10 miles per hour or less, applicators must use ½ swath displacement upwind at the downwind edge of the field. When the windspeed is between 11-15 miles per hour, applicators must use ¾ swath displacement upwind at the downwind edge of the field. • Do not apply when wind speeds exceed 15 mph at the application site. If the windspeed is greater than 10 mph, the boom length must be 65% or less of the wingspan for fixed wing aircraft and 75% or less of the rotor	Directions for Use, in a box titled "Mandatory Spray Drift Management" under the heading "Aerial Applications"

Description	Proposed Label Language for Acetamiprid Products	Placement on Label
	diameter for helicopters. Otherwise, the boom length must be 75% or less of the wingspan for fixed-wing aircraft and 90% or less of the rotor diameter for helicopters. • Do not apply during temperature inversions."	
Mandatory Spray Drift Management Application Restrictions for products that allow airblast applications	**"MANDATORY SPRAY DRIFT MANAGEMENT** **Airblast applications:** • Sprays must be directed into the canopy. • Do not apply when wind speeds exceed 15 miles per hour at the application site. • User must turn off outward pointing nozzles at row ends and when spraying outer row. • Do not apply during temperature inversions."	Directions for Use, in a box titled "Mandatory Spray Drift Management" under the heading "Airblast Applications"
Mandatory Spray Drift Management Application Restrictions for products applied as liquids and allow ground boom applications	**"MANDATORY SPRAY DRIFT MANAGEMENT** **Ground Boom Applications:** • User must only apply with the nozzle height recommended by the manufacturer, but no more than 4 feet above the ground or crop canopy. • Applicators are required to use a Medium or coarser droplet size (ASABE S572.1). • Do not apply when wind speeds exceed 15 miles per hour at the application site. • Do not apply during temperature inversions."	Directions for Use, in a box titled "Mandatory Spray Drift Management" under the heading "Ground Boom Applications"
Mandatory Spray Drift Management Application Restrictions for products that are applied as liquids and allow boom-less ground sprayer applications	**"MANDATORY SPRAY DRIFT MANAGEMENT** **Boom-less Ground Applications:** • Applicators are required to use a Medium or coarser droplet size (ASABE S572.1) for all applications. • Do not apply when wind speeds exceed 15 miles per hour at the application site. • Do not apply during temperature inversions."	Directions for Use, in a box titled "Mandatory Spray Drift Management" under the heading "Boom-less Applications"
Advisory Spray Drift Management Language for all products delivered via liquid spray applications	**"SPRAY DRIFT ADVISORIES** THE APPLICATOR IS RESPONSIBLE FOR AVOIDING OFF-SITE SPRAY DRIFT. BE AWARE OF NEARBY NON-TARGET SITES AND ENVIRONMENTAL CONDITIONS. **IMPORTANCE OF DROPLET SIZE** An effective way to reduce spray drift is to apply large droplets. Use the largest droplets that provide target pest control. While applying larger droplets will reduce spray drift, the potential for drift will be greater if applications are made improperly or under unfavorable environmental conditions. **Controlling Droplet Size – Ground Boom** ***(note to registrants:*** *remove if ground boom is prohibited on product labels)*	Directions for Use, just below the Spray Drift box, under the heading "Spray Drift Advisories"

Description	Proposed Label Language for Acetamiprid Products	Placement on Label
	• Volume - Increasing the spray volume so that larger droplets are produced will reduce spray drift. Use the highest practical spray volume for the application. If a greater spray volume is needed, consider using a nozzle with a higher flow rate. • Pressure - Use the lowest spray pressure recommended for the nozzle to produce the target spray volume and droplet size. • Spray Nozzle - Use a spray nozzle that is designed for the intended application. Consider using nozzles designed to reduce drift. **Controlling Droplet Size – Aircraft** ***(note to registrants:*** *remove if aerial application is prohibited on product labels)* • Adjust Nozzles - Follow nozzle manufacturers recommendations for setting up nozzles. Generally, to reduce fine droplets, nozzles should be oriented parallel with the airflow in flight. **BOOM HEIGHT – Ground Boom** ***(note to registrants:*** *remove if ground boom is prohibited on product labels)* For ground equipment, the boom should remain level with the crop and have minimal bounce. **RELEASE HEIGHT - Aircraft** ***(note to registrants:*** *remove if aerial application is prohibited on product labels)* Higher release heights increase the potential for spray drift. **SHIELDED SPRAYERS** Shielding the boom or individual nozzles can reduce spray drift. Consider using shielded sprayers. Verify that the shields are not interfering with the uniform deposition of the spray on the target area. **TEMPERATURE AND HUMIDITY** When making applications in hot and dry conditions, use larger droplets to reduce effects of evaporation. **TEMPERATURE INVERSIONS** Drift potential is high during a temperature inversion. Temperature inversions are characterized by increasing temperature with altitude and are common on nights with limited cloud cover and light to no wind. The presence of an inversion can be indicated by ground fog or by the movement of smoke from a ground source or an aircraft smoke generator. Smoke that layers and moves laterally in a concentrated cloud (under low wind conditions) indicates an inversion, while smoke that moves upward and rapidly dissipates indicates good vertical air mixing. Avoid applications during temperature inversions. **WIND** Drift potential generally increases with wind speed. AVOID APPLICATIONS DURING GUSTY WIND CONDITIONS. Applicators need to be familiar with local wind patterns and terrain that could affect spray drift."	

Description	Proposed Label Language for Acetamiprid Products	Placement on Label
Advisory Spray Drift Management Language for products that are applied as liquids and allow boom-less ground sprayer applications	**"SPRAY DRIFT ADVISORIES** **<u>Boom-less Ground Applications:</u>** Setting nozzles at the lowest effective height will help to reduce the potential for spray drift."	Directions for Use, just below the Spray Drift box, under the heading "Spray Drift Advisories"
Advisory Spray Drift Management Language for all products that allow liquid applications with handheld technologies	**"SPRAY DRIFT ADVISORIES** **<u>Handheld Technology Applications:</u>** • Take precautions to minimize spray drift."	Directions for Use, just below the Spray Drift box, under the heading "Spray Drift Advisories"
Buffer zones to Water Bodies	Ground Application • "Do not apply by ground within 25 feet of aquatic habitats (such as, but not limited to, lakes, reservoirs, rivers, streams, marshes, ponds, estuaries, and commercial fish ponds)." **Aerial Application** • "Do not apply by air within 150 feet of aquatic habitats (such as, but not limited to, lakes, reservoirs, rivers, streams, marshes, ponds, estuaries, and commercial fish ponds)."	Directions for use
Seed handling language for products that allow seed treatment	Add the following statements to labels to clean up spills, dispose of excess seed, and to avoid contamination of water bodies: • "Cover or collect treated seeds spilled during loading and planting in areas (such as in row ends)." • "Dispose of all excess treated seed by burying seed away from bodies of water." • "Do not contaminate bodies of water when disposing of planting equipment wash water."	Directions for use

Appendix C: Endangered Species Assessment

In 2013, the EPA, along with the Fish and Wildlife Service (FWS), the National Marine Fisheries Service (NMFS), and the United States Department of Agriculture (USDA) released a summary of their joint Interim Approaches for assessing risks to endangered and threatened (listed) species from pesticides. These Interim Approaches were developed jointly by the agencies in response to the National Academy of Sciences' (NAS) recommendations that discussed specific scientific and technical issues related to the development of pesticide risk assessments conducted on federally threatened and endangered species.

Since that time, EPA has conducted biological evaluations (BEs) on three pilot chemicals representing the first nationwide pesticide consultations. These initial consultations were pilots and were envisioned to be the start of an iterative process. The agencies are continuing to work to improve the consultation process. For example, advancements to the initial pilot interim methods have been proposed based on experience conducting the first three pilot BEs. Public input on those proposed revisions is currently being considered.

Also, a provision in the December 2018 Farm Bill included the establishment of a FIFRA Interagency Working Group to provide recommendations for improving the consultation process required under section 7 of the Endangered Species Act for pesticide registration and Registration Review and to increase opportunities for stakeholder input. This group includes representation from EPA, NMFS, FWS, USDA, and the Council on Environmental Quality (CEQ). Given this new law and that the first nationwide pesticide consultations were envisioned as pilots, the agencies are continuing to work collaboratively as consistent with the congressional intent of this new statutory provision. EPA has been tasked with a lead role on this group, and EPA hosted the first Principals Working Group meeting on June 6, 2019.

Given that the agencies are continuing to develop and work toward implementation of approaches to assess the potential risks of pesticides to listed species and their designated critical habitat, the ecological risk assessment supporting this PID for acetamiprid does not contain a complete ESA analysis that includes effects determinations for specific listed species or designated critical habitat. Although the EPA has not yet completed effects determinations for specific species or habitats, for this PID, the EPA's evaluation assumed, for all taxa of non-target wildlife and plants, that listed species and designated critical habitats may be present in the vicinity of the application of acetamiprid. This will allow the EPA to focus its future evaluations on the types of species where the potential for effects exists once the scientific methods being developed by the agencies have been fully vetted. Once that occurs, these methods will be applied to subsequent analyses for acetamiprid as part of completing this registration review.

Appendix D: Endocrine Disruptor Screening Program

As required by FIFRA and FFDCA, EPA reviews numerous studies to assess potential adverse outcomes from exposure to chemicals. Collectively, these studies include acute, sub-chronic and chronic toxicity, including assessments of carcinogenicity, neurotoxicity, developmental, reproductive, and general or systemic toxicity. These studies include endpoints which may be susceptible to endocrine influence, including effects on endocrine target organ histopathology, organ weights, estrus cyclicity, sexual maturation, fertility, pregnancy rates, reproductive loss, and sex ratios in offspring. For ecological hazard assessments, EPA evaluates acute tests and chronic studies that assess growth, developmental and reproductive effects in different taxonomic groups. As part of its most recent registration decision for acetamiprid, EPA reviewed these data and selected the most sensitive endpoints for relevant risk assessment scenarios from the existing hazard database. However, as required by FFDCA section 408(p), acetamiprid is subject to the endocrine screening part of the Endocrine Disruptor Screening Program (EDSP).

EPA has developed the EDSP to determine whether certain substances (including pesticide active and other ingredients) may have an effect in humans or wildlife similar to an effect produced by a "naturally occurring estrogen, or other such endocrine effects as the Administrator may designate." The EDSP employs a two-tiered approach to making the statutorily required determinations. Tier 1 consists of a battery of 11 screening assays to identify the potential of a chemical substance to interact with the estrogen, androgen, or thyroid (E, A, or T) hormonal systems. Chemicals that go through Tier 1 screening and are found to have the potential to interact with E, A, or T hormonal systems will proceed to the next stage of the EDSP where EPA will determine which, if any, of the Tier 2 tests are necessary based on the available data. Tier 2 testing is designed to identify any adverse endocrine-related effects caused by the substance, and establish a dose-response relationship between the dose and the E, A, or T effect.

Under FFDCA section 408(p), the agency must screen all pesticide chemicals. Between October 2009 and February 2010, EPA issued test orders/data call-ins for the first group of 67 chemicals, which contains 58 pesticide active ingredients and 9 inert ingredients. The agency has reviewed all of the assay data received for the List 1 chemicals and the conclusions of those reviews are available in the chemical-specific public dockets. A second list of chemicals identified for EDSP screening was published on June 14, 2013[4] and includes some pesticides scheduled for Registration Review and chemicals found in water. Neither of these lists should be construed as a list of known or likely endocrine disruptors. Acetamiprid is not on either list. For further information on the status of the EDSP, the policies and procedures, the lists of chemicals, future lists, the test guidelines and the Tier 1 screening battery, please visit our website.[5]

[4] See http://www.regulations.gov/#!documentDetail;D=EPA-HQ-OPPT-2009-0477-0074 for the final second list of chemicals.
[5] http://www.epa.gov/endo/

In this proposed interim decision, EPA is making no human health or environmental safety findings associated with the EDSP screening of acetamiprid. Before completing this registration review, the agency will make an EDSP FFDCA section 408(p) determination.

9b

Clothianidin and Thiamethoxam

Proposed Interim Registration Review Decision
Case Numbers 7620 and 7614

January 2020

Approved by: _____

Elissa Reaves, Ph.D.
Acting Director
Pesticide Re-evaluation Division

Date: 1-22-2020

Table of Contents

I. INTRODUCTION

This document is the Environmental Protection Agency's (EPA or the agency) Proposed Interim Registration Review Decision (PID) for clothianidin and thiamethoxam (PC Codes 044309 and 060109, case numbers 7620 and 7614, respectively), and is being issued pursuant to 40 CFR §§ 155.56 and 155.58. Clothianidin is a registered pesticide active ingredient but is also a major metabolite and degradate of thiamethoxam. Therefore, the ecological risks for these two chemicals were assessed together and both are included in this combined PID. A registration review decision is the agency's determination whether a pesticide continues to meet, or does not meet, the standard for registration in the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA). The agency may issue, when it determines it to be appropriate, an interim registration review decision before completing a registration review. Among other things, the interim registration review decision may require new risk mitigation measures, impose interim risk mitigation measures, identify data or information required to complete the review, and include schedules for submitting the required data, conducting the new risk assessment and completing the registration review. Additional information on clothianidin and thiamethoxam, can be found in the EPA's public docket (EPA-HQ-OPP-2011-0865 and EPA-HQ-OPP-2011-0581) at www.regulations.gov.

FIFRA, as amended by the Food Quality Protection Act (FQPA) of 1996, mandates the continuous review of existing pesticides. All pesticides distributed or sold in the United States must be registered by the EPA based on scientific data showing that they will not cause unreasonable risks to human health or to the environment when used as directed on product labeling. The registration review program is intended to make sure that, as the ability to assess and reduce risk evolves and as policies and practices change, all registered pesticides continue to meet the statutory standard of no unreasonable adverse effects. Changes in science, public policy, and pesticide use practices will occur over time. Through the registration review program, the agency periodically re-evaluates pesticides to make sure that as these changes occur, products in the marketplace can continue to be used safely. Information on this program is provided at http://www.epa.gov/pesticide-reevaluation. In 2006, the agency implemented the registration review program pursuant to FIFRA § 3(g) and will review each registered pesticide every 15 years to determine whether it continues to meet the FIFRA standard for registration.

The EPA is issuing a PID for clothianidin and thiamethoxam so that it can (1) move forward with aspects of the registration review that are complete and (2) implement interim risk mitigation (see Appendices A and B). The agency is currently working with the U.S. Fish and Wildlife Service and the National Marine Fisheries Service (together, the Services) to develop methodologies for conducting national threatened and endangered (listed) species assessments for pesticides in accordance with the Endangered Species Act (ESA) § 7. Therefore, although the EPA has not yet fully evaluated risks to listed species, the agency will complete its listed species assessment and any necessary consultation with the Services for clothianidin and thiamethoxam prior to completing the clothianidin and thiamethoxam registration review. Likewise, the agency will complete endocrine screening for clothianidin and thiamethoxam, pursuant to the Federal Food, Drug, and Cosmetic Act (FFDCA) § 408(p), before completing registration review. See Appendices C and D, respectively, for additional information on the listed species assessment and the endocrine screening for the clothianidin and thiamethoxam registration review.

Clothianidin and thiamethoxam are systemic, neonicotinoid insecticides with unique spectrums of activity that act on the nicotinic acetylcholine receptors (nAChRs) of the central nervous system of insects. They are in the N-nitroguanidine group of neonicotinoids, in subclass 4A of the Insecticide Resistance Action Committee (IRAC) mode of action classification scheme. The target pests for clothianidin and thiamethoxam products include a diverse set of insect pests, such as aphids, whiteflies, thrips, caterpillars, beetles, flies, stinkbugs, and others. Clothianidin and thiamethoxam products are registered for use on a wide variety of crops (*e.g.* corn, cotton, soybeans, root and tuber vegetables, pome fruit, stone fruit, berries, tree nuts, legumes, cereal grains, and oilseed crops and herbs). They are also registered on non-agricultural use sites such as turf, poultry houses, and ornamental plants. Products containing clothianidin and thiamethoxam can be applied via methods such as aerial, ground foliar sprays, soil treatments, chemigation and as a seed treatment. There are currently 45 active registered Section 3 end-use products containing clothianidin and 77 containing thiamethoxam. Products containing clothianidin were first registered in 2003 and products containing thiamethoxam were first registered in 1999, and therefore, neither were subject to reregistration.

This document is organized into five sections: the *Introduction*, which includes this summary and a summary of public comments and the EPA's responses; *Use and Usage*, which describes how and why clothianidin and thiamethoxam are used and summarizes data on their respective uses; *Scientific Assessments*, which summarizes the EPA's risks, updates or revisions to previous risk assessments, and provides broader context with a discussion of risk characterization; *Benefits Assessments*, which describes the utility of the chemical along with any potential impacts of mitigation; the *Proposed Interim Registration Review Decision*, which describes the mitigation measures proposed to address risks of concern and the regulatory rationale for the EPA's PID; and, lastly, the *Next Steps and Timeline* for completion of this registration review.

While this PID focuses on the specific risks, benefits, and mitigation measures for clothianidin and thiamethoxam, the EPA is issuing PIDs for all of the currently registered N-nitroguanidine neonicotinoid pesticides concurrently to ensure consistency across the class. The PIDs and supporting documents for the other N-nitroguanidine neonicotinoid pesticides (i.e., dinotefuran and imidacloprid) are available in the public dockets established for these cases.

A. Summary of Clothianidin and Thiamethoxam Registration Review

Pursuant to 40 CFR § 155.50, the EPA formally initiated registration review for clothianidin and thiamethoxam with the opening of a registration review docket for each of these cases. The following summary highlights the docket opening and other significant milestones that have occurred thus far during the registration review of clothianidin and thiamethoxam. The registration review docket ID for clothianidin is EPA-HQ-OPP-2011-0865 and the registration review docket ID for thiamethoxam is EPA-HQ-OPP-2011-0581.

- December 2011 - The clothianidin and thiamethoxam Preliminary Work Plans (PWPs) and supporting documents were posted to the docket for a 60-day public comment period, which was extended for 7 days. The following is a list of those documents:
    - *Clothianidin Summary Document Registration Review*

  - *Thiamethoxam Summary Document Registration Review*
  - *Clothianidin. Human Health Assessment Scoping Document in Support of Registration Review*
  - *Thiamethoxam. Human Health Assessment Scoping Document in Support of Registration Review*
  - *Thiamethoxam Registration Review: Human Health Scoping Information Regarding the Wood Preservative Uses (Post Peer Review Update)*
  - *Registration Review: Problem Formulation for the Environmental Fate and Ecological Risk, Endangered Species, and Drinking Water Exposure Assessments of Clothianidin*,
  - *Registration Review: Problem Formulation for the Environmental Fate and Ecological Risk, Endangered Species, and Drinking Water Exposure Assessments of Thiamethoxam*
  - *Problem Formulation for the Environmental Fate and Ecological Risk, Endangered Species, and Drinking Water Exposure Assessments in Support of the Registration Review of Thiamethoxam Antimicrobial Uses*

- June 2012 - The Final Work Plans (FWPs) for clothianidin and thiamethoxam (*Clothianidin Final Work Plan for Registration Review* and *Thiamethoxam Final Work Plan for Registration Review*) were issued. During the 60-day public comment period for the clothianidin and thiamethoxam PWPs, the agency received 175 and 14 public comments, respectively. The clothianidin and thiamethoxam FWPs included corrections to the list of data requirements needed to conduct a risk assessment to support a proposed registration review decision pursuant to 40 CFR § 155.53(b).

- July 2012 - The agency announced the availability of a petition received on March 20, 2012 entitled *Emergency Petition to Suspend: Clothianidin* from the Center for Food Safety (CFS) acting on behalf of 27 beekeeper and honey producers, and 4 environmental and consumer organizations. The petition and the agency's partial response to the petition were posted on July 27, 2012 in a new docket (EPA-HQ-OPP-2012-0334) and opened a 60-day public comment period that closed on September 25, 2012. The petition's remaining claims, as well as the 1,363 comments posted in response to the petition, will be addressed separately from this PID.

- March 2013 - Generic Data Call-Ins (GDCIs) for clothianidin (GDCI-044309-1185) and thiamethoxam (GDCI-060109-1309) were issued for data needed to conduct the registration review risk assessments. For both clothianidin and thiamethoxam, all data requirements have either been satisfied or waived; there are no outstanding GDCI requirements.

- January 2017 - The agency announced the availability of the *Preliminary Bee Risk Assessment to Support the Registration Review of Clothianidin and Thiamethoxam* for a 60-day public comment period.

- December 2017 – The agency announced the availability of the following assessments to support Registration Review for a 60-day public comment period:

  - *Clothianidin. Draft Human Health Risk Assessment in Support of Registration Review.* September 7, 2017.
  - *Thiamethoxam. Draft Human Health Risk Assessment in Support of Registration Review.* December 5, 2017.
  - *Clothianidin. Occupational and Residential Exposure Assessment for Registration Review.* September 7, 2017.
  - *Clothianidin – Drinking Water Exposure Assessment for Registration Review of All Registered Uses.* July 12, 2017.
  - *Clothianidin Acute and Chronic Aggregate Dietary (Food and Drinking Water) Exposure and Risk Assessments for Registration Review.* August 31, 2017.
  - *Thiamethoxam: Tier II Drinking Water Exposure Assessment to Support Registration Review.* July 13, 2017.
  - *Thiamethoxam. Acute and Chronic Aggregate Dietary (Food and Drinking Water) Exposure Assessments for Registration Review.* August 31, 2017.
  - *Clothianidin – Transmittal of the Preliminary Aquatic and Non-Pollinator Terrestrial Risk Assessment to Support Registration Review*. November 27, 2017.
  - *Thiamethoxam – Transmittal of the Preliminary Aquatic and Non-Pollinator Terrestrial Risk Assessment to Support Registration Review*. November 29, 2017.
  - *Biological and Economic Analysis Division (BEAD) Response to Public Comments Submitted in Response to BEAD's Assessment entitled "Benefits of Neonicotinoid Seed Treatments to Soybean Production."* December 5, 2017.
  - *Benefits of Neonicotinoid Insecticide Use in Pre-Bloom and Bloom Periods of Cotton*. November 21, 2017.
  - *Benefits of Neonicotinoid Insecticide Use in Pre-Bloom and Bloom Periods of Citrus*. November 21, 2017.

- January 2020 – The agency is now announcing the availability of the PID and the *Final Bee Risk Assessment to Support the Registration Review of Clothianidin and Thiamethoxam* in the clothianidin and thiamethoxam dockets for a 60-day public comment period. Along with the PID, the following documents are also being posted to the clothianidin and/or thiamethoxam dockets:
  - *Assessment of Usage, Benefits and Impacts of Potential Mitigation in Stone Fruit Production for Four Nitroguanidine Neonicotinoid Insecticides (Clothianidin, Dinotefuran, Imidacloprid, and Thiamethoxam).* December 6, 2019.
  - *Biological and Economic Analysis Division's (BEAD) Response to Comments on the Preliminary Risk Assessments and Benefit Assessments for Citrus, Cotton, Soybean Seed Treatment, and Other Crops Not Assessed for Neonicotinoid Insecticides.* December 23, 2019.
  - *Benefits and Impacts of Potential Mitigation for Neonicotinoid Seed Treatments on Small Grains, Vegetables, and Sugarbeet Crops.* August 30, 2018.
  - *Benefits of Neonicotinoid Insecticide Use and Impacts of Potential Risk Mitigation in Vegetables, Legumes, Tree Nuts, Herbs, and Tropical and Subtropical Fruit.* December 20, 2019.

- *Benefits of Neonicotinoid Insecticide Use in Berries (Strawberry, Caneberry, Cranberry, and Blueberry) and Impacts of Potential Mitigation.* December 6, 2019.
- *Benefits of Neonicotinoid Insecticide Use in Cucurbit Production and Impacts of Potential Risk Mitigation.* December 11, 2019.
- *Benefits of Neonicotinoid Insecticides Usage in Grapes and Impacts of Potential Mitigation.* October 23, 2019.
- *Clothianidin (044309) Screening Level Usage Analysis (SLUA).* July 8, 2019.
- *Estimate of Area Treated per Day for Insecticides in Poultry Houses and Amount of Clothianidin Handled per Day When Using a Mechanically Pressurized Handgun.* July 9, 2019.
- *Review of "The Value of Neonicotinoids in North American Agriculture" prepared by AgInfomatics, LLC, for Bayer CropScience L.P., Mitsui Chemicals Agro, Inc., Syngenta Crop Protection, LLC, and Valent U.S.A. LLC.* November 4, 2019.
- *Review of "The Value of Neonicotinoids in Turf and Ornamentals" prepared by AgInfomatics, LLC for Bayer CropScience, Mitsui, Syngenta, and Valent.* December 11, 2019.
- *Thiamethoxam (060109) Screening Level Usage Analysis (SLUA).* July 25, 2019.
- *Usage and Benefits of Neonicotinoid Insecticides in Rice and Response to Comments.* April 22, 2019.
- *Usage, Pest Management Benefits, and Possible Impacts of the Potential Mitigations of the Use of Four Nitroguanidine Neonicotinoids in Pome Fruits (Apple, Pear).* December 11, 2019.
- *Clothianidin. Response to Comments on HED's Draft Human Health Risk Assessment in Support of Registration Review, and an Updated Poultry House Assessment.* October 30, 2019.
- *Thiamethoxam. Revised Response to Comments on the Thiamethoxam Human Health Draft Risk Assessments for Registration Review.* January 14, 2020.
- *EFED Response to Public Comments Common to the Preliminary Pollinator and Preliminary Non-Pollinator Registration Review Risk Assessments Across the Four Neonicotinoid Pesticides (Imidacloprid, Thiamethoxam, Clothianidin, and Dinotefuran).* January 6, 2020.
- *Comparative analysis of Aquatic Invertebrate Risk Quotients generated for neonicotinoids using Raby et al. (2018) toxicity data.* January 7, 2020.
- *Clothianidin: Non-pollinator Addendum and Chemical-specific Response to Comments Document for Public Comments Received on the Registration Review Preliminary Pollinator and Preliminary Non-pollinator Risk Assessments.* January 8, 2020.
- *Thiamethoxam: Addendum to the Non-Pollinator Draft Risk Assessment (DRA) and Response to Public Comments Received on the Bee and Non-Pollinator DRAs*. January 6, 2020.
- *Attachment 1 to the Neonicotinoid Final Bee Risk Assessments: Tier II Method for Assessing Combined Nectar and Pollen Exposure to Honey Bee Colonies.* January 14, 2020.

- *Attachment 2 to the Neonicotinoid Final Bee Risk Assessments: Residue Bridging Analysis of Foliar and Soil Agricultural Uses of Neonicotinoids.* January 14, 2020.
- *Attachment 3 to the Neonicotinoid Final Bee Risk Assessments: Residue Bridging Analysis for Foliar and Soil Non-Agricultural Uses of Neonicotinoids.* January 14, 2020.
- *Attachment 4 to the Neonicotinoid Final Bee Risk Assessments: Residue Bridging Analysis for Seed Treatment Uses of Neonicotinoids.* January 14, 2020.
- *NOTE TO READER: Documents Supporting the Registration Review of Clothianidin*. January 17, 2020.
- *NOTE TO READER: Documents Supporting the Registration Review of Thiamethoxam*. January 17, 2020.

B. Summary of Public Comments on the Draft Risk Assessments and Agency Responses

As specified in section I.A., the clothianidin and thiamethoxam risk assessment documents were released in conjunction with two separate comment periods in 2017. The combined preliminary bee risk assessment for clothianidin and thiamethoxam was published on May 25, 2017 for a public comment period ending on July 24, 2017. The draft human health and non-pollinator ecological risk assessments for clothianidin and thiamethoxam, as well as various supporting benefits-related registration review documents, published on December 21, 2017 for a 60-day public comment period, which was extended by an additional 60 days, totaling 120 days in length and ending on April 21, 2018.

Across these two comment periods, the agency received a total of 996 distinct public comments. In addition, the comments included approximately 400,000 mass mailer campaign submissions. Comments were submitted by various individuals, organizations, and companies. Comments of a broader regulatory nature, and the agency's responses to those comments, are provided in the memorandum *Response from OPP's Pesticide Re-evaluation Division to Comments on the Draft Risk Assessments of the 4 Nitroguanidine-substituted Neonicotinoid Insecticides*. Responses to comments on the topics of neonicotinoid benefits, ecological effects and human health effects are captured in the following documents:

- *Biological and Economic Analysis Division's (BEAD) Response to Comments on the Preliminary Risk Assessments and Benefit Assessments for Citrus, Cotton, Soybean Seed Treatment, and Other Crops Not Assessed for Neonicotinoid Insecticides.* December 23, 2019.
- *Clothianidin. Response to Comments on HED's Draft Human Health Risk Assessment in Support of Registration Review, and an Updated Poultry House Assessment.* October 30, 2019.
- *Thiamethoxam. Revised Response to Comments on the Thiamethoxam Human Health Draft Risk Assessments for Registration Review.* January 14, 2020.

- *EFED Response to Public Comments Common to the Preliminary Pollinator and Preliminary Non-Pollinator Registration Review Risk Assessments Across the Four Neonicotinoid Pesticides (Imidacloprid, Thiamethoxam, Clothianidin, and Dinotefuran).* January 6, 2020.
- *Clothianidin: Non-pollinator Addendum and Chemical-specific Response to Comments Document for Public Comments Received on the Registration Review Preliminary Pollinator and Preliminary Non-pollinator Risk Assessments.* January 8, 2020.
- *Thiamethoxam: Addendum to the Non-Pollinator Draft Risk Assessment (DRA) and Response to Public Comments Received on the Bee and Non-Pollinator DRAs*. January 6, 2020.

Additionally, the agency received comments on the preliminary risk assessments that resulted in revised risk assessments and/or adjustments to EPA's risk management approach. These comments are captured below, along with the agency's responses to those comments. The agency thanks all commenters for their comments.

Comments Submitted by Syngenta Regarding the Thiamethoxam Draft Human Health Risk Assessment in EPA-HQ-OPP-2011-0581-0227

Comment: Syngenta noted that the Cruiser 5FS (100-941) label currently includes the following use restriction, 'Do not apply more than 38 gallons of Cruiser 5FS per 8-hour day for seed treatments utilizing an open system,' and requested the EPA to include this restriction in the risk assessment for the liquid product, open system seed treatment scenarios.

EPA Response: The agency agrees that the seed treatment exposure calculations using application rates from EPA Reg. # 100-941 should also include the gallons per day restriction noted on the label. However, the agency identified labels (*e.g.,* EPA Reg. # 100-1184) that did not include a gallons per day restriction. Additionally, the agency determined risks of concern for seed crop uses (specifically field, pop and sweet corn) identified on these labels, even when the maximum personal protection equipment (PPE; double-layer clothing and gloves and a respirator) were considered. As a result, the agency is proposing a requirement that commercial facilities perform thiamethoxam corn seed treatments only in closed loading systems. For more information, please refer to Section III.A.1 and IV.A.3 of this PID, as well as *Thiamethoxam. Revised Response to Public Comments on the Thiamethoxam Human Health Draft Risk Assessment for Registration Review,* available in the thiamethoxam docket.

Comment: Syngenta noted that the agency's occupational risk assessment for onion seed handlers used an onion seed throughput rate of 5,000 lb. seed treated/day. This value is inconsistent with EPA's SOP 15.1, where the onion seed throughput rate is defined as 3,000 lb. seed treated/day. The SOP value is also consistent with throughput rate of 3,000 lb. seed treated/day EPA used for onions in the *Clothianidin. Draft Human Health Risk Assessment in Support of Registration Review*. Based on this finding, Syngenta asked the agency to refine the thiamethoxam assessment to align with EPA's SOP and the clothianidin assessment.

EPA Response: The agency agrees that the value of 3,000 lbs. seed treated/day should have been used for the assessment of onion seed. After refining the assessment, the agency determined that there are no risks of concern for activities associated with treating onion seed (margin of errors (MOEs) range from 130 to 950; LOC = 100).

Comment: Syngenta noted that the seeding rate of 4 lb. seed/A for bulb onions should have been used in the risk assessment.

EPA Response: The agency agrees that the seeding rate of 4 lbs. seed/A, which results in 320 lbs. seed planted/day, should have been used for the assessment of onion seed. After refining the model, the agency determined that there are no risks of concern for activities associated with planting onion seed.

Comment: Syngenta noted the Cruiser 5FS (100-941) and Cruiser Maxx Rice (100-1369) labels currently include the following use restriction, 'Do not exceed 120 lb. seed per acre,' and requested this maximum rate be used in the agency's risk assessment.

EPA Response: The agency agrees that the identified labels include a restriction of 120 lbs. seed/A for rice. After modifying the rate used, based on this restriction, the agency determined that there are no risks of concern for activities associated with rice seed.

Comment Submitted by ELANCO Regarding Thiamethoxam's Draft Human Health Risk Assessment (EPA-HQ-OPP-2011-0581-0233)

Comment: ELANCO expressed concerns over an occupational exposure scenario in the draft human health risk assessment for thiamethoxam. The agency modeled the mixer/loader/applicator exposure scenario for dry flowable formulations via mechanically pressurized handgun (for poultry/livestock/horse barn sites) using an assumption of 1,000 gallons of product application volume per day. ELANCO did not believe the assumption of 1,000 gallons/day of product applied by mechanically pressurized handgun for these sites reflects actual use practices and asked the agency to refine this assessment.

EPA Response: The agency agrees that since the product label specifies spot treatment of poultry houses only, the assumption of 1,000 gallons/day is an overestimate for the mechanically-pressurized handgun scenario. The agency updated the area treatment assumptions for poultry houses and determined that 12,300 sq. ft. for a perimeter/feed line treatment of one house is appropriate. The agency also determined that the maximum number of poultry houses treated by one worker per day is 10, which resulted in a maximum area of 123,000 sq. ft. feedline/perimeter treated per day.

Using these refined assumptions for both clothianidin and thiamethoxam, the agency determined that the risk estimates changed substantially. For clothianidin, there are no longer risks of concern for poultry house treatments (MOEs range from 370 to 69,000), though there are still risks of concern for other livestock housing scenarios. For thiamethoxam, there is no risk of concern to mixers/loaders/applicators of dry flowable (DF) formulations using a mechanically-pressurized handgun in poultry houses with PPE (single-layer clothing and gloves, and a

respirator; MOE = 160). However, the refined assessments identified new exceedances for mixers/loaders/applicators of DF formulations of thiamethoxam using a backpack sprayer, even if the maximum PPE is considered (*e.g.,* double-layer of clothing and gloves, and a respirator; MOE = 75). For more detailed information, refer to Section III.A.1 of this PID, and *Estimate of Area Treated per Day for Insecticides in Poultry Houses and Amount of Clothianidin Handled per Day When Using a Mechanically Pressurized Handgun*; *Thiamethoxam. Revised Response to Public Comments on the Thiamethoxam Human Health Draft Risk Assessment for Registration Review*; and *Clothianidin. Response to Comments on HED's Draft Human Health Risk Assessment in Support of Registration Review, and an Updated Poultry House Assessment*; available in the dockets.

Comment Submitted by the Massachusetts Office of the Attorney General (EPA-HQ-OPP-2011-0920-0725):

Comment: The Massachusetts Office of the Attorney General (MA-OAG) expressed concerns regarding risks to pollinators from residential homeowner applications of neonicotinoids on gardens, lawns and ornamentals. MA-OAG also highlighted that many retailers have voluntarily committed to phasing out the sale of plants and other products containing neonicotinoid insecticides. MA-OAG suggests that the agency severely curtail the use of neonicotinoids.

EPA Response: The agency recognizes the potential risks to pollinators from homeowner applications of neonicotinoids on gardens, lawns and ornamentals. In response, the agency is proposing to require advisory label language that states, "Intended for use by professional applicators". Please refer to Section IV.A of this PID for additional details regarding the proposed label changes.

Comments Submitted Concerning the Preliminary Pollinator Risk Assessments:
The agency also received a number of comments regarding the preliminary pollinator risk assessments, including those concerning the scientific methodology or rationale in these assessments. These comments were considered in the preparation of the final pollinator risk assessments. The agency's responses can be found below. These comments were received from Academia, Beekeepers (BK), Beyond Pesticides (BP), the Center for Biological Diversity (CBD), California Citrus Mutual (CCM), the Center for Food Safety (CFS), CropLife America (CLA), Dancing Bee Gardens (DBG), GreenCAPE (GC), the National Corn Growers Association (NCGA), the National Cotton Council (NCC), the Natural Resources Defense Council (NRDC), the National Wildlife Federation (NWF), the Pesticide Policy Coalition (PPC), the Pollinator Stewardship Council (PSC), the San Francisco Estuary Institute (SFEI), the University of California – Riverside (UCR), the University of California – San Diego (UCSD), the United States Department of Agriculture (USDA), and Xerces Society for Invertebrate Conservation (XSIC).

For a more comprehensive account of the comments related to the preliminary pollinator risk assessments, including those summarized in this PID, refer to *EFED Response to Public Comments Common to the Preliminary Pollinator and Preliminary Non-Pollinator Registration Review Risk Assessments Across the Four Neonicotinoid Pesticides (Imidacloprid, Thiamethoxam, Clothianidin, and Dinotefuran), Clothianidin Non-pollinator Addendum and*

Chemical-specific Response to Comments Document for Public Comments Received on the Registration Review Preliminary Pollinator and Preliminary Non-pollinator Risk Assessments and *Thiamethoxam: Addendum to the Non-Pollinator Draft Risk Assessment (DRA) and Response to Public Comments Received on the Bee and Non-Pollinator DRAs*, which are available in the public dockets.

Summary of Comments (BK, BP, CBD, CCM, CFS, DBG, GC, NCC, NRDC, NWF, SFEI, UCR, UCSD): Several commenters asked the agency to refer to open literature studies for data and/or methodologies to be incorporated into the EPA's pollinator assessment. These studies covered a range of considerations including, but not limited to, assessing risk to additional pollinator species (*e.g.* non-*Apis*), sub-lethal effects, and toxicity endpoints.

EPA Response: EPA relies on the best available science at the time of conducting its assessments. In the risk assessment process, numerous studies are considered and evaluated for inclusion in the assessments based on the agency's open literature guidance. Open literature studies that meet the guidance criteria are then selected for inclusion in the risk assessments. The selected studies are then weighted based on the scientific evaluation. EPA acknowledges the growing body of studies/data/methodologies and has considered additional studies in the final pollinator assessments that were brought to the agency's attention as comments received on the preliminary pollinator assessments.

Summary of Comments (Academia, BK, CBD, CFS, CLA, DBG, NRDC, NWF, PSC, USDA, XSIC): Several commenters suggested the Tier II colony feeding studies were inadequate, claiming design or conduct flaws (*e.g.* lack of overwintering, removal of colonies due to supersedure, failure to consider genetic variability).

EPA Response: The agency reviewed the study protocols prior to test initiation and determined that the study designs were appropriate for generating data for use in a regulatory risk assessment. While EPA reviewed protocols and determined that the studies were appropriate for risk assessment, the agency acknowledges that there were some issues with the initial studies. Therefore, EPA incorporated revised studies into the final pollinator assessments. These new studies all included successful overwintering control hive components such as colony strength, number of broods, food stores, etc., however, the agency notes that the treatment-related effects measured after overwintering were equal to or less sensitive than those measured prior to overwintering; since endpoints were based on effects observed during the season of the application, they were also protective of effects that may occur after overwintering. Data evaluation records for these studies are publicly available (regulations.gov; EPA-HQ-OPP-2011-0581-0040 and EPA-HQ-OPP-2011-0865-0179) and list the perceived strengths and limitations of these studies.

Summary of Comments: Several commenters expressed concerns that the agency did not implement a consistent methodology for the four nitroguanidine-substituted neonicotinoids in the preliminary pollinator risk assessments.

EPA Response: The initial registrations for the four nitroguanidine-substituted neonicotinoids were not concurrent, and, as a result, the registration review schedule for these chemicals were

not concurrent. As such, the preparation of the initial risk assessments for these four chemicals occurred at different times, where imidacloprid was assessed prior to the remaining three nitroguanidine-substituted neonicotinoids. However, since the release of the preliminary pollinator assessments, the agency has made a programmatic decision to align the registration review schedules for all four nitroguanidine-substituted neonicotinoids. Consequently, the final pollinator assessments are now aligned in methodology and consistency to the greatest extent possible.

Summary of Comments: Several comments were submitted on the bee bread method to evaluate pollen exposure, specifically that an unvetted method should not be used (NCC, CBD, PPC); the bee bread method overestimates exposures to pollen in the hive, and that these estimates should be converted to nectar equivalents that can be compared to the sucrose no observed adverse effect concentration (NOAEC; CLA, NCGA). In addition, the USDA had several specific comments on use of the bee bread method (*e.g.*, unvetted methodology, seasonality, carbohydrate and protein tracking, foraging assumptions, etc.) to evaluate pollen exposure in the clothianidin and thiamethoxam preliminary bee risk assessments. For more detail on USDA's concerns, reference EPA-HQ-OPP-2011-0865-0220.

EPA Response: Based on the public comments received, and new data available, including new colony feeding studies with spiked pollen and a supplement of an expanded suite of available empirical residue in pollen and nectar studies, the method to evaluate the pollen route of exposure has been updated in the final pollinator risk assessments. In short, the updated approach considers exposure via residues in pollen (and nectar) on a total dietary basis by converting pollen concentrations into nectar equivalents and summing the residues from both matrices (where appropriate) to estimate a single exposure number for comparison to a sucrose-based endpoint (NOAEC). See *Attachment 1. Tier II Method for Assessing Combined Nectar and Pollen Exposure to Honey Bee Colonies,* within each chemical-specific docket for a full explanation of the revised pollen method.

Comments Submitted by Syngenta Regarding Pollen Residues Used in the Preliminary Bee Risk Assessment (EPA-HQ-OPP-2011-0581-0075):

Comment: Syngenta expressed concerns that the canola study (MRID 49819502) cited in the *Preliminary Bee Risk Assessment to Support the Registration Review of Clothianidin and Thiamethoxam* did not effectively identify the source (soil vs. treated seeds) of thiamethoxam residues in pollen. Syngenta was also concerned that the chronic EECs were based on a single sampling interval. Syngenta requested that the agency use the pollen and nectar residue data from another canola study (MRID 49775702) to refine the bee risk assessment.

EPA Response: The agency updated the seed treatment risk assessment analysis to include MRID 49775702. Please refer to the *Final Bee Risk Assessment to Support the Registration Review of Clothianidin and Thiamethoxam*, available in the clothianidin and thiamethoxam dockets.

Comments Submitted Concerning the Preliminary Non-Pollinator Risk Assessments:

The agency received numerous comments in response to the preliminary non-pollinator risk assessments conducted for the four nitroguanidine-substituted neonicotinoids, including comments concerning the scientific methodology or rationale in these assessments. These comments were considered in the preparation of the final non-pollinator risk assessments. These comments were received from the AVAAZ, the Bay Area Clean Water Agencies (BACWA), Bayer CropScience, the California Department of Pesticide Regulation (CDPR), CropLife America (CLA), the San Francisco Bay Regional Water Quality Control Board (SFBRWQCB), the Vermont Agency of Agriculture Food and Markets (VAAFM), and Xerces Society for Invertebrate Conservation (XSIC). The agency's response can be found below.

For a more comprehensive account of the comments related to the preliminary non-pollinator risk assessments and their responses, including those summarized in this PID, refer to *EFED Response to Public Comments Common to the Preliminary Pollinator and Preliminary Non-Pollinator Registration Review Risk Assessments Across the Four Neonicotinoid Pesticides (Imidacloprid, Thiamethoxam, Clothianidin, and Dinotefuran), Clothianidin Non-pollinator Addendum and Chemical-specific Response to Comments Document for Public Comments Received on the Registration Review Preliminary Pollinator and Preliminary Non-pollinator Risk Assessments* and *Thiamethoxam: Addendum to the Non-Pollinator Draft Risk Assessment (DRA) and Response to Public Comments Received on the Bee and Non-Pollinator DRAs*, which are available in the public dockets.

Summary of Comment (CDPR and VAAFM): CDPR asserted that the neonicotinoid assessments did not adequately consider the potential runoff from treated seeds planted greater than 2 cm below the soil surface as the EPA's Pesticide Water Calculator (PWC) model used in the assessment does not quantitatively estimate pesticide residues from treated seeds planted below 2 cm (EPA-HQ-OPP-2008-0844-1116). However, CDPR referenced monitoring data (Hladik *et. al.,* 2014) that found that pesticide detections in surface water can be associated with rainfall events following planting of treated seeds, suggesting a link between seed treatments and pesticide detections in surface water. It was noted, though, that this study does not identify the depth at which the seed treatments in question were planted. Additionally, VAAFM reported maximum concentrations of neonicotinoids in the streams receiving effluent from tile drains (see EPA-HQ-OPP-2008-0844-1175 for additional details). CDPR suggested employing refined future modeling efforts to include soil runoff modeling to account for subsurface flow such as tile drains commonly used in agriculture.

EPA Response: The agency recently re-evaluated its surface water modeling for seed treatments. The agency no longer models applications "at depth", which could potentially overlook pesticide residues in runoff from treated seeds planted at depths below 2 cm. Instead, the agency has elected to use the "increasing with depth" application of the PWC model, which assumes that some portion of the applied chemical will be available to runoff, even when planted at depth. These assumptions were implemented in the models included in the comparative aquatic neonicotinoid risk assessment and associated documents, which identified acute and chronic risk exceedances for aquatic invertebrates (see Section III.B.1 of this PID).

The agency is proposing label language to mitigate potential risks from runoff. The proposed label language covers treated seeds, but also includes statements for spray and foliar

applications. For a detailed description of the proposed label language please refer to Sections IV.A.7 and IV.A.8, and Appendix B.

Summary of Comments (AVAAZ, BACWA, CDPR, CLA, SFBRWQCB, XSIC): Several commenters (EPA-HQ-OPP-2008-0844-1192, EPA-HQ-OPP-2011-0865-1068, EPA-HQ-OPP-2008-0844-1116) assert that ample evidence exists in the literature to show that relatively small concentrations of neonicotinoids can trigger harmful effects; that invertebrates are harmed at levels well below the current aquatic life benchmarks, and that these benchmarks should be revised. The commenters also felt that the following studies should be considered in the assessments:

- Maloney, E. M., Morrissey, C. A., Headley, J. V., Peru, K. M., & Liber, K. (2017). Cumulative toxicity of neonicotinoid insecticide mixtures to *Chironomus dilutus* under acute exposure scenarios. *Environmental Toxicology and Chemistry*, 36(11), 3091-3101.
- Miles, J. C., Hua, J., Sepulveda, M. S., Krupke, C. H., & Hoverman, J. T. (2017). Effects of clothianidin on aquatic communities: Evaluating the impacts of lethal and sublethal exposure to neonicotinoids. *PloS One*, 12(3), e0174171.
- Raby, M., Nowierski, M., Perlov, D., Zhao, X., Hao, C., Poirier, D. G., & Sibley, P. K. (2018). Acute toxicity of 6 neonicotinoid insecticides to freshwater invertebrates. *Environmental Toxicology and Chemistry*, 37(5), 1430-1445.

Conversely, CLA (EPA-HQ-OPP-2008-0844-1562) asserted that the application of the most conservative endpoint to assess risk to all aquatic invertebrates is overly conservative and does not account for diversity of aquatic invertebrate communities.

EPA Response: The agency has considered the additional information provided from the above studies. Raby *et. al.* conducted a comparative analysis by testing the four nitroguanidine-substituted neonicotinoids on 7 aquatic invertebrate species in a controlled laboratory environment. The agency also performed a cursory review of Maloney *et. al.* and Miles *et.al.*, which report lethal concentrations (LC_{50}) similar to those reported in *Raby et. al*. Overall, the agency found the Raby *et. al.* study acceptable for quantitative use in risk assessment, however, the agency concluded that the study does not change the risk conclusions for aquatic invertebrates as described in the preliminary ecological risk assessments. For more information, refer to the *Comparative analysis of Aquatic Invertebrate Risk Quotients generated for neonicotinoids using Raby et al. (2018) toxicity data* available in each docket.

Comment Submitted by Syngenta Regarding the Avian Endpoints Used in the Preliminary Aquatic and Non-Pollinator Risk Assessment for Thiamethoxam (EPA-HQ-OPP-2011-0581-0228):

Comment: Syngenta noted that the endpoints reported for the mallard reproduction study were expressed in milligrams of active ingredient per kilogram of bodyweight (mg a.i./kg-bw), but should have been reported in milligrams of active ingredient per kilogram of diet (mg a.i./kg-diet; p. 82 of *Thiamethoxam – Transmittal of the Preliminary Aquatic and Non-Pollinator Terrestrial Risk Assessment to Support Registration Review)*. Syngenta asked that the agency review the reported figures and provide the daily dose calculations.

EPA Response: The agency confirmed that there was a typographical error in the endpoints reported for the mallard reproduction study, and that these figures should have been expressed as mg a.i./kg-diet. Please refer to *Thiamethoxam: Addendum to the Non-Pollinator Draft Risk Assessment (DRA) and Response to Public Comments Received on the Bee and Non-Pollinator DRAs*, available in the thiamethoxam docket, for the daily dose conversion calculation and further details.

II. USE AND USAGE

Clothianidin

Clothianidin is a nitroguanidine-substituted neonicotinoid insecticide, which was first registered for use as pesticide in the United States in 2003. Clothianidin is used to target a wide variety of insect pests including, but not limited to piercing sucking pests such as aphids, mealybugs, sharpshooters, Asian citrus and pear psyllids and stinkbugs; coleopteran pests such as corn rootworm, billbugs, white grubs, and plum curculio; and a variety of sporadic pests such seed maggots and symphylans. Products containing clothianidin are formulated as granular, dust, seed treatment, solid agar, pressurized liquid, emulsifiable concentrate, soluble concentrate, and ready-to-use solutions on a variety of agricultural and non-agricultural use sites. Agricultural sites include vegetable crops, tree fruits, tree nuts, and field crops. Applications can also be made to poultry litter manure in chicken houses for darkling beetles and other poultry houses pests and later utilized as outdoor fertilizer. Non-agricultural uses include turf and ornamental plants, and indoor and outdoor residential, commercial, and industrial sites.

The largest agricultural use for clothianidin, in terms of lbs. a.i. applied, has been in the form of seed treatments. On average, between 2005 and 2014, over 1,400,000 lbs. a.i. of clothianidin were used annually for seed treatments on various field crops including corn, cotton, soybean, and wheat.[1] There are also seed treatments registered for various vegetable crops. More recent data on seed treatment usage are not available.

From 2007-2016, soil and foliar usage (together) averaged about 300,000 lbs. a.i.[2], applied to approximately 400 million acres annually.[3] Agricultural sites with the highest usage of clothianidin in average pounds applied per year are cotton (10,000), rice (6,000), and soybean (5,000).[2] The highest percent crop treated (PCT) values are reported for table grapes (20%), broccoli (15%), and figs (10%).

The agency has limited usage data on non-agricultural use sites. In 2016, approximately 9,000 lbs. a.i. of clothianidin was used by pest management professionals for outdoor pest control (*i.e.*,

[1] *Clothianidin (044309) Screening Level Usage Analysis (SLUA), December 30, 2015.*
[2] *Clothianidin (044309) Screening Level Usage Analysis (SLUA), July 8, 2019*
[3] *Agricultural Market Research Data (AMRD). 2007-2017.*

turf and ornamental plants, including in residential areas) and over 4,000 lbs. a.i. for indoor pest control.[4]

Thiamethoxam

Thiamethoxam was first registered for use as a pesticide in the United States in 1999. Thiamethoxam is commonly used to target piercing sucking pests such as aphids, leafhoppers, and whitefly in addition to certain hard to kill pests such as pepper weevil and thrips. Products containing clothianidin are formulated as wettable powder, dust, granular, microencapsulated, solid agar, soluble concentrate/solid, flowable concentrate, emulsifiable concentrate, and ready-to-use solutions. Thiamethoxam is registered to control various insects on a wide variety of agricultural use sites (*e.g.* field, forage, fruit, spice, and vegetable crops) and non-agricultural use sites (*e.g.* in and around residential/domestic dwellings, food handling establishments, commercial/ institutional/industrial areas, livestock pens, poultry houses, wood or wooden structures, and transportation vehicles).

As an antimicrobial pesticide, thiamethoxam was also registered for use as a wood preservative, however, these registrations were cancelled on September 18, 2013.[5]

The largest agricultural use for thiamethoxam, in terms of lbs. a.i. applied, has been in the form of seed treatments. On average, between 2005 and 2014, approximately 800,000 lbs. a.i. of thiamethoxam were used annually for seed treatments on various field crops including corn, cotton, soybean, potato, and wheat.[6] There are also seed treatments registered for various vegetable crops. More recent data on seed treatment usage are not available.

From 2007-2017, soil and foliar usage (together) averaged about 100,000 lbs. a.i.[7], applied to approximately 1.7 million acres annually.[3] Agricultural sites with the highest usage of thiamethoxam in average pounds applied per year are cotton (36,000 lbs.), soybean (15,000 lbs.), and potatoes (10,000 lbs.).[6] The highest percent crop treated (PCT) values are reported for grapefruit (30%), lettuce (20%), peppers (20%), and strawberry (20%).

The agency has limited usage data on non-agricultural use sites. Usage of thiamethoxam by pest management professionals has not been reported in recent years.

III. SCIENTIFIC ASSESSMENTS

A. Human Health Risks

A summary of the agency's human health risk assessments for clothianidin and thiamethoxam are presented below. The agency used the most current science policies and risk assessment

[4] *Non-agricultural Market Research Data (NMRD), 2017.*
[5] *78 FR 57379.*
[6] *Thiamethoxam (*060109*) Screening Level Usage Analysis (SLUA), January 26, 2016.*
[7] *Thiamethoxam (*060109*) Screening Level Usage Analysis (SLUA), July 25, 2019.*

methodologies to prepare risk assessments in support of the registration review of clothianidin and thiamethoxam. For additional details on the human health assessment for clothianidin, see the *Clothianidin. Draft Human Health Risk Assessment in Support of Registration Review*, available in the public docket for clothianidin: EPA-HQ-OPP-2011-0865. For additional details on the human health assessment for thiamethoxam, see the following documents: *Thiamethoxam. Draft Human Health Risk Assessment for Registration Review;* and *Thiamethoxam Registration Review: Human Health Scoping Information Regarding the Wood Preservative Uses (Post Peer Review Update)*. Both documents are available on regulations.gov in the thiamethoxam docket: EPA-HQ-OPP-2011-0581.

1. Risk Summary and Characterization

The toxicology databases for both clothianidin and thiamethoxam are complete. Studies for clothianidin were performed via the oral, inhalation, and dermal routes of exposure. For thiamethoxam, studies were only conducted for oral and dermal routes of exposure, where the agency's Hazard and Science Policy Council (HASPOC) found that the inhalation toxicity study could be waived based on a weight-of-evidence (WOE) approach (TXR# 0057630, M. Lewis, 09/22/17). The risk assessments for each of these two active ingredients use conservative assumptions, and the most sensitive endpoint from the respective toxicity databases, and are therefore protective of all potential reproductive, developmental and neurotoxic effects. Given the completeness of the toxicity database; clear reproductive and developmental NOAELs; and protective neurotoxic endpoints, the agency determined that reductions of the Food Quality Protection Act (FQPA) safety factors to 1X are appropriate for both clothianidin and thiamethoxam. In addition, both clothianidin and thiamethoxam are classified as "not likely to be carcinogenic to humans" and therefore no quantitative cancer risk assessment was conducted for either chemical.

There are no adverse effects observed in the route-specific dermal toxicity studies up to the limit dose in any tissue or organ for either clothianidin or thiamethoxam. However, since increased susceptibility was observed, oral points-of-departure (PODs) were selected for dermal exposure scenarios because the dermal toxicity studies did not evaluate developmental or reproductive endpoints. For clothianidin, oral PODs were also selected for the inhalation routes of exposure because the inhalation toxicity study did not evaluate developmental or reproductive endpoints. For thiamethoxam, a route-specific subchronic inhalation study was not recommended (TXR# 0057630, M. Lewis, 09/22/17).

Residues of thiamethoxam are expressed in terms of the combined residues of the insecticide thiamethoxam and its metabolite CGA-322704, also referred to as clothianidin; *N*-[(2-chloro-thiazol-5-yl)methyl]-*N*′-methyl-*N*″-nitro-guanidine. As noted previously, clothianidin is a registered pesticide active ingredient but is also a major degradate of thiamethoxam. The agency conducted separate risk assessments for thiamethoxam and for clothianidin, which included residues resulting from application of thiamethoxam.

There were no dietary, residential, aggregate or bystander risks of concern identified for either clothianidin or thiamethoxam. However, the agency's human health risk assessments identified

potential risks of concern for certain occupational handler scenarios, which is described in further detail below, as well as in *Clothianidin. Draft Human Health Risk Assessment in Support of Registration Review* and *Thiamethoxam. Draft Human Health Risk Assessment for Registration Review,* which are available in the chemical-specific docket.

Clothianidin

Dietary Risk
There are no acute or chronic dietary (food and drinking water combined) exposure estimates of concern, as they are all below the agency's level of concern (*i.e.,*100% of the acute or chronic population adjusted dose (aPAD or cPAD, respectively)) using conservative assumptions such as 100% crop treated for all commodities, tolerance-level residues (acute), field-trial-average residues (chronic), high-end estimates for drinking water derived using the highest application rates and modeling based on the most vulnerable areas. The clothianidin acute risk estimate for the most highly exposed population subgroup, children 1 – 2 years old, was 29% of the aPAD. The chronic dietary estimate for the most highly exposed population subgroup (infants) was 9% of the cPAD.

Residential Handler, Residential Post-Application, and Non-Occupational Spray Drift Risk
There are no residential risk estimates of concern for handlers, as all scenarios (combined dermal and inhalation) resulted in margins of exposure (MOEs) greater than the EPA's level of concern (LOC) of 100, ranging from 460 to 27,000,000. There are also no post-application residential risks of concern for adults or children; all combined estimates (dermal, inhalation and incidental oral) are greater than the LOC of 100, with MOEs ranging from 160 to 1,400,000. While there is the potential for bystander exposure to drift from sprays applied to agricultural areas, exposures resulting from spray drift were not quantitatively assessed because the turf exposure assessment is considered to be protective.

Aggregate Risk
There is potential for aggregate exposure to clothianidin from combined exposure through dietary and residential sources. The EPA assessed potential aggregate risks for all exposure durations. The acute aggregate assessment is equivalent to the dietary risk assessment which, as mentioned previously, found no risks of concern. All short-term aggregate exposures are also not of concern (MOEs range from 150 to 390; LOC = 100). Chronic exposure to clothianidin (*i.e.*, continuous exposure for > 6 months) is not expected to occur, therefore, chronic aggregate risk estimates are equivalent to the dietary risk estimates, which are not of concern.

Occupational Handler and Occupational Post-Application Risk
Except for seed treatment use on corn, there are no agricultural use occupational handler scenarios that result in risk estimates of concern; MOEs for other agricultural uses range from 510 to 1,200,000 (LOC = 100). The MOE for occupational handlers performing multiple activities (loading/applying, sewing, bagging, *etc*.) for corn seed treatment is 71 with the currently label-required personal protective equipment (PPE) of single layer clothing (*i.e.,* long sleeves and pants) and gloves. With the addition of a respirator, the risk would no longer be of concern (MOE = 190). All other seed treatment scenarios did not result in risk estimates of concern, with MOEs ranging from 110 to 250,000.

Two non-agricultural scenarios resulted in risk estimates of concern (MOEs < LOC of 100). The first is for mixers/loaders/applicators of liquid formulations via mechanically-pressurized handguns in poultry houses and other livestock housing (i.e., barns/feedlots), with an MOE of 54. In the 2019 memorandum *Clothianidin. Response to Comments on HED's Draft Human Health Risk Assessment in Support of Registration Review, and an Updated Poultry House Assessment*, the agency updated some of its risk conclusions for non-agricultural use scenarios. On the basis of updated area treatment assumptions, the agency concluded that there are no longer occupational risk estimates of concern for use of clothianidin in poultry houses, with risk estimates (MOEs) ranging from 370 to 69,000 (LOC = 100). However, EPA also noted in the response-to-comments memo that uses on other livestock housing (i.e., barns/feedlots) are still assessed assuming the original use assumptions because the updated poultry house treatment area is not applicable to these scenarios. For scenarios in these other livestock houses, there are potential risks of concern for barn/feedlot uses with mechanically-pressurized handguns (MOE = 80). The addition of gloves to these use scenarios results in a MOE of 97.

The second non-agricultural scenario is for an applicator treating commercial buildings using liquid aerosol cans, which resulted in an MOE of 48. Adding gloves and a respirator would raise the MOE to 140, and the scenario would no longer be of concern. There were no other non-agricultural scenarios that resulted in risk estimates of concern, with MOEs ranging from 130 to 150,000. In addition, there are no occupational post-application risk estimates of concern, with all MOEs greater than the LOC of 100.

Thiamethoxam

Dietary Risk
There are no acute or chronic dietary risk estimates of concern for thiamethoxam, as they are all below 100% of the thiamethoxam aPAD and cPAD, respectively. Children 1 – 2 years old are the most highly exposed population subgroup for both acute dietary risk (8% of the aPAD) and chronic dietary risk (48% of the cPAD).

Residential Handler, Residential Post-Application, and Non-Occupational Spray Drift Risk
There are no residential risk estimates of concern for handlers (combined dermal and inhalation MOEs range from 770 to 260,000; LOC = 100). There are also no post-application residential risks of concern for adults or children; all estimates (dermal, inhalation and/or incidental oral MOEs range from 180 to 9.4×10^8). While there is the potential for bystander exposure to drift from sprays applied to agricultural areas, exposures resulting from spray drift were not quantitatively assessed because the turf exposure assessment is considered to be protective.

Aggregate Risk
There is potential for aggregate exposure to thiamethoxam from combined dietary and residential sources. The EPA assessed potential aggregate risks for all exposure durations. The acute aggregate assessment is equivalent to the dietary risk assessment, which, as mentioned previously, identified no risks of concern. There are no short-term aggregate risks of concern (MOEs range 140 to 610; LOC = 100). Chronic aggregate risk estimates for thiamethoxam are equivalent to the dietary risk estimates, which are not of concern.
Occupational Risks

The *Thiamethoxam. Draft Human Health Risk Assessment in Support of Registration Review* included an analysis of 92 different agricultural and non-agricultural occupational handler exposure scenarios. Of those 92 scenarios, 79 are not be of concern (*i.e.*, combined dermal + inhalation MOEs ≥ 100 with baseline attire, or engineering controls in the case of aerial applications).

For the 13 scenarios where the MOEs do not reach the target LOC of 100:

- Gloves mitigate potential risks of concern for:
    - mixing/loading liquid formulations for aerial applications to high-acreage field crops[8] (MOE increases from 98 to 520);
    - mixing/loading/applying liquid formulations for crack and crevice (C&C) via manually-pressurized handwand for applications in warehouses (MOE increases from 91 to 150);
    - mixing/loading/applying liquid formulations for crack and crevice (C&C) via manually-pressurized handwand for applications in childcare centers, schools and institutions (MOE increases from 91 to 150);
    - mixing/loading/applying liquid formulations for crack and crevice (C&C) via manually-pressurized handwand for applications in residential living spaces (MOE increases from 91 to 150);
    - mixing/loading/applying liquid formulations for crack and crevice (C&C) via manually-pressurized handwand for applications to mounds or nests (MOE increases from 6.7 to 630);
    - mixing/loading/applying DF formulations via manually-pressurized handwand to mounds or nests (MOE increases from 87 to 8,600); and
    - mixing/loading/applying DF formulations via mechanically-pressurized handgun for applications to landscaping trees, shrubs and bushes (MOE increases from 65 to 180).
- Gloves and a respirator would mitigate potential risks of concern for:
    - mixing/loading DF formulations for aerial application on sod (MOE increases from 44 to 200);
    - mixing/loading DF formulations for aerial application on high-acreage field crops (MOE increases from 53 to 250);
    - mixing/loading/applying DF formulations via mechanically-pressurized handgun for poultry-house applications (MOE increases from 57 to 160); and
    - mixing/loading/applying liquids with a mechanically-pressurized handgun for warehouse applications (MOE increases from 55 to 190).
- MOEs do not reach the target LOC for the following scenarios:
    - mixing/loading/applying DF formulations via mechanically-pressurized handgun to poultry/livestock house/horse barn/feed lots (MOE is 29 with double layer of protective clothing, gloves, and a respirator); and
    - commercial seed treatment for corn (field, pop, and sweet), safflower, and sorghum (MOEs ranged from 13 to 82).

[8] High-acreage crops include, but are not limited to barley, wheat, rice, cotton, corn, and other crops where 1,200 acres or more are treated per day.

During the public comment period on the draft risk assessment, Elanco contended that the agency's risk estimate was overly conservative because it assumed 1,000 gallons of product application volume per day.

In the 2019 response-to-comments memorandum *Thiamethoxam. Revised Response to Public Comments on the Thiamethoxam Human Health Draft Risk Assessment for Registration Review*, EPA determined that a treatment assumption of 12,300 ft^2 for a perimeter/feed line treatment of one poultry house, with at most 10 poultry houses treated in a day by one worker, is appropriate for assessing potential risks from applications in poultry houses with handheld equipment. Using these updated assumptions, and assuming the use of PPE consisting of gloves and a respirator, the risk estimate for mixing/loading/applying DF formulations using a mechanically-pressurized handgun in poultry houses reaches a combined (dermal plus inhalation) MOE of 160, which is not of concern to the agency.

The response-to-comments memo adds that the revised assumptions for poultry houses also result in a new risk exceedance for mixing/loading/applying DF formulations of thiamethoxam using a backpack sprayer. In this poultry house use scenario, the combined MOE for occupational handler risks is now of concern to the agency even considering maximum PPE (*e.g.*, double layer of clothing and a respirator; combined MOE = 75).

The agency also received comments from Syngenta that facilitated refinements to some of the risk calculations presented in the draft human health risk assessment. After incorporating the volumetric use restriction currently on the label for EPA Reg. #100-941 (Cruiser 5FS) limiting the gallons of product that may be handled per 8-hour day, EPA found that there are no risks of concern (*i.e.*, MOEs are above the LOC) for the seed crops listed on this label (including field corn, popcorn, sweet corn, cotton, flax, mustard, rice, safflower, and sunflower) for all seed treatment activities. However, other labels exist with corn (field, pop, and sweet) seed treatment which do not include volumetric use restrictions, and occupational risks for these labels remain of concern.

Syngenta also provided comments on onion seeding rates. Based on these comments, EPA is revising its assumptions for onion seed treatment rates, which resulted in no risks of concern for activities associated with treating onion seed (MOEs range from 130 to 950).

In addition, there are now no risks of concern for activities associated with planting treated onion seed (MOE= 280).

The EPA has also updated the assumption for the amount of rice seed handled per day. After incorporating a restriction currently on labels[9] capping the allowable amount of rice that may be planted at 120 lbs. seed/A, the MOE for activities associated with rice seed is no longer of concern (MOE =120).

[9] EPA Reg. numbers 100-941 (Cruiser 5FS) and 100-1369 (Cruiser Maxx Rice).

Cumulative Risks

EPA has not made a common mechanism of toxicity to humans finding as to clothianidin or thiamethoxam and any other substance, and they do not appear to produce a toxic metabolite produced by other substances. Therefore, EPA has not assumed that either clothianidin or thiamethoxam have a common mechanism of toxicity with other substances.

2. Human Incidents and Epidemiology

The agency reviewed incidents for clothianidin and thiamethoxam using the OPP Incident Data System (IDS) and the Centers for Disease Control and Prevention/National Institute for Occupational Safety and Health (CDC/NIOSH) Sentinel Event Notification System for Occupational Risk Pesticides (SENSOR) databases.

Clothianidin
In Main IDS, from January 1, 2012 to July 13, 2017,17 cases were reported involving clothianidin, all of which reported multiple active ingredients. For Aggregate IDS, from January 1, 2012 to April 28, 2017, 52 incidents were reported involving clothianidin and were classified as minor severity.

A query of SENSOR-Pesticides (1998 – 2013) identified four cases involving clothianidin. Of the clothianidin cases reported, three cases involved multiple active ingredients and the fourth case involved only clothianidin. One case was classified as moderate severity and three cases were classified as low severity. All clothianidin cases were occupational in nature.

Based on the continued low frequency of thiamethoxam and clothianidin incidents reported to both IDS and SENSOR-Pesticides, there does not appear to be a concern at this time. The agency will continue to monitor the incident information available for thiamethoxam and clothianidin and additional analyses will be conducted if ongoing human incident monitoring indicates a concern.

Thiamethoxam
In Main IDS, from January 1, 2012 to July 13, 2017, 45 cases were reported involving the active ingredient thiamethoxam. Of these 45 case reports, thiamethoxam was the only pesticidal active ingredient in nine incidents, each classified as moderate severity. The remaining 36 thiamethoxam incidents reported involved multiple active ingredients. In Aggregate IDS, from January 1, 2012 to July 13, 2017, 110 thiamethoxam incidents were reported. These thiamethoxam incidents were all classified as minor severity.

A query of SENSOR-Pesticides (1998 – 2013) identified 16 cases involving thiamethoxam. Eleven cases involved multiple active ingredients and five cases involved a single active ingredient. One case was high in severity, three cases were moderate in severity, and 12 cases were low in severity. Four of the cases were coded as occupational in nature. The one high severity thiamethoxam incident occurred in Michigan in 2011 and involved an adult male who

was not wearing the required PPE (gloves). He experienced a rash that lasted for more than 1.5 months and swelling in his neck that altered his voice.

3. Tolerances

Clothianidin

Tolerances for residues of clothianidin, including its metabolites, are established in 40 CFR §180.586. The tolerance expression for clothianidin contains a coverage and compliance statement and is therefore in accordance with current practices. There are clothianidin tolerance listings for several crop groups that have undergone revisions including Crop Groups/Subgroups 4, 5, 8 and 14, and these changes are summarized in **Table 1** below. The analytical reference standard for clothianidin expired in April 2018, and the registrant is responsible for maintaining reasonable amounts of this standard as long as tolerances remain published in 40 CFR §180.586. See Section 2.2.1 of the *Clothianidin. Draft Human Health Risk Assessment in Support of Registration* for directions on submitting an analytical reference standard for clothianidin.

There is a time-limited tolerance for rice which expired in 2012 for residues of clothianidin on rice seed, which the agency proposes to remove from the 40 CFR 180.586 (a) (2), because there is a permanent tolerance already for clothianidin on rice (grain). In addition, there are opportunities for international harmonization with the tolerances for clothianidin. Some listings are harmonized with Canadian MRLs and others with Codex MRLs. In the case of updates to Crop Groups 4 and 5, some commodities have moved to different crop groups. EPA recommends revising US tolerances to harmonize with Codex MRLs for subgroup 13-07H, Group 15 (except rice), and Group 16 (except rice straw). Additionally, EPA is proposing eliminating trailing zeros listed in tolerances consistent with agency policy. For a full list of proposed clothianidin tolerance changes, please refer to Appendix E Table 1 in this PID.

Table 1: Clothianidin 40 CFR § 180.586: Summary of Proposed Tolerance Actions

Current Commodity Listing	Current Tolerance (ppm)	Proposed Commodity Listing	Proposed Tolerance (ppm)
Vegetable, leafy, except *Brassica*, Group 4	3.0	Separate listings for: Leafy greens Subgroup 4-16A, Leafy petiole vegetable Subgroup 22B, Celtuce, and Florence fennel	3
Vegetable, *Brassica*, leafy, Group 5	1.9	Separate listings for: Brassica leafy greens Subgroup 4-16B; Vegetable, *Brassica*, head and stem, Group 5-16; and Kohlrabi	1.9 (No change)

Table 1: Clothianidin 40 CFR § 180.586: Summary of Proposed Tolerance Actions			
Current Commodity Listing	Current Tolerance (ppm)	Proposed Commodity Listing	Proposed Tolerance (ppm)
Vegetable, fruiting, Group 8, except pepper	0.2	Remove	--
Pepper	0.8	Remove	--
(Addition)	--	Tomato Subgroup 8-10A	0.2
(Addition)	--	Pepper/eggplant Subgroup 8-10B	0.8
Nut, tree, Group 14	0.01	Nut, tree, Group 14-12	0.01 (No change)
Berry, low-growing, Subgroup 13-07H, except strawberry	0.01	Berry, low-growing, Subgroup 13-07H, except strawberry (No change)	0.07
Grain, cereal, Group 15, except rice	0.01	Grain, cereal, Group 15, except rice (No change)	0.04
Grain, cereal, forage, fodder and straw, Group 16, except rice, straw	0.05	Grain, cereal, forage, fodder and straw, Group 16, except rice, straw (No change)	0.2

Thiamethoxam

Tolerances for residues of thiamethoxam, including its metabolites, are established in 40 CFR §180.565. The tolerance expression for thiamethoxam contains both a coverage and compliance statement and is, therefore, in accordance with current practices. There are tolerance listings for thiamethoxam in several crop groups that have undergone revisions including Crop Groups/Subgroups 4, 5A, 5B, 8, 10, 11, 12, and 14. Generally, crop group updates primarily reflect expansions to include additional commodities in the group (for example, inclusion of pistachio in the tree nut crop group). Tolerance actions being proposed for thiamethoxam are summarized in **Table 2** below.

An analytical reference standard for thiamethoxam will expire on October 31, 2020 and the analytical reference standard for CGA-322704 expired on April 1, 2018. The registrant is responsible for maintaining reasonable amounts of this standard as long as tolerances remain published in 40 CFR §180.565. See Section 2.2.1 of the *Thiamethoxam. Draft Human Health Risk Assessment in Support of Registration* for directions on submitting analytical reference standards.

Adequate data have been submitted to support the established tolerances for residues of thiamethoxam in or on food commodities. There are no outstanding data with respect to tolerances. In addition, there are opportunities for international harmonization with the tolerances for thiamethoxam. Some listings are harmonized with Canadian MRLs and others with Codex MRLs. In one instance (Subgroup 13-07A), Canadian and Codex MRLs are harmonized (0.5 ppm) and are greater than the US tolerance (0.35 ppm). For this case, the proposed increase to the US thiamethoxam tolerance is minor and supported by available data. Therefore, EPA is proposing a tolerance revision for harmonization purposes. In the case of updates to Crop Groups 4 and 5, some commodities have moved to different crop groups. Additionally, EPA is proposing

eliminating trailing zeros listed in tolerances consistent with agency policy. For a full list of proposed thiamethoxam tolerance changes, please refer to Appendix E Table 2 in this PID.

Table 2: Thiamethoxam 40 CFR § 180.565: Summary of Proposed Tolerance Actions

Current Commodity Listing	Current Tolerance (ppm)	Proposed Commodity Listing	Proposed Tolerance (ppm)
Vegetable, leafy, except *Brassica*, Group 4	4.0	Separate listings for: Leafy greens Subgroup 4-16A, Leafy petiole vegetable Subgroup 22B, Celtuce, and Florence fennel	4
Brassica, head and stem, Subgroup 5A	4.5	Separate listings for: Vegetable, *Brassica*, head and stem, Group 5-16; and Kohlrabi	4.5 (No change)
Brassica, leafy greens, Subgroup 5B	3.0	*Brassica* leafy greens Subgroup 4-16B	3
Vegetables, fruiting, Group 8	0.25	Vegetables, fruiting, Group 8-10	0.25 (No change)
Fruit, citrus, Group 10	0.4	Fruit, citrus, Group 10-10	0.4 (No change)
Fruit, pome, Group 11	0.2	Fruit, pome, Group 11-10	0.2
Fruit, stone, Group 12	0.5	Fruit, stone, Group 12-12	0.5
Nut, tree, Group 14	0.02	Nut, tree, Group 14-12	0.02
Pistachio	0.02	Remove	--
Caneberry, Subgroup 13-07A	0.35	Caneberry, Subgroup 13-07A (No change)	0.5

4. Human Health Data Needs

The human health database is complete for both clothianidin and thiamethoxam, and there are no data deficiencies at this time. As noted in the thiamethoxam draft human health risk assessment for registration review, an inhalation toxicity study is not available for thiamethoxam; however, the agency's HASPOC recommended, based on a WOE approach, that the study could be waived (TXR# 0057630, M. Lewis, 09/22/17).

B. Ecological Risks

A summary of the agency's ecological risk assessment is presented below. The agency used the most current science policies and risk assessment methodologies to prepare a risk assessment in support of the registration review of clothianidin and thiamethoxam. For additional details on the ecological assessment for clothianidin and thiamethoxam, see the following documents, which

are available in the public dockets for clothianidin and thiamethoxam EPA-HQ-OPP-2011-0865 and EPA-HQ-OPP-2011-0581) at www.regulations.gov.

- *Clothianidin – Transmittal of the Preliminary Aquatic and Non-Pollinator Terrestrial Risk Assessment to Support Registration Review*.
- *Thiamethoxam – Transmittal of the Preliminary Aquatic and Non-Pollinator Terrestrial Risk Assessment to Support Registration Review*.
- *Final Bee Risk Assessment to Support the Registration Review of Clothianidin and Thiamethoxam.*
- *Comparative Analysis of Aquatic Invertebrate Risk Quotients generated for neonicotinoids using Raby et al. (2018) toxicity data.*

The EPA is currently working with its federal partners and other stakeholders to implement an interim approach for assessing potential risk to listed species and their designated critical habitats. After the scientific methods necessary to complete risk assessments for listed species and their designated critical habitats are finalized, the agency will complete its listed species assessments for clothianidin and thiamethoxam. See Appendix C for more details. As such, potential risks for non-listed species only are described below.

1. Risk Summary and Characterization

Both clothianidin and thiamethoxam are water-soluble chemicals with low vapor pressure and Henry's Law Constants, indicating that these compounds are unlikely to volatilize in field conditions. Additionally, both active ingredients have low octanol: water partitioning coefficients, which suggests that clothianidin and thiamethoxam are unlikely to bioaccumulate.

Terrestrial Exposure and Risk - Overview

Thiamethoxam is applied through aerial and ground application methods, which includes sprayers, chemigation and soil drenching, and seed treatments. Clothianidin is applied via the same application methods, but also includes basal bark treatments and spot treatments. For terrestrial wildlife, the agency modeled potential dietary exposure based on consumption of clothianidin and thiamethoxam residues on food items following spray (foliar or soil) applications as well as from possible dietary ingestion of residues on treated seeds. For treated seeds, different seed sizes and planting rates could result in a range of exposures. For clothianidin, potential dietary exposure was also considered from fields where applied manure from poultry house operations may contain clothianidin residues resulting in potential contamination of potential food items (*e.g.*, insects) and/or incidental ingestion of contaminated soil particles.

Overall, acute risks to avian and mammalian species from foliar and soil treatments of clothianidin and thiamethoxam appear to be low. Soil incorporation following soil treatments (or following soil amendment applications of poultry litter with clothianidin residues) decreases potential risks from this use pattern considerably. Exposures from treated seeds result in the highest acute and chronic risks to terrestrial organisms. However, the risks vary considerably. A low number of small treated seeds (*e.g.* lettuce and sugar beets) are required to reach levels of concern for smaller birds and mammals because the surface of these seeds have higher

concentrations of a.i. applied. Also, these smaller seeds are easier for small birds and mammals to consume because of their small size. However, larger seeds (*e.g*. corn and soybean) pose far lower risks to birds and mammals because lower concentrations of a.i. are applied to the seed surface. Also, the larger size of these seeds prevents smaller birds and mammals from consuming them.

For terrestrial invertebrates, the primary routes of exposure assessed include contact of bees with spray droplets and oral ingestion via pollen and nectar. Additionally, exposure can occur from seed treatment dust. Exposure can vary based on use patterns and the attractiveness of a treated crop.

Terrestrial and semi-aquatic (*i.e.* wetland) plant exposure estimates typically include plants that reside near a use area that may be exposed via runoff and/or spray drift from ground and/or aerial applications of a pesticide. For clothianidin and thiamethoxam, the agency only modeled the maximum single foliar (ground) applications (0.4 lbs. a.i./A and 0.265 lbs. a.i./A, respectively) of each active ingredient to turf and/or ornamentals. Aerial applications are not prevalent based on clothianidin and thiamethoxam use patterns for turf or ornamentals, and, therefore, are not considered in these assessments. Risks of thiamethoxam and clothianidin are considered low for terrestrial and semi-aquatic plants.

Mammals – Risk Estimates
Clothianidin is classified as moderately toxic to mammals on an acute oral exposure basis. Chronic exposure with the Norway rat (*Rattus norvegicus*) resulted in effects on growth and maturation in offspring. The chronic mammalian risk quotients (RQs) calculated for clothianidin are based on the chronic mammalian rat no observed adverse effect level (NOAEL) of 9.8 mg/kg-bw/day. Thiamethoxam is considered slightly toxic to mammals (LD_{50} = 1563 mg/kg-bw) on an acute oral basis, and in a chronic exposure reproduction test reduced weight gain was seen in offspring at 158 mg/kg-bw/day (NOAEL 61 mg/kg-bw/day). Potential risk was evaluated at three different weight classes of mammal: small (15 g), medium (35 g), and large (1000 g). Further details on ecological risks are provided below in separate sub-sections for clothianidin and thiamethoxam.

Clothianidin:

Foliar Applications: There are no acute risks of concern via foliar applications for mammalian species of any weight class even when assessed using the maximum registered single application rate of 0.4 lbs. a.i./A (RQs <0.01 – 0.20; LOC = 0.5). Acute RQs are highest for small mammals feeding on short grass.

There are no chronic mammalian LOC exceedances on a chronic dietary basis for all application rates (highest RQ = 0.49; LOC = 1.0), but there are exceedances for dose-based RQs based on single application rates. Risk estimates rose with increases in the modeled application rate. For single applications at the 0.1 lbs. a.i./A rate, there was only a marginal exceedance of the chronic LOC (1.0) for small mammals consuming short grass (RQ = 1.06). At that same application rate but with an assumption of two applications per year, chronic dose-based RQs exceeded the LOC for small mammals consuming short grass and/or broadleaf plants (RQs = 1.99 and 1.12,

respectively) as well as medium-sized mammals consuming short grass (RQ = 1.70). Potential risks of concern are also identified for both small and medium mammals consuming short grass and/or broadleaf plants (highest RQ = 2.12) at an application rate of 0.2 lbs. a.i./A. At the single foliar application rate of 0.4 lbs. a.i./A, chronic dose-based risks of concern are identified for all mammal size classes depending on the dietary item (highest RQ = 4.24), with exception of fruits/pods/seeds and grains.

Soil Applications: Based on the acute analysis (LD_{50}/ft^2; herein referred to as "area-based analysis") for soil applications, the acute LOC (0.5) is exceeded for small mammals only at the highest two application rates assessed: 0.4 lbs. a.i./A (RQ = 0.61), which represents the highest soil application rate, and 0.49 lbs. a.i./A (RQ = 0.75), which represents residues in fields following soil amendment applications of manure pulled from clothianidin-treated poultry houses.

A second way in which the agency assessed potential risks of soil applications of clothianidin to mammals was by using the upper bound Kenaga EECs in arthropods following soil applications as a surrogate for potential exposures of likely dietary items following soil exposures. Based on this analysis, there are no acute risks of concern for mammals (LOC = 0.5; highest RQ = 0.10 for the scenario of exposed poultry litter used as a soil amendment). However, four chronic risk estimates exceed the LOC (1.0; highest RQ = 2.04), indicating chronic risks of concern to small-medium mammals from soil applications at the application rate of 0.4 lbs. a.i./A, as well as exposure to residues from poultry litter soil amendment applications on agricultural fields (0.49 lbs. a.i./A).

Treated Seed Applications: RQs were calculated for six crops (corn, soybean, cotton, sugar beet and lettuce) when assessing potential risks to mammals from clothianidin-treated seeds. Modeled uses were selected to be representative of high-acreage crops (*e.g.* corn, soybean, cotton), to provide a range of application rates (*e.g.* cotton 0.071 lbs. a.i./A to lettuce 0.198 lbs. a.i./A), and present a range of application rate to seed size ratios (*e.g.* lettuce and corn).

For all size classes of mammals, the acute LOC was exceeded (RQs ranged from 0.22 to 174) for dose-based exposures to any of the assessed seeds other than soybeans. Moreover, for all size classes of mammals, acute exceedances occur where less than 10% of the animal's diet consists of treated lettuce or sugar beet seeds (or crops for which lettuce and sugar beets serve as surrogates). Area-based analysis identified no risks of concern for mammals (RQs <0.01 to 0.31).

The chronic LOC was exceeded for all size classes of mammals consuming any of the assessed treated seed (RQs ranged from 4.57 to 3655). The highest chronic RQ exceedances for treated seed was for lettuce.

Thiamethoxam:

Foliar and Soil Applications: There were no acute or chronic risks of concern identified for mammals from any foliar or soil applications. Estimates presented in the agency's *Preliminary Risk Assessment to Support the Registration Review of Thiamethoxam* were based on an upper-

bound application rate for both foliar agricultural (0.086 lbs. a.i./A) and soil agricultural/non-agricultural uses (0.265 lbs. a.i./A). Modeling accounted for up to three applications of thiamethoxam are made per growing season.

Treated Seed Applications: There were potential acute risks of concern identified for mammals from certain thiamethoxam seed treatment uses. Sugar beets were the only crop assessed where there was an acute LOC exceedance for thiamethoxam-treated seeds. These exceedances were identified for all size classes of mammals (RQs = 0.99 – 2.16).

There were chronic risk exceedances for corn, cotton, and sugar beet (RQs = 2.73 – 55.33). There were no chronic LOC exceedances for soybean. Chronic LOC exceedances were an order of magnitude greater for sugar beet (RQs = 25.33 – 55.33) than for corn (2.79 – 6.08) or cotton (2.73 – 5.97). For both acute and chronic risks, RQs increased as mammal size decreased.

Mammals – Risk Characterization

Clothianidin and Thiamethoxam

There are several variables impacting potential risks to mammals from seed treatments, such as how far apart and how many seeds are available at a given time, the amount of cover provided by field conditions (newly planted fields are likely to be open and provide less cover than no till fields, making them less attractive as a forage location for smaller mammals), and whether or not seeds are on the surface of a field vs. incorporated into the soil. Seeds buried below the soil surface are not as easily found by foraging mammals, reducing the potential for exposure and increasing the amount of time required to find them, which in turn decreases the likelihood of potential chronic exposure. However, some mammals are highly capable of burrowing in soil and acquiring buried seeds and may cache them for later consumption. In addition, in the case of chronic risks, the impact of consuming treated seeds may vary by life stage. It is currently an uncertainty whether effects seen in laboratory-based reproduction studies occur at a sensitive life stage or are due to the entire exposure period.

Another source of uncertainty are the scaling factors used to predict toxicity in different size mammals. This is important because the number of seeds a mammal needs to consume before toxicological effects are expected vary by the size of the mammal, with larger mammals expected to be more sensitive based on standard scaling factors.

- For clothianidin:
    - the number of treated seeds required to reach the lowest observed adverse effect concentration (LOAEC; *e.g.* decreased body weight, stillbirths, delayed sexual maturation) for chronic effects would be 1 – 6 corn seeds, 1 – 10 lettuce seeds, 1 – 12 sugar beet seeds, 1 – 21 cotton seeds, and 2 – 58 soybean seeds, depending on mammal size; and
    - chronic exceedances occur when less than 10% of the animal's (all size classes of mammals) diet consists of clothianidin treated seeds (all evaluated treated seeds except soybean).

- For thiamethoxam:
    - there were reduced offspring body weight gains reported during the lactation period (NOAEL = 61 mg/kg-bw/day; LOAEL = 158 mg/kg-bw/day) in the chronic mammalian reproductive study;
    - based on the NOAEL, the number of seeds required to reach this chronic effect for corn, cotton, and sugar beet ranges from 2 – 37, 5 – 123, and 3 – 64, respectively; and
    - based on the LOAEL, the required number of seeds for these crops are 4 – 96, 14 – 320, and 7 – 166, respectively.

Although there are potential acute risks of concern for clothianidin (all seeds evaluated except soybean) and thiamethoxam (sugar beet) treated seeds, the uncertainties discussed above limit the likelihood that an animal will consume acutely toxic levels of treated seeds. Overall, for clothianidin and thiamethoxam, potential risk is associated with chronic consumption of treated seeds, where the estimated number of seeds required for chronic effects is low.

Birds, Reptiles, and Terrestrial-Phase Amphibians – Risk Estimates
Clothianidin is characterized as moderately toxic to birds on an acute oral exposure basis and practically nontoxic on a subacute dietary exposure basis. Northern bobwhite quail (*Colinus virginianus*) represented the most sensitive chronic toxicity endpoint (NOAEC: 205 mg/kg-diet; LOAEC: 525 mg/kg-diet), with effects on reduced eggshell thickness. Thiamethoxam is characterized as slightly toxic to birds on an acute oral exposure basis (LC_{50} = 576 mg/kg-bw/day) and practically non-toxic on a subacute dietary exposure basis (LC_{50} > 5200 mg/kg-diet). Weight loss was seen in a chronic avian reproductive study in parental males at 900 mg/kg-diet (NOAEC 300 mg/kg-diet). The most sensitive avian species assessed for thiamethoxam is the mallard duck for both acute and chronic exposures. Note that birds are used as surrogates for potential risks to terrestrial-phase amphibians and reptiles.

Clothianidin:

Foliar Applications: For foliar applications of clothianidin, there are no acute or chronic risks of concern for birds even when calculated using the maximum registered foliar single application rate of 0.4 lbs. a.i./A (RQs <0.01 – 0.33; LOCs = 0.5 for acute risks and 1.0 for chronic risks). RQs decreased with avian weight class and are highest (0.33) for small birds feeding on short grass.

Soil Applications: Area-based analysis identified LOC exceedances for small birds only at the highest soil application rate of 0.4 lbs. a.i./A (RQ = 0.63). Acute risks of concern are also identified following field applications of manure from clothianidin-treated poultry houses. This scenario is assumed to be equivalent to a soil application rate of clothianidin at 0.49 lbs. a.i./A and resulted in an RQ of 0.77.

Based on an analysis of using the upper bound Kenaga EECs in arthropods following soil applications as a surrogate for potential exposures of likely dietary items following soil exposures, there are no acute risks of concern for species of birds (highest RQ = 0.16 for the

scenario of spent poultry litter use). Similarly, chronic exposures for birds are below any effect level thresholds (highest chronic RQ = 0.22 for the scenario of spent poultry litter use).
Seed Treatment Formulations: As mentioned previously in the clothianidin mammal section, RQs are calculated for various crops when assessing potential risks to birds from treated seeds. Expected risks are highest for small birds and decreases with increasing avian body weight. For small and medium birds, there are acute dose-based species LOC exceedances for all crops (RQs range from 1.20 – 284). For large birds, there are acute dose-based species LOC exceedances for birds feeding on corn, sugar beets and lettuce (or for crops for which corn, sugar beets and lettuce serve as surrogates). Area-based analysis identified no risks of concern for avian species, but there is a chronic LOC exceedance for birds consuming any of the assessed treated seeds (RQs ranged from 5.0 to 1813). Moreover, for all size classes of birds, acute exceedances occur where less than 10% of the animal's diet consists of treated lettuce or sugar beet seeds.

Thiamethoxam:

Foliar and Soil Applications: There were no acute or chronic RQ exceedances identified for birds (acute LOC = 0.5; chronic LOC = 1.0) either directly from any foliar or soil applications, or from birds consuming arthropods with residues resulting from either a foliar or soil treatment. Therefore, there are no risks of concern for birds from foliar or soil applications.

Seed Treatment Formulations: RQs were calculated for corn, cotton, soy, and sugar beet when assessing potential risks to birds from thiamethoxam-treated seeds. No RQ exceedances were identified using an area-based analysis of potential risks, but there were acute dose-based exceedances for all crops except soybean, and chronic exceedances for all modeled crops and size classes. Chronic RQ exceedances range from 12.6 – 117. Both acute and chronic exceedances were highest for sugar beet (highest acute RQ = 29.6; chronic RQ = 117). Risk estimates were highest for small birds and decrease with increasing avian body weight.

Birds, Reptiles, and Terrestrial-Phase Amphibians – Risk Characterization
In field conditions, the exposure of birds to clothianidin-treated seed is dependent upon many variables beyond the amount of active ingredient on a given treated seed. These factors include whether or not the treated seed is buried or on the surface of a field (as in the case of an accidental seed spill), the depth at which buried seed is buried, the number and density of treated areas across the landscape, and the seed size relative to the size and foraging patterns of birds. For birds of any size, the attractiveness of the treated seed as a source of food is relative to the color or size of other available food sources. The size of a bird is also important in predicting effects expected from exposure, because larger birds generally need to consume more treated seeds before toxicological effects are observed. Using the chronic avian reproduction toxicity endpoint associated with diminished eggshell thickness, the number of treated seeds required to reach this level would be 1 – 19 corn seeds, 1 – 32 lettuce seeds, 1 – 39 sugar beet seeds, 1 – 69 cotton seeds, and 4 – 186 soybean seeds.

The size of a treated seed relative to the size of a given bird is another important variable to consider when characterizing potential risks from clothianidin-treated seed. In the case of small birds, treated seeds which are large either due to pelleting or the size of an individual seed may be too big for a small (20g) passerine bird to swallow. Based on minimum weights of field corn

seed (~225 mg), and cotton seed (~100 mg), these seeds are considered too big for most small passerine birds to consume. Therefore, acute and dietary risks from consumption of these seeds can be discounted for these size classes of passerines. Field corn seed is also considered too big for medium-sized passerine birds to consume. Other types of corn seed (*e.g.* sweet, pop, etc.) exhibit a size range such that the average seed size is below the weight threshold for medium-sized passerines. Consequently, medium-sized passerines could still potentially be affected by consuming other corn varieties.

The largest birds would physically be able to consume a wider range of treated seeds, due to their size, but would need to consume a greater number of seeds than their smaller counterparts to experience negative health effects. For large birds foraging in corn fields, nearly their entire diet (99%) would have to be made up of the treated seed in order to reach the acute LOC. Given the potential availability of other seed sources (*i.e.* remaining waste grain or seeds from weed species on the field), this may be more likely in instances of treated seed spillage than through normal foraging behavior.

Terrestrial Invertebrates – Risk Estimates

This section incorporates information provided in the *Preliminary Bee Risk Assessment to Support the Registration Review of Clothianidin and Thiamethoxam* as well as the more recent *Final Bee Risk Assessment to Support the Registration Review of Clothianidin and Thiamethoxam*, which are available on the public docket. The initial preliminary bee assessment in 2017 evaluated the risk of the registered agricultural uses of clothianidin and/or thiamethoxam to bees alone. The 2017 assessment utilized available data at the time. For clothianidin and thiamethoxam this included a robust registrant-submitted dataset to help characterize the acute and chronic toxicity of clothianidin and/or thiamethoxam to adult and larval honeybees at the Tier I (individual) level. In each assessment, available open literature data was also reviewed in addition to the required data.

The final 2019 bee risk assessment updates the preliminary bee assessment and incorporates additional information, submitted to the EPA since the previous assessment. This new assessment also includes additional residue study data, which provide residues of clothianidin and/or thiamethoxam in nectar, pollen, and other plant matrices for registered crop uses; as well as a residue bridging strategy to extrapolate, where appropriate, residue data among crops, chemicals, and plant matrices to address lack of residue data for certain crops between the neonicotinoids. This additional information includes higher tiered, Tier II and III (colony) level data. Tier II data included both semi-field tunnel (rate-response) and feeding (dose-response) studies to help better evaluate potential colony-level effects, and tier III data included whole colony full field studies to better evaluate colony-level effects. For clothianidin, there were Tier III field studies conducted on canola or maize seeds. Thiamethoxam had available Tier III field studies conducted on sunflower seed-treated fields, oilseed rape seed-treated fields, and a foliar-treated apple orchard. These Tier III studies were all included in the most recent assessment. Data was requested based on a tiered approach, as lower tiered data could trigger the need for higher tiered data.

During the scoping of the registration review for clothianidin and thiamethoxam, the agency identified the need to assess risk to terrestrial invertebrates. As a result, the agency issued

requirements for a robust set of pollinator data, which included both exposure and toxicity data, along with higher tiered pollinator tests such as Tier II (semi-field) and Tier III tests (full field). During testing, honeybees (*Apis mellifera*) were used as a surrogate for other species of bees (*e.g.* bumble bees, solitary bees). Risks to these other non-*Apis* bees are evaluated qualitatively based on available information. As the bee risk assessment framework used by the EPA indicates, honeybees are considered to be reasonable surrogates for other bee species and conclusions from the weight of evidence for the honeybee can be used to help inform about potential risks to other non-*Apis* species. An exception is noted based on the differences in attractiveness of crops to different bee species.

Among the four neonicotinoids (imidacloprid, clothianidin, thiamethoxam, dinotefuran), robust data sets of pollen and nectar residue data available for foliar and/or soil applications to the following bee-attractive crops and crop groups: cotton, cucurbits, citrus, stone fruit, pome fruit, tree nuts, berries/small fruits, and ornamentals. Surrogates were used in some areas where limited or no residue data was available. Generally, this risk assessment finds that foliar and/or soil applications of clothianidin and thiamethoxam to honeybee attractive crops which are not harvested prior to bloom result in a potential for colony-level risk. Robust data are also available for seed treatments of imidacloprid, clothianidin and thiamethoxam to several crops, including corn. In general, risks of neonicotinoid seed treatments to honeybee colonies are considered low.

As noted previously, clothianidin is a major degradate of thiamethoxam (in plants). As clothianidin and thiamethoxam have similar use patterns, and their toxic effects and the concentrations at which these toxic effects occur are similar for bees, the *Final Bee Risk Assessment to Support the Registration Review of Clothianidin and Thiamethoxam* expressed exposure and effects as "clothianidin equivalents" (c.e.), where thiamethoxam concentrations are converted using the molecular weight ratio of clothianidin to thiamethoxam (*i.e.*, ratio = 0.856)[2].

Based on the evaluated data, clothianidin and thiamethoxam are classified as toxic to adult honeybees with similar acute oral LD_{50} values (0.0037 µg c.e./bee and 0.0038 µg c.e./bee, respectively) and acute contact LD_{50} values (0.0275 µg c.e./bee and 0.021 µg c.e./bee, respectively). There are no acceptable definitive acute oral larval toxicity studies available for clothianidin and thiamethoxam. Therefore, acute dose-based RQs were not calculated for larvae. However, there is an acceptable larval chronic toxicity study for thiamethoxam, which was used to derive an acute oral toxicity estimate (> 0.03 µg c.e./larvae; 5% mortality). For clothianidin and thiamethoxam, there are acute contact risks to adult bees exposed to foliar applications (RQ = 52 and 5.1, respectively; LOC = 0.4). Also, for clothianidin and thiamethoxam, there are acute dose-based oral exposure risks from foliar use (RQs = 3,600 and 350, respectively); from soil (RQs ranged 1.2 – 7.0); and from seed treatment use (RQ = 79). The highest acute exceedances for clothianidin are from foliar uses on berries and small fruit, soil uses for cucurbits, and foliar uses for oilseed. For thiamethoxam, the highest acute exceedances are from foliar uses on ornamentals, soil uses for fruiting vegetables, and foliar uses for berries and small fruit.

For clothianidin and thiamethoxam, there were chronic oral toxicity exceedances (LOC = 1) for foliar and soil applications. Adult bee chronic RQs ranged from 3,600 – 36,000 for foliar applications, and 13 – 70 for soil applications. There were also chronic oral toxicity exceedances identified for larval bees (RQs ranged 300 to 1,500) from foliar uses of clothianidin and

thiamethoxam. For soil uses of clothianidin (non-agricultural), there were chronic exceedances to bee larvae (RQs ranged 2.1 to 2.3). There were also chronic oral exceedances for seed treatment uses for both adult and larval bees (RQ = 810 and 29, respectively). The highest chronic exceedances for clothianidin were from soil use for citrus and cucurbits, and foliar use on oilseed. For thiamethoxam, the highest chronic exceedances occurred from foliar use on ornamentals, berries and small fruit, and cucurbits.

Based on an analysis of Tier I data, for foliar applications, potential off-field dietary risks to individual bees exposed to spray drift extend >1000 feet from the edge of the treated field. There is uncertainty in this analysis including: assumptions on available attractive forage off field, use of individual level toxicity data, BeeREX default estimates for residues, and unrefined AgDRIFT™ modeling. Soil applications are assumed to have a low off-field risk because of low potential to drift. Off-field estimates of risk are based on screening-level exposure estimates, which cannot be refined with available residue data. Moreover, these estimates relied on assumptions regarding crop-attractiveness to bees, exposures, cultural practices (*i.e.* harvest cycles), environmental conditions (*i.e.* canopy coverage), wind conditions (*i.e.* unidirectional and constant), etc. Therefore, potential off-field risks may be overestimated. Additionally, exposure to individual bees from off-site movement of abraded seed dust during planting is noted as a potential exposure route of concern.

Due to neonicotinoid persistence in the environment, poultry litter usage estimates indicated potential risk to bees when applied at the maximum allowed rate (0.49 lbs. a.i./A; clothianidin only) when applied on multiple occasions (six whole house treatments) and then utilized as fertilizer on agricultural fields. Based on that maximum rate, RQs calculated using the Bee-REX model showed acute and chronic exceedances to adult bees (RQs 7 and 70, respectively) and chronic risk to larval bees (RQ of 2.3).

On a colony-level, potential risks were identified for several scenarios. Since risks to honey bees were identified at the Tier 1 (individual bee) level, the agency evaluated risks at the colony level (Tier II and Tier III). At the Tier II level, this involved comparing clothianidin and thiamethoxam residues measured in pollen and nectar in various crops to levels that affect honey bee colonies. At the Tier III level, this involved analysis of full field studies that were conducted for clothianidin and thiamethoxam seed treatments (various crops). In addition, this involved analysis of full field studies that were conducted on thiamethoxam foliar applications to orchards or melons. These Tier III studies contained significant uncertainties associated with the study design and availability of data which limited their utility. These uncertainties include the origin of the pollen and nectar brought back to the hives, high variability in the data collected (including in control hives), and inadequate replication or pseudo-replication (e.g. studies conducted using only one field). Ecological incidents were also considered as a line of evidence. For a detailed explanation of these risk estimates, please refer to the *Final Bee Risk Assessment to Support the Registration Review of Clothianidin and Thiamethoxam*, available in the dockets. The findings of the higher tier assessment are summarized below.

Terrestrial Invertebrates – Risk Characterization

The agency utilized several lines of evidence to better refine the risk calls including: incorporating information on crop bee attractiveness, agronomic practices (*e.g.,* harvest time

relative to bloom) to determine if exposure was present, a comparison of residues to adverse effects levels for entire hives (residues above NOAEC and LOAEC), and major categories of incidents. For comparison of residues to adverse effects levels for entire hives, EPA considered duration and frequency of exceedance, the magnitude of exceedance (including the ration of max residue value to NOAEC/LOAEC and percent of diet from the treated field needed to reach the NOAEC/LOAEC), as well as consideration of usage and geographic scale/spatial distribution of exposure.

It is important to note that multiple factors can influence the strength and survival of bees whether they are solitary or social. These factors, including disease, pests (*e.g.,* mites), nutrition, and bee management practices, can confound the interpretation of studies intended to examine the relationship of the test chemical to a receptor (*i.e*., larval or adult bee). Therefore, most studies attempt to minimize the extent to which these other factors impact the study; however, higher-tier studies afford less control over these other factors, and their role may become increasingly prominent as the duration of the study is extended. Although studies attempt to minimize the confounding effects of other environmental factors, there is uncertainty regarding the extent to which the effects of a chemical may be substantially different had these other factors been in place.

Strongest Evidence of On-field Risk: For foliar and soil applications of clothianidin and thiamethoxam, the lines of evidence are considered "strongest" for supporting the finding of colony-level risk resulting from applications to:

- For Clothianidin:
    - Cotton (foliar);
    - Cucurbits (foliar);
    - Grapes (foliar, pre-bloom); and
    - Ornamentals (foliar and soil).
- For Thiamethoxam:
    - Cotton (foliar);
    - Cucurbits (foliar);
    - Orchard crops (*i.e.*, citrus, pome, stone and tropical fruits, tree nuts; foliar, pre-bloom);
    - Citrus (soil, pre-bloom);
    - Berries (foliar and soil, pre-bloom;
    - Honeybee attractive fruiting vegetables (*i.e.*, okra, roselle, chilis and peppers; foliar); and
    - Ornamentals (foliar and soil).

These findings are supported by multiple lines evidence indicating residues exceed the clothianidin and/or thiamethoxam colony-level endpoints by a high magnitude, frequency and/or duration. In some cases, they are also supported by modeled residues or ecological incidents involving bees that are associated with the use.

Moderate Evidence of On-field Risk: For foliar and soil application of clothianidin and thiamethoxam, the strength of evidence is considered "moderate" in indicating a colony-level risk to honeybees for the following registered uses:

- Clothianidin and Thiamethoxam:
  - Citrus (soil, post-bloom);
  - Cucurbits (soil);
  - Residential lawns (foliar); and
  - Ornamentals (foliar and soil).
- Thiamethoxam only:
  - Honeybee attractive fruiting vegetables (soil).

These findings are supported by lines of evidence indicating residues exceed the clothianidin and/or thiamethoxam colony-level endpoints but the magnitude, frequency and/or duration of exceedance is limited.

Weakest Evidence of On-field Risk: For foliar, soil and seed treatment applications of clothianidin and thiamethoxam, the strength of evidence is considered "weakest" in indicating a colony-level risk to honeybees for the following registered uses:

- Clothianidin
  - Honeybee attractive root and tuber crops (*i.e.*, sweet potato, Jerusalem artichoke, edible burdock, dasheen, horseradish; foliar and soil); and
  - Turmeric (seed treatment).
- Thiamethoxam
  - Honeybee attractive root and tuber crops (foliar and soil);
  - Citrus (soil, post-bloom); and
  - Mint (foliar).

For thiamethoxam applications (foliar) to mint, the evidence is considered weakest because risk findings rely exclusively on residue data that are extrapolated (bridged) from other neonicotinoids or different crop groups where the influence of crop on the magnitude of the residue is highly uncertain. The clothianidin use for treated turmeric seed pieces, the evidence is considered weakest because risk findings rely on nectar and pollen exposures extrapolated from the size of treated seeds, but turmeric is planted as large seed pieces.

For clothianidin and thiamethoxam applications to honeybee attractive root and tuber crops, the evidence is considered weakest because of the following. Clothianidin residue data are available for potato pollen; however, this crop does not produce nectar like other crops in this group (*e.g.*, sweet potatoes). Residues in potato (*Solanum tuberosum*) pollen are below the colony level endpoints, however, the agency cannot conclude that nectar-producing honeybee attractive root and tuber crops pose a low risk because there are no residue data for nectars in this crop group. When considering residue data for other field crops (e.g., cotton, cucurbits), foliar and soil applications result in residues in nectar that are above the colony level endpoints. This suggests a potential concern for nectar-producing root and tuber crops. Available information suggests that several of these honeybee attractive root and tuber crops are cultivated primarily through their

roots and not through setting seed, however without further information on the timing of cultivation relative to bloom periods, honeybee exposure cannot be precluded.

Terrestrial Plants
No risks of concern to terrestrial plants are identified for either clothianidin or thiamethoxam. For further detail, please refer to *Clothianidin – Transmittal of the Preliminary Aquatic and Non-Pollinator Terrestrial Risk Assessment to Support Registration Review* and *Thiamethoxam – Transmittal of the Preliminary Aquatic and Non-Pollinator Terrestrial Risk Assessment to Support Registration Review*, both available in their respective dockets.

Aquatic Risks

Although clothianidin and thiamethoxam were assessed together in one bee risk assessment, separate aquatic assessments were conducted. In terrestrial plants, clothianidin is observed as a major degradate of thiamethoxam. In other environmental fate studies (e.g., hydrolysis, aerobic soil metabolism), clothianidin is a minor degradate. Therefore, in the aquatic risk assessment of thiamethoxam, only the parent compound is considered as a residue of concern. This section describes the risks to aquatic organisms from clothianidin and thiamethoxam applications.

Freshwater Fish, Estuarine/Marine Fish, and Aquatic-Phase Amphibians
On an acute basis, clothianidin is characterized as practically non-toxic to freshwater fish and no more than slightly toxic for estuarine/marine fish. Thiamethoxam is also characterized as practically non-toxic to fish on an acute exposure basis. Clothianidin and thiamethoxam both had minor effects on fish growth after chronic exposure. There are no risks of concern to fish or aquatic-phase amphibians from either clothianidin or thiamethoxam. The acute and chronic RQs for fish (which were used as surrogates for aquatic-phase amphibians when calculating RQs) did not exceed the acute (0.5) or chronic (1.0) LOC for any uses (clothianidin RQs $\leq$ 0.001; thiamethoxam RQs $\leq$ 0.002). Potential risks to fish and aquatic-phase amphibians are therefore considered low for these chemicals.

Freshwater Invertebrates
For aquatic invertebrates, the level of sensitivity varies greatly among species on an acute toxicity basis. For example, clothianidin is practically non-toxic to water fleas (*Daphnia magna*), but is very highly toxic to other taxa, including shrimp and aquatic insects. Reproduction is affected in both freshwater and estuarine/marine invertebrates. Effects on development were also observed in benthic invertebrates.

On an acute exposure basis, thiamethoxam is very highly toxic (*i.e.*, LC_{50} < 100 µg a.i./L) to aquatic invertebrates. Tested insect species are more sensitive on an acute exposure basis compared to tested species in other classes (*e.g.*, daphnids and mysid shrimp). On a chronic exposure basis, a decrease in survival is observed in aquatic insects exposed to 2.23 µg a.i./L, resulting in a NOAEC of 0.74. As with acute exposure, daphnids and mysid shrimp are orders of magnitude less sensitive when exposed to thiamethoxam on a chronic exposure basis.

The agency generated a *Comparative analysis of Aquatic Invertebrate Risk Quotients generated for neonicotinoids using Raby et al. (2018) toxicity data*, which became available following

publication of the *Clothianidin – Transmittal of the Preliminary Aquatic and Non-Pollinator Terrestrial Risk Assessment to Support Registration Review* (2017) and the *Thiamethoxam – Transmittal of the Preliminary Aquatic and Non-Pollinator Terrestrial Risk Assessment to Support Registration Review* (2017).The studies, located in the docket, were used to determine risks quotients using acute and chronic toxicity data provided in the two open literature papers published by researchers from the University of Guelph.[10,11] With use of the available raw data, EPA determined the results could be used quantitatively for risk assessment purposes (*i.e.,* to derive RQs). Upon the review of the Raby data, risks of concern were identified for all four neonicotinoid insecticides (clothianidin, thiamethoxam, dinotefuran, and imidacloprid) to freshwater invertebrates on both an acute and chronic basis.

On an acute basis across all tested species, LC_{50} values for dinotefuran were similar, but slightly higher than imidacloprid. On average, LC_{50} values for clothianidin were 2.4 times higher than those of imidacloprid and dinotefuran, suggesting that clothianidin may be relatively less acutely toxic than imidacloprid and dinotefuran. Thiamethoxam's LC_{50} values were 5.6 times higher than those of imidacloprid across all tested species, which suggests that thiamethoxam is potentially the least acutely toxic.

All four neonicotinoids present chronic risks of concern to freshwater invertebrates, where clothianidin and imidacloprid have similar toxicities. Based on midge data (generally more sensitive than mayflies), dinotefuran and thiamethoxam are relatively less sensitive (decreased factors of ~2.3 and 5.3, respectively) than imidacloprid and clothianidin. There is a ~4X factor difference in sensitivity across the four neonicotinoids where dinotefuran is the least sensitive. Dinotefuran and thiamethoxam are also reported as the least sensitive in mayfly data as well.

Two notable uncertainties within the Raby *et. al.* data include: 1) inconsistent analytical verification of concentrations, and 2) different control performance in the imidacloprid testing.

For 1), not all test concentrations were confirmed through analytical verification. As a result, the LC_{50} and NOAEC values are based on nominal concentrations. From the limited subset of test concentrations that were analyzed, the measured values were similar to the nominal concentrations, and are not expected to have a substantial impact on the reliability of the acute and chronic toxicity values.

For 2), the chronic midge test showed a reduction in the performance of control organisms with regards to growth and reproductive endpoints, relative to controls in the other tests. Due to this, there is potential that the imidacloprid midge toxicity endpoints underestimate the actual toxicity of imidacloprid to midges. However, the chronic endpoint used for comparison of the neonicotinoids done by the agency was the percent emergence endpoint, which for the

[10] Raby, M; Nowierski, M.; Perlov, D; Zhao, X.; Hao, C; Poirier, D.G. and P.K. Sibley. 2018a. Acute Toxicity of 6 Neonicotinoid Insecticides to Freshwater Invertebrates. Environmental Toxicology and Chemistry, 37 (5): 1430–1445. MRID 50776401.

[11] Raby, M; Zhao, X.; Hao, C.; Poirier, D.G. and P.K. Sibley. 2018b. Chronic toxicity of 6 neonicotinoid insecticides to Chironomus dilutus and Neocloeon triangulifer. Environmental Toxicology and Chemistry, 37 (10): 2727-2739. MRID 50776201.

imidacloprid controls did meet EPA test method standards and was generally one of the most sensitive endpoints across chemicals.

Both mayfly and midge studies tested all four neonicotinoids, however when considering exposure, dinotefuran tended to have the highest estimated exposure concentrations (EECs) among the four chemicals. The other three neonicotinoids were estimated to have similar EECs to each other. On an acute basis, for the mayfly and midge acute RQs, the majority of clothianidin and dinotefuran RQs were greater than those of imidacloprid. Thiamethoxam appears to present a lower acute risk concern when considering the midge RQs. On a chronic basis more generally, clothianidin, dinotefuran, and imidacloprid, have similar chronic RQs with a few exceptions: tree fruit RQs for imidacloprid were eleven times higher than the other A.I.s; foliar nursery and soil forestry applications RQs for clothianidin were an order of magnitude higher than imidacloprid; foliar and soil applications as well as seed treatment RQs for imidacloprid were 13-220 times higher than thiamethoxam. Overall thiamethoxam was found to have lower exceedances to aquatic invertebrates than the other three nitroguanidine neonicotinoids.

Estuarine/Marine Invertebrates
For clothianidin foliar applications, there are no acute risks identified for all uses (RQs < 0.5) except for use on rice (RQs = 1.6; foliar and seed treatment). The chronic LOC (1) is only exceeded for foliar uses on fruit and nut trees, ornamentals/shade trees, and rice (RQs ranged from 1.1 – 5.2). The chronic LOC (1) for soil applications is exceeded for tree fruits and nuts, cucurbits, fruiting and leafy vegetables, and low growing berries (RQs ranged 1.6 – 1.9). For clothianidin seed treatments, there are no acute LOC (0.5) exceedances, except for the use on rice (RQ ≤ 1.4). There are also no chronic LOC (1) exceedances except for use on rice (RQ = 1.7). For the poultry house use of clothianidin (0.49 lbs. a.i./A), the acute LOC is not exceeded (RQs ≤ 0.31), however, the chronic LOC is exceeded (RQ ≤ 3.0).

None of the saltwater (SW) invertebrate acute or chronic RQs exceeded the LOCs for thiamethoxam uses with foliar, soil and seed treatments.

Aquatic Vascular and Non-Vascular Plants
There are no risks of concern to aquatic plants from either clothianidin or thiamethoxam. The RQs for aquatic vascular and non-vascular plants did not exceed the LOC (1) for any uses (clothianidin RQs ≤ 0.16; thiamethoxam (RQs <0.001). For clothianidin, effects on yield were observed in both aquatic vascular and non-vascular plants but only at high test concentrations (0.075 lbs. a.i./A; single application).

2. Ecological Incidents

i. Pollinator Incidents

The Office of Pesticide Programs (OPP) maintains a database called the Incident Database System (IDS) in which wildlife incidents reported to the agency from a variety of sources are maintained. The sources of information for incidents include registrant reports (aggregated incidents) submitted under the FIFRA §6(a)(2) reporting requirement, as well as reports from

local, state, national and international-level government reports on bee kills, news articles, and correspondence made to the EPA by phone or via email (through beekill@epa.gov) generally reported by homeowners and beekeepers. A search of IDS for aggregated incidents was conducted on May 2, 2019 for clothianidin and thiamethoxam. Incidents in IDS are classified as "not determined," "unlikely," "possible," "probable," and "highly probable".

There were 54 ecological incidents affecting bees in the United States associated with the use of clothianidin that were reported in the IDS between 2010 and 2018. Some incidents involved clothianidin and other chemicals. The majority of reported incidents involved commercial honeybees. The incident reports' classifications ranged from unlikely to highly probable, where 15 incidents were classified as "highly probable," and 16 incidents were classified as "probable". Considering all reported incidents, 19 of the incidents were attributed to registered uses of clothianidin (*i.e.*, corn, cotton, canola, and sugar beet) at the time of the incident, but the legality of use was not determined in 34 of the reported incidents, and a single incident was considered a misuse. There were 27 incidents where entire honeybee colonies were affected that were associated with corn, however, there was insufficient evidence to correlate clothianidin or the other neonicotinoids to these incidents. All but four of these 27 incidents occurred prior to 2015.

From 2002 – 2018, there were 22 incidents reported in the US for honeybees in association with agricultural uses of thiamethoxam. Seven of the incidents with certainties of highly probable or possible have been reported in association with corn planting in Indiana, Minnesota, and Illinois. Observations included hundreds to thousands of dead bees and bees with behavioral impacts. Twelve incidents considered probable or possible were reported by the state of Washington in 2002 in association with applications of thiamethoxam to orchards (as unspecified, or to pears or cherries). In most of these incidents, the bee hives were located within the treated orchards. In addition, an incident was reported in California in association with thiamethoxam applications to lemon trees. In 2018, an incident was reported in association with an application to watermelons. One additional incident was associated with applications to an "agricultural area".

ii. Aquatic and Non-Pollinator Terrestrial Incidents

A review of the IDS database for incidents involving wildlife including aquatic organisms as well as plants was completed on June 15, 2017. There was one incident submitted for clothianidin for the Poncho Beta formulation, which reported crop damage in Idaho in August 2014 from spray drift. However, that incident was also associated with several other insecticides, fungicides, and herbicides. There were four incidents submitted for thiamethoxam. Three of the four incidents involved plant crops (*i.e.* beans, corn, etc.), and one incident involved birds. All four incidents listed thiamethoxam as a "possible" cause for the reported incident, however, these incidents were also associated with other chemicals.

In addition to the incidents described above, additional incidents are reported to the agency in aggregated incident reports. Pesticide registrants report certain types of incidents to the agency as aggregate counts of incidents occurring per product per quarter. Ecological incidents reported in aggregate reports include those categorized as 'minor fish and wildlife' (W – B), 'minor plant' (P – B), and 'other non-target' (ONT) incidents. 'Other non-target' incidents include reports of

adverse effects to insects and other terrestrial invertebrates. No aggregate incident reports for W – B or P – B have been submitted to the agency for clothianidin or thiamethoxam.

Although there were limited or no incident reports received by the agency for clothianidin or thiamethoxam related to terrestrial wildlife and/or plants, the absence of reported incidents should not be construed as the absence of incidents. Incident reports for non-target organisms typically provide information only on mortality events and plant damage incidents. Except for phytotoxic effects in terrestrial plants, sublethal effects, such as reduced growth or impaired reproduction, are rarely reported. EPA's changes in the registrant reporting requirements for incidents in 1998 may account for a reduced number of reported incidents. Registrants are now only required to submit detailed information on 'major' fish, wildlife, and plant incidents. Minor fish, wildlife, and plant incidents, as well as all other nontarget incidents, are generally reported aggregately and are not included in the Ecological Incident Information System (EIIS). In addition, there have been changes in state monitoring efforts due to lack of resources.

The agency will continue to monitor ecological incident information as it is reported to the agency. Detailed analyses of these incidents are conducted if reported information indicates concerns for risk to non-target organisms.

3. Ecological and Environmental Fate Data Needs

The ecological and environmental fate database for clothianidin and thiamethoxam is complete. No additional fate data is needed for the clothianidin and thiamethoxam registration review.

C. Benefits Assessment

This section of the PID is organized to begin with a brief benefits overview for clothianidin and thiamethoxam, followed by a more detailed summary of their usage in several crop groups (*e.g.* berries, citrus, cucurbits, pome fruit, stone fruit, etc.). Crop groups described below were the subjects of in-depth benefits assessment memoranda that are part of the documents being released in the neonicotinoid dockets at www.regulations.gov for public comment.

The EPA conducted a number of use site-specific benefits assessments for the neonicotinoids as a pesticide class. Each assessment considered the advantages of the individual neonicotinoid active ingredients, including their use in targeting particular pests, average application rates, acres treated and potential alternatives, which are described in detail in the benefits assessments available in the docket (see Section I.A. for a full list of available benefits documents).

The agency found that as a group, the neonicotinoid insecticides:

- Can control a variety of piercing and sucking pests including those that vector plant diseases such as aphids and whitefly;
- Each show certain benefits for the control of different pests depending on the use setting;
- Offer both immediate, contact control and systemic, residual control of pests over an extended period of time; and
- Are comparatively less expensive and more effective than some alternatives.

Clothianidin is a nitroguanidine-substituted neonicotinoid insecticide used to control damaging pests of concern across a wide range of agricultural and non-agricultural use sites. Neonicotinoids act on the central nervous system of insects, causing irreversible blockage of the postsynaptic nicotinergic acetylcholine receptors (via a selective agonistic mechanism). The primary pests targeted for control with clothianidin include piercing and sucking pests such as aphids, mealybugs, sharpshooters, Asian citrus and pear psyllids and stinkbugs; coleopteran pests such as corn rootworm, billbugs, white grubs, and plum curculio; and a variety of sporadic pests such seed maggots and symphylans. Clothianidin is registered for use on root and tuber vegetables, bulb vegetables, leafy vegetables (brassica and non-brassica), legumes, fruiting vegetables, cucurbits, citrus fruit, pome fruit, stone fruit, berries and small fruit, tree nuts, cereal grains, oilseed crops, and other unclassified crops.

Thiamethoxam is a second-generation neonicotinoid insecticide, belonging to the thianicotinyl subclass. Thiamethoxam acts on the central nervous system of insects by binding to the postsynaptic nicotinic acetylcholine receptor and has systemic and contact activity. The primary pests targeted for control with thiamethoxam include piercing sucking pests such as aphids, leafhoppers, and whitefly in addition to certain hard to kill pests such as pepper weevil and thrips. Thiamethoxam is also highly water soluble and is readily translocated in plant tissue giving it good systemic activity. Registered uses for thiamethoxam encompass a wide range of agricultural use sites, which includes root and tuber vegetables, leafy vegetables (brassica and non-brassica), legumes, fruiting vegetables, cucurbits, citrus fruit, pome fruit, stone fruit, berries and small fruit, cereal grains, etc. There are also a number of non-agricultural use sites (*e.g.* warehouses, schools, residential living spaces, etc.).

The following are summaries of the benefits assessments available in the public docket. [12,13]

Berries
Berries refer to strawberry, caneberry (blackberry, raspberry, *etc.*), cranberry, and blueberry, as well as multiple other small soft fruit grown on very small acreage. Neonicotinoids, including clothianidin and thiamethoxam, provide both contact and systemic control of numerous economically significant pests in berry crops.

Clothianidin is registered for use on cranberry and blueberry. Clothianidin is recommended for control of cranberry girdler and weevils in cranberry production. Weevil damage can result in plant damage and cranberry feeding damage can result in plant death. Alternatives for the control of weevils include chlorpyrifos and indoxacarb as well as other neonicotinoids (such as imidacloprid, dinotefuran, and acetamiprid). Clothianidin is the only insecticide recommended for control of cranberry girdler.

Thiamethoxam is registered for soil and foliar applications on several berry crops including blueberry, caneberry (including raspberry and blackberry), strawberry and cranberry. Strawberry and caneberry growers rely heavily on thiamethoxam, treating around a third of the acres grown. It is less used in blueberry, where use of imidacloprid is more common. There are no usage data

[12] https://www.regulations.gov/docket?D=EPA-HQ-OPP-2011-0865
[13] https://www.regulations.gov/docket?D=EPA-HQ-OPP-2011-0581

available for cranberry production. Thiamethoxam is used for the control of aphids and whiteflies, but primarily for Lygus bug in strawberry; aphids, potato leafhopper, root weevils, and spotted wing drosophila in caneberry; cranberry flea beetle, leafhopper, and weevil in cranberry; and aphids, sharpnosed leafhopper, and Japanese beetle in blueberry production. These pests cause direct feeding damage (i.e. Japanese beetle and cranberry flea beetle) and transmit diseases (i.e. aphids and leafhoppers). Alternatives vary greatly by crop and target pest, but generally include: organophosphates, pyrethroids and other neonicotinoids (such as imidacloprid and acetamiprid)

For more information, refer to *Benefits of Neonicotinoid Insecticide Use in Berries (Strawberry, Caneberry, Cranberry, and Blueberry) and Impacts of Potential Mitigation* available in the docket.

Citrus
On average from 2011 to 2015, there were 3,100 total citrus acres treated annually with clothianidin and 284,000 total citrus acres treated annually with thiamethoxam.[14] Data from 2014 to 2018 indicate substantial increases in usage, by 67% and 40% respectively.[15] In general, the Asian Citrus Psyllid (ACP) is the primary pest targeted by the neonicotinoids; thiamethoxam also targets rust mites and the Fuller rose beetle. ACP is an invasive species that transmits the pervasive bacterial disease Huanglongbing (HLB), also known as the citrus greening disease. Infected trees experience premature fruit drop, and the fruit available at harvest are smaller and have a bitter, metallic taste that impacts the quality of fruit produced. More than 90% of all Florida citrus acres are now affected by HLB. There is no cure for HLB and all infected trees eventually die; infected trees must be removed from commercial orchards to avoid contributing to the spread of the disease. Without thiamethoxam, growers would increase use of insecticides such as organophosphates (e.g., acephate, malathion) and pyrethroids (e.g., bifenthrin, lambda-cyhalothrin, cyfluthrin), as well as acetamiprid, a chloropyridinyl neonicotinoid. Control costs would increase, and control would likely be compromised as well, leading to an increased number of trees infected with HLB, which would have to be removed and replaced at substantial cost.

Thiamethoxam also targets citrus leafminer and mites, and, in California, the Fuller rose beetle. Alternatives for leafminer and mite include abamectin and spirotetramat. There do not appear to be good alternatives to thiamethoxam for the Fuller rose beetle.

For more information, see *Benefits of Neonicotinoid Insecticide Use in the Pre-Bloom and Bloom Periods of Citrus*.

Cotton
An average of 6.4 million acres of cotton are treated with a neonicotinoid insecticide. EPA estimates that almost 69% of acres receive at least one application of a neonicotinoid, primarily with imidacloprid and thiamethoxam. Accounting for multiple treatments per acre, nearly 9 million acres of cotton are treated with neonicotinoids annually. Seed treatments account for about 6 million acres, approximately 100,000 acres are treated at-plant, and over 2.8 million

[14] Market research data. 2011-2015.
[15] Market research data. 2014-2018.

acres are treated after crop emergence. Thiamethoxam accounts for more than 1.5 million acres of the area treated after crop emergence, clothianidin is used on just over 100,000 acres and the rest, about 1.2 million acres, is treated with imidacloprid.

Foliar usage of clothianidin and thiamethoxam in cotton most commonly targets plant and stink bugs. There are regional differences in usage and target pests. Clothianidin is rarely used in the Mid-South and Plains states. In the Plains states, the primary target pest of thiamethoxam is the flea hopper and there is some usage against aphids. These pests cause a variety of damage by piercing the boll to feed on developing seeds resulting in yield loss and loss of fiber quality. Without clothianidin, thiamethoxam, or other nitroguanidine neonicotinoids, growers would probably use a combination of an organophosphate with a pyrethroid, such as acephate or dicrotophos with lambda-cyhalothrin or bifenthrin, to control plant and stink bugs, which would increase costs – and lower income – by $3 to $7/acre, depending on the region, which could be as much as three percent of a grower's net operating revenue.

For more information, see *Benefits of Neonicotinoid Insecticide Use in the Pre-Bloom and Bloom Periods of Cotton*.

Cucurbits
Clothianidin has very limited use for foliar and soil applications on cucurbits, with 5,700 total acres treated annually, on average from 2011 – 2015. Thiamethoxam is primarily used as a soil or foliar application for cucumbers (12,000 total acres treated annually), but is also applied by other growers of other cucurbits (*e.g.* cantaloupes, squash, watermelon, pumpkins) via the same application methods. Nationally-targeted pests for cucurbits include the whitefly, aphid, thrips and cucumber beetle. There are several species of whiteflies and aphids that can vary by region, but these pests all threaten cucurbit crops by direct-feeding and by vectoring viruses or disorders. There are also several species of thrips that vary by region, and, these pests are known to cause leaf silvering, leaf curling, flower deformations, and fruit damage. Cucumber beetles occur nationally but are particularly a pest of concern in the northeast United States. Cucumber beetle larvae feed on the roots of cucurbit plants, while adults feed on leaves. The alternatives to neonicotinoids currently in use are bifenthrin, chlorpyrifos, permethrin, carbaryl and zeta-cypermethrin.

For more information, see *Benefits of Neonicotinoid Insecticide Use in Cucurbit Production and Impacts of Potential Risk Mitigation.*

Fruiting Vegetables, Brassica Vegetables, Leafy Green Vegetables, Tree Nuts, Root & Tuber Vegetables, Bulb Vegetables, and Tropical and Subtropical Fruit
These crop groups account for approximately 35% of neonicotinoids used in agriculture and about 25% of the acreage treated with neonicotinoids, not including seed treatments. Growers of fruiting vegetables and *Brassica* vegetables rely relatively heavily on clothianidin and thiamethoxam with about 10 to 15 percent of the crop treated, on average.[6] Only about five percent of the leafy greens, tree nuts, and carrots are treated with clothianidin and thiamethoxam; imidacloprid generally is the dominant neonicotinoid for these crops, as well as for pest control in tropical/subtropical fruit. There is little usage of clothianidin and thiamethoxam, or of other neonicotinoids, in bulb vegetables.

In general, neonicotinoids, including clothianidin and thiamethoxam, are used in both soil and foliar applications to manage piercing and sucking pests that feed off the sap of plants, these pests may also vector diseases. While imidacloprid is often used against aphids and whiteflies, clothianidin and thiamethoxam often target bagrada bug, stink bugs, leafhoppers, and thrips, as well as a number of soil-dwelling pests such as springtail and root maggots. Alternatives for these pests tend to be contact insecticides like OPs and pyrethroids, but which do not provide the residual systemic control of the neonicotinoids and may have to be applied multiple times throughout the season. Extension guides discourage use of broad-spectrum insecticides like pyrethroids early in the season because it may reduce populations of predatory and parasitic insects and result in secondary pest outbreaks later.

For more information, see *Benefits of Neonicotinoid Use and Impacts of Potential Mitigation in Vegetables, Legumes, Tree Nuts, Herbs, Tropical and Subtropical Fruit Crops*.

Grapes
Thiamethoxam has very limited use on grapes with an average of one percent of grape acreage treated or lower. Thiamethoxam is primarily used for the control of leafhoppers (which includes glassy-winged sharpshooter). Additionally, thiamethoxam is recommended for the control of grape pylloxera. These pests cause quality and yield impacts due to direct feeding damage and disease spread. Alternatives vary by target pest but consist generally of pyrethroids and organophosphate as well as other neonicotinoids (such as imidacloprid and acetamiprid).

Clothianidin accounts for 29,000 total acres treated (or 25PCT) in table grapes, 8,800 total acres treated (or 1PCT) in wine grapes, and 2,800 total acres treated (or 1PCT) in raisin grapes. Clothianidin is used almost exclusively for the control of mealybugs but is also recommended for the control of leafhoppers (which includes glassy-winged sharpshooters). These pests can cause quality and yield loss from direct feeding damage and disease transmission. Mealybugs contaminate fruit with egg clusters and honeydew produced by adults can render the fruit unmarketable. Grape mealybugs are also the primary vectors of the grapevine leafroll associated virus (GLRaV), which can spread across vineyards resulting in a 40% loss of crop yields. Alternative control options include spirotetramat and lime sulfur.

For more information, refer to *Benefits of Neonicotinoid Insecticides Usage in Grapes and Impacts of Potential Mitigation* available in the docket.

Pome Fruit
Clothianidin and thiamethoxam are registered for use in pome fruit crops (which includes apple and pear). Clothianidin accounts for 1,000 of the total acres treated (or 1PCT) in pear production; 20,300 of the total acres treated (or 13PCT) in eastern apple production; and there is no reported usage in western apple production. Clothianidin is used the control of pear psylla and mealybug in pear production and for the control of plum curculio and brown marmorated stinkbugs (BMSB) in apple production. These pests cause quality and yield impacts associated with direct feeding and mold growth due to honeydew secretion. Alternatives generally include pyrethroids, organophosphates, and other neonicotinoids (such as imidacloprid and acetamiprid).

Thiamethoxam accounts for 8,900 of the total acres treated (or 15PCT) in pear production; 80,800 of the total acres treated (or 50PCT) in eastern apple production; and 4,400 of the total acres treated (or 1PCT) in western apple production. Thiamethoxam is used for the control of pear psylla and mealybugs in pear production and plum curculio, aphid, and BMSB in apple production. These pests cause quality and yield impacts associated with direct feeding damage and mold growth due to honeydew secretions. Alternatives generally consist of pyrethroids, organophosphates, and other neonicotinoids (such as imidacloprid and acetamiprid).

For more information, refer to *Usage, Pest Management Benefits, and Possible Impacts of Potential Mitigation of the Use of the Four Nitroguanidine Neonicotinoids in Pome Fruits (Apple, Pear)* available in the docket.

Rice
The primary use of thiamethoxam and clothianidin is via seed. Foliar applications of clothianidin target the many of the same early season pests as seed treatment applications (e.g., rice water weevil, chinch bugs, aphids); therefore, foliar applications likely only occur when seed treatments are not used. Foliar applications of clothianidin occur between emergence and early tillering on less than 1,000 acres of rice annually. Depending on the target pest, foliar alternatives to clothianidin include pyrethroids, diflubenzuron, and neonicotinoid and chlorantraniliprole seed treatments, depending on the target pest.

For more information, refer to *Usage and Benefits of Neonicotinoid Insecticides in Rice and Response to Comments,* available in the docket.

Seed Treatments
Clothianidin and thiamethoxam are currently registered as a seed treatment for multiple field crops, such as canola, corn, cotton, soybean, sugarbeet, rice, and wheat, and vegetable crops, such as brassica, carrots, cucurbits, lettuce, and onion. The highest usage is on corn and soybean, simply by virtue of the large number of acres planted.

Clothianidin and thiamethoxam, along with imidacloprid, are some of only a few insecticidal seed treatments available. The neonicotinoids are valuable tools because they have both contact and systemic activity. Thus, they control both soil pests and above ground pests that attack early stages of the crop. Soil pests include corn rootworms, wireworms, grape colaspis, and maggots, but there are also many soil pests that are not well-identified. It is difficult to scout for soil pests in advance of planting and their presence is often hard to predict. Damage can be extensive; soil pests may attack the seed and/or developing roots and sprouts resulting in poor stand establishment and substantial yield reductions. Above ground pests such as aphids, leafhoppers, and thrips feed on newly emerged seedlings. In addition to direct feeding damage, such pests can transmit diseases. Depending on the crop, other pests include Hessian fly, leafminers, beetles, and the bagrada bug. As with soil pests, damage to seedlings can result in poor stands and substantial yield reductions.

Imidacloprid would be the most likely alternative for clothianidin and thiamethoxam seed treatments where imidacloprid is registered. A few other insecticides are available for a limited number of sites. For example, chlorpyrifos is registered for treating wheat, sorghum, and some

vegetable seeds; acetamiprid is registered for canola seed; and cyromazine is used to treat some vegetable seeds. Pyrethroids, such as permethrin and cyfluthrin, are registered for some sites as well. None of these, except for acetamiprid, has systemic activity and would only control soil pests. Chlorantraniliprole has limited systemic activity and only controls some of the insects controlled by noenicitinoid seed treatments in rice seed. At-plant soil applications may be used in lieu of seed treatments. Application rates are higher than for seed treatments, increasing chemical costs, but a larger zone around the seed may be protected from soil pests. Common insecticides applied at-plant include various carbamates, organophosphates, pyrethroids, and neonicotinoids. For above ground pests, insecticide applications immediately after the crop emerges. Compared to seed treatments, application rates and chemical costs are higher, and the growers are likely to incur additional equipment and labor costs to make the application.

For more information, refer to *Usage and Benefits of Neonicotinoid Insecticides in Rice and Response to Comments*, and *Benefits and Impacts of Potential Mitigation for Neonicotinoid Seed Treatments on Small Grains, Vegetables, and Sugarbeet Crops* available in the docket.

Stone Fruit
Clothianidin and thiamethoxam each account for about 6% of the peach/nectarine crop treated (9,000 and 11,500 total acres treated, respectively). Among stone fruit crops, clothianidin is registered only for peaches; thiamethoxam is registered for the entire crop group. Thiamethoxam is used to a fairly large extent in cherries (23% average annual crop treated at 49,300 total acres treated).

Important stone fruit pests targeted by clothianidin and thiamethoxam include the plum curculio, aphids, plant bugs, stink bugs, June beetles, and Oriental fruit moth. Treatments for all these pests is typically done soon after petal fall or close to harvest to avoid insect contamination of fruit. Alternative insecticides currently used or recommended include, carbamates, organophosphates, and pyrethroids, other nitroguanidine neonicotinoids (mainly imidacloprid), and the chloropyridinyl neonicotinoid acetamiprid. Use of these chemicals is likely to rise in the absence of clothianidin or thiamethoxam.

For more information, see *Assessment of Usage, Benefits and Impacts of Potential Mitigation in Stone Fruit Production for Four Nitroguanidine Neonicotinoid Insecticides (Clothianidin, Dinotefuran, Imidacloprid, and Thiamethoxam)*.

Turf and Ornamentals
Clothianidin and thiamethoxam have limited use on turf and ornamentals, where professional applicators reported that these two active ingredients were applied on approximately 3% of the acres treated. Clothianidin and thiamethoxam were reported to be important rotation partners for the management of southern chinch bugs in St. Augustine grass. Neonicotinoids are typically important to managing aphids, borers, white grubs, armored scales and whiteflies in the management of turf and ornamentals. Alternatives to clothianidin and thiamethoxam include other neonicotinoid chemistries (namely imidacloprid and dinotefuran), pyrethroids, organophosphates, avermectins, carbaryl and diamides.

For more information, see *Review of "The Value of Neonicotinoids in Turf and Ornamentals" prepared by AgInfomatics, LLC for Bayer CropScience, Mitsui, Syngenta, and Valent.*

IV. PROPOSED INTERIM REGISTRATION REVIEW DECISION

A. Proposed Risk Mitigation and Regulatory Rationale

As discussed previously, EPA recognizes that the neonicotinoids, including clothianidin and thiamethoxam, are a key tool for growers that provide unique and effective pest control. However, the agency has identified ecological risks of concern, particularly to pollinators and aquatic invertebrates, as a result of many of the same attributes that make the neonicotinoids effective pest management tools. Risk mitigation measures are being proposed to address ecological risks of concern identified for pollinators, birds, mammals, and to aquatic invertebrates; and human health risks of concern to occupational handlers from certain clothianidin and thiamethoxam uses, as described in Section III.

There are human health exceedances identified for several occupational use scenarios. EPA is proposing to mitigate these risks through the requirement of additional Personal Protection Equipment (PPE) such as gloves, respirators, or requiring closed loading systems for seed treatment on labels. Technical registrants are in general agreement with the proposed label changes that will significantly reduce, and eliminate in many scenarios, potential exposure to workers.

There are significant exceedances noted for honeybees. The protection of honeybee colonies is particularly important as, although honeybees are not native to the United States, they play a critical role in the pollination needs of many U.S. crops. While honeybees are often the focus, non-honeybees such as bumble bees, leafcutter bees, and blue orchard bees also play a unique and important role in commercial pollination services, and therefore are also important to protect both bees and agriculture. Additionally, it is important to put forth mitigation that reduces impact to wild native species of bees, as well as honeybees. Rate reductions for certain crops where bee exposure exists or crop stage restrictions that limit exposure during critical periods in the growing season, are expected to have the highest potential impact in reducing risks to all bees.

Due to the persistence of neonicotinoids in the environment, there are also potential exceedances to bees noted for clothianidin and thiamethoxam from usage on poultry litter in chicken houses at the maximum rate and number of applications annually. Once applied, this litter can be taken out of the chicken houses and utilized as fertilizer on agricultural fields, allowing for exposure to bees. The agency is proposing to mitigate these potential risks by reducing the number of poultry house (whole house) applications allowed annually for clothianidin and thiamethoxam.

There are potential risks to birds and small mammals associated with seeds that are coated with neonicotinoids. Mitigation was considered with the understanding of the high benefits associated with seed treatment uses (*e.g.,* early-stage crop protection from soil and above-ground pests), which have the potential to reduce overall neonicotinoid exposure and offer a lower overall risk profile compared to foliar uses. The agency is proposing additional advisory label language,

amplifying Best Management Practices (BMPs), and education programs to help inform farmers about the importance of picking up spilled seed, in order to reduce overall exposure to birds and mammals. High-tech planting equipment using GPS and computer controls is becoming increasingly common in the U.S., and these technologies also help decrease incidence of spills over older, human-operated equipment.

Potential risks to aquatic invertebrates, which fill a foundational role in ecological food webs, are a concern. EPA is proposing several measures for reducing overall exposure including targeted annual application rate reductions and drift and runoff mitigation.

Risks of concern were identified to honeybees in EPA's assessments. The protection of honeybee populations is particularly important as honeybees play a critical role in the pollination needs of many U.S. crops. In 2017 pollination services from operations with more than 5 colonies were valued at over 160 million dollars, and annual honey production in the US was valued at over 340 million dollars[16]. Although the focus of the pollinator risk assessments is on honeybees, the agency recognizes that numerous other species of bees occur in North America and that these non-*Apis* bees have ecological importance in addition to commercial importance in some cases. For example, it is important to note that several species of non-*Apis* bees are commercially managed for their pollination services, including bumble bees (*Bombus spp.)*, leaf cutting bees (*Megachile rotundata*), alkali bees (*Nomia melanderi*), blue orchard bees (*Osmia lignaria)*, and the Japanese horn-faced bee (*Osmia cornifrons*). Importantly, a growing body of information indicates native bees play an important role in crop and native plant pollination, in addition to their overall ecological importance via maintaining biological diversity. EPA is therefore proposing mitigation that reduces impact to honeybees that are also expected to benefit other pollinating insects. Of these measures, reductions in maximum application rates for certain crops where pollinator/bee exposure may occur, or crop stage restrictions which limit exposure during critical periods in the growing season, are expected to have the highest potential impact in reducing risks to all pollinators. These measures were developed in a manner intended to preserve the majority of pest management utility, while also considering risk reductions for bees.

EPA reached out to a variety of stakeholders while drafting its mitigation strategy in order to gain a better grasp of growing practices and potential benefits. EPA also conducted an analysis of common or rare application rates, which was helpful in identifying when conservative assumptions were made in the risk assessments regarding maximum rates. This analysis also allowed the agency to determine where targeted rate reductions would decrease overall potential risks, while minimizing potential impacts to users. Proposed mitigation measures were identified by evaluating each neonicotinoid active ingredient and each use scenario for each crop individually, to determine the best path forward.

Overall, EPA is proposing to address potential risks posed by current registered uses of clothianidin and/or thiamethoxam through the following risk mitigation measures:

- Cancelling certain clothianidin uses
- Restricting certain thiamethoxam uses
- Requiring additional PPE

[16] USDA, National Agricultural Statistics Service (NASS), Agricultural Statistics Board. (2018).

- Reducing maximum application rates or restricting applications during pre-bloom and/or bloom, targeting certain uses with potentially higher pollinator risks and lower benefits
- Preserving the current restrictions for application at-bloom
- Requiring additional label language reducing use by homeowners
- Applying targeted rate reductions for higher risk uses
- Requiring additional spray drift and runoff reduction label language
- Promoting voluntary stewardship efforts to encourage the use of best management practices, education, and outreach to applicators and beekeepers

In selecting appropriate mitigation, EPA considered the benefits of the use of clothianidin and/or thiamethoxam to determine whether any risks present unreasonable adverse effects. For many uses, the benefits are very high. In contrast, significant risks of concern were noted for certain crops. Due to the potential impact to growers' ability to address certain critical pest issues, in accordance with FIFRA's requirement to EPA to take into account the benefits of the use of pesticides in its decision-making, there are cases where the EPA is not proposing risk mitigation. An example of a crop in which the benefits of clothianidin and/or thiamethoxam were weighed against potential impacts of mitigation was citrus crops, where neonicotinoids, including clothianidin and thiamethoxam, are a key element in programs to control the ACP, an invasive pest that transmits HLB, a devastating and incurable disease. See section III.C. for more information. Additionally, EPA considered the overall extent and likelihood of exposure of certain risks of concern. For example, tree injections showed significant risk extending into the following growing season. However, they are an expensive and relatively infrequently used method to prevent tree loss. Due to the low amount of overall usage and strong benefits of the tree injection use, the agency is not proposing risk mitigation.

The proposed mitigation does not eliminate all potential risks of concern from the use of clothianidin or thiamethoxam, however, the proposed mitigation reduces the overall potential of risk and/or exposure. The agency finds the remaining risks to be reasonable under FIFRA, given the benefits of using clothianidin and thiamethoxam. The EPA is also proposing label changes to address general labeling improvements for all clothianidin and thiamethoxam products and uses.

1. Cancellation of Clothianidin Uses on Bulb Vegetables

The agency is proposing that cancellation of clothianidin use on bulbs is necessary in order to mitigate potential exceedances to aquatic invertebrates. The highest neonicotinoid exceedances to aquatic invertebrates from bulb use reached an RQ of 556. A benefits assessment was available for this use, which showed limited usage of neonicotinoids with no usage reported for clothianidin. Although the benefits assessment noted that there are some benefits of neonicotinoid use on bulbs in targeting thrips, alternatives to the neonicotinoids remain available for use on bulbs. In consideration of the high potential risk exceedances and the relatively low expected impacts to bulb growers, EPA is proposing that cancellation of these uses is necessary.

2. Thiamethoxam Use Restrictions for Risks to Occupational Handlers

As noted in Section III.A.1. of this PID, potential risks of concern have been identified for occupational handlers associated with:

- Mixing/loading/applying dry flowable formulations of thiamethoxam for application via backpack sprayer for poultry house applications
- Mixing/loading/applying dry flowable formulations of thiamethoxam for application via mechanically-pressurized handgun to livestock houses, horse barns, and feed lots

These potential risks exceed the EPA's level of concern even when maximum PPE is considered. Therefore, to protect the health of occupational handlers of thiamethoxam, the agency is proposing to restrict all uses for these two use scenarios: 1) DF formulations of thiamethoxam via backpack sprayer for poultry house applications, 2) DF formulations of thiamethoxam via mechanically-pressurized handgun for livestock houses, horse barns, and feed lot applications. It should be noted that even after these proposed restrictions, applicators would still have the option of making thiamethoxam applications in poultry houses, livestock houses, horse barns, and feed lots using alternative application technologies (*e.g.* manually-pressurized handwands) as allowed on labels, taking into account the various mitigation updates proposed in this PID.

3. Glove and Respirator Requirements for Certain Occupational Handlers

Human health exceedances are identified for clothianidin and thiamethoxam for several registered agricultural, seed treatment and non-agricultural (*e.g.* spray applications in commercial buildings) use scenarios. EPA is proposing to mitigate these risks by adding requirements for Personal Protection Equipment (PPE) such as gloves and/or respirator, along with requiring certain application restrictions for commercial facilities.

Most occupational handler risk estimates were not of concern with current baseline attire or with PPE, however, there were some scenarios where risks of concern were identified for workers performing activities (*e.g.*, mixing, loading and/or applying). To mitigate potential dermal and/or inhalation risks to handlers, the agency is proposing the following:

<u>For Clothianidin:</u>

- Proposed uses to add requirement for gloves and a respirator:
  - Corn – seed treatment use (*e.g.*, loading, applying, sewing, bagging, *etc.*)
  - Commercial Buildings – liquid (*i.e.* aerosol cans) application
- Proposed uses to add requirement for gloves:
  - Livestock housing (*i.e.*, non-poultry, barns/feedlots) – Mixing/loading/applying liquid formulation via mechanically-pressurized handgun

As stated in Section III.1 of this PID, there were several potential risks of concern to occupational handlers, including, dermal and inhalation scenarios for corn seed treatment handlers performing several activities (*e.g.* loading, applying, sewing, bagging, *etc.*). The MOE is 71 (LOC = 100) with the current label-required single layer. The agency is therefore proposing the use of a respirator and updating the glove statements for all handlers of clothianidin corn seed treatments. The MOE for the liquid application via aerosol can to treat for bed bugs in commercial buildings was 48. The agency is proposing a label requirement for gloves and a respirator, which results in no risk of concern. The MOE for mixers/loaders/applicators of liquid formulations via mechanically-pressurized handguns in livestock housing was 80. The agency proposes a glove requirement, which no longer results in a risk of concern.

For Thiamethoxam:

- Proposed uses to add requirement for gloves and a respirator:
    - Sod – Mixing/loading dry flowable (DF) formulations for aerial application
    - High-acreage field crops (*e.g.,* barley, wheat, rice, cotton, corn) – Mixing/loading DF formulations for aerial application
    - Warehouses – Mixing/loading/applying liquid formulations via mechanically-pressurized handgun
    - Poultry Houses – Mixing/loading/applying DF formulations via mechanically-pressurized handgun
- Proposed uses to add requirement for gloves:
    - Warehouses – Mixing/loading/applying liquid crack and crevice (C&C) treatment via manually-pressurized handwand
    - Childcare centers, schools and institutions – Mixing/loading/applying liquid C&C treatment via manually-pressurized handwand
    - Residential living spaces – Mixing/loading/applying liquid C&C treatment via manually-pressurized handwand
    - Mounds or nests – Mixing/loading/applying liquid formulations via manually-pressurized handwand
    - Mounds or nests – Mixing/loading/applying DF formulations via manually-pressurized handgun
    - Landscaping trees, shrubs and bushes – Mixing/loading/applying DF formulations via mechanically-pressurized handgun

As noted in Section III.1 of this PID, there were several potential risks of concern to occupational handlers from thiamethoxam uses. Potential risks of concern were identified for mixers/loaders of DF formulations for aerial applications to sod and high-acreage field crops (sod, MOE = 44; high-acreage field crops, MOE = 53). EPA proposes requiring gloves and a respirator, which resolves these potential risks of concern. The MOE for mixers/loaders/applicators of liquid formulations using a mechanically-pressurized handgun to warehouses was 55. This scenario no longer results in a risk of concern with the addition of gloves and a respirator. A potential risk of concern was identified for mixers/loaders/applicators of DF formulations via mechanically-pressurized handguns to poultry houses (MOE = 57), which is eliminated with the addition of gloves and a respirator.

Also, there were six non-agricultural use scenarios with potential risks of concern for mixers/loaders/applicators. For liquid formulations applied via manually-pressurized handwands, there were potential risks of concern associated with crack & crevice (C&C) applications in warehouses (MOE = 91); C&C applications in childcare centers, schools and institutions (MOE = 91); C&C applications to residential living spaces (MOE = 91); and applications to mounds or nests (MOE = 6.7). For these use scenarios, the agency proposes a glove requirement to the label, which eliminates these risks. The MOE for DF formulations applied via manually-pressurized handgun to mounds or nests was 87. The addition of gloves negates this potential risk. Finally, a potential risk of concern was identified for DF formulations applied via mechanically-pressurized handgun to landscaping trees, shrubs and bushes (MOE = 65). Therefore, the agency proposes requiring gloves, which results in no risk of concern.

In addition, the agency is proposing to update the glove statements currently on labels to be consistent with the Label Review Manual. The proposed new language does not fundamentally change the personal protective equipment that workers need to use, and therefore should impose no impacts on users. With cooperation from stakeholders, the proposed label changes would significantly reduce, and eliminate in many scenarios, risks of concern to workers.

The EPA has recently required fit testing, training, and medical evaluations[17] for all handlers who are required to wear respirators and whose work falls within the scope of the WPS.[18] If a clothianidin handler currently does not have a respirator, an additional cost will be incurred by the handler or the handler's employer, which includes the cost of the respirator plus, for WPS-covered products, the cost for a respirator fit test, training, and medical exam.

Respirator costs are extremely variable depending upon the protection level desired, disposability, comfort, and the kinds of vapors and particulates being filtered. Based on available information that the EPA has, the average cost of a disposable particulate filtering face-piece respirator) is about $5 and an elastomeric half mask respirator is $35, with their replacement cartridges averaging around $19.[19] The agency expects that the average cost of a particulate filtering facepiece respirator is lower than the average cost of an elastomeric half mask respirator. The estimated cost of a respirator fit test, training and medical exam is about $180 annually.[20] The impact of the proposed respirator requirement is likely to be substantially lower for a clothianidin or thiamethoxam handler who is already using a respirator because the handler or handler's employer uses other chemicals requiring a respirator in the production system or as part of the business (*i.e.*, the handler or employer will only incur the cost of purchasing filters for the respirator on a more frequent basis). Respirator fit tests are currently required by the Occupational Safety and Health Administration (OSHA) for other occupational settings to ensure proper protection.[21]

The EPA acknowledges that requiring a respirator and the associated fit testing, training, and medical evaluation places a burden on handlers or employers. However, the proper fit and use of respirators is essential to accomplish the protections respirators are intended to provide. In estimating the inhalation risks, and the risk reduction associated with different respirators, the EPA's human health risk assessments assume National Institute for Occupational Safety and Health (NIOSH) protection factors (*i.e.*, respirators are used according to OSHA's standards). If the respirator does not fit properly, use of clothianidin and thiamethoxam may cause unreasonable adverse effects on the pesticide handler.

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[17] Fit testing, training, and medical evaluations must be conducted according to OSHA regulations 29 CFR § 1910.134, 29 CFR § 1910.134(k)(1)(i) through(vi), and 29 CFR § 1910.134, respectively.
[18] 40 CFR 170 (see also Appendix A of chapter 10 of the Label Review Manual, available at https://www.epa.gov/pesticide-registration/label-review-manual)
[19]Gempler's. 2016. Commercial-Grade Outdoor Work Gear Online Catalogue. Accessed online on August 26, 2016, at http://www.gemplers.com/respirators
[20] Economic Analysis of the Agricultural Worker Protection Standard Revisions. Biological and Economic Analysis Division, Office of Pesticide Programs, U.S. EPA. 2015. p. 205. Available at www.regulations.gov, docket number EPA-HQ-OPP-2011-0184-2522
[21] 29 CFR § 1910.134

4. Closed System Requirement for Thiamethoxam Corn Seed Treatments

As noted in Section III.A.1. of this PID, potential risks of concern have been identified for occupational handlers from the use of thiamethoxam for corn seed treatments in commercial facilities. Even with maximum PPE (double layer of clothing, gloves, and an elastomeric half-mask respirator) required for these uses, certain field, pop, and sweet corn seed treatment scenarios still have MOEs of concern for certain activities, ranging from 13 – 43. These MOEs are well below the agency's level of concern of 100. To protect the health of workers involved in commercial seed treatments of corn using thiamethoxam, EPA is therefore proposing that the use of a closed loading system be required for all thiamethoxam corn seed treatments conducted in commercial facilities. With the addition of a closed loading system, EPA would no longer expect any potential risks of concern to human health for corn seed treatments of thiamethoxam in commercial facilities.

EPA is proposing that all thiamethoxam products registered for corn seed treatment uses must include the following statement on labels:

- "Must be applied by closed system seed treatment application processes when applied in commercial seed treatment facilities."

EPA identified no risk estimates of concern for corn seed treatment uses of thiamethoxam in the case of on-farm seed treatments, and mitigation is therefore not being proposed for that use scenario. The closed system requirement being proposed in this PID is for commercial facilities only.

5. Poultry House Use Requirements for Clothianidin

Ecological risks of concern for both bees and aquatic invertebrates have been identified as a result of poultry house uses of clothianidin. Single application rates associated with non-agricultural uses account for some of the highest application rates, where poultry house applications were up to 0.49 lbs. a.i./A. There is a potential chronic risk for aquatic invertebrates from the application of clothianidin to poultry houses (RQs $\leq$ 7.2). Additionally, soil amendments of clothianidin-treated poultry litter (from the use in poultry houses) pose a risk when applied to fields with honeybee attractive plants (*e.g.*, pasture). Screening level RQs for applications of poultry litter from treated poultry houses resulted in acute and chronic LOC exceedances for adult bees (RQs = 7 and 70, respectively).

To help mitigate these potential risks, EPA is proposing that the all clothianidin products registered for poultry house uses must include the following statements:

- "Limit applications to one whole house treatment and 5 perimeter (partial house) treatments per year."
- "Do not apply to more than 30,000 sq. ft. per year per house."

The goal of these proposed statements is to reduce the total environmental loading of clothianidin resulting from poultry house uses. Limiting both the number and square footage of allowable poultry house treatments per year will limit the amount of clothianidin entering the

environment, when treated poultry litter is removed from poultry houses and used as a soil amendment in agricultural fields, while still retaining the benefits of clothianidin for poultry producers as a treatment for darkling beetles and other poultry houses pests. These proposed limits on poultry house uses of clothianidin will also reduce the exposure of applicators to this pesticide.

6. Application Rate Reductions

Application rate reductions are being proposed for several uses in order to reduce risks to both bees and aquatic invertebrates. For pollinators, these rate reductions focus on certain crops with the highest potential reduction of risks to bees. For bees and aquatic invertebrates, measured rate reductions are a part of a multi-faceted approach to reducing overall exposure. The additional approaches include spray drift and runoff reduction language, current application timing restrictions, and pesticide education and outreach efforts. The goal of these proposed maximum annual application rate reductions is to reduce the total environmental loading of clothianidin and/or thiamethoxam resulting from the various uses specified, while still providing growers with the ability to use these tools as an effective means of pest control.

As part of the assessments of the benefits for the neonicotinoids, EPA also assessed the impacts of potential mitigation, including the effect of reducing rates. This information was critical in identifying sites and rates where rate reductions would achieve the greatest reduction in risk while minimizing the potential impacts on users of clothianidin and/or thiamethoxam. Although these proposed rate reductions do not eliminate all risks, they are expected to contribute to reducing risk overall. The benefits of these uses outweigh the remaining reduced risks of concern.

To help mitigate risks to non-target organisms, EPA is proposing the following reductions in the maximum allowable annual application rates for foliar and/or soil applications of clothianidin and thiamethoxam products:

i. Clothianidin

Table 3. Proposed Maximum Annual Application Rates for Clothianidin

Crop/Crop Group	Current Rate (Max. Annual)	Proposed Rate (Max. Annual)
Berries and small fruit (excluding grape and strawberry)	Maximum combined annual application rate, regardless of formulation type: 0.20 lbs. a.i./A per year	Maximum combined annual application rate, regardless of formulation type: 0.16 lbs. a.i./A per year
Cotton	Maximum combined annual application rate, regardless of formulation type: 0.20 lbs. a.i./A per year	Maximum combined annual application rate, regardless of formulation type: 0.15 lbs. a.i./A per year
Fruiting Vegetables	Foliar: 0.20 lbs. a.i./A per year	Foliar: 0.17 lbs. a.i./A per year
Pome Fruit	Foliar: 0.20 lbs. a.i./A per year	Foliar: 0.16 lbs. a.i./A per year

Crop/Crop Group	Current Rate (Max. Annual)	Proposed Rate (Max. Annual)
Production/Commercial Ornamentals	Foliar and soil: 0.40 lbs. a.i./A per year	Foliar and soil: 0.30 lbs. a.i./A per year
Tree Nuts	Foliar: 0.20 lbs. a.i./A per year Soil: 0.40 lbs. a.i./A per year	Foliar: 0.16 lbs. a.i./A per year Soil: 0.38 lbs. a.i./A per year
Turf	Foliar: 0.40 lbs. a.i./A per year	Foliar: 0.30 lbs. a.i./A per year

Berries and small fruits
In this crop group, clothianidin is registered for use only on cranberry and blueberry. EPA is proposing to reduce the current maximum annual application rate, regardless of the application method, from 0.20 lbs. a.i./A per year to 0.16 lbs. a.i./A per year. This mitigation is being proposed to address aquatic invertebrate exceedances.

Potential risks to aquatic invertebrates are noted for foliar applications of clothianidin to cranberries, with RQs up to 96. The agency is uncertain as to the impact this mitigation will have on growers. Clothianidin was registered for use on cranberries and blueberries in 2016 and usage data are not available. EPA encourages comment on the feasibility of pest control at these rates and the extent to which growers' production practices will be affected.

Cotton
For cotton, EPA is proposing reducing the current maximum combined rate of 0.20 lbs. a.i./A per year, regardless of formulation type, and reducing it to 0.15 lbs. a.i./A per year applied annually. This mitigation measure is being proposed to address pollinator and aquatic invertebrate risk exceedances.

Potential risks from cotton foliar use is considered under the strongest category of evidence for pollinator exceedances. Acute and chronic foliar exceedances are identified for adult bees (RQs = 346 and 2,729, respectively). Foliar applications of clothianidin resulted in chronic RQs that ranged from 30 to 59 for freshwater aquatic invertebrates. Cotton is considered one of the major drivers of potential pollinator risk. However, clothianidin is also considered highly beneficial to cotton growers throughout the growing season for a variety of pests.

Available usage data show that an average of 8,900 lbs. of clothianidin is applied as a foliar treatment each year; less than two percent of the cotton crop is treated with a foliar application of clothianidin, although over 12% of the cotton crop in California and Arizona receives foliar treatment. Nationally, the average annual application rate is 0.097 lbs. a.i./A per year, which is well below the proposed new annual rate of 0.15 lbs. a.i./A per year, however, annual application rates of 0.160 lbs. a.i./A per year are observed on about 13% of the acres treated with clothianidin. With consideration of current usage and typical rates, these rate reductions are expected to have impact on some users. The proposed rate would allow only one application at the maximum single application of 0.10 lb a.i./A per year. Growers who would normally make a second application may have to use alternative insecticides.

Fruiting Vegetables
For the fruiting vegetables crop group, EPA is proposing reducing the current maximum foliar annual application rate from 0.20 lbs. a.i./A per year to 0.17 lbs. a.i./A per year. This rate reduction is targeted at reducing potential risk to aquatic invertebrates.

Potential risks to aquatic invertebrates are noted for both foliar and soil applications of clothianidin from fruiting vegetable use, with RQs ranging up to 768 and the highest exceedances identified for foliar uses. The agency expects that the potential impacts to growers from this mitigation will be low. According to usage data, annual rates above 0.12 lbs. a.i./A per year are used on only about one percent of the area treated with clothianidin, inclusive of soil applications. The proposed rate allows at least two foliar applications of clothianidin per year.

Pome Fruit
For pome fruit, EPA is proposing to reduce the current maximum annual foliar application rate of 0.20 lbs. a.i./A per year to 0.16/year lbs. a.i./A. This mitigation is being proposed for aquatic invertebrate risk exceedances.

Potential risks to aquatic invertebrates are noted for applications of clothianidin from pome fruit use, with a chronic RQ of 108. A rate reduction of clothianidin in apple will impact about 11% of the Eastern apple crop acreage that use clothianidin to control plum curculio and brown marmorated stink bug. For apple orchards treated with clothianidin, approximately 90% of the base acres are treated with average annual rates of 0.16 lbs. a.i./A per year (MRD, 2013-2017). Thus, a reduction in the annual rate is likely to affect about 10% of Eastern apple crop acreage facing severe pest pressure. For pear, about 1% of the crop acreage is treated with clothianidin to control pear psylla and mealybug. Of the pear crop acreage treated with clothianidin, nearly 98% are treated at the maximum annual rate of 0.20 lbs. a.i./A per year. For these pear crops, a rate reduction is likely to have a significant impact on the use clothianidin. Benefits are considered high for pome fruit use of clothianidin. Alternatives to clothianidin in pome fruit include organophosphates, pyrethroids, and other neonicotinoids (such as imidacloprid and acetamiprid).

Production/Commercial Ornamentals
For production/commercial ornamentals, EPA is proposing a reduction of the current maximum annual foliar and soil application rate from 0.40 lbs. a.i./A per year to 0.30 lbs. a.i./A per year. This rate reduction is targeted at reducing potential risk to pollinators and aquatic invertebrates (nursery only). These rate reductions apply to ornamental ground cover, ornamental trees, forestry, ornamental woody shrubs and vines, and outdoor greenhouses/nurseries. This mitigation does not apply to indoor commercial nursery, Christmas trees, greenhouse uses, or forestry use on public land and quarantine application by USDA.

Potential risks from ornamentals are considered under the strongest category of evidence for pollinator exceedances based on bridged residue studies and three bee kill incident reports (see *Final Bee Risk Assessment to Support the Registration Review of Clothianidin and Thiamethoxam*). Also, potential risks to aquatic invertebrates are noted for foliar and soil applications, with chronic RQs ranging from 30 to 86 for foliar applications and from 29 to 83 for soil applications. Benefits are considered high for the use of neonicotinoids, however, clothianidin is one of the least used neonicotinoid active ingredients for these use sites (3%).

Other than the available 2014 AgInfomatics report and review, usage data is limited. This rate reduction is considered to have potentially moderate impacts on current usage.

Tree nut
For tree nuts, EPA proposes reducing the current maximum foliar annual application rate from 0.20 lbs. a.i./A per year to 0.166 lbs. a.i./A per year, and a reduction in the maximum soil annual application rate from 0.40 lbs. a.i./A per year to 0.38 lbs. a.i./A per year. This mitigation measure is being proposed for aquatic invertebrate exceedances.

Potential risks from tree nut uses are noted for aquatic invertebrates. Aquatic invertebrate exceedances for foliar applications ranged from 256 to 433 and for soil applications from 18 to 84. Highest benefits of clothianidin use on tree nuts are in pecans where PCTs may be as high as 10 and average around 5.[4] The average annual rate is 0.127 lbs. a.i./A per year. Therefore, the proposed annual foliar rate reduction is expected to have low impact on growers. Reductions in the annual soil application rates are expected to have low impacts on current usage; soil applications appear rare to nonexistent.

Turf
For turf, EPA is proposing reducing the current maximum annual foliar and soil application rate from 0.40 lbs. a.i./A per year to 0.30 lbs. a.i./A per year. This rate reduction is targeted at reducing potential risk to aquatic invertebrates.

Potential risks to aquatic invertebrates are noted for foliar applications of clothianidin on turf, where RQs ranged from 46 to 71. There is also moderate evidence (high initial residues and a bee kill incident) indicating that use of clothianidin on attractive flowering weed species presents potential risk to honeybee colonies. Benefits are considered high for the use of neonicotinoids, however, clothianidin is one of the least used neonicotinoid active ingredients for this use site. Other than the available 2014 AgInfomatics report and review, usage data is limited. AgInfomatics reported that clothianidin is important for southern chinch bug control in St. Augustine grass, and a rate reduction of clothianidin in turf may negatively impact turf management efficacy against southern chinch bugs in St. Augustine grass. Overall, this rate reduction is considered to have potentially moderate impact on turf given the current usage.

ii. Thiamethoxam

Table 4. Proposed Maximum Annual Application Rates for Thiamethoxam

Crop/Crop Group	Current Rate (Max. Annual)	Proposed Rate (Max. Annual)
Berries and Small Fruit (Foliar Applications)	Bushberry Subgroup (including but not limited to highbush blueberry, gooseberry, etc.)	
	0.188 lbs. a.i./A per year	0.15 lbs. a.i./A per year
	Caneberry Subgroup (including but not limited to blackberry, raspberry, etc.)	
	0.094 lbs. a.i./A per year	0.07 lbs. a.i./A per year
	Low Growing Berry Subgroup (including but not limited to lowbush blueberry, strawberry, cranberry, etc.)	
	0.188 lbs. a.i./A per year	0.15 lbs. a.i./A per year

Crop/Crop Group	Current Rate (Max. Annual)	Proposed Rate (Max. Annual)
	Small Fruit Vine Climbing Subgroup (including but not limited to maypop; excluding grape, fuzzy kiwi fruit and gooseberry)	
	0.109 lbs. a.i./A per year	0.09 lbs. a.i./A per year
Berries and Small Fruit (Soil Applications)	Bushberry Subgroup (including but not limited to highbush blueberry, gooseberry, etc.)	
	0.188 lbs. a.i./A per year	0.15 lbs. a.i./A per year
	Low Growing Berry Subgroup (including but not limited to lowbush blueberry, strawberry, cranberry, etc.)	
	0.188 lbs. a.i./A per year	0.15 lbs. a.i./A per year
	Small Fruit Vine Climbing Subgroup (including but not limited to maypop; excluding grape, fuzzy kiwi fruit and gooseberry)	
	0.266 lbs. a.i./A per year	0.22 lbs. a.i./A per year
Cotton	Maximum combined annual application rate, regardless of formulation type: 0.125 lbs. a.i./A per year	Maximum combined annual application rate, regardless of formulation type: 0.09 lbs. a.i./A per year

Berries and small fruits
The berries and small fruits group includes several subgroups of crops such as bushberry, caneberry, low growing berry, and vine climbing small fruit, but not including grape. EPA is proposing reducing the current maximum foliar annual application rate for the bushberry subgroup from 0.188 lbs. a.i./A per year to 0.15 lbs. a.i./A per year; the caneberry subgroup from 0.094 lbs. a.i./A per year to 0.07 lbs. a.i./A per year; the low growing berry subgroup from 0.188 lbs. a.i./A per year to 0.15 lbs. a.i./A per year; and the small fruit vine climbing subgroup from 0.109 lbs. a.i./A per year to 0.09 lbs. a.i./A per year.

The agency is also proposing reducing the current maximum soil annual application rate for the bushberry subgroup from 0.188 lbs. a.i./A per year to 0.15 lbs. a.i./A per year; the low growing berry subgroup from 0.188 lbs. a.i./A per year to 0.15 lbs. a.i./A per year; and the small fruit vine climbing subgroup from 0.266 lbs. a.i./A per year to 0.22 lbs. a.i./A per year. This mitigation is being proposed to reduce potential pollinator risk.

Potential risks from foliar and soil, pre-bloom applications to berries is considered under the strongest category of evidence for pollinator exceedances. Foliar exceedances for adult pollinators are identified with an acute RQ of 170 and a chronic RQ of 860. A foliar chronic exceedance is also identified for larval bees (RQ = 35). Soil exceedances to adult pollinators are identified with an acute RQ of 15 and a chronic RQ of 71. A soil exceedance is also identified for larval bees (Chronic RQ = 3.9). Benefits are also considered substantial for thiamethoxam's use on berries and small fruit, where PCTs ranged 7 – 32%. The agency expects a potential moderate impact on usage.

The agency expects variable impacts on growers, depending on the crop. Growers of caneberry are most likely to experience an impact; the average annual application rate is 0.092 lbs. a.i./A per year (*i.e.,* most users apply thiamethoxam at or near the current maximum application rate).

In some years, 10% of blueberry acres are treated at rates of 0.163 lbs. a.i./A per year, implying that some growers may face potential sporadic constraints. However, proposed rates would allow strawberry growers at least two applications per year and is likely to affect very few acres.

Cotton
For cotton, EPA is proposing to reduce the current maximum combined rate of 0.125 lbs. a.i./A per year, regardless of formulation type, and reducing it to 0.09 lbs. a.i./A per year applied annually. This mitigation is being proposed to reduce potential pollinator risk.

Potential risks from cotton foliar use is considered under the strongest category of evidence for pollinator exceedances. There are acute and chronic foliar exceedances for adult bees (RQs = 53 and 66, respectively). There is also a chronic foliar exceedance for larval bees (RQ = 2.7). Cotton is considered to be one of the major drivers of potential pollinator risk. Thiamethoxam is also considered highly beneficial to cotton growers throughout the growing season for a variety of pests.

Available usage data show that an average of 62,300 lbs. of thiamethoxam is applied as a foliar treatment each year to 1.5 million acres. Also, the average annual application rate is 0.065 lbs. a.i./A per year, which is well below the proposed new annual rate of 0.098 lbs. a.i./A; rates of 0.10 lbs. a.i./A per year are used on about 8% of the acres. With consideration of current usage and typical rates, these rate reductions may impact some users. The proposed rate would allow only one application at the maximum single application of 0.063 lbs. a.i./A. Growers who would normally make a second application may have to use alternative insecticides.

7. Crop Stage Restrictions

Crop stage restrictions can limit exposure during critical periods in the growing season when exposures to pollinators are more likely to occur. In its final bee risk assessment, the agency analyzed a large volume of scientific data showing residues of neonicotinoids in pollen and nectar over time. Through this analysis the agency calculated pre-bloom intervals to determine at what stage in the growing season risk exceedances went above the level of concern. By selecting application restrictions based on crop stage, the agency expects potential exposure can be significantly reduced. These proposed restrictions were preferable only in crops with distinct phenological stages which are easily identifiable by growers.

i. Clothianidin

Table 5. Proposed Crop Stage-based Application Restrictions for Clothianidin

Crop/Crop Group	Proposed Risk Mitigation
Cucurbits	The agency is proposing a crop stage restriction for both foliar and soil labels, to prohibit use from vining to harvest or after the emergence of the first true (non-cotyledon) leaf

Crop/Crop Group	Proposed Risk Mitigation
Avocado, banana, dates and olives	The agency is proposing a crop stage restriction for foliar labels, to prohibit foliar application pre-bloom until after flowering is complete and all petals have fallen off.

Cucurbits
For cucurbits, EPA is proposing a crop stage restriction for both foliar and soil labels, to prohibit use on vining to harvest or after the emergence of the first true (non-cotyledon) leaf. The applicator has a choice to either utilize crop stage frame of reference (*e.g.,* vining to harvest or first true (non-cotyledon) leaf). The agency encourages input from stakeholders regarding the best identifier for crop stage.

Potential risks to pollinators are noted under the strongest evidence of risk for cucurbit foliar uses, and under the moderate evidence of risk for cucurbit soil uses. Foliar RQ exceedances for adult pollinators are identified with an acute RQ of 0.5 and a chronic RQ of 4.1. RQ exceedances for adult pollinators from soil applications are identified for both acute and chronic (RQs = 5.2 and 53, respectively). Also, there is an RQ exceedance from soil application for larval pollinators (max larval RQ = 2.16). Neonicotinoid residue data indicate that residues remained in the plant at high levels for weeks after application as seen by the lowest observed adverse effect concentration (LOAEC) shown reached at 19 days after application for foliar and 47 days for soil. Available benefits information identified clothianidin's usage as mostly negligible, and neonicotinoids are not typically used after vining. Therefore, a restriction from vining to harvest is not likely to significantly impact current usage.

Tropical and Subtropical Fruit
For avocado, banana, dates, and olives; EPA is proposing a crop stage restriction for foliar use, to prohibit foliar application pre-bloom until after flowering is complete and all petals have fallen off. The agency is not proposing crop stage restrictions for other fruit trees in this crop group.

Potential risks to pollinators are noted under the weakest evidence of risk for foliar and soil post-bloom. Mitigation is being proposed on crops in this group that are considered to have higher acreage and to be pollinator attractive, and no mitigation is being done on low acreage or non-bee attractive crops. Clothianidin's usage varies across the crops in the tropical and subtropical fruit group, with relatively high usage on fig and pomegranate trees. From the information available on avocado, dates, and olives, the agency anticipates low impacts to users. California accounts for about 90% of total U.S. acreage of these crops and, based on data from California Pesticide Use Reports, usage of clothianidin is rare on avocado, dates, and olives. EPA is specifically requesting public comments to better understand potential impacts on banana production.

ii. Thiamethoxam

Table 6. Proposed Crop Stage-based Application Restrictions for Thiamethoxam

Crop/Crop Group	Proposed Mitigation
Cucurbits	The agency is proposing a crop stage restriction for foliar labels only, to prohibit use vining to harvest or after the emergence of the first true (non-cotyledon) leaf.
Fruiting Vegetables	The agency is proposing a crop stage restriction for both foliar and soil labels, to not apply after the appearance of the initial flower buds until flowering is complete and all petals have fallen off. Additionally, for tomatoes, peppers, chili peppers and okra only, EPA is also proposing to not apply after 5 days after planting or transplanting regardless of application method.
Pome Fruit	The agency is proposing crop stage restrictions for foliar labels only, to not apply from bud-break (also known as "swollen bud stage" in pear or "silver-tip stage" in apple) until after petal fall is complete.
Stone Fruit	The agency is proposing a crop stage restriction for foliar labels, to prohibit foliar application from bud break until after petal fall is complete.
Tree Nuts	The agency is proposing the following crop stage restrictions for foliar labels only: For walnuts and pecans: "Do not apply prior to bud break or until after petal fall is complete." For other tree nut crops: "Do not apply prior to bloom or until after petal fall is complete."
Avocado, banana, dates and olives	The agency is proposing a crop stage restriction for foliar labels, to prohibit foliar application pre-bloom until after flowering is complete and all petals have fallen off.

Cucurbits
For cucurbits, EPA is proposing a crop stage restriction for foliar labels, to prohibit use from vining to harvest or after the emergence of the first true (non-cotyledon) leaf. The applicator has a choice to utilize either crop stage frame of reference (*e.g.,* vining to harvest or first true (non-cotyledon) leaf). The agency encourages input from stakeholders regarding the best identifier for crop stage.

Potential risks to pollinators are noted under the strongest evidence of risk for cucurbit foliar uses, and under the strongest evidence of risk for cucurbit foliar uses. Foliar exceedances to adult pollinators are identified with an acute RQ of 23 and a chronic RQ of 1400. Acute and chronic

risk exceedances to adult pollinators from soil applications are identified (RQs = 4.6 and 23, respectively). Also, there are chronic foliar and soil RQ exceedances for larval pollinators (larval RQs = 56 and 1.2, respectively). Neonicotinoid residue data indicate that residues remained in the plant at high levels for weeks after application as seen by the lowest observed adverse effect concentration (LOAEC) shown reached at 19 days after application for foliar and 47 days for soil. According to EPA's assessment, thiamethoxam's usage is primarily at-plant or immediately after crop emergence. Therefore, a restriction from vining to harvest is likely to have a marginal impact on current usage.

Fruiting Vegetables
For the fruiting vegetables crop group, EPA is proposing a crop stage restriction for both foliar and soil labels, to not apply after the appearance of the initial flower buds until flowering is complete and all petals have fallen off. For tomatoes, peppers, chili peppers and okra, EPA is also proposing to restrict application after 5 days after planting or transplanting regardless of application method.

Potential risks to pollinators are noted under the strongest evidence of risk for foliar and under the moderate evidence of risk for soil uses of pollinator attractive fruiting vegetables. Pollinator risk exceedances from foliar application are identified with an adult bee acute RQ of 38 and a chronic RQ of 240; soil application risk exceedances for adult bees are identified for both acute (RQ = 109) and chronic (RQ = 430). Chronic risk exceedances are also identified for larval bees from foliar and soil applications (RQs = 1.3 and 18, respectively). Benefits are considered to be high for thiamethoxam's use on fruiting vegetables, where PCTs ranged from 19 – 31%. Thiamethoxam is particularly important to pepper growers. Applications after crop emergence or transplanting account for around two-thirds of the neonicotinoid-treated acres of peppers and tomato acres. Thiamethoxam targets season-long pests. Thrips and leafhopper can target fruit directly and viral diseases vectored by these pests can seriously impact the development, quality and/or yield of the harvested fruit. Aside from neonicotinoids, California extension only recommends carbaryl for leafhopper control; it is not systemic and may have to be applied multiple times to achieve control throughout the season. Alternatives for thrips include pyrethroids, OPs, acetamiprid, and cyantraniliprole; oxamyl might provide good systemic control but EPA has previously proposed cancelling use of oxamyl on tomato.

Pome Fruit
For pome fruit, the agency is proposing crop stage restrictions for foliar labels only. For pears, the agency proposes to prohibit foliar applications from swollen bud stage until after petal fall is complete. For non-pear pome fruit (including but not limited to apple), the agency proposes a prohibition on foliar applications from the silver-tip stage until after petal fall is complete.

Potential risks to pollinators are noted under the strongest evidence of risk for foliar, pre-bloom applications of thiamethoxam to pome fruit. Acute and chronic foliar exceedances are identified for adult bees (RQs = 52 and 400, respectively). Additionally, a chronic exceedance is identified for larval bees (RQ = 18). Foliar exceedances are also identified for freshwater invertebrates (RQs ranged 5.2 to 5.6). Benefits are also considered to be low to high for thiamethoxam's use on pome fruit, where PCTs ranged from 1 – 50%. Thiamethoxam is particularly important to eastern apple growers. Available benefits information identified thiamethoxam as most used

post-bloom (65 – 80%), therefore, the proposed restrictions are likely to have low to moderate impact on current usage. Thiamethoxam is the primary control option of plum curculio during the pre-bloom and bloom period in eastern apple production (accounting for 17 PCT). The prohibition of thiamethoxam use during this time period will likely lead to an increase in the use of the leading alternatives, lambda-cyhalothrin and phosmet. There is likely a limited impact to pear and western apple growers from this restriction.

Stone Fruit
For stone fruit, the agency is proposing crop stage restriction for foliar labels, to prohibit foliar application from bud break until after petal fall is complete.

Potential risks to pollinators are noted under the strongest evidence of risk for foliar, pre-bloom applications of thiamethoxam to stone fruit. Acute and chronic foliar exceedances are identified for adult bees (RQs = 1.1 and 5.2, respectively). Foliar RQ exceedances are also identified for freshwater invertebrates (RQs ranged 5.2 to 5.6). Available benefits information identified thiamethoxam as most used post-bloom (>80%), therefore, the proposed restrictions are likely to have low impact on current usage.

Tree Nuts
For tree nuts, EPA is proposing crop stage restrictions for foliar labels. For walnuts and pecans, the agency proposes to prohibit use prior to bud break or until after petal fall is complete, and for other tree nut crops, the agency proposes to prohibit use prior to bloom or until after petal fall is complete. The applicator has a choice to utilize either crop stage frame of reference (*e.g.,* prior to bud break or until after petal fall is complete). EPA is specifically requesting public comments to better understand potential impacts from these proposed crop stage restrictions. Available data for pecans indicates that almost 20% of total acres treated with neonicotinoids occurs prior to or around bloom although this time period includes a period after bloom and prior to nut swell. The proposal would allow dormant season applications of thiamethoxam prior to bud break.

Potential risks to pollinators are noted under the strongest evidence of risk for foliar, pre-bloom applications of thiamethoxam to tree nuts. Residue studies report residue exceedances, where residues persisted for 13 – 21 days before exceeding the LOAEC, and 21 days before exceeding the NOAEC. Benefits are also considered low for thiamethoxam's use on tree nuts, where PCTs are about 1% or less for pecans and pistachios. Given thiamethoxam's minimal use on tree nut crops, the agency anticipates low impacts on growers.

Tropical and Subtropical Fruit – Avocado, Banana, Dates and Olives
For avocado, banana, dates and olives; EPA is proposing a crop stage restriction for foliar labels, to prohibit foliar application pre-bloom until after flowering is complete and all petals have fallen off. The agency is not proposing crop stage restrictions for other fruit trees in this crop group.

Potential risks to pollinators are noted under the strongest evidence of risk for foliar, pre-bloom applications of thiamethoxam. Mitigation is being proposed on crops in this group that are considered both higher acreage and pollinator attractive, no mitigation is being done on low usage or non-bee attractive crops. Neonicotinoids are generally considered important to

pomegranate production (PCT = ~46%, neonicotinoids). From the information available on avocado, dates, and olives, the agency anticipates low impacts to users. California accounts for about 90% of total U.S. acreage of these crops and, based on data from California Pesticide Use Reports, usage of thiamethoxam is rare on avocado, dates, and olives. EPA is specifically requesting public comments to better understand potential impacts on banana production.

8. Advisory Statements for Clothianidin and Thiamethoxam Seed Treatment Uses

Acute and chronic dietary risks of concern have been identified for birds and mammals exposed to clothianidin and/or thiamethoxam treated seeds. The potential for risk depends on the size of the animal and the treated seed. However, the risk potential is also dependent on factors affecting exposure (*e.g.* application rates, timing, seed depth).

To help mitigate these risks, EPA is proposing that all pesticide products that contain either clothianidin and/or thiamethoxam and are registered for seed treatment uses must include the following advisory statements:

- "Cover or collect treated seeds spilled during loading and planting in areas (such as in row ends)."
- "Dispose of all excess treated seed by burying seed away from bodies of water."
- "Do not contaminate bodies of water when disposing of planting equipment wash water."

The purpose of these required advisory statements is to encourage the adoption of best management practices when handling and planting clothianidin- and/or thiamethoxam-treated seeds that will reduce the exposure of birds and mammals to treated seeds. Covering or collecting spilled seed and burying excess seed are measures that will reduce the likelihood that animals will find and consume treated seeds. Water bodies tend to be gathering points for birds and mammals. Therefore, disposing of equipment wash-water away from these water bodies will decrease the chance of contaminating these water bodies with neonicotinoid residues. Likewise, disposing of excess seeds away from these water bodies will decrease the likelihood of animals incidentally ingesting treated seeds while visiting a body of water. Finally, although these advisory statements were developed with the primary intention of reducing the exposure of birds and mammals to neonicotinoid-treated seed, adding these statements to labels is also expected to benefit aquatic organisms by reducing neonicotinoid loading in aquatic systems.

9. Residential Ornamental Advisory

For application to ornamental plants, the agency identified significant risks of concern. In the agency's final bee risk assessment, ornamentals are designated under the strongest evidence for potential pollinator risk. Potential risks to aquatic invertebrates are also identified, with RQs ranging up to 86. Clothianidin and thiamethoxam use on ornamentals is limited, with both chemistries applied to approximately 3% of the crop acreage treated. However, other than the available 2014 AgInfomatics report and review, usage data is limited. To help mitigate these risks, the agency is proposing the following advisory language for residential uses:

- "Intended for use by professional applicators."

This is due to the high risks of concern, the potential extent of exposure, particularly to bees, and to decrease the likelihood of misapplication or overapplication where significant risks of concern have been identified for these uses.

10. Spray Drift Reduction and Runoff Reduction

EPA is proposing label changes to reduce off-target spray drift and establish a baseline level of protection against spray drift that is consistent across all clothianidin and thiamethoxam products. Reducing spray drift will reduce the extent of environmental exposure and risk to non-target plants and animals. Although the agency is not making a complete endangered species finding at this time, these label changes are expected to reduce the extent of exposure and may reduce risk to listed species whose range and/or critical habitat co-occur with the use of clothianidin or thiamethoxam.

The agency is proposing the following spray drift mitigation language be included on all clothianidin and thiamethoxam product labels. The proposed spray drift language is intended to be mandatory, enforceable statements and supersede any existing language already on product labels (either advisory or mandatory) covering the same topics. The agency is providing recommendations which allow clothianidin and thiamethoxam registrants to standardize all advisory language on clothianidin and thiamethoxam product labels. Registrants must ensure that any existing advisory language left on labels does not contradict or modify the new mandatory spray drift statements proposed in this proposed interim decision once effective.

These mandatory spray drift mitigation measures are proposed for aerial applications for all products delivered via liquid spray:

- Applicators must not spray during temperature inversions.
- For aerial applications, do not apply when wind speeds exceed 15 mph at the application site. If the windspeed is greater than 10 mph, the boom length must be 65% or less of the wingspan for fixed wing aircraft and 75% or less of the rotor diameter for helicopters. Otherwise, the boom length must be 75% or less of the wingspan for fixed-wing aircraft and 90% or less of the rotor diameter for helicopters.
- For aerial applicators, if the windspeed is 10 miles per hour or less, applicators must use ½ swath displacement upwind at the downwind edge of the field. When the windspeed is between 11-15 miles per hour, applicators must use ¾ swath displacement upwind at the downwind edge of the field.
- For aerial applications, the release height must be no higher than 10 feet from the top of the crop canopy or ground, unless a greater application height is required for pilot safety.
- Specify spray droplet size of medium or coarser (ASABE S572.1)
- Do not apply by air within 150 feet of lakes, reservoirs, rivers, permanent streams, marshes or natural ponds, estuaries and commercial fish farm ponds.

These mandatory spray drift mitigation measures are proposed for ground applications delivered via liquid spray:

- Applicators must not spray during temperature inversions.

- Do not apply when wind speeds exceed 15 mph at the application site.
- User must only apply with the release height recommended by the manufacturer, but no more than 4 feet above the ground or crop canopy.
- Specify spray droplet size of medium or coarser (ASABE S572.1)
- For air blast applications, nozzles directed out of the orchard must be turned off in the outer row.
- For air blast applications, applications must be directed into the canopy foliage.
- Do not apply by ground within 25 feet of lakes, reservoirs, rivers, permanent streams, marshes or natural ponds, estuaries and commercial fish farm ponds.

To reduce the amount of clothianidin and thiamethoxam that can enter waterbodies from runoff, EPA is proposing a vegetative filter strip (VFS) requirement for all clothianidin and thiamethoxam agricultural products of 10 feet. Currently some clothianidin and thiamethoxam product labels already have a VFS requirement of 10 feet on labels. VFS are intended to reduce sediment loads to adjacent water bodies, and also show some efficacy in reducing runoff volume as well. As a consequence, they may have some utility in reducing movement of pesticides, particularly those bound to sediments into natural waters.

They are somewhat expensive to implement and maintain, and they must be maintained, or they will lose efficacy and channelized flow across the VFS will develop after a few years. VFS are most effective at removing non-source point pollutants (e.g., pesticides) from runoff water sources. However, the effectiveness of a VFS is influenced by various land management practices (e.g., flood and furrow irrigated fields, etc.) which may impact their utility. The agency has considered several additional sources of research which contextualize the benefits of VFS and has determined that proposing the use of VFS is appropriate mitigation to reduce clothianidin and thiamethoxam residues in aquatic habitats. EPA is not proposing a VFS requirement in Western irrigated agriculture because a VFS would be more expensive to maintain, and runoff is less likely. In the west, areas where agriculture is irrigated would likely require irrigation to maintain a VFS, and on fields where water is managed carefully there is less likely to be runoff and erosion into a waterbody.

The following proposed mitigation measure applies to all agricultural uses of clothianidin and thiamethoxam. This proposed mitigation requirement is separate and in addition to the spray drift buffer zones described above; spray drift buffer zones are still proposed to be required if a vegetated filter strip is present. The proposed vegetative filter strip requirement reads as follows:

- Construct and maintain a vegetative filter strip, according to the width specified below, of grass or other permanent vegetation between the field edge and nearby down gradient aquatic habitat (e.g., lakes, reservoirs, rivers, permanent streams, marshes, natural ponds, estuaries, commercial fish farm ponds).
    - Only apply products onto fields where a maintained vegetative filter strip of at least 10 feet exists between the field edge and where a down gradient aquatic habitat exists. This minimum required width of 10 feet may be reduced under the following conditions:
        - Western irrigated agriculture is exempt from this requirement. Western irrigated agriculture is defined as irrigated farmland in the following

states: WA, OR, CA, ID, NV, UT, AZ, MT, WY, CO, NM, and TX (west of I-35).

In addition to the drift reduction measures and VFS discussed above, EPA is proposing measures to reduce the perimeter treatment area and increase label clarity and consistency, thus reducing the overall amount of clothianidin and thiamethoxam that enters waterbodies and outdoor drainage systems. Specific measures are intended to ensure areas sprayed are permeable and less runoff-prone, reduce offsite-drift to waterbodies, as well as to reduce the potential for over-spraying. Although potential risks to aquatic organisms are expected to remain after the implementation of the measures, these proposed label changes are directionally correct with respect to reducing the amount of environmental exposure. The following mandatory and advisory mitigation measures for all clothianidin and thiamethoxam outdoor residential and commercial use sites to reduce the amount of runoff entering waterbodies and drainage systems:

- Band and perimeter treatment is limited to an area of application no more than 7' out x 2' feet up maximum around buildings or structures.
- Spot treatment is application to limited areas on which insects are likely to occur, but which will not be in contact with food or utensils and will not ordinarily be contacted by workers. These areas may occur on floors, walls, and bases or undersides of equipment. For this purpose, a "spot treatment" will not exceed 2' x 1' square feet.
- Do not apply to impervious horizontal surfaces such as sidewalks, driveways, and patios except as a spot or crack and crevice treatment.
- Do not apply to the point of runoff.
- Do not apply during rainfall.
- Avoid applying when rain is expected within 24 hours except when product requires watering in.

Impacts of Spray Drift and Runoff Mitigation

Wind Speed, Boom Length/Swath Displacement, and Release Height

Current requirements for aerial applications are:

- Do not apply thiamethoxam when wind speeds exceed 10 mph at the application site. The boom length must be 75% or less of the wingspan or rotor diameter.
- Do not apply clothianidin when wind speeds exceed 10 and 15 mph at the application site (the label provides conflicting directions). The boom length must be 75% or less of the wingspan and 90% of rotor diameter.
- The release height of both active ingredients must be no higher than 10 feet from the top of the crop canopy or ground, unless a greater application height is required for pilot safety.
- There are no requirements for swath displacement on current labels.

There are no proposed changes for release height. Proposed changes will allow applications of thiamethoxam at higher wind speed, which will provide growers with greater flexibility to make applications in a timely manner. Further, at wind speeds of 10 mph or less, the boom length for helicopter is increased to 90 percent of the rotor diameter, which may necessitate fewer passes to

complete an application, likely decreasing application costs. The proposed changes will provide clarity to clothianidin users. To the extent that users make applications at wind speeds between 10 and 15 mph, boom lengths will be reduced under the proposal, which may necessitate more passes to complete an application, potentially increasing application costs. Currently, there are no requirements for swath displacement. The agency has not assessed the impacts of a ½ or ¾ swath displacement upwind at the downwind edge of the field. The agency invites comments if this mitigation would impact growers.

Current requirements for ground applications are:

- Do not apply thiamethoxam when wind speeds exceed 10 mph at the application site.
- The release height for thiamethoxam must be no higher than 10 feet from the top of the crop canopy or ground (*i.e.*, same as for aerial applications)
- Do not apply clothianidin when wind speeds exceed 15 mph at the application site.
- The release height for thiamethoxam must be no higher than 4 feet from the top of the crop canopy or ground

Proposed changes will allow thiamethoxam applications at higher wind speed, which will increase the flexibility growers have to make applications in a timely manner.

Proposed changes will allow applications of thiamethoxam at higher wind speed, which will provide growers with greater flexibility to make applications in a timely manner. Based on previous reviews of recommended release heights for optimal coverage across common nozzle types, a release height of 4 feet or less should not impact growers when making applications of clothianidin or thiamethoxam.

Temperature Inversions (Ground and Aerial Applications)
Labels are currently silent on inversions or have advisory language to discourage applying during inversions. The proposed requirement could result in delays to intended applications and, more generally, reduce the amount of time users have to apply clothianidin and thiamethoxam. Management of production activities will be more complex. Potentially, growers could switch to a different active ingredient that does not have this restriction, but that would be costly and potentially difficult in a short period of time. Moreover, temperature inversions are more likely to occur a couple of hours before sunset and after sunrise, which is also when applications may be timed to avoid spraying when pollinators are active, complicating growers' ability to follow good stewardship programs.

Droplet Size
Currently, growers are advised to apply using medium or coarser droplets or the largest droplet that provides effective control.

The agency is establishing a mandatory droplet size of medium or coarser for all neonicotinoids to address the potential risks of neonicotinoids to terrestrial and aquatic invertebrates. Components of applications, including droplet size, are complex, but essentially insects need to come into contact with, or ingest, a lethal dose of insecticide to be effectively controlled which requires proper coverage throughout the plant or foliage. Systemic insecticides, like clothianidin

and thiamethoxam, control some insects regardless of droplet size due to the systemic movement within the plant. However, neonicotinoids, including clothianidin and thiamethoxam, are valuable because they also have immediate, contact activity, especially when applied to the foliage.

Generally, entomologists accept that good coverage is required for maximum efficacy during an application and that fine droplets provide better coverage than medium or coarser droplets. Requiring larger droplet size than a grower would normally use could decrease the immediate, control of pests, which could result in reduced yields or quality of produce. Furthermore, higher rates of survival of the target pest(s) could undermine resistance management efforts by selecting for more tolerant biotypes. To compensate, growers could use higher application rates than they otherwise would, if allowed; make more frequent applications; and/or select alternative products. These actions would likely increase pest control costs.

Requirements for Air Blast Sprayers
There are currently no specific requirements air blast applications. The agency does not anticipate impacts to the users of clothianidin or thiamethoxam from requirements to direct spray into the canopy and to turn off nozzles that would treat the outer orchard rows as this corresponds to good application practices. The agency invites comments if this mitigation would impact applicators.

Buffers and Vegetative Filter Strips
Currently, users of clothianidin and thiamethoxam are not to cultivate or plant crops within 25-foot of aquatic areas to provide a VFS. The proposed requirement for would reduce the size of the VFS to 10 feet or less for irrigated agriculture, but maintain the 25-foot area as a buffer. Reducing the size of the VFS could reduce the costs growers incur to maintain the VFS and potentially increase the cultivated area of their fields, although they could not apply thiamethoxam or clothianidin within the area previously part of the VFS due to the proposed buffer.

However, the proposed 150-foot buffer from aquatic habitats for aerial applications represents a substantial change that could impact usage of thiamethoxam and clothianidin. Currently, aerial applications are used for nearly 30% of the area treated with clothianidin and almost 20% of the area treated with thiamethoxam. Aerial applications are most common in soybean, in terms of total acres and the proportion of acres treated by air, but aerial applications are relatively common in some small acreage crops including lettuce, and *brassica* vegetables.[22] Aerial applications account for over 10% of the Florida orange acreage treated with clothianidin.

If growing areas are adjacent to water bodies, buffers may require growers to leave a portion of the land dedicated to crops untreated or remove land from production. The impact of this mitigation can be highly localized and depends on the size and shape of a field. Leaving an area untreated in a field can harbor insects and serve as a source of re-infestation, requiring subsequent applications.

[22] Market Research Data. 2013-2017.

Removing land from production can decrease revenue from lost crop area. EPA previously estimated impacts of lost productive lands from increasing vegetative filter strips for pyrethroids, which also restrict application near water bodies. Buffers do not need to be maintained like vegetative filter strips, but the value of lost cropped area is likely to be similar. For the earlier BEAD analysis, lost crop areas were presented for increases in lost are of 15 and 25 feet. However, the proposed buffer for aerial applications is 150 feet, an increase of 125 feet over the existing vegetative filter strip. Using the same method that was used for pyrethroids, the value of the potential lost crop area from the increased buffer can also be estimated. The estimated impacts disproportionally affect growers producing crops from small acreage fields, as a greater portion of the total field is lost to a buffer. For example, clothianidin and thiamethoxam have significant aerial applications to soybeans and cotton. The median size soybean field is 13.6 acres, and if that field is assumed to be rectangular with a waterbody along the long side, the lost crop value is estimated to be $116 per acre for the increase in lost cropped area from a buffer change to 150 feet from 25 feet. The impacts are greater for smaller fields as is typical for vegetable production. For example, ten percent of tomato fields are 2.2 acres or smaller and a 150-foot buffer for clothianidin and thiamethoxam could mean that almost 68% of the field could be lost to a buffer if the field were adjacent to a water body.

The greatest impacts may be incurred by Florida orange growers who may be constrained from making aerial applications of clothianidin for ACP control. Aerial applications may be part of coordinated treatment programs among multiple growers. EPA encourages comments on the impacts the buffer may have. Instead of taking land out of production, a grower could switch to a different chemical that does not have a buffer requirement, apply an alternative to only those areas of the field that is within the buffer or accept pest damage in the buffered areas. Leaving an area untreated in a field can harbor insects and serve as a source of re-infestation, requiring subsequent applications.

Impacts of Mitigation Measures for Residential and Commercial Use Sites
The agency did not assess the impacts of runoff mitigation measures for residential and commercial use sites, in particular the definition of ‘spot treatment’. In general, however, these measures appear consistent with good application practices. The agency invites comments if this mitigation would impact applicators.

11. Pesticide Resistance Management

Pesticide resistance occurs when genetic or behavioral changes enable a portion of a pest population to tolerate or survive what would otherwise be lethal doses of a given pesticide. The development of such resistance is influenced by a number of factors. One important factor is the repeated use of pesticides with the same mode (or mechanism) of action. This practice kills sensitive pest individuals but allows less susceptible ones in the targeted population to survive and reproduce, thus increasing in numbers. These individuals will eventually be unaffected by the repeated pesticide applications and may become a substantial portion of the pest population. An alternative approach, recommended by resistance management experts as part of integrated pest management (IPM) programs, is to use pesticides with different chemical modes (or mechanisms) of action against the same target pest population. This approach may delay and/or prevent the development of resistance to a particular mode (or mechanism) of action without

resorting to increased rates and frequency of application, possibly prolonging the useful life of pesticides.

The EPA is proposing resistance-management labeling, as listed in Appendix B, for products containing clothianidin and thiamethoxam, in order to provide pesticide users with easy access to important information to help maintain the effectiveness of useful pesticides. Additional information on the EPA's guidance for resistance management can be found at the following website: https://www.epa.gov/pesticide-registration/prn-2017-1-guidance-pesticide-registrants-pesticide-resistance-management.

B. Stewardship

In addition to establishing both advisory and compulsory language for product labels, EPA's registration review provides an opportunity to inform stakeholders and the general public about opportunities to minimize potential ecological risks and promote pollinator health more generally. Beyond the mitigation measures proposed above, voluntary stewardship activities and use of best management practices (BMPs) can be effective in further reducing pesticide exposure to at risk taxa. Examples of these activities include:

- promoting the creation of additional pollinator habitat;
- improving pesticide users' understanding and adherence to label directions which advise users on seed spill clean-clean up, reduction in drift/runoff, and minimizing exposure to pollinators;
- promoting integrated pest management (IPM) solutions;
- encouraging growers to take care when planting treated seed to reduce the amount of exposed seed; and,
- increasing awareness of potential impacts of pesticides through education (*e.g.,* training courses, pamphlets, workshops/conferences, and through tv, radio, social media and other communication platforms).

Habitat loss is a significant issue with negative impacts on the health of bees. With access to a healthy and diverse diet through a thriving habitat, bees may be better able to tolerate stressors such as pests, disease, and exposure to pesticides. As a healthy diet is crucial to maintaining flourishing pollinator populations, and the protection of pollinator habitat is not something that can be directly addressed on a pesticide product label, EPA and other federal/state/tribal and local government agencies and non-government organizations (NGOs) promote pollinator habitat through active education and outreach programs. Helpful guidance on pollinator protection can be found on the EPA's pollinator protection webpage[23].

Users should take several precautions while using neonicotinoid products to minimize potential exposure to pollinators. First, users should not apply neonicotinoids when bees and other pollinators are actively foraging on pollinator-attractive plants during bloom. Secondly, users should consider a pesticide's ability to drift to other non-target areas and be aware of the presence of bee colonies or highly bee-attractive plants nearby an application site. With

[23] https://www.epa.gov/pollinator-protection

applications to lawns, its beneficial to mow prior to applications, as this reduces the potential for pollinator attractive weeds that could expose bees to pesticides. Although the cultivation and protection of pollinator habitat is typically encouraged, in this case, taking steps to ensure a lawn is mowed prior to neonicotinoid applications can reduce potential direct exposure for visiting pollinators. Other things the public can do to minimize potential exposure of pollinators are listed on EPA's, *What You Can Do to Protect Honey Bees and Other Pollinators* webpage[24].

Treated seed is most likely to become available to birds and mammals through accidental spills, excess unplanted seed on the edges of the field, shallow planted seed, and the improper disposal of treated seed. An effective method to reduce exposure would be encouraging growers to take additional care when planting treated seed to ensure any exposed seed is retrieved. The American Seed Trade Organization has published a guide[25] to help educate applicators on practices to help reduce potential risks to the environment from seed treatments. The agency encourages public and private participation in creating tools and fostering effective communication to help reach applicators and educate them on practices that can reduce risks to the environment.

The technical registrants for the neonicotinoids, including Bayer, BASF, Mitsui, Syngenta, and Valent, coordinated to develop a voluntary proposal to promote product stewardship for their product seed treatments and applications in agricultural crops, production and landscape ornamental plants, turfgrass and pest-management setting (structural, commercial and residential). Their proposal includes a summary of the current neonicotinoid stewardship program, as well as their proposal for an enhanced registrant-initiated stewardship program for expansion and amplification of stewardship efforts. This document, *Neonicotinoid Stewardship Program – Current Summary and Proposal,* is included in the public docket for each of the neonicotinoids along with their PIDs.

The agency encourages strong pollinator protection stewardship in both the public and private sector. EPA will continue to work with its partners at the federal, state, tribal, and local levels, along with non-governmental organizations to promote pollinator protection, education, and outreach. This includes coordinating with states and tribes on pollinator protection plans (*i.e.;* managed pollinator protection plans), coordinating with stakeholders on extension of, and education around, existing BMPs, and continued education and outreach to the public on pollinator protection. In addition, the agency plans on continuing conversations with the registrants on the *Neonicotinoid Stewardship Program*.

C. Tolerance Actions

Tolerance actions are proposed for clothianidin and thiamethoxam. The agency plans to modify several established tolerances, mainly in response to revisions to the uses included in various crop groups and subgroups. There are also opportunities for international harmonization with the tolerances for clothianidin and thiamethoxam. Some listings are proposed to be harmonized with Canadian MRLs and others with Codex MRLs. Additionally, EPA is proposing eliminating

[24] https://www.epa.gov/pollinator-protection/what-you-can-do-protect-honey-bees-and-other-pollinators
[25] https://seed-treatment-guide.com/

trailing zeros listed in tolerances consistent with agency policy. All proposed tolerance revisions for clothianidin and thiamethoxam are listed in Section III.A.3 and Appendix E.

D. Proposed Interim Registration Review Decision

In accordance with 40 CFR §§ 155.56 and 155.58, the agency is issuing this PID. Except for the Endocrine Disruptor Screening Program (EDSP), the Endangered Species Act (ESA) components of this case, the agency has made the following PID:

(1) no additional data are required at this time; and (2) changes to the affected registrations or their labeling are needed at this time, as described in Section IV.A and Appendices A and B.

In this PID, the agency is making no human health or environmental safety findings associated with the EDSP screening of clothianidin and thiamethoxam, nor is it making a complete endangered species finding. Although the agency is not making a complete endangered species finding at this time, the proposed mitigation described in this document is expected to reduce the extent of environmental exposure and may reduce risk to listed species whose range and/or critical habitat co-occur with the use of clothianidin and thiamethoxam. The agency's final registration review decision for clothianidin and thiamethoxam will be dependent upon the result of the agency's ESA assessment and any needed § 7 consultation with the Services, and an EDSP FFDCA § 408(p) determination.

E. Data Requirements

- *Reference Standards:*
  - The analytical reference standard for clothianidin has expired and must be submitted to the EPA's National Pesticide Standards Repository (see https://www.epa.gov/pesticide-analytical-methods/national-pesticide-standard-repository).
  - An analytical reference standard for thiamethoxam is available at the EPA's National Pesticide Standards Repository (see https://www.epa.gov/pesticide-analytical-methods/national-pesticide-standard-repository). However, the agency proposes to require analytical reference standards for thiamethoxam's metabolite CGA-322704 to be submitted to National Pesticides Standards Repository. Note that the current analytical reference standard for thiamethoxam will expire on October 31, 2020.

V. NEXT STEPS AND TIMELINE

A. Proposed Interim Registration Review Decision

A Federal Register Notice will announce the availability of this PID for clothianidin and thiamethoxam and will allow a 60-day comment period on the PID. If there are no significant comments or additional information submitted to the docket during the comment period that

leads the agency to change its PID, the EPA may issue an interim registration review decision for clothianidin and thiamethoxam. However, a final decision for clothianidin and thiamethoxam may be issued without the agency having previously issued an interim decision. A final decision on the clothianidin and thiamethoxam registration review case will occur after: (1) an EDSP FFDCA § 408(p) determination, and (2) an endangered species determination under the ESA and any needed § 7 consultation with the Services.

B. Implementation of Mitigation Measures

Once the Interim Registration Review Decision is issued, the clothianidin and thiamethoxam registrants must submit amended labels that include the label changes described in Appendix B. The revised labels and registration amendments must be submitted to the agency for review within 60 days following issuance of the Interim Registration Review Decision in the clothianidin and thiamethoxam dockets.

Appendix A: Summary of Proposed Actions for Clothianidin and Thiamethoxam

Table 1: Summary of Proposed Actions for Clothianidin

Registration Review Case#: 7620
PC Code: 044309
Chemical Type: insecticide
Chemical Family: nitroguanidine-substituted neonicotinoid
[Mode or Mechanism (for herbicides)] of Action: Nicotinic acetylcholine receptor (NACHR) competitive modulators

Affected Population(s)	Source of Exposure	Route of Exposure	Duration of Exposure	Potential Risk(s) of Concern	Proposed Actions
Occupational Handlers	Aerial and ground application, treated seeds	Dermal and inhalation	Short and intermediate term	Systemic effects	• Require additional PPE (*e.g.*, gloves and respirators) • Precautionary statements • Use Restrictions
Pollinators	Residues on treated site	Ingestion and contact	Acute and chronic	Acute and chronic toxicity	• Reduce application rates • Crop stage restrictions • Use deletions • Use restrictions • Buffers • Spray drift reduction
Aquatic Invertebrates	Runoff from treated sites	Contact and ingestion	Acute and chronic	Acute and chronic toxicity	• Spray drift reduction • Prevent runoff • Vegetative filter strips • Reduce perimeter treatment applications
Birds and Mammals	Residues on ingested seeds	Dietary and ingestion	Acute and chronic	Acute and chronic toxicity	• Clean up spills of treated seeds

Table 2: Summary of Proposed Actions for Thiamethoxam

Registration Review Case#: 7614
PC Code: 060109
Chemical Type: insecticide
Chemical Family: nitroguanidine-substituted neonicotinoid
[Mode or Mechanism (for herbicides)] of Action: Nicotinic acetylcholine receptor (NACHR) competitive modulators

Affected Population(s)	Source of Exposure	Route of Exposure	Duration of Exposure	Potential Risk(s) of Concern	Proposed Actions
Occupational Handlers	Aerial and ground application	Dermal and inhalation	Short and intermediate term	Systemic effects	• Require additional PPE (gloves and respirators) • Precautionary statements • Require closed loading for seed treatment • Cancel equipment/application uses
Pollinators	Residues on treated site	Ingestion and contact	Acute and chronic	Acute and chronic toxicity	• Reduce application rates • Bloom restrictions • Use deletions • Use restrictions • Buffers • Spray drift reduction
Aquatic Invertebrates	Runoff from treated sites	Contact and ingestion	Acute and chronic	Acute and chronic toxicity	• Spray drift reduction • Prevent runoff • Vegetative filter strips • Reduce perimeter treatment applications
Birds and Mammals	Residues on ingested seeds	Dietary and ingestion	Acute and chronic	Acute and chronic toxicity	• Clean up spills of treated seeds

Appendix B: Proposed Labeling Changes for Clothianidin and Thiamethoxam Products

Table 1: Proposed Labeling Changes for Clothianidin Products

Description	Proposed Label Language for Clothianidin Products	Placement on Label
Technical Products		
For any product that allows use on bulb vegetables	Delete foliar and soil use on bulbs.	Directions for Use
End Use Products		
Mode/Mechanism of Action Group Number	**Note to registrant:** • Include the name of the **ACTIVE INGREDIENT** in the first column • Include the word "**GROUP"** in the second column • Include the **MODE/MECHANISM OF ACTION CODE** in the third column (for herbicides this is the Mechanism of Action, for fungicides this is the FRAC Code, and for insecticides this is the Primary Site of Action) • Include the type of pesticide in the fourth column. **CLOTHIANIDIN** | **GROUP** | **4A** | **INSECTICIDE**	Front Panel, upper right quadrant. All text should be black, bold face and all caps on a white background, except the mode of action code, which should be white, bold face and all caps on a black background; all text and columns should be surrounded by a black rectangle.
Updated Gloves Statement	Update the gloves statements to be consistent with Chapter 10 of the Label Review Manual. In particular, remove reference to specific categories in EPA's chemical-resistance category selection chart and list the appropriate chemical-resistant glove types to use.	In the Personal Protective Equipment (PPE) within the Precautionary Statements and Agricultural Use Requirements, if applicable
Additional PPE (gloves and a respirator) for seed treatments to corn	"Handlers must wear chemical resistant gloves and a respirator while handling (*e.g.,* loading, applying, sewing, bagging, etc.) treated corn seeds."	In the Personal Protective Equipment (PPE) within the Precautionary Statements and

Description	Proposed Label Language for Clothianidin Products	Placement on Label
		Agricultural Use Requirements, if applicable
Additional PPE (gloves and a respirator) for liquid aerosol application to commercial buildings	"Applicators must wear chemical resistant gloves and a respirator while treating commercial buildings with liquid aerosol formulations."	In the Personal Protective Equipment (PPE) within the Precautionary Statements and Agricultural Use Requirements, if applicable
Additional PPE (gloves) for liquid/foliar application to barn/feedlot applied via mechanically-pressurized handgun	"Applicators and handlers must wear chemical resistant gloves while mixing, loading, or applying liquid foliar formulations for a mechanically-pressurized handgun for livestock houses (Note: This does not include poultry houses. Only non-poultry livestock houses (*i.e.,* barns/feedlots))."	In the Personal Protective Equipment (PPE) within the Precautionary Statements and Agricultural Use Requirements, if applicable
Requirements for Non-WPS Uses, including the use of any products requiring respirators for in-field, seed, or post-harvest treatments.	Respirator fit testing, medical qualification, and training Using a program that conforms to OSHA's requirements (see 29 CFR Part 1910.134), employers must verify that any handler who uses a respirator is: • Fit-tested and fit-checked, • Trained, and • Examined by a qualified medical practitioner to ensure physical ability to safely wear the style of respirator to be worn. A qualified medical practitioner is a physician or other licensed health care professional who will evaluate the ability of a worker to wear a respirator. The initial evaluation consists of a questionnaire that asks about medical conditions (such as a heart condition) that would be problematic for respirator use. If concerns are identified, then additional evaluations, such as a physical exam, might be necessary. The initial evaluation must be done before respirator use begins. Handlers must be reexamined by a qualified medical practitioner if their health status or respirator style or use conditions change. Upon request by local/state/federal/tribal enforcement personnel, employers must provide documentation demonstrating how they have complied with these requirements.	Precautionary Statements under the heading "Hazards to Humans and Domestic Animals"

Description	Proposed Label Language for Clothianidin Products	Placement on Label
Directions for mixing/loading products packaged in water soluble bags	Instructions for Introducing Water Soluble Packages Directly into Spray tanks: "Soluble Packages (WSPs) are designed to dissolve in water. Agitation may be used, if necessary, to help dissolve the WSP. Failure to follow handling and mixing instructions can increase your exposure to the pesticide products in WSPs. WSPs, when used properly, qualify as a closed mixing/loading system under the Agricultural Worker Protection Standard [40 CFR 170.607(d)]. Handling Instructions Follow these steps when handling pesticide products in WSPs. 1. Mix in spray tank only. 2. Handle the WSP in a manner that protects package from breakage and/or unintended release of contents. If package is broken, put on PPE required for clean-up and then continue with mixing instructions. 3. Keep the WSP in outer packaging until just before use. 4. Keep the WSP dry prior to adding to the spray tank. 5. Handle with dry gloves and according to the label instructions for PPE. 6. Keep the WSP intact. Do not cut or puncture the WSP. 7. Reseal the WSP outer packaging to protect any unused WSP(s). Mixing Instructions Follow the steps below when mixing this product, including if it is tank-mixed with other pesticide products. If being tank-mixed, the mixing directions 1 through 9 below take precedence over the mixing directions of the other tank mix products. WSPs may, in some cases, be mixed with other pesticide products so long as the directions for use of all the pesticide product components do not conflict. Do not tank-mix this product with products that prohibit tank-mixing or have conflicting mixing directions. 1. If a basket or strainer is present in the tank hatch, remove prior to adding the WSP to the tank. 2. Fill tank with water to approximately one-third to one-half of the desired final volume of spray. 3. Stop adding water and stop any agitation. 4. Place intact/unopened WSP into the tank. 5. Do not spray water from a hose or fill pipe to break or dissolve the WSP.	Directions for Use for mixing/loading WSP

Description	Proposed Label Language for Clothianidin Products	Placement on Label
	6. Start mechanical and recirculation agitation from the bottom of tank without using any overhead recirculation, if possible. If overhead recirculation cannot be turned off, close the hatch before starting agitation. 7. Dissolving the WSP may take up to 5 minutes or longer, depending on water temperature, water hardness and intensity of agitation. 8. Stop agitation before tank lid is opened. 9. Open the lid to the tank, exercising caution to avoid contact with dusts or spray mix, to verify that the WSP has fully dissolved and the contents have been thoroughly mixed into the solution. 10. Do not add other allowed products or complete filling the tank until the bags have fully dissolved and pesticide is thoroughly mixed. 11. Once the WSP has fully dissolved and any other products have been added to the tank, resume filling the tank with water to the desired level, close the tank lid, and resume agitation. 12. Use the spray solution when mixing is complete. 13. Maintain agitation of the diluted pesticide mix during transport and application. 14. It is unlawful to use any registered pesticide, including WSPs, in a manner inconsistent with its label. ENGINEERING CONTROLS STATEMENT Water soluble packets, when used correctly, qualify as a closed mixing/loading system under the Worker Protection Standard [40 CFR 170.607(d)]. Mixers and loaders handling this product while it is enclosed in intact water soluble packets may elect to wear reduced PPE of long-sleeved shirt, long pants, shoes, socks, a chemical-resistant apron, and chemical-resistant gloves. When reduced PPE is worn because a closed system is being used, handlers must be provided all PPE specified above for "applicators and other handlers" and have such PPE immediately available for use in an emergency, such as in case of a spill or equipment break-down."	
All outdoor foliar spray uses	Update the bee advisory box according to the following: https://www.epa.gov/pollinator-protection/new-labeling-neonicotinoid-pesticides	Follows directly after the Environmental Hazard statement
All outdoor foliar spray uses	For foliar spray application to crops under contract pollinator services: "Do not apply this product while bees are foraging. Do not apply this product until flowering is complete and all petals have fallen unless the following condition has been met. If an application must be made when managed bees are at the treatment site, the beekeeper providing the	Directions for Use

Description	Proposed Label Language for Clothianidin Products	Placement on Label
	pollination services must be notified no less than 48 hours prior to the time of the planned application so that the bees can be removed, covered or otherwise protected prior to spraying." For foliar spray application to crops not under contract pollinator services: "Do not apply this product while bees are foraging. Do not apply this product until flowering is complete and all petals have fallen off unless the application is made in response to a public health emergency declared by appropriate State or Federal authorities."	
All outdoor foliar spray uses	"Do not apply by ground within 25 feet, or by air within 150 feet of lakes, reservoirs, rivers, permanent streams, marshes or natural ponds, estuaries and commercial fish farm ponds."	Directions for use
Resistance-management labeling statements for insecticides and acaricides	Include resistance management label language for insecticides/acaricides from PRN 2017-1 (https://www.epa.gov/pesticide-registration/pesticide-registration-notices-year).	Directions for Use, prior to directions for specific crops
Additional Required Labeling Action Applies to all products delivered via liquid spray applications	Remove information about volumetric mean diameter from all labels where such information currently appears.	Directions for Use
Berries and small fruit, excluding grape and strawberry, set maximum annual rate	Maximum annual application rate for berries, regardless of application method, is not to exceed 0.16 lbs. a.i./A per year.	Directions for Use
Cotton, set maximum annual rate	Regardless of application method, apply no more than 0.15 lbs. a.i./A per year, including seed treatment, soil drench and foliar sprays.	Directions for Use
Fruiting Vegetables, set maximum annual rate for foliar spray	For foliar spray only: maximum annual application rate is not to exceed 0.17 lbs. a.i./A per year.	Directions for Use
Ornamentals, which includes ornamental trees, forestry, ornamental woody shrubs and vines, and outdoor greenhouse/nursery. This mitigation does not include	For both foliar spray and soil drench: maximum annual application rate is not to exceed 0.30 lbs. a.i./A per year.	Directions for Use

Description	Proposed Label Language for Clothianidin Products	Placement on Label
indoor commercial nursery, Christmas trees, greenhouse uses, or forestry use on public land and quarantine application by USDA.		
Pome fruit, set maximum annual rate for foliar spray	For foliar spray only: maximum annual application rate is not to exceed 0.16 lbs. a.i./A per year.	Directions for Use
Tree nuts, set maximum annual rate for foliar spray and soil drench	For foliar spray only: maximum annual application rate is not to exceed 0.16 lbs. a.i./A per year. Soil drench: maximum annual application rate is not to exceed 0.38 lbs. a.i./A per year.	Directions for Use
Turf, set maximum annual rate for foliar spray	For foliar spray only: maximum annual application rate is not to exceed 0.30 lbs. a.i./A per year.	Directions for Use
Avocado, banana, dates, and olives, add application timing restriction based on crop stage	For foliar spray only: "Do not apply before bloom until after flowering is complete and all petals have fallen off."	Directions for Use
Cucurbit, add application timing restriction based on crop stage	For foliar spray and soil drench: "Do not apply after vining or appearance of the first true (non-cotyledon) leaf until harvest."	Directions for Use
All agricultural foliar spray uses	"VEGETATIVE FILTER STRIPS Construct and maintain a vegetative filter strip, according to the width specified below, of grass or other permanent vegetation between the field edge and nearby down gradient aquatic habitat (such as, but not limited to, lakes; reservoirs; rivers; permanent streams; marshes or natural ponds; estuaries; and commercial fish farm ponds). Only apply products containing clothianidin onto fields where a maintained vegetative filter strip of at **least 10 feet** exists between the field edge and where a down gradient aquatic habitat exists. Western irrigated agriculture is exempt from this requirement. Western irrigated agriculture is defined as irrigated farmland in the following states: WA, OR, CA, ID, NV, UT, AZ, MT, WY, CO, NM, and TX (west of I-35). For further guidance on vegetated filter strips, refer to the following publication for information on constructing and maintaining effective buffers: Conservation Buffers to Reduce Pesticide Losses. Natural Resources Conservation Services. https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs144p2_030970.pdf"	Directions for Use

Description	Proposed Label Language for Clothianidin Products	Placement on Label
Ornamentals, which includes Ornamental ground cover, Christmas tree plantations, Ornamental and/or shade trees, ornamental herbaceous plants, ornamental nonflowering plants, and ornamental woody shrubs and vines	"Intended for use by professional applicators."	Directions for Use
Poultry houses set maximum number of applications and add maximum application area	"Do not apply more than one whole house treatment and 5 perimeter (partial house) treatments per year." "Do not apply to more than 30,000 sq. ft. per year per house."	Directions for Use
Seed treatments, add to seed bad tag	Add the following statements to tags to clean up spills, dispose of excess seed to avoid contamination of water bodies: "Cover or collect treated seeds spilled during loading and planting in areas (such as in row ends)." "Dispose of all excess treated seed by burying seed away from bodies of water." "Do not contaminate bodies of water when disposing of planting equipment wash water."	Directions for use
All outdoor non-agricultural spray applications	"All outdoor spray applications must be limited to spot or crack-and-crevice treatments only, except for the following permitted uses: 1. Application to soil, lawn, turf, and other vegetation; 2. Perimeter band treatments of 7 feet wide or less from the base of a man-made structure to pervious surfaces (*e.g.*, soil, mulch, or lawn) 3. Applications to the side of a man-made structure, up to 2 feet above ground level; 4. Applications to underside of eaves, soffits, doors, or windows permanently protected from rainfall by a covering, overhang, awning, or other structure; 5. Applications around potential exterior pest entry points into man-made structures such as doorways and windows, when limited to a band not to exceed one inch;	Directions for Use

Description	Proposed Label Language for Clothianidin Products	Placement on Label
	6. Applications to vertical surfaces directly above pervious surfaces such as bare soil, lawn, turf, mulch or other vegetation, and not over a hard impervious surface (e.g., driveways, sidewalks), drainage, or other condition that could result in runoff into storm drains, drainage ditches, gutters, or surface waters, to control occasional invaders or aggregating pests."	
Outdoor non-agricultural spray applications	"Do not apply directly to impervious horizontal surfaces such as sidewalks, driveways, and patios except as a spot or crack-and-crevice treatment." "Do not apply or irrigate to the point of run-off."	Directions for Use
Outdoor non-agricultural spray applications – rain related statements (except for products that require watering-in)	"Do not make applications during rain. Avoid making applications when rainfall is expected within 24 hours to allow product sufficient time to dry." "Excessive rainfall within 24 hours after application may cause unintended run-off of pesticide application."	Directions for Use
Outdoor non-agricultural spot treatments	"Spot treatment is application to limited areas on which insects are likely to occur, but which will not be in contact with food or utensils and will not ordinarily be contacted by workers. These areas may occur on floors, walls, and bases or undersides of equipment. Spot treatments must not exceed two square feet in size (2ft. by 1 ft.), not to exceed 10 % of the entire treatment area"	Directions for Use
Spray Drift Management Application Restrictions for all products delivered via liquid spray application and allow aerial application	**"MANDATORY SPRAY DRIFT MANAGEMENT** **<u>Aerial Applications</u>**: • Do not release spray at a height greater than 10 ft above the ground or vegetative canopy, unless a greater application height is necessary for pilot safety. • Applicators are required to use a medium or coarser (ASABE S572.1) droplet size. • Do not apply when wind speeds exceed 15 mph at the application site. If the windspeed is greater than 10 mph, the boom length must be 65% or less of the wingspan for fixed wing aircraft and 75% or less of the rotor diameter for helicopters. Otherwise, the boom length must be 75% or less of the wingspan for fixed-wing aircraft and 90% or less of the rotor diameter for helicopters. • For aerial applicators, if the windspeed is 10 miles per hour or less, applicators must use ½ swath displacement upwind at the downwind edge of the field. When the windspeed is between 11-15 miles per hour, applicators must use ¾ swath displacement upwind at the downwind edge of the field. • Do not apply during temperature inversions."	Directions for Use, in a box titled "Mandatory Spray Drift" under the heading "Aerial Applications"

Description	Proposed Label Language for Clothianidin Products	Placement on Label
Spray Drift Management Application Restrictions for products that are delivered via spray applications and that allow airblast applications	**"MANDATORY SPRAY DRIFT MANAGEMENT** **<u>Airblast applications:</u>** • Sprays must be directed into the canopy. • Do not apply when wind speeds exceed 15 miles per hour at the application site. • User must turn off outward pointing nozzles at row ends and when spraying outer row. • Do not apply during temperature inversions."	Directions for Use, in a box titled "Mandatory Spray Drift" under the heading "Airblast Applications"
Spray Drift Management Application Restrictions for products that are delivered via liquid spray applications and allow ground boom applications	**"MANDATORY SPRAY DRIFT MANAGEMENT** **<u>Ground Boom Applications:</u>** • User must only apply with the release height recommended by the manufacturer, but no more than 4 feet above the ground or crop canopy. • Applicators are required to use a medium or coarser droplet size (ASABE S572.1). • Do not apply when wind speeds exceed 15 miles per hour at the application site. • Do not apply during temperature inversions."	Directions for Use, in a box titled "Mandatory Spray Drift" under the heading "Ground Boom Applications"
Spray Drift Management Application Restrictions for products that are delivered via liquid spray applications and that allow boom-less ground sprayer applications	**"MANDATORY SPRAY DRIFT MANAGEMENT** **<u>Boomless Ground Applications:</u>** • Applicators are required to use a medium or coarser droplet size (ASABE S572.1) for all applications. • Do not apply when wind speeds exceed 15 miles per hour at the application site. • Do not apply during temperature inversions."	Directions for Use, in a box titled "Mandatory Spray Drift" under the heading "Boomless Applications"
Advisory Spray Drift Management Language for all products delivered via liquid spray application	**"SPRAY DRIFT ADVISORIES** THE APPLICATOR IS RESPONSIBLE FOR AVOIDING OFF-SITE SPRAY DRIFT. BE AWARE OF NEARBY NON-TARGET SITES AND ENVIRONMENTAL CONDITIONS. **IMPORTANCE OF DROPLET SIZE** An effective way to reduce spray drift is to apply large droplets. Use the largest droplets that provide target pest control. While applying larger droplets will reduce spray drift, the potential for drift will be greater if applications are made improperly or under unfavorable environmental conditions. **Controlling Droplet Size – Ground Boom** ***(note to registrants:*** *remove if ground boom is prohibited on product labels)*	Directions for Use, just below the Spray Drift box, under the heading "Spray Drift Advisories"

Description	Proposed Label Language for Clothianidin Products	Placement on Label
	• Volume - Increasing the spray volume so that larger droplets are produced will reduce spray drift. Use the highest practical spray volume for the application. If a greater spray volume is needed, consider using a nozzle with a higher flow rate. • Pressure - Use the lowest spray pressure recommended for the nozzle to produce the target spray volume and droplet size. • Spray Nozzle - Use a spray nozzle that is designed for the intended application. Consider using nozzles designed to reduce drift. **Controlling Droplet Size – Aircraft** ***(note to registrants:*** *remove if aerial application is prohibited on product labels)* • Adjust Nozzles - Follow nozzle manufacturers' recommendations for setting up nozzles. Generally, to reduce fine droplets, nozzles should be oriented parallel with the airflow in flight. **BOOM HEIGHT – Ground Boom** ***(note to registrants:*** *remove if ground boom is prohibited on product labels)* For ground equipment, the boom should remain level with the crop and have minimal bounce. **RELEASE HEIGHT - Aircraft** ***(note to registrants:*** *remove if aerial application is prohibited on product labels)* Higher release heights increase the potential for spray drift. **SHIELDED SPRAYERS** Shielding the boom or individual nozzles can reduce spray drift. Consider using shielded sprayers. Verify that the shields are not interfering with the uniform deposition of the spray on the target area. **TEMPERATURE AND HUMIDITY** When making applications in hot and dry conditions, use larger droplets to reduce effects of evaporation. **TEMPERATURE INVERSIONS** Drift potential is high during a temperature inversion. Temperature inversions are characterized by increasing temperature with altitude and are common on nights with limited cloud cover and light to no wind. The presence of an inversion can be indicated by ground fog or by the movement of smoke from a ground source or an aircraft smoke generator. Smoke that layers and moves laterally in a concentrated cloud (under low wind conditions) indicates an inversion,	

Description	Proposed Label Language for Clothianidin Products	Placement on Label
	while smoke that moves upward and rapidly dissipates indicates good vertical air mixing. Avoid applications during temperature inversions. **WIND** Drift potential generally increases with wind speed. AVOID APPLICATIONS DURING GUSTY WIND CONDITIONS. Applicators need to be familiar with local wind patterns and terrain that could affect spray drift."	
Advisory Spray Drift Management Language for products that are applied as liquids and allow boom-less ground sprayer applications	**"SPRAY DRIFT ADVISORIES** **Boomless Ground Applications:** • Setting nozzles at the lowest effective height will help to reduce the potential for spray drift."	Directions for Use, just below the Spray Drift box, under the heading "Spray Drift Advisories"
Advisory Spray Drift Management Language for all products that allow liquid applications with handheld technologies	**"SPRAY DRIFT ADVISORIES** **Handheld Technology Applications:** • Take precautions to minimize spray drift."	Directions for Use, just below the Spray Drift box, under the heading "Spray Drift Advisories"

Table 2: Proposed Labeling Changes for Thiamethoxam Products

Description	Proposed Label Language for Thiamethoxam Products	Placement on Label
End Use Products		
Mode/Mechanism of Action Group Number	**Note to registrant:** • Include the name of the **ACTIVE INGREDIENT** in the first column • Include the word "**GROUP"** in the second column • Include the **MODE/MECHANISM OF ACTION CODE** in the third column (for herbicides this is the Mechanism of Action, for fungicides this is the FRAC Code, and for insecticides this is the Primary Site of Action) • Include the type of pesticide in the fourth column. **THIAMETHOXAM** | **GROUP** | **4A** | **INSECTICIDE**	Front Panel, upper right quadrant. All text should be black, bold face and all caps on a white background, except the mode of action code, which should be white, bold face and all caps on a black background; all text and columns should be surrounded by a black rectangle.
Updated Gloves Statement	Update the gloves statements to be consistent with Chapter 10 of the Label Review Manual. In particular, remove reference to specific categories in EPA's chemical-resistance category selection chart and list the appropriate chemical-resistant glove types to use.	In the Personal Protective Equipment (PPE) within the Precautionary Statements and Agricultural Use Requirements, if applicable
Additional PPE (gloves and a respirator) for mixing/loading/applying dry flowable formulations for poultry houses and warehouses	"Handlers and applicators must wear chemical resistant gloves and a respirator while mixing, loading, or applying using a mechanically pressurized handgun."	In the Personal Protective Equipment (PPE) within the Precautionary Statements and Agricultural Use Requirements, if applicable
Additional PPE (gloves) for mixing/loading liquids for aerial applications to barley, beans (dry),	"Handlers must wear chemical resistant gloves while mixing or loading."	In the Personal Protective Equipment (PPE) within the Precautionary

Description	Proposed Label Language for Thiamethoxam Products	Placement on Label
canola/rapeseed, corn (field), cotton, cowpea/blackeyed pea, flax, garbanzos (including chick peas), lentils, lupine (grain), mustard, peas (field), potato, rice, sorghum, soybeans, sugar beet, sunflower, tobacco, triticale, and wheat		Statements and Agricultural Use Requirements, if applicable
Additional PPE (gloves) for mixing/loading/applying dry flowable formulations with a manually-pressurized handwand to poultry/livestock house/ horse barn/feed lot, and mounds/nests	"Handlers and applicators must wear chemical resistant gloves while mixing, loading, or applying with a manually-pressurized handwand."	In the Personal Protective Equipment (PPE) within the Precautionary Statements and Agricultural Use Requirements, if applicable
Additional PPE (gloves) for mixing /loading/applying liquids with a manually-pressurized handwand to mounds/nests	"Handlers and applicators must wear chemical resistant gloves while mixing, loading, or applying with a manually-pressurized handwand."	In the Personal Protective Equipment (PPE) within the Precautionary Statements and Agricultural Use Requirements, if applicable
Additional PPE (gloves) for mixing/loading/applying dry flowable formulations with a mechanically-pressurized handgun to landscaping, trees/shrubs/bushes	"Handlers and applicators must wear chemical resistant gloves while mixing, loading, or applying with a mechanically-pressurized handgun."	In the Personal Protective Equipment (PPE) within the Precautionary Statements and Agricultural Use Requirements, if applicable

Description	Proposed Label Language for Thiamethoxam Products	Placement on Label
Additional PPE (gloves) for mixing/loading/applying crack and crevice treatments with a manually-pressurized handwand to warehouses, childcare center/schools/institutions, and residential living spaces	"Handlers and applicators must wear chemical resistant gloves while mixing, loading, or applying crack and crevice treatments with a manually-pressurized handwand."	In the Personal Protective Equipment (PPE) within the Precautionary Statements and Agricultural Use Requirements, if applicable
Requirements for Non-WPS Uses requiring respirators	"Respirator fit testing, medical qualification, and training: Using a program that conforms to OSHA's requirements (see 29 CFR Part 1910.134), employers must verify that any handler who uses a respirator is: • Fit-tested and fit-checked, • Trained, and • Examined by a qualified medical practitioner to ensure physical ability to safely wear the style of respirator to be worn. A qualified medical practitioner is a physician or other licensed health care professional who will evaluate the ability of a worker to wear a respirator. The initial evaluation consists of a questionnaire that asks about medical conditions (such as a heart condition) that would be problematic for respirator use. If concerns are identified, then additional evaluations, such as a physical exam, might be necessary. The initial evaluation must be done before respirator use begins. Handlers must be reexamined by a qualified medical practitioner if their health status or respirator style or use conditions change. Upon request by local/state/federal/tribal enforcement personnel, employers must provide documentation demonstrating how they have complied with these requirements."	Precautionary Statements under the heading "Hazards to Humans and Domestic Animals"
Directions for mixing/loading products packaged in water soluble bags	Instructions for Introducing Water Soluble Packages Directly into Spray tanks: "Soluble Packages (WSPs) are designed to dissolve in water. Agitation may be used, if necessary, to help dissolve the WSP. Failure to follow handling and mixing instructions can increase your exposure to the pesticide products in WSPs. WSPs, when used properly, qualify as a closed mixing/loading system under the Agricultural Worker Protection Standard [40 CFR 170.607(d)]. Handling Instructions Follow these steps when handling pesticide products in WSPs.	Directions for Use for mixing/loading WSP

Description	Proposed Label Language for Thiamethoxam Products	Placement on Label
	1. Mix in spray tank only. 2. Handle the WSP in a manner that protects package from breakage and/or unintended release of contents. If package is broken, put on PPE required for clean-up and then continue with mixing instructions. 3. Keep the WSP in outer packaging until just before use. 4. Keep the WSP dry prior to adding to the spray tank. 5. Handle with dry gloves and according to the label instructions for PPE. 6. Keep the WSP intact. Do not cut or puncture the WSP. 7. Reseal the WSP outer packaging to protect any unused WSP(s). Mixing Instructions Follow the steps below when mixing this product, including if it is tank-mixed with other pesticide products. If being tank-mixed, the mixing directions 1 through 9 below take precedence over the mixing directions of the other tank mix products. WSPs may, in some cases, be mixed with other pesticide products so long as the directions for use of all the pesticide product components do not conflict. Do not tank-mix this product with products that prohibit tank-mixing or have conflicting mixing directions. 1. If a basket or strainer is present in the tank hatch, remove prior to adding the WSP to the tank. 2. Fill tank with water to approximately one-third to one-half of the desired final volume of spray. 3. Stop adding water and stop any agitation. 4. Place intact/unopened WSP into the tank. 5. Do not spray water from a hose or fill pipe to break or dissolve the WSP. 6. Start mechanical and recirculation agitation from the bottom of tank without using any overhead recirculation, if possible. If overhead recirculation cannot be turned off, close the hatch before starting agitation. 7. Dissolving the WSP may take up to 5 minutes or longer, depending on water temperature, water hardness and intensity of agitation. 8. Stop agitation before tank lid is opened. 9. Open the lid to the tank, exercising caution to avoid contact with dusts or spray mix, to verify that the WSP has fully dissolved and the contents have been thoroughly mixed into the solution. 10. Do not add other allowed products or complete filling the tank until the bags have fully dissolved and pesticide is thoroughly mixed.	

Description	Proposed Label Language for Thiamethoxam Products	Placement on Label
	11. Once the WSP has fully dissolved and any other products have been added to the tank, resume filling the tank with water to the desired level, close the tank lid, and resume agitation. 12. Use the spray solution when mixing is complete. 13. Maintain agitation of the diluted pesticide mix during transport and application. 14. It is unlawful to use any registered pesticide, including WSPs, in a manner inconsistent with its label. ENGINEERING CONTROLS STATEMENT Water soluble packets, when used correctly, qualify as a closed mixing/loading system under the Worker Protection Standard [40 CFR 170.607(d)]. Mixers and loaders handling this product while it is enclosed in intact water soluble packets may elect to wear reduced PPE of long-sleeved shirt, long pants, shoes, socks, a chemical-resistant apron, and chemical-resistant gloves. When reduced PPE is worn because a closed system is being used, handlers must be provided all PPE specified above for "applicators and other handlers" and have such PPE immediately available for use in an emergency, such as in case of a spill or equipment break-down."	
All outdoor foliar spray uses	Update the bee advisory box according to the following: https://www.epa.gov/pollinator-protection/new-labeling-neonicotinoid-pesticides	Follows directly after the Environmental Hazard statement
All outdoor foliar spray uses	For foliar application to crops under contract pollinator services: "Do not apply this product while bees are foraging. Do not apply this product until flowering is complete and all petals have fallen unless the following condition has been met. If an application must be made when managed bees are at the treatment site, the beekeeper providing the pollination services must be notified no less than 48 hours prior to the time of the planned application so that the bees can be removed, covered or otherwise protected prior to spraying." For foliar application to crops not under contract pollinator services: "Do not apply this product while bees are foraging. Do not apply this product until flowering is complete and all petals have fallen off unless the application is made in response to a public health emergency declared by appropriate State or Federal authorities."	Directions for use
All outdoor foliar spray uses	"Do not apply by ground within 25 feet, or by air within 150 feet of lakes, reservoirs, rivers, permanent streams, marshes or natural ponds, estuaries and commercial fish farm ponds."	Directions for Use
Resistance-management labeling statements for insecticides and acaricides	Include resistance management label language for insecticides/acaricides from PRN 2017-1 (https://www.epa.gov/pesticide-registration/pesticide-registration-notices-year)	Directions for Use, prior to directions for specific crops

Description	Proposed Label Language for Thiamethoxam Products	Placement on Label
Additional Required Labeling Action Applies to all products delivered via liquid spray applications	Remove information about volumetric mean diameter from all labels where such information currently appears.	Directions for Use
Seed treatments to corn	"Must be applied by closed system seed treatment application processes in a commercial seed treatment facility."	Directions for Use
Berries and small fruits, not including grapes, set maximum annual rate for foliar spray and soil drench uses	**Foliar Sprays:** Bushberry Subgroup (including but not limited to highbush blueberry, gooseberry, red currant, etc.): maximum annual application rate is not to exceed to 0.15 lbs. a.i./A per year. Caneberry Subgroup (including but not limited to blackberry, raspberry, etc.): maximum annual application rate is not to exceed 0.07 lbs. a.i./A per year. Low Growing Berry Subgroup (including but not limited to lowbush blueberry, strawberry, cranberry, etc.): maximum annual application rate is not to exceed 0.15 lbs. a.i./A per year. Small Fruit Vine Climbing Subgroup (including but not limited to maypop; excluding grape, fuzzy kiwi fruit and gooseberry): maximum annual application rate is not to exceed 0.09 lbs. a.i./A per year. **Soil Drench:** Bushberry Subgroup (including but not limited to highbush blueberry, gooseberry, red currant, etc.): maximum annual application rate is not to exceed 0.15 lbs. a.i./A per year. Low Growing Berry Subgroup (including but not limited to lowbush blueberry, strawberry, cranberry, etc.): maximum annual application rate is not to exceed 0.15 lbs. a.i./A per year. Small Fruit Vine Climbing Subgroup (including but not limited to maypop; excluding grape, fuzzy kiwi fruit and gooseberry): maximum annual application rate is not to exceed 0.22 lbs. a.i./A per year.	Directions for Use
Cotton, set maximum annual rate	Regardless of formulation or method of application, apply no more than 0.09 lbs. a.i./A per year, including seed treatment, soil drench and foliar spray uses.	Directions for Use
Avocado, banana, dates, and olives, add application	For foliar spray only: "Do not apply before bloom until after flowering is complete and all petals have fallen off."	Directions for Use

Description	Proposed Label Language for Thiamethoxam Products	Placement on Label
timing restriction based on crop stage		
Cucurbit, add application timing restriction based on crop stage for foliar spray uses	For foliar spray only: "Do not apply after vining or appearance of the first true (non-cotyledon) leaf until harvest."	Directions for Use
Fruiting vegetables, set maximum annual rate for foliar spray, and add application timing restriction based on crop stage	For foliar spray only: "Do not apply after the appearance of the initial flower buds until flowering is complete and all petals have fallen off." For soil drench only: "For tomatoes, peppers, chili peppers and okra only, do not apply after 5 days after planting or transplanting regardless of application method."	Directions for Use
Pome fruit, add application timing restriction for foliar spray uses	For foliar spray only: "Do not apply from bud break (also known as "swollen bud stage" in pear, or "silver-tip stage" in apple) until after flowering is complete and all petals have fallen off."	Directions for Use
Stone Fruit, add application timing restriction for foliar spray uses	For foliar spray only: "Do not apply from bud break until after flowering is complete and all petals have fallen off."	Directions for Use
Tree nut, add application timing restriction for foliar spray uses	For walnuts and pecans: "Do not apply prior to bud break until after flowering is complete and all petals have fallen off." For other tree nuts crops: "Do not apply prior to bloom until after flowering is complete and all petals have fallen off."	Directions for Use
All agricultural foliar spray uses	"VEGETATIVE FILTER STRIPS Construct and maintain a vegetative filter strip, according to the width specified below, of grass or other permanent vegetation between the field edge and nearby down gradient aquatic habitat (such as, but not limited to, lakes; reservoirs; rivers; permanent streams; marshes or natural ponds; estuaries; and commercial fish farm ponds). Only apply products containing thiamethoxam onto fields where a maintained vegetative filter strip of at **least 10 feet** exists between the field edge and where a down gradient aquatic habitat exists.	Directions for Use

Description	Proposed Label Language for Thiamethoxam Products	Placement on Label
	Western irrigated agriculture is exempt from this requirement. Western irrigated agriculture is defined as irrigated farmland in the following states: WA, OR, CA, ID, NV, UT, AZ, MT, WY, CO, NM, and TX (west of I-35). For further guidance on vegetated filter strips, refer to the following publication for information on constructing and maintaining effective buffers: Conservation Buffers to Reduce Pesticide Losses. Natural Resources Conservation Services. https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs144p2_030970.pdf"	
Ornamentals, which includes Ornamental ground cover, Christmas tree plantations, Ornamental and/or shade trees, ornamental herbaceous plants, ornamental nonflowering plants, and ornamental woody shrubs and vines	"Intended for use by professional applicators."	Directions for Use
All outdoor non-agricultural spray applications	"All outdoor spray applications must be limited to spot or crack-and-crevice treatments only, except for the following permitted uses: 1. Application to soil, lawn, turf, and other vegetation; 2. Perimeter band treatments of 7 feet wide or less from the base of a man-made structure to pervious surfaces (*e.g.*, soil, mulch, or lawn) 3. Applications to the side of a man-made structure, up to 2 feet above ground level; 4. Applications to underside of eaves, soffits, doors, or windows permanently protected from rainfall by a covering, overhang, awning, or other structure; 5. Applications around potential exterior pest entry points into man-made structures such as doorways and windows, when limited to a band not to exceed one inch; 6. Applications to vertical surfaces directly above pervious surfaces such as bare soil, lawn, turf, mulch or other vegetation, and not over a hard impervious surface (e.g., driveways, sidewalks),	Directions for Use

Description	Proposed Label Language for Thiamethoxam Products	Placement on Label
	drainage, or other condition that could result in runoff into storm drains, drainage ditches, gutters, or surface waters, to control occasional invaders or aggregating pests."	
Outdoor non-agricultural spray applications	"Do not apply directly to impervious horizontal surfaces such as sidewalks, driveways, and patios except as a spot or crack-and-crevice treatment." "Do not apply or irrigate to the point of run-off."	Directions for Use
Outdoor non-agricultural spray applications – rain related statements (except for products that require watering-in)	"Do not make applications during rain. Avoid making applications when rainfall is expected within 24 hours to allow product sufficient time to dry." "Excessive rainfall within 24 hours after application may cause unintended run-off of pesticide application."	Directions for Use
Outdoor non-agricultural spot treatments	"Spot treatment is application to limited areas on which insects are likely to occur, but which will not be in contact with food or utensils and will not ordinarily be contacted by workers. These areas may occur on floors, walls, and bases or undersides of equipment. Spot treatments must not exceed two square feet in size (2ft. by 1 ft.), not to exceed 10 % of the entire treatment area."	Directions for Use
Spray Drift Management Application Restrictions for all products delivered via liquid spray application and allow aerial application	**"MANDATORY SPRAY DRIFT MANAGEMENT** **Aerial Applications**: • Do not release spray at a height greater than 10 ft above the ground or vegetative canopy, unless a greater application height is necessary for pilot safety. • Applicators are required to use a medium or coarser (ASABE S572.1) droplet size. • Do not apply when wind speeds exceed 15 mph at the application site. If the windspeed is greater than 10 mph, the boom length must be 65% or less of the wingspan for fixed wing aircraft and 75% or less of the rotor diameter for helicopters. Otherwise, the boom length must be 75% or less of the wingspan for fixed-wing aircraft and 90% or less of the rotor diameter for helicopters. • For aerial applicators, if the windspeed is 10 miles per hour or less, applicators must use ½ swath displacement upwind at the downwind edge of the field. When the windspeed is between 11-15 miles per hour, applicators must use ¾ swath displacement upwind at the downwind edge of the field. • Do not apply during temperature inversions."	Directions for Use, in a box titled "Mandatory Spray Drift" under the heading "Aerial Applications"
Spray Drift Management Application Restrictions for products that are delivered via liquid spray applications and that allow airblast applications	**"MANDATORY SPRAY DRIFT MANAGEMENT** **Airblast applications:** • Sprays must be directed into the canopy. • Do not apply when wind speeds exceed 15 miles per hour at the application site.	Directions for Use, in a box titled "Mandatory Spray Drift" under the heading "Airblast Applications"

Description	Proposed Label Language for Thiamethoxam Products	Placement on Label
	• User must turn off outward pointing nozzles at row ends and when spraying outer row. • Do not apply during temperature inversions."	
Spray Drift Management Application Restrictions for products that are delivered via liquid spray applications and that allow ground boom applications	**"MANDATORY SPRAY DRIFT MANAGEMENT** **Ground Boom Applications:** • User must only apply with the release height recommended by the manufacturer, but no more than 4 feet above the ground or crop canopy. • Applicators are required to use a medium or coarser droplet size (ASABE S572.1). • Do not apply when wind speeds exceed 15 miles per hour at the application site. • Do not apply during temperature inversions."	Directions for Use, in a box titled "Mandatory Spray Drift" under the heading "Ground Boom Applications"
Spray Drift Management Application Restrictions for products that are delivered via liquid spray applications and that allow boom-less ground sprayer applications	**"MANDATORY SPRAY DRIFT MANAGEMENT** **Boomless Ground Applications:** • Applicators are required to use a medium or coarser droplet size (ASABE S572.1) for all applications. • Do not apply when wind speeds exceed 15 miles per hour at the application site. Do not apply during temperature inversions."	Directions for Use, in a box titled "Mandatory Spray Drift" under the heading "Boomless Applications"
Advisory Spray Drift Management Language for all products delivered via liquid spray application	**"SPRAY DRIFT ADVISORIES** THE APPLICATOR IS RESPONSIBLE FOR AVOIDING OFF-SITE SPRAY DRIFT. BE AWARE OF NEARBY NON-TARGET SITES AND ENVIRONMENTAL CONDITIONS. **IMPORTANCE OF DROPLET SIZE** An effective way to reduce spray drift is to apply large droplets. Use the largest droplets that provide target pest control. While applying larger droplets will reduce spray drift, the potential for drift will be greater if applications are made improperly or under unfavorable environmental conditions. **Controlling Droplet Size – Ground Boom** ***(note to registrants:*** *remove if ground boom is prohibited on product labels)* • Volume - Increasing the spray volume so that larger droplets are produced will reduce spray drift. Use the highest practical spray volume for the application. If a greater spray volume is needed, consider using a nozzle with a higher flow rate. • Pressure - Use the lowest spray pressure recommended for the nozzle to produce the target spray volume and droplet size. • Spray Nozzle - Use a spray nozzle that is designed for the intended application. Consider using nozzles designed to reduce drift.	Directions for Use, just below the Spray Drift box, under the heading "Spray Drift Advisories"

Description	Proposed Label Language for Thiamethoxam Products	Placement on Label
	Controlling Droplet Size – Aircraft ***(note to registrants:*** *remove if aerial application is prohibited on product labels)* • Adjust Nozzles - Follow nozzle manufacturers' recommendations for setting up nozzles. Generally, to reduce fine droplets, nozzles should be oriented parallel with the airflow in flight. **BOOM HEIGHT – Ground Boom** ***(note to registrants:*** *remove if ground boom is prohibited on product labels)* For ground equipment, the boom should remain level with the crop and have minimal bounce. **RELEASE HEIGHT - Aircraft** ***(note to registrants:*** *remove if aerial application is prohibited on product labels)* Higher release heights increase the potential for spray drift. **SHIELDED SPRAYERS** Shielding the boom or individual nozzles can reduce spray drift. Consider using shielded sprayers. Verify that the shields are not interfering with the uniform deposition of the spray on the target area. **TEMPERATURE AND HUMIDITY** When making applications in hot and dry conditions, use larger droplets to reduce effects of evaporation. **TEMPERATURE INVERSIONS** Drift potential is high during a temperature inversion. Temperature inversions are characterized by increasing temperature with altitude and are common on nights with limited cloud cover and light to no wind. The presence of an inversion can be indicated by ground fog or by the movement of smoke from a ground source or an aircraft smoke generator. Smoke that layers and moves laterally in a concentrated cloud (under low wind conditions) indicates an inversion, while smoke that moves upward and rapidly dissipates indicates good vertical air mixing. Avoid applications during temperature inversions. **WIND** Drift potential generally increases with wind speed. AVOID APPLICATIONS DURING GUSTY WIND CONDITIONS. Applicators need to be familiar with local wind patterns and terrain that could affect spray drift."	

Description	Proposed Label Language for Thiamethoxam Products	Placement on Label
Advisory Spray Drift Management Language for products that are applied as liquids and allow boom-less ground sprayer applications	**"SPRAY DRIFT ADVISORIES** **Boomless Ground Applications:** Setting nozzles at the lowest effective height will help to reduce the potential for spray drift."	Directions for Use, just below the Spray Drift box, under the heading "Spray Drift Advisories"
Advisory Spray Drift Management Language for all products that allow liquid applications with handheld technologies	**"SPRAY DRIFT ADVISORIES** **Handheld Technology Applications:** • Take precautions to minimize spray drift."	Directions for Use, just below the Spray Drift box, under the heading "Spray Drift Advisories"

Appendix C: Endangered Species Assessment

In 2013, the EPA, along with the Fish and Wildlife Service (FWS), the National Marine Fisheries Service (NMFS), and the United States Department of Agriculture (USDA) released a summary of their joint Interim Approaches for assessing risks to endangered and threatened (listed) species from pesticides. These Interim Approaches were developed jointly by the agencies in response to the National Academy of Sciences' (NAS) recommendations that discussed specific scientific and technical issues related to the development of pesticide risk assessments conducted on federally threatened and endangered species.

Since that time, EPA has conducted biological evaluations (BEs) on three pilot chemicals representing the first nationwide pesticide consultations. These initial consultations were pilots and were envisioned to be the start of an iterative process. The agencies are continuing to work to improve the consultation process. For example, advancements to the initial pilot interim methods have been proposed based on experience conducting the first three pilot BEs. Public input on those proposed revisions is currently being considered.

Also, a provision in the December 2018 Farm Bill included the establishment of a FIFRA Interagency Working Group to provide recommendations for improving the consultation process required under section 7 of the Endangered Species Act for pesticide registration and Registration Review and to increase opportunities for stakeholder input. This group includes representation from EPA, NMFS, FWS, USDA, and the Council on Environmental Quality (CEQ). Given this new law and that the first nationwide pesticide consultations were envisioned as pilots, the agencies are continuing to work collaboratively as consistent with the congressional intent of this new statutory provision. EPA has been tasked with a lead role on this group, and EPA hosted the first Principals Working Group meeting on June 6, 2019.

Given that the agencies are continuing to develop and work toward implementation of approaches to assess the potential risks of pesticides to listed species and their designated critical habitat, the ecological risk assessment supporting this PID for clothianidin and thiamethoxam does not contain a complete ESA analysis that includes effects determinations for specific listed species or designated critical habitat. Although the EPA has not yet completed effects determinations for specific species or habitats, for this PID, the EPA's evaluation assumed, for all taxa of non-target wildlife and plants, that listed species and designated critical habitats may be present in the vicinity of the application of clothianidin or thiamethoxam. This will allow the EPA to focus its future evaluations on the types of species where the potential for effects exists once the scientific methods being developed by the agencies have been fully vetted. Once that occurs, these methods will be applied to subsequent analyses for clothianidin and thiamethoxam as part of completing this registration review.

Appendix D: Endocrine Disruptor Screening Program

As required by FIFRA and FFDCA, the EPA reviews numerous studies to assess potential adverse outcomes from exposure to chemicals. Collectively, these studies include acute, sub-chronic and chronic toxicity, including assessments of carcinogenicity, neurotoxicity, developmental, reproductive, and general or systemic toxicity. These studies include endpoints which may be susceptible to endocrine influence, including effects on endocrine target organ histopathology, organ weights, estrus cyclicity, sexual maturation, fertility, pregnancy rates, reproductive loss, and sex ratios in offspring. For ecological hazard assessments, the EPA evaluates acute tests and chronic studies that assess growth, developmental and reproductive effects in different taxonomic groups. As part of its most recent registration decision for Clothianidin, the EPA reviewed these data and selected the most sensitive endpoints for relevant risk assessment scenarios from the existing hazard database. However, as required by FFDCA § 408(p), clothianidin and and thiamethoxam are subject to the endocrine screening part of the Endocrine Disruptor Screening Program (EDSP).

The EPA has developed the EDSP to determine whether certain substances (including pesticide active and other ingredients) may have an effect in humans or wildlife similar to an effect produced by a "naturally occurring estrogen, or other such endocrine effects as the Administrator may designate." The EDSP employs a two-tiered approach to making the statutorily required determinations. Tier 1 consists of a battery of 11 screening assays to identify the potential of a chemical substance to interact with the estrogen, androgen, or thyroid (E, A, or T) hormonal systems. Chemicals that go through Tier 1 screening and are found to have the potential to interact with E, A, or T hormonal systems will proceed to the next stage of the EDSP where the EPA will determine which, if any, of the Tier 2 tests are necessary based on the available data. Tier 2 testing is designed to identify any adverse endocrine-related effects caused by the substance, and establish a dose-response relationship between the dose and the E, A, or T effect.

Under FFDCA § 408(p), the agency must screen all pesticide chemicals. Between October 2009 and February 2010, the EPA issued test orders/data call-ins for the first group of 67 chemicals, which contains 58 pesticide active ingredients and 9 inert ingredients. The agency has reviewed all of the assay data received for the List 1 chemicals and the conclusions of those reviews are available in the chemical-specific public dockets. A second list of chemicals identified for EDSP screening was published on June 14, 2013,[26] and includes some pesticides scheduled for Registration Review and chemicals found in water. Neither of these lists should be construed as a list of known or likely endocrine disruptors. Neither clothianidin nor thiamethoxam are on either list. For further information on the status of the EDSP, the policies and procedures, the lists of chemicals, future lists, the test guidelines and the Tier 1 screening battery, please visit the EPA website.[27]

[26] See http://www.regulations.gov/#!documentDetail;D=EPA-HQ-OPPT-2009-0477-0074 for the final second list of chemicals.
[27] https://www.epa.gov/endocrine-disruption

In this PID, the EPA is making no human health or environmental safety findings associated with the EDSP screening of clothianidin and thiamethoxam. Before completing this registration review, the agency will make an EDSP FFDCA § 408(p) determination.

Appendix E: Summary of Proposed Tolerance Actions

Table 1: Clothianidin

Clothianidin 40 CFR §180.586. Summary of Proposed Tolerance Actions			
Commodity	Currently Established Tolerance (ppm)	Proposed Tolerance (ppm)	Comments (*correct commodity definition*)
§180.586(a) General			
Barley, grain	None	0.15	Based on new uses of thiamethoxam. Recommended tolerance levels from HED, 30 January 2019, D446686.
Barley, hay	None	0.5	Based on new uses of thiamethoxam. Recommended tolerance levels from HED, 30 January 2019, D446686.
Barley, straw	None	0.3	Based on new uses of thiamethoxam. Recommended tolerance levels from HED, 30 January 2019, D446686.
Berry, low-growing, Subgroup 13-07H, except strawberry	0.01	0.07	Update to harmonize with Codex MRLs.
Brassica leafy greens Subgroup 4-16B	None	1.9	Commodity displaced by crop group conversion.
Celtuce	None	3	Commodity displaced by crop group conversion.
Corn, field, forage	None	0.6	Based on new uses of thiamethoxam. Recommended tolerance levels from HED, 30 January 2019, D446686.
Corn, field, stover	None	0.3	Based on new uses of thiamethoxam. Recommended tolerance levels from HED, 30 January 2019, D446686.
Corn, pop, stover	None	0.15	Based on new uses of thiamethoxam. Recommended tolerance levels from HED, 30 January 2019, D446686.
Corn, sweet, forage	None	0.7	Based on new uses of thiamethoxam. Recommended tolerance levels from HED, 30 January 2019, D446686.
Corn, sweet, stover	None	0.15	Based on new uses of thiamethoxam. Recommended tolerance levels from HED, 30 January 2019, D446686.
Cotton, undelinted seed	0.20	0.2	Correct number of significant figures to be consistent with EPA policy.
Florence fennel	None	3	Commodity displaced by crop group conversion.
Fruit, pome	1.0	1	Correct number of significant figures to be consistent with EPA policy.
Grain, cereal, forage, fodder and straw, Group 16, except rice, straw	0.05	0.2	Update to harmonize with Codex MRLs.
Grain, cereal, Group 15, except rice	0.01	0.04	Update to harmonize with Codex MRLs.
Grape	0.60	0.6	Correct number of significant figures to be consistent with EPA policy.
Kohlrabi	None	1.9	Commodity displaced by crop group conversion.

Clothianidin 40 CFR §180.586. Summary of Proposed Tolerance Actions			
Commodity	Currently Established Tolerance (ppm)	Proposed Tolerance (ppm)	Comments (*correct commodity definition*)
Leafy greens Subgroup 4-16A	None	3	Commodity displaced by crop group conversion.
Leafy petiole vegetable Subgroup 22B	None	3	Commodity displaced by crop group conversion.
Oat, grain	None	0.15	Based on new uses of thiamethoxam. Recommended tolerance levels from HED, 30 January 2019, D446686.
Peach	0.80	0.8	Correct number of significant figures to be consistent with EPA policy.
Pepper	0.8	Remove	Change definition to: Pepper/eggplant Subgroup 8-10B
Pepper/eggplant Subgroup 8-10B	None	0.8	Commodity displaced by crop group conversion.
Pomegranate	0.20	0.2	Correct number of significant figures to be consistent with EPA policy.
Potato, chips	0.6	0.8	Based on new uses of thiamethoxam. Recommended tolerance levels from HED, 30 January 2019, D446686.
Potato, granules/flakes	1.5	2	Based on new uses of thiamethoxam. Recommended tolerance levels from HED, 30 January 2019, D446686.
Rice, grain	None	0.5	Based on new uses of thiamethoxam. Recommended tolerance levels from HED, 30 January 2019, D446686.
Rice, seed	0.01	Remove	Expired June 23, 2012.
Rye, grain	None	0.15	Based on new uses of thiamethoxam. Recommended tolerance levels from HED, 30 January 2019, D446686.
Sorghum, grain, forage	None	1	Based on new uses of thiamethoxam. Recommended tolerance levels from HED, 30 January 2019, D446686.
Sorghum, grain, grain	None	0.15	Based on new uses of thiamethoxam. Recommended tolerance levels from HED, 30 January 2019, D446686.
Sorghum, grain, stover	None	0.8	Based on new uses of thiamethoxam. Recommended tolerance levels from HED, 30 January 2019, D446686.
Tomato Subgroup 8-10A	None	0.2	Commodity displaced by crop group conversion.
Triticale, grain	None	0.15	Based on new uses of thiamethoxam. Recommended tolerance levels from HED, 30 January 2019, D446686.
Vegetable, brassica, leafy, Group 5	1.9	Remove	Divide into separate listings: *Brassica* leafy greens Subgroup 4-16B; Vegetable, *Brassica*, head and stem, Group 5-16; and Kohlrabi.
Vegetable, fruiting, Group 8, except pepper	0.2	Remove	Divide into separate listings: Tomato Subgroup 8-10A; Pepper/eggplant Subgroup 8-10B.

Clothianidin 40 CFR §180.586. Summary of Proposed Tolerance Actions			
Commodity	Currently Established Tolerance (ppm)	Proposed Tolerance (ppm)	Comments (*correct commodity definition*)
Vegetable, head and stem *Brassica* Group 5-16	None	1.9	Commodity displaced by crop group conversion.
Vegetable, leafy, except brassica, Group 4	3	Remove	Divide into separate listings: Leafy green Subgroup 4-16A; Correct number of significant figures to be consistent with EPA policy.
Vegetable, tuberous and corm, Subgroup 1C	0.3	0.4	Based on new uses of thiamethoxam. Recommended tolerance levels from HED, 30 January 2019, D446686.
Wheat, forage	None	0.8	Based on new uses of thiamethoxam. Recommended tolerance levels from HED, 30 January 2019, D446686.
Wheat, grain	None	0.15	Based on new uses of thiamethoxam. Recommended tolerance levels from HED, 30 January 2019, D446686.
Wheat, hay	None	1.5	Based on new uses of thiamethoxam. Recommended tolerance levels from HED, 30 January 2019, D446686.
Wheat, straw	None	0.8	Based on new uses of thiamethoxam. Recommended tolerance levels from HED, 30 January 2019, D446686.

Table 2. Thiamethoxam

Thiamethoxam 40 CFR §180.565. Summary of Proposed Tolerance Actions			
Commodity	Currently Established Tolerance (ppm)	Proposed Tolerance (ppm)	Comments (*correct commodity definition*)
§180.565(a) General			
Alfalfa, forage	0.05	10	Based on new uses of thiamethoxam. Recommended tolerance levels from HED, 30 January 2019, D446686.
Alfalfa, hay	0.12	8	Based on new uses of thiamethoxam. Recommended tolerance levels from HED, 30 January 2019, D446686.
Alfalfa, seed	None	1	Based on new uses of thiamethoxam. Recommended tolerance levels from HED, 30 January 2019, D446686.
Barley, grain	0.4	0.9	Based on new uses of thiamethoxam. Recommended tolerance levels from HED, 30 January 2019, D446686.
Barley, hay	0.4	1.5	Based on new uses of thiamethoxam. Recommended tolerance levels from HED, 30 January 2019, D446686.
Barley, straw	0.4	3	Based on new uses of thiamethoxam. Recommended tolerance levels from HED, 30 January 2019, D446686.
Brassica leafy greens Subgroup 4-16B	None	3	Update definition, and correct number of significant figures to be consistent with EPA policy.

Thiamethoxam 40 CFR §180.565. Summary of Proposed Tolerance Actions			
Commodity	Currently Established Tolerance (ppm)	Proposed Tolerance (ppm)	Comments (*correct commodity definition*)
Brassica, head and stem, Subgroup 5-A	4.5	Remove	Divide into separate listings: Vegetable, *Brassica*, head and stem, Group 5-16; and Kohlrabi.
Brassica, leafy greens, Subgroup 5-B	3	Remove	See *Brassica* leafy greens Subgroup 4-16B.
Caneberry Subgroup 13-07A	0.35	0.5	Update to harmonize with Codex MRLs.
Cattle meat byproducts	0.04	0.15	Based on new uses of thiamethoxam. Recommended tolerance levels from HED, 30 January 2019, D446686.
Celtuce	None	4	Commodity displaced by group conversion.
Corn, field, forage	0.1	0.7	Based on new uses of thiamethoxam. Recommended tolerance levels from HED, 30 January 2019, D446686.
Corn, field, stover	0.05	1	Based on new uses of thiamethoxam. Recommended tolerance levels from HED, 30 January 2019, D446686.
Corn, pop, forage	0.1	0.7	Based on new uses of thiamethoxam. Recommended tolerance levels from HED, 30 January 2019, D446686.
Corn, pop, stover	0.05	0.7	Based on new uses of thiamethoxam. Recommended tolerance levels from HED, 30 January 2019, D446686.
Corn, sweet, forage	0.1	5	Based on new uses of thiamethoxam. Recommended tolerance levels from HED, 30 January 2019, D446686.
Corn, sweet, stover	0.05	0.5	Based on new uses of thiamethoxam. Recommended tolerance levels from HED, 30 January 2019, D446686.
Florence fennel	None	4	Commodity displaced by group conversion.
Fruit, citrus, Group 10	0.4	Remove	See Fruit, citrus, Group 10-10.
Fruit, citrus, Group 10-10	None	0.4	Update definition.
Fruit, pome, Group 11	0.2	Remove	See Fruit, pome, Group 11-10.
Fruit, pome, Group 11-10	None	0.2	Update definition.
Fruit, stone, Group 12	0.5	Remove	See Fruit, stone, Group 12-12.
Fruit, stone, Group 12-12	None	0.5	Update definition.
Goat meat byproducts	0.04	0.15	Based on new uses of thiamethoxam. Recommended tolerance levels from HED, 30 January 2019, D446686.
Horse meat byproducts	0.04	0.15	Based on new uses of thiamethoxam. Recommended tolerance levels from HED, 30 January 2019, D446686.
Kohlrabi	None	4.5	Commodity displaced by group conversion.
Leafy greens Subgroup 4-16A	None	4	Commodity displaced by group conversion.

Thiamethoxam 40 CFR §180.565. Summary of Proposed Tolerance Actions			
Commodity	Currently Established Tolerance (ppm)	Proposed Tolerance (ppm)	Comments (*correct commodity definition*)
Leafy petiole Subgroup 22B	None	4	Commodity displaced by group conversion.
Milk	0.02	0.07	Based on new uses of thiamethoxam. Recommended tolerance levels from HED, 30 January 2019, D446686.
Nut, tree, Group 14	0.02	Remove	See Nut, tree, Group 14-12.
Nut, tree, Group 14-12	None	0.02	Update definition.
Oat, grain	None	0.9	Based on new uses of thiamethoxam. Recommended tolerance levels from HED, 30 January 2019, D446686.
Pistachio	0.02	Remove	See Nut, tree, Group 14-12.
Potato	None	0.15	Based on new uses of thiamethoxam. Recommended tolerance levels from HED, 30 January 2019, D446686.
Rice, grain	None	6	Based on new uses of thiamethoxam. Recommended tolerance levels from HED, 30 January 2019, D446686.
Rice, straw	None	2	Based on new uses of thiamethoxam. Recommended tolerance levels from HED, 30 January 2019, D446686.
Rye, grain	None	0.9	Based on new uses of thiamethoxam. Recommended tolerance levels from HED, 30 January 2019, D446686.
Sheep meat byproducts	0.05	0.15	Based on new uses of thiamethoxam. Recommended tolerance levels from HED, 30 January 2019, D446686.
Sorghum, grain, forage	0.02	0.9	Based on new uses of thiamethoxam. Recommended tolerance levels from HED, 30 January 2019, D446686.
Sorghum, grain, grain	None	0.6	Based on new uses of thiamethoxam. Recommended tolerance levels from HED, 30 January 2019, D446686.
Sorghum, grain, stover	0.02	1.5	Based on new uses of thiamethoxam. Recommended tolerance levels from HED, 30 January 2019, D446686.
Sorghum, sweet, stalk	None	0.7	Based on new uses of thiamethoxam. Recommended tolerance levels from HED, 30 January 2019, D446686.
Sugarcane	None	0.2	Based on new uses of thiamethoxam. Recommended tolerance levels from HED, 30 January 2019, D446686.
Triticale, grain	None	0.3	Based on new uses of thiamethoxam. Recommended tolerance levels from HED, 30 January 2019, D446686.
Vegetable, fruiting, Group 8	0.25	Remove	See Vegetables, fruiting, Group 8-10
Vegetable, head and stem Brassica Group 5-16	None	4.5	Commodity displaced by group conversion.

Thiamethoxam 40 CFR §180.565. Summary of Proposed Tolerance Actions			
Commodity	Currently Established Tolerance (ppm)	Proposed Tolerance (ppm)	Comments (*correct commodity definition*)
Vegetable, leafy, except brassica, Group 4	4.0	Remove	Divide into separate listings: Leafy greens Subgroup 4-16A, Leafy petiole vegetable Subgroup 22B, Celtuce, and Florence fennel
Vegetables, fruiting, Group 8-10	None	0.25	Commodity displaced by group conversion.
Wheat, bran	None	0.4	Based on new uses of thiamethoxam. Recommended tolerance levels from HED, 30 January 2019, D446686.
Wheat, forage	0.5	3	Based on new uses of thiamethoxam. Recommended tolerance levels from HED, 30 January 2019, D446686.
Wheat, grain	None	0.3	Based on new uses of thiamethoxam. Recommended tolerance levels from HED, 30 January 2019, D446686.
Wheat, hay	0.02	8	Based on new uses of thiamethoxam. Recommended tolerance levels from HED, 30 January 2019, D446686.
Wheat, straw	0.02	6	Based on new uses of thiamethoxam. Recommended tolerance levels from HED, 30 January 2019, D446686.

Dinotefuran

Proposed Interim Registration Review Decision
Case Number 7441

January 2020

Approved by: _____

Elissa Reaves, Ph.D.
Director
Pesticide Re-evaluation Division

Date: 1-22-2020

Table of Contents

I. INTRODUCTION

This document is the Environmental Protection Agency's (EPA or the agency) Proposed Interim Registration Review Decision (PID) for dinotefuran (PC Code 044312, case 7441), and is being issued pursuant to 40 CFR §§ 155.56 and 155.58. A registration review decision is the agency's determination whether a pesticide continues to meet, or does not meet, the standard for registration in the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA). The agency may issue, when it determines it to be appropriate, an interim registration review decision before completing a registration review. Among other things, the interim registration review decision may require new risk mitigation measures, impose interim risk mitigation measures, identify data or information required to complete the review, and include schedules for submitting the required data, conducting the new risk assessment and completing the registration review. Additional information on dinotefuran, can be found in the EPA's public docket (EPA-HQ-OPP-2011-0920) at www.regulations.gov.

FIFRA, as amended by the Food Quality Protection Act (FQPA) of 1996, mandates the continuous review of existing pesticides. All pesticides distributed or sold in the United States must be registered by the EPA based on scientific data showing that they will not cause unreasonable risks to human health or to the environment when used as directed on product labeling. The registration review program is intended to make sure that, as the ability to assess and reduce risk evolves and as policies and practices change, all registered pesticides continue to meet the statutory standard of no unreasonable adverse effects. Changes in science, public policy, and pesticide use practices will occur over time. Through the registration review program, the agency periodically re-evaluates pesticides to make sure that as these changes occur, products in the marketplace can continue to be used safely. Information on this program is provided at http://www.epa.gov/pesticide-reevaluation. In 2006, the agency implemented the registration review program pursuant to FIFRA § 3(g) and will review each registered pesticide every 15 years to determine whether it continues to meet the FIFRA standard for registration.

The EPA is issuing a PID for dinotefuran so that it can (1) move forward with aspects of the registration review that are complete and (2) implement interim risk mitigation (see Appendices A and B). The agency is currently working with the U.S. Fish and Wildlife Service and the National Marine Fisheries Service (together, the Services) to develop methodologies for conducting national threatened and endangered (listed) species assessments for pesticides in accordance with the Endangered Species Act (ESA) § 7. Therefore, although the EPA has not yet fully evaluated risks to listed species, the agency will complete its listed species assessment and any necessary consultation with the Services for dinotefuran prior to completing the dinotefuran registration review. Likewise, the agency will complete endocrine screening for dinotefuran, pursuant to the Federal Food, Drug, and Cosmetic Act (FFDCA) § 408(p), before completing registration review. See Appendices C and D, respectively, for additional information on the endangered species assessment and the endocrine screening for the dinotefuran registration review.

Dinotefuran is a broad-spectrum systemic, neonicotinoid insecticide (in the nitroguanidine subclass), which acts on the neonicotinoid acetylcholine receptors (nAChRs) of the central nervous system of insects. Dinotefuran is categorized in the Mode of Action subclass 4A by the

Insecticide Resistance Action Committee (IRAC), a specialist technical group of the agrochemical industry association CropLife. Dinotefuran is used to target a variety of pests including aphids, whiteflies, thrips, leafhoppers, stinkbugs, mole crickets, white grubs, beetles and lacebugs. Products containing dinotefuran can be applied in both agricultural and non-agricultural settings. Agricultural use sites include, but are not limited to, cucurbit vegetables, grapes, nut trees, fruiting vegetables, brassica vegetables and leafy vegetables. Non-agricultural use sites include forest trees, ornamental plants, turf, animal and pet premises, and commercial/industrial buildings. There are 58 Section 3 product registrations, 12 Section 24 (c) Special Local Needs Registrations (SLN), and 13 Section 18 Emergency Exemptions containing dinotefuran. The first dinotefuran product was registered in the United States in 2004, and therefore dinotefuran was not subject to the reregistration process under FIFRA.

This document is organized into five sections: the *Introduction*, which includes this summary and a summary of public comments and the EPA's responses; *Use and Usage*, which describes how and why dinotefuran is used and summarizes data on its use; *Scientific Assessments*, which summarizes the EPA's risk and benefits assessments, updates or revisions to previous risk assessments, and provides broader context with a discussion of risk characterization; the *Proposed Interim Registration Review Decision*, which describes the mitigation measures proposed to address risks of concern and the regulatory rationale for the EPA's PID; and, lastly, the *Next Steps and Timeline* for completion of this registration review.

While this PID focuses on the specific risks, benefits, and mitigation measures for dinotefuran, the EPA is issuing PIDs for all of the currently registered N-nitroguanidine neonicotinoid pesticides concurrently to ensure consistency across the class. The PIDs and supporting documents for clothianidin, dinotefuran, and thiamethoxam are available in the public dockets established for each of these cases.

A. Summary of Dinotefuran Registration Review

Pursuant to 40 CFR § 155.50, the EPA formally initiated registration review for dinotefuran with the opening of the registration review docket for the case. The following summary highlights the docket opening and other significant milestones that have occurred thus far during the registration review of dinotefuran.

- December 2011 - The Dinotefuran Summary Document, Human Health Scoping Document, and Environmental Fate and Effects Problem Formulation were posted to the docket for a 60-day public comment period.

- June 2012 - The *Dinotefuran Final Work Plan* (FWP) was issued. During the comment period for the Dinotefuran Summary Document the agency received one public comment, which did not result in changes to the work plan, data requirements or timeline in the PWP.

- March 2013 - Generic Data Call-In (GDCI) for dinotefuran was issued for data needed to conduct the registration review risk assessments. For dinotefuran, all data requirements were satisfied.

- January 2017 - The agency announced the early availability of the *Draft Assessment of the Potential Effects of Dinotefuran on Bees,* a 60-day public comment period was later opened to coincide with the other neonicotinoids starting May 25, 2017 and ending July 24, 2017.

- December 2017 – The agency announced the availability of the following documents to support Registration Review for 120-day public comment period which included a 60-day comment period extension:
    - *Preliminary Ecological Risk Assessment (excluding terrestrial invertebrates) for the Registration Review of Dinotefuran*
    - *Dinotefuran: Registration Review Drinking Water Assessment and the Dinotefuran: Human Health Draft Risk Assessment for Registration Review*
    - *Benefits of Neonicotinoid Insecticide Use in Pre-Bloom and Bloom Periods of Cotton*
    - *Benefits of Neonicotinoid Insecticide Use in Pre-Bloom and Bloom Periods of Citrus*

- January 2020 – The agency is now announcing the availability of the PID and the *Final Bee Risk Assessment to Support the Registration Review of Dinotefuran* in the docket, for a 60-day public comment period. Along with the PID, the following documents are also posted in the dinotefuran docket:
    - *Benefits of Neonicotinoid Insecticide Use in Cucurbit Production and Impacts of Potential Risk Mitigation*, December 11, 2019
    - *Benefits of Neonicotinoid Insecticide Usage in Grapes and Impacts of Potential Mitigation*, October 23, 2019
    - *Usage, Pest Management Benefits, and Possible Impacts of the Potential Mitigation of the Use of the Four Nitroguanidine Neonicotinoids in Pome Fruits (Apple, Pear)*, December 11, 2019
    - *Assessment of Usage, Benefits and Impacts of Potential Mitigation in Stone Fruit Production for Four Nitroguanidine Neonicotinoid Insecticides (Clothianidin, Dinotefuran, Imidacloprid, and Thiamethoxam)*, December 6, 2019
    - *Usage and Benefits of Neonicotinoid Insecticides in Rice and Response to Comments*, April 22, 2019
    - *Benefits of Neonicotinoid Insecticide Use in Berries (Strawberry, Caneberry, Cranberry, and Blueberry) and Impacts of Potential Mitigation*, December 6, 2019
    - *Benefits of Neonicotinoid Insecticide Use and Impacts of Potential Risk Mitigation in Vegetables, Legumes, Tree Nuts, Herbs, and Tropical and Subtropical Fruit.* December 20, 2019
    - *Review of "The Value of Neonicotinoids in North American Agriculture" prepared by AgInfomatics, LLC for Bayer CropScience, Syngenta, and Valent,* November 4, 2019
    - *Review of "The Value of Neonicotinoids in Turf and Ornamentals" prepared by AgInfomatics, LLC for Bayer CropScience, Mitsui, Syngenta, and Valent*, December 11, 2019

- *Comparative analysis of Aquatic Invertebrate Risk Quotients generated for neonicotinoids using Raby et al. (2018) toxicity data*, January 7, 2020
- *Final Bee Risk Assessment to Support the Registration Review of Dinotefuran*, January 14, 2020
- *Note to Reader: Documents Supporting the Registration Review of Dinotefuran*

B. Summary of Public Comments on the Draft Risk Assessments and Agency Responses

Two separate comment periods were held in 2017 for the dinotefuran risk assessment documents. The *Draft Assessment of the Potential Effects of Dinotefuran on Bees* was published on January 12, 2017 for a 60-day public comment period. The draft human health and non-pollinator ecological risk assessments for dinotefuran, and various supporting benefits-related registration review documents, published on December 21, 2017 for a 120-day public comment period. Although the initial comment deadline for these registration review documents was February 20, 2018, the comment period was extended for an additional 60 days, resulting in a revised comment submission deadline of April 21, 2018.

Across these two comment periods, the agency received a total of 727 public comments. Comments were submitted by various individuals, organizations, and companies. Comments of a broader regulatory nature, and the agency's responses to those comments, are provided in the memorandum *Response from OPP's Pesticide Re-evaluation Division to Comments on the Draft Risk Assessments of 4 Neonicotinoid Insecticides* available in the public docket. Comments on the topics of neonicotinoid benefits, ecological effects, and human health effects are noted and responded to in the following memoranda:

- *Biological and Economic Analysis Division's (BEAD) Response to Comments on the Preliminary Risk Assessments and Benefit Assessments for Citrus, Cotton, Soybean Seed Treatment, and Other Crops Not Assessed for Neonicotinoid Insecticides*. December 23, 2019.
- *Dinotefuran: Response to Public Comments Regarding the Draft Bee and Non-Bee Ecological Risk Assessments for the Registration Review of Dinotefuran.* January 7, 2020.
- *Dinotefuran: Response to Comments on the Human Health Risk Assessment for Registration Review (EPA-HQ-OPP-2011-0920-0753)*, October 5, 2018.

Additionally, the agency received comments on the preliminary risk assessments that resulted in revised risk assessments and/or adjustments to EPA's risk management approach. These comments are captured below, along with the agency's responses to those comments. The agency thanks all commenters for their comments.

Comment Submitted by the Massachusetts Office of the Attorney General (EPA-HQ-OPP-2011-0920-0725):

Comment: The Massachusetts Office of the Attorney General (MA-OAG) expressed concerns regarding risks to pollinators from residential homeowner applications of neonicotinoids on

gardens, lawns and ornamentals. MA-OAG also highlighted that many retailers have voluntarily committed to phasing out the sale of plants and other products containing neonicotinoid insecticides. MA-OAG suggests that the agency severely curtail the use of neonicotinoids.

EPA Response: EPA thanks the Massachusetts Office of the Attorney General for its comment. The agency recognizes the potential risks to pollinators from homeowner applications of neonicotinoids on gardens, lawns, and ornamentals. In response, the agency is proposing certain rate reductions and require advisory label language for residential ornamental labels stating, "Intended for use by professional applicators". Please refer to Section IV.A of this PID for additional details regarding the proposed label changes.

Comment Submitted by the National Association of State Departments of Agriculture (EPA-HQ-OPP-2011-0920-0583):

Comment: The National Association of State Departments of Agriculture (NASDA) encourages the agency to fully articulate risk mitigation measures with state lead agencies, registrants, producers, users, and the agricultural stakeholder community to facilitate an informed risk assessment. Furthermore, NASDA is concerned that the agency did not articulate the benefits in the draft pollinator risk assessments.

EPA Response: The agency continues to encourage public/stakeholder participation through the public comment period. Moreover, the agency prepared refined risk assessments in response to substantive comments, and also provided several additional benefits assessments (see Section I.A) to support the registration review of all the neonicotinoids, including dinotefuran. The agency carefully considered the risks and benefits described in these assessments to develop the risk mitigation proposals, which are detailed in this PID. In accordance with EPA policy, the agency is opening a 60-day public comment period for the proposed mitigation described in this PID prior to issuing a final decision.

Comments Submitted Concerning the Preliminary Pollinator Risk Assessments:

The agency received numerous comments in response to publication of the preliminary pollinator risk assessments for clothianidin, dinotefuran, imidacloprid, and thiamethoxam, which were considered in the preparation of the final pollinator risk assessments. The agency's responses can be found below. These comments were received from Mitsui Chemicals Agro, Inc. (MCAG), Beekeepers (BK), Beyond Pesticides (BP), the Center for Biological Diversity (CBD), California Citrus Mutual (CCM), the Center for Food Safety (CFS), CropLife America (CLA), Dancing Bee Gardens (DBG), GreenCAPE (GC), the National Corn Growers Association (NCGA), the National Cotton Council (NCC), the Natural Resources Defense Council (NRDC), the National Wildlife Federation (NWF), the Pesticide Policy Coalition (PPC), the San Francisco Estuary Institute (SFEI), the University of California – Riverside (UCR), the University of California – San Diego (UCSD), and the United States Department of Agriculture (USDA).

The agency also received abundant generalized comments regarding the preliminary pollinator risk assessments, including those concerning the scientific methodology or rationale in these assessments. For a more comprehensive account of the comments related to the preliminary pollinator risk assessments, including those summarized in this PID, refer to *EFED Response to Public Comments Common to the Preliminary Pollinator and Preliminary Non-Pollinator*

Registration Review Risk Assessments Across the Four Neonicotinoid Pesticides (Imidacloprid, Thiamethoxam, Clothianidin, and Dinotefuran) and *Dinotefuran: Response to Public Comments Regarding the Draft Bee and Non-Bee Ecological Risk Assessments for the Registration Review of Dinotefuran,* available in the public dockets.

Summary of MCAG Comments (EPA-HQ-OPP-2011-0920-0588):
MCAG Comment: MCAG stated "On pages 1, 9, 10, 14, 20, 21, 35, 63, 64, 66, 67, 69, 71, 72, 118, and 127, maximum application rates and risk assessment results and conclusions are presented for Crop Subgroup 14: Tree Nuts. There are no tolerances for dinotefuran on Crop Subgroup 14: Tree Nuts. Dinotefuran labels show use rates for Ornamental Non-bearing Nut Trees. As this assessment is not intended to include ornamental uses of dinotefuran, all mention of Tree Nuts should be removed."

EPA Response: EPA appreciates the clarification on the Crop Subgroup 14: Tree Nuts use. The final bee assessment includes ornamental non-bearing nut trees as part of the evaluation of ornamental uses of dinotefuran and removes reference to Crop Subgroup 14.

MCAG Comment: MCAG identified numerous errors throughout the document, including: reported endpoints, reported residues, and citations.

EPA Response: EPA appreciates the editorial corrections and has incorporated all changes as appropriate in the final bee risk assessment, which will be published along with the Proposed Interim Decision for dinotefuran. These corrections do not impact the analyses or conclusions presented in the final risk assessment.

MCAG Comment: MCAG provided several comments related to the clarification of Tier I risk conclusions for acute exposures to larval bees and requested EPA modify risk conclusion statements to clarify that risks from acute larval exposures are not anticipated for tuberous and corm vegetables or for any soil application.

EPA Response: EPA appreciates the clarification provided on risk conclusions and notes that conclusions presented in the final bee risk assessment are based on the available Tier I and II toxicity data as well as the submitted residue studies. The Tier I conclusions, which formed the basis for the draft bee risk assessment, are now summarized in Table 5.9 of the final assessment.

MCAG Comment: MCAG commented on the approach to estimating off-field exposure via spray drift described in the draft bee risk assessment and concludes "exposure to residues deposited off-site are not significant and given the uncertainties inherent in the risk assessment assumptions, no spray buffers are needed to protect honeybees."

EPA Response: EPA estimated off-field exposure via spray drift according to label directions, and current internal guidance and models.

MCAG Comment: MCAG stated "the chronic larval toxicity endpoint should be set at a no observed adverse effect concentration (NOAEC) of 0.33 µg/larva (corresponding to 0.0825

µg/larva/day) with a lowest observed adverse effect concentration (LOAEC) of 0.85 µg ai/larva (corresponding to 0.2125 µg/larva/day) based on the 22 -day observation."

EPA Response: EPA updated the statistics for the 8-d larval mortality, 15-d pupal mortality, and 21-d adult emergence endpoints using the Cochran-Armitage trend test (consistent with OECD guidance). The resulting NOAEC and LOAEC for 8-d larval mortality are <0.13 and 0.13 ug/larvae, respectively, based on statistically significant 14% effect ($p = 0.01$) at lowest concentration tested. The DER has been amended with updated statistics but did not change the most sensitive endpoint or resulting NOAEC/LOAEC values. This does not result in a change to the risk assessment or prior conclusions.

Summary of Comments (Academia, BK, CBD, CFS, CLA, DBG, NRDC, NWF, PSC, USDA, XSIC): Several commenters suggested the Tier II colony feeding studies were inadequate, claiming design or conduct flaws (*e.g.* lack of overwintering, removal of colonies due to supersedure, failure to consider genetic variability).

EPA Response: The agency reviewed the study protocols prior to test initiation and determined that the study designs were appropriate for generating data for use in a regulatory risk assessment. While EPA reviewed protocols and determined that the studies were appropriate for risk assessment, the agency acknowledges that there were some issues with the initial studies. Therefore, EPA incorporated revised studies into the final pollinator assessments. These new studies all included successful overwintering control hive components such as colony strength, number of broods, food stores, etc., however, the agency notes that the treatment-related effects measured after overwintering were equal to or less sensitive than those measured prior to overwintering; since endpoints were based on effects observed during the season of the application, they were also protective of effects that may occur after overwintering. Data evaluation records for these studies are publicly available (regulations.gov; EPA-HQ-OPP-2011-0581-0040 and EPA-HQ-OPP-2011-0865-0179) and list the perceived strengths and limitations of these studies.

Summary of Comments (BK, BP, CBD, CCM, CFS, DBG, GC, NCC, NRDC, NWF, SFEI, UCR, UCSD): Several commenters asked the agency to refer to open literature studies for data and/or methodologies to be incorporated into the EPA's pollinator assessment. These studies covered a range of considerations including, but not limited to, assessing risk to additional pollinator species (*e.g.* non-apis), sub-lethal effects, and toxicity endpoints.

EPA Response: The agency thanks the commenters for their comments. EPA relies on the best available science at the time of conducting its assessments. In the risk assessment process, numerous studies are considered and evaluated for inclusion in the assessments based on the agency's open literature guidance. Open literature studies that meet the guidance criteria are then selected for inclusion in the risk assessments. The selected studies are then weighted based on the scientific evaluation. EPA acknowledges the growing body of studies/data/methodologies and has considered additional studies in the final pollinator assessments that were brought to the agency's attention as comments received on the preliminary pollinator assessments.

Summary of Comments: Several commenters expressed concerns that the agency did not implement a consistent methodology for the four nitroguanidine-substituted neonicotinoids in the preliminary pollinator risk assessments.

EPA Response: The agency thanks the commenters for their feedback. The initial registrations for the four nitroguanidine-substituted neonicotinoids were not concurrent, and, as a result, the registration review schedule for these chemicals were not concurrent. As such, the preparation of the initial risk assessments for these four chemicals occurred at different times, where imidacloprid was assessed prior to the remaining three nitroguanidine-substituted neonicotinoids. However, since the release of the preliminary pollinator assessments, the agency has made a programmatic decision to align the registration review schedules for all four nitroguanidine-substituted neonicotinoids. Consequently, the final pollinator assessments are now aligned in methodology and consistency to the greatest extent possible.

Summary of Comments: Several comments were submitted on the bee bread method to evaluate pollen exposure, specifically that an unvetted method should not be used (NCC, CBD, PPC); the bee bread method overestimates exposures to pollen in the hive, and that these estimates should be converted to nectar equivalents that can be compared to the sucrose NOAEC (CLA, NCGA).

EPA Response: The agency thanks the commenters for their comments. Based on the public comments received, and new data available, including a new colony feeding studies with spiked pollen and a supplement of an expanded suite of available empirical residue in pollen and nectar studies, the method to evaluate the pollen route of exposure has been updated in the final pollinator risk assessments. In short, the updated approach considers exposure via residues in pollen (and nectar) on a total dietary basis by converting pollen concentrations into nectar equivalents and summing the residues from both matrices (where appropriate) to estimate a single exposure number for comparison to a sucrose-based endpoint (NOAEC). See *Attachment* 1. *Tier II Method for Assessing Combined Nectar and Pollen Exposure to Honey Bee Colonies,* within each chemical-specific docket for a full explanation of the revised pollen method.

Comments Submitted Concerning the Preliminary Non-Pollinator Risk Assessments:
The agency received numerous comments in response to the preliminary non-pollinator risk assessments conducted for the four nitroguanidine-substituted neonicotinoids, which were considered in the preparation of the final non-pollinator risk assessments and comments concerned the scientific methodology or rationale in these assessments. These comments were received from a variety of stakeholders including, but not limited to, the Agricultural Retailers Association (ARA), AVAAZ, the Bay Area Clean Water Agencies (BACWA), MCAG, the California Department of Pesticide Regulation (CDPR), CropLife America (CLA), North Dakota Grain Growers Association (NDGGA), Louisiana State University Agricultural Center, the San Francisco Bay Regional Water Quality Control Board (SFBRWQCB), the University of Minnesota (UMN). The agency's response can be found below.

For a more comprehensive account of the comments related to the preliminary non-pollinator risk assessments and their responses, including those summarized in this PID, refer to *EFED Response to Public Comments Common to the Preliminary Pollinator and Preliminary Non-*

Pollinator Registration Review Risk Assessments Across the Four Neonicotinoid Pesticides (Imidacloprid, Thiamethoxam, Clothianidin, and Dinotefuran) and *Dinotefuran: Response to Public Comments Regarding the Draft Bee and Non-Bee Ecological Risk Assessments for the Registration Review of Dinotefuran,* available in the public dockets.

Summary of Comments (AVAAZ, BACWA, CDPR, CLA, SFBRWQCB, XSIC):
Commenters (EPA-HQ-OPP-2008-0844-1192, EPA-HQ-2008-0844-1116, EPA-HQ-OPP-2011-0920-0750, EPA-HQ-OPP-0920-0712, EPA-HQ-OPP-2011-0920-0693) assert that ample evidence exists in the literature to show that relatively small concentrations of neonicotinoids can trigger harmful effects; that invertebrates are harmed at levels well below the current aquatic life benchmarks, and that these benchmarks should be revised. The commenters also felt that the following studies should be considered in the assessments:

- Maloney, E. M., Morrissey, C. A., Headley, J. V., Peru, K. M., & Liber, K. (2017). Cumulative toxicity of neonicotinoid insecticide mixtures to *Chironomus dilutus* under acute exposure scenarios. *Environmental Toxicology and Chemistry*, 36(11), 3091-3101.
- Miles, J. C., Hua, J., Sepulveda, M. S., Krupke, C. H., & Hoverman, J. T. (2017). Effects of clothianidin on aquatic communities: Evaluating the impacts of lethal and sublethal exposure to neonicotinoids. *PloS One*, 12(3), e0174171.
- Raby, M., Nowierski, M., Perlov, D., Zhao, X., Hao, C., Poirier, D. G., & Sibley, P. K. (2018). Acute toxicity of 6 neonicotinoid insecticides to freshwater invertebrates. *Environmental Toxicology and Chemistry*, 37(5), 1430-1445.

Conversely, one commenter (EPA-HQ-OPP-2011-0920-0711) asserted that the application of the most conservative endpoint to assess risk to all aquatic invertebrates is overly conservative and does not account for diversity of aquatic invertebrate communities.

EPA Response: The agency thanks the commenters for their feedback. The agency has considered the additional information provided from the above studies. Raby *et. al.* conducted a comparative analysis by testing the four nitroguanidine-substituted neonicotinoids on 7 aquatic invertebrate species in a controlled laboratory environment. The agency also performed a cursory review of Maloney *et. al.* and Miles *et.al.*, which report lethal concentrations (LC_{50}) similar to those reported in *Raby et. al*. Overall, the agency found the Raby *et. al.* study acceptable for quantitative use in risk assessment, however, the agency concluded that there are no significant changes in the risk conclusions for aquatic invertebrates as described in the preliminary ecological risk assessments. For more information, refer to the *Comparative analysis of Aquatic Invertebrate Risk Quotients generated for neonicotinoids using Raby et al. (2018) toxicity data* available in each docket.

Comment Submitted by MCAG (EPA-HQ-OPP-2011-0920-0728):
MCAG provided information suggesting that dinotefuran is different than the other nitroguanidine substituted neonicotinoids (imidacloprid, clothianidin, and thiamethoxam), stating "based on the available toxicity data, dinotefuran is generally less acutely and chronically toxic than the other neonicotinoids".

EPA Response: In the ecological risk assessments for the nitroguanidine-substituted neonicotinoids (referred to as "neonicotinoids"), the aquatic invertebrate toxicity data available at the time of publication was characterized. The neonicotinoids evaluated include clothianidin, dinotefuran, imidacloprid and thiamethoxam. Of the four chemicals, imidacloprid has the largest database of aquatic invertebrate toxicity data. Although clothianidin and thiamethoxam had fewer data available than imidacloprid, there were still data for several different test species, including aquatic life stage insects. Dinotefuran had the smallest toxicity database of all four chemicals, relying heavily upon cladoceran data, which are not sensitive to the neonicotinoids relative to other tested aquatic invertebrate species.

There are some important notes relevant to the available toxicity databases. First, there is a difference in sensitivity among test species to the same neonicotinoid. Among different mayfly species, the neonicotinoids have 96-h LC_{50} values that span orders of magnitude. Therefore, the most sensitive toxicity endpoints used in risk assessment may be dependent upon which species are tested. In the case of imidacloprid, which has the largest database of toxicity data, the fact that this chemical has the lowest toxicity endpoints may not be a function of its lower toxicity but rather of the sensitivity of the tested species. The most sensitive test species for imidacloprid was *Cloeon dipterum* (a mayfly) for acute exposures and *Caenis horaria* (also a mayfly) for chronic exposures. At the time of the original risk assessments, none of the other three chemicals had toxicity data for this test species.

After the draft ecological risk assessments for the neonicotinoids were posted to the docket, two studies were published focusing on the toxicity of these compounds to aquatic invertebrates (Raby et al. 2018a and Raby et al. 2018b). EFED has reviewed these two studies and has determined that their results may be used quantitatively for risk assessment purposes, *i.e.*, to derive Risk Quotients (RQs). Given that the toxicity data generated by Raby et al. 2018 (a and b) were from the same lab, this data set allows for a unique opportunity to compare the toxicities of the neonicotinoids, decreasing the variability that may be due to tests from different labs. A complete discussion of the comparative risk of the four nitroguanidine substituted neonicotinoids can be found in the memorandum "Comparative analysis of Aquatic Invertebrate Risk Quotients Generated for Neonicotinoids using Raby et al. (2018) Toxicity Data" (US EPA, 2020).

As discussed in the analysis and considering the two most sensitive species tested, the four chemicals are relatively similar in toxicity on an acute and chronic exposure basis for the mayfly, but there were differences in sensitivities observed among the chemicals for the midge. When considering exposure, dinotefuran tends to have the highest EECs among the four chemicals. Overall, for the same uses, the chemicals represent a similar risk concern.

RQs for dinotefuran based on the acute and chronic toxicity data for the two most sensitive species presented in Raby et al. are provided in Table 1 of *Dinotefuran: Response to Comments Regarding the Draft Bee and Non-Bee Ecological Risk Assessments for the Registration Review of Dinotefuran*. Those RQs supersede those presented in the draft risk assessment.

II. USE AND USAGE

Dinotefuran is a neonicotinoid insecticide (in the nitroguanidine subclass) that has contact and systemic activity used to control a variety of insects. Dinotefuran has numerous agricultural and non-agricultural uses. Agricultural use sites include field crops, fruits, and vegetables as well as Christmas tree plantations, and dinotefuran can be applied via soil and foliar applications methods (both ground and by air) as well as a tree/trunk injection. Non-agricultural uses include indoor residential and commercial sites, including food handling establishments, outdoor residential and commercial sites such as gardens, lawns, and ornamental plantings; and pets and livestock. It is applied by both professional pest control operators and homeowners with surface, space, and directed crack and crevice sprayers, and aerosol sprays. End-use formulations include ready-to-use, pressurized liquids, dust, emulsifiable concentrates, granules, soluble concentrates, pellets/tablets, impregnated material, and water-soluble packaging.

Agricultural Usage

From 2007-2017, dinotefuran usage averaged about 32,000 pounds AI[1], applied to approximately 230,000 acres[2]. Usage has been increasing over time. Major agricultural uses in terms of total average pounds applied include rice, cotton, cucurbits, and fruiting vegetables[1]. In terms of percent crop treated (PCT), cantaloupes and celery are the highest with an average of 25 percent; around 10 percent of the acreage in brassica vegetables and other cucurbits are treated with dinotefuran.

In 2016, usage of dinotefuran was reported to be used for industrial vegetation management, including forestry, but quantitative estimates were not reported[3]. In 2012, approximately 10,000 lbs AI of dinotefuran was estimated to have been used in horticultural nurseries and greenhouses[4].

Non-Agricultural Use

The agency has limited usage data on non-agricultural use sites. In 2014, approximately 37,000 lbs AI of dinotefuran was used in and around food handling establishments[5]. There was also usage by professional pest control operations in and around other commercial establishments and

[1] *Dinotefuran (044312) Screening Level Usage Analysis (SLUA), July 8, 2019*
[2] *Agricultural Market Research Data (AMRD). various years. Data collected and sold by a private market research firm. Data collected on pesticide use for about 60 crops by annual surveys of agricultural users in the continental United States. Survey methodology provides statistically valid results, typically at the state level.*
[3] *Non-Agricultural Market Research Proprietary Data. 2017b. Studies conducted and sold by a consulting and research firm. Report on vegetation management. [Accessed June 2019.]*
[4] *Kline and Company, 2013. Professional Turf and Ornamental Markets for Pesticides and Fertilizers, 2012.*
[5] *Kline and Company, 2015. Pest Control in Food Handling Establishments 2014: U.S. Market Analysis and Opportunities. [Accessed June 2019.]*

residential buildings reported in 2016, but quantitative estimates are not available[6]. Direct to consumer sales are not reported in available usage data[7].

III. SCIENTIFIC ASSESSMENTS

A. Human Health Risks

A summary of the agency's human health risk assessment is presented below. The agency used the most current science policies and risk assessment methodologies to prepare a risk assessment in support of the registration review of dinotefuran. For additional details on the human health assessment for dinotefuran, see the *Dinotefuran: Human Health Draft Risk Assessment for Registration Review*, which is available in the public docket.

1. Risk Summary and Characterization

There are no residue chemistry, toxicology, or occupational/residential exposure data gaps for dinotefuran. Acute and chronic dietary exposure and risk estimates are not of concern for dinotefuran. Dinotefuran is classified as "not likely to be carcinogenic to humans" based on lack of evidence of carcinogenicity in rats and mice and there is no evidence of mutagenicity. Dinotefuran has low acute toxicity by oral, dermal, or inhalation exposure routes (Toxicity Category III or IV). It does not irritate the eye (Toxicity Category IV), but causes a low level of skin irritation (Toxicity Category IV); it is not a dermal sensitizer. The Food Quality Protection Act (FQPA) Safety Factor (SF) for dinotefuran has been reduced to 1X because (1) there is an adequate toxicity database for dinotefuran; (2) the prenatal developmental studies in rabbits and rats and the 2-generation reproduction study in rats showed no indication of increased susceptibility to *in utero* and/or postnatal exposure to dinotefuran; (3) the neurotoxic potential of dinotefuran has been adequately considered; and (4) there are no residual uncertainties identified in the exposure databases. Therefore, the level of concern (LOC) = 100.

No hazard was identified for the short- and intermediate-term dermal and inhalation routes of exposure, residential handler, occupational handler, and occupational post-application exposures were not assessed. The only potential non-dietary exposure pathway that was quantitatively assessed is the incidental oral exposure pathway for children 1 to <2 years old and the resulting MOEs are greater than HED's level of concern (LOC = 100); however, although the exposure pathway potentially exists, incidental oral post-application risk estimates did not result in risk estimates of concern (MOEs ≥ 100). Additionally, there were no aggregate risks of concern identified.

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[6] *Non-Agricultural Market Research Proprietary Data. 2017a. Studies conducted and sold by a consulting and research firm. Report on professional turf and ornamental plants and professional pest control pesticide usage. [Accessed June 2019.]*

[7] *Non-Agricultural Market Research Proprietary Data. 2017a. Studies conducted and sold by a consulting and research firm. Report on consumer pesticide usage. [Accessed June 2019.]*

Dietary, Residential Handler, Residential Post-Application, Aggregate, Bystander, and Occupational Handler and Post-Application Risks

No risks of concern were identified for dietary, residential handler, residential post-application, aggregate, or occupational handler or post-application exposures. The only potential post-application exposure pathway that was quantitatively assessed is the incidental oral exposure pathway for children 1 to <2 years old. The resulting MOEs range from 1,200 to 5,500,000 and are significantly greater than the LOC of 100; therefore, there are no post-application risks of concern. A quantitative bystander spray drift assessment for dinotefuran was not needed because the potential residues from direct applications to residential turf are greater than the potential residues resulting from drift from nearby agricultural endpoints (i.e., the residential post-application risk assessment is protective of potential bystander risks.

Since no hazard was identified for the short-term and intermediate-term dermal and inhalation routes of exposure, occupational handler and post-application exposures were not assessed, and there are no expected risks of concern.

Cumulative Risks

EPA has not made a common mechanism of toxicity to humans finding as to dinotefuran and any other substance and it does not appear to produce a toxic metabolite produced by other substances. Therefore, EPA has not assumed that dinotefuran has a common mechanism of toxicity with other substances for this assessment.

2. Human Incidents and Epidemiology

One hundred and two dinotefuran incidents were previously reviewed in 2011, and based on the low severity and frequency of cases reported to IDS, further analysis was not warranted. In the current analysis covering incidents reported from January 1, 2012 to July 11, 2017, five cases involving a single active ingredient and 45 cases involving multiple active ingredients were reported to Main IDS; another 810 cases are recorded in the Aggregate IDS (these incidents are typically of low severity). A query of SENSOR-Pesticides 1998-2013 identified 31 cases involving dinotefuran. Based on the continued low severity of dinotefuran incidents reported to both IDS and SENSOR-Pesticides, there does not appear to be a concern at this time.

The agency will continue to monitor the incident data. Additional analyses will be conducted if ongoing human incident monitoring indicates a concern.

3. Tolerances

Tolerances are established under 40 CFR § 180.603 for residues of dinotefuran, including its metabolites and degradates, for plants and livestock commodities as well as food handling establishments. There are/were time-limited tolerances for stone and pome fruits (expires 12/31/2021) and fuzzy kiwifruit (expires 12/31/2022). EPA intends to update crop group definitions for several commodities, revoke individual tolerances for some commodities that will be covered in the appropriate crop groupings, and increase some tolerances to harmonize with

Codex Maximum Residue Limits (MRLs); there are no MRLs established in Canada and Mexico for dinotefuran.

Revisions are proposed at this time to include updated crop group definitions, update tolerances per the EPA's guidance on trailing zeros, as well as increased tolerance levels for international harmonization. Only the proposed tolerance revisions are presented in below. The agency will use its FFDCA rulemaking authority to undertake the needed tolerance changes.

Dinotefuran 40 CFR § 180.603: Summary of Proposed Tolerance Actions			
Commodity	Established Tolerance (ppm)	Proposed Tolerance (ppm)	Comments (*correct commodity definition*)
40 CFR 180.603 (a)(1) Plant Commodities			
Brassica leafy greens subgroup 4-16B	--	15	1) Crop group conversion/revision 2) Correct number of significant figures to be consistent with EPA policy
Brassica, head and stem, subgroup 5A	1.4	--	Tolerance should be revoked upon establishment of Vegetable, Head and Stem *Brassica*, Group 5-16 and kohlrabi
Brassica, leafy greens, subgroup 5B	15.0	--	Tolerance should be revoked upon establishment of *Brassica* leafy greens subgroup 4-16B
Celtuce	5.0[8]	5	1) Separate tolerance for celtuce is needed as it is left out when crop group 4 is converted to 4-16A and 4-16B 2) Correct number of significant figures to be consistent with EPA policy
Cotton, gin byproducts	8.0	8	Correct number of significant figures to be consistent with EPA policy
Florence fennel	5.0[1]	5	1) Separate tolerance for Florence fennel is needed as it is left out when crop group 4 is converted to 4-16A and 4-16B 2) Correct number of significant figures to be consistent with EPA policy
Grape, raisin	2.5	3	1) Harmonization with Codex MRL 2) Correct number of significant figures to be consistent with EPA policy
Kohlrabi	1.4[9]	2	1) Separate tolerance for kohlrabi is needed as it is left out when crop group 5 is converted to 5-16 and 22B 2) Harmonization with Codex MRL (increase from 1.4 to 2.0 ppm) 3) Correct number of significant figures to be consistent with EPA policy
Leaf Petiole Vegetable Subgroup 22B	--	5	Crop group conversion/revision
Leafy greens subgroup 4-16A	--	5	Crop group conversion/revision and correct number of significant figures to be consistent with EPA policy
Onion, green, subgroup 3-07B	5.0	5	Correct number of significant figures to be consistent with EPA policy
Peach	1.0	1	
Rice, grain	9.0	9	
Tomato, paste	1.0	1	
Turnip, greens	15.0	15	
Vegetable, fruiting, group 8	0.7	--	Tolerance should be revoked upon establishment of Vegetable, fruiting, group 8-10
Vegetable, fruiting, group 8-10	--	0.7	Crop group conversion/revision
Vegetable, Head and Stem *Brassica*, Group 5-16	--	2	1) Crop group conversion/revision

[8] At present, celtuce and Florence fennel are covered by crop group 4 tolerance.
[9] At present, kohlrabi is covered by crop group 5A tolerance.

Dinotefuran 40 CFR § 180.603: Summary of Proposed Tolerance Actions			
Commodity	Established Tolerance (ppm)	Proposed Tolerance (ppm)	Comments (*correct commodity definition*)
			2) Harmonization with Codex MRL (increase from 1.4 to 2.0 ppm) 3) Correct number of significant figures to be consistent with EPA policy
Vegetable, leafy, except *Brassica*, group 4	5.0	--	Tolerance should be revoked upon establishment of Leafy greens subgroup 4-16A, Leaf Petiole Vegetable Subgroup 22B, celtuce, and Florence fennel
40 CFR 180.603 (b)-Section 18			
Fruit, pome, group 11-10	--	2[3]	1) Commodity definition correction 2) Correct number of significant figures to be consistent with EPA policy
Fruit pome, group 11	2.0	Remove	
Fruit stone, group 12	2.0	Remove	

4. Human Health Data Needs

There are no residue chemistry, toxicology, or occupational/residential exposure data gaps for dinotefuran. No additional human health data are anticipated to be needed to support this registration review at this time.

B. Ecological Risks

A summary of the agency's ecological risk assessment is presented below. The agency used the most current science policies and risk assessment methodologies to prepare a risk assessment in support of the registration review of dinotefuran. For additional details on the ecological assessment for dinotefuran, see the following documents, which are available in the public docket (EPA-HQ-OPP-2011-0920) at www.regulations.gov.

- *Preliminary Ecological Risk Assessment (excluding terrestrial invertebrates) for the Registration Review of Dinotefuran*
- *Draft Assessment of the Potential Effects of Dinotefuran on Bees*
- *Final Bee Risk Assessment to Support the Registration Review of Dinotefuran*
- *Comparative analysis of Aquatic Invertebrate Risk Quotients generated for neonicotinoids using Raby et al. (2018) toxicity data*

The EPA is currently working with its federal partners and other stakeholders to implement an interim approach for assessing potential risk to listed species and their designated critical habitats. Once the scientific methods necessary to complete risk assessments for listed species and their designated critical habitats are finalized, the agency will complete its endangered species assessment for dinotefuran. See Appendix C for more details. As such, potential risks for non-listed species only are described below.

5. Risk Summary and Characterization

Terrestrial Exposure

Dinotefuran is applied through aerial and ground application methods, which includes sprayers, chemigation and soil drenching. For terrestrial wildlife, the agency modeled potential dietary exposure based on consumption of dinotefuran residues on food items following spray (foliar or soil) applications. Overall, acute risks to avian and mammalian species from foliar and soil treatments of dinotefuran are not expected. Soil incorporation following soil treatments, decreases potential risks from this use pattern considerably.

For terrestrial invertebrates, the primary routes of exposure assessed include contact of bees with spray droplets and oral ingestion via pollen and nectar. Exposure can vary based on use patterns and the attractiveness of a treated crop.

Mammals, Birds, Reptiles, and Terrestrial-Phase Amphibians

Dinotefuran is practically non-toxic to moderately toxic to birds (and to terrestrial-phase amphibians and reptiles for which birds serve as surrogates) and practically non-toxic to mammals on an acute basis. Overall, potential acute risks to birds and mammals from foliar and trunk injection treatments appear to be low. There is the potential for acute effects to birds from soil (spray) treatments at the highest application rate (0.54 lb AI/A; ornamentals including non-bearing nut trees), with Risk Quotients (RQs) ranging from 0.01 to 0.83[10] (soil incorporation following soil treatments decreases potential risks from this use pattern considerably). Unlike the other nitroguanidine substituted neonicotinoids, dinotefuran is not registered as a seed treatment and thus, not a route of exposure.

Although the possibility of exposure exists for terrestrial wildlife such as mammals, birds, reptiles, and terrestrial-phase amphibians, acute and chronic risks of concern have not been identified for any of the assessed dinotefuran uses or application methods.

Terrestrial Invertebrates (honeybees) – *Risk Estimates*

This section incorporates information provided in the *Draft Assessment of the Potential Effects of Dinotefuran on Bees* as well as the more recent *Final Bee Risk Assessment to Support the Registration Review of Dinotefuran*, which are available in the public docket. The 2017 draft pollinator assessment utilized available data to evaluate potential risk associated with the registered agricultural uses of dinotefuran to bees alone. The available data included a registration review required Tier I (individual bee) level dataset to help characterize the acute and chronic toxicity of dinotefuran to adult and larval honeybees. In both assessments, available open literature data were also reviewed.

The final 2019 bee risk assessment updates the draft pollinator assessment and incorporates additional information submitted to the EPA since the time of the previous draft assessment. This

[10] RQs exceeding the LOC represent potential risks of concern. The LOC for acute risks is 0.5.

new assessment includes data on residues of dinotefuran in nectar, pollen, and other plant matrices associated with registered crop uses. It utilizes a residue bridging strategy to extrapolate between crops, chemicals, and plant matrices to address lack of residue data for certain crops between the neonicotinoids, where appropriate. This additional information includes higher tiered, Tier II (colony) level) pollinator studies. Tier II data included a sucrose colony feeding (dose-response) study to better evaluate potential colony level effects. Data were required based on a tiered approach, as lower tiered data could trigger the need for higher tiered data.

The agency is concerned about potential risks from neonicotinoid use to all pollinators. During testing, honeybees (*Apis mellifera*) were used as a surrogate for other species of pollinators (*e.g.* bumblebees, monarchs, etc.). Risks to these other non-*Apis* bees are evaluated qualitatively based on available information. As the pollinator risk assessment framework used by the EPA indicates, the honeybees (*Apis mellifera*) are considered to be reasonable surrogates (in the absence of data to the contrary) for other bee species, and conclusions from the weight of evidence for the honeybee can be used to help inform about potential risks to other non-*Apis* species. An exception is noted based on the differences in attractiveness of crops to different bee species.

Among the four nitroguanidine neonicotinoids (imidacloprid, clothianidin, thiamethoxam, dinotefuran), robust data sets of pollen and nectar residue data are available for foliar and/or soil applications to the following bee-attractive crops and crop groups: cotton, cucurbits, citrus, stone fruit, pome fruit, berries/small fruits, and ornamentals (including non-bearing nut trees). Surrogate data were used where limited or no residue dinotefuran data were available. Generally, the dinotefuran risk assessment finds that applications of dinotefuran to honeybee attractive crops that are not harvested prior to bloom result in a potential for colony-level risk.

Dinotefuran is highly toxic to adult bees on an acute contact (48-hr LD_{50} = 0.024 µg a.i./bee) and oral (48-hr LD_{50} = 0.0076 µg a.i./bee) basis. Dinotefuran is classified as non-toxic with endpoints up to 3.3 µg a.i./larva (111 mg a.i./kg diet) to honey bee larvae on an acute (single dose dietary) exposure basis. RQ exceedances for larvae are orders of magnitude lower than those of adults, with acute contact RQs ranging from 7.4 to 20. Acute RQ exceedances associated with on-field foliar use of dinotefuran range from <0.3 to 760 and soil use exceedances range from <0.1 to 12 (LOC = 0.4). The highest acute foliar RQ exceedances noted are associated with use on brassica head and stem vegetables, fruiting vegetables, cucurbit vegetables, bulb vegetables, stone fruit, and low growing berries (except strawberry); while the highest soil-applied RQ exceedances result from use on potatoes, leafy vegetables, brassica head and stem vegetables, fruiting vegetables, cucurbits, kiwi, tuberous and corm vegetables, and small fruit vine climbing subgroup (except kiwi).

One study is available that examines the chronic toxicity of dinotefuran for adult honeybees through dietary exposure. The NOAEC and the LOAEC based on mortality are 0.0015 and 0.0035 µg a.i./bee, respectively. In a larval chronic 21-day study, individual honeybee (*Apis mellifera*) larvae were exposed *in vitro* to technical grade dinotefuran. No statistically significant differences were detected between the negative control and treatment groups for pupal mortality, adult emergence, or growth (body weight of emerged bees); however, high mortality in the control group observed at Day 14 limits the extent to which the study can detect treatment

effects. The NOAEC is less than the lowest dinotefuran treatment level (*i.e.*, NOAEC: <0.0325 µg a.i./larva/day). As with the acute data, RQ exceedances for honeybee larvae are orders of magnitude lower than those of adults. Chronic RQ exceedances associated with on-field foliar use of dinotefuran range from 28 to 3900 and soil use RQ exceedances range from 0.9 to 60.

Based on an analysis of Tier I data, for foliar applications, potential off-field dietary risks to individual bees exposed to spray drift extend 1000 feet from the edge of the treated field. There is uncertainty in this analysis including: assumption of available attractive forage off field, use of individual level toxicity data, BeeREX default estimates for residues, and unrefined AgDRIFT™ modeling. Soil applications are assumed to have a low off-field risk because of low potential to drift.

Off-field estimates of risk are based on screening-level exposure estimates, which cannot be refined with available residue data. Moreover, these estimates relied on assumptions regarding crop-attractiveness to bees, exposures, cultural practices (*i.e.* harvest cycles), environmental conditions (*i.e.* canopy coverage), wind conditions (*i.e.* unidirectional and constant), etc. Therefore, potential off-field risks may be overestimated.

On a colony-level, potential risks were identified for several scenarios. Since risks to honey bees were identified at the Tier 1 (individual bee) level, the Agency evaluated risks at the colony level (Tier II and Tier III). At the Tier II level, this involved comparing dinotefuran residues measured in pollen and nectar in various crops to levels that affect honey bee colonies. These analyses may not reasonably represent non-*Apis* bees (e.g., bumblebees), due to different crop attractiveness. The findings of the higher tier assessment are summarized below.

Terrestrial Invertebrates – Risk Characterization

The agency utilized several lines of evidence to better refine the risk calls including: incorporating information on crop bee attractiveness, agronomic practices (*e.g.,* harvest time relative to bloom) to determine if exposure was present, a comparison of residues to adverse effects levels for entire hives (residues above NOAEC and LOAEC), and major categories of incidents. For comparison of residues to adverse effects levels for entire hives, EPA considered duration and frequency of exceedance, the magnitude of exceedance (including the ration of max residue value to NOAEC/LOAEC and percent of diet from the treated field needed to reach the NOAEC/LOAEC), as well as consideration of usage and geographic scale/spatial distribution of exposure.

It is important to note that multiple factors can influence the strength and survival of bees, whether they are solitary or social. These factors, including disease, pests (*e.g.,* mites), nutrition, and bee management practices, can confound the interpretation of studies intended to examine the relationship of the test chemical to a receptor (*i.e.*, larval or adult bee). Therefore, most studies attempt to minimize the extent to which these other factors impact the study; however, higher-tier studies, which are conducted outside the laboratory, afford less control over these other factors, and their role may become increasingly prominent as the duration of the study is extended. Although study protocols attempt to minimize the confounding effects of other

environmental factors, there is uncertainty regarding the extent to which the effects of a chemical may be substantially different had these other factors been not be in place.

Strongest Evidence of Risk: For foliar, soil, and trunk injection applications of dinotefuran, the lines of evidence are considered "strongest" for supporting the finding of colony-level risk resulting from applications to (with corresponding application method and timing of application with highest level of concern):

- cotton (foliar)
- stone fruit (foliar, pre-bloom)
- berries (foliar, pre-bloom),
- pollinator-attractive fruiting vegetables (foliar), and
- pollinator-attractive ornamentals and forest trees (foliar, soil, trunk injection)

These findings are supported by multiple lines of evidence indicating that residues exceed the dinotefuran colony-level NOAEC by a high magnitude, frequency and/or duration. In some cases, they are also supported by modeled residues or ecological incidents involving bees that are associated with the use.

Moderate Evidence of Risk: For foliar and soil application of dinotefuran, the strength of evidence is considered "moderate" in indicating a colony-level risk to honey bees for the following registered uses:

- cucurbits (foliar),
- berries (soil, pre-bloom), and
- turf (residential lawns with bee-attractive blooming weeds).

These findings are supported by lines of evidence indicating that residues exceed the dinotefuran colony-level NOAEC but the magnitude, frequency and/or duration of exceedance is limited.

Weakest Evidence of Risk: For foliar and soil applications of dinotefuran, the strength of evidence is considered "weakest" in indicating a colony-level risk to honey bees for the following registered uses:

- pollinator-attractive root/tubers (foliar, soil),
- pollinator-attractive fruiting vegetables (soil), and
- stone fruit (soil, pre-bloom)

Honeybees in particular play an important role in commercial pollination services for certain crops. Although the focus of the pollinator risk assessments is on honeybees, the agency recognizes that numerous other species of bees occur in North America and that these non-*Apis* bees have ecological importance in addition to commercial importance in some cases. For example, it is important to note that several species of non-*Apis* bees are commercially managed for their pollination services, including bumble bees (*Bombus spp.)*, leaf cutting bees (*Megachile rotundata*), alkali bees (*Nomia melanderi*), blue orchard bees (*Osmia lignaria)*, and the Japanese

horn-faced bee (*Osmia cornifrons*). Importantly, a growing body of information indicates native bees play an important role in crop and native plant pollination, in addition to their overall ecological importance via maintaining biological diversity.

Off-field drift of dinotefuran (from foliar spray applications) is another potential route of exposure which can present risks to bees. Off-field drift was calculated via the AgDRIFT model which considers a variety of factors including wind speed, spray nozzle type, release height, etc. Spray drift from foliar treatments resulted in risks at greater than 1,000 feet from the field for honey bees. Off-field estimates of risk are based on exposure estimates which cannot be refined with available residue data. Moreover, these estimates relied on conservative assumptions regarding crop-attractiveness to bees, exposures, cultural practices (*i.e.* harvest cycles), environmental conditions (*i.e.* canopy coverage), wind conditions (*i.e.* unidirectional and constant), etc. Therefore, potential off-field risks may be overestimated. Additionally, adult chronic endpoints were considered very sensitive, even with the additional modeling (section 5.1.3 of the final pollinator assessment) using coarser droplet sizes, the drift distances were not appreciably affected.

Terrestrial Plants

No risks of concern are identified for terrestrial plants. No effects were observed in the available vegetative vigor and seedling emergence studies, which tested the maximum application rate for dinotefuran. RQs were not calculated because the highest test concentrations did not yield adverse effects.

Aquatic Risks

Dinotefuran is applied through aerial and ground application methods, which includes sprayers, chemigation and soil drenching. For aquatic wildlife, the agency modeled potential exposure based on the likelihood of dinotefuran residues reaching aquatic waterbodies. Dinotefuran's chemical properties indicate it is readily soluble in water and that volatilization and bioaccumulation in aquatic organisms are negligible. Dinotefuran is considered persistent in aquatic environments with the exception of conditions that favor aqueous photolysis. The major routes transporting dinotefuran from treatment sites to aquatic habitats include runoff and spray drift.

Freshwater Invertebrates

From the initial *Preliminary Ecological Risk Assessment (excluding terrestrial invertebrates) for the Registration Review of Dinotefuran*, meaningful acute and chronic RQs for dinotefuran to freshwater invertebrates could not be calculated because definitive toxicity endpoints were not available for data classified as quantitative. The RQs available were calculated based on available qualitative data. EECs were highest for rice with a 1-day average water column level of 349 µg/L from combined (soil and foliar) applications. The use of dinotefuran on rice yielded the highest chronic RQ for freshwater invertebrates (84, LOC = 1). Chronic RQs for all other crops were at least an order of magnitude lower, ranging from 1.38 – 8.23. The acute RQ exceedance for rice was highest at 34.9; with all other acute RQs ranging from 0.48 – 6.52 based on the most

sensitive species (*trichoptera*) data. Aquatic invertebrate exposure from the rice use is expected; however, potential impacts could be limited based on available use practice information, limited national geographic footprint, and best management practices such as increased water holding times, water conservation practices, and in-furrow/row rice (non-flooded field) usage. These factors, along with current buffer and spray drift label language, have the potential to significantly reduce the potential for dinotefuran runoff to adjacent aquatic water bodies from the aquatic risk driver, rice.

Comparative Analysis of Aquatic Invertebrate Risk Quotients

The agency generated a *Comparative analysis of Aquatic Invertebrate Risk Quotients generated for neonicotinoids using Raby et al. (2018) toxicity data*, which became available following publication of the *Preliminary Ecological Risk Assessment (excluding terrestrial invertebrates) for the Registration Review of Dinotefuran*. The studies, located in the docket, were used to determine RQs using acute and chronic toxicity data provided in the two open literature papers published by researchers from the University of Guelph, Raby data (Raby *et al.* 2018a[11] and Raby *et al.* 2018b[12]). With use of the available raw data, EPA determined the results could be used quantitatively for risk assessment purposes (*i.e.,* to derive RQs). Upon the review of the Raby data, risks of concern were identified for all four neonicotinoid insecticides (dinotefuran, clothianidin, thiamethoxam, and imidacloprid) to freshwater invertebrates on both an acute and chronic basis.

On an acute basis across all tested species, LC_{50} values for dinotefuran were similar, but slightly higher than imidacloprid. LC_{50} values for clothianidin on average were 2.4 times higher than those of imidacloprid and dinotefuran, suggesting that clothianidin may be somewhat less toxic on an acute basis than imidacloprid and dinotefuran. Thiamethoxam LC_{50} values were 5.6 times higher than those of imidacloprid across all tested species, suggesting that thiamethoxam is potentially the least toxic on an acute basis.

All four neonicotinoids present risks of concern to freshwater invertebrates on a chronic basis as well, with clothianidin and imidacloprid having similar toxicity, dinotefuran being ~2.3 times less sensitive, and thiamethoxam being ~5.3 times less sensitive than imidacloprid and clothianidin based on midge data (which was generally more sensitive than mayfly, the other tested species in the chronic test). There is a ~4 times difference in sensitivity across the four neonics with dinotefuran being the least sensitive; despite an almost 20 times difference between mayfly toxic endpoints. There is a similar trend with the mayfly data with dinotefuran (and thiamethoxam) being the least sensitive.

Two notable uncertainties with the Raby data include: 1) inconsistent analytical verification of concentrations, and 2) differing control performance in the imidacloprid testing.

[1] Raby, M; Nowierski, M.; Perlov, D; Zhao, X.; Hao, C; Poirier, D.G. and P.K. Sibley. 2018a. Acute Toxicity of 6 Neonicotinoid Insecticides to Freshwater Invertebrates. Environmental Toxicology and Chemistry, 37 (5): 1430–1445. MRID 50776401.

[12] Raby, M; Zhao, X.; Hao, C.; Poirier, D.G. and P.K. Sibley. 2018b. Chronic toxicity of 6 neonicotinoid insecticides to Chironomus dilutus and Neocloeon triangulifer. Environmental Toxicology and Chemistry, 37 (10): 2727-2739. MRID 50776201.

For 1), not all test concentrations were confirmed through analytical verification. As a result, the LC_{50} and NOAEC values are based on nominal concentrations. From the limited subset of test concentrations that were analyzed, the measured values were similar to the nominal concentrations, and is not expected to have a substantial impact on the reliability of the acute and chronic toxicity values.

For 2), the chronic midge test showed a reduction in the performance of control organisms with regards to growth and reproductive endpoints, relative to controls in the other tests. Due to this, there is potential that the imidacloprid midge toxicity endpoints underestimate the actual toxicity of imidacloprid to midges. However, the chronic endpoint used for comparison of the neonicotinoids done by the agency was the percent emergence endpoint, which for the imidacloprid controls did meet EPA test method standards and was generally one of the most sensitive endpoints across chemicals.

Both mayfly and midge studies tested all four neonicotinoids, however when considering exposure, dinotefuran tended to have the highest EECs among the four chemicals. The other three neonicotinoids were estimated to have similar EECs to each other. On an acute basis, for the mayfly and midge acute RQs, the majority of clothianidin and dinotefuran RQs were greater than those of imidacloprid. Thiamethoxam appears to present a lower acute risk concern when considering the midge RQs. On a chronic basis more generally, clothianidin, dinotefuran, and imidacloprid, have similar chronic RQs with a few exceptions: tree fruit RQs for imidacloprid were eleven times higher than the other A.I.s; foliar nursery and soil forestry applications RQs for clothianidin were an order of magnitude higher than imidacloprid; foliar and soil applications as well as seed treatment RQs for imidacloprid were 13-220 times higher than thiamethoxam. Overall thiamethoxam was found to have lower exceedances to aquatic invertebrates than the other three nitroguanidine neonicotinoids.

Estuarine/Marine Invertebrates

Acute RQs for estuarine/marine invertebrates in the initial dinotefuran non-pollinator draft risk assessment did not show exceedances. Meaningful RQs could not be calculated for estuarine/marine invertebrates on a chronic exposure basis because the available study showed effects at all test concentration, resulting in a non-definitive NOAEC of < 44 µg/L, the lowest concentration tested. At this lowest test concentration, effects on female dry weight were seen, up to 17% decrease. This LOAEC of 44 ug/L was lower than modeled concentration for maximum exposure scenario (rice) and within an order of magnitude of all other scenarios (EECs range from 4.14 to 24.7 for all uses except rice, which is 252 ppb), suggesting that risk to estuarine/marine invertebrates from chronic exposure to dinotefuran is uncertain, but cannot be precluded.

Fish and Aquatic-Phase Amphibians

No effects were observed at the highest treatment levels tested for freshwater and estuarine/marine fish (surrogate for aquatic-phase amphibians), RQ values therefore were not

particularly meaningful. As estimated environmental concentrations (EECs) do not approach these treatment levels, direct risk to fish is not a concern.

While the potential risk of direct effects of dinotefuran to fish and amphibians is considered low, the potential exists for indirect risks to fish and aquatic-phase amphibians through reduction in their invertebrate prey base.

Aquatic Vascular and Non-Vascular Plants

No risks of concern were identified for aquatic plants. Non-listed species RQs for vascular and non-vascular aquatic plants could not be calculated because definitive toxicity endpoints are not available for the tested species.

6. Ecological Incidents

There are no incidents reported for plants, aquatic or terrestrial vertebrates, or aquatic insects. All of the available incidents reported are regarding bees. The search reflects reported incidents since the initial registration of dinotefuran and includes any reports in the Incident Database System (IDS) as of March 2019. The sources of information for incidents include, registrant reports submitted under the FIFRA § 6(a)(2) reporting requirement, as well as reports from local, state, national and international level government reports on bee kills, news articles, and correspondence made to the EPA by phone or via email (through beekill@epa.gov) generally reported by homeowners and beekeepers.

All reported incidents were associated with dinotefuran use on ornamentals, and their relevance to agricultural uses are unknown. Four major incidents dated between June of 2013 and August 2015 on the west coast were noted, all involving large numbers of bumblebees and other insects found dead around the treated ornamental trees (*Myoporum* and linden). Three of the four incidents were associated with spray applications and one from basal trunk application. One incident was associated with a June 2013 basal trunk application to linden trees resulting in a number of bee deaths months was later found to be made by the Oregon Department of Agriculture (ODA) in accordance with the label. During a similar timeframe, ODA also deduced that another dinotefuran incident which resulted in 25,000 to 50,000 bumblebees killed as a result of a misuse application not in accordance with label requirements. The remaining two major incidents listed are still of unknown legality. More detail can be found in EPA's *Final Bee Risk Assessment to Support the Registration Review of Dinotefuran*.

The agency will continue to monitor ecological incident information as it is reported to the agency. Detailed analyses of these incidents will be conducted if reported information indicates concerns for risk to non-target organisms.

7. Ecological and Environmental Fate Data Needs

There are no data deficiencies for the registered uses of dinotefuran with regards to ecological and environmental fate and effects. The agency does not anticipate any further ecological and environmental fate and effects data needs for the dinotefuran registration review at this time.

C. Benefits Assessment

The EPA conducted a number of use site-specific benefits assessments for the neonicotinoids as a pesticide class. Each assessment considered the advantages of the individual neonicotinoid active ingredients, including their use in targeting particular pests, average application rates, acres treated, and potential alternatives, which are which are described in detail in the benefits assessments available in the docket (see section 1.A. for a full list of available benefits documents).

The agency found that as a group, the neonicotinoid insecticides:

- can control a variety of piercing and sucking pests including those that vector plant diseases such as aphids and whitefly;
- each show certain benefits for the control of particular pests;
- offer both immediate, contact control and systemic, residual control of pests over an extended period of time;
- are comparatively less expensive and more effective than some alternatives;

Alternatives to dinotefuran, depending on the crop or use site and target pest, include organophosphates, pyrethroids, and carbamates, as well as alternative nitroguanidine and chloropyridinyl neonicotinoids such as imidacloprid, thiamethoxam, and acetamiprid, respectively.

The following are summaries of the benefits assessments available in the public docket[13].

Cotton
Although registered for cotton, surveys of insecticide use in an available cotton report showed little or no usage of dinotefuran as of 2015. More recent data[14], through 2017, show an increase in usage. There are anecdotal reports of dinotefuran used against Silverleaf whitefly in the Southeast. The Silverleaf whitefly is a pest that only sporadically reaches damaging levels.

For more information, see *Benefits of Neonicotinoid Insecticide Use in the Pre-Bloom and Bloom Periods of Cotton*.

Citrus
Dinotefuran is only registered for non-bearing ornamental citrus trees. Its primary benefit is likely as part of an overall strategy to control the Asian citrus psyllid (ACP) and other citrus pests in residential and nursery setting to ultimately protect commercial production from Huanglongbing bacterial disease (HLB), also known as citrus greening disease (UC IPM, 2019)[15]. ACP vectors HLB, which negatively affects both the quantity and quality of fruit and may kill trees within a few years. There may be limited options for insecticides to control the ACP in residential areas; dinotefuran and other neonicotinoids may provide both immediate

[13] https://www.regulations.gov/docket?D=EPA-HQ-OPP-2011-0920
[14] *Dinotefuran (044312) Screening Level Usage Analysis (SLUA), July 8, 2019*
[15] UC IPM, 2019. "Floriculture and Ornamental Nurseries: Citrus Pests." University of California Agricultural Extension

contact and residual control, reducing the need for frequent applications of contact insecticides like pyrethroids.

Grape
Usage of dinotefuran on grapes is relatively low compared to imidacloprid and clothianidin; however, in terms of agricultural crops to which dinotefuran is applied, grapes are one of the top three in average pounds of dinotefuran applied. Applications of nitroguanidine neonicotinoids to table, raisin, and wine grapes are often made post-bloom, with imidacloprid being the leading insecticide prior to and during bloom. Neonicotinoids, like dinotefuran, provide rapid control via contact activity and residual control through systemic activity, as well as an important rotation partner for resistance management and in providing disease control and prevention.

Dinotefuran is used to target primarily leafhoppers, including sharpshooter, and mealybugs. Damage from these pests can result in quality and yield reductions. Sharpshooters vector Pierce's Disease which is a fatal bacterial disease for grapes that can result in 100% yield loss.

For more information, see *Benefits of Neonicotinoid Insecticide Use in Grapes and Impacts of Potential Mitigation*.

Rice
Dinotefuran is a foliar-applied insecticide to control rice stink bugs late season. Dinotefuran is applied to 92,300 acres annually. The national PCT for rice is only 3%, but rice is a top agricultural use site with 3,000 lbs. AI applied per year. Use in Texas accounts for nearly 90% of dinotefuran applied to rice nationally and the average PCT for rice grown in Texas is 43%. The average application rate used in Texas is 0.095 pounds active ingredient per acre compared to the maximum labeled rate of 0.131 pounds active ingredient per acre. In Texas, an average of 1.2 applications are made per year.

While there is potential for yield losses associated with rice stink bug feeding, the major concern with their feeding is reduction in quality of grain, because the discoloration reduces the price farmers are paid for their crop and reduces the ability to export. Rice stink bug is only considered a pest in the Mid-South and Gulf Coast. Dinotefuran is a critical tool to combat pyrethroid-resistant rice stink bugs in Texas. Dinotefuran provides growers with the greatest flexibility in rice stink bug control over alternatives, such as pyrethroids or carbaryl, due to its greater residual control, short pre-harvest interval (PHI), and no water-holding period requirements.

For more information, see *Usage and Benefits of Neonicotinoid Insecticides in Rice and Response to Comments*.

Stone Fruit
Among the stone fruits, dinotefuran is only registered for use on peaches and nectarines. The nitroguanidine neonicotinoids as a group are used to control a variety of pests in stone fruits. Important pests targeted by dinotefuran in these crops include the plum curculio, plant bugs, and stinkbugs. Approximately 2% of the peach and nectarine crops are treated with dinotefuran, and about 200 pounds of active ingredient are applied to 1,800 acres of peaches and nectarines annually. The average single application rate of dinotefuran use on peaches and nectarines is

0.123 pounds of active ingredient per acre. On average, one treatment is made annually. Given the low usage of dinotefuran in peaches and nectarines, the agency did not assess rate reduction impacts.

For more information, see *Assessment of Usage, Benefits and Impacts of Potential Mitigation in Stone Fruit Production for Four Nitroguanidine Neonicotinoid Insecticides (Clothianidin, Dinotefuran, Imidacloprid, and Thiamethoxam)*.

Pome Fruit
Neonicotinoid target pests for pome fruit (apple and pear) include several economically significant pests that can reduce pome fruit yield. The major use of the nitroguanidine neonicotinoids is during the post-bloom to harvest periods of the pome fruit production cycle. However, 20-30% of neonicotinoid usage occurs during the pre-bloom and bloom period. Early season control can be important to manage early season pests that can build up to high population densities if not controlled early season.

Dinotefuran use on apples is small, and negligible in pears as it is currently only available in that crop as a FIFRA Section-18 emergency exception use. There are relatively few instances of dinotefuran use in the market research database in recent years and thus the agency did not assess the impact of a potential application rate reduction on users. Dinotefuran use on pome fruit accounts for an average of 1,700 total acres treated and 200 pounds applied at 1% PCT. The average application rate for dinotefuran use on pome fruit is 0.122 pounds active ingredient per acre.

For more information, see *Usage, Pest Management Benefits, and Possible Impacts of Potential Mitigation of the Use of the Four Nitroguanidine Neonicotinoids in Pome Fruits (Apple, Pear)*

Berries
Berries refer to strawberry, caneberry (*e.g.*, blackberry and raspberry), cranberry, and blueberry, as well as multiple other small soft fruit grown on very small acreage. Dinotefuran is only registered for use on cranberry and blueberry.

Berry pests, targeted by the neonicotinoids, cause direct feeding damage which can cause reductions in the aesthetic quality of harvested fruit (*e.g.,* tarnished plant bug, cranberry root weevil, blueberry maggot), transmit diseases which can result in plant death and/or crop loss (*e.g.,* aphids, leafhoppers). The detection of a single individual of some of these pests (e.g., blueberry maggot) in harvested fruit can result in processors or buyers rejecting all of the harvest from an entire field.

To date, imidacloprid and thiamethoxam are the most frequently used and/or recommended neonicotinoids. Dinotefuran was registered for cranberry and blueberry in 2016; current usage data and recommendations do not provide much information. It is recommended in crop manuals for control of cranberry root weevil[16] in cranberry. Dinotefuran can be utilized as both a foliar

[16] Murray *et al*., 2017; Rodriguez-Saona, 2013b; Guédot *et al*., 2018; DeLange *et al*., 2015

application (for immediate contact control) and soil application (for residual control) for some berry crops.

For more information, see *Benefits of Neonicotinoid Insecticide Use in Berries (Strawberry, Caneberry, Cranberry, and Blueberry) and Impacts of Potential Mitigation*.

Cucurbits
The cucurbits benefits assessment includes usage in cantaloupes, watermelon, squash, cucumber, and pumpkin from emergence to harvest in the Western, Southern, and Northern production regions. Key pests treated by neonicotinoids include primarily aphids, whitefly, and cucumber beetle. Although imidacloprid is the most utilized neonicotinoid active ingredient on cucurbits, there is considerable usage of dinotefuran. Dinotefuran usage however is relatively low, except for usage on cantaloupe (4,200 average lbs. applied per year; 23 PCT) and squash (1,000; 9 PCT).

Extension publications recommend up to three applications of neonicotinoids on cucurbits, primarily dinotefuran, to control whiteflies and prevent cucurbit yellow stunting disorder virus (CYSDV) across the season (Palumbo 2017). Dinotefuran is also recommended at-plant with two subsequent applications during emergence-to-vining (Palumbo 2017). According to pesticide market research data (2013-2017), imidacloprid is most commonly used in cucurbits prior to crop emergence while dinotefuran may be more commonly applied in the emergence-to-vining period.

Dinotefuran is mostly applied to cucurbits foliarly, accounting for two-thirds of all dinotefuran-treated acres, and soil applications make up the other third. Growers applied dinotefuran at or near the foliar labeled maximum application rate on 46% of foliarly-treated acres and applied dinotefuran at or near 0.267 lbs. AI/A on 97% of soil-treated acres. Thus, a 10% rate reduction would have a significant impact on growers using dinotefuran via foliar application. A 20% rate reduction to 0.262 lbs. AI/A, would impact more than 90% of soil-treated acres of dinotefuran.

For more information, see *Benefits of Neonicotinoid Insecticide Use in Cucurbit Production and Impacts of Potential Risk Mitigation.*

Other Crops: Fruiting vegetables, Brassica vegetables, Leafy Green vegetables, Tree Nuts, Root & Tuber vegetables, Bulb vegetables, Herbs, Peanut, Legume Vegetables, and Tropical and Subtropical Fruit
In general, neonicotinoids, including dinotefuran, are widely used and provide high benefits to the producers of fruiting vegetables, leafy vegetables, and *Brassica* vegetables. Dinotefuran provides both contact and residual control of several important insect pests, primarily piercing and sucking pests that feed off the sap of plants and that may vector disease. Because it is systemic, both soil and foliar applications can be used, permitting growers flexibility in terms of application timing and method. Dinotefuran is less widely used in production of root and tuber crops, bulb vegetables, and certain tropical fruits like avocados, dates, and olives. In these crops, target pests may be uncommon or rarely damaging and/or there are cost effective alternatives, which may include other neonicotinoids such as imidacloprid. Proposed restrictions on the use of imidacloprid may increase the use of, and the benefits of, dinotefuran.

For more information, see *Benefits of Neonicotinoid Use and Impacts of Potential Mitigation in Vegetables, Legumes, Tree Nuts, Herbs, Tropical and Subtropical Fruit Crops*.

Turf and Ornamentals

The registrants of neonicotinoid insecticides commissioned a series of reports, prepared by the agricultural consulting firm AgInfomatics in 2014 on the value of neonicotinoids, or equivalently the impacts of a ban on their use on turf and ornamentals in the United States and Canada. The reports quantified the agronomic, environmental, and socio-economic values of neonicotinoids using a Choice Experiment to homeowners and professionals who manage turf and ornamentals. The turf and ornamentals industries in the U.S. account for over 400,000 businesses, millions of jobs, and billions in annual revenues. Turf and ornamentals add value to the homes of consumers through various means such as aesthetics, recreation, energy and water conservation. Insects can damage areas with turf and ornamentals, and thus reduce their value to consumers. Over 19,000 homeowners were surveyed by AgInfomatics and segmented into three markets based on the predominate "homescape" type: "flowers and shrubs," "lawns," and "trees." Over 700 turf and ornamentals professionals were surveyed through various professional associations and segmented into five business types: trees, greenhouse, lawn, nursery, and landscape ornamentals.

The results of the homeowner survey showed that homeowners value neonicotinoid insecticides. The top concerns of homeowners applying insecticides to their homescape center around efficacy and safety (humans, pets, wildlife and bees) according to the data gathered in the choice experiment. The results show that when given a choice between two options, both of which are efficacious and safe for humans, the homeowners preferred the option that had the additional attribute of being safe on bees.

The results of the professional survey showed that professionals value neonicotinoids because professionals reported that neonicotinoids offer systemic properties; exhibit long-term efficacy; and provide a low-risk to the applicators, customers and their pets. The most used neonicotinoid active ingredient was imidacloprid (75% of survey respondents), followed by dinotefuran (17%), clothianidin (3%) and thiamethoxam (3%). Based on the results of this report, the most difficult pests to manage in the absence of neonicotinoids would be aphids, borers, white grubs, armored scales and whiteflies, respectively. Professionals stated that the negative business impacts from the absence of neonicotinoids would be driven mostly by the cost increases associated with the use of alternatives (*e.g.*, chemical and labor costs) and lower customer satisfaction. The possible alternatives in the absence of the neonicotinoids in order of preference are pyrethroids, organophosphates, avermectins, carbamates, and diamides.

Results from the econometric analysis using the Choice Experiment indicated that homeowners had different willingness to pay for pesticides based on their attributes. Although the authors used a rigorous approach, there were inconsistencies between model results and interpretation of results in the text. For example, AgInfomatics' survey omitted pertinent information relevant to the decision-making process of consumers. These omissions resulted in conclusions where AgInfomatics overvalued or undervalued the benefits of neonicotinoids within certain homeowner market segments relative to alternatives.

In addition to the homeowner and professionals' surveys, there were three case studies completed by AgInfomatics highlighting the benefits of neonicotinoids to control Southern chinch bugs in turf, silverleaf whiteflies in ornamentals, and emerald ash borers in trees. The emerald ash borer case study provided additional support on the value of neonicotinoids, including dinotefuran in USDA pest management programs for additional invasive species (*e.g.*, spotted lanternfly, Asian longhorned beetle) attacking trees on federal lands.

Although there were areas for improvement in the report's methodology, results, and general conclusions; EPA agrees with AgInfomatics that neonicotinoids are a useful tool and often a top choice for pest control in the turf and ornamental industries.

For more information, see *Review of "The Value of Neonicotinoids in Turf and Ornamentals" prepared by AgInfomatics, LLC for Bayer CropScience, Mitsui, Syngenta, and Valent*, available in the public docket.

IV. PROPOSED INTERIM REGISTRATION REVIEW DECISION

A. Proposed Risk Mitigation and Regulatory Rationale

EPA's risk management approach for the neonicotinoids aims to preserve a key tool for growers while maximizing targeted risk reduction. Mitigation is being proposed for the potential ecological risks of concern noted for pollinators and aquatic invertebrates, as described in Section III.

Risks of concern were identified to aquatic invertebrates, which play a foundational role in aquatic ecosystems. The agency is proposing several risk mitigation measures for reducing exposure to aquatic invertebrates, including targeted annual application rate reductions, along with spray drift and runoff management measures.

Risks of concern were identified to honeybees in EPA's assessments. The protection of honeybee populations is particularly important as honeybees play a critical role in the pollination needs of many U.S. crops. In 2017 pollination services from operations with more than 5 colonies were valued at over 160 million dollars, and annual honey production in the US was valued at over 340 million dollars[17]. Although the focus of the pollinator risk assessments is on honeybees, the agency recognizes that numerous other species of bees occur in North America and that these non-*Apis* bees have ecological importance in addition to commercial importance in some cases. For example, it is important to note that several species of non-*Apis* bees are commercially managed for their pollination services, including bumble bees (*Bombus spp.)*, leaf cutting bees (*Megachile rotundata*), alkali bees (*Nomia melanderi*), blue orchard bees (*Osmia lignaria)*, and the Japanese horn-faced bee (*Osmia cornifrons*). Importantly, a growing body of information indicates native bees play an important role in crop and native plant pollination, in addition to their overall ecological importance via maintaining biological diversity. EPA is therefore proposing mitigation that reduces impact to honeybees that are also expected to benefit other

[17] USDA, National Agricultural Statistics Service (NASS), Agricultural Statistics Board. (2018).

pollinating insects. Of these measures, reductions in maximum application rates for certain crops where pollinator/bee exposure may occur, or crop stage restrictions which limit exposure during critical periods in the growing season, are expected to have the highest potential impact in reducing risks to all pollinators. These measures were developed in a manner intended to preserve the majority of pest management utility, while also considering risk reductions for bees.

EPA reached out to a variety of stakeholders while developing the mitigation strategy in order to gain a better grasp of growing practices and potential benefits. As part of its assessments of the impacts of potential mitigation, EPA reviewed available information on the distribution of application rates used by applicators, and this information contributed to identifying when assumptions were made in the risk assessments regarding maximum rates may have overestimated certain risks. These analyses also allowed the EPA to determine where targeted rate reductions would decrease overall potential risks, while minimizing potential impacts to users. Proposed risk mitigation measures were identified by evaluating each neonicotinoid active ingredient and each use scenario for each crop individually, to determine the best path forward.

Overall, EPA is proposing addressing risk posed by current registered uses of dinotefuran uses through the following risk mitigation measures:

- Cancel use on bulb vegetables;
- Reduce maximum application rates or restricting applications during pre-bloom and/or bloom, targeting certain uses with potentially higher pollinator risks and lower benefits;
- Preserve the current restrictions for application at-bloom;
- Require advisory language for residential ornamental uses;
- Apply targeted application rate reductions for higher risk uses;
- Require additional spray drift and runoff reduction label language; and,
- Promote voluntary stewardship efforts to encourage employment of best management practices, education, and outreach to applicators and beekeepers.

In selecting appropriate mitigation, EPA considered both the risks and benefits of dinotefuran use. Due to the potential impact to growers' ability to address certain critical pest issues, the agency did not propose risk mitigation on several uses, including citrus and grapes. For citrus crops, the neonicotinoids are a key element in programs to control the ACP, an invasive pest that transmits HLB, a devastating and incurable disease. In grapes, the neonicotinoids are used similarly to combat sharpshooters which vector Pierce's Disease, a fatal bacterial disease for grapes that can result in 100% yield loss. For other uses where mitigation was proposed, the mitigation does not completely eliminate all risks of concern from the use of dinotefuran, however does reduce overall risk and/or exposure. The agency finds the remaining risks to be reasonable under FIFRA given the benefits of the use of dinotefuran. The EPA is also proposing label changes to address general labeling improvements for all dinotefuran products.

1. Cancellation of Uses

The agency is proposing cancellation of dinotefuran use on bulb vegetable crops in order to mitigate potential exceedances to aquatic invertebrates. In a review of available comparative data, dinotefuran was found to have similar chronic LOC exceedances to the other neonicotinoids which calculated potential risk to aquatic invertebrates from bulb use reached

RQs over 500 for aquatic invertebrates. Dinotefuran is rarely used on bulb vegetables; between 2013 and 2017, less than one percent of the acres grown was treated with dinotefuran. Although there are some particular benefits of neonicotinoids in general for the control of thrips, effective alternatives to the neonicotinoids, including dinotefuran, remain available for use on bulbs. In consideration of the high potential risk and the relatively low expected impacts to bulb growers, EPA is proposing cancellation of this use.

See *Benefits of Neonicotinoid Use and Impacts of Potential Risk Mitigation in Vegetables, Legumes, Tree Nuts, Herbs, and Tropical and Subtropical Fruit Crops* for more information.

2. Application Rate Reductions

As noted in section III.B. of this PID, EPA has identified several categories of ecological risks of concern as a result of dinotefuran uses, including pollinators and aquatic invertebrates. To help mitigate these risks, EPA is proposing the following reductions in the maximum allowable annual application rates for foliar and soil applications of dinotefuran products:

Table 1. Proposed Maximum Annual Application Rates for Dinotefuran

Crop/Crop Group	Current Rate (Max. Annual)	Proposed Mitigation (Max. Annual)
Leafy Vegetables	Foliar: 0.268 lbs. AI/A/yr	Foliar: 0.23 lbs. AI/A/yr
Brassica/Cole	Foliar: 0.266 lbs. AI/A/yr	Foliar: 0.23 lbs. AI/A/yr
Fruiting Vegetables	Foliar: 0.268 lbs. AI/A/yr	Foliar: 0.23 lbs. AI/A/yr
Cotton	Maximum combined annual application rate regardless of formulation type: 0.263 lbs. AI/A/yr	Maximum combined annual application rate regardless of formulation type: 0.19 lbs. AI/A/yr
Production/Commercial Ornamentals	Foliar and soil: 0.54 lbs. AI/A/yr	Foliar and soil: 0.40 lbs. AI/A/yr

Application rate reductions are being proposed for several uses in order to reduce potential risk exceedances to both pollinators and aquatic invertebrates. For pollinators, these proposed rate reductions focus on certain crops where pollinator/bee exposure and where the highest potential reduction of risks to pollinators is possible. For pollinators and aquatic invertebrates, measured rate reductions are a part of a multi-faceted approach to reducing overall exposure. The goal of these proposed maximum annual application rate reductions is to reduce the total environmental loading of neonicotinoids resulting from the various uses specified, while still providing growers with the ability to use these tools as an effective means of pest control. Additional measures to reduce risk to pollinators and aquatic invertebrates include spray drift and runoff reduction language discussed in Section IV.A.5 of this document.

As part of the assessments of the benefits of neonicotinoids, EPA also analyzed the impacts of potential mitigation, including the effect of reducing rates. This information was critical in identifying sites and rates where rate reductions would achieve the greatest reductions in risk while minimizing the impacts on users of dinotefuran. Although these proposed rate reductions do not eliminate all risks, they are expected to contribute to reducing risk overall. The benefits of these uses outweighs the remaining reduced risks of concern.

Leafy vegetables
For the leafy vegetables crop group, EPA is proposing reducing the current maximum annual foliar application rate from 0.268 lbs. AI/A to 0.23. This rate reduction is targeted at reducing potential risk to aquatic invertebrates.

Potential risk to aquatic invertebrates was noted for foliar applications of dinotefuran from leafy vegetable use, with comparative neonicotinoid foliar RQs up to 989. Benefits of the use of neonicotinoids are high, in general, but dinotefuran use on leafy vegetables is low, with PCTs around 1%. Proposed restrictions on the use of imidacloprid, however, may result in growers shifting to dinotefuran. Average annual application rate is 0.222 lbs. AI/A/year, lower than the proposed mitigation. Around 40% of the acres treated with dinotefuran are treated at rates of 0.210 lbs AI/A/year or more although soil applications are included in this estimate. This mitigation could preclude a grower from making a second application of dinotefuran; the applicator would have to use an alternative insecticide. However, the number of acres affected may be small.

Brassica/Cole
For the brassica/cole crop group which includes broccoli, cabbage, cauliflower, and similar crops, EPA is proposing reducing the current maximum annual application rate from 0.266 lbs. AI/A to not exceed a rate of 0.23 lbs. AI/A annually for foliar applications only. This rate reduction is targeted at reducing potential risk to aquatic invertebrates and to align more with average annual rates.

Potential risk to aquatic invertebrates was noted for both foliar and soil applications of neonicotinoids from brassica/cole crop use, with comparative neonicotinoid RQs ranging up to 680 with the highest exceedances identified for foliar uses. In general, there are high benefits from the use of neonicotinoids in brassica. Dinotefuran's use on brassica/cole crops averages less than 10% of the crop treated, considerably less than imidacloprid and thiamethoxam. Average annual application rates of dinotefuran applied nationally to brassica/cole is approximately 0.222 lbs. AI/A/year, below the proposed new rate, but around 40% of the acres treated with dinotefuran are treated at rates of 0.210 lbs AI/A/year or more. This mitigation could preclude a grower from making a second application of dinotefuran; the applicator would have to use an alternative insecticide.

Fruiting Vegetables
For the fruiting vegetables crop group, EPA is proposing reducing the current maximum annual foliar application rate from 0.268 to 0.23 lbs. AI/A. This rate reduction is targeted at reducing potential risk to aquatic invertebrates.

Potential risk to aquatic invertebrates was noted for foliar applications of dinotefuran from fruiting vegetable use, with comparative neonicotinoid RQs up to 768. Benefits of neonicotinoid use are high, but dinotefuran's use on fruiting vegetables, with PCTs around 5 – 10%, is much lower than that of imidacloprid and thiamethoxam. The average annual rate for dinotefuran to fruiting vegetables is 0.25 lbs. AI/A, above the proposed new rate, and annual rates above 0.210 lbs. AI/A are observed on about 75% of the treated acreage. However, soil applications are used on some of these acres. This mitigation could preclude a grower from making a second

application of dinotefuran; the applicator would have to use an alternative insecticide, but the number of acres affected, given the PCT, may be low.

Cotton
For cotton, EPA is proposing reducing the current maximum combined rate of 0.263 lbs. AI/A regardless of formulation type and reducing it to 0.19 lbs. AI/A applied annually. This mitigation is being proposed to address pollinator exceedances.

Potential risks from dinotefuran cotton foliar use was considered under the strongest category of evidence for pollinator exceedances. Foliar adult honeybee RQs reached 56 on an acute basis and 2900 on a chronic basis. Cotton is considered to be one of the major drivers of potential pollinator risk. To date, usage of dinotefuran on cotton has been sporadic; multiple applications in a year appear rare. With consideration of current usage, the reduction in the annual rate is unlikely to impact users.

Production/Commercial Ornamentals
For production/commercial ornamentals, EPA is proposing reducing the current maximum annual foliar and soil application rate from 0.54 lbs. AI/A to 0.40. This rate reduction is targeted at reducing potential risk to pollinators and aquatic invertebrates (nursery only). These rate reductions apply to ornamental ground cover, ornamental trees, forestry, ornamental woody shrubs and vines, and outdoor greenhouse/nursery. This mitigation does not include indoor commercial nursery, greenhouse uses, Christmas trees, or forestry use on public land and quarantine application by USDA.

Potential risks from dinotefuran use on ornamentals was included under the strongest category of evidence for pollinator exceedances. Residues exceeded the colony-level endpoint for periods of time ranging from 22 days (foliar applications) to 617 days (soil applications). In addition, multiple ecological incidents have been associated with dinotefuran applications to ornamental plants that span foliar and soil applications methods. Ornamentals are considered to be one of the major drivers of potential pollinator and aquatic invertebrate risk. Benefits are considered to be high for this use of dinotefuran as data showed that an average of 139,000 lbs. are applied annually. Other than the available 2014 AgInfomatics report and review, usage data was limited. This rate reduction is considered to potentially have moderate impacts on usage.

3. Crop Stage Restrictions

As noted in section III.B.1., risks were identified for several taxa described in the draft risk assessments. Crop stage restrictions can limit exposure during critical periods in the growing season when exposures to pollinators are more likely to occur. In its final bee risk assessment, the agency analyzed a large volume of scientific data showing residues of neonicotinoids in pollen and nectar over time. Through this analysis the agency calculated pre-bloom intervals to determine at what stage in the growing season risk exceedances went above the level of concern. By selecting application restrictions based on crop stage, the agency expects potential exposure can be significantly reduced. These proposed restrictions were preferable only in crops with distinct phenological stages which were easily identifiable by growers.

Table 2. Proposed Crop Stage Restrictions for Dinotefuran

Crop/Crop Group	Proposed Mitigation
Fruiting Vegetables	The agency is proposing a crop stage restriction for both foliar and soil applications, to prohibit application after the appearance of the initial flower buds until flowering is complete and all petals have fallen off. Additionally, for tomatoes, peppers, chili peppers and okra only, EPA is also proposing to not apply after 5 days after planting or transplanting regardless of application method.
Stone Fruit	The agency is proposing a crop stage restriction to prohibit application from bud break until after petal fall is complete and all petals have fallen off

Fruiting Vegetables
For the fruiting vegetables crop group, EPA is proposing a crop stage restriction for both foliar and soil labels, to prohibit application after the appearance of the initial flower buds until flowering is complete and all petals have fallen off. For tomatoes, peppers, chili peppers and okra only, EPA is also proposing to prohibit application 5 days after planting or transplanting regardless of application method for all crops in the crop group.

Potential risk to pollinators was noted under the strongest evidence of risk for foliar uses of fruiting vegetables, and soil uses were listed under weakest evidence of risk. LOC exceedances for pollinators were identified with RQs up to 3800. Benefits of neonicotinoid use are high, but dinotefuran's use on fruiting vegetables, with PCTs about 5 – 7%, is much lower than that of imidacloprid and thiamethoxam.

Applications of neonicotinoids after crop emergence or transplanting account for around two-thirds of the treated acres of peppers and tomato acres. Dinotefuran targets season-long pests, particularly aphids and whitefly that vector viral diseases, which can seriously impact the development, quality and/or yield of the harvested fruit. The proposed restriction will preclude most of these applications and is likely to result in impacts on growers.

Stone Fruit
For stone fruit, EPA is proposing a crop stage restriction to prohibit application from bud break until after petal fall is complete and all petals have fallen off. Potential risk to pollinators was noted under the strongest evidence of risk for foliar pre-bloom uses on stone fruit crops, while soil uses were listed under weakest evidence of risk pre-bloom. There was low risk deemed to pollinators from post-bloom uses. Exceedances to pollinators were identified with RQs ranging up to 3900. EPA is targeting a 12-day pre-bloom interval to reduce potential exposure. Dinotefuran has limited overall usage on stone fruit, and the majority of this use applied post-bloom, therefore the proposed changes are not expected to significantly impact growers.

4. Residential Ornamental Advisory

For application to ornamental plants, the agency identified significant risks of concern. Potential risks from use on ornamentals was assigned the category, strongest evidence of potential pollinator risk, in the agency's bee risk assessment. Risk to aquatic invertebrates was also

identified. Benefits were considered high for this use, however, other than the available 2014 AgInfomatics report and review, usage data was limited. The agency is proposing adding language to residential labels advising that ornamental products are, "Intended for use by professional applicators". This is due to the high risks of concern, the potential extent of exposure, particularly to bees, and to decrease the likelihood of misapplication or overapplication where significant risks of concern have been identified for these uses.

5. Label Language Improvements

EPA is proposing several advisory label language changes intended to better inform applicators of pollinator risks and reduce pollinator exposures. This includes updates to the current advisory bee language, water soluble packaging, and language to better clarify whether products are for indoor or outdoor use. For more information, please see Appendix B.

6. Spray Drift and Runoff Reduction

EPA is proposing label changes to reduce off-target spray drift and establish a baseline level of protection against spray drift that is consistent across all dinotefuran products. Reducing spray drift will reduce the extent of environmental exposure and risk to non-target plants and animals. Although the agency is not making a complete endangered species finding at this time, these label changes are expected to reduce the extent of exposure and may reduce risk to listed species whose range and/or critical habitat co-occur with the use of dinotefuran.

The agency is proposing the following spray drift mitigation language be included on all dinotefuran product labels. The proposed spray drift language is intended to be mandatory, enforceable statements and supersede any existing language already on product labels (either advisory or mandatory) covering the same topics. The agency is providing recommendations which allow dinotefuran registrants to standardize all advisory language on dinotefuran product labels. Registrants must ensure that any existing advisory language left on labels does not contradict or modify the new mandatory spray drift statements proposed in this proposed interim decision once effective.

These mandatory spray drift mitigation measures are proposed for aerial applications for all products delivered via liquid spray:

- Applicators must not spray during temperature inversions.
- For aerial applications, do not apply when wind speeds exceed 15 mph at the application site. If the windspeed is greater than 10 mph, the boom length must be 65% or less of the wingspan for fixed wing aircraft and 75% or less of the rotor diameter for helicopters. Otherwise, the boom length must be 75% or less of the wingspan for fixed-wing aircraft and 90% or less of the rotor diameter for helicopters.
- For aerial applicators, if the windspeed is 10 miles per hour or less, applicators must use ½ swath displacement upwind at the downwind edge of the field. When the windspeed is between 11-15 miles per hour, applicators must use ¾ swath displacement upwind at the downwind edge of the field.

- For aerial applications, the release height must be no higher than 10 feet from the top of the crop canopy or ground, unless a greater application height is required for pilot safety.
- Specify spray droplet size of medium or coarser (ASABE S572.1)
- Do not apply by air within 150 feet of lakes, reservoirs, rivers, permanent streams, marshes or natural ponds, estuaries and commercial fish farm ponds.

These mandatory spray drift mitigation measures are proposed for ground applications delivered via liquid spray:

- Applicators must not spray during temperature inversions.
- Do not apply when wind speeds exceed 15 mph at the application site.
- User must only apply with the release height recommended by the manufacturer, but no more than 4 feet above the ground or crop canopy.
- Specify spray droplet size of medium or coarser (ASABE S572.1)
- For air blast applications, nozzles directed out of the orchard must be turned off in the outer row.
- For air blast applications, applications must be directed into the canopy foliage.
- Do not apply by ground within 25 feet of lakes, reservoirs, rivers, permanent streams, marshes or natural ponds, estuaries and commercial fish farm ponds.

To reduce the amount of dinotefuran that can enter waterbodies from runoff, EPA is proposing a vegetative filter strip (VFS) requirement for all dinotefuran agricultural products of 10 feet. Currently some dinotefuran product labels have a 25 feet VFS requirement on labels, the proposed mitigation would reduce this requirement to 10 feet across all relevant labels. VFS are intended to reduce sediment loads to adjacent water bodies, and also show some efficacy in reducing runoff volume as well. As a consequence, they may have some utility in reducing movement of pesticides, particularly those bound to sediments into natural waters.

They are somewhat expensive to implement and maintain, and they must be maintained or they will lose efficacy and channelized flow across the VFS will develop after a few years. VFS are most effective at removing non-source point pollutants (e.g., pesticides) from runoff water sources. However, the effectiveness of a VFS is influenced by various land management practices (e.g., flood and furrow irrigated fields, etc.) which may impact their utility. The Agency has considered several additional sources of research which contextualize the benefits of VFS and has determined that proposing the use of VFS is appropriate mitigation to reduce dinotefuran residues in aquatic habitats. EPA is not proposing a VFS requirement in Western irrigated agriculture because a VFS would be more expensive to maintain, and runoff is less likely. In the west, areas where agriculture is irrigated would likely require irrigation to maintain a VFS, and on fields where water is managed carefully there is less likely to be runoff and erosion into a waterbody.

The following proposed mitigation measure applies to all agricultural uses of dinotefuran. This proposed mitigation requirement is separate and in addition to the spray drift buffer zones described above; spray drift buffer zones are still proposed to be required if a vegetated filter strip is present. The proposed vegetative filter strip requirement reads as follows:

- "Construct and maintain a vegetative filter strip, according to the width specified below, of grass or other permanent vegetation between the field edge and nearby down gradient aquatic habitat (e.g., lakes, reservoirs, rivers, permanent streams, marshes, natural ponds, estuaries, commercial fish farm ponds).
    - Only apply products onto fields where a maintained vegetative filter strip of at least 10 feet exists between the field edge and where a down gradient aquatic habitat exists. This minimum required width of 10 feet may be reduced under the following conditions:
        - Western irrigated agriculture is exempt from this requirement. Western irrigated agriculture is defined as irrigated farmland in the following states: WA, OR, CA, ID, NV, UT, AZ, MT, WY, CO, NM, and TX (west of I-35).

Impacts of Spray Drift and Runoff Reduction Mitigation
Applications are currently prohibited during temperature inversions, therefore the requirement listed above does not represent a change in use directions. Requirements listed above for airblast applications are also consistent with current requirements.

Wind Speed, Boom Length/Swath Displacement, and Release Height
Current requirements for aerial applications are:

- Do not apply when wind speeds exceed 10 mph at the application site. The boom length must be 75% or less of the wingspan or rotor diameter.
- The release height must be no higher than 10 feet from the top of the crop canopy or ground, unless a greater application height is required for pilot safety.

There are no proposed changes for release height. Proposed changes will allow applications at higher wind speed, which will provide growers with greater flexibility to make applications in a timely manner. Further, at wind speeds of 10 mph or less, the boom length for helicopter is increased to 90 percent of the rotor diameter, which may necessitate fewer passes to complete an application, likely decreasing application costs. Currently, there are no requirements for swath displacement. The agency has not assessed the impacts of a ½ or ¾ swath displacement upwind at the downwind edge of the field. The agency invites comments if this mitigation would impact growers.

Current requirements for ground applications are:

- Do not apply when wind speeds exceed 10 mph at the application site.
- The release height must be no higher than 10 feet from the top of the crop canopy or ground

Proposed changes will allow applications at higher wind speed, which will provide growers with greater flexibility to make applications in a timely manner. Based on previous reviews of recommended release heights for optimal coverage across common nozzle types, a release height of 4 feet or less should not impact growers when making applications of dinotefuran.

Droplet Size

The agency is considering establishing a mandatory droplet size of medium or coarser. Components of applications, including droplet size, are complex, but essentially insects need to come into contact with, or ingest, a lethal dose of insecticide to be effectively controlled which requires proper coverage throughout the plant. Systemic insecticides, like dinotefuran, control some insects regardless of droplet size due to the systemic movement within the plant. However, neonicotinoids, including dinotefuran, are valuable because they have immediate, contact activity, especially when applied to the foliage.

Generally, entomologists accept that good coverage is required for maximum efficacy during a foliar application and that fine droplets provide better coverage than medium or coarser droplets. Requiring larger droplet size than a grower would normally use could decrease the immediate, contact control of pests, which could result in reduced yields or quality of produce. Furthermore, higher rates of survival of the target pest(s) could undermine resistance management efforts by selecting for more tolerant biotypes. To compensate, growers could use higher application rates than they would otherwise, make more frequent applications, and/or select alternative products (pyrethroids, carbaryl, diflubenzuron, etc., depending on the target pest). These actions would increase pest control costs.

Buffers and Vegetative Filter Strips

Currently, a 25-foot VFS is required between the field edge and down gradient aquatic habitat to prevent runoff. The proposed requirement for would reduce the size of the VFS to 10 feet and require a 25-foot buffer from aquatic habitats for ground applications. Reducing the size of the VFS could reduce the costs growers incur to maintain the VFS and potentially increase the cultivated area of their fields, although they could not apply dinotefuran within the area previously part of the VFS due to the proposed buffer.

However, the new 150-foot buffer from aquatic habitats for aerial applications represents a substantial change that could impact usage of dinotefuran. Currently, aerial applications are used for nearly two-thirds of the area treated with dinotefuran and is particularly common in rice, lettuce, and *brassica* vegetables (MRD, 2013-2017).

If growing areas are adjacent to water bodies, buffers may require growers to leave a portion of the land dedicated to crops untreated or remove land from production. The impact of this mitigation can be highly localized and depends on the size and shape of a field. Leaving an area untreated in a field can harbor insects and serve as a source of re-infestation, requiring subsequent applications.

Removing land from production can decrease revenue from lost crop area. EPA previously estimated impacts of lost productive lands from increasing vegetative filter strips for pyrethroids, which also restrict application near water bodies. Buffers do not need to be maintained like vegetative filter strips, but the value of lost cropped area is likely to be similar. For the earlier BEAD analysis, lost crop areas were presented for increases in lost area of 15 and 25 feet. However, the proposed buffer for aerial applications is 150 feet, an increase of 125 feet over the existing vegetative filter strip. Using the same method that was used for pyrethroids, the value of the potential lost crop area from the increased buffer can also be estimated. The estimated

impacts disproportionally affect growers producing crops from small acreage fields, as a greater portion of the total field is lost to a buffer. For example, dinotefuran is widely used on various vegetable crops such as tomato. The median size tomato field is 5.4 acres, and if that field is assumed to be rectangular with a waterbody along the long side, the lost crop value is estimated to be $1,748 per acre for the increase in lost cropped area of 125 feet. The impacts are greater for smaller fields. Ten percent of tomato fields are 0.2 acres or smaller and a 150-foot buffer would preclude use of dinotefuran if the field were adjacent to a water body. Aerial applications are particularly common on brassica crops. For broccoli, the median field size is 7.4 acres, and if the aerial buffer meant production would be lost, the estimated revenue loss would be equivalent to $1,985 per acre. For crops with lower revenue per acre or grown on larger fields, the estimated loss per acre is lower, however impacts as a proportion of grower income may be similar or even greater. The crop with the highest area treated with dinotefuran is rice, and the median field size is 38.4 acres. The estimated cost, in terms of foregone production, of a 125-foot increase in the buffer over the existing VFS in that field is equivalent to $112 per acre.

Instead of taking land out of production, a grower could switch to a different chemical that does not have a buffer requirement, accept pest damage in the buffered areas, or apply an alternative to only those areas of the field that is within the buffer.

In addition to the drift reduction measures and VFS discussed above, EPA is proposing measures to reduce the perimeter treatment area and increase label clarity and consistency, thus reducing the overall amount of dinotefuran that enters waterbodies and outdoor drainage systems. Specific measures are intended to ensure areas sprayed are permeable and less runoff-prone, reduce offsite-drift to waterbodies, as well as to reduce the potential for overspraying. Although potential risks to aquatic organisms are expected to remain after the implementation of the measures, these proposed label changes are directionally correct with respect to reducing the amount of environmental exposure. The following mandatory and advisory mitigation measures for all dinotefuran outdoor residential and commercial use sites to reduce the amount of runoff entering waterbodies and drainage systems:

- Band and perimeter treatment is limited to an area of application no more than 7’ out x 2’ feet up maximum around buildings or structures.
- Spot treatment is application to limited areas on which insects are likely to occur, but which will not be in contact with food or utensils and will not ordinarily be contacted by workers. These areas may occur on floors, walls, and bases or undersides of equipment. For this purpose, a “spot treatment” will not exceed 2’ x 1’ square feet.
- Do not apply to impervious horizontal surfaces such as sidewalks, driveways, and patios except as a spot or crack and crevice treatment.
- Do not apply to the point of runoff.
- Do not apply during rainfall.
- Avoid applying when rain is expected within 24 hours except when product requires watering in.

Impacts of Mitigation Measures for Residential and Commercial Use Sites
The agency did not assess the impacts of runoff mitigation measures for residential and commercial use sites, in particular the definition of ‘spot treatment’. In general, however, the

agency considers these measures consistent with application practices. The agency invites comments if this mitigation would impact applicators.

In addition to including the following spray drift restrictions on dinotefuran labels, all references to volumetric mean diameter (VMD) information for spray droplets are proposed to be removed from all dinotefuran labels where such information currently appears and to establish label consistency by requiring standardized spray drift advisory language. The proposed new language below, which cites American Society of Agricultural & Biological Engineers (ASABE) S572.1, eliminates the need for VMD information.

7. Pesticide Resistance Management

Pesticide resistance occurs when genetic or behavioral changes enable a portion of a pest population to tolerate or survive what would otherwise be lethal doses of a given pesticide. The development of such resistance is influenced by a number of factors. One important factor is the repeated use of pesticides with the same mode (or mechanism) of action. This practice kills sensitive pest individuals but allows less susceptible ones in the targeted population to survive and reproduce, thus increasing in numbers. These individuals will eventually be unaffected by the repeated pesticide applications and may become a substantial portion of the pest population. An alternative approach, recommended by resistance management experts as part of integrated pest management (IPM) programs, is to use pesticides with different chemical modes (or mechanisms) of action against the same target pest population. This approach may delay and/or prevent the development of resistance to a particular mode (or mechanism) of action without resorting to increased rates and frequency of application, possibly prolonging the useful life of pesticides.

The EPA is proposing resistance-management labeling, as listed in Appendix B, for products containing dinotefuran, in order to provide pesticide users with easy access to important information to help maintain the effectiveness of useful pesticides. Additional information on the EPA's guidance for resistance management can be found at the following website: https://www.epa.gov/pesticide-registration/prn-2017-1-guidance-pesticide-registrants-pesticide-resistance-management.

B. Stewardship

In addition to updating product labels to ensure pesticides continue to meet the safety standard, EPA's registration review for the N-nitroguanidine neonicotinoids provides an opportunity to inform stakeholders and the general public about opportunities to minimize potential ecological risks and promote pollinator health more generally. Beyond the mitigation measures proposed above, voluntary stewardship activities and use of best management practices (BMPs) can be effective in further reducing pesticide exposure to at risk taxa. Examples of these activities include:

- promoting the creation of additional pollinator habitat;

- improving pesticide users' understanding and adherence to label directions which advise users on seed spill clean-clean up, reduction in drift/runoff, and minimizing exposure to pollinators;
- promoting integrated pest management (IPM) solutions;
- encouraging growers to take care when planting treated seed to reduce the amount of exposed seed; and,
- increasing awareness of potential impacts of pesticides through education (*e.g.,* training courses, pamphlets, workshops/conferences, and through tv, radio, social media and other communication platforms).

Habitat loss is a significant issue with negative impacts on the health of bees. With access to a healthy and diverse diet through a thriving habitat, bees may be better able to tolerate stressors such as pests, disease, and exposure to pesticides. As a healthy diet is crucial to maintaining flourishing pollinator populations, and the protection of pollinator habitat is not something that can be directly addressed on a pesticide product label, EPA and other federal/state/tribal and local government agencies and non-government organizations (NGOs) promote pollinator habitat through active education and outreach programs. Helpful guidance on pollinator protection can be found on the EPA's pollinator protection webpage[18].

As highlighted by several of the proposed mandatory and advisory label statements outlined in section IV.A.1, users should not apply neonicotinoids when bees and other pollinators are actively foraging on pollinator-attractive plants during bloom; consider a pesticide's ability to drift to other non-target areas; and be aware of the presence of bee colonies or highly bee-attractive plants nearby an application site. With applications to lawns, its beneficial to mow prior to applications. Although the cultivation and protection of pollinator habitat is typically encouraged, in this case, taking steps to ensure a lawn is mowed prior to neonicotinoid applications can reduce potential direct exposure for visiting pollinators. Other things the public can do to minimize potential exposure of pollinators are listed on EPA's, *What You Can Do to Protect Honey Bees and Other Pollinators* webpage[19].

As highlighted in section III.B.1, treated seed is most likely to become available to birds and mammals through accidental spills, excess unplanted seed on the edges of the field, shallow planted seed, and the improper disposal of treated seed. An effective method to reduce exposure would be encouraging growers to take additional care when planting treated seed to ensure any exposed seed is retrieved. While the EPA is proposing advisory language for covering seeds and cleaning up spillage, the American Seed Trade Organization has also published a guide[20] to help educate applicators on practices to help reduce potential risks to the environment from seed treatments. The agency encourages public and private participation in creating tools and fostering effective communication to help reach applicators and educate them on practices that can reduce risks to the environment.

[18] https://www.epa.gov/pollinator-protection
[19] https://www.epa.gov/pollinator-protection/what-you-can-do-protect-honey-bees-and-other-pollinators
[20] https://seed-treatment-guide.com/

The technical registrants for the neonicotinoids, including Bayer, BASF, Mitsui, Syngenta, and Valent, coordinated to develop a voluntary proposal to promote product stewardship for their product seed treatments and applications in agricultural crops, production and landscape ornamental plants, turfgrass and pest-management setting (structural, commercial and residential). Their proposal includes a summary of the current neonicotinoid stewardship program, as well as their proposal for an enhanced registrant-initiated stewardship program for expansion and amplification of stewardship efforts. This document, *Neonicotinoid Stewardship Program – Current Summary and Proposal,* is included in the public docket for each of the neonicotinoids along with their PIDs.

The agency encourages strong pollinator protection stewardship in both the public and private sector. EPA will continue to work with its partners at the federal, state, tribal, and local levels, along with non-governmental organizations to promote pollinator protection, education, and outreach. This includes coordinating with states and tribes on pollinator protection plans (*i.e.;* managed pollinator protection plans), coordinating with stakeholders on extension of, and education around, existing BMPs, and continued education and outreach to the public on pollinator protection. In addition, the agency plans on continuing conversations with the registrants on the *Neonicotinoid Stewardship Program*.

C. Tolerance Actions

The agency proposes conversion to updated crop groups for several crop groups, updates for consistency with the EPA's policy on trailing zeros, and harmonization of certain tolerances with Codex Maximum Residue Limits (MRLs); there are no MRLs established in Canada and Mexico for dinotefuran. Tolerances are proposed to be revoked for vegetable leafy (except *Brassica*) group 4, *Brassica* leafy greens subgroup 5B, *Brassica* head and stem subgroup 5A, and vegetable fruiting group 8. Tolerances are proposed to be established for leafy greens subgroup 4-16A, leaf petiole vegetable subgroup 22B, *Brassica* leafy greens subgroup 4-16B, vegetable head and stem *Brassica* group 5-16, and vegetable fruiting group 8-10. For more details, all proposed tolerance revisions for dinotefuran are listed in Section III.A.3. The agency will use its FFDCA rulemaking authority to undertake needed tolerance changes.

D. Proposed Interim Registration Review Decision

In accordance with 40 CFR §§ 155.56 and 155.58, the agency is issuing this PID. Except for the Endocrine Disruptor Screening Program (EDSP) and the Endangered Species Act (ESA) components of this case, the agency has made the following PID:

(1) no additional data are required at this time; and (2) changes to the affected registrations or their labeling are needed at this time, as described in Section IV. A and Appendices A and B.

In this PID, the agency is making no human health or environmental safety findings associated with the EDSP screening of dinotefuran, nor is it making a complete endangered species finding. Although the agency is not making a complete endangered species finding at this time, the proposed mitigation described in this document is expected to reduce the extent of environmental exposure and may reduce risk to listed species whose range and/or critical habitat co-occur with

the use of dinotefuran. The agency's final registration review decision for dinotefuran will be dependent upon the result of the agency's ESA assessment and any needed § 7 consultation with the Services and an EDSP FFDCA § 408(p) determination.

E. Data Requirements

The agency does not anticipate calling-in additional data for the dinotefuran registration review at this time.

V. NEXT STEPS AND TIMELINE

A. Proposed Interim Registration Review Decision

A Federal Register Notice will announce the availability of this PID for dinotefuran and will allow a 60-day comment period on the PID. If there are no significant comments or additional information submitted to the docket during the comment period that leads the agency to change its PID, the EPA may issue an interim registration review decision for dinotefuran. However, a final decision for dinotefuran may be issued without the agency having previously issued an interim decision. A final decision on the dinotefuran registration review case will occur after: (1) an EDSP FFDCA § 408(p) determination and (2) an endangered species determination under the ESA and any needed § 7 consultation with the Services.

B. Implementation of Mitigation Measures

Once the Interim Registration Review Decision is issued, the dinotefuran registrants must submit amended labels that include the label changes described in Appendices A – D. The revised labels and registration amendments must be submitted to the agency for review within 60 days following issuance of the Interim Registration Review Decision.

Appendix A: Summary of Proposed Actions for Dinotefuran

Registration Review Case#: 7441
PC Code: 044312
Chemical Type: insecticide
Chemical Family: Neonicotinoids
[Mode or Mechanism (for herbicides)] of Action: Nicotinic acetylcholine receptor (NACHR) competitive modulators

Affected Population(s)	Source of Exposure	Route of Exposure	Duration of Exposure	Potential Risk(s) of Concern	Proposed Actions
Pollinators	Residues on treated site	Ingestion and contact	Acute and chronic	Acute and chronic toxicity	• Reduce application rates • Crop stage restrictions • General/other use restrictions • Spray drift reduction
Aquatic Invertebrates	Runoff from treated sites	Ingestion and contact	Acute and chronic	Acute and chronic toxicity	• Reduce application rates • Spray drift and runoff reduction • Vegetative filter strips • Use deletion for bulb vegetables • Reduce perimeter treatment applications

Appendix B: Proposed Labeling Changes for Dinotefuran Products

<table>
<tr><th>Description</th><th>Proposed Label Language for Dinotefuran Products</th><th>Placement on Label</th></tr>
<tr><td></td><td>Technical Products</td><td></td></tr>
<tr><td>Foliar spray and soil drench use on bulb vegetables</td><td>Delete foliar spray and soil drench use on bulb vegetables.</td><td>Directions for Use</td></tr>
<tr><td colspan="3">End Use Products</td></tr>
<tr><td>Mode/Mechanism of Action Group Number</td><td>Note to registrant:
Include the name of the ACTIVE INGREDIENT in the first column
Include the word “GROUP” in the second column
Include the MODE/MECHANISM OF ACTION CODE in the third column (for herbicides this is the Mechanism of Action, for fungicides this is the FRAC Code, and for insecticides this is the Primary Site of Action)
Include the type of pesticide in the fourth column.
<table><tr><td>Dinotefuran</td><td>GROUP</td><td>4A</td><td>INSECTICIDE</td></tr></table></td><td>Front Panel, upper right quadrant.
All text should be black, bold face and all caps on a white background, except the mode of action code, which should be white, bold face and all caps on a black background; all text and columns should be surrounded by a black rectangle.</td></tr>
<tr><td>Updated Gloves Statement</td><td>Update the gloves statements to be consistent with Chapter 10 of the Label Review Manual. In particular, remove reference to specific categories in EPA’s chemical-resistance category selection chart and list the appropriate chemical-resistant glove types to use.</td><td>In the Personal Protective Equipment (PPE) within the Precautionary Statements and Agricultural Use Requirements, if applicable</td></tr>
<tr><td>Resistance-management labeling statements for insecticides and acaricides</td><td>Include resistance management label language for insecticides/acaricides from PRN 2017-1 (https://www.epa.gov/pesticide-registration/pesticide-registration-notices-year)</td><td>Directions for Use, prior to directions for specific crops</td></tr>
<tr><td>Additional Required Labelling Action
Applies to all products delivered via liquid spray applications</td><td>Remove information about volumetric mean diameter from all labels where such information currently appears.</td><td>Directions for Use</td></tr>
</table>

Description	Proposed Label Language for Dinotefuran Products	Placement on Label
Directions for mixing/loading products packaged in water soluble bags	Instructions for Introducing Water Soluble Packages Directly into Spray tanks: "Soluble Packages (WSPs) are designed to dissolve in water. Agitation may be used, if necessary, to help dissolve the WSP. Failure to follow handling and mixing instructions can increase your exposure to the pesticide products in WSPs. WSPs, when used properly, qualify as a closed mixing/loading system under the Agricultural Worker Protection Standard [40 CFR 170.607(d)]. Handling Instructions Follow these steps when handling pesticide products in WSPs. 1. Mix in spray tank only. 2. Handle the WSP in a manner that protects package from breakage and/or unintended release of contents. If package is broken, put on PPE required for clean-up and then continue with mixing instructions. 3. Keep the WSP in outer packaging until just before use. 4. Keep the WSP dry prior to adding to the spray tank. 5. Handle with dry gloves and according to the label instructions for PPE. 6. Keep the WSP intact. Do not cut or puncture the WSP. 7. Reseal the WSP outer packaging to protect any unused WSP(s). Mixing Instructions Follow the steps below when mixing this product, including if it is tank-mixed with other pesticide products. If being tank-mixed, the mixing directions 1 through 9 below take precedence over the mixing directions of the other tank mix products. WSPs may, in some cases, be mixed with other pesticide products so long as the directions for use of all the pesticide product components do not conflict. Do not tank-mix this product with products that prohibit tank-mixing or have conflicting mixing directions. 1. If a basket or strainer is present in the tank hatch, remove prior to adding the WSP to the tank. 2. Fill tank with water to approximately one-third to one-half of the desired final volume of spray. 3. Stop adding water and stop any agitation. 4. Place intact/unopened WSP into the tank. 5. Do not spray water from a hose or fill pipe to break or dissolve the WSP.	

Description	Proposed Label Language for Dinotefuran Products	Placement on Label
	6. Start mechanical and recirculation agitation from the bottom of tank without using any overhead recirculation, if possible. If overhead recirculation cannot be turned off, close the hatch before starting agitation. 7. Dissolving the WSP may take up to 5 minutes or longer, depending on water temperature, water hardness and intensity of agitation. 8. Stop agitation before tank lid is opened. 9. Open the lid to the tank, exercising caution to avoid contact with dusts or spray mix, to verify that the WSP has fully dissolved and the contents have been thoroughly mixed into the solution. 10. Do not add other allowed products or complete filling the tank until the bags have fully dissolved and pesticide is thoroughly mixed. 11. Once the WSP has fully dissolved and any other products have been added to the tank, resume filling the tank with water to the desired level, close the tank lid, and resume agitation. 12. Use the spray solution when mixing is complete. 13. Maintain agitation of the diluted pesticide mix during transport and application. 14. It is unlawful to use any registered pesticide, including WSPs, in a manner inconsistent with its label. ENGINEERING CONTROLS STATEMENT Water soluble packets, when used correctly, qualify as a closed mixing/loading system under the Worker Protection Standard [40 CFR 170.607(d)]. Mixers and loaders handling this product while it is enclosed in intact water soluble packets may elect to wear reduced PPE of long-sleeved shirt, long pants, shoes, socks, a chemical-resistant apron, and chemical-resistant gloves. When reduced PPE is worn because a closed system is being used, handlers must be provided all PPE specified above for "applicators and other handlers" and have such PPE immediately available for use in an emergency, such as in case of a spill or equipment break-down."	
All outdoor foliar spray uses	Update the bee advisory box according to the following: https://www.epa.gov/pollinator-protection/new-labeling-neonicotinoid-pesticides	Follows directly after the Environmental Hazard statement
All outdoor foliar spray uses	For foliar spray application to crops under contract pollinator services: "Do not apply this product while bees are foraging. Do not apply this product until flowering is complete and all petals have fallen unless the following condition has been met. If an application must be made when managed bees are at the treatment site, the beekeeper providing the pollination services must be notified no less than 48 hours prior	Directions for use

Description	Proposed Label Language for Dinotefuran Products	Placement on Label
	to the time of the planned application so that the bees can be removed, covered or otherwise protected prior to spraying." For foliar spray application to crops not under contract pollinator services: "Do not apply this product while bees are foraging. Do not apply this product until flowering is complete and all petals have fallen off unless the application is made in response to a public health emergency declared by appropriate State or Federal authorities."	
All outdoor foliar spray uses	"Do not apply by ground within 25 feet, or by air within 150 feet of lakes, reservoirs, rivers, permanent streams, marshes or natural ponds, estuaries and commercial fish farm ponds."	Directions for use
Brassica (cole) leafy vegetables, set maximum annual rate for foliar spray	Foliar spray only: maximum annual application rate is not to exceed 0.23 lbs. AI/A/yr	Directions for use
Leafy vegetables, set maximum annual rate for foliar spray	Foliar spray only: maximum annual application rate is not to exceed 0.23 lbs. AI/A/yr	Directions for use
Fruiting vegetables, set maximum annual rate for foliar spray, and add application timing restriction based on crop stage	Foliar spray only: maximum annual application rate is not to exceed 0.23 lbs. AI/A/yr For all outdoor uses: "Do not apply after the appearance of the initial flower buds until flowering is complete and all petals have fallen off." "For tomatoes, peppers, chili peppers and okra only, do not apply after 5 days after planting or transplanting regardless of application method."	Directions for use
Stone Fruit add application timing restriction based on crop stage	"Do not apply from bud break until after petal fall is complete and all petals have fallen off."	Directions for use
Cotton set maximum annual rate	Regardless of application method, apply no more than 0.19 lbs. active ingredient per acre per year, including soil drench and foliar sprays.	Directions for use
For all agricultural foliar spray uses	"VEGETATIVE FILTER STRIPS Construct and maintain a vegetative filter strip, according to the width specified below, of grass or other permanent vegetation between the field edge and nearby down gradient aquatic habitat (such as, but not limited to, lakes; reservoirs; rivers; permanent streams; marshes or natural ponds; estuaries; and commercial fish farm ponds).	Directions for use

Description	Proposed Label Language for Dinotefuran Products	Placement on Label
	Only apply products containing dinotefuran onto fields where a maintained vegetative filter strip of at least 10 feet exists between the field edge and where a down gradient aquatic habitat exists. Western irrigated agriculture is exempt from this requirement. Western irrigated agriculture is defined as irrigated farmland in the following states: WA, OR, CA, ID, NV, UT, AZ, MT, WY, CO, NM, and TX (west of I-35). For further guidance on vegetated filter strips, refer to the following publication for information on constructing and maintaining effective buffers: Conservation Buffers to Reduce Pesticide Losses. Natural Resources Conservation Services. https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs144p2_030970.pdf"	
Ornamentals, which includes ornamental ground cover, Christmas trees, ornamental and/or shade trees, ornamental herbaceous plants, ornamental nonflowering plants, ornamental woody shrubs and vines	"Intended for use by professional applicators."	Directions for use
Production/Commercial Ornamentals, which includes ornamental trees, forestry, ornamental woody shrubs and vines, and outdoor greenhouse/nursery set maximum annual rate for foliar spray and soil drench. Does not include indoor commercial nursery, Christmas trees, greenhouse uses, or forestry use on public land and quarantine application by USDA.	For both foliar spray and soil drench: maximum annual application rate is not to exceed 0.40 lbs. AI/A/yr	Directions for use
All outdoor non-agricultural spray applications	"All outdoor spray applications must be limited to spot or crack-and-crevice treatments only, except for the following permitted uses:	Directions for Use

Description	Proposed Label Language for Dinotefuran Products	Placement on Label
	1. Application to soil, lawn, turf, and other vegetation; 2. Perimeter band treatments of 7 feet wide or less from the base of a man-made structure to pervious surfaces (*e.g.*, soil, mulch, or lawn) 3. Applications to the side of a man-made structure, up to 2 feet above ground level; 4. Applications to underside of eaves, soffits, doors, or windows permanently protected from rainfall by a covering, overhang, awning, or other structure; 5. Applications around potential exterior pest entry points into man-made structures such as doorways and windows, when limited to a band not to exceed one inch; 6. Applications to vertical surfaces directly above pervious surfaces such as bare soil, lawn, turf, mulch or other vegetation, and not over a hard impervious surface (e.g., driveways, sidewalks), drainage, or other condition that could result in runoff into storm drains, drainage ditches, gutters, or surface waters, to control occasional invaders or aggregating pests."	
For outdoor non-agricultural spray applications	"Do not apply directly to impervious horizontal surfaces such as sidewalks, driveways, and patios except as a spot or crack-and-crevice treatment." "Do not apply or irrigate to the point of run-off."	Directions for use
For outdoor non-agricultural spray applications – rain related statements (except for products that require watering-in)	"Do not make applications during rain. Avoid making applications when rainfall is expected within 24 hours to allow product sufficient time to dry." "Excessive rainfall within 24 hours after application may cause unintended run-off of pesticide application."	Directions for use
Spot treatment guidance statement	"Spot treatment is application to limited areas on which insects are likely to occur, but which will not be in contact with food or utensils and will not ordinarily be contacted by workers. These areas may occur on floors, walls, and bases or undersides of equipment. Spot treatments must not exceed two square feet in size (2 ft. by 1 ft.), not to exceed 10 % of the entire treatment area"	Directions for use
Spray Drift Management Application Restrictions for all products delivered via liquid spray application and allow aerial application	**"MANDATORY SPRAY DRIFT MANAGEMENT** **Aerial Applications**: • Do not release spray at a height greater than 10 ft above the ground or vegetative canopy, unless a greater application height is necessary for pilot safety.	Directions for Use, in a box titled "Spray Drift Management" under the heading "Aerial Applications"

Description	Proposed Label Language for Dinotefuran Products	Placement on Label
	• Applicators are required to use a medium or coarser (ASABE S572.1) droplet size. • Do not apply when wind speeds exceed 15 mph at the application site. If the windspeed is greater than 10 mph, the boom length must be 65% or less of the wingspan for fixed wing aircraft and 75% or less of the rotor diameter for helicopters. Otherwise, the boom length must be 75% or less of the wingspan for fixed-wing aircraft and 90% or less of the rotor diameter for helicopters For aerial applicators, if the windspeed is 10 miles per hour or less, applicators must use ½ swath displacement upwind at the downwind edge of the field. When the windspeed is between 11-15 miles per hour, applicators must use ¾ swath displacement upwind at the downwind edge of the field Do not apply during temperature inversions."	
Spray Drift Management Application Restrictions for products that allow airblast applications	**"SPRAY DRIFT** **Airblast applications:** • Sprays must be directed into the canopy. • Do not apply when wind speeds exceed 15 miles per hour at the application site. • User must turn off outward pointing nozzles at row ends and when spraying outer row. • Do not apply during temperature inversions."	Directions for Use, in a box titled "Spray Drift Management" under the heading "Airblast Applications"
Spray Drift Management Application Restrictions for products that are applied as liquids and allow ground boom applications	**"SPRAY DRIFT** **Ground Boom Applications:** • User must only apply with the release height recommended by the manufacturer, but no more than 4 feet above the ground or crop canopy. • Applicators are required to use a medium or coarser droplet size (ASABE S572.1). • Do not apply when wind speeds exceed 15 miles per hour at the application site. Do not apply during temperature inversions."	Directions for Use, in a box titled "Spray Drift Management" under the heading "Ground Boom Applications"
Spray Drift Management Application Restrictions for products that are applied as liquids and allow boom-less ground sprayer applications	**"SPRAY DRIFT** **Boomless Ground Applications:** • Applicators are required to use a medium or coarser droplet size (ASABE S572.1) for all applications. • Do not apply when wind speeds exceed 15 miles per hour at the application site. • Do not apply during temperature inversions."	Directions for Use, in a box titled "Spray Drift Management" under the heading "Boomless Applications"

Description	Proposed Label Language for Dinotefuran Products	Placement on Label
Advisory Spray Drift Management Language for all products delivered via liquid spray application	**"SPRAY DRIFT ADVISORIES** THE APPLICATOR IS RESPONSIBLE FOR AVOIDING OFF-SITE SPRAY DRIFT. BE AWARE OF NEARBY NON-TARGET SITES AND ENVIRONMENTAL CONDITIONS. **IMPORTANCE OF DROPLET SIZE** An effective way to reduce spray drift is to apply large droplets. Use the largest droplets that provide target pest control. While applying larger droplets will reduce spray drift, the potential for drift will be greater if applications are made improperly or under unfavorable environmental conditions. **Controlling Droplet Size – Ground Boom** ***(note to registrants:*** *remove if ground boom is prohibited on product labels)* • Volume - Increasing the spray volume so that larger droplets are produced will reduce spray drift. Use the highest practical spray volume for the application. If a greater spray volume is needed, consider using a nozzle with a higher flow rate. • Pressure - Use the lowest spray pressure recommended for the nozzle to produce the target spray volume and droplet size. • Spray Nozzle - Use a spray nozzle that is designed for the intended application. Consider using nozzles designed to reduce drift. **Controlling Droplet Size – Aircraft** ***(note to registrants:*** *remove if aerial application is prohibited on product labels)* • Adjust Nozzles - Follow nozzle manufacturers' recommendations for setting up nozzles. Generally, to reduce fine droplets, nozzles should be oriented parallel with the airflow in flight. **BOOM HEIGHT – Ground Boom** ***(note to registrants:*** *remove if ground boom is prohibited on product labels)* For ground equipment, the boom should remain level with the crop and have minimal bounce. **RELEASE HEIGHT - Aircraft** ***(note to registrants:*** *remove if aerial application is prohibited on product labels)* Higher release heights increase the potential for spray drift. **SHIELDED SPRAYERS**	Directions for Use, just below the Spray Drift box, under the heading "Spray Drift Advisories"

Description	Proposed Label Language for Dinotefuran Products	Placement on Label
	Shielding the boom or individual nozzles can reduce spray drift. Consider using shielded sprayers. Verify that the shields are not interfering with the uniform deposition of the spray on the target area. **TEMPERATURE AND HUMIDITY** When making applications in hot and dry conditions, use larger droplets to reduce effects of evaporation. **TEMPERATURE INVERSIONS** Drift potential is high during a temperature inversion. Temperature inversions are characterized by increasing temperature with altitude and are common on nights with limited cloud cover and light to no wind. The presence of an inversion can be indicated by ground fog or by the movement of smoke from a ground source or an aircraft smoke generator. Smoke that layers and moves laterally in a concentrated cloud (under low wind conditions) indicates an inversion, while smoke that moves upward and rapidly dissipates indicates good vertical air mixing. Avoid applications during temperature inversions. **WIND** Drift potential generally increases with wind speed. AVOID APPLICATIONS DURING GUSTY WIND CONDITIONS. Applicators need to be familiar with local wind patterns and terrain that could affect spray drift."	
Advisory Spray Drift Management Language for products that are applied as liquids and allow boom-less ground sprayer applications	**"SPRAY DRIFT ADVISORIES** **Boomless Ground Applications:** • Setting nozzles at the lowest effective height will help to reduce the potential for spray drift."	Directions for Use, just below the Spray Drift box, under the heading "Spray Drift Advisories"
Advisory Spray Drift Management Language for all products that allow liquid applications with handheld technologies	**"SPRAY DRIFT ADVISORIES** **Handheld Technology Applications:** • Take precautions to minimize spray drift."	Directions for Use, just below the Spray Drift box, under the heading "Spray Drift Advisories"

Appendix C: Endangered Species Assessment

In 2013, the EPA, along with the Fish and Wildlife Service (FWS), the National Marine Fisheries Service (NMFS), and the United States Department of Agriculture (USDA) released a summary of their joint Interim Approaches for assessing risks to endangered and threatened (listed) species from pesticides[21]. These Interim Approaches were developed jointly by the agencies in response to the National Academy of Sciences' (NAS) recommendations that discussed specific scientific and technical issues related to the development of pesticide risk assessments conducted on federally threatened and endangered species.

Since that time, EPA has conducted biological evaluations (BEs) on three pilot chemicals representing the first nationwide pesticide consultations. These initial consultations were pilots and were envisioned to be the start of an iterative process. The agencies are continuing to work to improve the consultation process. For example, advancements to the initial pilot interim methods have been proposed based on experience conducting the first three pilot BEs. Public input on those proposed revisions is currently being considered.

Also, a provision in the December 2018 Farm Bill included the establishment of a FIFRA Interagency Working Group to provide recommendations for improving the consultation process required under section 7 of the Endangered Species Act for pesticide registration and Registration Review and to increase opportunities for stakeholder input. This group includes representation from EPA, NMFS, FWS, USDA, and the Council on Environmental Quality (CEQ). Given this new law and that the first nationwide pesticide consultations were envisioned as pilots, the agencies are continuing to work collaboratively as consistent with the congressional intent of this new statutory provision. EPA has been tasked with a lead role on this group, and EPA hosted the first Principals Working Group meeting on June 6, 2019.

Given that the agencies are continuing to develop and work toward implementation of approaches to assess the potential risks of pesticides to listed species and their designated critical habitat, the ecological risk assessment supporting this PID for dinotefuran does not contain a complete ESA analysis that includes effects determinations for specific listed species or designated critical habitat. Although the EPA has not yet completed effects determinations for specific species or habitats, for this PID, the EPA's evaluation assumed, for all taxa of non-target wildlife and plants, that listed species and designated critical habitats may be present in the vicinity of the application of dinotefuran. This will allow the EPA to focus its future evaluations on the types of species where the potential for effects exists once the scientific methods being developed by the agencies have been fully vetted. Once that occurs, these methods will be applied to subsequent analyses for dinotefuran as part of completing this registration review.

[21] https://www.epa.gov/endangered-species/draft-revised-method-national-level-endangered-species-risk-assessment-process

Appendix D: Endocrine Disruptor Screening Program

As required by FIFRA and FFDCA, the EPA reviews numerous studies to assess potential adverse outcomes from exposure to chemicals. Collectively, these studies include acute, sub-chronic and chronic toxicity, including assessments of carcinogenicity, neurotoxicity, developmental, reproductive, and general or systemic toxicity. These studies include endpoints which may be susceptible to endocrine influence, including effects on endocrine target organ histopathology, organ weights, estrus cyclicity, sexual maturation, fertility, pregnancy rates, reproductive loss, and sex ratios in offspring. For ecological hazard assessments, the EPA evaluates acute tests and chronic studies that assess growth, developmental and reproductive effects in different taxonomic groups. As part of its most recent registration decision for dinotefuran, the EPA reviewed these data and selected the most sensitive endpoints for relevant risk assessment scenarios from the existing hazard database. However, as required by FFDCA § 408(p), dinotefuran is subject to the endocrine screening part of the Endocrine Disruptor Screening Program (EDSP).

The EPA has developed the EDSP to determine whether certain substances (including pesticide active and other ingredients) may have an effect in humans or wildlife similar to an effect produced by a "naturally occurring estrogen, or other such endocrine effects as the Administrator may designate." The EDSP employs a two-tiered approach to making the statutorily required determinations. Tier 1 consists of a battery of 11 screening assays to identify the potential of a chemical substance to interact with the estrogen, androgen, or thyroid (E, A, or T) hormonal systems. Chemicals that go through Tier 1 screening and are found to have the potential to interact with E, A, or T hormonal systems will proceed to the next stage of the EDSP where the EPA will determine which, if any, of the Tier 2 tests are necessary based on the available data. Tier 2 testing is designed to identify any adverse endocrine-related effects caused by the substance, and establish a dose-response relationship between the dose and the E, A, or T effect.

Under FFDCA § 408(p), the agency must screen all pesticide chemicals. Between October 2009 and February 2010, the EPA issued test orders/data call-ins for the first group of 67 chemicals, which contains 58 pesticide active ingredients and 9 inert ingredients. The agency has reviewed all of the assay data received for the List 1 chemicals and the conclusions of those reviews are available in the chemical-specific public dockets. A second list of chemicals identified for EDSP screening was published on June 14, 2013,[22] and includes some pesticides scheduled for Registration Review and chemicals found in water. Neither of these lists should be construed as a list of known or likely endocrine disruptors. Dinotefuran is not on either list. For further information on the status of the EDSP, the policies and procedures, the lists of chemicals, future lists, the test guidelines and the Tier 1 screening battery, please visit the EPA website.[23]

In this PID, the EPA is making no human health or environmental safety findings associated with the EDSP screening of dinotefuran. Before completing this registration review, the agency will make an EDSP FFDCA § 408(p) determination.

[22] See http://www.regulations.gov/#!documentDetail;D=EPA-HQ-OPPT-2009-0477-0074 for the final second list of chemicals.
[23] https://www.epa.gov/endocrine-disruption

Imidacloprid

Proposed Interim Registration Review Decision
Case Number 7605

January 2020

Approved by: _____

Elissa Reaves, Ph.D.
Acting Director
Pesticide Re-evaluation Division

Date: 1-22-2020

Table of Contents

I. INTRODUCTION

This document is the Environmental Protection Agency's (EPA or the agency) Proposed Interim Registration Review Decision (PID) for imidacloprid (PC Code 129099) and is being issued pursuant to 40 CFR §§ 155.56 and 155.58. A registration review decision is the agency's determination whether a pesticide continues to meet, or does not meet, the standard for registration in the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA). The agency may issue, when it determines it to be appropriate, an interim registration review decision before completing a registration review. Among other things, the interim registration review decision may require new risk mitigation measures, impose interim risk mitigation measures, identify data or information required to complete the review, and include schedules for submitting the required data, conducting the new risk assessment and completing the registration review. Additional information on imidacloprid, can be found in the EPA's public docket (EPA-HQ-OPP-2008-0844) at www.regulations.gov.

FIFRA, as amended by the Food Quality Protection Act (FQPA) of 1996, mandates the continuous review of existing pesticides. All pesticides distributed or sold in the United States must be registered by the EPA based on scientific data showing that they will not cause unreasonable risks to human health or to the environment when used as directed on product labeling. The registration review program is intended to make sure that, as the ability to assess and reduce risk evolves and as policies and practices change, all registered pesticides continue to meet the statutory standard of no unreasonable adverse effects. Changes in science, public policy, and pesticide use practices will occur over time. Through the registration review program, the agency periodically re-evaluates pesticides to make sure that as these changes occur, products in the marketplace can continue to be used safely. Information on this program is provided at http://www.epa.gov/pesticide-reevaluation. In 2006, the agency implemented the registration review program pursuant to FIFRA § 3(g) and will review each registered pesticide every 15 years to determine whether it continues to meet the FIFRA standard for registration.

The EPA is issuing a PID for imidacloprid so that it can (1) move forward with aspects of the registration review that are complete and (2) implement interim risk mitigation (see Appendices A and B). The agency is currently working with the U.S. Fish and Wildlife Service and the National Marine Fisheries Service (together, the Services) to develop methodologies for conducting national threatened and endangered (listed) species assessments for pesticides in accordance with the Endangered Species Act (ESA) § 7. Therefore, although the EPA has not yet fully evaluated risks to listed species, the agency will complete its listed species assessment and any necessary consultation with the Services for imidacloprid prior to completing the imidacloprid registration review. Likewise, the agency will complete endocrine screening for imidacloprid, pursuant to the Federal Food, Drug, and Cosmetic Act (FFDCA) § 408(p), before completing registration review. See Appendices C and D, respectively, for additional information on the endangered species assessment and the endocrine screening for the imidacloprid registration review.

Imidacloprid is an N-nitroguanidine neonicotinoid insecticide, which causes irreversible blockage of the postsynaptic nicotinic acetylcholine receptors. It is a xylem and phloem-mobile systemic compound that is readily taken up by the roots of the plants and translocated through

the plant via transpiration. There are over five hundred FIFRA § 3 and § 24(c) (Special Local Needs) products containing imidacloprid registered in the United States. Products containing imidacloprid can be formulated as granules, ready-to-use solutions, emulsifiable concentrates, flowable concentrates, water soluble packages (WSP), dust, impregnated materials, etc. Products can be applied via liquid spray of drench, broadcast granules, baits, and as seed treatment. Imidacloprid products can be applied to a variety of agricultural crops, including but not limited to, root and tuber vegetables, fruiting vegetables, oilseed crops, citrus fruit, leafy green vegetables, cucurbit vegetables and tropical and subtropical fruits. Imidacloprid products are also registered on non-agricultural use sites including but not limited to, turf and ornamentals, forestry, Christmas tree plantations, pet spot-on and collar products, baits and pellets, and in farm/residential/commercial areas. The first imidacloprid product was registered for use in 1994, and as a result, imidacloprid was not reviewed under the reregistration process.

This document is organized in five sections: the *Introduction*, which includes this summary and a summary of public comments and the EPA's responses; *Use and Usage*, which describes how and why imidacloprid is used and summarizes data on its use; *Scientific Assessments*, which summarizes the EPA's risks, and updates or revisions to previous risk assessments, and provides broader context with a discussion of risk characterization; *Benefits Assessments*, which describes the utility of the chemical along with any potential impacts of mitigation; the *Proposed Interim Registration Review Decision*, which describes the mitigation measures proposed to address risks of concern and the regulatory rationale for the EPA's PID; and, lastly, the *Next Steps and Timeline* for completion of this registration review.

While this PID focuses on the specific risks, benefits, and mitigation measures for imidacloprid, the EPA is issuing PIDs for all of the currently registered N-nitroguanidine neonicotinoid pesticides concurrently to ensure consistency across the class. The PIDs and supporting documents for clothianidin, dinotefuran, and thiamethoxam are available in the public dockets established for each of these cases.

A. Summary of Imidacloprid Registration Review

Pursuant to 40 CFR § 155.50, the EPA formally initiated registration review for imidacloprid with the opening of the registration review docket for the case. The following summary highlights the docket opening and other significant milestones that have occurred thus far during the registration review of imidacloprid.

- December 2008 – The imidacloprid *Summary Document*, Human Health Scoping Document, and Environmental Fate and Effects Problem Formulation were posted to the docket for a 60-day public comment period.

- June 2009 – The *Final Work Plan* (FWP) for Imidacloprid was issued. During the comment period the agency received one comment concerning trade irritants. The Final Work Plan was amended in July 2010 to include additional data necessary to support the registration review of imidacloprid.

- November 2010 – A Generic Data Call-In (GDCI) for imidacloprid was issued for data needed to conduct the registration review risk assessments; all data requirements have been satisfied.

- January 2016 – The agency announced the availability of the *Preliminary Pollinator Assessment to Support the Registration Review of Imidacloprid* for a 60-day public comment period which was then extended 30-days.

- January 2017 – The agency announced the availability of the *Preliminary Aquatic Risk Assessment to Support the Registration Review of Imidacloprid* for a 60-day public comment period.

- September 2017 – The agency announced the availability of the *Imidacloprid: Human Health Draft Risk Assessment for Registration Review*, *Imidacloprid. Acute and Chronic Aggregate Dietary (Food and Drinking Water) Exposure and Risk Assessments for the Registration Review Risk Assessment.*, and *Imidacloprid. Occupational and Residential Exposure Assessment for Registration Review.* for a 60-day public comment period.

- December 2017 – The agency announced the availability of the following documents to support Registration Review for a 60-day public comment period which was then extended for an additional 60 days to April 21, 2018:
    - *Biological and Economic Analysis Division (BEAD) Response to Public Comments Submitted in Response to BEAD's Assessment entitled "Benefits of Neonicotinoid Seed Treatments to Soybean Production" Dated October 15, 2014, OPP Docket: EPA-HQ-OPP-2014-0737,* December 5, 2017
    - *Benefits of Neonicotinoid Insecticide Use in Pre-Bloom and Bloom Periods of Cotton,* December 5, 2017
    - *Benefits of Neonicotinoid Insecticide Use in Pre-Bloom and Bloom Periods of Citrus,* November 21, 2017
    - *Imidacloprid Transmittal of the Preliminary Terrestrial Risk Assessment to Support Registration Review,* November 28, 2017

- January 2020 – The agency is now announcing the availability of the PID in the docket for imidacloprid, for a 60-day public comment period. Along with the PID, the following documents are also posted to the imidacloprid docket:
    - *Benefits of Neonicotinoid Insecticide Use in Cucurbit Production and Impacts of Potential Risk Mitigation*, December 11, 2019
    - *Benefits of Neonicotinoid Insecticide Usage in Grapes and Impacts of Potential Mitigation,* October 23, 2019
    - *Benefits and Impacts of Potential Mitigation for Neonicotinoid Seed Treatments on Small Grains, Vegetables, and Sugarbeet Crops,* August 30, 2018
    - *Usage, Pest Management Benefits, and Possible Impacts of the Potential Mitigation of the Use of the Four Nitroguanidine Neonicotinoids in Pome Fruits (Apple, Pear)*, December 11, 2019

- *Assessment of Usage, Benefits and Impacts of Potential Mitigation in Stone Fruit Production for Four Nitroguanidine Neonicotinoid Insecticides (Clothianidin, Dinotefuran, Imidacloprid, and Thiamethoxam)*, December 6, 2019
- *Usage and Benefits of Neonicotinoid Insecticides in Rice and Response to Comments,* April 22, 2019
- *Benefits of Neonicotinoid Insecticide Use in Berries (Strawberry, Caneberry, Cranberry, and Blueberry) and Impacts of Potential Mitigation,* December 6, 2019
- *Benefits of Neonicotinoid Insecticide Use and Impacts of Potential Risk Mitigation in Vegetables, Legumes, Tree Nuts, Herbs, and Tropical and Subtropical Fruit.* December 20, 2019
- *Review of "The Value of Neonicotinoids in North American Agriculture" prepared by AgInfomatics, LLC for Bayer CropScience, Mitsui, Syngenta, and Valent,* November 4, 2019
- *Review of "The Value of Neonicotinoids in Turf and Ornamentals" prepared by AgInfomatics, LLC for Bayer CropScience, Mitsui, Syngenta, and Valent*, December 11, 2019
- *Comparative analysis of Aquatic Invertebrate Risk Quotients generated for neonicotinoids using Raby et al. (2018) toxicity data,* January 7, 2020
- *Flumethrin: Tier I Update Review of Human Incidents and Epidemiology for Proposed Interim Decision*[1]*,* September 17, 2019
- *Imidacloprid. Updated Residential Exposure Assessment in Response to Draft Risk Assessment (DRA) Comments.*, February 11, 2019
- *Imidacloprid. Updated Non-Occupational Spray Drift Exposure Assessment in Response to Draft Risk Assessment (DRA) Comments*, January 10, 2020
- *Final Bee Risk Assessment to Support the Registration Review of Imidacloprid,* January 14, 2020
- *Note to Reader: Documents Supporting the Registration Review of Imidacloprid*

The agency will be posting a reader's guide in the docket to assist with navigation of the imidacloprid supporting documents.

B. Summary of Public Comments on the Draft Risk Assessments and Agency Responses

Two separate comment periods were held for imidacloprid risk assessment documents. The *Preliminary Pollinator Assessment to Support the Registration Review of Imidacloprid* was published January 4, 2016 for for an initial 60-day public comment period. The comment period for the draft human health and non-pollinator ecological risk assessments for imidacloprid, as well as various supporting benefits-related registration review documents, opened on December 21, 2017 for an initial 60-day public comment period.

[1] Flumethrin updated human incident assessment composed of only incidents related to the combined imidacloprid and flumethrin product.

Across these comment periods, the agency received a total of 1,433 unique/distinct public comments to the imidacloprid docket. In addition, the neonicotinoids received approximately 400,000 mass mail campaign submissions. Comments were submitted by various individuals, organizations, and companies. Comments of a broader regulatory nature, and the agency's responses to those comments, are provided in the memorandum *Response from the Pesticide Re-evaluation Division to Comments on the Draft Risk Assessments and Benefits Assessments Supporting the Registration Review of the Nitroguanidine-substituted Neonicotinoid Insecticides*. Comments on the topics of neonicotinoid benefits, ecological effects and human health effects are noted and responded to in the following memoranda:

- *Biological and Economic Analysis Division's (BEAD) Response to Comments on the Preliminary Risk Assessments and Benefit Assessments for Citrus, Cotton, Soybean Seed Treatment, and Other Crops Not Assessed for Neonicotinoid Insecticides*. December 23, 2019.
- *EFED Response to Public Comments Common to the Preliminary Pollinator and Preliminary Non-Pollinator Registration Review Risk Assessments Across the Four Neonicotinoid Pesticides (Imidacloprid, Thiamethoxam, Clothianidin, and Dinotefuran),* January 6, 2020
- *Imidacloprid: Response to Public Comments Related to the Preliminary Risk Assessments and Addendum to the Non-Pollinator Risk Assessments in Support of Registration Review (Docket No. EPA-HQ-OPP-2008-0844),* January 8, 2020
- *Imidacloprid: Draft Human Health Risk Assessment (DRA) for Registration Review – Response to Comments,* November 12, 2019

Additionally, the agency received comments to the preliminary risk assessments that resulted in revised risk assessments and/or adjustments to EPA's risk management approach. These comments are captured below, along with the agency's responses to those comments. The agency thanks all commenters for their comments.

Comment Submitted by Bayer Healthcare, LLC. in EPA-HQ-OPP-2008-0844-1247

Comment: In response to EPA's identification of data gaps in the TTR and dermal absorption studies used in the imidacloprid human health risk assessment, Bayer CropScience (BCS) submitted the results of an imidacloprid-specific TTR study and a formulation-specific *in vivo* dermal absorption study to refine the EPA's imidacloprid human health risk assessment.

EPA Response: The agency thanks BCS for its comment and study submissions. The agency reviewed these studies and determined that the TTR and dermal absorption data deficiencies are now satisfied and that the dermal absorption factor (DAF) can be reduced from 7.2% to 4.8%. The agency refined the residential handler and post-application risk estimates using these studies and determined that there are no residential handler or post-application risks of concern associated with the pet collar use. EPA also identified with the newly available data new potential risks of concern associated with use on turf in non-irrigated plots, however, there are no remaining residential post-application exposure risks of concern associated with use on turf in irrigated plots. For a more detailed description of the updated risk estimates, please refer to

Imidacloprid. Updated Residential Exposure Assessment in Response to Draft Risk Assessment (DRA) Comments, available in the public docket.

Comment Submitted by the Massachusetts Office of the Attorney General (EPA-HQ-OPP-2011-0920-0725):

Comment: The Massachusetts Office of the Attorney General (MA-OAG) expressed concerns regarding risks to pollinators from residential homeowner applications of neonicotinoids on gardens, lawns and ornamentals. MA-OAG also highlighted that many retailers have voluntarily committed to phasing out the sale of plants and other products containing neonicotinoid insecticides. MA-OAG suggests that the agency severely curtail the use of neonicotinoids.

EPA Response: EPA thanks the Massachusetts Office of the Attorney General for its comment. The agency recognizes the potential risks to pollinators from homeowner applications of neonicotinoids on gardens, lawns, and ornamentals. In response, the agency is proposing certain rate reductions and require advisory label language for residential ornamental labels stating, "Intended for use by professional applicators". Please refer to Section IV.A of this PID for additional details regarding the proposed label changes.

Comment Submitted by the National Association of State Departments of Agriculture (EPA-HQ-OPP-2008-0844-1043):

Comment: The National Association of State Departments of Agriculture (NASDA) encourages the agency to fully articulate risk mitigation measures with state lead agencies, registrants, producers, users, and the agricultural stakeholder community to facilitate an informed risk assessment. Furthermore, NASDA is concerned that the agency did not articulate the benefits in the *Preliminary Pollinator Assessment to Support the Registration Review of Imidacloprid.*

EPA Response: The agency continues to encourage public/stakeholder participation through the public comment period. Moreover, the agency prepared refined risk assessments in response to substantive comments, and also provided several additional benefits assessments (see Section I.A) to support the registration review of all the neonicotinoids, including imidacloprid. The agency carefully considered the risks and benefits described in these assessments to develop the risk mitigation proposals, which are detailed in this PID. In accordance with EPA policy, the agency is opening a 60-day public comment period for the proposed mitigation described in this PID prior to issuing a final decision.

Comments Submitted Concerning the Preliminary Pollinator Risk Assessments:

The agency received numerous comments in response to publication of the preliminary pollinator risk assessments for clothianidin, dinotefuran, imidacloprid, and thiamethoxam, which were considered in the preparation of the final pollinator risk assessments. The agency's responses can be found below. These comments were received from BCS, Beekeepers (BK), Beyond Pesticides (BP), the Center for Biological Diversity (CBD), California Citrus Mutual (CCM), the Center for Food Safety (CFS), CropLife America (CLA), Dancing Bee Gardens (DBG), GreenCAPE (GC), the National Corn Growers Association (NCGA), the National Cotton Council (NCC), the Natural Resources Defense Council (NRDC), the National Wildlife Federation (NWF), the

Pesticide Policy Coalition (PPC), the San Francisco Estuary Institute (SFEI), the University of California – Riverside (UCR), the University of California – San Diego (UCSD), and the United States Department of Agriculture (USDA).

The agency also received abundant generalized comments regarding the preliminary pollinator risk assessments, including those concerning the scientific methodology or rationale in these assessments. For a more comprehensive account of the comments related to the preliminary pollinator risk assessments, including those summarized in this PID, refer to *EFED Response to Public Comments Common to the Preliminary Pollinator and Preliminary Non-Pollinator Registration Review Risk Assessments Across the Four Neonicotinoid Pesticides (Imidacloprid, Thiamethoxam, Clothianidin, and Dinotefuran),* available in the public dockets.

Summary of Comment (BCS): Bayer CropScience, commenting on behalf of the Imidacloprid EPA DCI cost-sharing consortium (Bayer, Nufarm, Ensystex, Helena, UPI, and Albaugh), expressed concerns over the kinetics model half-life estimates for imidacloprid. BCS asks that the agency provide more accurate half-life estimates for imidacloprid.

EPA Response: The preliminary pollinator assessment for imidacloprid reported a half-life range of 305 days to > 2,000 days. The agency has considered additional information since the assessment was published and identified a half-life range of 139 days to 608 days. This refined half-life range has a mean half-life of 254 days, which the agency used as the modeling input in the final pollinator assessment (available in the docket).

Summary of Comments (BK, BP, CBD, CCM, CFS, DBG, GC, NCC, NRDC, NWF, SFEI, UCR, UCSD): Several commenters asked the agency to refer to open literature studies for data and/or methodologies to be incorporated into the EPA's pollinator assessment. These studies covered a range of considerations including, but not limited to, assessing risk to additional pollinator species (*e.g.* non-apis), sub-lethal effects, and toxicity endpoints.

EPA Response: The agency thanks the commenters for their comments. EPA relies on the best available science at the time of conducting its assessments. In the risk assessment process, numerous studies are considered and evaluated for inclusion in the assessments based on the agency's open literature guidance. Open literature studies that meet the guidance criteria are then selected for inclusion in the risk assessments. The selected studies are then weighted based on the scientific evaluation. EPA acknowledges the growing body of studies/data/methodologies, and has considered additional studies in the final pollinator assessments that were brought to the agency's attention as comments received on the preliminary pollinator assessments.

Summary of Comments (Academia, BK, CBD, CFS, CLA, DBG, NRDC, NWF, PSC, USDA, XSIC): Several commenters suggested the Tier II colony feeding studies were inadequate, claiming design or conduct flaws (*e.g.* lack of overwintering, removal of colonies due to supersedure, failure to consider genetic variability).

EPA Response: The agency reviewed the study protocols prior to test initiation and determined that the study designs were appropriate for generating data for use in a regulatory risk assessment. While EPA reviewed protocols and determined that the studies were appropriate for

risk assessment, the agency acknowledges that there were some issues with the initial studies. Therefore, EPA incorporated revised studies into the final pollinator assessments. These new studies all included successful overwintering control hive components such as colony strength, number of broods, food stores, etc., however, the agency notes that the treatment-related effects measured after overwintering were equal to or less sensitive than those measured prior to overwintering; since endpoints were based on effects observed during the season of the application, they were also protective of effects that may occur after overwintering. Data evaluation records for these studies are publicly available (regulations.gov; EPA-HQ-OPP-2011-0581-0040 and EPA-HQ-OPP-2011-0865-0179) and list the perceived strengths and limitations of these studies.

Summary of Comments: Several commenters expressed concerns that the agency did not implement a consistent methodology for the four nitroguanidine-substituted neonicotinoids in the preliminary pollinator risk assessments.

EPA Response: The agency thanks the commenters for their feedback. The initial registrations for the four nitroguanidine-substituted neonicotinoids were not concurrent, and, as a result, the registration review schedules for these chemicals were not concurrent. As such, the preparation of the initial risk assessments for these four chemicals occurred at different times, where imidacloprid was assessed prior to the remaining three nitroguanidine-substituted neonicotinoids. However, since the release of the preliminary pollinator assessments, the agency has made a programmatic decision to align the registration review schedules for all four nitroguanidine-substituted neonicotinoids. Consequently, the final pollinator assessments are now aligned in methodology and consistency to the greatest extent possible.

Summary of Comments: Several comments concerned the bee bread method to evaluate pollen exposure. The nature of these comments include: an unvetted method should not be used in this risk assessment (NCC, CBD, PPC); the bee bread method overestimates exposures to pollen in the hive, and that these estimates should be converted to nectar equivalents that can be compared to the sucrose No Observed Adverse Effects Concentration (NOAEC) (CLA, NCGA).

EPA Response: The agency thanks the commenters for their comments. Based on the public comments received, and new data available, including a new colony feeding studies with spiked pollen and a supplement of an expanded suite of available empirical residue in pollen and nectar studies, the method to evaluate the pollen route of exposure has been updated in the final pollinator risk assessments. In short, the updated approach considers exposure via contaminated pollen (and nectar) on a total dietary basis by converting pollen concentrations into nectar equivalents and summing the residues from both matrices (where appropriate) to estimate a single exposure number for comparison to a sucrose-based endpoint (NOAEC). See *Attachment* 1. *Tier II Method for Assessing Combined Nectar and Pollen Exposure to Honey Bee Colonies,* within each chemical-specific docket for a full explanation of the revised pollen method.

Comments Submitted Concerning the Preliminary Non-Pollinator Risk Assessments:
The agency received numerous comments in response to the preliminary non-pollinator risk assessments conducted for the four nitroguanidine-substituted neonicotinoids, which were considered in the preparation of the final non-pollinator risk assessments and comments

concerned the scientific methodology or rationale in these assessments. These comments were received from the, AVAAZ, the Bay Area Clean Water Agencies (BACWA), Bayer CropScience (BCS), the California Department of Pesticide Regulation (CDPR), CropLife America (CLA), the San Francisco Bay Regional Water Quality Control Board (SFBRWQCB), the Vermont Agency of Agriculture Food and Markets (VAAFM), and Xerces Society for Invertebrate Conservation (XSIC). The agency's response can be found below.

For a more comprehensive account of the comments related to the preliminary non-pollinator risk assessments and their responses, including those summarized in this PID, refer to *EFED Response to Public Comments Common to the Preliminary Pollinator and Preliminary Non-Pollinator Registration Review Risk Assessments Across the Four Neonicotinoid Pesticides (Imidacloprid, Thiamethoxam, Clothianidin, and Dinotefuran)* and *Imidacloprid: Response to Public Comments Related to the Preliminary Risk Assessments and Addendum to the Non-Pollinator Risk Assessments in Support of Registration Review (Docket No. EPA-HQ-OPP-2008-0844),* available in the public dockets.

Summary of Comment (BCS): Bayer CropScience, on behalf of the imidacloprid EPA DCI cost-sharing consortium members (Bayer, Nufarm, Ensystex, Helena, UPI, and Albaugh) noted (EPA-HQ-OPP-2008-0844-1186) that the foliar rate for tobacco (0.561 kg a.i./ha) was incorrectly listed in the seed treatment column of Table 3-6, p. 38 in the *Preliminary Aquatic Risk Assessment to Support the Registration Review of Imidacloprid.*

EPA Response: The agency thanks BCS for their comment. The agency confirmed that there is a typographical error in Table 3-6. The application rate (0.561 kg a.i./ha) should have been listed under "soil application".

Summary of Comment (BCS): Bayer, on behalf of the imidacloprid EPA DCI cost-sharing consortium members, noted (EPA-HQ-OPP-2008-0844-1187) that the "Commercial (Perimeter Treatment): (0.5 lbs a.i./A, CA)" scenario in the *Preliminary Aquatic Risk Assessment to Support the Registration Review of Imidacloprid* (see Table 5-3, p. 89), incorrectly indicates a LOC exceedance for freshwater chronic risk.

EPA Response: The agency confirmed that there is a typographical error in Table 5-3. A chronic RQ of 0.9 is below the LOC (1), and not a risk of concern.

Summary of Comment (CPDR and VAAFM): CPDR asserted that the neonicotinoid assessments did not adequately consider the potential runoff from treated seeds planted greater than 2 cm below the soil surface as the EPA's Pesticide Water Calculator (PWC) model used in the assessment does not quantitatively estimate pesticide residues from treated seeds planted below 2 cm. However, CPDR referenced monitoring data (Hladik *et. al.,* 2014) that found that pesticide detections in surface water can be associated with rainfall events following planting of treated crop-seeds, thus suggesting a link between seed treatments and pesticide detections in surface water. It was noted, though, that this study does not identify the depth at which the seed treatments in question were planted. Additionally, VAAFM reported maximum concentrations of neonicotinoids in the streams receiving effluent from tiles drains (see EPA-HQ-OPP-2008-0844-

1175 for detail). CDPR suggested employing refined future modeling efforts to include soil runoff modeling to account for subsurface flow such as tile drains commonly used in agriculture.

EPA Response: The agency thanks CDPR and VAAFM for their comments and submitting this monitoring data. The agency recently re-evaluated its surface water modeling for seed treatments. The agency no longer models applications "at depth", which could potentially overlook pesticide residues in runoff from treated seeds planted at depths below 2 cm. Instead, the agency has elected to use the "increasing with depth" application of the PWC model, which assumes that some portion of the applied chemical will be available to runoff, even when planted at depth. These assumptions were implemented in the models included in the comparative aquatic neonicotinoid risk assessment and associated documents, which identified acute and chronic risk exceedances for aquatic invertebrates (see Section III.B.1 of this PID).

Moreover, the agency is proposing label language to mitigate potential risks from runoff. The proposed label language covers treated seeds, but also includes statements for spray and foliar applications. For a detailed description of the proposed label language please refer to Section IV.A.8 and Appendix B.

Summary of Comments (AVAAZ, BACWA, CDPR, CLA, SFBRWQCB, XSIC):
Commenters (EPA-HQ-OPP-2008-0844-1192, EPA-HQ-OPP-2008-0844-1116) assert that ample evidence exists in the literature to show that relatively small concentrations of neonicotinoids can trigger harmful effects; that invertebrates are harmed at levels well below the current aquatic life benchmarks, and that these benchmarks should be revised. The commenters also felt that the following studies should be considered in the assessments:

- Maloney, E. M., Morrissey, C. A., Headley, J. V., Peru, K. M., & Liber, K. (2017). Cumulative toxicity of neonicotinoid insecticide mixtures to *Chironomus dilutus* under acute exposure scenarios. *Environmental Toxicology and Chemistry*, 36(11), 3091-3101.
- Miles, J. C., Hua, J., Sepulveda, M. S., Krupke, C. H., & Hoverman, J. T. (2017). Effects of clothianidin on aquatic communities: Evaluating the impacts of lethal and sublethal exposure to neonicotinoids. *PloS One*, 12(3), e0174171.
- Raby, M., Nowierski, M., Perlov, D., Zhao, X., Hao, C., Poirier, D. G., & Sibley, P. K. (2018). Acute toxicity of 6 neonicotinoid insecticides to freshwater invertebrates. *Environmental Toxicology and Chemistry*, 37(5), 1430-1445.

Conversely, one commenter (EPA-HQ-OPP-2008-0844-1562) asserted that the application of the most conservative endpoint to assess risk to all aquatic invertebrates is overly conservative and does not account for diversity of aquatic invertebrate communities.

EPA Response: The agency thanks the commenters for their feedback. The agency has considered the additional information provided from the above studies. Raby *et. al.* conducted a comparative analysis by testing the four nitroguanidine-substituted neonicotinoids on 7 aquatic invertebrate species in a controlled laboratory environment. The agency also performed a cursory review of Maloney *et. al.* and Miles *et.al.*, which report lethal concentrations (LC_{50}) similar to those reported in *Raby et. al*. Overall, the agency found the Raby *et. al.* study acceptable for quantitative use in risk assessment, however, the agency concluded that there are no significant

changes in the risk conclusions for aquatic invertebrates as described in the preliminary ecological risk assessments. For more information, refer to the *Comparative analysis of Aquatic Invertebrate Risk Quotients generated for neonicotinoids using Raby et al. (2018) toxicity data* available in each docket.

II. USE AND USAGE

Imidacloprid is a nitroguanidine neonicotinoid insecticide with the first product registered for use in the United States in 1994. Products containing imidacloprid are used to control a variety of sucking and piercing insect pests including thrips, aphids, and whiteflies, as well as soil insects such as beetles, grubs, and wireworms. Products containing imidacloprid are formulated as wettable powders, granules, seed treatment, trunk injection and soluble concentrates on a wide variety of agricultural and non-agricultural use sites. Agricultural sites include but are not limited to vegetable crops, tree fruits, tree nuts, and field crops as well as forestry (including lumber and pulp production; non-agricultural uses include but are not limited to turf and ornamental plants, and indoor and outdoor residential and commercial sites including pet products. There are over five hundred FIFRA § 3 and § 24 (c) registrations in the United States, including eighteen registrations for the technical grade active ingredient.

Agricultural Usage

The largest agricultural use for imidacloprid, in terms of pounds active ingredient (AI) applied, has been in the form of seed treatments. On average, between 2005 and 2015, over 700,000 lbs. of imidacloprid were used annually for seed treatments on various field crops including corn, cotton, soybean, potato, and wheat[2]. There are also seed treatments registered for various vegetable crops. More recent data on seed treatment usage are not available.

From 2007-2017, soil and foliar usage averaged about 800,000 lbs. AI[3], applied to approximately 5.6 million acres[4] annually. Agricultural sites with the highest usage of imidacloprid in average pounds applied per year are cotton (100,000 lbs), oranges (80,000 lbs), and potatoes (80,000 lbs)[3]. The highest percent crop treated (PCT) values are reported for broccoli (70%), cauliflower (70%), and lettuce (70%)[3].

In 2016, approximately 5,000 pounds of imidacloprid was reported to be used for industrial vegetation management, including forestry[5].

[2] *Imidacloprid (129099) Screening Level Usage Analysis (SLUA), March 14, 2017*
[3] *Imidacloprid (129099) Screening Level Usage Analysis (SLUA), December 9, 2019*
[4] *Agricultural Market Research Data (AMRD). 2007-2017. Data collected and sold by a private market research firm. Data collected on pesticide use for about 60 crops by annual surveys of agricultural users in the continental United States. Survey methodology provides statistically valid results, typically at the state level.*
[5] *Non-agricultural Market Research Data (NMRD), 2017. Data on consumer and professional pest control markets collected and sold by a private market research firm.*

Non-Agricultural Usage

The agency has limited usage data on non-agricultural use sites. In 2016, approximately 300,000 lbs of imidacloprid was used by pest management professionals (*i.e.*, applicators who typically apply pesticides to turf and ornamental plants, including in residential areas)[5]. Additionally, approximately 40,000 lbs of imidacloprid was purchased in 2016 directly by consumers for indoor and outdoor use.

III. SCIENTIFIC ASSESSMENTS

A. Human Health Risks

A summary of the agency's human health risk assessment is presented below. The agency used the most current science policies and risk assessment methodologies to prepare a risk assessment in support of the registration review of imidacloprid. For additional details on the human health assessment for imidacloprid, see the *Imidacloprid: Human Health Draft Risk Assessment for Registration Review, Imidacloprid: Updated Residential Exposure Assessment in Response to Draft Risk Assessment (DRA) Comments*, and *Imidacloprid. Updated Non-Occupational Spray Drift Exposure Assessment in Response to Draft Risk Assessment (DRA) Comments*, which are available in the public docket.

1. Risk Summary and Characterization

Humans may be exposed to imidacloprid in food and drinking water from crop uses, residential applications, in occupational settings, and from exposures to spray drift. The primary target system for mammals via the oral route is the nervous system; observed effects include tremors/trembling, decreased motor activity, etc., in multiple neurotoxicity studies in the dog and rat. No signs of toxicity were observed through the dermal and inhalation routes in the available studies and there was no evidence of carcinogenic potential in the database. Imidacloprid is classified as a Group E chemical ("Evidence of non-carcinogenicity for humans"), oral Toxicity Category II (high oral lethality), and dermal Toxicity Category IV (low lethality by the dermal and inhalation routes). Because the toxicology database is sufficient to support risk assessment, the assessments are unlikely to underestimate exposure, and the observed neurotoxic and fetal and offspring effects are well characterized and protected for, and the FQPA Safety Factor was reduced to 1X. Therefore, the level of concern (LOC) for all assessments is 100 based on the interspecies (10X) and intraspecies (10X) extrapolation. The toxic effects used by the agency to estimate risk in the human health assessment are based on evidence of neurotoxicity in the 90-day rat study. As a result of information received as part of public comments, EPA has drafted an updated assessment, *Imidacloprid: Updated Residential Exposure Assessment in Response to Draft Risk Assessment (DRA) Comments*, which is available in the public docket.

Dietary (Food + Water) Risks

The acute dietary assessment assumed tolerance-level residues for most registered commodities, and all crops were assumed to have 100% of the crop treated. No acute dietary risks of concern were identified, as all populations resulted in acute population adjusted doses (aPAD) of less than 100% which is HED's level of concern. The highest exposed population subgroup was children 1-2 years old with an aPAD of 93%.

The chronic dietary assessment also assumed tolerance-level residues but incorporated average percent crop treated for several commodities. All chronic exposure analyses were below the level of concern. The most highly exposed population subgroup was children 1-2 years old at 12% of the chronic population adjusted dose (cPAD).

Residential Risks

Residential uses of imidacloprid include lawns and gardens, homes, commercial establishments, crack-and-crevice treatments, pet uses, structural pest control, and wood preservation. Generally, short-term dermal and incidental oral post-application exposures (short-term) are expected as a result of these residential uses, with the exception of intermediate- and long-term exposures from the pet collar and spot-on uses, as they present the potential for prolonged exposure via a continuous source and frequent contact (*i.e.*, playing with pets).

All residential handler scenarios resulted in margins of exposure (MOEs) greater than HED's LOC of 100, which makes these risks not of concern. MOEs ranged from 110 to 950,000; the lowest MOE was associated with applying pet collars to large dogs. Since the previous human health risk assessment, the combined residential post-application exposure risk estimates for the pet collar use have been updated and are no longer of concern (*i.e.,* MOEs ≥ the LOC of 100) for all scenarios.

The post-application residential MOEs (combined dermal and inhalation) for foliar spray and granular irrigated turf are not of concern (MOEs ≥ LOC of 100) however, there are risk estimates that indicate potential concern for adults (dermal exposure, high-contact activities), and children 1 to <2 years old (dermal exposure, high contact activities and hand-to-mouth) using additional turf transferable residue (TTR) data submitted during the public comments on the human health risk assessment from the foliar and granular non-irrigated plots. Following review of this data, the agency updated its exposure assumptions, resulting in these risks of concern. For children 1 to <2 years old, combined dermal and incidental oral estimates are of concern with an MOE of 25, dermal high-contact play on treated turf scenarios resulted in an MOE of concern of 36, and the hand to mouth scenario resulted in an MOE of concern of 83. For adults, the high-contact play modeled scenario resulted in an MOE of concern of 71. Detailed discussion of this data and the resulting risks of concern are in, *Imidacloprid: Human Health Draft Risk Assessment for Registration Review* and *Imidacloprid: Updated Residential Exposure Assessment in Response to Draft Risk Assessment (DRA) Comments,* available in the imidacloprid docket.

Bystander Risks

Previously, a quantitative spray drift assessment for imidacloprid was not required because the residential turf post-application MOEs was not of concern and was protective of bystander risks. After review of the TTR data submitted during the public comment period, non-occupational spray drift exposure was reassessed and determined to not be of concern. For more information please see, *Imidacloprid. Updated Non-Occupational Spray Drift Exposure Assessment in Response to Draft Risk Assessment (DRA) Comments*, available in the imidacloprid docket.

Occupational Risks

Most occupational handler risk estimates were not of concern (*i.e.*, MOEs $\geq$ 100) with current baseline attire (long-sleeved shirt, long pants, shoes and socks) or with personal protective equipment (PPE and gloves). The exception was for workers performing activities related to: on-farm seed treatment to barley, canola, cotton, millet, and wheat (MOEs ranged from 4 to 94); the handgun application for citrus (MOE = 58); and seed planter exposure for flax which showed a slight exceedance (MOE = 98). Workers conducting seed treatment on barley and cotton would need to wear double layer clothing and gloves to reach acceptable MOEs; for workers applying imidacloprid to citrus using handguns, only the addition of gloves would be needed; uses such as canola, millet, and wheat show lower MOEs ranging from 4 to 37, which would require further mitigation such as conducting applications in commercial seed treatment facilities, to reduce risks below EPA's level of concern.

The occupational post-application dermal exposure assessment resulted in MOEs greater than the LOC of 100 and were not of concern; MOEs ranged from 440 to 4,800.

Cumulative Risks

EPA has not made a common mechanism of toxicity to humans finding for imidacloprid and any other substance, and it does not appear to produce a toxic metabolite produced by other substances. Therefore, EPA has not assumed that imidacloprid has a common mechanism of toxicity with other substances for this assessment.

2. Human Incidents and Epidemiology

An incident review was conducted from January 1, 2000 to August 27, 2008 and there were a large number (436) of single chemical incidents involving imidacloprid reported in the Office of Pesticide Program's Incident Data System (IDS). In the most recent IDS analysis, including search results from January 1, 2011 to April 26, 2016, 44 incidents were reported for single chemical (exposure to imidacloprid only), and 518 incidents reported for multiple active ingredients (combined exposure to imidacloprid and other active ingredients). In the aggregate IDS, 2,828 incidents were reported involving imidacloprid. In addition, the Sentinel Event Notification System for Occupational Risk (SENSOR) was queried from 1998 to 2013, and 318 cases involved imidacloprid (114 involved only imidacloprid). A query of the National Pesticide

Information Center (NPIC) from January 1, 2010 to December 31, 2015, identified 111 incidents, and 96 of those were reported to the California's Pesticide Incident Surveillance Programs (PISP) involving imidacloprid and other chemicals (2010 to 2013).

Since the 2017 draft human health risk assessment, a new human health incident memo, *Flumethrin: Tier I Update Review of Human Incidents and Epidemiology for Proposed Interim Decision*, was posted to the docket. Although the report was made as part of the flumethrin registration review, all incidents noted were from a single combined flumethrin-imidacloprid product (Seresto™ Collar, EPA Reg. No. 11556-155) and incorporate incidents from January 1, 2016 to August 27, 2019. During this time in the Main IDS there were 252 human health incidents reported that involved the active ingredient imidacloprid. Of these 252 incidents, 19 were classified as major severity and 233 were classified as moderate severity. In Aggregate IDS, there were 374 human health incidents reported involving imidacloprid. These incidents were classified as minor severity.

Of the 19 major severity incidents in main IDS that were further reviewed, the symptoms most often reported were dermal (8) and neurological (7). However, a patient could exhibit multiple symptoms. Dermal symptoms reported include rash, redness, skin lesions, hives, and pruritus. Neurological symptoms reported include headaches, numbness, tingling and one person reported seizures. The total number of imidacloprid incidents reported to IDS, from 2013 to 2018, appeared to be increasing over time. The agency will continue to monitor the incident data and if a concern is triggered, additional analysis will be conducted.

3. Tolerances

Tolerances for imidacloprid are established on a variety of raw agricultural and livestock commodities for the U.S.; for Canada, Mexico and Codex the residue definition is harmonized. However, there are many international tolerances that are not harmonized with the U.S. tolerance. Most cannot be harmonized because the U.S. uses have higher application rates, and thus higher tolerance levels. The agency proposes increasing the US tolerances for residues of imidacloprid on citrus fruits and coffee to harmonize with Canada and Codex MRLs. Additionally, EPA is proposing eliminating trailing zeros listed in tolerances consistent with agency policy. All proposed tolerance revisions for imidacloprid are listed in Appendix E: Summary of Proposed Tolerance Actions.

4. Human Health Data Needs

The human health database for imidacloprid is complete. No additional data is needed for the imidacloprid registration review.

B. Ecological Risks

A summary of the agency's ecological risk assessment is presented below. The agency used the most current science policies and risk assessment methodologies to prepare a risk assessment in support of the registration review of imidacloprid. For additional details on the ecological

assessment for imidacloprid, see the following documents, which is available in the public docket (EPA-HQ-OPP-2008-0844) at www.regulations.gov.

- *Preliminary Aquatic Risk Assessment to Support the Registration Review of Imidacloprid*
- *Imidacloprid – Transmittal of the Preliminary Terrestrial Risk Assessment to Support the Registration Review*
- *Final Bee Risk Assessment to Support the Registration Review of Imidacloprid*
- *Comparative Analysis of Aquatic Invertebrate Risk Quotients generated for neonicotinoids using Raby et al. (2018) toxicity data*

The EPA is currently working with its federal partners and other stakeholders to implement an interim approach for assessing potential risk to listed species and their designated critical habitats. Once the scientific methods necessary to complete risk assessments for listed species and their designated critical habitats are finalized, the agency will complete its endangered species assessment for imidacloprid. See Appendix C for more details. As such, potential risks for non-listed species only are described below.

5. Risk Summary and Characterization

Terrestrial Exposure

Imidacloprid is applied through aerial and ground application methods, which includes sprayers, chemigation and soil drenching, and seed treatment. For terrestrial wildlife, the agency modeled potential dietary exposure based on consumption of imidacloprid residues on food items following spray (foliar or soil) applications as well as from ingestion of residues on treated seeds. For treated seeds, different seed sizes and planting rates could result in a range of exposures. EPA also considered potential bird and mammal dietary exposure from fields where applied manure from poultry house operations may contain imidacloprid residues resulting in contamination of food items (*e.g.*, insects) and/or incidental ingestion of contaminated soil particles.

Overall, acute risks to avian and mammalian species from foliar and soil treatments of imidacloprid appear to be low. Soil incorporation following soil treatments, including incorporation of treated poultry litter, decreases potential risks from this use pattern considerably. Exposures from treated seed results in the highest acute and chronic risks to terrestrial organisms. However, the risks vary considerably. A low number of small treated seeds (*e.g.* lettuce and sugar beets) are required to reach levels of concern for smaller birds and mammals because the surface of these seeds have higher concentrations of a.i. applied. Also, these smaller seeds are easier for small birds and mammals to consume because of their small size. However, larger seeds (*e.g*. corn and soybean) pose far lower risks to birds and mammals because lower concentrations of a.i. are applied to the seed surface. Also, the larger size of these seeds prevents smaller birds and mammals from consuming them.

For terrestrial invertebrates, the primary routes of exposure assessed include contact of bees with spray droplets and oral ingestion via pollen and nectar. Additionally, exposure can occur from

seed treatment dust. Exposure can vary based on use patterns and the attractiveness of a treated crop.

For terrestrial plants, available data indicate they are not sensitive to imidacloprid up to 2X its maximum single foliar application rate of 0.25 lb a.i./A. Therefore, exposure modeling (and risk estimation) for terrestrial plants was not conducted.

Mammals – Risk Estimates

Imidacloprid is classified as moderately toxic to mammals on an acute oral exposure basis. Chronic exposure in the Norway rat (*Rattus norvegicus*) resulted in reductions in parental and offspring body weight. The chronic mammalian risk quotients (RQs) calculated for imidacloprid were based on the chronic mammalian rat 2-generation reproduction NOAEL of 16.5 mg/kg-bw/d. Potential risk was evaluated at three different weight classes of mammal: small (15 g), medium (35 g), and large (1000 g). Further details on mammalian risks are provided below.

Foliar Applications: There were no acute risks of concern via foliar applications for mammalian species of any weight class, even when assessed using the maximum registered single application rate of 0.4 lb a.i./A (RQs <0.01 – 0.11; LOC = 0.5). Acute RQs were highest for small mammals feeding on short grass.

There were no chronic LOC exceedances on a chronic dietary basis for all application rates (highest RQ = 0.44; LOC = 1.0), but there were exceedances for dose-based RQs for 15 of 17 uses (highest RQ = 2.9 on citrus/pome). Expected risks rose with increases in the modeled application rate and for smaller sized mammals.

Soil Applications: There were no acute risks of concern via soil applications for mammalian species of any weight class even when assessed using the maximum registered single application rate of 0.4 lb a.i./A (RQs <0.01 – 0.37). Acute RQs decreased with weight class and were highest for small mammals feeding on short grass.

There were no chronic LOC exceedances on a chronic dietary bases for all application rates (highest RQ = 0.19), but there were dose-based risks of concern for 18 uses (highest RQ = 1.2). Expected risks rose with increases in the modeled application rate and for smaller mammals. No exceedances to mammals were noted from use on poultry litter.

Treated Seed Applications: RQs were calculated for six crops (corn, soybean, cotton, wheat, sorghum, and potato) when assessing potential risks to mammals from imidacloprid-treated seeds. Modeled uses were selected to be representative of high acreage crops (*e.g.,* corn, soybean, cotton), to provide a range of application rates (*e.g.,* sorghum 0.023 to potato 0.878 lb a.i./A) and present a range of application rate to seed size ratios. The acute species LOC was exceeded for four of the six scenarios (RQs ranged from <0.01 to 1.1; LOC = 0.5) for dose-based exposures. The highest acute RQ exceedances were for use on cotton.

The chronic LOC was exceeded for all size classes of mammals consuming each of the assessed treated seed with the exception of potato (RQs ranged from 0.3 to 29; LOC = 1.0), indicating potential chronic risk. The highest chronic RQ exceedances for treated seed was for cotton.

Mammals - Risk characterization
There are several variables impacting exposure to mammals from seed treatments, such as how far apart and how many seeds are available at a given time, the amount of cover provided by field conditions (newly planted fields are likely to be open and provide less cover than no till fields, making them less attractive as a forage location for smaller mammals), and whether or not seeds are on the surface of a field vs. incorporated into the soil. Seeds buried below the soil surface are not as easily found by foraging mammals, reducing the potential for exposure and increasing the amount of time required to find them, which in turn decreases the likelihood of potential chronic exposure. However, some mammals are highly capable of burrowing in soil and acquiring buried seeds and may cache them for later consumption. In addition, in the case of chronic risks, the impact of consuming treated seeds may vary by life stage. It is currently an uncertainty whether effects seen in laboratory-based reproduction studies occur at a specific sensitive life stage or are due to exposure over the entire exposure period.

Another source of uncertainty are the scaling factors used to predict toxicity in different size mammals. This is important because the number of seeds a mammal needs to consume before toxicological effect are expected varies by the size of the mammal, with larger mammals requiring a larger dosage for toxicological effects to be likely. According to the agency's *Imidacloprid – Transmittal of the Preliminary Terrestrial Risk Assessment to Support the Registration Review*, the percent of a mammals' diet that would need to be imidacloprid-treated seed in order to exceed the acute level of concern would be 34-78% for sorghum/wheat seed, 37-82% for corn seed, 160-331% for soybean seed, 47-96% for cotton seed, and 2200-3688% for potato seed, depending on mammal size. Dietary percentages greater than 100% indicate a low potential for risk while risk increases as the dietary percentage decreases below 100% since it is presumed more likely that a mammal would consume smaller fraction of its diet from the treated field. The highest potential risk scenario identified was small (≤15g) mammals consuming sorghum seed. In this example, an individual small sized mammal would need to consume 34% of its daily diet as treated sorghum/wheat seed in a day to exceed the acute level of concern.

Although our risk estimates indicate the potential for acute risks of concern, specifically for smaller sized mammals, there is uncertainty associated with the percentage of an individual mammal is likely ot be treated seed. Overall, risk of concern is more likely from chronic (long-term) consumption of treated seed.

Birds, Reptiles, and Terrestrial-Phase Amphibians – Risk Estimates
Imidacloprid is characterized as highly toxic to birds on an acute oral exposure basis and slightly toxic on a subacute dietary exposure basis. Japanese quail (*Coturnix coturnix japonica*) represents the most sensitive acute toxicity endpoint while mallard duck (*Anas platyrhynchos*) represents the most sensitive chronic toxicity endpoint with effects on egg production, egg hatchability, and adult body weight. Further details on ecological risks to birds, reptiles, and terrestrial phase amphibians from exposure to imidacloprid are provided below. Note that birds are used as surrogates for potential risks to terrestrial-phase amphibians and reptiles.

Foliar Applications: For foliar applications of imidacloprid, there were no acute or chronic risks of concern for birds on a dietary basis even when calculated using the maximum registered foliar single application rate of 0.4 lb a.i./A (RQs <0.01 – 0.86; LOCs = 0.5 for acute risks and 1.0 for chronic risks). Acute exceedances were identified on a dose basis with RQs ranging from <0.01 to 9.8 among all bird types, dietary items, and uses. Small and medium size herbivorous birds have the greatest frequency of exceeding the acute risk LOC, with exceedances in all 17 crop scenarios (representing 26 registered use patterns) for at least 3 of the 4 dietary categories. For large herbivorous birds, acute dose-based RQs range from 0.02 to 1.2, and LOC exceedances mainly occur for birds consuming short grass. For insectivores, acute dose-based RQ values range from 0.13 to 3.8 and exceed the acute LOC for small and medium insectivores, except for marginal exceedances for tree nuts and citrus/pome fruits. Lowest overall risk from foliar applications of imidacloprid is expected for granivores, with no exceedances of the acute risk LOC. RQs decreased with avian weight class and were highest for small birds feeding on short grass. In practice, given that most herbivorous avian species are expected to be classified as large birds (≥1,000 g), it is unlikely that herbivorous species will be at risk. However, it is possible that smaller omnivorous species that consume available foliage (e.g., seedlings) may be at risk.

Soil Applications: The potential for acute risk to birds consuming contaminated arthropods was identified for small and medium size birds for all crop exposure scenarios modeled (RQ range = 0.68 to 4.2). Chronic dose-based RQ values were not calculated for birds per the T-REX model. On a dietary basis, acute risk was not indicated (maximum acute RQ = 0.03). On a chronic dietary basis, risks to birds are not indicated since the chronic RQ values are below the LOC for all uses (RQs range from 0.14 to 0.38).

Based on an acute analysis (LD_{50}/ft^2) for soil applications of imidacloprid, the acute LOC was exceeded for small and medium size birds for all crop exposure scenarios modeled (acute RQ range from 1.2 to 20). For large birds, the crop uses with the highest application rates (*e.g.*, bulb vegetables, fruiting vegetables, citrus) slightly exceed the acute LOC of 0.2 with an RQs of 0.23. Potential risk to birds from use in poultry litter was not assessed in the terrestrial draft imidacloprid risk assessment.

Seed Treatment Formulations: As mentioned previously in the section for mammals, RQs representing potential risks to birds from imidacloprid-treated seeds were calculated for various crops and rates. Expected risks are highest for small birds and decrease with increasing avian body weight. For small and medium birds, there are acute dose-based LOC exceedances for all crops (RQs range from 0.15 to 99). For large birds, there are acute dose-based species LOC exceedances for birds feeding on soybean, wheat, corn, sorghum, and cotton seeds. On a chronic basis, the LOC was exceeded for birds consuming all of the assessed treated seeds (RQs ranged from 1.0 to 41). The highest chronic exceedances for all sizes of birds was from treated cotton seed with an RQ of 41.

Birds, Reptiles, and Terrestrial-Phase Amphibians - Risk characterization
In field conditions, the exposure of birds to imidacloprid seed is dependent upon many variables beyond the amount of active ingredient on a given treated seed. These factors include whether or not the treated seed is buried or on the surface of a field (as in the case of an accidental seed spill), the depth at which buried seed is buried, the number and density of treated areas across the

landscape, and the seed size relative to the size and foraging patterns of birds. For birds of any size, the attractiveness of the treated seed as a source of food is relative to the color or size of other available food sources. The size of a bird is also important in predicting effects expected from exposure, because larger birds generally need to consume more treated seeds before toxicological effects are observed.

Based on the agency's *Imidacloprid – Transmittal of the Preliminary Terrestrial Risk Assessment to Support the Registration Review*, the percent of which a bird's diet would need to consist of imidacloprid-treated seed in order to exceed the acute level of concern would be only 3% for field corn seed (risk only to large birds), 12% soybean seed (risk only to large birds), 1-4% cotton seed, and 1-3% sorghum/wheat seed, depending on bird size. The highest risk was identified for small size birds which would need to consume less than a single treated sorghum and wheat seed to exceed the acute level of concern, while with small or medium size birds consuming cotton, sorghum, and wheat seed, a bird would only need to consume 1-4 seeds [two (cotton) or four (sorghum and wheat)] to exceed the acute level of concern.

The size of a treated seed relative to the size of a given bird is another important variable to consider when characterizing potential risks from imidacloprid-treated seed. In the case of small birds, treated seeds which are large either due to pelleting or the size of an individual seed, may be too big for a small bird to swallow. Based on minimum weights of field corn seed (~225 mg), and cotton seed (~100 mg), these seeds are considered too big for most small passerine birds to consume. Examples of seeds too large for small passerine (20g) bird consumption includes are field corn, soybean, cotton, and potato. Therefore, acute and dietary risks from consumption of these seeds can be discounted for these size classes of passerines. Field corn and potato seeds are also considered too big for medium-sized passerine birds to consume. Other types of corn seed (*e.g.,* sweet, pop, etc.) exhibit a size range such that the average seed size is below the weight threshold for medium-sized passerines. Consequently, medium-sized passerines could still potentially be affected by consuming other corn varieties.

The largest birds would physically be able to consume a wider range of treated seeds, due to their size, but would need to consume a greater number of seeds than their smaller counterparts to experience negative health effects. As an example, for large birds foraging in cotton fields, 4% of their diet would have to be made up of the imidacloprid-treated seed in order to reach the species acute LOC compared to 1% of a medium bird's diet. Given the potential availability of other seed sources (*i.e.* remaining waste grain or seeds from weed species on the field), eating diets made up entirely of a specific seed type is unlikely but may be more likely in instances of treated seed spillage than through normal foraging behavior.

Terrestrial Invertebrates – Risk Estimates
This section incorporates information provided in the *Preliminary Pollinator Assessment to Support the Registration Review of Imidacloprid* as well as the more recent *Final Bee Risk Assessment to Support the Registration Review of Imidacloprid*, which are available in the public docket. The initial preliminary pollinator assessment published in 2016 evaluated the potential risk associated with the registered agricultural uses of imidacloprid to bees alone. The 2016 assessment utilized available data at the time. This included a robust registration review required dataset to help characterize the acute and chronic toxicity of imidacloprid to adult and larval

honeybees at the Tier I (individual bee effects) level. In each assessment (2016 and 2019), a plethora of available open literature data were also reviewed in addition to the required data.

The final 2019 bee risk assessment then updates the preliminary pollinator assessment and incorporates additional information submitted to the EPA since the previous assessment. This new assessment also includes additional residue study data, which provide information on residues of imidacloprid in nectar, pollen, and other plant matrices for registered crop uses; as well as a residue bridging strategy to extrapolate residue data among crops, chemicals, and plant matrices to address lack of residue data for certain crops between the neonicotinoids where appropriate. This additional information includes higher tiered (Tier II and III) data. Tier II data included both semi-field tunnel (rate-response) and feeding (dose-response) studies to help better evaluate potential colony-level effects, and tier III data evaluated colony-level effects which represented a more real-world scenario, however was associated with more uncertainty.

Imidacloprid is unique compared to the other neonicotinoids as it had the availability of Tier III full-field studies conducted on pumpkin and cotton, which were incorporated into the recent assessment. Data were requested based on a tiered approach, as lower tiered data could trigger the need for higher tiered data.

During the scoping of the registration review for imidacloprid, the agency identified the need to assess risk to terrestrial invertebrates. As a result, the agency issued requirements for a robust set of pollinator data, which included both exposure and toxicity data, along with higher tiered pollinator tests such as Tier II (semi-field) and Tier III tests (full field). During testing, honeybees (*Apis mellifera*) were used as a surrogate for other species of bees (*e.g.* bumblebees, solitary bees). Risks to these other non-*Apis* bees are evaluated qualitatively based on available information. As the pollinator risk assessment framework used by the EPA indicates, honeybees are intended to be reasonable surrogates for other bee species, and conclusions from the weight of evidence for the honeybee can be used to help inform about potential risks to other non-*Apis* species. An exception is noted based on the differences in attractiveness of crops to different bee species.

Among the four neonicotinoids (imidacloprid, clothianidin, thiamethoxam, and dinotefuran), robust data sets of pollen and nectar residue data are available for foliar and/or soil applications to the following bee-attractive crops and crop groups: cotton, cucurbits, citrus, stone fruit, pome fruit, tree nuts, berries/small fruits, and ornamentals. Surrogate residue data from the other neonicotinoids were used to represent uses on crops where limited or no residue data were available. Generally, the imidacloprid risk assessment found that foliar or soil applications of imidacloprid to honeybee attractive crops that are not harvested prior to bloom result in the potential for colony-level risks of concern. Risks associated with pre-bloom applications are generally greater than those associated with post-bloom applications.

Based on the evaluated data, imidacloprid is classified as very highly toxic to adult honeybees with acute oral and acute contact LD_{50} values of 0.0039 and 0.043 µg a.i/bee, respectively. For larval toxicity, there was no acute oral study available. At the Tier 1 (individual bee) level, acute contact RQs ranged from 2.5 to 31 (LOC = 0.4). Acute oral exposure to adult honey bees foraging on the treated field based on refined exposure (measured residues) from foliar

applications resulted in RQ exceedances up to 32 (orange), soil use RQ exceedances up to 126 (ornamentals), and combined foliar and soil exceedances up to 208 (cotton). The highest acute exceedances were from uses on citrus, pome fruit, ornamentals and turf.

For chronic oral toxicity to adult bees, a 10-day study indicated a No Observed Adverse Effect Concentration (NOAEC), at 0.0011 µg a.i/bee/day. The Lowest Observed Adverse Effect Concentration (LOAEC) based on significant effects on food consumption for this study was 0.0018 µg a.i/bee/day. A 21-day chronic toxicity test did not show significant effects up to and including the highest concentration tested, 40 µg a.i/L (equivalent to 0.00183 µg a.i/bee). At the Tier 1 (individual bee) level, chronic adult oral RQ exceedances from on-field foliar use of imidacloprid based on refined exposure (measured residues) are up to 86 (orange), soil use exceedances are up to 224 (ornamental), foliar and seed exceedances are up to 7.7 (cotton) and, foliar and soil exceedances are up to 518 (cotton) (LOC = 1.0). Like with the acute risk exceedances, the highest chronic risk exceedances noted were from uses on citrus, pome fruit, ornamentals and turf.

Based on an analysis of Tier I data, for foliar applications, potential off-field dietary risks to individual bees exposed to spray drift extend greater than 1000 feet from the edge of the treated field. There is uncertainty in this analysis including: assumptions on available attractive forage off field, use of individual level toxicity data, BeeREX default estimates for residues, and unrefined AgDRIFT™ modeling. Soil applications are assumed to have a low off-field risk because of low potential to drift.

Off-field estimates of risk are based on screening-level exposure estimates, which cannot be refined with available residue data. Moreover, these estimates relied on assumptions regarding crop-attractiveness to bees, exposures, cultural practices (*i.e.* harvest cycles), environmental conditions (*i.e.* canopy coverage), wind conditions (*i.e.* unidirectional and constant), etc. Therefore, potential off-field risks may be overestimated. Additionally, exposure to individual bees from off-site movement of abraded seed dust during planting is noted as a potential exposure route of concern.

Imidacloprid exposure to pollinators also exists where applications are made to poultry litter manure in broiler houses which are later used as outdoor fertilizer. Due to neonicotinoid persistence in the environment, poultry litter use resulted in acute risks of concern for bees when applied at the maximum allowed rate (0.032 – 0.756 lb a.i./A) and number of applications (six whole house treatments) and then utilized as fertilizer on agricultural fields. Based on that maximum rate, RQs calculated using the Bee-REX model showed exceedances up to 5.5 (larval chronic) and up to 21 (adult chronic). For the lowest application rate of 0.032 lb ai/A, RQ values are 0.23 (larval chronic) and 0.91 (adult chronic); below the LOC of 1.

On a colony-level, potential risks were identified for several scenarios. Since risks to honey bees were identified at the Tier 1 (individual bee) level, the Agency evaluated risks at the colony level (Tier II and Tier III). At the Tier II level, this involved comparing imidacloprid residues measured in pollen and nectar in various crops to levels that affect honey bee colonies. At the Tier III level, this involved analysis of full field studies that were conducted for pumpkin and cotton. These Tier III studies contained significant uncertainties associated with the study design

and availability of data which limited their utility. These uncertainties include the origin of the pollen and nectar brought back to the hives, high variability in the data collected (including in control hives), and inadequate replication or pseudo-replication (*e.g.* studies conducted using only one field). Ecological incidents were also considered as a line of evidence. For a detailed explanation of these risk estimates, please refer to the *Final Bee Risk Assessment to Support the Registration Review of Imidacloprid*, available in the docket. The findings of the higher tier assessment are summarized below.

Terrestrial Invertebrates – Risk Characterization
The agency utilized several lines of evidence to better refine the risk calls including: incorporating information on crop bee attractiveness, agronomic practices (*e.g.,* harvest time relative to bloom) to determine if exposure was present, a comparison of residues to adverse effects levels for entire hives (residues above NOAEC and LOAEC), and major categories of incidents. For comparison of residues to adverse effects levels for entire hives, EPA considered duration and frequency of exceedance, the magnitude of exceedance (including the ration of max residue value to NOAEC/LOAEC and percent of diet from the treated field needed to reach the NOAEC/LOAEC), as well as consideration of usage and geographic scale/spatial distribution of exposure.

It is important to note that multiple factors can influence the strength and survival of bees whether they are solitary or social. These factors, including disease, pests (*e.g.,* mites), nutrition, and bee management practices, can confound the interpretation of studies intended to examine the relationship of the test chemical to a receptor (*i.e*., larval or adult bee). Therefore, most studies attempt to minimize the extent to which these other factors impact the study; however, higher-tier studies afford less control over these other factors, and their role may become increasingly prominent as the duration of the study is extended. Although studies attempt to minimize the confounding effects of other environmental factors, there is uncertainty regarding the extent to which the effects of a chemical may be substantially different had these other factors not been present.

Strongest Evidence of Risk: For foliar and soil applications of imidacloprid, the lines of evidence are considered "strongest" for supporting the finding of colony-level risk resulting from applications to (with corresponding application method and timing of application with highest level of concern):

- citrus, banana/plantain (foliar and soil, pre-bloom),
- cotton (combined foliar + soil)
- berries (foliar and soil, pre-bloom),
- cucurbits (soil)
- attractive fruiting vegetables (chilies, peppers, foliar and soil), and
- attractive ornamentals and forest trees (foliar, soil)

These findings are supported by multiple lines of evidence indicating that residues exceed the imidacloprid colony-level endpoints by a high magnitude, frequency and/or duration. In some cases, they are also supported by modeled residues or ecological incidents involving bees that are associated with the use.

Moderate Evidence of Risk: For foliar, soil, and trunk injection application of imidacloprid, the strength of evidence is considered "moderate" in indicating a colony-level risk to honeybees for the following registered uses:

- citrus (soil, post-bloom),
- tree nuts (soil, post-bloom),
- cotton (foliar and soil),
- turf (including residential lawns), and
- ornamentals and forestry (trunk injection).

These findings are supported by lines evidence indicating that residues exceed the imidacloprid colony-level endpoints but the magnitude, frequency and/or duration of exceedance is limited. In some cases, residues exceed only for a subset of sites or crops, possibly due to the impact of soil type (*e.g.,* soil applications to cotton).

Weakest Evidence of Risk: For foliar, soil and seed treatment applications of imidacloprid, the strength of evidence is considered "weakest" in indicating a colony-level risk to honeybees for the following registered uses:

- root/tubers (foliar, soil),
- legumes (soil, seed, beans),
- citrus (foliar, post-bloom),
- pome and stone fruit (foliar & soil, post-bloom),
- herbs and spices (foliar, soil),
- tropical fruit (foliar & soil, post-bloom), and
- hops/peanut (foliar, soil, seed)

Terrestrial Plants

Imidacloprid was not found to be toxic to terrestrial plants when tested up to its maximum single application rate. Due to the low sensitivity of terrestrial plants to imidacloprid applications up to the maximum single rate, a quantitative risk assessment was not conducted for terrestrial plants.

Aquatic Risks

Imidacloprid is applied through aerial and ground application methods, which includes sprayers, chemigation and soil drenching, and seed treatment. For aquatic wildlife, the agency modeled potential exposure based on the likelihood of imidacloprid residues reaching aquatic waterbodies. Imidacloprid's chemical properties indicate it is readily soluble in water and that volatilization and bioaccumulation in aquatic organisms are negligible. Imidacloprid is considered persistent in aquatic environments with the exception of conditions that favor aqueous photolysis. The major routes transporting imidacloprid from treatment sites to aquatic habitats include runoff and spray drift.

Freshwater Invertebrates

Based on the *Preliminary Aquatic Risk Assessment to Support the Registration Review of Imidacloprid* dated December 22, 2016, acute and chronic risks of concern to freshwater invertebrates for imidacloprid were identified for both agricultural and non-agricultural soil, foliar, and combined application method uses. All uses associated with foliar spray and combination application methods showed the potential for acute and chronic risks to freshwater invertebrates. Acute RQs ranged from <0.01 to 44 and exceeding the LOC of 0.5, while chronic RQs ranged from <0.01 to 2130 exceeding the chronic LOC of 1.0. Chronic freshwater RQ exceedances were generally highest for combined applications (39 to 2130), then foliar (82 to 1020), followed by soil (<0.01 to 699), and then seed (<0.01 to 84). A similar trend was seen with acute risks of concern.

Comparative Analysis of Aquatic Invertebrate Risk Quotients

While imidacloprid had a fairly comprehensive dataset for the agency to estimate potential aquatic risk, the other neonicotinoids in this group had much more limited dataset for the draft aquatic risk assessment. The agency generated a *Comparative analysis of Aquatic Invertebrate Risk Quotients generated for neonicotinoids using Raby et al. (2018) toxicity data*, which became available following publication of the *Preliminary Aquatic Risk Assessment to Support the Registration Review of Imidacloprid* (2016). The studies, located in the docket, were used to determine RQs using acute and chronic toxicity data provided in the two open literature papers published by researchers from the University of Guelph, Raby data (Raby *et al.* 2018a[6] and Raby *et al.* 2018b[7]). With use of the available raw data, EPA determined the results could be used quantitatively for risk assessment purposes (*i.e.,* to derive RQs). Upon the review of the Raby data, risks of concern were identified for all four neonicotinoid insecticides (dinotefuran, clothianidin, thiamethoxam, and imidacloprid) to freshwater invertebrates on both an acute and chronic basis.

On an acute basis across all tested species, LC_{50} values for dinotefuran were similar, but slightly higher than imidacloprid. LC_{50} values for clothianidin on average were 2.4 times higher than those of imidacloprid and dinotefuran, suggesting that clothianidin may be somewhat less toxic on an acute basis than imidacloprid and dinotefuran. Thiamethoxam LC_{50} values were 5.6 times higher than those of imidacloprid across all tested species, suggesting that thiamethoxam is potentially the least toxic on an acute basis.

All four neonicotinoids present risks of concern to freshwater invertebrates on a chronic basis as well, with clothianidin and imidacloprid having similar toxicity, dinotefuran being ~2.3 times less sensitive, and thiamethoxam being ~5.3 times less sensitive than imidacloprid and clothianidin based on midge data (which was generally more sensitive than mayfly, the other tested species in the chronic test). There is a ~4 times difference in sensitivity across the four neonics with dinotefuran being the least sensitive; despite an almost 20 times difference between

[1] Raby, M; Nowierski, M.; Perlov, D; Zhao, X.; Hao, C; Poirier, D.G. and P.K. Sibley. 2018a. Acute Toxicity of 6 Neonicotinoid Insecticides to Freshwater Invertebrates. Environmental Toxicology and Chemistry, 37 (5): 1430–1445. MRID 50776401.

[7] Raby, M; Zhao, X.; Hao, C.; Poirier, D.G. and P.K. Sibley. 2018b. Chronic toxicity of 6 neonicotinoid insecticides to Chironomus dilutus and Neocloeon triangulifer. Environmental Toxicology and Chemistry, 37 (10): 2727-2739. MRID 50776201.

mayfly toxic endpoints. There is a similar trend with the mayfly data with dinotefuran (and thiamethoxam) being the least sensitive.

Two notable uncertainties with the Raby data include: 1) inconsistent analytical verification of concentrations, and 2) differing control performance in the imidacloprid testing.

For 1), not all test concentrations were confirmed through analytical verification. As a result, the LC_{50} and NOAEC values are based on nominal concentrations. From the limited subset of test concentrations that were analyzed, the measured values were similar to the nominal concentrations, and is not expected to have a substantial impact on the reliability of the acute and chronic toxicity values.

For 2), the chronic midge test showed a reduction in the performance of control organisms with regards to growth and reproductive endpoints, relative to controls in the other tests. Due to this, there is potential that the imidacloprid midge toxicity endpoints underestimate the actual toxicity of imidacloprid to midges. However, the chronic endpoint used for comparison of the neonicotinoids done by the agency was the percent emergence endpoint, which for the imidacloprid controls did meet EPA test method standards and was generally one of the most sensitive endpoints across chemicals.

Both mayfly and midge studies tested all four neonicotinoids, however when considering exposure, dinotefuran tended to have the highest estimated exposure concentrations (EECs) among the four chemicals. The other three neonicotinoids were estimated to have similar EECs to each other. On an acute basis, for the mayfly and midge acute RQs, the majority of clothianidin and dinotefuran RQs were greater than those of imidacloprid. Thiamethoxam appears to present a lower acute risk concern when considering the midge RQs. On a chronic basis more generally, clothianidin, dinotefuran, and imidacloprid, have similar chronic RQs with a few exceptions: tree fruit RQs for imidacloprid were eleven times higher than the other A.I.s; foliar nursery and soil forestry applications RQs for clothianidin were an order of magnitude higher than imidacloprid; foliar and soil applications as well as seed treatment RQs for imidacloprid were 13-220 times higher than thiamethoxam. Overall thiamethoxam was found to have lower exceedances to aquatic invertebrates than the other three nitroguanidine neonicotinoids.

Estuarine/Marine Invertebrates

Acute risks were not identified for saltwater invertebrates. Chronic risks to saltwater invertebrates were identified for all application methods with RQs ranging from <0.01 to 131. The highest exceedances being identified from combined uses (2.4 to 131) followed by foliar (5.0 to 63), soil (<0.01 to 43), then seed treatment (<0.01 to 5.1) (LOC = 1.0).

Freshwater/Estuarine/Marine Fish and Aquatic-Phase Amphibians

The *Preliminary Aquatic Risk Assessment to Support the Registration Review of Imidacloprid*, dated December 22, 2016, noted no direct risks of concern to fish or aquatic phase amphibians from any of the agricultural or non-agricultural uses assessed. The limited number of aquatic incidents reported for imidacloprid indicate a lack of direct adverse impacts on fish. Furthermore, available monitoring data indicate detected concentrations of imidacloprid are

several orders of magnitude below levels shown to cause adverse effects in fish and aquatic-phase amphibians. While the potential risk of direct effects of imidacloprid to fish and amphibians is considered low, the potential exists for indirect risks to fish and aquatic-phase amphibians through reduction in their invertebrate prey base.

Aquatic Vascular and Non-Vascular Plants
Potential imidacloprid risk to aquatic plants is expected to be low. Aquatic plants were not assessed as available data for vascular and non-vascular aquatic plants indicate toxicity endpoints that are several orders of magnitude above the highest EECs in surface waters.

6. Ecological Incidents

Ecological incidents were noted as possibly stemming from imidacloprid usage for several taxa. The certainty of these incidents stemming directly from imidacloprid use varies. It is important to note incident information serves as one line of evidence, and that the absence of reports does not indicate an absence of general incidents or pollinator losses due to pesticides.

Terrestrial non-pollinator incidents

A review of the Environmental Information Incident System (EIIS) incident database yielded 16 reported terrestrial organism incidents from 1995 to 2017. These incidents are discussed in more detail in, *Imidacloprid – Transmittal of the Preliminary Terrestrial Risk Assessment to Support the Registration Review*. For incidents originating from foliar applications, the reports primarily concern plant damage to agricultural crops, but are all associated with either "unlikely" or "possible" certainty indices due to the presence of multiple pesticides or no confirmatory residue analysis to confirm the presence of imidacloprid.

For the soil or ground-applied related incidents reported, 4 of the 7 incidents (57%) were associated with a "possible" certainty. Three of these incidents involved deaths to birds, yet there was no confirmatory residue analysis conducted in any of these cases to implicate imidacloprid or any other chemical as the cause of the mortality. In two other reports associated with higher certainty, plant damage was the reported effect, although at least one of these reports cites a misuse of the chemical. As described previously, imidacloprid did not show significant effects to ten species of plants at the highest application rate (0.5 lbs. AI/A) permitted, therefore it is unlikely to be the cause of the incident. In a recent (2016) report, 25 American goldfinches were reported dead shortly following a soil drench application to elm trees with a product containing 75% imidacloprid. A subsequent residue analysis of the livers and stomachs detected imidacloprid residues at 2.1 and 2.2 ppm, respectively, which indicates imidacloprid's presence in the bird. The pathology report also noted grass seeds in the stomachs of the birds.

For the sole report associated with a seed treatment application, although a large number of birds were reported as allegedly dying due to ingestion of imidacloprid-treated wheat seeds, a subsequent residue analysis did not detect imidacloprid in the birds. This incident was categorized as "possible."

For 3 of the 4 incidents in the unknown method of application category, the incidents appear to be associated with homeowner lawn care products, specifically grub control products. Although these incidents list damage to the homeowner lawns, the relevancy of these incidents relative to others where agricultural crops and or avian and mammalian wildlife is concerned is low given that homeowner-applied products are subject to a greater chance of misuse relative to those made by certified applicators.

Aquatic incidents

The incident database (1995 to 2017) also noted two wildlife incident reports concerning aquatic organisms (*i.e.,* fish and invertebrates). Both incidents were associated with non-agricultural uses of imidacloprid on turf. One of these incidents was notably a misuse, which in addition to imidacloprid, also contained the pesticides thiophanate-methyl and deltamethrin, the latter of which is known to be more toxic to fish which was the affected species in the incident report. These two aquatic incidents are categorized in more detail in, *Preliminary Aquatic Risk Assessment to Support the Registration Review of Imidacloprid*.

Pollinator incidents

The source of pollinator incidents includes not only EIIS but registrant reports submitted under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) §6(a)(2) reporting requirement, as well as reports from local, state, national and international level government reports on bee kill incidents, news articles, and correspondence made to the agency by phone or via email (through beekill@epa.gov) generally reported by homeowners and beekeepers. These incidents are described in more detail in, *Final Bee Risk Assessment to Support the Registration Review of Imidacloprid*, in the imidacloprid docket.

14 of the 19 incidents summarized either included a follow-up investigation that confirmed through residue analysis the presence of imidacloprid in at least one matrix (dead bees, floral pollen, nectar), or were submitted by the registrant under FIFRA 6(a)(2), which provides a higher confidence of imidacloprid being associated with these incidents. Ten of these incidents originated from an agricultural use while others were mainly from residential and commercial use on ornamentals. In some of these instances, other chemicals (including other neonicotinoid chemicals) were also detected. For others, the incident was determined to originate from a misuse of imidacloprid.

Of the ten incidents reported on agricultural crops, half were from soil applications and half were from seed treatment applications. Of the soil applications, four reported dead honeybees near citrus and soybean fields, while one reported dead bumble bees in greenhouse tomatoes. Most non-agricultural incidents involved applications to ornamental tree species; linden, arbutus, and laurel.

Several other incident reports were more anecdotal in the narrative, as they provided information without a confirmatory residue analysis such as news reports and beekeeper organization newsletters. Of the incidents that provided a residue analysis, imidacloprid concentrations of dead bee samples were quantified as high as 2,456 µg/L.

Pet incidents

The EPA has received and evaluated numerous pet incidents since imidacloprid's registration in 1994; however, a comparative assessment of pet incidents across all registered pet products based on usage data is not available. The agency is conducting similar analyses on other pesticides registered for direct treatments to pets, such as spot-ons, and may consider conducting such analyses for other active ingredients with products registered for direct treatments to pets, such as collars. EPA has been engaged with stakeholders on a variety of different actions to address potential risks to pets from the use of pet spot-on products; additional information on this project can be found here: https://www.epa.gov/pets/epa-evaluation-pet-spot-products-analysis-and-plans-reducing-harmful-effects. As additional information is gathered through this project, EPA will be evaluating the use of pet products generally, including those that contain imidacloprid, to determine if additional changes are needed to pet product registrations.

The agency will continue to monitor ecological incident information as it is reported to the agency. Detailed analyses of these incidents are conducted if reported information indicates concerns for risk to non-target organisms.

7. Ecological and Environmental Fate Data Needs

The ecological and environmental fate database for imidacloprid is complete. No additional data are needed for the imidacloprid registration review.

C. Benefits Assessment

The EPA conducted a number of use site-specific benefits assessments for the neonicotinoids as a pesticide class. Each assessment considered the advantages of the individual neonicotinoid active ingredients, including their use in targeting particular pests, average application rates, acres treated, and potential alternatives, which are described in detail in the benefits assessments available in the docket (see section 1.A. for a full list of available benefits documents).

The agency found that as a group, the neonicotinoid insecticides:

- can control a variety of piercing and sucking pests including those that vector plant diseases such as aphids and whitefly;
- each show certain benefits for the control of particular pests;
- offer both immediate, contact control and systemic, residual control of pests over an extended period of time;
- are comparatively less expensive and more effective than some alternatives;

For imidacloprid specifically, the agency found benefits of usage includes selective activity, a unique mode of action for resistance management, systemic and translaminar activity, minimal toxicity to most predatory or parasitoid insects, and the capacity to target hard-to-control pests. Imidacloprid usage suggests it provides superior control of aphids and whitefly (while other neonicotinoids are beneficial for control of other insects). Alternatives to imidacloprid, depending on the crop or use site and target pest, include organophosphates, pyrethroids, and

carbamates, as well as alternative nitroguanidine and chloropyridinyl neonicotinoids such as thiamethoxam and acetamiprid, respectively.

The following are summaries of the benefits assessments available in the public docket[8]:

Cotton
An average of 6.4 million acres of cotton are treated with a neonicotinoid insecticide. EPA estimates that almost 69% of acres receive at least one application of a neonicotinoid primarily with imidacloprid and thiamethoxam. Accounting for multiple treatments per acre, nearly 9 million acres of cotton are treated with neonicotinoids annually; imidacloprid accounts for about 35% of these acres. Imidacloprid is applied primarily via seed treatment but is also registered for foliar and soil treatments. An average total of 3.2 million acres are treated with imidacloprid annually with a total of 192,000 average pounds of active ingredient applied at an average application rate of 0.060 lbs. AI/A. The vast majority of treated cotton acreage is via seed treatment at rates below the overall average. Rates of at-plant soil applications and in-season foliar applications average 0.169 lbs AI/A and 0.071 lbs AI/A, respectively. Of cotton foliar applications (both via ground and aerial applications), imidacloprid accounts for over half of the neonicotinoid use in terms of pounds applied but less than 40% of the acres treated.

Foliar usage of imidacloprid in cotton most commonly targets plant bugs, aphids, and stink bugs. There are regional differences in pest pressure. Stink bugs are somewhat more common targets in the Southeast than in the Mid-South and Plains states. In the Plains states, the primary target pest is the fleahopper. These pests cause a variety of damage throughout the growing season and can account for not only early season yield losses but in the case of "sticky cotton", when lint and other contaminants adhere to cotton processing equipment, caused by late season whiteflies and aphids, limiting the viability and sale of final product. Without imidacloprid or other nitroguanidine neonicotinoids, growers would probably use a combination of an organophosphate with a pyrethroid, such as acephate or dicrotophos with lambda-cyhalothrin or bifenthrin, which would increase costs – and lower income – by $3 to $7/acre, depending on the region.

For more information, see *Benefits of Neonicotinoid Insecticide Use in the Pre-Bloom and Bloom Periods of Cotton*, available in the public docket.

Citrus
Based on information from market research data, imidacloprid and thiamethoxam were the main neonicotinoid active ingredients used on citrus groves nationally from 2011 – 2015. On average, 104,000 pounds of imidacloprid were used annually on 274,000 acres of citrus with over 417,000 total acres treated with imidacloprid for an average of 1.5 applications per year. Neonicotinoids are used on citrus as part of programs to control the Asian citrus psyllid (ACP), a vector for Huanglongbing bacterial disease (HLB), also known as citrus greening disease. HLB is currently incurable; it negatively affects both the quantity and quality of fruit and may kill trees within a few years. Without imidacloprid, used in conjunction with other neonicotinoids, growers would increase use of other insecticides such as organophosphates and pyrethroids like acephate,

[8] https://www.regulations.gov/docket?D=EPA-HQ-OPP-2008-0844

dicrotophos, bifenthrin, lambda-cyhalothrin, and cyfluthrin, as well as acetamiprid, a chloropyridinyl neonicotinoid. Control costs would increase, and control would likely be compromised as well, leading to an increased number of trees infected with HLB, which would have to be removed and replaced at substantial cost.

In citrus production, neonicotinoids are also used to control a variety of other insect pests such as aphids, leafminers, citrus rust mite, fuller rose beetle, and scale insects, that occur outside the bloom period.

For more information, see *Benefits of Neonicotinoid Insecticide Use in the Pre-Bloom and Bloom Periods of Citrus*, available in the public docket.

Grape

Pesticide usage data from 2013 – 2017 indicate that over 500,000 acres of grapes are treated annually in the U.S. with imidacloprid, or around 50% of table, raisin, and wine grapes. Applications are most often made post-bloom, but imidacloprid is also a leading insecticide prior to and during bloom. Extension guides recommend imidacloprid in a regiment for most grape insect pests. The primary target pests are leafhoppers, including sharpshooters, and mealy bugs, with the grape berry moth and Japanese beetle being important pests of grapes in the northeast. Damage from these pests can result in quality and yield reductions. Sharpshooters vector Pierce's Disease which is a fatal bacterial disease for grapes that can result in 100% yield loss. Imidacloprid provides rapid control via contact activity and residual control through systemic activity. More generally, neonicotinoids are important rotation partners for resistance management.

Neonicotinoids provide substantial benefits to grape growers, given that the alternative insecticides are limited and/or more expensive depending on target pest. If imidacloprid and other neonicotinoids were unavailable, yield and quality loss, including losses from disease, would be likely.

For more information, see *Benefits of Neonicotinoid Insecticide Use in Grapes and Impacts of Potential Mitigation*, available in the public docket.

Rice

While EPA conducted a benefits assessment for rice, imidacloprid is not registered for use in rice and thus was not included in the rice benefits assessment.

Stone Fruit

The stone fruit benefits assessment included apricot, sweet and tart cherries, peaches/nectarines, and plums/prunes as well as several other varieties and hybrids. The proportion of U.S. cherry crop treated with either imidacloprid (40%) or thiamethoxam (23%) is substantial while applications to peach/nectarine crop treated with neonicotinoids is far less, imidacloprid makes up the most with 8%. For apricot and plums/prune, about 5% of the crop is treated with imidacloprid, while use of other neonicotinoids is negligible. Thus, the focus of the benefits assessment was on cherry and peach.

Pests on stone fruit for which imidacloprid may be used include plum curculio, aphids, cherry fruit fly, stink bugs, plant bugs, oriental fruit moth, and spotted wing Drosophila. Of these, plum curculio is a significant pest for which post-bloom control is critical. However, among the nitroguanidine neonicotinoids, thiamethoxam is considered more efficacious than imidacloprid for this pest. Plum curculio is a beetle which deposits eggs on or near developing fruit. Its larvae feed inside fruit and this can lead to fruit drop or cosmetic damage to larger fruit (USDA 2011). In addition, buyers and processors have a zero-tolerance policy for infestations, and detection of a single larva will result in rejection of the entire harvest from a given orchard block. Imidacloprid is more often utilized to manage fruit flies, another critical pest in terms of both yield/quality loss and the threat of harvest rejection, as any fly infestation in harvested fruits also faces a 'zero tolerance' policy among buyers. Aphids targeted by imidacloprid use can be occasionally serious pests, particularly to young trees. The spotted wing Drosophila is a tiny "vinegar" fly, native to east Asia, which was accidentally introduced into the United States in 2009. It prefers soft-skinned fruit for oviposition and (unlike fruit flies) has the ability to lay eggs in undamaged fruit. Like the curculio and fruit flies, Drosophila larvae are internal fruit feeders, and feeding increases the incidence of fungal and bacterial diseases in the affected fruit. Among stone fruit, however, cherries are most vulnerable to this pest, though it can be found on ripe plums and peaches as well. Due in part to the difficulty of detecting this tiny insect, its damage, and the zero tolerance among buyers for any infestation in the harvest, cherry growers in particular rely on frequent treatments of multiple insecticides in affected areas. Imidacloprid is one of these options.

For more information, see *Assessment of Usage, Benefits and Impacts of Potential Mitigation in Stone Fruit Production for Four Nitroguanidine Neonicotinoid Insecticides (Clothianidin, Dinotefuran, Imidacloprid, and Thiamethoxam)*, available in the public docket.

Pome Fruit
Imidacloprid is applied to approximately 158,200 total acres of pome fruit with a total of approximately 18,700 pounds applied (2013-2017). Imidacloprid use on Western apples accounts for approximately 95% of the total acres treated with nitroguanidine neonicotinoids. Imidacloprid is applied at an average rate of 0.106 lbs. AI/A for Western apples and 0.128 lbs. AI/A for Eastern apples. Imidacloprid is also used on pear, about 11% of the acres grown are treated at an average rate of 0.204 lbs. AI/A.

Imidacloprid is used for the control of pear psylla and mealybugs in pear and aphids and brown marmorated stink bug (BMSB) in apple production. These target pests can result in quality and yield loss. The majority of imidacloprid use is during the post-bloom to harvest periods of the pome fruit production cycle. However, 20-30% of the pome fruit crop is treated with neonicotinoids during the pre-bloom and bloom periods. For aphid control in Western apple production, imidacloprid is the second most used insecticide, following chlorpyrifos, during the pre-bloom and bloom periods, and the number one control option post-bloom. Early season control can be important to manage early season pests that can build up to high population densities if not controlled early season.

For more information, see *Usage, Pest Management Benefits, and Possible Impacts of Potential Mitigation of the Use of the Four Nitroguanidine Neonicotinoids in Pome Fruits (Apple, Pear)*, available in the public docket.

Berries

Berries refer to strawberry, caneberry (blackberry, raspberry, *etc.*), cranberry, and blueberry, as well as multiple other small soft fruit grown on very small acreage. Neonicotinoids, of which imidacloprid is often the most commonly used, provide both contact and systemic control of numerous economically significant pests in berry crops. Imidacloprid is used for the control of strawberry aphids, spittlebug, potato leafhopper, and whiteflies in strawberry; aphids, potato leafhopper, spotted wing drosophila (SWD), and thrips in caneberry; blackheaded fireworm, cranberry flea beetle, rootgrubs/rootworms, and weevils in cranberry; and aphids, sharpnosed leafhopper, blueberry maggot, and Japanese beetle in blueberry. These target pests cause direct feeding damage which can cause reductions in the aesthetic quality of harvested fruit (*e.g.,* Japanese beetle), transmit diseases which can result in plant death and/or crop loss (*e.g.,* aphids, leafhoppers, whiteflies), and can present damage during harvest that can potentially result in complete crop rejection, of a grower's entire field (*e.g.,* blueberry maggot).

A very high proportion of caneberries and blueberries are treated with imidacloprid while about ten percent of strawberry acreage is treated with imidacloprid. Data are not available for insecticide usage in cranberry. The alternatives to imidacloprid vary by crop and target pest and consist primarily of organophosphates, pyrethroids, flupyradifurone and acetamiprid in strawberry; organophosphates and pyrethroids in caneberry; organophosphates and spinosyns in cranberry; and acetamiprid, pyrethroids, organophosphates, and carbamates in blueberries. Imidacloprid, compared to its alternatives, offers flexibility of application method, cheaper cost compared to some alternatives, superior control compared to some alternatives, and longer residual control which reduces the number of applications needed resulting in further reduction of application costs.

For more information, see *Benefits of Neonicotinoid Insecticide Use in Berries (Strawberry, Caneberry, Cranberry, and Blueberry) and Impacts of Potential Mitigation*, available in the public docket.

Cucurbits

The cucurbits benefits assessment for the neonicotinoids includes usage in cantaloupes, watermelon, squash, cucumber, and pumpkin from emergence to harvest in the Western, Southern, and Northern production regions. Key pests treated by neonicotinoids include whiteflies and aphids. Imidacloprid is the most utilized neonicotinoid active ingredient on cucurbits followed by dinotefuran. Imidacloprid is applied most to cantaloupe (8,600 lbs. AI/A annually); however, in total, an average of 26,000 pounds of imidacloprid are applied annually to cucurbits.

According to pesticide market research data (2013-2017), imidacloprid is the most commonly-used insecticide prior to crop emergence. Imidacloprid is most commonly used on cucurbits to target aphids both prior-to-crop emergence and crop emergence-to-vining followed closely by its use to target cucumber beetle.

For more information, see *Benefits of Neonicotinoid Insecticide Use in Cucurbit Production and Impacts of Potential Risk Mitigation*, available in the public docket.

Other Crops: Fruiting vegetables, Brassica vegetables, Leafy Green vegetables, Tree Nuts, Root & Tuber vegetables, Bulb vegetables, Herbs, Peanut, Legume Vegetables, and Tropical and Subtropical Fruit

Neonicotinoids provide both contact and residual control of several important insect pests, primarily piercing and sucking pests that feed off the sap of plants and that may vector disease. Because they are systemic, both soil and foliar applications can be used, permitting growers flexibility in terms of application timing and method. Neonicotinoids are less widely used in production of bulb vegetables, succulent and dried legumes, peanut, and certain tropical fruits like avocados, dates, and olives. In these crops, target pests may be uncommon or rarely damaging and/or there are cost effective alternatives. Data for some small-acreage crops, such as herbs, are not available from which to draw conclusions.

In general, usage of imidacloprid is highest among the neonicotinoids. Most of the neonicotinoid usage in tree nuts is associated with imidacloprid although relatively little is used in almond production. Imidacloprid is also the primary neonicotinoid used in production of tropical fruits, for which acreage in the continental United States is generally very small. Of the crops grown on more than 10,000 acres, usage of imidacloprid is high in pomegranate, but low in avocado, dates, and olive. On peppers and tomatoes, 32% and 65% of the acreage is treated with imidacloprid, respectively. Similarly, the percent of acres treated with imidacloprid is high in most of the leafy vegetables and *Brassica* vegetables, ranging from nearly 35% to 75%. Imidacloprid is also the primary neonicotinoid used in production of root and tuber crops; over 20% of carrot acreage and over 35% of potato acreage are treated with imidacloprid, often by chemigation. However, 10% or less of peanut, dry and succulent beans and peas, and bulb vegetables are treated with imidacloprid.

To some extent, other neonicotinoids could be used as alternatives to imidacloprid. However, the pest spectrum is slightly different; imidacloprid tends to provide control over a greater range of sucking and piercing insects. Dinotefuran is not registered for use in tree crops; thiamethoxam is the only other nitroguanidine neonicotinoid registered for foliar application in carrot and imidacloprid is the only neonicotinoid registered for soil and foliar applications in legumes and peanut. Absent imidacloprid, alternative pest control strategies would vary widely across these crops and pests. Broad-spectrum insecticides such as organophosphates and pyrethroids may be used in some situations; more selective insecticides possibly in conjunction with insect growth regulators might be feasible in other situations. Few, if any, of these options have systemic activity and multiple applications may be needed to provide similar control to a single imidacloprid application.

For more information, see *Benefits of Neonicotinoid Use and Impacts of Potential Mitigation in Vegetables, Legumes, Tree Nuts, Herbs, Tropical and Subtropical Fruit Crops*, available in the public docket.

Turf and Ornamentals

The registrants of neonicotinoid insecticides commissioned a series of reports, prepared by the agricultural consulting firm AgInfomatics in 2014 on the value of neonicotinoids, or equivalently the impacts of a ban on their use on turf and ornamentals in the United States and Canada. The reports quantified the agronomic, environmental, and socio-economic values of neonicotinoids using a Choice Experiment to homeowners and professionals who manage turf and ornamentals. The turf and ornamentals industries in the U.S. account for over 400,000 businesses, millions of jobs, and billions in annual revenues. Turf and ornamentals add value to the homes of consumers through various means such as aesthetics, recreation, energy and water conservation. Insects can damage areas with turf and ornamentals, and thus reduce their value to consumers. Over 19,000 homeowners were surveyed by AgInfomatics and segmented into three markets based on the predominate "homescape" type: "flowers and shrubs," "lawns," and "trees." Over 700 turf and ornamentals professionals were surveyed through various professional associations and segmented into five business types: trees, greenhouse, lawn, nursery, and landscape ornamentals. The results of the homeowner survey showed that homeowners value neonicotinoid insecticides. The top concerns of homeowners applying insecticides to their homescape center around efficacy and safety (humans, pets, wildlife and bees) according to the data gathered in the choice experiment. The results show that when given a choice between two options, both of which are efficacious and safe for humans, the homeowners preferred the option that had the additional attribute of being safe on bees.

The results of the professional survey showed that professionals value neonicotinoids because professionals reported that neonicotinoids offer systemic properties; exhibit long-term efficacy; and provide a low-risk to the applicators, customers and their pets. The most used neonicotinoid active ingredient was imidacloprid (75% of survey respondents), followed by dinotefuran (17%), clothianidin (3%) and thiamethoxam (3%). Based on the results of this report, the most difficult pests to manage in the absence of neonicotinoids would be aphids, borers, white grubs, armored scales and whiteflies, respectively. Professionals stated that the negative business impacts from the absence of neonicotinoids would be driven mostly by the cost increases associated with the use of alternatives (*e.g.*, chemical and labor costs) and lower customer satisfaction. The possible alternatives in the absence of the neonicotinoids in order of preference are pyrethroids, organophosphates, avermectins, carbamates, and diamides.

Results from the econometric analysis using the Choice Experiment indicated that homeowners had different willingness to pay for pesticides based on their attributes. Although the authors used a rigorous approach, there were inconsistencies between model results and interpretation of results in the text. For example, AgInfomatics' survey omitted pertinent information relevant to the decision-making process of consumers. These omissions resulted in conclusions where AgInfomatics overvalued or undervalued the benefits of neonicotinoids within certain homeowner market segments relative to alternatives.

In addition to the homeowner and professionals' surveys, there were three case studies completed by AgInfomatics highlighting the benefits of neonicotinoids to control Southern chinch bugs in turf, silverleaf whiteflies in ornamentals, and emerald ash borers in trees. The emerald ash borer case study provided additional support on the value of neonicotinoids,

including imidacloprid in USDA pest management programs for additional invasive species (*e.g.*, spotted lanternfly, Asian longhorned beetle) attacking trees on federal lands.

Although there were areas for improvement in the report's methodology, results, and general conclusions; EPA agrees with AgInfomatics that neonicotinoids are a useful tool and often a top choice for pest control in the turf and ornamental industries.

For more information, see *Review of "The Value of Neonicotinoids in Turf and Ornamentals" prepared by AgInfomatics, LLC for Bayer CropScience, Mitsui, Syngenta, and Valent*, available in the public docket.

IV. PROPOSED INTERIM REGISTRATION REVIEW DECISION

A. Proposed Risk Mitigation and Regulatory Rationale

As discussed previously, EPA recognizes that the neonicotinoids, including imidacloprid, are a key tool for growers that provide unique and effective pest control. However, the agency has identified ecological risks of concern, particularly to pollinators and aquatic invertebrates, as a result of many of the same attributes that make the neonicotinoids effective pest management tools. Risk mitigation measures are being proposed to address human health risks of concern from imidacloprid to occupational handler and residential post-application scenarios; and ecological risks of concern identified for pollinators, birds, mammals, and to aquatic invertebrates, as described in Section III.

Risks of concern were identified to aquatic invertebrates, which play a foundational role in aquatic ecosystems. The agency is proposing several risk mitigation measures for reducing exposure to aquatic invertebrates, including targeted annual application rate reductions, along with spray drift and runoff management measures.

Risks of concern were identified to honeybees in EPA's assessments. The protection of honeybee populations is particularly important as honeybees play a critical role in the pollination needs of many U.S. crops. In 2017, pollination services from operations with more than 5 colonies were valued at over 160 million dollars, and annual honey production in the US was valued at over 340 million dollars[9]. Although the focus of the pollinator risk assessments is on honeybees, the agency recognizes that numerous other species of bees occur in North America and that these non-*Apis* bees have ecological importance in addition to commercial importance in some cases. For example, it is important to note that several species of non-*Apis* bees are commercially managed for their pollination services, including bumble bees (*Bombus spp.)*, leaf cutting bees (*Megachile rotundata*), alkali bees (*Nomia melanderi*), blue orchard bees (*Osmia lignaria)*, and the Japanese horn-faced bee (*Osmia cornifrons*). Importantly, a growing body of information indicates native bees play an important role in crop and native plant pollination, in addition to their overall ecological importance via maintaining biological diversity. EPA is therefore

[9] USDA, National Agricultural Statistics Service (NASS), Agricultural Statistics Board. (2018).

proposing mitigation that reduces impact to honeybees that are also expected to benefit other pollinating insects. Of these measures, reductions in maximum application rates for certain crops where pollinator/bee exposure may occur, or crop stage restrictions which limit exposure during critical periods in the growing season, are expected to have the highest potential impact in reducing risks to all pollinators. These measures were developed in a manner intended to preserve the majority of pest management utility, while also considering risk reductions for bees.

EPA reached out to a variety of stakeholders while developing the mitigation strategy in order to gain a better grasp of growing practices and potential benefits. As part of its assessments of the impacts of potential mitigation, EPA reviewed available information on the distribution of application rates used by applicators, and this information contributed to identifying when assumptions were made in the risk assessments regarding maximum rates may have overestimated certain risks. These analyses also allowed the EPA to determine where targeted rate reductions would decrease overall potential risks, while minimizing potential impacts to users. Proposed risk mitigation measures were identified by evaluating each neonicotinoid active ingredient and each use scenario for each crop individually, to determine the best path forward.

Overall, EPA is proposing addressing risk posed by current registered uses of imidacloprid uses through the following risk mitigation measures:

- Cancel residential spray applications to turf, on-farm seed treatment (of canola, millet, and wheat), and use on bulb vegetables;
- Require additional PPE;
- Reduce maximum application rates or restricting applications during pre-bloom and/or bloom, targeting certain uses with potentially higher pollinator risks and lower benefits;
- Preserve the current restrictions for application at-bloom;
- Require advisory language for residential ornamental uses;
- Apply targeted application rate reductions for higher risk uses;
- Require additional spray drift and runoff reduction label language; and,
- Promote voluntary stewardship efforts to encourage employment of best management practices, education, and outreach to applicators and beekeepers.

In selecting appropriate mitigation, EPA considered both the risks and benefits of imidacloprid use. Due to the potential impact to growers' ability to address certain critical pest issues, the agency did not propose risk mitigation on several uses, including citrus and grapes. For citrus crops, the neonicotinoids are a key element in programs to control the ACP, an invasive pest that transmits HLB, a devastating and incurable disease. In grapes, the neonicotinoids are used similarly to combat sharpshooters which vector Pierce's Disease, a fatal bacterial disease for grapes that can result in 100% yield loss. For other uses where mitigation was proposed, the mitigation does not completely eliminate all risks of concern from the use of imidacloprid, however does reduce overall risk and/or exposure. The agency finds the remaining risks to be reasonable under FIFRA given the benefits of the use of imidacloprid. The EPA is also proposing label changes to address general labeling improvements for all imidacloprid products.

1. Cancellation of Uses

The agency is proposing cancellation of imidacloprid residential spray applications to turf. This cancellation would eliminate risks of concern to both children and adults from the residential turf use. Although this use has potentially high benefits to homeowners, EPA is required to address non-occupational residential risks of concern under FQPA to ensure, "reasonable certainty that no harm will result from aggregate exposure" from each pesticide from dietary or other sources such as food, drinking water, and residential uses. Therefore, cancellation of the residential turf use is necessary and is being proposed.

The agency is also proposing cancellation of imidacloprid use on bulb vegetables to mitigate risks of concern to aquatic invertebrates. The highest risk estimates to aquatic invertebrates from bulb vegetable use were up to an RQ of 556. A benefits assessment was conducted for this use which showed limited usage of neonicotinoids, with an average of approximately 2,000 lbs. applied annually and a percent crop treated of 2-3% for imidacloprid. Although the benefits assessment noted that there were some benefits of neonicotinoids to target thrips, effective alternatives to the neonicotinoids remain available for use on bulbs. Cancellation of this use would also eliminate the risks identified for birds from foliar use of bulbs. In consideration of the potential risks and the relatively low expected benefits, EPA is proposing cancellation of this use.

2. Prohibition of On-farm Seed Treatment for Canola, Millet, and Wheat

As noted in Section III.A.1. of this PID, risks of concern have been identified for occupational handlers for the use on canola, millet, and wheat via on-farm seed treatment activities. Even with the maximum PPE (double layer of clothing, gloves, and an elastomeric half-mask respirator) required for these uses, MOEs ranged from 2 – 25, (LOC= 100). To address potential occupational risk concerns for workers involved in on-farm seed treatments of canola, millet, and wheat using imidacloprid, EPA is proposing prohibiting use of on-farm treatment facilities for these crops, and a requirement that treatment be conducted in commercial seed treatment facilities only. EPA is proposing that all imidacloprid products registered for canola, millet, and wheat seed treatment uses must include the following statement:

- "Must be applied in commercial seed treatment facilities only."

The aggregate impacts of this prohibition are uncertain because data on the extent of on-farm treatment of canola, millet, and wheat seed are unknown.

3. Personal Protection Equipment

Human health risks of concern were identified for several registered agricultural, seed treatment and liquid/foliar citrus handgun spray application use scenarios. EPA is proposing to mitigate these risks through cancellation of certain uses, where necessary, and adding requirements for Personal Protection Equipment (PPE) such as gloves, along with requiring certain applications take place in commercial seed treatment facilities. With cooperation from stakeholders there was

mutual agreement on the proposed label changes that would significantly reduce, and eliminate in many scenarios, risks of concern to workers.

Most occupational handler risk estimates were not of concern with current baseline attire or with personal protective equipment, however, several scenarios for workers performing activities related to: on-farm seed treatment to barley, cotton, and citrus were of concern. As stated in Section III.1 of this PID, there were several potential risks of concern to occupational handlers, including, short- and intermediate-term combined dermal and inhalation scenarios for barley and cotton seed treatment use and citrus handgun application. MOEs for seed treatment uses included barley and cotton, both with an MOE of 39 (LOC=100) with the current label-required single layer clothing and gloves. The agency is therefore proposing adding double-layer clothing and gloves for all handlers of imidacloprid barley and cotton on-farm seed treatments. The MOE for the liquid/foliar handgun application use on citrus was 58 without the current label language which does not require gloves. With the addition of single-layer gloves the MOE would be 160 and not of concern. The agency does not anticipate any risks of concern to handlers of imidacloprid with the addition of this risk mitigation.

Therefore, to mitigate potential dermal and/or inhalation risks to handlers, the agency is proposing requiring double-layer clothing and gloves for certain uses.

- Proposed uses to add requirement for double-layer clothing and gloves:
  - Barley – on-farm seed treatment use
  - Cotton – on-farm seed treatment use
- Proposed uses to add requirement for gloves:
  - Citrus – liquid/foliar handgun application

In addition, the agency is proposing to update the glove statements currently on labels to be consistent with the Label Review Manual[10]. The proposed new language does not fundamentally change the personal protective equipment that workers need to use, and therefore should impose no impacts on users. With cooperation from stakeholders, there was mutual agreement on the proposed label changes that would significantly reduce, and eliminate in many scenarios, risks of concern to workers.

4. Application Rate Reductions

Ecological risks of concern were identified for terrestrial and aquatic invertebrates as well as to birds and mammals, described in more detail in the draft risk assessments. To help mitigate these risks, EPA is proposing the following reductions in the maximum allowable annual application rates for foliar and soil applications of imidacloprid products.

[10] https://www.epa.gov/pesticide-registration/label-review-manual

Table 1. Proposed Maximum Annual Application Rates for Imidacloprid

Crop/Crop Group	Current Rate (Max. Annual)	Proposed Rate (Max. Annual)
Berries and small fruits (non-grapes)	Foliar and soil: 0.50 lbs. AI/A/yr	Maximum combined annual application rate for any berries regardless of formulation type should not exceed 0.40 lbs. AI/A/yr.
Brassica/Cole	Foliar: 0.23 lbs. AI/A/yr	Foliar: 0.20 lbs. AI/A/yr
Leafy Vegetables	Foliar: 0.23 lbs. AI/A/yr	Foliar: 0.20 lbs. AI/A/yr
Fruiting Vegetables	Foliar: 0.23 lbs. AI/A/yr	Foliar: 0.20 lbs. AI/A/yr
Root and tuber (not including potato)	Foliar: 0.12 lbs. AI/A/yr Soil: 0.38 lbs. AI/A/yr	Foliar: 0.10 lbs. AI/A/yr Soil: 0.31 lbs. AI/A/yr
Legumes (not including soybeans or peanuts)	Foliar: 0.13 lbs. AI/A	Foliar: 0.11 lbs. AI/A
Peanuts	Foliar: 0.13 lbs. AI/A	Foliar: 0.12 lbs. AI/A
Stone Fruit	Foliar: 0.50 lbs. AI/A Soil: 0.38 lbs. AI/A	Foliar: 0.40 lbs. AI/A Soil: 0.34 lbs. AI/A
Pome Fruit	Foliar: 0.50 lbs. AI/A	Foliar: 0.40 lbs. AI/A
Tree Nuts	Foliar: 0.36 lbs. AI/A Soil: 0.50 lbs. AI/A	Foliar: to 0.30 lbs. AI/A Soil: 0.36 lbs. AI/A
Cotton	Maximum combined annual application rate regardless of formulation type: 0.50 lbs. AI/A	Maximum combined annual application rate regardless of formulation type: 0.37 lbs. AI/A
Turf	Foliar and soil: 0.40 lbs. AI/A	Foliar and soil: 0.30 lbs. AI/A.
Production/Commercial Ornamentals	Foliar and soil: 0.40 lbs. AI/A	Foliar and soil: 0.30 lbs. AI/A

Application rate reductions are being proposed for several uses in order to reduce risks to both bees and aquatic invertebrates. For pollinators, these rate reductions focus on certain crops with the highest potential reduction of risks to bees. For bees and aquatic invertebrates, measured rate reductions are a part of a multi-faceted approach to reducing overall exposure. The additional approaches include spray drift and runoff reduction language, current application timing restrictions, and pesticide education and outreach efforts. The goal of these proposed maximum annual application rate reductions is to reduce the total environmental loading of imidacloprid resulting from the various uses specified, while still providing growers with the ability to use these tools as an effective means of pest control.

As part of the assessments of the benefits for the neonicotinoids, EPA also assessed the impacts of potential mitigation, including the effect of reducing rates. This information was critical in identifying sites and rates where rate reductions would achieve the greatest reduction in risk while minimizing the potential impacts on users of imidacloprid. Although these proposed rate reductions do not eliminate all risks, they are expected to contribute to reducing risk overall. The benefits of these uses outweigh the remaining reduced risks of concern.

Berries and small fruits (non-grape)
The berries and small fruits crop group includes crops such as, strawberries, cranberry, caneberry, and other berries and small fruit for which benefits and impacts have not been assessed by the agency. EPA is proposing reducing the current maximum annual application rate

of 0.5 lbs. AI/A, to not exceed a combined annual application rate of 0.40 lbs. AI/A/yr for any berries regardless of formulation type. This mitigation is being proposed to address both pollinator and aquatic invertebrate risks.

Risks from the berries and small fruits category were considered in the category, strongest evidence of potential pollinator risk pre-bloom, in the agency's bee risk assessment. Both acute and chronic risks of concern were identified to aquatic invertebrates with risk estimates up to an RQ of 172. In addition to addressing risks of concern to bees, rate reductions also help reduce potential aquatic invertebrate risk. Available data indicates that 90% of blueberry acres were treated at 0.20 lbs. AI/A/year or less and the other 10% are treated at the higher 0.48 lbs AI/A/year rate. The average annual application rate for imidacloprid is 0.11 lbs. AI/A on caneberries and 0.42 lbs. AI/A on strawberry, therefore for cases like caneberries, limited impacts of the proposed mitigation are expected. However, it is uncertain whether there may be greater impacts to use of imidacloprid on strawberries. The agency does not have information on application rates for cranberry and blueberry and therefore the potential impacts of this mitigation for those crops could not be assessed.

Brassica/Cole
For the brassica/cole crop group, which includes broccoli, EPA is proposing reducing the current maximum annual application rate from 0.23 lbs. AI/A to 0.20 lbs. AI/A annually for foliar applications. This rate reduction is targeted at reducing potential risk to aquatic invertebrates and represents a reduction in the foliar rate to align closer with the average rate.

Potential risk to aquatic invertebrates was noted for both foliar and soil applications of imidacloprid to brassica/cole, with RQs up to 680 with the highest risk identified for foliar use. Benefits were considered to be high for imidacloprid's use on brassica/cole crops, with PCT's ranging from 10 – 67%. Imidacloprid is particularly important to broccoli growers for general control whitefly in brassica. The average annual application rates of imidacloprid applied nationally to brassica/cole is 0.206 lbs. AI/A, slightly above the proposed rate. Potential impacts to growers from this mitigation could vary. Data show that over 25% of the brassica and leafy vegetable acres treated with imidacloprid utilize annual application rates of 0.304 lbs AI/A/year, but this figure includes soil applications. Nearly 40% of the vegetable acres treated with imidacloprid are treated at rates above 0.20 lbs AI/A/year. Thus, there are likely some situations where growers make multiple applications of imidacloprid and would have to use an alternative insecticide or insecticides for one of those applications.

Leafy vegetables
For the leafy vegetables, EPA is proposing to reduce the current maximum annual foliar application rate from 0.23 lbs. AI/A to 0.20 lbs. AI/A. This rate reduction is targeted at reducing potential risk to aquatic invertebrates only and represents a reduction in rates to align closer with the average rate.

Potential risk to aquatic invertebrates was noted for both foliar and soil applications of imidacloprid to leafy vegetables, with RQs up to 989 with the highest risk identified for foliar use. The benefits were considered to be high for imidacloprid's use on leafy vegetables with PCTs ranging from 33 – 74%. Imidacloprid is particularly important to lettuce growers to

combat contamination issues at harvest. The average annual rate for imidacloprid to leafy vegetables is 0.206 lbs. AI/A, just above the proposed rate. Potential impacts to growers from this mitigation could vary. Data show that over 25% of the brassica and leafy vegetable acres treated with imidacloprid utilize annual application rates of 0.304 lbs AI/A/year, but this figure accounts includes soil applications. Nearly 40% of the vegetable acres treated with imidacloprid are treated at rates above 0.20 lbs AI/A/year. Thus, there are likely some situations where growers make multiple applications of imidacloprid and would have to use an alternative insecticide or insecticides for one of those applications.

Fruiting Vegetables
For fruiting vegetables, EPA is proposing reducing the current maximum annual foliar application rate from 0.23 lbs. AI/A to 0.20 lbs. AI/A. This rate reduction is targeted at reducing potential risk to aquatic invertebrates.

Potential risk to aquatic invertebrates was noted for both foliar and soil applications of imidacloprid to fruiting vegetables, with RQs ranging up to 768 with the highest risk identified for foliar use. Imidacloprid plays an important role in early season crop protection in carrots, and based on usage on potato, it is likely important for use on other root and tubers. The PCT is 23% for carrots and is primarily applied by chemigation. The average annual application rate for imidacloprid on carrots is 0.277 lb AI/A/year and around 90% of acres are treated at rates of 0.304 lb AI/A/year or more. 74% of the treated carrot acres are treated at a single application rate of 0.304 lb AI/A or more. EPA would expect a decrease in product performance at the lower rate. Foliar applications are less important in carrots; however, they may be a valuable method for other root and tuber crops. However, based on the magnitude of the risk exceedance for carrots, a rate reduction is being proposed.

Root and tuber (not including potato)
For the root and tuber crop group (not including potato), EPA is proposing reducing the current maximum annual foliar application rate from 0.12 lbs. AI/A to 0.10 lbs. AI/A and the maximum annual soil application rate from 0.38 to 0.31. These rate reductions are targeted at reducing potential risk to aquatic invertebrates.

Potential risk to aquatic invertebrates was noted for both foliar and soil applications from root and tuber use, with foliar RQs ranging up to 2130, and soil RQs up to 998. Benefits were considered moderate for imidacloprid's use on root and tubers, with PCTs as high as 23%. Imidacloprid is particularly important to carrot growers. The average annual rate for imidacloprid on root and tuber is 0.277, however due to substantial aquatic invertebrate risk, a rate reduction is being proposed.

Legumes (not including soybeans or peanuts)
For the legumes crop group (dry and succulent beans and peas, not including soybeans or peanuts), EPA is proposing reducing the current maximum annual foliar application rate from 0.13 lbs. AI/A to 0.11 lbs. AI/A. This rate reduction is targeted at reducing potential risk to aquatic invertebrates only and represents a reduction in the foliar rate to align closer with the average rate.

Potential risk to aquatic invertebrates was identified for both foliar applications of imidacloprid to legumes (not including soybeans or peanuts), with RQs ranging up to 400. Benefits were considered low for imidacloprid's use on legumes (not including soybeans or peanuts), with PCTs ranging from 4 – 6%. The average annual rate for imidacloprid to this crop group is 0.087 lbs. AI/A, below the proposed rate so potential impacts to growers from this mitigation are considered likely to be low.

Peanuts
For peanuts, EPA is proposing reducing the current maximum annual foliar application rate from 0.13 lbs. AI/A to 0.12 lbs. AI/A. This rate reduction is targeted at reducing potential risk to aquatic invertebrates.

Potential risk to aquatic invertebrates was noted for foliar applications of imidacloprid to peanuts, with RQs up to 149. Benefits were considered high for this use as it is the only neonicotinoid registered for peanuts, however, the PCT was less than 1% with a total of 41,000 lbs. applied annually. This rate reduction is likely to have very low impacts to growers on current usage, which is primarily soil applications prior to crop emergence.

Stone Fruit
For stone fruit, EPA is proposing reducing the current maximum soil annual application rate of 0.38 lbs. AI/A to 0.34 lbs. AI/A, and a reduction in the maximum foliar annual application rate from 0.50 lbs. AI/A to 0.40. This mitigation is being proposed both for pollinator and aquatic invertebrate risk.

Risks from stone fruit use were assigned the category, weakest evidence of potential pollinator exceedances post-bloom, in the agency's bee risk assessment. The systemic fate properties of imidacloprid contributed to risks of concern both after bloom and before harvest. Foliar RQs ranged up to 824 on an acute basis and 2920 on a chronic basis. Aquatic invertebrate risk for foliar applications ranged up to 330. Soil risks were identified for pollinators with RQs up to 11. For soil application, the agency expects little impact on the growers from a 10% reduction in the current maximum annual application rate as soil treatment to stone fruit is rare. For foliar application, a 20% reduction in the current maximum annual application rate is likely to affect a sizeable number of cherry acres. As discussed in Section III C, the agency's stone fruit assessment focuses on cherries and peaches, because imidacloprid is little used on peaches, the agency did not assess potential impacts to growers for peaches. Other neonicotinoid alternatives are available for stone fruit however impacts to growers could vary.

Pome Fruit
For pome fruit, EPA is proposing reducing the current maximum foliar annual application rate of 0.50 lbs. AI/A to 0.40. This mitigation is being proposed both for pollinator and aquatic invertebrate risks.

Risk from pome fruit use assigned the category, weakest evidence of potential pollinator risk post-bloom, in the agency's bee risk assessment. The systemic fate properties of imidacloprid contributed to risks of concern both after bloom and before harvest. Foliar adult honeybee RQs ranged up to 7301. Aquatic invertebrate risk for foliar applications ranged up to 743. These risks

of concern represent some of the greatest risks compared to other agricultural uses. Benefits are considered high for pome fruit use of imidacloprid post-bloom and medium for pre- and at-bloom usage. Other neonicotinoid alternatives are available for pome fruit however impacts to growers is considered moderate.

Tree nut
For tree nuts, EPA is proposing reducing the current maximum soil annual application rate of 0.50 lbs. AI/A to 0.36 lbs. AI/A; and a reduction in the maximum foliar annual application rate from 0.36 lbs. AI/A to 0.30. This mitigation is being proposed both for pollinator and aquatic invertebrate risks.

Risks from tree nut use were assigned the category moderate category of evidence for pollinator risk from soil applications post-bloom in the agency's bee risk assessment, and aquatic risk from primarily foliar usage. Adult honeybee RQs ranged up to 14. Aquatic invertebrate risks ranged up to 433. The proposed soil rate was based on a safety finding for current tolerances of no greater than 0.36 lbs. AI/A per year, while the proposed foliar rate was below this requirement. These rate reductions are expected to have low impacts on current usage because, across all application methods, around 5-10% of acres are treated at rates greater than 0.30 lbs. AI/A/year.

Cotton
For cotton, EPA is proposing reducing the current maximum combined rate of 0.50 lbs. AI/A regardless of formulation type and reducing it to 0.37 lbs. AI/A applied annually. This mitigation is being proposed for pollinator risk.

Potential risks from cotton combined foliar and soil use was considered under the strongest category of evidence for pollinator risk. Soil adult honeybee RQs ranged reached 2.6 on an acute basis and 9.3 on a chronic basis to adults, while foliar adult honeybee RQs reached up to 494 on an acute basis and 1752 chronic. Cotton is considered one of the major drivers of potential pollinator risk. Imidacloprid is considered highly beneficial to cotton growers throughout the growing season for a variety of pests.

Available usage data show that the average annual application rate is 0.151 lbs. AI/A per year with less than 3% of acres treated with rates of 0.37 lbs. AI/A annually or more. The majority of growers were found to apply imidacloprid to cotton at an average of less than 0.3 lbs. AI/A annually, well below the proposed annual rate of 0.37 lbs. AI/A. Affected users may have to switch to alternative insecticides or mix additional insecticides with imidacloprid to maintain pest control. With consideration of current usage and typical rates, these rate reductions are considered to have potentially low to medium impacts to users.

Turf
For turf, EPA is proposing reducing the current maximum annual foliar and soil application rate from 0.40 lbs. AI/A to 0.30. This rate reduction is targeted at reducing potential risk to aquatic invertebrates.

Potential risk to aquatic invertebrates was noted for applications of imidacloprid from turf, with RQs ranging up to 236. Risk to bees assigned the category, moderate evidence of potential

pollinator risk, in the agency's bee risk assessment. Benefits were considered high for this use for imidacloprid, as it accounts for 75% of turf treated with neonicotinoids. Other than the available 2014 AgInfomatics report and review, current usage data was limited. This rate reduction is considered to potentially have moderate impacts on usage.

Production and Commercial Ornamentals
For production and commercial ornamentals, EPA is proposing reducing the current maximum annual foliar and soil application rate from 0.40 lbs. AI/A to 0.30. This rate reduction is targeted at reducing potential risk to pollinators and aquatic invertebrates (nursery only). These rate reductions apply to ornamental ground cover, ornamental trees, forestry, ornamental woody shrubs and vines, and outdoor greenhouse/nursery. This risk mitigation does not include indoor commercial nursery, Christmas trees, greenhouse uses, or forestry use on public land and quarantine application by USDA.

Potential risks from use on ornamentals assigned the category, strongest evidence of potential pollinator risk, in the agency's bee risk assessment. Risk to aquatic invertebrates were identified, with RQs ranging up to 1020. Benefits were considered high for this use, as 75% of neonicotinoid usage on ornamentals is with imidacloprid. Other than the available 2014 AgInfomatics report and review, usage data was limited. This rate reduction is considered to have potentially moderate impacts on current usage.

5. Crop Stage Restrictions

As noted in section four, risks were identified for several taxa described in the draft risk assessments. Crop stage restrictions can limit exposure during critical periods in the growing season when exposures to pollinators are more likely to occur. In its final bee risk assessment, the agency analyzed a large volume of scientific data assessing residues of neonicotinoids in pollen and nectar over time. Through this analysis the agency calculated pre-bloom intervals to determine at what stage in the growing season risk exceedances went above the level of concern. By selecting application restrictions based on crop stage, the agency expects potential exposure can be significantly reduced. These proposed restrictions were preferable only in crops with distinct phenological stages which were easily identifiable by growers.

Table 2. Proposed Crop Stage-based application Restrictions for Imidacloprid

Crop/Crop Group	Proposed Risk Mitigation
Fruiting Vegetables	For both foliar and soil applications: prohibit application after the appearance of the initial flower buds until flowering is complete and all petals have fallen off. For tomatoes, peppers, chili peppers and okra only: Do not apply after 5 days after planting or transplanting regardless of application method.
Cucurbits	For both foliar and soil applications: prohibit use from vining to harvest or after the emergence of the first true (non-cotyledon) leaf
Tropical and Subtropical Fruit (avocado, banana, dates, and olives only)	For foliar applications: prohibit foliar application pre-bloom until after flowering is complete and all petals have fallen off; and For soil applications: prohibit post-bloom application.

Fruiting Vegetables
For the fruiting vegetables crop group, EPA is proposing a crop stage restriction for both foliar and soil applications, to prohibit application after the appearance of the initial flower buds until flowering is complete and all petals have fallen off. For tomatoes, peppers, chili peppers and okra, EPA is proposing to prohibit application after 5 days after planting or transplanting regardless of application method for all crops in the crop group.

Potential risk to pollinators was assigned the category, strongest evidence of potential pollinator risk, in the agency's bee risk assessment for foliar and soil uses of pollinator attractive fruiting vegetables. Benefits were considered high for imidacloprid's use on fruiting vegetables, though PCTs ranged from 32% to 65%. Imidacloprid is considered particularly important to tomato growers. Applications after crop emergence or transplanting account for around two-thirds of the treated acres of peppers and tomato acres. Imidacloprid targets season-long pests. Thrips, stinkbug and pepper weevil can target fruit directly and viral diseases vectored by aphids and whitefly can seriously impact the development, quality and/or yield of the harvested fruit. The proposed changes are expected to potentially impact growers.

Cucurbits
For cucurbits, EPA is proposing a crop stage restriction for both foliar and soil applications, to prohibit use from vining to harvest or after the emergence of the first true (non-cotyledon) leaf. The applicator would have a choice to either utilize either crop stage description [*e.g.,* vining to harvest or first true (non-cotyledon) leaf]. The agency encourages input from stakeholders regarding the best identifier for crop stage.

Risk to pollinators was assigned the category, strongest evidence of potential pollinator risk, in the agency's bee risk assessment for cucurbit soil uses. Based on available residue data, imidacloprid remained in the plant matrices at high levels for months after application. Residues exceeded the lowest observed effect concentration (LOEC) at 65 days after application for foliar applications and 67 days for soil applications. Available benefits information identified imidacloprid usage to most commonly occur prior to crop emergence, therefore, a restriction from vining to harvest is likely to not significantly impact current usage.

Tropical and Subtropical Fruit
For avocado, banana, dates, and olives, EPA is proposing a crop stage restriction for foliar labels to prohibit foliar application from pre-bloom until after flowering is complete and all petals have fallen off; and to prohibit post-bloom application for soil applications. No mitigation is proposed for other fruit trees in this crop group.

Risk to pollinators was assigned the category, weakest evidence of potential pollinator risk, in the agency's bee risk assessment for foliar and soil post-bloom applications. Risk mitigation is being proposed on crops in this group considered to have higher usage and to be pollinator attractive, however, no risk mitigation is being proposed for lower acreage or non-bee attractive crops. An exception is provided for pomegranate as well, due to available usage data showing imidacloprid use on pomegranate as particularly beneficial. From the information available on avocado, dates, and olives, the agency anticipates low impacts to users. California accounts for

about 90% of total U.S. acreage of these crops and, based on data from California Pesticide Use Reports, usage of imidacloprid is rare on avocado, dates, and olives. EPA is specifically requesting public comments to better understand potential impacts on banana production.

6. Residential Ornamental Advisory

For application to ornamental plants, the agency identified significant risks of concern. Potential risks from use on ornamentals was assigned the category, strongest evidence of potential pollinator risk, in the agency's bee risk assessment. Risk to aquatic invertebrates was also identified, with RQs ranging up to 1020. Benefits were considered high for this use, as 75% of neonicotinoid usage on ornamentals is with imidacloprid. However, other than the available 2014 AgInfomatics report and review, usage data was limited. The agency is proposing adding language to residential labels advising that ornamental products are, "Intended for use by professional applicators". This is due to the high risks of concern, the potential extent of exposure, particularly to bees, and to decrease the likelihood of misapplication or overapplication where significant risks of concern have been identified for these uses.

7. Label Language Improvements

EPA is proposing several advisory label language changes intended to better inform and/or discourage the applicator from creating exposures that may lead to increased risks of concern. This includes updates to the current advisory bee language, water soluble packaging, and language to better clarify whether products are for indoor or outdoor use. For more information, please see Appendix B.

The agency is also proposing revising the PHI to 7-days on the Admire® 2F label to reflect other pomegranate labels, based on information listed in the 2008 scoping document (PP# 5E6920, J. Tyler, 14-JUN-2006; D322834).

Risks of concern were identified to birds and small mammals associated with seeds that are treated with imidacloprid for which EPA is proposing additional advisory label language, encouraging the promotion of Best Management Practices (BMPs) and education programs to help inform users about the importance of picking up spilled seed in order to reduce exposure to birds and mammals. The agency's understanding of these risks includes characterization that indicate only a portion of birds and mammals are likely to be impacted. Risk mitigation measures were considered with the understanding of the high benefits associated with seed treatment uses, which through their use, have the potential to reduce overall neonicotinoid exposure and offer a lower overall ecological risk compared to foliar uses.

8. Restrictions to Poultry House Uses

Due to the persistence of neonicotinoids in the environment, potential risks of concern to honeybees were also identified for imidacloprid from use on poultry litter in broiler houses at the maximum annual application rate. Once applied, the litter can be applied as a fertilizer on agricultural fields, contributing to ecological exposure. EPA is proposing to reduce risk from this use by reducing the number of whole house applications allowed annually for imidacloprid.

In order to reduce exposure to pollinators, EPA is proposing that all imidacloprid products registered for poultry house uses must include the following statements:

- "Limit applications to one whole house treatment and 5 perimeter (partial house) treatments per year."
- "Do not apply to more than 30,000 sq. ft. per year per house."

The goal of these proposed statements is to reduce the total environmental loading of imidacloprid resulting from poultry house uses. Limiting both the number and square footage of allowable poultry house treatments per year will limit the amount of imidacloprid entering the environment when treated poultry litter is removed from poultry houses and used as a soil amendment in agricultural fields. The proposed mitigation retains the use of imidacloprid for poultry producers, recognizing its importance in treating for darkling beetles and other poultry house pests.

9. Spray Drift and Runoff Reduction

EPA is proposing label changes to reduce off-target spray drift and establish a baseline level of protection against spray drift that is consistent across all imidacloprid products. Reducing spray drift will reduce the extent of environmental exposure and risk to non-target plants and animals. Although the agency is not making a complete endangered species finding at this time, these label changes are expected to reduce the extent of exposure and may reduce risk to listed species whose range and/or critical habitat co-occur with the use of imidacloprid.

The agency is proposing the following spray drift mitigation language be included on all imidacloprid product labels. The proposed spray drift language is intended to be mandatory, enforceable statements and supersede any existing language already on product labels (either advisory or mandatory) covering the same topics. The agency is providing recommendations which allow imidacloprid registrants to standardize all advisory language on imidacloprid product labels. Registrants must ensure that any existing advisory language left on labels does not contradict or modify the new mandatory spray drift statements proposed in this proposed interim decision once effective.

These mandatory spray drift mitigation measures are proposed for aerial applications for all products delivered via liquid spray:

- Applicators must not spray during temperature inversions.
- For aerial applications, do not apply when wind speeds exceed 15 mph at the application site. If the windspeed is greater than 10 mph, the boom length must be 65% or less of the wingspan for fixed wing aircraft and 75% or less of the rotor diameter for helicopters. Otherwise, the boom length must be 75% or less of the wingspan for fixed-wing aircraft and 90% or less of the rotor diameter for helicopters.
- For aerial applicators, if the windspeed is 10 miles per hour or less, applicators must use ½ swath displacement upwind at the downwind edge of the field. When the windspeed is between 11-15 miles per hour, applicators must use ¾ swath displacement upwind at the downwind edge of the field.

- For aerial applications, the release height must be no higher than 10 feet from the top of the crop canopy or ground, unless a greater application height is required for pilot safety.
- Specify spray droplet size of medium or coarser (ASABE S572.1)
- Do not apply by air within 150 feet of lakes, reservoirs, rivers, permanent streams, marshes or natural ponds, estuaries and commercial fish farm ponds.

These mandatory spray drift mitigation measures are proposed for ground applications delivered via liquid spray:

- Applicators must not spray during temperature inversions.
- Do not apply when wind speeds exceed 15 mph at the application site.
- User must only apply with the release height recommended by the manufacturer, but no more than 4 feet above the ground or crop canopy.
- Specify spray droplet size of medium or coarser (ASABE S572.1)
- For air blast applications, nozzles directed out of the orchard must be turned off in the outer row.
- For air blast applications, applications must be directed into the canopy foliage.
- Do not apply by ground within 25 feet of lakes, reservoirs, rivers, permanent streams, marshes or natural ponds, estuaries and commercial fish farm ponds.

To reduce the amount of imidacloprid that can enter waterbodies from runoff, EPA is proposing a vegetative filter strip (VFS) requirement for all imidacloprid agricultural products of 10 feet. Currently some imidacloprid product labels already have a VFS requirement of 10 feet on labels. VFS are intended to reduce sediment loads to adjacent water bodies, and also show some efficacy in reducing runoff volume as well. As a consequence, they may have some utility in reducing movement of pesticides, particularly those bound to sediments into natural waters.

They are somewhat expensive to implement and maintain, and they must be maintained, or they will lose efficacy and channelized flow across the VFS will develop after a few years. VFS are most effective at removing non-source point pollutants (e.g., pesticides) from runoff water sources. However, the effectiveness of a VFS is influenced by various land management practices (e.g., flood and furrow irrigated fields, etc.) which may impact their utility. The Agency has considered several additional sources of research which contextualize the benefits of VFS and has determined that proposing the use of VFS is appropriate mitigation to reduce imidacloprid residues in aquatic habitats. EPA is not proposing a VFS requirement in Western irrigated agriculture because a VFS would be more expensive to maintain, and runoff is less likely. In the west, areas where agriculture is irrigated would likely require irrigation to maintain a VFS, and on fields where water is managed carefully there is less likely to be runoff and erosion into a waterbody.

The following proposed mitigation measure applies to all agricultural uses of imidacloprid. This proposed mitigation requirement is separate and in addition to the spray drift buffer zones described above; spray drift buffer zones are still proposed to be required if a vegetated filter strip is present. The proposed vegetative filter strip requirement reads as follows:

- Construct and maintain a vegetative filter strip, according to the width specified below, of grass or other permanent vegetation between the field edge and nearby down gradient aquatic habitat (e.g., lakes, reservoirs, rivers, permanent streams, marshes, natural ponds, estuaries, commercial fish farm ponds).
    - Only apply products onto fields where a maintained vegetative filter strip of at least 10 feet exists between the field edge and where a down gradient aquatic habitat exists. This minimum required width of 10 feet may be reduced under the following conditions:
        - Western irrigated agriculture is exempt from this requirement. Western irrigated agriculture is defined as irrigated farmland in the following states: WA, OR, CA, ID, NV, UT, AZ, MT, WY, CO, NM, and TX (west of I-35).

Impacts of Spray Drift and Runoff Mitigation

EPA examined a subset of labels from single AI products of imidacloprid (EPA Reg # 264-827, 34704-931). These labels represent more than 40% of all imidacloprid applied to agricultural crops (MRD 2013-2017). This was not an exhaustive label review, but this was preformed to have an idea of the spray drift statements currently on labels to determine if any of the changes would lead to an impact to growers.

Wind Speed, Percent Usable Boom Length, Swath Displacement and Release Height (aerial applications)
Labels reviewed have a wind speed restriction of 15 mph and the boom length must not exceed 75% of the wing span or rotor diameter. Therefore, there should be little impact when applications are made when wind speed is 15 mph when applications are made with fixed wing aircraft. Additionally, there would be increased percent usable boom length (90% or less) of the rotor diameter for helicopters which could mean more area can be covered in less time. However, when wind speeds are between 10 and 15 mph, applicators using fixed wing aircraft, will need to reduce the swath width. This will lead to more passes being made and will cause applications to take longer which is likely to be more expensive. Another option would be to use a different, more expensive chemical that does not have this restriction.

Labels reviewed do not address swath displacement based upon wind speed. The agency has not assessed the impacts of windspeed restrictions for aerial applications and the requirement of a ½ or ¾ swath displacement upwind at the downwind edge of the field. The agency invites comments if this mitigation would impact growers.

Labels reviewed currently require applicators to release imidacloprid at a height no higher than 10 feet from the top of the crop canopy or ground, unless a greater application height is required for pilot safety. Therefore, the agency does not expect an impact for requiring this language as mandatory for all imidacloprid labels.

Wind Speed and Release Heights (ground applications)
Labels reviewed have a mandatory wind speed restriction of 15-mph, and one of the labels reviewed indicate wind speed restrictions do not apply to applications made in-furrow or below

soil-level (EPA Reg # 264-827). Therefore, the agency does not anticipate an impact of a 15-mph wind speed restriction.

Labels reviewed currently do not specify a release height for ground application. However, previous analysis for release heights for most nozzles indicate a release height of 4ft should not impact grower when making applications of imidacloprid.

Temperature Inversions (ground and aerial applications)
Labels reviewed have a mandatory language prohibiting applications during inversions; therefore, the agency does not anticipate an impact in restricting applications during temperature inversions. The agency notes that some applicators may make applications in the evening hours to avoid spraying during the daytime to avoid making applications when pollinators are active. Temperature inversions are generally considered to be more likely to occur a couple of hours before and after sunset and sunrise. These growers would likely switch to a different active ingredient that does not have this restriction.

Droplet Size (aerial and ground applications, excluding airblast sprayers)
The Agency is considering establishing a mandatory droplet size of medium to coarser for all neonicotinoids to address the potential risks of neonicotinoids to terrestrial and aquatic invertebrates. Components of applications, including droplet size, are complex, but essentially insects need to come into contact with, or ingest, a lethal dose of insecticide to be effectively controlled which requires proper coverage throughout the plant. Hypothetically, systemic insecticides, like neonicotinoids, might control some insects with a larger droplet size due to the systemic movement within the plant, but systemic activity alone does not mean effective control will still occur. Buchholz and Nauen (2001)[11] showed that the control from neonicotinoids was more complex than an active ingredient being systemic, i.e., control was a "combination of systemic and contact properties." The authors indicate that factors such as the cuticular properties of leaves, metabolism and stage of insect (e.g., mobile versus quiescent stages), and the physio-chemical properties of the insecticide contribute to the performance of neonicotinoids. Furthermore, Basso et al. (2016)[12] showed that contact with neonicotinoids was needed to control insects on large plants compared with smaller plants, presumably due to poor translocation in large plants.

The labels reviewed provide advisory language that suggests growers should apply with the largest droplet that provides effective control. Generally, entomologists accept that good coverage is required for maximum efficacy during an application and that fine droplets provide better coverage than coarse droplets. BEAD expects that droplet size restrictions could decrease the control of pests with contact neonicotinoids. If control was reduced, BEAD anticipates growers would increase rates, make more frequent applications, and/or select alternative products (pyrethroids, carbaryl, diflubenzuron, etc., depending on the target pest). Additionally, growers may face financial impacts due to increased cost of applications and/or reduced yields or

[11] Buchholz, A. and R. Nauen. 2001. Translocation and translaminar bioavailability of two neonicotinoid insecticides after foliar application to cabbage and cotton. Pest Mgmt. Sci. 58: 10-16.
[12] Basso, C.J., C.C. Kuss, O.H. de Castro Pias, D.S. Muraro, and L. Cutti. 2016. Neonicotinoid insecticide systemicity in soybean plants and its effect on brown stink bugs. Pesq. Agropec. Trop., Goiânia 46: 96-101.

quality due to poor control. Furthermore, mandatory droplet size could lead to reduced rates being successfully delivered to the target pest(s) via poor coverage and undermine resistance management efforts.

Buffers (ground and aerial applications)
Labels reviewed prohibit applications within 25 feet (ground), or within 150 feet (aerially) of lakes; reservoirs; rivers; permanent streams; marshes or natural ponds; estuaries and commercial fish farm ponds. Therefore, the agency does not anticipate an impact with buffer requirements. However, the agency did not assess this mitigation on a crop by crop basis or review labels for specific crops that may be impacted by this mitigation. The impact of this mitigation can be highly localized and depends on the size and shape of a field. Leaving an area untreated in a field can harbor insects and serve as a source of re-infestation, requiring subsequent applications. If a grower were using an imidacloprid product that does not currently have this restriction, the grower would likely switch to a different chemical that does not have this restriction. These impacts will disproportionally affect growers producing crops from small acreage fields.

Requirements for Air Blast Sprayers
Labels reviewed have mandatory language requiring that spray is only directed in the canopy, is prohibited from going beyond the edge of the cultivated area and is directed inward, toward the orchard/vineyard when treating the outer row. Therefore, the agency does not expect impacts associated with the proposed mitigation.

Impacts of Vegetative Filter Strips
Labels reviewed require a 10-foot VFS. Therefore, the agency does not anticipate an impact with VFS requirements. However, the agency did not assess this mitigation on a crop by crop basis or review labels for specific crops that may be impacted by this mitigation. The impact of this mitigation can be highly localized and depends on the size and shape of a field. In some situations, VFS may require growers to remove land from production thus decreasing revenue. These impacts will disproportionally affect growers producing crops from small acreage fields. If a grower were using an imidacloprid product that does not currently have this restriction, the grower would likely switch to a different chemical that does not have this restriction.

In addition to the drift reduction measures and VFS discussed above, EPA is proposing measures to reduce the perimeter treatment area and increase label clarity and consistency, thus reducing the overall amount of imidacloprid that enters waterbodies and outdoor drainage systems. Specific measures are intended to ensure areas sprayed are permeable and less runoff-prone, reduce offsite-drift to waterbodies, as well as to reduce the potential for overspraying. Although potential risks to aquatic organisms are expected to remain after the implementation of the measures, these proposed label changes are directionally correct with respect to reducing the amount of environmental exposure. The following mandatory and advisory mitigation measures for all imidacloprid outdoor residential and commercial use sites to reduce the amount of runoff entering waterbodies and drainage systems:

- Band and perimeter treatment is limited to an area of application no more than 7’ out x 2’ feet up maximum around buildings or structures.
- Spot treatment is application to limited areas on which insects are likely to occur, but which will not be in contact with food or utensils and will not ordinarily be contacted by

workers. These areas may occur on floors, walls, and bases or undersides of equipment. For this purpose, a "spot treatment" will not exceed 2' x 1' square feet.
- Do not apply to impervious horizontal surfaces such as sidewalks, driveways, and patios except as a spot or crack and crevice treatment.
- Do not apply to the point of runoff.
- Do not apply during rainfall.
- Avoid applying when rain is expected within 24 hours except when product requires watering in.

Impacts of Mitigation Measures for Residential and Commercial Use Sites
The agency did not assess the impacts of runoff mitigation measures residential and commercial use sites; however, the agency considers these measures are consistent with application practices. The agency invites comments if this mitigation would impact applicators.

In addition to including the following spray drift restrictions on imidacloprid labels, all references to volumetric mean diameter (VMD) information for spray droplets are proposed to be removed from all imidacloprid labels where such information currently appears and to establish label consistency by requiring standardized spray drift advisory language. The proposed new language below, which cites American Society of Agricultural & Biological Engineers (ASABE) S572.1, eliminates the need for VMD information.

10. Pesticide Resistance Management

Pesticide resistance occurs when genetic or behavioral changes enable a portion of a pest population to tolerate or survive what would otherwise be lethal doses of a given pesticide. The development of such resistance is influenced by a number of factors. One important factor is the repeated use of pesticides with the same mode (or mechanism) of action. This practice kills sensitive pest individuals but allows less susceptible ones in the targeted population to survive and reproduce, thus increasing in numbers. These individuals will eventually be unaffected by the repeated pesticide applications and may become a substantial portion of the pest population. An alternative approach, recommended by resistance management experts as part of integrated pest management (IPM) programs, is to use pesticides with different chemical modes (or mechanisms) of action against the same target pest population. This approach may delay and/or prevent the development of resistance to a particular mode (or mechanism) of action without resorting to increased rates and frequency of application, possibly prolonging the useful life of pesticides.

The EPA is proposing resistance-management labeling, as listed in Appendix B, for products containing imidacloprid, in order to provide pesticide users with easy access to important information to help maintain the effectiveness of useful pesticides. Additional information on the EPA's guidance for resistance management can be found at the following website: https://www.epa.gov/pesticide-registration/prn-2017-1-guidance-pesticide-registrants-pesticide-resistance-management.

B. Stewardship

In addition to establishing both advisory and compulsory language for product labels, EPA's registration review provides an opportunity to inform stakeholders and the general public about opportunities to minimize potential ecological risks and promote pollinator health more generally. Beyond the mitigation measures proposed above, voluntary stewardship activities and use of best management practices (BMPs) can be effective in further reducing pesticide exposure to at risk taxa. Examples of these activities include:

- promoting the creation of additional pollinator habitat;
- improving pesticide users' understanding and adherence to label directions which advise users on seed spill clean-clean up, reduction in drift/runoff, and minimizing exposure to pollinators;
- promoting integrated pest management (IPM) solutions;
- encouraging growers to take care when planting treated seed to reduce the amount of exposed seed; and,
- increasing awareness of potential impacts of pesticides through education (*e.g.,* training courses, pamphlets, workshops/conferences, and through tv, radio, social media and other communication platforms).

Habitat loss is a significant issue with negative impacts on the health of bees. With access to a healthy and diverse diet through a thriving habitat, bees may be better able to tolerate stressors such as pests, disease, and exposure to pesticides. As a healthy diet is crucial to maintaining flourishing pollinator populations, and the protection of pollinator habitat is not something that can be directly addressed on a pesticide product label, EPA and other federal/state/tribal and local government agencies and non-government organizations (NGOs) promote pollinator habitat through active education and outreach programs. Helpful guidance on pollinator protection can be found on the EPA's pollinator protection webpage[13].

Users should take several precautions while using neonicotinoid products to minimize potential exposure to pollinators. First, users should not apply neonicotinoids when bees and other pollinators are actively foraging on pollinator-attractive plants during bloom. Secondly, users should consider a pesticide's ability to drift to other non-target areas and be aware of the presence of bee colonies or highly bee-attractive plants nearby an application site. With applications to lawns, its beneficial to mow prior to applications. Although the cultivation and protection of pollinator habitat is typically encouraged, in this case, taking steps to ensure a lawn is mowed prior to neonicotinoid applications can reduce potential direct exposure for visiting pollinators. Other things the public can do to minimize potential exposure of pollinators are listed on EPA's, *What You Can Do to Protect Honey Bees and Other Pollinators* webpage[14].

Treated seed is most likely to become available to birds and mammals through accidental spills, excess unplanted seed on the edges of the field, shallow planted seed, and the improper disposal

[13] https://www.epa.gov/pollinator-protection
[14] https://www.epa.gov/pollinator-protection/what-you-can-do-protect-honey-bees-and-other-pollinators

of treated seed. An effective method to reduce exposure would be encouraging growers to take additional care when planting treated seed to ensure any exposed seed is retrieved. The American Seed Trade Organization has published a guide[15] to help educate applicators on practices to help reduce potential risks to the environment from seed treatments. The agency encourages public and private participation in creating tools and fostering effective communication to help reach applicators and educate them on practices that can reduce risks to the environment.
The technical registrants for the neonicotinoids, including Bayer, BASF, Mitsui, Syngenta, and Valent, coordinated to develop a voluntary proposal to promote product stewardship for their product seed treatments and applications in agricultural crops, production and landscape ornamental plants, turfgrass and pest-management setting (structural, commercial and residential). Their proposal includes a summary of the current neonicotinoid stewardship program, as well as their proposal for an enhanced registrant-initiated stewardship program for expansion and amplification of stewardship efforts. This document, *Neonicotinoid Stewardship Program – Current Summary and Proposal,* is included in the public docket for each of the neonicotinoids along with their PIDs.

The agency encourages strong pollinator protection stewardship in both the public and private sector. EPA will continue to work with its partners at the federal, state, tribal, and local levels, along with non-governmental organizations to promote pollinator protection, education, and outreach. This includes coordinating with states and tribes on pollinator protection plans (*i.e.;* managed pollinator protection plans), coordinating with stakeholders on extension of, and education around, existing BMPs, and continued education and outreach to the public on pollinator protection. In addition, the agency plans on continuing conversations with the registrants on the *Neonicotinoid Stewardship Program*.

C. Tolerance Actions

The agency proposes increasing the tolerances for residues of imidacloprid on citrus fruits and coffee to harmonize with Canada and Codex MRLs. Tolerances are proposed to be revoked for apple, okra, pecan, pistachio, watercress, watercress (upland), and vegetable legume group 6. Tolerances are proposed to be established for celtuce, fennel/florence/fresh leaves and stalk, kohlrabi, and soybean vegetable. Additionally, EPA is proposing eliminating trailing zeros listed in tolerances consistent with agency policy. All proposed tolerance revisions for imidacloprid are listed in Section III.A.3 for more details. The agency will use its FFDCA rulemaking authority to undertake needed tolerances changes.

D. Proposed Interim Registration Review Decision

In accordance with 40 CFR §§ 155.56 and 155.58, the agency is issuing this PID. Except for the Endocrine Disruptor Screening Program (EDSP) and the Endangered Species Act (ESA) components of this case, the agency has made the following PID:

(1) no additional data are required at this time; and (2) changes to the affected registrations and their labeling are needed at this time, as described in Section IV. A and Appendices A and B.

[15] https://seed-treatment-guide.com/

In this PID, the agency is making no human health or environmental safety findings associated with the EDSP screening of imidacloprid, nor is it making a complete endangered species finding. Although the agency is not making a complete endangered species finding at this time, the proposed mitigation described in this document is expected to reduce the extent of environmental exposure and may reduce risk to listed species whose range and/or critical habitat co-occur with the use of imidacloprid. The agency's final registration review decision for imidacloprid will be dependent upon the result of the agency's ESA assessment and any needed § 7 consultation with the Services and an EDSP FFDCA § 408(p) determination.

E. Data Requirements

The agency does not anticipate calling-in additional data for the imidacloprid registration review at this time.

V. NEXT STEPS AND TIMELINE

A. Proposed Interim Registration Review Decision

A Federal Register Notice will announce the availability of this PID for imidacloprid and will allow a 60-day comment period on the PID. If there are no significant comments or additional information submitted to the docket during the comment period that leads the agency to change its PID, the EPA may issue an interim registration review decision for imidacloprid. However, a final decision for imidacloprid may be issued without the agency having previously issued an interim decision. A final decision on the imidacloprid registration review case will occur after: (1) an EDSP FFDCA § 408(p) determination and (2) an endangered species determination under the ESA and any needed § 7 consultation with the Services.

B. Implementation of Mitigation Measures

Once the Interim Registration Review Decision is issued, the imidacloprid registrants must submit amended labels that include the label changes described in Appendix B. The revised labels and registration amendments must be submitted to the agency for review within 60 days following issuance of the Interim Registration Review Decision.

Appendix A: Summary of Proposed Actions for Imidacloprid

Registration Review Case#: 7605
PC Code: 129099
Chemical Type: Insecticide
Chemical Family: Neonicotinoids
Mode of Action: Nicotinic acetylcholine receptor (NACHR) competitive modulators

Affected Population(s)	Source of Exposure	Route of Exposure	Duration of Exposure	Potential Risk(s) of Concern	Proposed Actions
Pollinators	Residues on treated site	Ingestion and contact	Acute and chronic	Acute and chronic toxicity	• Reduce application rates • Crop stage restrictions • General other use restrictions • Spray drift reduction
Occupational Handlers	Aerial and ground application	Dermal and inhalation	Short and intermediate term	Portal of entry effects	• Require additional PPE (e.g., double layer clothing, gloves) • Precautionary statements • Prohibition of on-farm seed treatments for canola, millet, and wheat
Residential post-application (adults and children)	Ground application	Dermal and inhalation	Short and intermediate term	Portal of entry effects	• Use deletion for residential spray applications to turf
Aquatic Invertebrates	Runoff from treated sites	Ingestion and contact	Acute and chronic	Acute and chronic toxicity	• Reduce application rates • Spray drift and runoff reduction • Vegetative filter strips • Use deletion for bulb vegetables • Reduce perimeter treatment applications
Birds and Mammals	Residues on ingested seeds	Dietary and ingestion	Acute and chronic	Acute and chronic toxicity	• Clean up spills of treated seeds

Appendix B: Proposed Labeling Changes for Imidacloprid Products

<table>
<tr><th>Description</th><th>Proposed Label Language for Imidacloprid Products</th><th>Placement on Label</th></tr>
<tr><td colspan="3">Technical Products</td></tr>
<tr><td>Residential turf use</td><td>Delete residential spray use on turf.</td><td>Directions for Use</td></tr>
<tr><td>Foliar spray and soil drench use on bulb vegetables</td><td>Delete foliar spray and soil drench use on bulb vegetables.</td><td>Directions for Use</td></tr>
<tr><td colspan="3">End Use Products</td></tr>
<tr><td>Mode/Mechanism of Action Group Number</td><td>Note to registrant:
• Include the name of the ACTIVE INGREDIENT in the first column
• Include the word “GROUP” in the second column
• Include the MODE/MECHANISM OF ACTION CODE in the third column (for herbicides this is the Mechanism of Action, for fungicides this is the FRAC Code, and for insecticides this is the Primary Site of Action)
• Include the type of pesticide in the fourth column.
<table><tr><td>Imidacloprid</td><td>GROUP</td><td>4A</td><td>INSECTICIDE</td></tr></table></td><td>Front Panel, upper right quadrant.
All text should be black, bold face and all caps on a white background, except the mode of action code, which should be white, bold face and all caps on a black background; all text and columns should be surrounded by a black rectangle.</td></tr>
<tr><td>Updated Gloves Statement</td><td>Update the gloves statements to be consistent with Chapter 10 of the Label Review Manual. In particular, remove reference to specific categories in EPA’s chemical-resistance category selection chart and list the appropriate chemical-resistant glove types to use.</td><td>In the Personal Protective Equipment (PPE) within the Precautionary Statements and Agricultural Use Requirements, if applicable</td></tr>
<tr><td>Additional PPE (double layer clothes and gloves) for seed treatments to barley and cotton</td><td>“Applicators must wear two layers of clothing and chemical resistant gloves while applying on-farm seed treatments to barley and cotton.”</td><td>Personal Protective Equipment (PPE) within the Precautionary Statements</td></tr>
<tr><td>Additional PPE (gloves) for liquid spray applications to citrus by handgun</td><td>“Applicators must wear chemical resistant gloves for liquid spray applications by handgun.”</td><td>PPE within the Precautionary Statements</td></tr>
<tr><td>Resistance-management labeling statements for insecticides and acaricides</td><td>Include resistance management label language for insecticides/acaricides from PRN 2017-1 (https://www.epa.gov/pesticide-registration/pesticide-registration-notices-year)</td><td>Directions for Use, prior to directions for specific crops</td></tr>
</table>

Description	Proposed Label Language for Imidacloprid Products	Placement on Label
Additional Required Labelling Action Applies to all products delivered via liquid spray applications	Remove information about volumetric mean diameter from all labels where such information currently appears.	Directions for Use
Seed treatments to canola, millet, and wheat	"Apply in a commercial seed treatment facility."	Directions for Use
Directions for mixing/loading products packaged in water soluble bags	Instructions for Introducing Water Soluble Packages Directly into Spray tanks: "Soluble Packages (WSPs) are designed to dissolve in water. Agitation may be used, if necessary, to help dissolve the WSP. Failure to follow handling and mixing instructions can increase your exposure to the pesticide products in WSPs. WSPs, when used properly, qualify as a closed mixing/loading system under the Agricultural Worker Protection Standard [40 CFR 170.607(d)]. Handling Instructions Follow these steps when handling pesticide products in WSPs. 1. Mix in spray tank only. 2. Handle the WSP in a manner that protects package from breakage and/or unintended release of contents. If package is broken, put on PPE required for clean-up and then continue with mixing instructions. 3. Keep the WSP in outer packaging until just before use. 4. Keep the WSP dry prior to adding to the spray tank. 5. Handle with dry gloves and according to the label instructions for PPE. 6. Keep the WSP intact. Do not cut or puncture the WSP. 7. Reseal the WSP outer packaging to protect any unused WSP(s). Mixing Instructions Follow the steps below when mixing this product, including if it is tank-mixed with other pesticide products. If being tank-mixed, the mixing directions 1 through 9 below take precedence over the mixing directions of the other tank mix products. WSPs may, in some cases, be mixed with other pesticide products so long as the directions for use of all the pesticide product components do not conflict. Do not tank-mix this product with products that prohibit tank-mixing or have conflicting mixing directions.	Directions for Use for mixing/loading WSP

Description	Proposed Label Language for Imidacloprid Products	Placement on Label
	1. If a basket or strainer is present in the tank hatch, remove prior to adding the WSP to the tank. 2. Fill tank with water to approximately one-third to one-half of the desired final volume of spray. 3. Stop adding water and stop any agitation. 4. Place intact/unopened WSP into the tank. 5. Do not spray water from a hose or fill pipe to break or dissolve the WSP. 6. Start mechanical and recirculation agitation from the bottom of tank without using any overhead recirculation, if possible. If overhead recirculation cannot be turned off, close the hatch before starting agitation. 7. Dissolving the WSP may take up to 5 minutes or longer, depending on water temperature, water hardness and intensity of agitation. 8. Stop agitation before tank lid is opened. 9. Open the lid to the tank, exercising caution to avoid contact with dusts or spray mix, to verify that the WSP has fully dissolved and the contents have been thoroughly mixed into the solution. 10. Do not add other allowed products or complete filling the tank until the bags have fully dissolved and pesticide is thoroughly mixed. 11. Once the WSP has fully dissolved and any other products have been added to the tank, resume filling the tank with water to the desired level, close the tank lid, and resume agitation. 12. Use the spray solution when mixing is complete. 13. Maintain agitation of the diluted pesticide mix during transport and application. 14. It is unlawful to use any registered pesticide, including WSPs, in a manner inconsistent with its label. ENGINEERING CONTROLS STATEMENT Water soluble packets, when used correctly, qualify as a closed mixing/loading system under the Worker Protection Standard [40 CFR 170.607(d)]. Mixers and loaders handling this product while it is enclosed in intact water soluble packets may elect to wear reduced PPE of long-sleeved shirt, long pants, shoes, socks, a chemical-resistant apron, and chemical-resistant gloves. When reduced PPE is worn because a closed system is being used, handlers must be provided all PPE specified above for "applicators and other handlers" and have such PPE immediately available for use in an emergency, such as in case of a spill or equipment break-down."	
All outdoor foliar spray uses	Update the bee advisory box according to the following: https://www.epa.gov/pollinator-protection/new-labeling-neonicotinoid-pesticides	Follows directly after the Environmental Hazard statement

Description	Proposed Label Language for Imidacloprid Products	Placement on Label
All outdoor foliar spray uses	For foliar spray application to crops under contract pollinator services: "Do not apply this product while bees are foraging. Do not apply this product until flowering is complete and all petals have fallen unless the following condition has been met. If an application must be made when managed bees are at the treatment site, the beekeeper providing the pollination services must be notified no less than 48 hours prior to the time of the planned application so that the bees can be removed, covered or otherwise protected prior to spraying." For foliar spray application to crops not under contract pollinator services: "Do not apply this product while bees are foraging. Do not apply this product until flowering is complete and all petals have fallen off unless the application is made in response to a public health emergency declared by appropriate State or Federal authorities."	Directions for use
All outdoor foliar spray uses	"Do not apply by ground within 25 feet, or by air within 150 feet of lakes, reservoirs, rivers, permanent streams, marshes or natural ponds, estuaries and commercial fish farm ponds."	Directions for use
Resistance-management labeling statements for insecticides and acaricides	Include resistance management label language for insecticides/acaricides from PRN 2017-1 (https://www.epa.gov/pesticide-registration/pesticide-registration-notices-year).	Directions for Use, prior to directions for specific crops
Additional Required Labeling Action Applies to all products delivered via liquid spray applications	Remove information about volumetric mean diameter from all labels where such information currently appears.	Directions for Use
Berries and small fruits, not including grapes, set maximum annual rate	Maximum annual application rate for berries regardless of application method is not exceed 0.40 lbs. AI/A/yr.	Directions for use
Brassica (cole) leafy vegetables, set maximum annual rate for foliar spray	Foliar spray only: maximum annual application rate is not to exceed 0.20 lbs. AI/A/yr.	Directions for use
Leafy vegetables, set maximum annual rate for foliar spray	Foliar spray only: maximum annual application rate is not to exceed 0.20 lbs. AI/A/yr.	Directions for use
Fruiting vegetables, set maximum annual rate for	Foliar spray only: maximum annual application rate is not to exceed 0.20 lbs. AI/A/yr.	Directions for use

Description	Proposed Label Language for Imidacloprid Products	Placement on Label
foliar spray, and add application timing restriction based on crop stage	All: "Do not apply after the appearance of the initial flower buds until flowering is complete and all petals have fallen off." For tomatoes, peppers, chili peppers and okra only: "Do not apply after 5 days after planting or transplanting regardless of application method."	
Root and tuber vegetables, not including potatoes, set maximum annual rate for foliar spray and soil drench	Foliar spray: maximum annual application rate is not to exceed 0.10 lbs. AI/A/yr. Soil drench: maximum annual application rate is not to exceed 0.31 lbs AI/A/yr.	Directions for use
Legumes, not including soybeans and peanuts, set maximum annual rate for foliar spray	Foliar spray only: maximum annual application rate is not to exceed 0.11 lbs. AI/A/yr.	Directions for use
Peanuts, set maximum annual rate for foliar spray	Foliar spray only: maximum annual application rate is not to exceed 0.12 lbs. AI/A/yr.	Directions for use
Stone fruit, set maximum annual rate for foliar spray and soil drench	Foliar spray: maximum annual application rate is not to exceed 0.40 lbs. AI/A/yr. Soil drench: maximum annual application rate is not to exceed 0.34 lbs. AI/A/yr.	Directions for use
Pome fruit, set maximum annual rate for foliar spray	Foliar spray only: maximum annual application rate is not to exceed 0.40 lbs. AI/A/yr.	Directions for use
Tree nut set maximum annual rate for foliar spray and soil drench	Foliar spray: maximum annual application rate is not to exceed 0.30 lbs. AI/A/yr. Soil drench: maximum annual application rate is not to exceed 0.36 lbs. AI/A/yr.	Directions for use
Cotton set maximum annual rate	Regardless of application method, apply no more than 0.37 lbs. active ingredient per acre per year, including seed treatment, soil drench and foliar sprays.	Directions for use
Cucurbit, add application timing restriction based on crop stage	For foliar spray and soil drench: "Do not apply after vining or appearance of the first true (non-cotyledon) leaf until harvest."	Directions for use
Avocado, banana, dates, and olives, add application timing restriction based on crop stage	Foliar spray: "Do not apply before bloom until after flowering is complete and all petals have fallen off." Soil drench: "Do not apply once bloom has occurred until the next growing season."	Directions for use
All agricultural foliar spray uses	"VEGETATIVE FILTER STRIPS Construct and maintain a vegetative filter strip, according to the width specified below, of grass or other permanent vegetation between the field edge and nearby down gradient aquatic habitat (such as, but not limited to, lakes; reservoirs; rivers; permanent streams; marshes or natural ponds; estuaries; and commercial fish farm ponds).	Directions for use

Description	Proposed Label Language for Imidacloprid Products	Placement on Label
	Only apply products containing imidacloprid onto fields where a maintained vegetative filter strip of at least 10 feet exists between the field edge and where a down gradient aquatic habitat exists. Western irrigated agriculture is exempt from this requirement. Western irrigated agriculture is defined as irrigated farmland in the following states: WA, OR, CA, ID, NV, UT, AZ, MT, WY, CO, NM, and TX (west of I-35). For further guidance on vegetated filter strips, refer to the following publication for information on constructing and maintaining effective buffers: Conservation Buffers to Reduce Pesticide Losses. Natural Resources Conservation Services. https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs144p2_030970.pdf"	
Ornamentals, which includes ornamental ground cover, Christmas trees, ornamental and/or shade trees, ornamental herbaceous plants, ornamental nonflowering plants, ornamental woody shrubs and vines	"Intended for use by professional applicators."	Directions for use
Ornamentals, which includes ornamental trees, forestry, ornamental woody shrubs and vines, and outdoor greenhouse/nursery set maximum annual rate for foliar spray and soil drench. Does not include indoor commercial nursery, Christmas trees, greenhouse uses, or forestry use on public land and quarantine application by USDA.	For both foliar spray and soil drench: maximum annual application rate is not to exceed 0.30 lbs. AI/A/yr.	Directions for use
Turf/sod set maximum annual rate	Maximum annual application rate regardless of application method is not to exceed 0.34 lbs. AI/A/yr.	Directions for use

Description	Proposed Label Language for Imidacloprid Products	Placement on Label
Poultry houses set maximum number of applications and add maximum application area	"Do not apply more than one whole house treatment and 5 perimeter (partial house) treatments per year." "Do not apply to more than 30,000 sq. ft. per year per house."	Directions for use
Seed treatments, add to seed bad tag	Add the following statements to labels to clean up spills, dispose of excess seed to avoid contamination of water bodies: "Cover or collect treated seeds spilled during loading and planting in areas (such as in row ends)." "Dispose of all excess treated seed by burying seed away from bodies of water." "Do not contaminate bodies of water when disposing of planting equipment wash water."	Directions for use
All outdoor non-agricultural spray applications	"All outdoor spray applications must be limited to spot or crack-and-crevice treatments only, except for the following permitted uses: 1. Application to soil, lawn, turf, and other vegetation; 2. Perimeter band treatments of 7 feet wide or less from the base of a man-made structure to pervious surfaces (*e.g.*, soil, mulch, or lawn) 3. Applications to the side of a man-made structure, up to 2 feet above ground level; 4. Applications to underside of eaves, soffits, doors, or windows permanently protected from rainfall by a covering, overhang, awning, or other structure; 5. Applications around potential exterior pest entry points into man-made structures such as doorways and windows, when limited to a band not to exceed one inch; 6. Applications to vertical surfaces directly above pervious surfaces such as bare soil, lawn, turf, mulch or other vegetation, and not over a hard impervious surface (e.g., driveways, sidewalks), drainage, or other condition that could result in runoff into storm drains, drainage ditches, gutters, or surface waters, to control occasional invaders or aggregating pests."	Directions for Use
Outdoor non-agricultural spray applications	"Do not apply directly to impervious horizontal surfaces such as sidewalks, driveways, and patios except as a spot or crack-and-crevice treatment." "Do not apply or irrigate to the point of run-off."	Directions for use

Description	Proposed Label Language for Imidacloprid Products	Placement on Label
Outdoor non-agricultural spray applications – rain related statements (except for products that require watering-in)	"Do not make applications during rain. Avoid making applications when rainfall is expected within 24 hours to allow product sufficient time to dry." "Excessive rainfall within 24 hours after application may cause unintended run-off of pesticide application."	Directions for use
Outdoor non-agricultural spot treatments	"Spot treatment is application to limited areas on which insects are likely to occur, but which will not be in contact with food or utensils and will not ordinarily be contacted by workers. These areas may occur on floors, walls, and bases or undersides of equipment. Spot treatments must not exceed two square feet in size (2ft. by 1 ft.), not to exceed 10% of the entire treatment area."	Directions for use
Spray Drift Management Application Restrictions for all products delivered via liquid spray application and allow aerial application	**"MANDATORY SPRAY DRIFT MANAGEMENT** **Aerial Applications**: • Do not release spray at a height greater than 10 ft above the ground or vegetative canopy, unless a greater application height is necessary for pilot safety. • Applicators are required to use a medium or coarser (ASABE S572.1) droplet size. • Do not apply when wind speeds exceed 15 mph at the application site. If the windspeed is greater than 10 mph, the boom length must be 65% or less of the wingspan for fixed wing aircraft and 75% or less of the rotor diameter for helicopters. Otherwise, the boom length must be 75% or less of the wingspan for fixed-wing aircraft and 90% or less of the rotor diameter for helicopters For aerial applicators, if the windspeed is 10 miles per hour or less, applicators must use ½ swath displacement upwind at the downwind edge of the field. When the windspeed is between 11-15 miles per hour, applicators must use ¾ swath displacement upwind at the downwind edge of the field Do not apply during temperature inversions."	Directions for Use, in a box titled "Mandatory Spray Drift Managment" under the heading "Aerial Applications"
Spray Drift Management Application Restrictions for products that allow airblast applications	**"MANDATORY SPRAY DRIFT MANAGEMENT** **Airblast applications:** • Sprays must be directed into the canopy foliage. • Do not apply when wind speeds exceed 15 miles per hour at the application site.	Directions for Use, in a box titled "Mandatory Spray Drift Management" under the heading "Airblast Applications"

Description	Proposed Label Language for Imidacloprid Products	Placement on Label
	• User must turn off outward pointing nozzles at row ends and when spraying outer row. • Do not apply during temperature inversions."	
Spray Drift Management Application Restrictions for products that are applied as liquids and allow ground boom applications	**"MANDATORY SPRAY DRIFT MANGEMENT** **Ground Boom Applications:** • User must only apply with the release height recommended by the manufacturer, but no more than 4 feet above the ground or crop canopy. • Applicators are required to use a medium or coarser droplet size (ASABE S572.1). • Do not apply when wind speeds exceed 15 miles per hour at the application site. • Do not apply during temperature inversions."	Directions for Use, in a box titled "Mandatory Spray Drift Management" under the heading "Ground Boom Applications"
Spray Drift Management Application Restrictions for products that are applied as liquids and allow boom-less ground sprayer applications	**"MANDATORY SPRAY DRIFT MANAGEMENT** **Boomless Ground Applications:** • Applicators are required to use a medium or coarser droplet size (ASABE S572.1) for all applications. • Do not apply when wind speeds exceed 15 miles per hour at the application site. • Do not apply during temperature inversions."	Directions for Use, in a box titled "Mandatory Spray Drift Management" under the heading "Boomless Applications"
Advisory Spray Drift Management Language for all products delivered via liquid spray application	**"SPRAY DRIFT ADVISORIES** THE APPLICATOR IS RESPONSIBLE FOR AVOIDING OFF-SITE SPRAY DRIFT. BE AWARE OF NEARBY NON-TARGET SITES AND ENVIRONMENTAL CONDITIONS. **IMPORTANCE OF DROPLET SIZE** An effective way to reduce spray drift is to apply large droplets. Use the largest droplets that provide target pest control. While applying larger droplets will reduce spray drift, the potential for drift will be greater if applications are made improperly or under unfavorable environmental conditions. **Controlling Droplet Size – Ground Boom** ***(note to registrants:*** *remove if ground boom is prohibited on product labels)* • Volume - Increasing the spray volume so that larger droplets are produced will reduce spray drift. Use the highest practical spray volume for the application. If a greater spray volume is needed, consider using a nozzle with a higher flow rate. • Pressure - Use the lowest spray pressure recommended for the nozzle to produce the target spray volume and droplet size. • Spray Nozzle - Use a spray nozzle that is designed for the intended application. Consider using nozzles designed to reduce drift.	Directions for Use, just below the Spray Drift box, under the heading "Spray Drift Advisories"

Description	Proposed Label Language for Imidacloprid Products	Placement on Label
	Controlling Droplet Size – Aircraft ***(note to registrants:*** *remove if aerial application is prohibited on product labels)* • Adjust Nozzles - Follow nozzle manufacturers' recommendations for setting up nozzles. Generally, to reduce fine droplets, nozzles should be oriented parallel with the airflow in flight. **BOOM HEIGHT – Ground Boom** ***(note to registrants:*** *remove if ground boom is prohibited on product labels)* For ground equipment, the boom should remain level with the crop and have minimal bounce. **RELEASE HEIGHT - Aircraft** ***(note to registrants:*** *remove if aerial application is prohibited on product labels)* Higher release heights increase the potential for spray drift. **SHIELDED SPRAYERS** Shielding the boom or individual nozzles can reduce spray drift. Consider using shielded sprayers. Verify that the shields are not interfering with the uniform deposition of the spray on the target area. **TEMPERATURE AND HUMIDITY** When making applications in hot and dry conditions, use larger droplets to reduce effects of evaporation. **TEMPERATURE INVERSIONS** Drift potential is high during a temperature inversion. Temperature inversions are characterized by increasing temperature with altitude and are common on nights with limited cloud cover and light to no wind. The presence of an inversion can be indicated by ground fog or by the movement of smoke from a ground source or an aircraft smoke generator. Smoke that layers and moves laterally in a concentrated cloud (under low wind conditions) indicates an inversion, while smoke that moves upward and rapidly dissipates indicates good vertical air mixing. Avoid applications during temperature inversions. **WIND** Drift potential generally increases with wind speed. AVOID APPLICATIONS DURING GUSTY WIND CONDITIONS.	

Description	Proposed Label Language for Imidacloprid Products	Placement on Label
	Applicators need to be familiar with local wind patterns and terrain that could affect spray drift."	
Advisory Spray Drift Management Language for products that are applied as liquids and allow boom-less ground sprayer applications	**"SPRAY DRIFT ADVISORIES** **Boomless Ground Applications:** • Setting nozzles at the lowest effective height will help to reduce the potential for spray drift."	Directions for Use, just below the Spray Drift box, under the heading "Spray Drift Advisories"
Advisory Spray Drift Management Language for all products that allow liquid applications with handheld technologies	**"SPRAY DRIFT ADVISORIES** **Handheld Technology Applications:** • Take precautions to minimize spray drift."	Directions for Use, just below the Spray Drift box, under the heading "Spray Drift Advisories"
Admire® 2F (EPA Registration Number 264-758) label change		
PHI revision for pomegranate	PHI for pomegranate is 7-days.	Directions for use

Appendix C: Endangered Species Assessment

In 2013, the EPA, along with the Fish and Wildlife Service (FWS), the National Marine Fisheries Service (NMFS), and the United States Department of Agriculture (USDA) released a summary of their joint Interim Approaches for assessing risks to endangered and threatened (listed) species from pesticides[16]. These Interim Approaches were developed jointly by the agencies in response to the National Academy of Sciences' (NAS) recommendations that discussed specific scientific and technical issues related to the development of pesticide risk assessments conducted on federally threatened and endangered species.

Since that time, EPA has conducted biological evaluations (BEs) on three pilot chemicals representing the first nationwide pesticide consultations. These initial consultations were pilots and were envisioned to be the start of an iterative process. The agencies are continuing to work to improve the consultation process. For example, advancements to the initial pilot interim methods have been proposed based on experience conducting the first three pilot BEs. Public input on those proposed revisions is currently being considered.

Also, a provision in the December 2018 Farm Bill included the establishment of a FIFRA Interagency Working Group to provide recommendations for improving the consultation process required under section 7 of the Endangered Species Act for pesticide registration and Registration Review and to increase opportunities for stakeholder input. This group includes representation from EPA, NMFS, FWS, USDA, and the Council on Environmental Quality (CEQ). Given this new law and that the first nationwide pesticide consultations were envisioned as pilots, the agencies are continuing to work collaboratively as consistent with the congressional intent of this new statutory provision. EPA has been tasked with a lead role on this group, and EPA hosted the first Principals Working Group meeting on June 6, 2019.

Given that the agencies are continuing to develop and work toward implementation of approaches to assess the potential risks of pesticides to listed species and their designated critical habitat, the ecological risk assessment supporting this PID for imidacloprid does not contain a complete ESA analysis that includes effects determinations for specific listed species or designated critical habitat. Although the EPA has not yet completed effects determinations for specific species or habitats, for this PID, the EPA's evaluation assumed, for all taxa of non-target wildlife and plants, that listed species and designated critical habitats may be present in the vicinity of the application of imidacloprid. This will allow the EPA to focus its future evaluations on the types of species where the potential for effects exists once the scientific methods being developed by the agencies have been fully vetted. Once that occurs, these methods will be applied to subsequent analyses for imidacloprid as part of completing this registration review.

[16] https://www.epa.gov/endangered-species/draft-revised-method-national-level-endangered-species-risk-assessment-process

Appendix D: Endocrine Disruptor Screening Program

As required by FIFRA and FFDCA, the EPA reviews numerous studies to assess potential adverse outcomes from exposure to chemicals. Collectively, these studies include acute, sub-chronic and chronic toxicity, including assessments of carcinogenicity, neurotoxicity, developmental, reproductive, and general or systemic toxicity. These studies include endpoints which may be susceptible to endocrine influence, including effects on endocrine target organ histopathology, organ weights, estrus cyclicity, sexual maturation, fertility, pregnancy rates, reproductive loss, and sex ratios in offspring. For ecological hazard assessments, the EPA evaluates acute tests and chronic studies that assess growth, developmental and reproductive effects in different taxonomic groups. As part of its most recent registration decision for imidacloprid, the EPA reviewed these data and selected the most sensitive endpoints for relevant risk assessment scenarios from the existing hazard database. However, as required by FFDCA § 408(p), imidacloprid is subject to the endocrine screening part of the Endocrine Disruptor Screening Program (EDSP).

The EPA has developed the EDSP to determine whether certain substances (including pesticide active and other ingredients) may have an effect in humans or wildlife similar to an effect produced by a "naturally occurring estrogen, or other such endocrine effects as the Administrator may designate." The EDSP employs a two-tiered approach to making the statutorily required determinations. Tier 1 consists of a battery of 11 screening assays to identify the potential of a chemical substance to interact with the estrogen, androgen, or thyroid (E, A, or T) hormonal systems. Chemicals that go through Tier 1 screening and are found to have the potential to interact with E, A, or T hormonal systems will proceed to the next stage of the EDSP where the EPA will determine which, if any, of the Tier 2 tests are necessary based on the available data. Tier 2 testing is designed to identify any adverse endocrine-related effects caused by the substance, and establish a dose-response relationship between the dose and the E, A, or T effect.

Under FFDCA § 408(p), the agency must screen all pesticide chemicals. Between October 2009 and February 2010, the EPA issued test orders/data call-ins for the first group of 67 chemicals, which contains 58 pesticide active ingredients and 9 inert ingredients. The agency has reviewed all of the assay data received for the List 1 chemicals and the conclusions of those reviews are available in the chemical-specific public dockets. A second list of chemicals identified for EDSP screening was published on June 14, 2013,[17] and includes some pesticides scheduled for Registration Review and chemicals found in water. Neither of these lists should be construed as a list of known or likely endocrine disruptors. Imidacloprid is not on either list. For further information on the status of the EDSP, the policies and procedures, the lists of chemicals, future lists, the test guidelines and the Tier 1 screening battery, please visit the EPA website.[18]

In this PID, the EPA is making no human health or environmental safety findings associated with the EDSP screening of imidacloprid. Before completing this registration review, the agency will make an EDSP FFDCA § 408(p) determination.

[17] See http://www.regulations.gov/#!documentDetail;D=EPA-HQ-OPPT-2009-0477-0074 for the final second list of chemicals.
[18] https://www.epa.gov/endocrine-disruption

Appendix E: Summary of Proposed Tolerance Actions

Imidacloprid 40 CFR §180.472. Summary of Proposed Tolerance Actions			
Commodity	Currently Established Tolerance (ppm)	Proposed Tolerance (ppm)	Comments (*correct commodity definition*)
§180.472(a) General			
Acerola	1.0	1	Correct number of significant figures to be consistent with EPA policy
Almond, hulls	4.0	4	Correct number of significant figures to be consistent with EPA policy
Apple	0.5	-	Tolerance should be revoked upon establishment of Fruit, pome, group 11-10
Apple, wet pomace	3.0	3	Correct number of significant figures to be consistent with EPA policy
Aspirated grain fractions	240	240	Grain, aspirated fractions
Atemoya	0.30	0.3	Correct number of significant figures to be consistent with EPA policy
Avocado	1.0	1	Correct number of significant figures to be consistent with EPA policy
Banana	0.50	0.5	Correct number of significant figures to be consistent with EPA policy
Beet, sugar, molasses	0.30	0.3	Correct number of significant figures to be consistent with EPA policy
Beet, sugar, tops	0.50	0.5	Correct number of significant figures to be consistent with EPA policy
Biriba	0.30	0.3	Correct number of significant figures to be consistent with EPA policy
Caneberry, subgroup 13-A	2.5	2.5	Caneberry subgroup 13-07A
Canistel	1.0	1	Correct number of significant figures to be consistent with EPA policy
Cattle, fat	0.30	0.3	Correct number of significant figures to be consistent with EPA policy
Cattle, meat	0.30	0.3	Correct number of significant figures to be consistent with EPA policy
Cattle, meat byproducts	0.30	0.3	Correct number of significant figures to be consistent with EPA policy
Celtuce	-	6	Commodity displaced by the crop group conversion.
Cherimoya	0.30	0.3	Correct number of significant figures to be consistent with EPA policy
Citrus, dried pulp	5.0	5	Correct number of significant figures to be consistent with EPA policy
Coffee, green bean	0.8	1	Harmonize with Codex MRL
Cotton, gin byproducts	4.0	4	Correct number of significant figures to be consistent with EPA policy
Cotton, meal	8.0	8	Correct number of significant figures to be consistent with EPA policy
Cotton, undelinted seed	6.0	6	Correct number of significant figures to be consistent with EPA policy
Custard apple	0.30	0.3	Correct number of significant figures to be consistent with EPA policy
Feijoa	1.0	1	Correct number of significant figures to be consistent with EPA policy
Fennel, florence, fresh leaves and stalk	-	6	Commodity displaced by the crop group conversion.
Fruit, citrus, group 10	0.7	1	Fruit, citrus, group 10-10, Harmonize with Codex MRL

Imidacloprid 40 CFR §180.472. Summary of Proposed Tolerance Actions			
Commodity	Currently Established Tolerance (ppm)	Proposed Tolerance (ppm)	Comments (*correct commodity definition*)
Fruit, pome, group 11	0.60	0.6	Corrected value to be consistent with EPA Rounding Class Practice. Fruit, pome, group 11-10
Fruit, stone, group 12	3.0	3	Corrected value to be consistent with EPA Rounding Class Practice. Fruit, stone, group 12-12
Goat, fat	0.30	0.3	Correct number of significant figures to be consistent with EPA policy
Goat, meat	0.30	0.3	Correct number of significant figures to be consistent with EPA policy
Goat, meat byproducts	0.30	0.3	Correct number of significant figures to be consistent with EPA policy
Grain, cereal, forage, fodder and straw, group 16, forage, except rice	7.0	7	Correct number of significant figures to be consistent with EPA policy
Grain, cereal, forage, fodder and straw, group 16, hay, except rice	6.0	6	Correct number of significant figures to be consistent with EPA policy
Grain, cereal, forage, fodder and straw, group 16, stover, except rice	0.30	0.3	Correct number of significant figures to be consistent with EPA policy
Grain, cereal, forage, fodder and straw, group 16, straw, except rice	3.0	3	Correct number of significant figures to be consistent with EPA policy
Grape	1.0	1	Correct number of significant figures to be consistent with EPA policy
Grape, juice	1.0	1	Correct number of significant figures to be consistent with EPA policy
Grape, raisin	1.0	1	Correct number of significant figures to be consistent with EPA policy
Guava	1.0	1	Correct number of significant figures to be consistent with EPA policy
Herbs subgroup 19A, dried herbs	48.0	48	Herb subgroup 19A, dried herbs. Correct number of significant figures to be consistent with EPA policy
Herbs subgroup 19-A, fresh herbs	8.0	8	Corrected value to be consistent with EPA Rounding Class Practice. Herb subgroup 19A, fresh herbs
Hog, fat	0.30	0.3	Correct number of significant figures to be consistent with EPA policy
Hog, meat	0.30	0.3	Correct number of significant figures to be consistent with EPA policy
Hog, meat byproducts	0.30	0.3	Correct number of significant figures to be consistent with EPA policy
Hop, dried cones	6.0	6	Correct number of significant figures to be consistent with EPA policy
Horse, fat	0.30	0.3	Correct number of significant figures to be consistent with EPA policy
Horse, meat	0.30	0.3	Correct number of significant figures to be consistent with EPA policy
Horse, meat byproducts	0.30	0.3	Correct number of significant figures to be consistent with EPA policy
Ilama	0.30	0.3	Correct number of significant figures to be consistent with EPA policy
Jaboticaba	1.0	1	Correct number of significant figures to be consistent with EPA policy

Imidacloprid 40 CFR §180.472. Summary of Proposed Tolerance Actions			
Commodity	Currently Established Tolerance (ppm)	Proposed Tolerance (ppm)	Comments (*correct commodity definition*)
Kava, leaves	4.0	4	Correct number of significant figures to be consistent with EPA policy
Kava, roots	0.40	0.4	Correct number of significant figures to be consistent with EPA policy
Kohlrabi	-	6	Commodity displaced by the crop group conversion.
Leaf petioles subgroup 4B	6.0	6	Correct number of significant figures to be consistent with EPA policy
Leaf petioles subgroup 4B	6.0	6	Corrected value to be consistent with EPA Rounding Class Practice. Leaf petiole vegetable subgroup 22B
Leafy greens subgroup 4A	3.5	3.5	Leafy greens subgroup 4-16
Lettuce, head	3.5	-	See Leafy greens subgroup 4-16
Lettuce, leaf	3.5	-	See Leafy greens subgroup 4-16
Longan	3.0	3	Correct number of significant figures to be consistent with EPA policy
Lychee	3.0	3	Correct number of significant figures to be consistent with EPA policy
Mango	1.0	1	Correct number of significant figures to be consistent with EPA policy
Milk	0.10	0.1	Correct number of significant figures to be consistent with EPA policy
Nut, tree, group 14	0.05	0.05	Nut, tree, group 14-12
Okra	1	-	Tolerance should be revoked upon establishment of Vegetable, fruiting, group 8-10
Onion, dry bulbs, subgroup 3-07A	0.15	0.15	Onion, bulb, subgroup 3-07A
Papaya	1.0	1	Correct number of significant figures to be consistent with EPA policy
Passionfruit	1.0	1	Correct number of significant figures to be consistent with EPA policy
Pecan	0.05	-	Tolerance should be revoked upon establishment of Nut, tree, group 14-12
Persimmon	3.0	3	Correct number of significant figures to be consistent with EPA policy
Pistachio	0.05	-	Tolerance should be revoked upon establishment of Nut, tree, group 14-12
Pomegranate	0.90	0.9	Correct number of significant figures to be consistent with EPA policy
Potato, chip	0.40	0.4	Corrected value to be consistent with EPA Rounding Class Practice. Potato, chips
Potato, processed potato waste	0.90	0.9	Correct number of significant figures to be consistent with EPA policy
Pulasan	3.0	3	Correct number of significant figures to be consistent with EPA policy
Rambutan	3.0	3	Correct number of significant figures to be consistent with EPA policy
Sapodilla	1.0	1	Correct number of significant figures to be consistent with EPA policy
Sapote, black	1.0	1	Correct number of significant figures to be consistent with EPA policy
Sapote, mamey	1.0	1	Correct number of significant figures to be consistent with EPA policy
Sheep, fat	0.30	0.3	Correct number of significant figures to be consistent with EPA policy

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Commodity	Currently Established Tolerance (ppm)	Proposed Tolerance (ppm)	Comments (*correct commodity definition*)
Sheep, meat	0.30	0.3	Correct number of significant figures to be consistent with EPA policy
Sheep, meat byproducts	0.30	0.3	Correct number of significant figures to be consistent with EPA policy
Soursop	0.30	0.3	Correct number of significant figures to be consistent with EPA policy
Soybean, forage	8.0	8	Correct number of significant figures to be consistent with EPA policy
Soybean, meal	4.0	4	Correct number of significant figures to be consistent with EPA policy
Spanish lime	3.0	3	Correct number of significant figures to be consistent with EPA policy
Star apple	1.0	1	Correct number of significant figures to be consistent with EPA policy
Starfruit	1.0	1	Correct number of significant figures to be consistent with EPA policy
Strawberry	0.50	0.5	Correct number of significant figures to be consistent with EPA policy
Sugar apple	0.30	0.3	Correct number of significant figures to be consistent with EPA policy
Tomato, paste	6.0	6	Correct number of significant figures to be consistent with EPA policy
Tomato, puree	3.0	3	Correct number of significant figures to be consistent with EPA policy
Vegetable, brassica leafy, group 5	3.5	3.5	Brassica head and stem vegetable group 5-16
Vegetable, cucurbit, group 9	0.50	0.5	Corrected value to be consistent with EPA Rounding Class Practice.
Vegetable, fruiting, group 8	1.0	1	Corrected value to be consistent with EPA Rounding Class Practice. Vegetable, fruiting, group 8-10
Vegetable, leaves of root and tuber, group 2	4.0	4	Correct number of significant figures to be consistent with EPA policy
Vegetable, legume, group 6, except soybean	4.0	4	Correct number of significant figures to be consistent with EPA policy
Vegetable, root and tuber, group 1, except sugar beet	0.40	0.4	Correct number of significant figures to be consistent with EPA policy
Vegetable, root and tuber, group 1, except sugar beet	0.40	0.4	Corrected value to be consistent with EPA Rounding Class Practice. Vegetable, root and tuber (except sugar beet), subgroup 1B
Watercress	3.5	-	Tolerance should be revoked upon establishment of Leafy greens subgroup 4-16
Watercress, upland	3.5	-	Tolerance should be revoked upon establishment of Leafy greens subgroup 4-16
Wax jambu	1.0	1	Correct number of significant figures to be consistent with EPA policy
§180.472(d) Indirect or inadvertent residues			
Soybean, vegetable	-	0.3	Only commodity not covered by vegetable, legume, group 6, except soybean tolerance in (a).
Vegetable, legume, group 6	0.3	-	Covered by vegetable, legume, group 6, except soybean tolerance in (a) and soybean, vegetable in (d).