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

OFFICE OF CHEMICAL SAFETY
AND POLLUTION PREVENTION

MEMORANDUM

DATE: September 15, 2011

SUBJECT: **Dinotefuran: Human Health Assessment Scoping Document in Support of Registration Review.**

PC Code: 044312
Decision No.: 448720
Petition No.: N/A
Risk Assessment Type: Single Chemical
TXR No.: N/A
MRID No.: N/A

DP Barcode: 389549
Registration No.: N/A
Regulatory Action: Registration Review
Case No.: 7441
CAS No.: 165252-70-0
40 CFR: §180.603

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Executive Summary

The Health Effects Division (HED) Dinotefuran Registration Review Team has evaluated the status of the human health assessments for the insecticide dinotefuran to determine the scope of work necessary to support Registration Review. HED has considered recent risk assessments for dinotefuran, updates to its toxicity, exposure and usage databases, and the latest Agency science policy and risk assessment methodologies. The most recent risk assessment for dinotefuran was conducted in 2011: *Dinotefuran ID#: 11VA02 Section 18 Emergency Exemption for Use on Pome Fruits and Stone Fruits in Virginia, New Jersey, Pennsylvania, Maryland, Delaware, West*

Virginia, and North Carolina to Control Stink Bugs (DP# 388993, B. O'Keefe, 05/31/2011). Additional documents used in this scoping document are cited below.

Dinotefuran ((*RS*)-1-methyl-2-nitro-3-(tetrahydro-3-furylmethyl) guanidine) is a broad spectrum insecticide belonging to the nitroguanidine sub-class of the neonicotinoid class of pesticides. In addition to Section 18 emergency uses on pome fruits and stone fruits, dinotefuran is registered for use on leafy vegetables (except *Brassica*), cotton, fruiting vegetables, cucurbits, potatoes, grapes, head and stem *Brassica* vegetables, and leafy *Brassica* vegetables as well as professional turf management, professional ornamental production, in the residential lawn and garden markets, and as bait pet spot-on products.

Sufficient data are available to assess the toxicity of dinotefuran. All requisite guideline toxicity studies, including carcinogenicity, developmental and reproductive toxicity, neurotoxicity and immunotoxicity studies have been submitted. Since the last risk assessment, a developmental neurotoxicity study and two immunotoxicity studies (rat + mouse) have been submitted. Once all of the requisite data have been reviewed for weight of evidence, the dinotefuran HED Registration Review Team will re-evaluate the sensitivity determination, as well as the points of departure and safety factors, used for risk assessment purposes.

Sufficient residue data are available for dietary risk assessment and tolerance assessment. There are no outstanding residue chemistry data requirements at this time.

No new exposure data are required to assess occupational exposure. The existing registrants for dinotefuran are members of the Agricultural Re-entry Task Force (ARTF) and the Agricultural Handlers Exposure Task Force (AHETF).

There is potential for exposure in residential settings during the application of currently registered products containing dinotefuran, and from entering areas previously treated with dinotefuran, such as lawns where children might play, pets children might play with, or golf courses and home gardens that could lead to exposures for adults. As a conditional requirement for the registration of dinotefuran dog spot-on products, HED required that a fur dislodgeability study be performed (875.2300) and this study remains outstanding.

Introduction

HED has evaluated the status of the human health risk assessments for dinotefuran to determine whether sufficient data are available and whether any updates are needed to support Registration Review. HED has considered the most recent risk assessment for dinotefuran (DP# 388993, B. O'Keefe, 05/31/2011) and HED and OPPIN databases and conducted a screening-level literature search for any information that would aid in assessing human health risks to dinotefuran. Dinotefuran is an insecticide currently registered for ground and broadcast aerosol application to, leafy vegetables (except *Brassica*), cotton, fruiting vegetables (including greenhouse), cucurbits, potatoes, grapes, head and stem *Brassica* vegetables, and leafy *Brassica* vegetables as well as professional turf management, professional ornamental production, in the residential lawn and garden markets, as pet spot on products and ant and roach bait and fogger aerosol products. Dinotefuran is also registered for use on pome and stone fruits (under FIFRA Section 18 emergency Exemptions in Virginia, New Jersey, Pennsylvania, Maryland, Delaware, West Virginia and North Carolina). The end-use products of dinotefuran include liquid and soluble granular, gel, foam and dust, bait station, water soluble packets and spot-on liquid formulations. There are currently 42 end-use products, 3 intermediate formulations and 3 technical products registered for dinotefuran.

Based on the existing use pattern for dinotefuran, residential, occupational and dietary (food and water) exposures are likely.

The new uses for the upcoming dinotefuran action (Petition No. 1E7863) are as follows: low growing berry subgroup 13-07H, except strawberry; watercress; green onion subgroup 3-07B; bulb onion subgroup 3-07A; peach; tuberous and corm vegetable subgroup 1C; small fruit, vine climbing, subgroup 13-07F, except fuzzy kiwifruit; chives; and tea.

Hazard Identification/Toxicology of Dinotefuran

The toxicological data base for dinotefuran is complete and adequate for risk assessment. All toxicity data requirements for conventional pesticide registration under the current 40 CFR Part 158.500 have been satisfied.

Dinotefuran has low acute oral, dermal and inhalation toxicity and is not an eye or skin irritant or a dermal sensitizer.

The available toxicity data show the spleen/thymus and nervous systems to be targets of dinotefuran-induced toxicity. Treatment-related changes in reproductive parameters were also observed in the 2-generation reproduction study (rats). Neurotoxicity was manifested as changes in motor activity in rats (ACN, SCN), decreased grip strength in adult offspring (2-generation reproduction study) and observed tremors and prone position in rabbits (developmental toxicity study). Decreased spleen and thymus weights were observed in all species tested but no evidence of functional immunotoxicity was observed in recently submitted immunotoxicity studies (rat and mouse) of dinotefuran. .

There was no evidence of increased susceptibility following *in utero* exposures in the prenatal developmental toxicity studies in rats and rabbits. In the reproduction toxicity study, there was evidence for increased qualitative susceptibility. Effects seen in offspring at the LOAEL included effects not seen in adults (decreased body weight, decreased thymus weight, and decreased grip strength [not evaluated in adults in the reproduction study, but evaluated and not found in the neurotoxicity studies in adults]). The decreases in offspring body weight occurred during lactation and were greater than the minimal decreases in body weight gain seen in parental animals. However, the level of concern for the observed susceptibility is low since 1) clear NOAELs and LOAELs are established for the endpoints of concern for parental and offspring toxicity; 2) the effects in the offspring were seen in the presence of parental toxicity; and 3) the effects were seen only at the highest dose tested (907 mg/kg/day) which approaches the Limit Dose of 1000 mg/kg/day. In the range-finding developmental neurotoxicity and immunotoxicity study, dinotefuran showed no evidence of an effect on the functionality of the immune system in rats that were exposed to dinotefuran during the prenatal, postnatal, and post-weaning periods. Further, no concerns for developmental neurotoxicity were seen in a guideline DNT study where the offspring NOAEL approached or exceeded the Limit Dose (784 mg/kg/day, gestation; 1643 mg/kg/day, lactation).

Dinotefuran is not mutagenic in bacteria or cultured mammalian cells. There is also no indication of a clastogenic effect up to toxic doses *in vivo*. Dinotefuran is characterized as "not likely" to be a human carcinogen based on the absence of significant tumor increases in two adequate rodent carcinogenicity studies.

In 2003, HED selected toxicity endpoints based on the most sensitive effect, decreased thymus weight (observed at the lowest dose tested, 20 mg/kg/day) in the chronic toxicity study in dogs which was also protective of neurotoxicity and reproductive effects. An additional 10X uncertainty factor (UF_L) was included in the cRfD for absence of a NOAEL in this study. This endpoint (decreased thymus weight) has been subject to comprehensive reevaluation in the context of a 2005 FIFRA Scientific Advisory Panel entitled "A Comparison of the Results of Studies on Pesticides from 1- or 2-year Dog Studies with Dog Studies of Shorter Duration" and, as such, may not be appropriate for future risk assessments of dinotefuran. Endpoints from the most recent risk assessment are otherwise consistent with current policy; they are valid and presented in Attachment 3 Table 4.

The FQPA safety factor will be re-examined based on the current policy and guideline requirements. At the time of the registration review risk assessment, if risk methodologies for applying uncertainty factors have been revised, these inputs will also be incorporated into the risk assessment.

As required by FIFRA and FFDCA, EPA reviews numerous studies to assess potential adverse outcomes from exposure to chemicals. Collectively, these studies include acute, subchronic 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, 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), dinotefuran 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. Dinotefuran is not among the group of 58 pesticide active ingredients on the initial list to be screened under the EDSP. Accordingly, as part of registration review, EPA will issue future EDSP orders/data call-ins, requiring the submission of EDSP screening assays for dinotefuran. For further information on the status of the EDSP, the policies and procedures, the list of 67 chemicals, future lists, the test guidelines and the Tier 1 screening battery, please visit our website: http://www.epa.gov/endo/.

Conclusions:
HED will consider the existing toxicity database as well as all additional toxicity studies received during registration review and will re-evaluate the sensitivity determination, as well as the points of departure and safety factors, used for risk assessment purposes.

Dietary Exposure

Unrefined acute and partially refined chronic dietary exposure assessments were conducted for all existing food uses of dinotefuran and drinking water. Tolerance level residues (except for pome and stone fruit and grape commodities) assuming 100% crop treated were used to assess dinotefuran dietary exposure.

The most recent acute and chronic aggregate dietary (food and drinking water) exposure and risk assessments were conducted using the Dietary Exposure Evaluation Model DEEM-FCID™, Version 2.03, which uses food consumption data from the U.S. Department of Agriculture's Continuing Surveys of Food Intakes by Individuals (CSFII) from 1994-1996 and 1998. Estimated drinking water concentrations (EDWCs) in surface water were generated using the

PRZM-EXAMS model. Ground water EDWCs were generated using SCI-GROW model. The modeled peak surface water value of 281 ppb was used in the acute dietary assessment. The modeled annual mean surface water value of 129 ppb was used in the chronic dietary assessment.

At the 95th percentile, the food and drinking water exposure to infants, less than 1 year old (the most highly exposed population subgroup), from the existing uses of dinotefuran results in an estimated risk equivalent to 5% of the acute population adjusted dose (aPAD).

For the U.S. Population, the existing uses of dinotefuran resulted in an exposure which is equivalent to 41% of the chronic population adjusted dose (cPAD). The most highly exposed subpopulation was Children, 1-2 years old, with an exposure equivalent to 84% of the cPAD.

Conclusions:
There are no Residue Chemistry data gaps. A new dietary assessment for dinotefuran may be required for the purpose of registration review if EFED water values are revised according to new policies, or if the FQPA uncertainty factor is removed.

Residential Exposure

Dinotefuran is registered for use on several residential/non-agricultural use sites; i.e., outdoor residential (lawns, ornamentals, flower gardens, vegetable gardens), indoor residential (pet quarters, bait stations, dog and cat spot-on products, foggers) and recreational (golf courses) sites. Dinotefuran formulations include baits, gels, soluble concentrates, granulars, soluble granules, and ready-to-use (RTU) products, including total-release foggers and RTU sprays.

Residential Handlers:
HED has determined that residential handlers are likely to be exposed to dinotefuran residues via dermal and inhalation routes during handling activities, i.e. mixing, loading, and applying pesticide. HED expects the duration of residential handler exposure to only be short-term (1-30 days). However, a short-term dermal hazard endpoint was not identified. All of the potential residential handler exposure scenarios for the registered uses of dinotefuran were assessed in previous human health risk assessments. No risks of concern were identified; refer to 5 through 7 of the attachments for a summary of residential handler use patterns and corresponding risk estimates. The residential handler assessments were based primarily on the following data sources: the residential standard operating procedures (SOPs), and unit exposure values from the Pesticide Handler Exposure Database (PHED) and from the Outdoor Residential Exposure Task Force (ORETF) studies.

Residential Postapplication:
HED has determined that there is potential for post-application exposure to adults and children ages 3 to < 6 from the many residential uses of dinotefuran. Potential routes of exposure include dermal and inhalation for adults and children, and incidental oral ingestion for children 1 to 3 years of age. While it is assumed that most residential uses of dinotefuran will result in short-term (1 to 30 days) post-application exposures, it is also believed that intermediate-term exposures (> 30 days to 180 days) are possible. As mentioned above, a short-term dermal hazard endpoint was not identified, and therefore, as a screen for potential short-term exposures,

intermediate-term dermal exposures were assessed. HED believes post-application inhalation exposure due to fogger use is negligible. Incidental oral hand-to-mouth exposures to children 1 to 3 years of age from uses on pets, turf and indoor carpets and other surfaces are likely to occur. These exposure scenarios were all assessed in the previous human-health risk assessments; no risks of concern were identified (Table 7). The residential post-application assessments are based upon reliable surrogate study data that are not expected to underestimate risks. The residential Standard Operating Procedures (SOPs) are based upon reasonable "worst-case" assumptions, and they are not expected to underestimate risk.

Based on the Agency's current practices, a quantitative post-application inhalation exposure assessment has not been performed for dinotefuran at this time. However, volatilization of pesticides may be a potential source of post-application inhalation exposure to individuals nearby to pesticide applications. The Agency sought expert advice and input on issues related to volatilization of pesticides from its Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) Scientific Advisory Panel (SAP) in December 2009. The Agency received the SAP's final report on March 2, 2010 (http://www.epa.gov/scipoly/SAP/meetings/2009/120109meeting.html). The Agency is in the process of evaluating the SAP report and may, as appropriate, develop policies and procedures to identify the need for and, subsequently, the way to incorporate post-application inhalation exposure into the Agency's risk assessments. If new policies or procedures are put into place, the Agency may revisit the need for a quantitative post-application inhalation exposure assessment for dinotefuran.

Residential Exposure Data Requirements:
Dinotefuran is currently registered for use in pet spot on products. Therefore, there is potential for incidental oral and dermal exposure to small children. As a conditional requirement for the registration of dinotefuran dog spot-on products, HED required that a fur dislodgeability study be performed. HED has reviewed draft protocols for conducting a pet fur dislodgeability study based on the use of spot-on products for dogs. Submission of the final fur dislodgeability study remains outstanding.

Conclusion:
There is sufficient information available to assess residential exposure. A revised residential assessment will need to be performed to include residential handler scenarios and updated residential post-application scenarios. HED is currently revising its residential SOPs, including those used to determine exposure associated with registered treatments of dinotefuran. A new assessment will be needed to incorporate new guidance from the updated SOPs to refine exposure estimates.

Aggregate Risk Assessment

In the most recent human health risk assessment (DP# 388933, B. O'Keefe, 05/31/2011), aggregate exposure assessments were performed for acute aggregate dietary exposure (food + drinking water), chronic aggregate dietary exposure (food + drinking water), and residential intermediate-term exposure to children (from dermal and incidental oral exposures) and adults (from dermal and inhalation exposures). A cancer aggregate risk assessment was not performed

because dinotefuran is not carcinogenic. All potential exposure pathways were assessed in the aggregate risk assessment.

Conclusions:
The aggregate acute and chronic dietary risk estimates for all populations, resulting from aggregate exposure to dinotefuran in food and drinking water are below HED's level of concern.

Occupational Exposure

Dinotefuran is registered for use on numerous agricultural use sites. It is also registered for use on several non-agricultural use sites.

Occupational Handlers:
There is a potential for handler short- and intermediate-term dermal and inhalation exposures to dinotefuran during mixing, loading, and applying activities. Therefore, occupational handler risk assessments have been conducted for all registered uses. As mentioned above, a short-term dermal hazard endpoint was not identified, and therefore, only intermediate-term dermal exposures were assessed. No chemical specific data are available with which to assess potential dinotefuran exposure to pesticide handlers. Therefore, estimates of exposure to pesticide handlers are based upon data available in the Occupational Pesticide Handler Exposure Database (http://www.epa.gov/pesticides/science/handler-exposure-data.html). The risk calculations were based on maximum application rates and assuming maximum area treated per day. Handler's exposure and risk were calculated at baseline, i.e. long pants, a long-sleeved shirt, with and without chemical resistant gloves, and no respirator. The exposure levels from these assessments were adequate to cover the most highly exposed occupational pesticide handlers for all currently registered use patterns, and resulted in risk estimates (margins of exposure (MOEs) and aggregate risk indexes (ARIs)) that did not exceed HED's level of concern (all MOEs $\geq$100 and all ARIs $\geq$1). The representative occupational handler scenarios that have been assessed are listed in the attachment 4 as Tables 8 and 9.

Post-application Exposure:
Post application short- and intermediate-term dermal and inhalation exposures are possible for workers tending treated food crops and nursery and landscape ornamentals. As mentioned above, a short-term dermal hazard endpoint was not identified, and therefore, only intermediate-term dermal exposures were assessed. Based on the Agency's current practices, a quantitative occupational post-application inhalation exposure assessment has not been performed for dinotefuran. However, there are multiple potential sources of post-application inhalation exposure to individuals performing post-application activities in previously treated fields. These potential sources include volatilization of pesticides and resuspension of dusts and/or particulates that contain pesticides. The Agency sought expert advice and input on issues related to volatilization of pesticides from its FIFRA SAP in December 2009. The Agency received the SAP's final report on March 2, 2010 (http://www.epa.gov/scipoly/SAP/meetings/2009/120109meeting.html). The Agency is in the process of evaluating the SAP report as well as available post application inhalation exposure data generated by the Agricultural Re-entry Task Force (ARTF) and may, as appropriate, develop policies and procedures, to identify the need for and, subsequently, the way to

incorporate occupational post-application inhalation exposure into the Agency's risk assessments. If new policies or procedures are put into place, the Agency may revisit the need for a quantitative occupational post-application inhalation exposure assessment for dinotefuran.

For all registered uses, risk estimates for post application intermediate-term dermal exposures do not exceed HED's level of concern (Table 10).

Conclusions:
There is sufficient information available to assess occupational post-application exposure. However, due to revisions in standard TCs used by HED new occupational post application worker exposure and risk assessments may need to be conducted during registration review.

Based on the Agency's current practices, a quantitative occupational post-application inhalation exposure assessment has not been performed for dinotefuran; however, if new policies or procedures are put into place, the Agency may revisit the need for a quantitative occupational post-application inhalation exposure assessment.

Public Health and Pesticide Epidemiology Data

For this evaluation, both of the OPP Incident Data Systems (IDS) were consulted for pesticide incident data on the active ingredient dinotefuran. In Aggregate IDS, from January 1, 2006 to June 13, 2011, there are 94 incidents involving dinotefuran. For the main IDS, from January 1, 2006 to Jun 13, 2011, there are three cases reported for single chemical only in the database (classified as moderate severity), and two additional incidents that involved more than one chemical. Overall, there are few incidents involving dinotefuran reported to IDS, and most are of lower severity. Dinotefuran is not included in the Agricultural Health Study.
Based on the low frequency and severity of incident cases, there does not appear to be a concern at this time that would warrant further investigation. The Agency will continue to monitor the incident information and if a concern is triggered, additional analysis will be included in the risk assessment.

Tolerance Assessment and International Harmonization

No maximum residue limits (MRLs) for dinotefuran have been established or proposed by Codex or Canada for any agricultural commodity.

U.S. tolerances are currently established for residues of dinotefuran, (RS)-1-methyl-2-nitro-3-((tetrahydro-3-furanyl)methyl)guanidine, including its metabolites and degradates, in or on the commodities listed below. Compliance with the tolerance levels specified below is to be determined by measuring only the sum of dinotefuran and its metabolites DN, 1-methyl-3-(tetrahydro-3-furylmethyl)guanidine, and UF, 1-methyl-3-(tetrahydro-3-furylmethyl)urea, calculated as the stoichiometric equivalent of dinotefuran in or on the commodities listed at the indicated levels (Table 3).

The tolerance expression for dinotefuran has been reviewed to ensure that it appropriately covers the metabolites and degradates of dinotefuran and that it specifies the residues to be measured for each commodity.

Environmental Justice

Potential areas of environmental justice concerns, to the extent possible, were considered in the human health risk assessment, in accordance with U.S. Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations," (http://www.eh.doe.gov/nepa/tools/guidance/Volume1/2-6-EO_12898envjustice.pdf). The Office of Pesticide Programs (OPP) typically considers highest potential exposures from the legal use of a pesticide when conducting human health risk assessments, including, but not limited to, people who obtain drinking water from sources near agricultural areas, the variability of diets within the U.S., and people who may be exposed when harvesting crops. Should these highest exposures indicate potential risks of concern, OPP further refines the risk assessments to ensure that the risk estimates are based on the best available information.

Cumulative

The Agency has not determined whether dinotefuran shares a common mechanism of toxicity with other chemical substances. For information on EPA's efforts to determine which chemicals have a common mechanism of toxicity and to evaluate the cumulative effects of such chemicals, see the policy statements released by EPA's Office of Pesticide Programs concerning common mechanistic determinations and procedures for cumulating effects from substances found to have a common mechanism on EPA's website at http://www.epa.gov/pesticides/cumulative.

Human Studies

Dinotefuran occupational and residential handler risk assessments rely in part on data from studies in which adult human subjects were intentionally exposed to a pesticide or other chemical. These studies have been determined to require a review of their ethical conduct, and have received that review. The Agency has reviewed these studies, which comprise PHED AHETF, ORETF and ARTF, and has determined that they have been conducted ethically.

Data Requirements

Toxicology
No additional toxicology data for dinotefuran are needed for risk assessment purposes.

Residue Chemistry
No additional residue chemistry data for dinotefuran are needed for risk assessment purposes.

Occupational Exposure

- 875.2300 As a conditional requirement for the registration of dinotefuran dog spot-on products, HED required that a fur dislodgeability study be performed. HED has reviewed draft protocols for conducting a pet fur dislodgeability study based on the use of

spot-on products for dogs. Submission of the final fur dislodgeability study remains outstanding.

References

Memoranda Relevant to Registration Review of Dinotefuran			
Author	**Barcode (DP#)**	**Date**	**Title**
S. Recore	D392283	08/08/11	Dinotefuran: Review of Human Incidents
B. O'Keefe	387315	07/06/11	Dinotefuran HED Comments on Conditional Range Finding Study for Loading Based Dislodgeability of Residues from Petting Simulations on Dogs.
B. O'Keefe	388993	05/31/11	Dinotefuran ID#: 11VA02 Section 18 Emergency Exemption for Use on Pome Fruits and Stone Fruits in Virginia, New Jersey, Pennsylvania, Maryland, Delaware, West Virginia, and North Carolina to Control Stink Bugs.
B. O'Keefe	378123	02/28/11	Dinotefuran: Occupational and Residential Exposure Assessment for Proposed Section 3 Use on Christmas Trees, Trees in Plantations, Reforestation Nurseries, Forests, and Woodland Areas.
C. Walls	371986	09/10/10	Dinotefuran: Occupational and Residential Exposure Assessment for Proposed Section 3 Registration of Broadcast Aerosol Use at Residential and Commercial (Non-food) Sites.
K. Rury	370221	02/25/10	Dinotefuran: Occupational and Residential Exposure Assessment for proposed new uses of dinotefuran on greenhouse grown tomatoes.
B. O'Keefe	368147	11/17/09	Dinotefuran. Review of Protocol for Transferability of Residues from Petting Simulation to Dogs.
B. O'Keefe	358026	08/06/09	Dinotefuran: Occupational and Residential Exposure Assessment for proposed new uses of dinotefuran on turnip greens and *Brassica* (cole) leafy vegetables, crop subgroup 5 (broccoli raab, collards, kale, mizuna, Chinese cabbage (bok choy), mustard greens, mustard spinach, and rape greens).
B. O'Keefe	354340	10/27/08	ID#: 08TX11 Section 18 Emergency Exemptions for the Use of Dinotefuran on Rice in Texas to Control Stink Bugs.
S. Recore	347177	05/07/08	Dinotefuran: Occupational and Residential Exposure Assessment for Proposed Section 3 Registration of Dinotefuran Aerosol Use and Total-Release Aerosol Use at Residential and Commercial (Non-food) Sites.
J. Arthur	342524	12/10/07	Occupational and Residential Exposure Assessment for Proposed Section 3 Registration of Dinotefuran on Domestic Pets.
J. Arthur	342532	12/10/07	Occupational and Residential Exposure Assessment for Proposed Section 3 Registration of Dinotefuran on Domestic Pets.
J. Arthur	338600	10/26/07	Occupational and Residential Exposure Assessment for Proposed Section 3 Registration of Dinotefuran Crack and Crevice Use at Residential (Non-food) Use Sites.
B. O'Keefe	332831	11/16/06	ID#: 06TX38 Section 18 Exemption for the use of Dinotefuran on Brassica Leafy Vegetables in Texas. PC Code: 044312, DP Barcode: D332831

J. Arthur	331426	09/14/06	HED Review of Draft Protocol for Study on Dislodgeability of Dinotefuran from Cat Spot-on Products (DP# 331426, Chemical# 044312)
J. Arthur	331019	07/27/06	Dinotefuran: HED Response to Request for Conducting Pet Spot-On Bridging Studies. PC#: 044312. DP#: D331019
J. Arthur	327128	02/23/06	Revised Occupational and Residential Exposure Assessment for Proposed Section 3 Registration of Dinotefuran on Domestic Pets.
J. Arthur	319872	08/01/05	Occupational and Residential Exposure Assessment for Proposed Section 3 Registration of Dinotefuran on Domestic Pets.
B. O'Keefe	309937	12/08/04	Occupational Exposure Assessment for Proposed New Uses of Dinotefuran on Cotton, Fruiting Vegetables, Cucurbits, Potatoes, Grapes, and Head and Stem *Brassica* Vegetables. DP Bar Code D309937, PC Code 044312, EPA Reg. Nos. 33657-17 & 33657-21
J, Arthur	285650	04/27/04	Occupational and Residential Exposure Assessment for Proposed Section 3 Registration of Dinotefuran on Leafy Vegetables and Residential (Non-food) Use Sites.
K. Raffaele	TXR0052409	03/05/2004	Dinotefuran – Report of the Hazard Identification Assessment Review Committee

Attachments

1. Chemical Identity Table

2. Tolerance Summary Table

3. Endpoint Selection Table

4. Occupational and Residential Exposure Tables

Attachment 1

Chemical Identity Tables

Table 1. Nomenclature of Dinotefuran

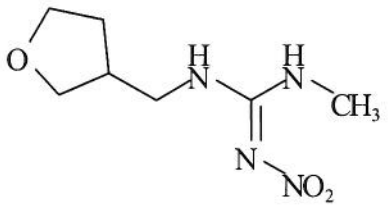
Compound	
Common name	Dinotefuran
Company experimental name	MTI-446
IUPAC name	(RS)-1-Methyl-2-nitro-3-(tetrahydro-3-furylmethyl)-guanidine
CAS name	N-Methyl-N'-nitro-N"-[(tetrahydro-3-furanyl)methyl)]guanidine
CAS #	165252-70-0

Table 2. Physicochemical Properties of the Technical Grade Dinotefuran.

Parameter	Value			Reference
Melting point/range	107.5°C			MRID No. 45639702
pH	5.6 @ 25°C			MRID No. 45654201
Density	1.40 g/cm^3 @ 20°C			MRID No. 45639702
Water solubility (20°C)	39.83 x 10^3 mg/L (pH 6.98)			MRID No. 45639702
Solvent solubility (mg/L at 20°C)	g/100 mL Solvent			MRID No. 45639702
	Hexane	9 x 10^{-7}		
	Heptane	1.05 x 10^{-6}		
	Xylene	0.0072		
	Toluene	0.0149		
	Dichloromethane	6.45		
	Acetone	6.13		
	Methanol	6.00		
	Ethanol	2.01		
	Ethyl Acetate	0.52		
Vapor pressure at 30°C	< 1.7 x 10^{-6} Pa			MRID No. 45639702
Dissociation constant (pK$_a$)	12.6 @ 20°C (estimated)			MRID No. 45639702
Octanol/water partition coefficient Log(K$_{OW}$)	-0.549 (K$_{ow}$ = 0.283) @ 25°C			MRID No. 45639702
UV/visible absorption spectrum	Media	Absorbance Maximum 268 nm	ϵ_{max}: Molar Absorbance Coefficient	MRID No. 45639702
	Acidic	1.0469	12,600	
		1.0180	12,300	
	Neutral	1.3017	12,500	
		1.2668	12,300	
	Basic	0.8869	10,700	
		0.9662	11,700	

Attachment 2
Tolerance Summary Table

Dinotefuran (044312; 09/07/2011)

Table 3. Summary of US and International Tolerances and Maximum Residue Limits				
Residue Definition:				
US	Canada		Mexico[1]	Codex[2]
40 CFR 180.603 Plants: sum of dinotefuran (RS)-1-methyl-2-nitro-3-((tetrahydro-3-furanyl)methyl)guanidine and its metabolites DN, 1-methyl-3-(tetrahydro-3-furylmethyl)guanidine, and UF, 1-methyl-3-(tetrahydro-3-furylmethyl)urea, calculated as the stoichiometric equivalent of dinotefuran	None			None
Commodity	*Tolerance (ppm) /Maximum Residue Limit (mg/kg)*			
	US	Canada	Mexico[1]	Codex[2]
Brassica, head and stem, subgroup 5A	1.4			
Brassica, leafy greens, subgroup 5B	15.0			
Cotton, undelinted seed	0.4			
Cotton, gin byproducts	8.0			
Grape	0.9			
Grape, raisin	2.5			
Potato	0.05			
Potato, chips	0.1			
Potato, granules/flakes	0.15			
Tomato, paste	1.0			
Turnip, greens	15.0			
Vegetable, fruiting, group 8	0.7			
Vegetable, cucurbit, group 9	0.5			
Vegetable, leafy, except Brassica, group 4	5.0			
Livestock : sum of dinotefuran, (RS)-1-methyl-2-nitro-3-((tetrahydro-3-furanyl)methyl)guanidine		None		None
Cattle, fat	0.05			
Cattle, meat	0.05			
Cattle, meat byproducts	0.05			
Goat, fat	0.05			
Goat, meat	0.05			
Goat, meat byproducts	0.05			
Hog, fat	0.05			

Table 3. Summary of US and International Tolerances and Maximum Residue Limits				
Residue Definition:				
US	Canada		Mexico[1]	Codex[2]
Hog, meat	0.05			
Hog, meat byproducts	0.05			
Horse, fat	0.05			
Horse, meat	0.05			
Horse, meat byproducts	0.05			
Milk	0.05			
Sheep, fat	0.05			
Sheep, meat	0.05			
Sheep, meat byproducts	0.05			
Completed: M. Negussie; 09/07/2011				

[1] Mexico adopts US tolerances and/or Codex MRLs for its export purposes.

[2] * = absent at the limit of quantitation; Po = postharvest treatment, such as treatment of stored grains. PoP = processed postharvest treated commodity, such as processing of treated stored wheat. (fat) = to be measured on the fat portion of the sample. F = measured in the milk fat. MRLs indicated as proposed have not been finalized by the CCPR and the CAC.

b) *Section 18 emergency exemptions.* Time-limited tolerances specified in the following table are established for combined residues of Dinotefuran, [*N* -methyl- *N* '-nitro- *N* " -((tetrahydro-3-furanyl)methyl)guanidine] and its metabolites DN [1-methyl-3-(tetrahydro-3-furylmethyl)guanidine] and UF [1-methyl-3-(tetrahydro-3-furylmethyl)urea], expressed as dinotefuran in or on the specified agricultural commodities, resulting from use of the pesticide pursuant to FFIFRA section 18 emergency exemptions. The tolerances expire and are revoked on the date specified in the table.

Commodity	Parts per million	Expiration/revocation date
Rice, grain	2.8	12/31/12

Attachment 3
Endpoint Selection Table

Table 4a. Summary of Toxicological Doses and Endpoints for Dinotefuran for Use in Dietary and Non-Occupational Human Health Risk Assessments				
Exposure/ Scenario	**Point of Departure**	**Uncertainty/FQPA Safety Factors**	**RfD, PAD, Level of Concern for Risk Assessment**	**Study and Toxicological Effects**
Acute Dietary (General Population, including Infants and Children)	NOAEL=125 mg/kg/day	UF_A= 10x UF_H= 10x FQPA SF= 1x	Acute RfD = 1.25 mg/kg/day aPAD =1.25 mg/kg/day	Developmental Toxicity Study in Rabbits LOAEL = 300 mg/kg/day based on clinical signs in does (prone position, tremor, erythema) seen following a single dose.
Chronic Dietary (All Populations)	LOAEL=20 mg/kg/day	UF_A= 10x UF_H= 10x FQPA SF= 10x, which is a UF_L	Chronic RfD = 0.02 mg/kg/day cPAD = 0.02 mg/kg/day	Chronic Toxicity in Dogs LOAEL = 20 mg/kg/day based on decreased thymus weight in males.
Incidental Oral Short-Term (1-30 days)	NOAEL=33 mg/kg/day	UF_A= 10x UF_H= 10x FQPA SF= 1x	Residential LOC for MOE = 100	Subchronic Neurotoxicity Study in Rats LOAEL = 327 mg/kg/day based on increased motor activity during week two.
Incidental Oral Intermediate-Term (1-6 months)	NOAEL=22 mg/kg/day	UF_A= 10x UF_H= 10x FQPA SF= 1x	Residential LOC for MOE = 100	Chronic Toxicity in Dogs LOAEL = 108 mg/kg/day based on decreased body weight and body weight gains in females.
Dermal Short-Term (1-30 days)	No systemic toxicity was seen at the limit dose in a 28-day rat dermal toxicity study in which neurotoxicity was evaluated and there are no developmental toxicity concerns. No hazard was identified for this exposure scenario.			
Dermal Intermediate-Term (1-6 months)	NOAEL=22 mg/kg/day	UF_A= 10x UF_H= 10x FQPA SF= 1x	Residential LOC for MOE = 100	Chronic Toxicity in Dogs LOAEL = 108 mg/kg/day based on decreased body weight and body weight gains in females.
Inhalation Short- Term (1-30 days)	LOAEL=60 mg/kg/day	UF_A= 10x UF_H= 10x FQPA SF= 10x, which is a UF_L	Residential LOC for MOE = 1000	28-day Inhalation Toxicity Study in Rats LOAEL = 60 mg/kg/day based on decreased body weight gain in males.
Inhalation Intermediate-Term (1-6 months)	LOAEL=60 mg/kg/day	UF_A= 10x UF_H= 10x FQPA SF= 10x, which is a UF_L	Residential LOC for MOE = 1000	28-day Inhalation Toxicity Study in Rats LOAEL = 60 mg/kg/day based on decreased body weight gain in males.
Cancer (oral, dermal, inhalation)	Classification: "Not likely to be Carcinogenic to Humans" based on the absence of significant tumor increases in two adequate rodent carcinogenicity studies.			

Table 4b. Summary of Toxicological Doses and Endpoints for Dinotefuran for Use in Occupational Human Health Risk Assessments				
Exposure/ Scenario	**Point of Departure**	**Uncertainty Factors**	**Level of Concern for Risk Assessment**	**Study and Toxicological Effects**
Dermal Short-Term (1-30 days)	NA	NA	NA	No systemic toxicity was seen at the limit dose in a 28-day rat dermal toxicity study in which neurotoxicity was evaluated and there are no developmental toxicity concerns. No hazard was identified for this exposure scenario
Dermal Intermediate-Term (1-6 months)	NOAEL=22 mg/kg/day	UF_A= 10x UF_H= 10x	Occupational LOC for MOE = 100	Chronic Toxicity in Dogs LOAEL = 108 mg/kg/day based on decreased body weight and body weight gains in females.
Inhalation Short-Term (1-30 days)	LOAEL=60 mg/kg/day	UF_A=10x UF_H=10x UF_L= 10x	Occupational LOC for MOE = 1000	28-day Inhalation Toxicity Study in Rats LOAEL = 60 mg/kg/day based on decreased body weight gain in males.
Inhalation Intermediate-term (1-6 months)	LOAEL=60 mg/kg/day	UF_A=10x UF_H=10x UF_L= 10x	Occupational LOC for MOE = 1000	28-day Inhalation Toxicity Study in Rats LOAEL = 60 mg/kg/day based on decreased body weight gain in males.
Cancer (oral, dermal, inhalation)	Classification: "Not likely to be Carcinogenic to Humans" based on the absence of significant tumor increases in two adequate rodent carcinogenicity studies.			

Attachment 4
Occupational and Residential Exposure Tables

Table 5. Residential Exposure Scenarios for Dinotefuran.

Crop/Use Site	Application Equipment[1]	Formulation Type(s)[2]	Max. App. Rate	Scenario Covered[3]		
				Mixer/ Loader	Applicator	M/L/A
Ornamentals	LPHW	L	0.00123 lb ai/gal	NA	NA	Y
Trees and ornamental shrubs	sprinkler can	G	Trees: 1 tsp/inch tree diameter. (0.0014 lb. ai per teaspoon) 0.0014 lb ai/gal	NA	NA	Y
	sprinkler can	G	Shrubs: 3 tsp/foot of shrub height (0.0014 lb. ai per teaspoon) 0.0014 lb ai/gal	NA	NA	Y
Turf	groundboom, aerial, chemigation, handgun & hose-end sprayer	L	0.54 lb ai/A	Y	Y	Y
Grass, lawns, turf , ornamentals, ground cover, around trees, shrubs & flowerbeds	belly grinder	G	0.008 -0.012 lbs ai/1000 ft^2 (0.35 - 0.52 lb ai/A)	NA	NA	Y
Ant Bait on lawns, golf courses, horse farms, & non-cropped & non-grazed areas on farms, and rangeland for horse farms only.	hand, belly grinder, push type spreader	Granular Bait	Single mound treatment: 1-2 tblsp. (0.000078 lb ai/tblsp). Broadcast or Aerial: 0.0038-0.0076 lbs ai/A	NA	Y	Y
Fire Ant Bait on lawns, golf courses, horse farms, & non-cropped & non-grazed areas on farms, and rangeland for horse farms only.	hand, belly grinder, push type spreader	Granular Bait	Single mound treatment: 1-2 tblsp. (0.000001 lb ai/tblsp). Broadcast: 0.00005 - 0.0001 lbs ai/A	NA	Y	Y
Cat Spot-On	squeeze tube syringe	L	Cats ≤ 9 lb: 192 mg ai/treatment Cats > 9 lb: 320 mg ai/treatment	NA	Y	NA
Dog Spot-On	squeeze tube syringe	L	Dogs 2.5-10 lb: 286 mg ai/treatment Dogs 11-20 lb: 440 mg ai/treatment Dogs 21-55 lb: 880 mg ai/treatment Dogs 56-100 lb: 1320 mg ai/treatment Dogs ≥ 101 lb: 1628 mg	NA	Y	NA
Outdoor and indoor ornamental & household plants and garden vegetables.	trigger-spray pump	RTU	Spray until surface is slightly moist. (0.042 lb ai per gallon; 0.01 lb ai per quart)	NA	Y	NA
Total release fogger for residential and commercial	Fogger	RTU	8.0 oz to 1.5 lb per fogger unit. (0.009 lb ai per 144 ft^2 or ~ 1000 ft^3)	NA	Y	NA
Indoor aerosol spray	aerosol spray can	Aerosol	0.00626 lb ai/can 2 cans/day	NA	Y	NA
Crack & crevice	bulbous hand duster or powder duster	RTU Dust	0.00005 lb ai/ft^2	NA	NA	Y

Table 6. Summary of Residential Handler Exposures and Risks.							
Scenarios Assessed	**DP#**	**Application Rate**	**Area Treated/ Amount Applied (per day)**	**Exposure Route**	**MOE**	**ARI**	**Total ARI[1]**
M/L/A Liquids: hose-end sprayer	285650	0.54 lb ai/A	0.5 acre	Dermal	1700	17	17
				Inhalation	970,000	970	
M/L/A Liquids: low pressure handwand	285650	0.00123 lb ai/gal	5 gal	Dermal	8,500	85	85
				Inhalation	23,000,000	23,000	
M/L/A Granular: open mixing sprinkler can	285650	0.0014 lb ai/gal	5 gal	Dermal	70,000	700	700
				Inhalation	40,000,000	40,000	
M/L/A Granular: open pour belly grinder	285650	0.012 lb ai/1000 ft^2 (0.52 lb ai/A)	0.5 acre	Dermal	180	1.8	1.8
				Inhalation	260,000	260	
M/L/A Granular: push type spreader	285650	0.0076 lb ai/A	0.5 acre	Dermal	2,000,000	20,000	20,000
				Inhalation	1.2E+9	1,200,000	
Application Granular: by hand	285650	0.000078 lb ai/ mound	5 mounds	Dermal	30.000	300	300
				Inhalation	20,000,000	20,000	
Application Liquid: RTU trigger-pump sprayer	285650	0.042 lb ai/gal	1 gal	Dermal	9,200	92	90
				Inhalation	800,000	800	
Application Liquid: squeeze tube	327128 342524 342532	Cats ≤ 9 lb: 192 mg ai/treatment Cats > 9 lb: 320 mg ai/treatment Dogs 2.5-10 lb: 286 mg ai/treatment Dogs 11-20 lb: 440 mg ai/treatment Dogs 21-55 lb: 880 mg ai/treatment Dogs 56-100 lb: 1320 mg ai/treatment Dogs ≥ 101 lb: 1628 mg	1 tube	Negligible exposure is expected from these products due to self contained packaging and minimal handling requirements.			
Total release fogger for residential and commercial	347177	8.0 oz to 1.5 lb per fogger unit. (0.009 lb ai per 144 ft^2 or ~ 1000 ft^3)	1 can / 12 ft x 12 ft room	Exposures from applying with total release fogger are expected to be lower than exposures from applying with aerosol cans due to self contained packaging and directions to immediately leave the area once the fogger is triggered.			
Indoor aerosol spray	347177	0.00626 lb ai/can	2 cans/day	Dermal	38,000	380	150
				Inhalation	260,000	260	
Crack & crevice	338600	0.00005 lb ai/ft^2	500 ft^2	Dermal	970,000	9,700	2,800
				Inhalation	3,900,000	3,900	

Table 7. Summary of Residential Post Application Oral & Inhalation Child Exposures and Risk Estimates.				
Crop Group	DP#	Application Rate	Activities	MOE
Treated Lawns	285650	0.54 lb ai/A	oral hand-to-mouth	5,800
			oral object-to-mouth	11,000
			oral ingestion of soil	800,000
			oral ingestion of granules	1,600
Treated Dogs and Puppies	285650	200 mg ai/animal	oral hand-to-mouth	230
	342532	0.0157 mg/cm^2		2,100
	327128	40.3 mg ai/animal		4,600
		80.7 mg ai/animal		2,300
		161.6 mg ai/animal		1,100
		193.8 mg ai/animal		960
Treated Cats and Kittens	285650	200 mg ai/animal	oral hand-to-mouth	230
	342524	0.00685 mg/cm^2		4,800
		0.0102 mg/cm^2		3,200
	327128	192 mg ai/animal		960
		320 mg ai/animal		580
Treated Carpets	285650	0.039 mg/cm^2	inhalation	190,000
			oral hand-to-mouth	190
	347177	12 µg ai/cm^2	oral from crack and crevice	1,300
		15 µg ai/cm^2	oral from spot treatment	410
		4.3 µg ai/cm^2	oral from fogger	1,400
Indoor Total Release Fogger	285650	125 mg ai/m^3	inhalation	1,000
Crack and Crevice Dust	338600	0.0244 mg/cm^2	oral hand-to-mouth	300
Broadcast Aerosol Spray	371986	0.00061 mg ai/cm^2	oral hand-to-mouth	10,000

Table 8. Occupational Exposure Scenarios for Dinotefuran.						
Crop/Use Site	Application Equipment[1]	Formulation Type(s)[2]	Max. App. Rate	Scenario Covered[3]		
				Mixer/ Loader	Applicator	M/L/A
Section 3 Agricultural Uses						
Brassica Leafy Vegetables, Crop Subgroup 5	groundboom, aerial	SG	Foliar at 0.141 lb ai/A	Y	Y	NA
Cotton	groundboom, aerial, chemigation	SG, L	Foliar at 0.134 lb ai/A	Y	Y	NA
Cucurbits	groundboom, aerial, chemigation	SG, L	Foliar at 0.179 lb ai/A Soil at0.268 b ai/A	Y	Y	NA
Fruiting Vegetables	groundboom, aerial, chemigation	SG, L	Foliar at 0.179 lb ai/A Soil at0.268 b ai/A	Y	Y	NA
Grapes	groundboom, aerial, chemigation	SG, L	Foliar at 0.179 lb ai/A Soil at0.268 b ai/A	Y	Y	NA
Head & Stem *Brassica* Vegetables	groundboom, aerial, chemigation	SG, L	Foliar at 0.179 lb ai/A Soil at0.268 b ai/A	Y	Y	NA
Leafy Vegetables	aerial, ground, chemigation	SG, L	Foliar at 0.134 lb ai/A Soil at 0.268 lb ai/A	Y	Y	N/A
Potatoes	groundboom, aerial, chemigation	SG, L	Foliar at 0.134 lb ai/A Soil at0.268 b ai/A	Y	Y	NA
Turnip Greens	groundboom, aerial	SG	Foliar at 0.141 lb ai/A	Y	Y	NA
Greenhouse Grown Tomatoes	LPHW, HPHW, backpack sprayer, chemigation	SG	Foliar at 0.2 lb ai/A	Y	NA	Y
	LPHW, HPHW, backpack sprayer	SG	Soil Drench at 0.54 b ai/A	Y	NA	Y
Section 18 Agricultural Uses						
Pome Fruit	Airblast	DF	Foliar at 0.304 lb ai/A	Y	Y	NA
Stone Fruit	Airblast	DF	Foliar at 0.304 lb ai/A	Y	Y	NA
Rice	Aerial	SG	Foliar at 0.13 lb ai/A	Y	Y	NA
Brassica Leafy Vegetables	groundboom, aerial, chemigation	SG	Foliar at 0.179 lb ai/A Soil at0.268 b ai/A	Y	Y	NA
Other Uses						
Christmas Trees, trees in Plantations Reforestation Nurseries, Forests, and Woodland Areas	foliar, airblast & broadcast sprays	SG	0.2 lb ai/A 0.1 lb ai/100 gal	Y	Y	NA
	soil media drench	SG	0.3 lb ai/100 gal 0.003 lb ai/gal 2.4 g ai/inch of trunk diameter at breast height	NA	NA	Y
	Chemigation	SG	0.1 to 0.2 lb ai/A 0.05 to 0.1 lb ai/100 gal	Y	NA	NA
	basal trunk spray	SG	0.0003 lb ai/gal 2.12 g ai/inch of trunk diameter at breast height	Y	NA	NA
Ornamental Trees, Non-Bearing Fruit Trees, Non-Bearing Nut Trees, Christmas Trees, trees in Plantations Reforestation Nurseries, Forests, and Woodland Areas	tree trunk injection	SG	2 g ai (0.83 tsp, or 0.001 lb) per inch of trunk diameter at breast height 0.264 lb ai/day/applicator	Y	NA	NA

Table 8. Occupational Exposure Scenarios for Dinotefuran.						
Crop/Use Site	Application Equipment[1]	Formulation Type(s)[2]	Max. App. Rate	Scenario Covered[3]		
				Mixer/ Loader	Applicator	M/L/A
Ornamentals	LPHW, HPHW, backpack sprayer	L	0.268 lb ai/A	NA	NA	Y
Trees and ornamental shrubs	sprinkler can	G	Trees: 1 tsp/inch tree diameter. (0.0014 lb. ai per teaspoon)	NA	NA	Y
	sprinkler can	G	Shrubs: 3 tsp/foot of shrub height (0.0014 lb. ai per teaspoon)	NA	NA	Y
Turf	groundboom, aerial, chemigation, handgun & hose-end sprayer	L	0.54 lb ai/A	Y	Y	Y
Grass, lawns, turf, ornamentals, ground cover, around trees, shrubs & flowerbeds	belly grinder	G	0.008 -0.012 lbs ai/1000 ft^2 (0.35 - 0.52 lb ai/A)	NA	NA	Y
Indoor (including residential and food and non-food areas of food service/handling establishments) & pet areas. Outdoor (surfaces of buildings, porches, patios, etc.)	LPHW, backpack sprayer	L	3.2 to 6.4 fl oz of product/gal/1000 ft^2 (0.04 to 0.08 lb ai/gal)	NA	NA	Y
Ant Bait on lawns, golf courses, horse farms, & non-cropped & non-grazed areas on farms, and rangeland for horse farms only.	hand, belly grinder, push type spreader, tractor-drawn spreader, aerial	Granular Bait	Single mound treatment: 1-2 tblsp. (0.000078 lb ai/tblsp). Broadcast or Aerial: 0.0038-0.0076 lbs ai/A	Y	Y	Y
Fire Ant Bait on lawns, golf courses, horse farms, & non-cropped & non-grazed areas on farms, and rangeland for horse farms only.	hand, belly grinder, push type spreader, tractor-drawn spreader, aerial	Granular Bait	Single mound treatment: 1-2 tblsp. (0.000001 lb ai/tblsp). Broadcast or Aerial: 0.00005 - 0.0001 lbs ai/A	Y	Y	Y
Fly Bait in industrial, commercial & agricultural settings.	Hand	Granular Bait	0.25 lbs per 500ft^2	NA	Y	NA
Cockroach Bait Station	Hand	NA	At least, 10 bait stations in kitchen; 2 in each bathroom.	NA	Y	NA
Cockroach Gel Bait	Syringe	Gel	Spots or a line of gel in cracks and crevices as needed in areas of roach traffic. (30 to 120 g per unit)	NA	Y	NA
Cat Spot-On	Syringe	L	Cats ≤ 9 lb: 192 mg ai/treatment Cats > 9 lb: 320 mg ai/treatment	NA	Y	NA
Dog Spot-On	Syringe	L	Dogs 2.5-10 lb: 286 mg ai/treatment Dogs 11-20 lb: 440 mg ai/treatment Dogs 21-55 lb: 880 mg ai/treatment Dogs 56-100 lb: 1320 mg ai/treatment Dogs ≥ 101 lb: 1628 mg	NA	Y	NA

Table 8. Occupational Exposure Scenarios for Dinotefuran.						
Crop/Use Site	Application Equipment[1]	Formulation Type(s)[2]	Max. App. Rate	Scenario Covered[3]		
				Mixer/ Loader	Applicator	M/L/A
Outdoor and indoor ornamental & household plants and garden vegetables.	trigger-spray pump	RTU	Spray until surface is slightly moist. (0.042 lb ai per gallon; 0.01 lb ai per quart)	NA	Y	NA
Total release fogger for residential and commercial	Fogger	RTU	8.0 oz to 1.5 lb per fogger unit. (0.009 lb ai per 144 ft^2, 1000 ft^3, 12 ft x 12 ft room)	NA	Y	NA
Indoor aerosol spray	aerosol spray can	Aerosol	0.00626 lb ai/can 2 cans/day	NA	Y	NA
Crack & crevice	bulbous hand duster or powder duster	RTU Dust	0.00005 lb ai/ft^2	NA	NA	Y

Table 9. Summary of Occupational Handler Exposures and Risks.							
Scenarios Assessed	DP#	Application Rate	Area Treated/ Amount Applied (per day)	Exposure Route	MOE	ARI	Total ARI[1]
Soluble Concentrate							
M/L/A Liquids: high pressure handwand	285650	0.00123 lb ai/100 gal	1000 gal	Dermal	1,200	12	8.5
				Inhalation	29,000	29	
M/L/A Liquids: low pressure handwand	285650	0.08 lb ai/gal	40 gal	Dermal	3,700	37	20
				Inhalation	43,000	43	
M/L/A Liquids: backpack sprayer	285650	0.08 lb ai/gal	40 gal	Dermal	650	6.5	5.6
				Inhalation	44,000	44	
M/L Liquids: open mixing groundboom	285650	0.54 lb ai/A	80 acres	Dermal	5,000	50	32
				Inhalation	80,000	80	
	309937	0.134 lb ai/A	200 acres	Dermal	8,300	83	51
				Inhalation	130,000	130	
	309937	0.268 lb ai/A	80 acres	Dermal	10,000	1,000	140
				Inhalation	160,000	160	
M/L Liquids: open mixing aerial	309937	0.134 lb ai/A	1200 acres	Dermal	1,400	14	8.6
				Inhalation	22,000	22	
M/L Liquids: open mixing aerial or chemigation	285650	0.54 lb ai/A	350 acres	Dermal	1,200	12	7
				Inhalation	19,000	19	
	309937	0.268 lb ai/A	350 acres	Dermal	2,400	24	15
				Inhalation	37,000	37	
M/L Liquids: open mixing airblast	309937	0.179 lb ai/A	40 acres	Dermal	31,000	31	29
				Inhalation	490,000	490	
	388993	0.304 lb ai/A	40 acres	Dermal	1,900	19	19
				Inhalation	1,600,000	1,600	
Apply Liquids: groundboom (open cab)	285650	0.54 lb ai/A	80 acres	Dermal	8,500	85	52
				Inhalation	130,000	130	
	309937	0.134 lb ai/A	200 acres	Dermal	14,000	140	84
				Inhalation	210,000	210	
	309937	0.268 lb ai/A	80 acres	Dermal	17,000	170	100
				Inhalation	260,000	260	
Apply Liquids: aerial (enclosed cockpit)	285650	0.54 lb ai/A	350 acres	Dermal	5,500	55	48
				Inhalation	300,000	300	
	309937	0.134 lb ai/A	1200 acres	Dermal	6,400	64	55
				Inhalation	380,000	380	
	309937	0.268 lb ai/A	350 acres	Dermal	11,000	110	94
				Inhalation	660,000	660	
Applying Liquids: airblast (open cab)	309937	0.179 lb ai/A	40 acres	Dermal	3,000	30	24
				Inhalation	130,000	130	
	388993	0.304 lb ai/A	40 acres	Dermal	1,200	12	10
				Inhalation	77,000	77	
Flagging Liquids: aerially applied	309937	0.134 lb ai/A	350 acres	Dermal	10,000	100	72
				Inhalation	260,000	260	
	309937	0.268 lb ai/A		Dermal	5,000	50	24
				Inhalation	47,000	47	
M/L/A Liquids: handgun (lawn) sprayer	285650	0.54 lb ai/A	5 acres	Dermal	3,800	38	38
				Inhalation	820,000	820	
Soluble Granule							
M/L/A Liquids: high pressure handwand	285650	0.123 lb ai/100 gal	1000 gal	Dermal	1,200	12	8.5
				Inhalation	29,000	29	
	378123	0.003 lb ai/gal		Dermal	1,100	11	5.6
				Inhalation	12,000	12	
M/L/A Liquids: high pressure handwand as foliar	370221	0.2 lb ai/A	10 acres	Dermal	1,000	10	9.0
				Inhalation	70,000	70	
M/L/A Liquids: high pressure handwand as soil drench	370221	0.54 lb ai/A	10 acres	Dermal	380	3.8	3.3
				Inhalation	26,000	26	
M/L/A Liquids: low pressure handwand	285650	0.00123 lb ai/gal	40 gal	Dermal	1,000	10	10
				Inhalation	2,900,000	2,900	
	378123	0.003 lb ai/gal		Dermal	1,700,000	17,000	1,100
				Inhalation	1,200,000	1,200	

Table 9. Summary of Occupational Handler Exposures and Risks.							
Scenarios Assessed	DP#	Application Rate	Area Treated/ Amount Applied (per day)	Exposure Route	MOE	ARI	Total ARI[1]
M/L/A Liquids: low pressure handwand as foliar	370221	0.2 lb ai/A	0.4 acres	Dermal	150,000	1,500	800
				Inhalation	1,800,000	1,800	
M/L/A Liquids: low pressure handwand as soil drench	370221	0.54 lb ai/A	0.4 acres	Dermal	55,000	550	300
				Inhalation	650,000	650	
M/L/A Liquids: backpack sprayer	285650	0.00123 lb ai/gal	40 gal	Dermal	42,000	420	370
				Inhalation	2,900,000	2,900	
	378123	0.003 lb ai/gal		Dermal	300,000	3,000	840
				Inhalation	1,200,000	1,200	
M/L/A Liquids: backpack sprayer as foliar	370221	0.2 lb ai/A	0.4 acres	Dermal	26,000	260	220
				Inhalation	1,800,000	1,800	
M/L/A Liquids: backpack sprayer as soil drench	370221	0.54 lb ai/A	0.4 acres	Dermal	9,500	95	83
				Inhalation	650,000	650	
M/L Granular: open mixing groundboom	285650	0.54 lb ai/A	80 acres	Dermal	14,000	140	43
				Inhalation	60,000	60	
M/L Liquids: open mixing groundboom	378123	0.2 lb ai/A	200 acres	Dermal	98,000	980	80
				Inhalation	88,000	88	
M/L Dry Flowable: open mixing groundboom	309937	0.134 lb ai/A	200 acres	Dermal	29,000	290	120
				Inhalation	200,000	200	
	309937 332831	0.268 lb ai/A	80 acres	Dermal	36,000	360	150
				Inhalation	250,000	250	
	358026	0.14 lb ai/A	80 acres	Dermal	6,900	69	61
				Inhalation	490,000	490	
M/L Granular: open mixing aerial or chemigation	285650	0.54 lb ai/A	350 acres	Dermal	3,200	32	9.1
				Inhalation	13,000	13	
M/L Dry Flowable: open mixing aerial	309937	0.134 lb ai/A	1200 acres	Dermal	4,800	48	20
				Inhalation	34,000	34	
	309937 332831	0.268 lb ai/A	350 acres	Dermal	8,300	83	34
				Inhalation	58,000	58	
	358026	0.14 lb ai/A	350 acres	Dermal	1,600	16	14
				Inhalation	110,000	110	
	354340	0.13 lb ai/A	1200 acres	Dermal	5,000	50	21
				Inhalation	35,000	35	
M/L Liquids: open mixing chemigation	378123	0.54 lb ai/A	350 acres	Dermal	21,000	210	17
				Inhalation	19,000	19	
M/L Soluble Granular: chemigation as foliar	370221	0.2 lb ai/A	0.4 acres	Dermal	970,000	9,700	640
				Inhalation	690,000	690	
M/L Soluble Granular: chemigation as soil drench	370221	0.54 lb ai/A	0.4 acres	Dermal	36,000	360	68
				Inhalation	69,000	69	
M/L Liquids: open mixing aerial	378123	0.2 lb ai/A	1200 acres	Dermal	16,000	160	13
				Inhalation	15,000	15	
M/L Liquids: open mixing airblast	378123	0.2 lb ai/A	40 acres	Dermal	490,000	4,900	400
				Inhalation	440,000	440	
M/L Dry Flowable: open mixing airblast	309937	0.179 lb ai/A	40 acres	Dermal	110,000	1,100	450
				Inhalation	760,000	760	
	388993	0.304 lb ai/A	40 acres	Dermal	1,900	19	13
				Inhalation	39,000	39	
Apply Liquids: groundboom (open cab)	285650	0.54 lb ai/A	80 acres	Dermal	8,500	85	50
				Inhalation	130,000	130	
	378123	0.2 lb ai/A	200 acres	Dermal	160,000	1,600	130
				Inhalation	140,000	140	
	309937	0.134 lb ai/A	200 acres	Dermal	14,000	140	84
				Inhalation	210,000	210	
	309937 332831	0.268 lb ai/A	80 acres	Dermal	17,000	170	100
				Inhalation	260,000	260	
	358026	0.14 lb ai/A	80 acres	Dermal	33,000	330	200
				Inhalation	510,000	510	
Apply Liquids: aerial (enclosed cockpit)	285650	0.54 lb ai/A	350 acres	Dermal	5,400	54	45
				Inhalation	330,000	330	
	378123	0.2 lb ai/A	1200 acres	Dermal	75,000	750	190
				Inhalation	260,000	260	

Table 9. Summary of Occupational Handler Exposures and Risks.							
Scenarios Assessed	DP#	Application Rate	Area Treated/ Amount Applied (per day)	Exposure Route	MOE	ARI	Total ARI[1]
	309937	0.134 lb ai/A	1200 acres	Dermal	6,400	64	55
				Inhalation	380,000	380	
	354340	0.13 lb ai/A	1200 acres	Dermal	6,600	66	57
				Inhalation	400,000	400	
	309937 332831	0.268 lb ai/A	350 acres	Dermal	11,000	110	94
				Inhalation	660,000	660	
	358026	0.14 lb ai/A	350 acres	Dermal	21,000	210	180
				Inhalation	1,300,000	1,300	
Apply Liquids: airblast (open cab)	378123	0.2 lb ai/A	40 acres	Dermal	47,000	470	94
				Inhalation	120,000	120	
	309937	0.179 lb ai/A	40 acres	Dermal	3,000	30	24
				Inhalation	130,000	130	
	388993	0.304 lb ai/A	40 acres	Dermal	1,200	12	10
				Inhalation	77,000	77	
Flagging Liquids: aerially applied	285650	0.54 lb ai/A	350 acres	Dermal	2,500	25	22
				Inhalation	210,000	210	
	378123	0.2 lb ai/A	1200 acres	Dermal	34,000	340	44
				Inhalation	50,000	50	
	309937	0.134 lb ai/A	350 acres	Dermal	10,000	100	72
				Inhalation	260,000	260	
	354340	0.13 lb ai/A		Dermal	10,000	100	72
				Inhalation	260,000	260	
	309937 332831	0.268 lb ai/A		Dermal	5,000	50	36
				Inhalation	130,000	130	
	358026	0.14 lb ai/A	350 acres	Dermal	9,500	95	69
				Inhalation	240,000	240	
M/L/A Water Dispersible Granules: handgun (lawn) sprayer	285650	0.54 lb ai/A	5 acres	Dermal	3,200	32	30
				Inhalation	700,000	700	
M/L/A Granular: open mixing (sprinkler can)	285650	00014 lb ai/gal	10 gal	Dermal	65,000	650	625
				Inhalation	19,000,000	19,000	
M/L/A Granular: open pour (belly grinder)	285650	0.012 lb ai/1000 ft^2	1 acre	Dermal	1,000	10	9.1
				Inhalation	130,000	130	
ML Liquids for Tree Injection	378123	0.264 lb ai/day		Dermal	16,000,000	160,000	12,000
				Inhalation	13,000,000	13,000	
Granular Baits							
Hand Application Granular: spoon (ant bait)	285650	0.000078 lb ai/mound	20 mounds	Dermal	1,700,000	17,000	13,000
				Inhalation	60,000,000	60,000	
M/L/A Granular: open pour (belly grinder) (ant bait)	285650	0.0076 lb ai/A	1 acre	Dermal	67,000	670	625
				Inhalation	9,000,000	9,000	
M/L/A Granular: push type spreader (ant bait)	285650	0.0076 lb ai/A	5 acres	Dermal	390,000	390	380
				Inhalation	15,000,000	15,000	
M/L Granular: tractor drawn spreader (ant bait)	285650	0.0076 lb ai/A	200 acres	Dermal	400,000	4,000	1,100
				Inhalation	1,600,000	1,600	
Applicator Granular: tractor drawn spreader (ant bait)	285650	0.0076 lb ai/A	200 acres	Dermal	340,000	3,400	1,400
				Inhalation	2,300,000	2,300	
M/L Granular: aerial (ant bait)	285650	0.0076 lb ai/A	1200 acres	Dermal	67,000	670	190
				Inhalation	270,000	270	
Applicator Granular: aerial (ant bait)	285650	0.0076 lb ai/A	1200 acres	Dermal	330,000	3,300	313
				Inhalation	350,000	350	
Flagging Granular: aerially applied (ant bait)	285650	0.0076 lb ai/A	350 acres	Dermal	690,000	6,900	4,300
				Inhalation	11,000,000	11,000	
Hand Application Granular: open pour (fly bait)	285650	0.25 lb ai/500 ft^2	1000 ft^2	Dermal	140	1.4	1.3
				Inhalation	18,000	18	
Bait Stations (solid)							
Placement by Hand	285650	Negligible exposure expected due to self-contained packaging and minimal handling requirements.					
Gel Baits							
Hand Applied Gel Baits	285650	Negligible exposure expected due to self-contained packaging and minimal handling requirements.					
Pet Spot-On Treatments							
Hand Application, Squeeze Tube	285650	Negligible exposure expected due to self-contained packaging and minimal handling requirements.					

Table 9. Summary of Occupational Handler Exposures and Risks.							
Scenarios Assessed	DP#	Application Rate	Area Treated/ Amount Applied (per day)	Exposure Route	MOE	ARI	Total ARI[1]
	327128 342524 342532						
Ready-To-Use (RTU)							
Application: trigger pump sprayer	285650	0.042 lb ai/gal	2 gal	Dermal	4,500	45	40
				Inhalation	400,000	400	
Total Release Fogger							
Application: total release fogger	285650 347177	Exposures from applying with total release fogger are expected to be lower than exposures from applying with aerosol cans due to self contained packaging and directions to immediately leave the area once the fogger is triggered.					
Broadcast Aerosol							
Indoor aerosol spray	347177 371986	0.00626 lb ai/can	2 cans/day	Dermal	38,000	380	150
				Inhalation	260,000	260	
Crack & Crevice Duster							
M/L/A Dust: crack & crevice	338600	0.00005 lb ai/ft^2	500 ft^2	Dermal	970,000	9,700	2,800
				Inhalation	3,900,000	3,900	

Table 10. Summary of Occupational Post Application Intermediate-Term Dermal Exposures and Risk Estimates.					
Crop Group	DP#	Application Rate	Dermal Transfer Coefficient (cm2/hr)	Activities	MOE
Golf Course Maintenance	285650	0.54 lb ai/A	3400	mow, seed, mechanical weed, aerate, fertilize, prune	5,500
Turf Farms	285650	0.54 lb ai/A	6800	mow, scout, mechanical weed, irrigate	2,800
Nursery and Greenhouse	285650	0.268 lb ai/A	110	pruning & tying	10,000
			175	pinching	6,300
			400	hand harvest, replanting	2,800
Leafy Vegetables	285650	0.134 lb ai/A	500	hand weed, irrigate, scout, thinning	4,000
			1500	irrigating, scouting	1,300
			2500	hand harvest, hand prune, thinning	800
Cotton	309937	0.134 lb ai/A	1500	irrigating, hand weed, scouting	1,300
			2500	hand harvest	790
Vegetables, Head & Stem *Brassica*	309937	0.179 lb ai/A	2000	thinning	740
			4000	scouting	370
			5000	hand harvest, hand prune, hand weed, irrigate	300
Fruiting Vegetables	309937	0.179 lb ai/A	500	hand weed	3,000
			700	scouting, irrigating	2,100
			1000	tying, training, staking, hand prune, hand harvest	1,500
Cucurbits	309937	0.179 lb ai/A	1500	hand weed, irrigate, scout	990
			2500	hand harvest, hand prune, thinning	600
Potato	309937	0.179 lb ai/A	300	hand weed	5,000
			1500	irrigate, scouting	990
Grapes	309937	0.179 lb ai/A	500	Hand weed	3,000
			1000	Scouting	1,500
			5000	tying, training, hand harvest, hand prune, leaf pulling	300
			10000	cane turning, girdling	150
Turnip Greens and *Brassica* Leafy Greens	358026	0.141 lb ai/A	500	hand weed, irrigate, scout, thin at minimum foliage	3,800
			1500	irrigate, scout at full foliage	1,300
			2500	hand prune, hand harvest, thin at full foliage	760
Brassica Leafy Greens	332831	0.179 lb ai/A	500	hand weed	3,000
			1500	irrigate, scout	990
			2500	hand harvest, thin	600
Greenhouse Grown Tomatoes	370221	0.2 lb ai/A	1000	thinning, tying, training, staking, hand prune, hand harvest	3,000
Christmas Trees	378123	0.2 lb ai/A	3000	thinning	3,700
Nursery and Potted Plants	378123	0.2 lb ai/A	110	pruning, tying	100,000
			175	pinching	64,000
			400	hand harvest, replanting	28,000
Stone Fruit and Pome Fruit	388993	0.304 lb ai/A	100	orchard maintenance, propping	8,800
			580	hand prune, training, scouting	1,500
			1400	hand harvest	625
			3600	thinning fruit	240
Rice	354340	0.13 lb ai/A	100	scouting at minimum foliage	20,000
			1500	scouting at full foliage	1,300