OFFICE OF CHEMICAL SAFETY AND POLLUTION PREVENTION

WASHINGTON, D.C. 20460

MEMORANDUM

DATE: July 31, 2024

SUBJECT: **Fluindapyr.** Occupational and Residential Exposure Assessment for Proposed Uses on Soybeans, Sod Farms, Athletic Fields and Residential Turfgrass and Lawns.

PC Code: 138008
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Petition No.: 3E9059, 2F9020

Risk Assessment Type: Occupational/Residential Exposure Assessment
TXR No.: NA
MRID No.: NA

Task Group No.: 00484663
Parent Case No.: 00478167
Registration No.: 279-3637, 279-3638, 279-3639, 279-3640, 279-3641, 279-3642, 279-3643
Regulatory Action: Section 3 Registration

Reg. Review Case No.: NA
40 CFR: §180.716

FROM: Brent Davis, Biologist
Risk Assessment Branch III (RAB3)
Health Effects Division (HED; 7509T)

THRU: Thomas Moriarty, Branch Chief,
Risk Assessment Branch III (RAB3)
Health Effects Division (HED; 7509T)

and

Kelly Lowe, ExpoSAC Reviewer
Alexis Hardie, ExpoSAC Reviewer
Exposure Science Advisory Committee (ExpoSAC) / HED

TO: Carmen Swinger/Nathan Mellor, RM 21
Cynthia Giles-Parker, Branch Chief
Fungicide Branch
Registration Division (RD; 7505T)

The conclusions conveyed in this assessment were developed in full compliance with *EPA Scientific Integrity Policy for Transparent and Objective Science*, and EPA Scientific Integrity Program's *Approaches for Expressing and Resolving Differing Scientific Opinions.* The full text of *EPA Scientific Integrity Policy for Transparent and Objective Science*, as updated and approved by the Scientific Integrity Committee and EPA Science Advisor can be found here: https://www.epa.gov/system/files/documents/2023-12/scientific_integrity_policy_2012_accessible.pdf. The full text of the EPA Scientific Integrity Program's *Approaches for Expressing and Resolving Differing Scientific Opinions* can be found here: https://www.epa.gov/scientific-integrity/approaches-expressing-and-resolving-differing-scientific-opinions.

Introduction

The Registration Division (RD) requested that the Health Effects Division (HED) conduct an exposure and risk assessment to evaluate the hazard and exposure data and conduct an occupational and residential exposure assessment, as needed, to estimate the risks to human health that will result from the proposed uses of fluindapyr on soybeans, sod farms, athletic fields, and residential lawns. An occupational and residential exposure (ORE) assessment for proposed uses of fluindapyr, including soybeans, was previously completed in October of 2020 (L. Bacon, E. Lang, D455860, 10/27/2020). However, the proposed soybean uses were withdrawn by the petitioner prior to being registered. The recommendations and conclusions from the previous ORE regarding the use of fluindapyr on soybeans remains valid and unchanged (L. Bacon, E. Lang, D455860, 10/27/2020). A summary of the findings and an assessment of occupational and residential exposure risks resulting from the proposed uses of fluindapyr are provided in this document.

It is HED policy to use the best available data to assess exposure. Several sources of generic data were used in this assessment as surrogate data in the absence of chemical-specific data, including: Pesticide Handlers Exposure Database Version 1.1 (PHED 1.1); the Agricultural Handler Exposure Task Force (AHETF) database; the Outdoor Residential Exposure Task Force (ORETF) database; the Residential SOPs (Lawns and Turf), and other registrant-submitted exposure monitoring studies (MRID 44339801). Some of these data are proprietary, and subject to the data protection provisions of the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA).

Note: This memorandum was reviewed by the Exposure Science Advisory Committee (ExpoSAC) on 07/06/2023.

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1.0 Executive Summary

Fluindapyr [3-(difluoromethyl)-*N*-(7-fluoro-1,1,3-trimethyl-2,3-dihydro-1*H*-inden-4-yl)-1-methyl-1*H*-pyrazole-4-carboxamide] is formulated as a racemic mixture of R and S stereoisomers. Fluindapyr is an active ingredient (ai) in the group 7 fungicides and is a pyrazole carboxamide pesticide. The pesticidal mode of action for fluindapyr is as a succinate dehydrogenase inhibitor (SDHI). Fluindapyr is registered for use on cereal grains except rice, crop group 15, tree nut crop group 14-12, ornamentals (in public/commercial landscapes or properties and greenhouses) and non-cropland areas (e.g., commercial turf, golf courses, roadsides, industrial sites, utility rights-of-way and railways).

Proposed Use Profile
The registrant, FMC Corporation, has submitted a petition for tolerances on soybeans. Soybean uses are being proposed in the following fluindapyr end-use products (EPs): F9944-74 (EPA Reg. No. 279-3637), F4412-1 (EPA Reg. No. 279-3642) and F4413-1 (EPA Reg. No. 279-3643). Additionally, EP F4406-1 (EPA Reg. No. 279-3640) is proposing soybean as a rotational crop only, with an immediate plant back interval. F9944-74, F4412-1, and F4413-1 are formulated as an SC ranging from 10.5% to 42.4% ai, and intended for post-emergent application via aerial, ground, or chemigation equipment. The application rates are 0.05 to 0.11 lb ai/A; the retreatment interval is 14 days and up to 2 applications may be made. The maximum seasonal use rate is 0.224 lb ai/A. The pre-harvest intervals (PHIs) are 7 days for forage and 21 days for soybean seed. The end-use product labels associated with the petition require baseline attire (i.e., long-sleeved shirt, pants, shoes, and socks) plus personal protective equipment (PPE) consisting of chemical-resistant gloves. The restricted-entry interval (REI) specified on each product label for soybean is 12 hours.

Furthermore, FMC Corporation is submitting an application to expand the use sites for end-use products (EPs) F9944-74 T&O SC Fungicide (EPA Reg. No. 279-3639) and F4406-1 T&O SC Fungicide (EPA Reg. No. 279-3641) to include residential lawns, athletic fields, and sod farms. F9944-74 T&O SC Fungicide (EPA Reg. No. 279-3639) and F4406-1 T&O SC Fungicide (EPA Reg. No. 279-3641) are formulated as a SC, containing 42.4 % (4 lb ai/gal - flutriafol) and 20.9% (2 lb ai/gal) fluindapyr, respectively. Both EPs specify a maximum single application rate of 0.27 lb ai/A, and applications may be made via groundboom, chemigation and handheld equipment. Both product labels require applicators and other handlers to wear a long-sleeved shirt, long pants, shoes, and socks; and PPE consisting of chemical-resistant gloves. Since the proposed label requires the use of specific attire and/or PPE, HED has made the assumption that these products are not for homeowner use. The REI specified on each product label is 12 hours.

Exposure Profile
Based on the proposed use patterns, occupational and residential exposures are expected. Residential exposures are expected to be short-term (1 to 30 days) only in duration. Since the proposed label requires the use of specific attire and/or PPE, residential handler exposures are not anticipated to occur because the applications are not intended to be made by homeowner or residential applicators. However, there is a potential for post-application dermal exposure to adults and children 1 to < 2 years old and children's incidental oral exposure from hand-to-mouth activities while contacting treated surfaces. Occupational dermal and inhalation handler and post-application exposure is expected to be both short- (1 to 30 days) and intermediate-term (1 to 6 months) in duration. Additionally, non-

occupational adult short-term dermal and children short-term dermal and incidental oral exposures may occur from residues resulting from spray drift following applications to agricultural and/or non-agricultural areas.

Hazard Characterization

HED has determined that the toxicology database for fluindapyr is complete and adequate to assess occupational/residential exposure. Fluindapyr produces adverse liver effects that progress with time in treated dogs, while similar effects are not seen in rats and mice at high dose levels (above 330 mg/kg/day in rats and above the limit dose in mice). In dogs, reduced body weight was observed at 8 mg/kg/day, which was used as a chronic toxicity endpoint for risk assessment. Fluindapyr did not demonstrate neurotoxic potential. In the reproduction study, fluindapyr induces substantial adverse reproductive, offspring, and parental effects observed at the lowest-observed adverse-effect level (LOAEL) of 142/173 mg/kg/day (males/females) (no-observed adverse-effect level (NOAEL) = 30 mg/kg/day). These effects were used as the toxicity endpoints for incidental oral, dermal, and inhalation exposure assessments. Data on *in utero* and postnatal exposures do not indicate any increase in sensitivity of the young animals. In addition, fluindapyr is "not likely to be carcinogenic to humans" and quantitation of cancer risk is not required, nor conducted. However, fluindapyr causes an increase in thyroid follicular hypertrophy/hyperplasia in the parental animals of both F1 and P generations. This finding raises the concern about the potential impact to the developing brain in response to changing thyroid levels brought on by thyroid effect in the parents. The Hazard and Science Policy Council (HASPOC) recommended a comparative thyroid assay (CTA) for fluindapyr to address this concern (J. Camp, TXR 0057980, 12/04/2019). This study has not been submitted yet; therefore, at this time, a database uncertainty factor (10X) has been placed on fluindapyr to address this concern. Therefore, the total uncertainty factor for risk assessment on fluindapyr (dermal, inhalation, and incidental oral exposures) is 1,000X (10X for interspecies uncertainty, 10X for intraspecies difference, and 10X for lack of a CTA).

Residential Exposure and Risk

Based upon the proposed uses of fluindapyr, a residential handler assessment was not conducted. However, there are residential post-application exposures expected for the proposed uses of fluindapyr on athletic fields and residential lawns and turf. Chemical-specific TTR data (MRID 51970301) were submitted and used in the assessment consistent with the 2012 Residential SOPs (Table 6.2.1). Using the chemical-specific TTR data for liquid applications to athletic fields and residential lawns, no risks of concern were identified (i.e., the margins of exposure (MOEs) are ≥ the LOC of 1,000). The post-application adult dermal risk estimates range from 3,200 to 160,000 while the resulting combined post-application dermal and incidental oral risk estimates for children 1 to < 2 years old range from 1,700 to 1,900; MOEs are presented in Table 6.2.2.

Additionally, there are existing residential post-application exposures that have been reassessed (e.g., golf courses) using the new chemical-specific TTR data and included in this assessment for consideration in the aggregate risk assessment for fluindapyr. Estimated risks from dermal exposure were not of concern for either adult (MOE = 41,000), youth 11 to < 16 years old (MOE = 41,000), or kids 6 to < 11 years old (MOE = 35,000); MOEs are presented in Table 5.2.2.

Occupational Exposure and Risk

A recently completed occupational handler risk assessment evaluated the use of fluindapyr on soybeans under the same application parameters (e.g. rate method) as the proposed use on soybeans, and no risks of concern were identified (i.e., MOEs ≥ LOC of 1,000). Additionally, occupational post-application exposure and risk estimates for soybeans indicated that short- and intermediate-term MOEs are not of concern on day of application. The results of the existing occupational exposure assessment conducted on soybeans remain valid and unchanged (L. Bacon, E. Lang, D455860, 10/27/2020). The MOEs from the proposed soybean use are provided in this memo.

For the proposed use on sod farms, athletic fields, and residential lawns, there were no risks of concern at labeled rate with required attire (i.e., long-sleeved shirt, long pants, socks, and shoes with chemical-resistant gloves). Combined dermal and inhalation MOEs range from 1,600 to 500,000 (LOC = 1,000). Short-term dermal occupational post-application exposures were not of concern (i.e., MOE ≥ LOC of 1,000) on the day of application using chemical-specific TTR data.

Fluindapyr is classified as Toxicity Category III via the dermal route and Toxicity Category IV for skin and eye irritation potential. It is a moderate skin sensitizer. Under 40 CFR 156.208 I (2) (iii), ai's classified as Acute III or IV for acute dermal, eye irritation and primary skin irritation are assigned a 12-hour REI. Furthermore, the short- and intermediate-term post-application risk estimates were not a concern on day 0 (12 hours following application) for all post-application activities. Therefore, the [156 subpart K] Worker Protection Statement interim REI of 12 hours is adequate to protect agricultural workers from post-application exposures to fluindapyr.

Based on the Agency's current practices, a quantitative non-cancer occupational post-application inhalation exposure assessment was not performed for fluindapyr at this time. 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 fluindapyr.

Human Studies Review

This risk assessment relies in part on data from studies in which adult human subjects were intentionally exposed to a pesticide or other chemical. These data, which include studies from PHED 1.1, the AHETF database, the ORETF, the Residential SOPs (Turf/Lawn and Gardens/Trees), and other registrant-submitted exposure monitoring studies (MRID 44339801) are (1) subject to ethics review pursuant to 40 CFR 26, (2) have received that review, and (3) are compliant with applicable ethics requirements. For certain studies, the ethics review may have included review by the Human Studies Review Board. Descriptions of data sources, as well as guidance on their use, can be found at the Agency website[1].

2.0 Risk Assessment Conclusions and Recommendations

[1] https://www.epa.gov/pesticide-science-and-assessing-pesticide-risks/occupational-pesticide-handler-exposure-data and https://www.epa.gov/pesticide-science-and-assessing-pesticide-risks/occupational-pesticide-post-application-exposure

2.1 Summary of Risk Estimates

Residential post-application dermal exposures (adults) and combined dermal and incidental oral (children 1 to < 2 years old) exposures and risks from contact with treated turf on residential lawns and athletic fields do not result in any risks of concern using the chemical-specific TTR data for liquid applications. The post-application adult dermal risk estimates range from 3,200 to 160,000; and the children 1 to < 2 years old combined dermal and incidental oral risk estimates resulted in MOEs between 1,700 to 1,900 (LOC = 1,000).

All occupational handler scenarios for the proposed uses resulted in combined dermal and inhalation risk estimates that are not of concern assuming label required attire and PPE (i.e., long sleeved shirt, long pants, socks, and shoes with chemical resistant gloves). MOEs range from 1,600 to 500,000 (LOC = 1,000). Chemical specific TTR data was used to determine post-application exposures from contact with treated turf in sod farms. All post-application scenarios resulted in dermal risk estimates greater than the LOC of 1,000 on day 0; MOE = 16,000.

2.2 Label Recommendations

None.

2.3 Data Deficiencies and Requirements

None.

3.0 Hazard Characterization

Acute Toxicity

Fluindapyr exhibited low acute toxicity with oral, dermal, and inhalation dosing resulting in Toxicity Category III for oral and dermal routes of exposure and IV for the inhalation route of exposure. It was not an eye or dermal irritant, but it produced moderate skin sensitization with local lymph node assay.

3.1. Summary of Acute Toxicity Data for Fluindapyr (Technical ai).

Guideline No.	Study Type	MRID(s)	Results	Toxicity Category
870.1100	Acute Oral (rat)	50518084	LD_{50} > 2000 mg/kg (F)	III
870.1200	Acute Dermal (rat)	50518085	LD_{50} > 2000 mg/kg (M & F)	III
870.1300	Acute Inhalation (rat)	50518086	LC_{50} > 5.19 mg/L (M & F)	IV*
870.2400	Primary Eye Irritation (rabbit)	50518087	Non-irritating	IV
870.2500	Primary Skin Irritation (rabbit)	50518088	Non-irritating	IV
870.2600	Dermal Sensitization (mouse)	50518089	Moderately sensitizing+ (LLNA)	NA

*: Treated rats showed signs of ↑ respiratory rate, hunched posture, ataxia, & piloerection.
+: SI values: 1.97, 3.44, 5.46 for 10, 25, and 50% (w/w), respectively

Toxicological PODs Used for Risk Assessment

Incidental Oral Exposure Endpoints (all durations): The two-generation reproduction study in rats was selected to evaluate incidental oral exposure scenarios based on offspring effects (decrease F1 & F2 pup body weights, and decreases in thymus and spleen weights), parental effects (increased incidence

of thyroid hyperplasia/ hypertrophy), and reproductive effects (corpora lutea vacuolation, increase epithelium mucification, increase anestrous epithelium of the vagina, delayed vaginal opening, increase in acyclic cycles with corresponding decrease in regular cycles, decrease in antral follicle counts, increase in seminal vesicle weight, decreases in ovary and uterine weights, and attenuated endometrium) observed at the LOAEL of 142/173 mg/kg/day (males/females) (NOAEL = 30 mg/kg/day). This study is appropriate for the route and duration of exposure and is protective of all other findings noted in the toxicological database. The LOC for incidental oral exposures is 1000X (10X for intra species variation and 10X for interspecies differences and 10X Food Quality Protection Act safety factor (FQPA SF)/ Database uncertainty factor (UF_{DB})).

Dermal and Inhalation exposures (all durations): A acceptable dermal toxicity study is not available for fluindapyr and a new one was not recommended by HASPOC (Camp, J., TXR 0057980, 12/04/2019), therefore, an oral point of departure was selected to evaluate dermal exposure scenarios. The data from the two-generation reproduction study in rat was instead employed for establishing the toxicity endpoint and POD for dermal and inhalation risk assessment. The two-generation reproduction study in rats resulted in a NOAEL and LOAEL of 30 and 142/173 (males/females) mg/kg/day, respectively, based on offspring effects (decrease F1 & F2 pup body weights, and decreases in thymus and spleen weights), parental (increased incidence of thyroid hyperplasia/ hypertrophy) and reproductive effects (corpora lutea vacuolation, increased epithelium mucification, increased anestrous epithelium of the vagina, delayed vaginal opening, increase in acyclic cycles with corresponding decrease in regular cycles, decrease in antral follicle counts, increase in seminal vesicle weight, decreases in ovary and uterine weights, and attenuated endometrium). The LOC for dermal and inhalation exposures is 1,000 (10X for intra species variation, 10X for interspecies differences, and 10X FQPA SF/UF_{DB}). A dermal absorption factor (DAF) of 17% should be employed for dermal risk assessment.

The toxicity endpoints selected for incidental oral, inhalation, and dermal routes of exposure are the same; therefore, these routes of exposure may be combined to assess aggregate risks.

Table 3.2. Summary of Toxicological Doses and Endpoints for Fluindapyr for Use in Non-Occupational Human Health Risk Assessments.

Exposure/ Scenario	Point of Departure	Uncertainty/ FQPA SF	LOC for Risk Assessment	Study and Toxicological Effects
Incidental Oral Short-Term (1 to 30 days)	NOAEL= 30 mg/kg/day	UF_A = 10X UF_H = 10X FQPA SF/UF_{db} = 10X	LOC = 1,000	Two-generation reproduction study LOAEL = 142 mg/kg/day based on offspring, parental, and reproductive effects+
Dermal Short (1 to 30 days) and Intermediate-Term (1 to 6 months)	NOAEL= 30 mg/kg/day DAF = 17%	UF_A = 10X UF_H = 10X FQPA SF/UF_{db} = 10X	LOC = 1,000	Two-generation reproduction study LOAEL = 142 mg/kg/day based on offspring, parental, and reproductive effects+
Inhalation Short- (1 to 30 days) and Intermediate-Term (1 to 6 months)	NOAEL= 30 mg/kg/day	UF_A = 10X UF_H = 10X FQPA SF/UF_{db} = 10X	LOC = 1,000	Two-generation reproduction study LOAEL = 142 mg/kg/day based on offspring, parental, and reproductive effects+

Table 3.2. Summary of Toxicological Doses and Endpoints for Fluindapyr for Use in Non-Occupational Human Health Risk Assessments.

Exposure/ Scenario	Point of Departure	Uncertainty/ FQPA SF	LOC for Risk Assessment	Study and Toxicological Effects
Cancer (oral, dermal, inhalation)	Fluindapyr is classified as "not likely to be carcinogenic to humans" and quantitation of cancer risk is not required.			

Point of Departure (PoD) = A data point or an estimated point that is derived from observed dose-response data and used to mark the beginning of extrapolation to determine risk associated with lower environmentally relevant human exposures. NOAEL = no-observed adverse-effect level. LOAEL = lowest-observed adverse-effect level. UF = uncertainty factor. UF_A = extrapolation from animal to human (interspecies). UF_H = potential variation in sensitivity among members of the human population (intraspecies). SF = Safety Factor. UF_{db} = database uncertainty factor due to the requirement for a comparative thyroid assay (CTA). LOC = level of concern.
⁺Offspring effects: decrease F1 & F2 pup body weights and decreases in thymus and spleen weights.
Parental effects: increased incidence of thyroid hyperplasia/ hypertrophy.
Reproductive effects: corpora lutea vacuolation, increase epithelium mucification, increase anestrous epithelium of the vagina, delayed vaginal opening, increase in acyclic cycles (with corresponding decrease in regular cycles), decrease in antral follicle counts, increase in seminal vesicle weight, decreases in ovary and uterine weights, and attenuated endometrium.

Table 3.3. Summary of Toxicological Doses and Endpoints for Fluindapyr for Use in Occupational Human Health Risk Assessments

Exposure/ Scenarios	Point of Departure	Uncertainty Factor	LOC	Study and Toxicological Effects
Dermal Short (1 to 30-days) and Intermediate-Term (1 to 6 months)	NOAEL= 30 mg/kg/day DAF = 17%	UF_A = 10X UF_H = 10X UF_{db} = 10X	LOC = 1,000	Two-generation reproduction study LOAEL = 142 mg/kg/day based on offspring, parental, and reproductive effects⁺
Inhalation Short- (1 to 30 days) and Intermediate-Term (1 to 6 months)	NOAEL= 30 mg/kg/day	UF_A = 10X UF_H = 10X UF_{db} = 10X	LOC = 1,000	Two-generation reproduction study LOAEL = 142 mg/kg/day based on offspring, parental, and reproductive effects⁺
Cancer (oral, dermal, inhalation)	Fluindapyr is classified as "not likely to be carcinogenic to humans" and quantitation of cancer risk is not required.			

Point of Departure (PoD) = A data point or an estimated point that is derived from observed dose-response data and used to mark the beginning of extrapolation to determine risk associated with lower environmentally relevant human exposures. NOAEL = no-observed adverse-effect level. LOAEL = lowest-observed adverse-effect level. UF = uncertainty factor. UF_A = extrapolation from animal to human (interspecies). UF_H = potential variation in sensitivity among members of the human population (intraspecies). UF_{db} = database uncertainty factor due to the requirement for a comparative thyroid assay (CTA). LOC = level of concern.
⁺Offspring effects: decrease F1 & F2 pup body weights, thymus and in spleen weights.
Parental effects: increased incidence of thyroid hyperplasia/ hypertrophy.
Reproductive effects: corpora lutea vacuolation, increase epithelium mucification, increase anestrous epithelium of the vagina, delayed vaginal opening, increase in acyclic cycles (with corresponding decrease in regular cycles), decrease in antral follicle counts, increase in seminal vesicle weight, decreases in ovary and uterine weights, and attenuated endometrium.

Cancer Classification

Fluindapyr produced a slight increase in hepatocellular adenomas in male CD-1 mice. The tumor incidence and related toxicology data were evaluated by the Cancer Assessment Review Committee (CARC), which classified fluindapyr as "Not Likely to be Carcinogenic to Humans". This was based on the lack of treatment-related tumors seen in male or female rats or mice and no concern for

mutagenicity (Louden, R., TXR 0057930, 09/03/2019). Quantification of carcinogenic potential is not required for fluindapyr.

Absorption
A DAF of 17% was recommended for fluindapyr based on the DAFs of structurally related chemicals with a similar mode of fungicidal action (e.g., penflufen, sedaxane, fluxapyroxad benzovindiflupyr, bixafen, and penthiopyrad). The DAFs for structurally related chemicals ranged from 5.4% to 17% based on *in vivo* dermal penetration studies or extrapolation of oral/dermal studies. Since no inhalation absorption data are available, toxicity by the inhalation route is considered equivalent to the estimated toxicity by the oral route of exposure.

Body Weight
Since the dermal and inhalation PODs are based on developmental and/or fetal effects, the body weight appropriate for the adult dermal and inhalation assessments is 69 kg. For the assessment of incidental oral exposure, the body weight used for children 1 to < 2 years old was 11 kg.

4.0 Use Profile

Fluindapyr EPs proposing soybean uses (EPA Reg. Nos. 279-3637 (F9944-74), 279-3642 (F4412-1) and 279-3643 (F4413-1) are formulated as an SC ranging from 10.5% to 42.4% ai, intended for post-emergent application via aerial, ground, or chemigation equipment. The application rates are 0.05 to 0.11 lb ai/A; the retreatment interval is 14 days and up to 2 applications may be made. The maximum seasonal use rate is 0.224 lb ai/A. The PHIs are 7 days for forage and 21 days for soybean seed. The EP labels associated with the petition require baseline attire (i.e., long-sleeved shirt, pants, shoes, and socks) plus PPE of chemical-resistant gloves. The REI specified on each product label for soybean is 12 hours. Fluindapyr EP F4406-1 (EPA Reg. No. 279-3640) is proposing soybean as a rotational crop only; soybean can be planted immediately after fields are treated with F4406-1.

Furthermore, FMC Corporation is submitting a new use application to expand the use sites for EPs F9944-74 T&O SC Fungicide (EPA Reg. No. 279-3639) and F4406-1 T&O SC Fungicide (EPA Reg. No. 279-3641) to include residential lawns, athletic fields, and sod farms. Both EPs, F9944-74 T&O SC Fungicide (EPA Reg. No. 279-3639) and F4406-1 T&O SC Fungicide (EPA Reg. No. 279-3641), are formulated as SCs containing 42.4 % (4 lb ai/gal of product) and 20.9% (2 lb ai/gal of product) fluindapyr, respectively. Both EPs specify a maximum single application rate of 0.27 lb ai/A, and applications may be made via groundboom, chemigation, and handheld equipment. A retreatment interval (RTI) of 14 days is specified. Both product labels require applicators and other handlers to wear long-sleeved shirts, long pants, shoes, and socks; and PPE consisting of chemical-resistant gloves. The proposed REI is 12 hours.

Table 4.1 provides a summary of the proposed use directions.

Table 4.1. Summary of Proposed Directions for Use of Fluindapyr based on Maximum Rates.						
Product [EPA Reg. No.] (Amount of ai)	**Application Timing, Type, and Equipment**	**Application Rate ((lb ai/A, unless otherwise noted))**	**Max. No. Applic. per Season**	**Max. Annual Application Rate (lb ai/A/yr)**	**PHI (days)**	**Use Directions and Limitations**
Soybeans						
F9944-74 [279-3637] (4 lb ai/gallon)	Post-emergent application via air or groundboom	0.08 to 0.11 lb ai/A	2	0.224 lb ai/A/yr	7 (forage/hay) 21 (seed)	REI is 12 hours. 14-day RTI.
F4412-1 [279-3642] (1 lb ai/gallon)	Post-emergent application via air, airblast or chemigation	0.055 to 0.07 lb ai/A	2	0.224 lb ai/A/yr	7 (forage/hay) 21 (seed)	REI is 12 hours. 14-day RTI.
F4413-1 [279-3643] (1.5 lb ai/gallon)	Post-emergent application via air, airblast, or chemigation	0.05 to 0.068 lb ai/A	2	0.224 lb ai/A/yr	7 (forage/hay) 21 (seed)	REI is 12 hours. 14-day RTI.
Turf (Sod Farms, Athletic Fields, and Residential Lawns)						
F9944-74 T&O SC Fungicide [279-3639] (4.0 lb ai/gal)	Post- emergence Broadcast; by Groundboom, Chemigation or Handheld Equipment	0.18 to 0.27 lb ai/A (0.0042 to 0.0063 lb ai/gal)	4	1.08 lb ai/A/yr	NA	Apply in a minimum of 43 GPA (1 gallon per 1,000 sq ft). REI is 12 hours. 7-28 days RTI (depending on target disease).
F4406-1 T&O SC Fungicide [279-3641] (2.0 lb ai/gal)						

1. REI = re-entry interval. GPA = gallons per acre. RTI = retreatment interval.

5.0 Residential Exposure and Risk Estimates

5.1 Residential Handler Exposure/Risk Estimates

HED uses the term "handlers" to describe those individuals who are involved in the pesticide application process. HED believes that there are distinct tasks related to applications and that exposures can vary depending on the specifics of each task. Residential handlers are addressed somewhat differently by HED as homeowners are assumed to complete all elements of an application without use of any protective equipment.

The proposed EP labels require all handlers to wear specific clothing (e.g., long sleeve shirt/long pants) and use PPE (i.e., chemical resistant gloves). Therefore, HED has made the assumption that these products are not for homeowner use and has not conducted a quantitative residential handler assessment.

5.2 Residential Post-application Exposure/Risk Estimates

There is the potential for post-application exposure for individuals exposed as a result of being in an environment that has been previously treated with fluindapyr. The quantitative exposure and risk assessment for residential post-application exposures is based on the proposed use on turf in areas including athletic fields, sod farms, and residential lawns.

Additionally, there are existing residential post-application exposures that have been previously assessed using default TTR values and resulted in no risk estimates of concern (J. Smith, *et al*., D448649, 10/27/2020). However, for the purpose of aggregate risk assessment, the existing residential post-application exposure estimates for golf courses have been reassessed using new chemical-specific TTR data (MRID 51970301).

The lifestages selected for each post-application scenario are based on an analysis provided as an Appendix in the 2012 Residential SOPs[2]. While not the only lifestage potentially exposed for these post-application scenarios, the lifestage that is included in the quantitative assessment is health protective for the exposures and risk estimates for any other potentially exposed lifestage.

Residential Post-application Exposure Data and Assumptions

A series of assumptions and exposure factors served as the basis for completing the residential post-application risk assessment. Each assumption and factor is detailed in the 2012 Residential SOPs[2].

Application Rate: Application rate information may be found in Table 4.1.

Exposure Duration: Based on the proposed use patterns, exposures are anticipated to be short-term in duration only.

Residential Post-application Non-Cancer Exposure and Risk Equations

The algorithms used to estimate residential post-application exposure and dose can be found in the 2012 Residential SOPs[3].

Combining Exposure and Risk Estimates

Since dermal and incidental oral exposure routes share a common toxicological endpoint, risk estimates have been combined for those routes using the following formula:

Total MOE = Point of Departure (mg/kg/day) ÷ [Combined Dermal Dose (mg/kg/day) + Incidental Oral Dose (mg/kg/day)]

[2] Available: http://www.epa.gov/pesticide-science-and-assessing-pesticide-risks/standard-operating-procedures-residential-pesticide

[3] http://www.epa.gov/pesticide-science-and-assessing-pesticide-risks/standard-operating-procedures-residential-pesticide

The incidental oral scenarios (i.e., hand-to-mouth and object-to-mouth) should be considered inter-related and it is likely that they occur interspersed amongst each other across time. Combining these scenarios with the dermal exposure scenario would be overly-conservative because of the conservative nature of each individual assessment. Therefore, the post-application exposure scenarios that were combined for children 1 to < 2 years old are the dermal and hand-to-mouth scenarios. This combination should be considered a protective estimate of children's exposure.

Turf Transferrable Residues: Chemical-specific TTR data is available for fluindapyr [MRID 51970301] (See Appendix B for study parameters and data). HED has reviewed the submitted TTR data and found it to be acceptable for risk assessment for fluindapyr.

The TTR study was conducted on turf in Pennsylvania (PA), Kansas (KS), and California (CA). In the study, three liquid broadcast applications were made at a target rate of 0.27 lb ai/A using either a tractor-mounted sprayer (CA) or CO_2 backpack boom sprayers (PA, KS) to each plot at each location, with a targeted 7-day RTI between applications. Turf residues were periodically collected using the Modified California Roller Technique up to 35 days after the last treatment (35DAT3). The field fortification recovery data was used to correct the reported TTR data. The predicted residue level on the day of treatment (day 0) was highest (i.e., 0.014 µg/cm^2) for the CA site. For the post-application turf scenarios, HED has used the TTR data from the CA location as it represents the most conservative scenario.

Table 5.2.1. Summary of Regression Analysis Results for TTR Data Used on Occupational Dermal Post-Application Analysis. (MRID 51970301).

Statistic	Region/State CA
Application Rate (lb ai/A)	0.27
Measured Average Day 0 Residue (µg/cm^2)	0.0172
Predicted Day 0 Residue (µg/cm^2)	0.014
Slope	-0.145
Half-Life (days)	4.8
R^2	0.9316

Summary of Residential Post-application Non-Cancer Exposure and Risk Estimates

For the fluindapyr residential post-application assessments, the chemical-specific TTR data were used as described above to calculate the estimated residential post-application dermal (adults and children) exposures and risks from contact with treated athletic fields and residential lawns with day-of-application (i.e., "day 0") TTR data, which is detailed in Table 5.2.2. Residential post-application dermal exposures (adults and children 11 to < 16 years old) and combined dermal and incidental oral (children 1 to < 2 years old) exposures and risks did not result in any risks of concern using the CA predicted day 0 residue (0.014 µg/cm^2).

Table 5.2.2. Residential Post-Application Non-Cancer Exposure and Risk Estimates for Liquid Formulations of Fluindapyr on Athletic Fields and Residential Lawns.

Lifestage	Use Site	Post-application Exposure Scenario		Applic. Rate[1]	Dose (mg/kg/day)[2]	MOEs (LOC = 1,000)[3]	Combined Dermal + Incidental Oral MOEs (LOC = 1,000)[4]
		Activity	Route of Exposure				
CA Site Day 0 TTR Residue 0.014 µg/cm^2							
Adult	Treated Turf	High Contact Lawn Activities[5]	Dermal	0.27 lb ai/A	0.00931	3,200	--
Adult		Golfing[6]	Dermal		0.000731	41,000	--
Children (11 to < 16 years old)					0.000735	41,000	--
Children (6 to < 11 years old)					0.000863	35,000	--
Adult		Mowing Turf	Dermal		0.000190	160,000	--
Children (11 to < 16 years old)							
Children (1 to < 2 years old)		High Contact Lawn Activities[5]	Dermal		0.0159	1,900	--
			Hand-to-Mouth Incidental Oral		0.00192	16,000	1,700
			Object-to-mouth Incidental Oral		0.000058	520,000	1,900
			Incidental Soil Ingestion		0.0000101	3,300,000	1,900

1. Based on registered labels (EPA Reg. Nos. 279-3639, 279-3641).
2. Dose (mg/kg/day) algorithms provided in 2012 Residential SOPs (https://www.epa.gov/pesticide-science-and-assessing-pesticide-risks/standard-operating-procedures-residential-pesticide).
3. MOE = POD (30 mg/kg/day) ÷ Dose (mg/kg/day).
4. Combined MOE = 1 ÷ [(1/dermal MOE) + (1/inhalation MOE) + (1/incidental oral MOE)], where applicable.
5. The proposed athletic field and registered public turf use (i.e., landscape areas around public, intuitional, and commercial properties) result in the same exposure using chemical specific TTR data.
6. The golfing post-application activity is from an existing registered fluindapyr use for golf courses (see J. Smith, *et al.*, D448649, 10/27/2020). For the purpose of aggregate risk assessment, the existing residential post-application exposure estimates for golf course have been reassessed using chemical-specific TTR data (MRID 51970301).

5.3 Residential Risk Estimates for Use in Aggregate Assessment

Table 5.3.1 reflects the residential risk estimates that are recommended for use in the aggregate assessment for fluindapyr:

- The recommended residential exposure for use in the adult aggregate assessment is dermal exposure from post-application exposure to residue from treated golf course.
- The recommended residential exposure for the children 11 to <16 years old aggregate assessment is dermal exposure from post-application exposure to residue from treated golf courses.
- The recommended residential exposure for the children 6 to <11 years old aggregate assessment is dermal exposure from post-application exposure to residue from treated golf courses.

- The recommended residential exposure for use in the children 1 to <2 years old aggregate assessment is combined dermal and hand-to-mouth exposures from post-application exposure to treated turf with liquid formulations.

Table 5.3.1. Recommendations for the Residential Exposures for the Fluindapyr Aggregate Assessment.

Lifestage	Exposure Scenario	Dose (mg/kg/day)[1]				MOE[2]			
		Dermal	Inhalation	Oral	Total	Dermal	Inhalation	Oral	Total
Adult	Turf - Lawns	0.00931	NA	NA	0.00931	3,200	NA	NA	3,200
Children (1<2 years old)		0.0159		0.00192	0.0178	1,900		16,000	1,680
Children (11 to <16 years)	Turf – Golf courses	0.000735	NA	NA	0.000735	41,000	NA	NA	41,000
Children (6 to <11 years)		0.000863			0.000863	35,000			35,000

1. Dose = the highest dose for each applicable lifestage of all residential scenarios assessed. Total = dermal + inhalation + incidental oral (where applicable).
2. Combined MOE = 1 ÷ [(1/dermal MOE) + (1/inhalation MOE) + (1/incidental oral MOE)], where applicable.

6.0 Non-Occupational Spray Drift Exposure and Risk Estimates

Spray drift is a potential source of exposure to individuals who are located in close proximity to pesticide applications. This is particularly the case with aerial application, which tends to have the highest amount of drift as evaluated, but spray drift can also be a potential source of exposure from the ground application methods. The Agency has developed best spray drift management practices with input from the Spray Drift Task Force[4], EPA Regional Offices, and State Lead Agencies for pesticide regulation as well as other parties (see the Agency's Spray Drift website for more information).[5] The Agency has also prepared a draft document on how to appropriately consider spray drift as a potential source of exposure in risk assessments for pesticides. The approach is outlined in the revised 2013 *Residential Exposure Assessment Standard Operating Procedures Addenda 1: Consideration of Spray Drift*, which can be found at https://www.regulations.gov in docket identification number EPA-HQ-OPP-2013-0676. The potential for spray drift from fluindapyr uses will be evaluated during the ongoing Registration Review process to ensure that all uses for that pesticide will be considered concurrently.

7.0 Non-Occupational Bystander Post-Application Inhalation Exposure and Risk Estimates

Volatilization of pesticides may be a source of post-application inhalation exposure to individuals nearby pesticide applications. The Agency sought expert advice and input on issues related to

[4] This task force was organized in 1990, pursuant to the provisions of FIFRA section 3(c)(2)(B)(ii). It was comprised of pesticide registrants and those applying for registration of pesticide products to give them the option of fulfilling spray drift data requirements by participating in the task force, which would share the cost of developing a generic spray drift database expected to be capable of satisfying spray drift data requirements for virtually all pesticide product registrations in the United States and Canada. See https://www.epa.gov/pesticide-registration/prn-90-3-announcing-formation-industry-wide-spray-drift-task-force

[5] EPA's webpage is available online: Reducing Pesticide Drift | US EPA. It contains extensive information about EPA's efforts to reduce spray drift as well as additional materials and links to educational materials that provide information about practices for reducing spray drift.

volatilization of pesticides from FIFRA Scientific Advisory Panel (SAP) in December 2009, and received the SAP's final report on March 2, 2010[6]. The Agency has evaluated the SAP report and has developed a Volatilization Screening Tool and a subsequent Volatilization Screening Analysis (*Human Health Bystander Screening Level Analysis: Volatilization of Conventional Pesticides*[7]). During Registration Review, the Agency will utilize this analysis to determine if data (i.e., flux studies, route-specific inhalation toxicological studies) or further analysis is required for fluindapyr.

8.0 Occupational Exposure and Risk Estimates

8.1 Occupational Handler Exposure/Risk Estimates

HED uses the term handlers to describe those individuals who are involved in the pesticide application process. HED believes that there are distinct job functions or tasks related to applications and exposures can vary depending on the specifics of each task. Job requirements (amount of chemical used in each application), the kinds of equipment used, the target being treated, and the level of protection used by a handler can cause exposure levels to differ in a manner specific to each application event.

Based on the anticipated use patterns and current labeling, types of equipment and techniques that can potentially be used, occupational handler exposure is expected from the proposed uses. The quantitative exposure/risk assessment developed for occupational handlers is based on the scenarios presented in Table 8.1.1.

Occupational Handler Exposure Data and Assumptions

A series of assumptions and exposure factors served as the basis for completing the occupational handler risk assessments. Each assumption and factor is detailed below on an individual basis.

Application Rate:
The fluindapyr quantitative exposure/risk assessment developed for occupational handlers is based on the proposed application rates listed in Table 4.1.

Unit Exposures:
It is the policy of HED to use the best available data to assess handler exposure. Sources of generic handler data, used as surrogate data in the absence of chemical-specific data, include PHED 1.1, the AHETF database, the Outdoor Residential Exposure Task Force (ORETF) database, or other registrant-submitted occupational exposure studies. Some of these data are proprietary (e.g., AHETF data), and subject to the data protection provisions of FIFRA. The standard values recommended for use in predicting handler exposure that are used in this assessment, known as "unit exposures", are outlined in the "Occupational Pesticide Handler Unit Exposure Surrogate Reference Table[8]", which, along with

[6] http://archive.epa.gov/scipoly/sap/meetings/web/pdf/120309meetingminutes.pdf
[7] https://www.regulations.gov/document/EPA-HQ-OPP-2014-0219-0002
[8] Available: https://www.epa.gov/sites/default/files/2021-05/documents/occupational-pesticide-handler-unit-exposure-surrogate-reference-table-may-2021.pdf

additional information on HED policy on use of surrogate data, including descriptions of the various sources, can be found at the Agency website[9].

Area Treated or Amount Handled:
The inputs for area treated were based on information in ExpoSAC Policy 9.2.

Exposure Duration:
HED classifies exposures from 1 to 30 days as short-term and exposures 30 days to six months as intermediate-term. Exposure duration is determined by many things, including the exposed population, the use site, the pest pressure triggering the use of the pesticide, and the cultural practices surrounding that use site. For most agricultural uses, it is reasonable to believe that occupational handlers will not apply the same chemical every day for more than a one-month time frame; however, there may be a large agribusiness and/or commercial applicators who may apply a product over a period of weeks (e.g., completing multiple applications for multiple clients within a region). For fluindapyr, based on the proposed use patterns, short- and intermediate-term exposures are expected.

Personal Protective Equipment: Estimates of dermal and inhalation exposure were calculated for and presented for the label-required baseline attire (i.e., single layer and no respirator) plus label required PPE (i.e., chemical-resistant gloves).

Occupational Handler Non-Cancer Exposure and Risk Estimate Equations
The algorithms used to estimate non-cancer exposure and dose for occupational handlers can be found in Appendix A.

Combining Exposures/Risk Estimates:
Dermal and inhalation risk estimates were combined in this assessment, since the toxicological effects for these exposure routes were similar. Dermal and inhalation risk estimates were combined using the following formula:

Total MOE = Point of Departure (mg/kg/day) ÷ Combined dermal dose (mg/kg/day) + inhalation dose (mg/kg/day)

Summary of Occupational Handler Non-Cancer Exposure and Risk Estimates
A recently completed occupational and residential exposure and risk assessment evaluated the use of fluindapyr on soybeans under the same application parameters (e.g. rate method) as the proposed use on soybeans, and no risks of concern were identified (i.e., MOEs ≥ LOC of 1,000). The results of the existing occupational exposure assessment conducted on soybeans remain valid and unchanged (L. Bacon, E. Lang, D455860, 10/27/2020). The handler MOEs from the proposed soybean use are presented below.

For the proposed use on sod farms athletic fields and residential lawns, there were no combined dermal and inhalation risk estimates of concern identified in the occupational handler exposure and risk assessment when considering label-required baseline attire and PPE (i.e., chemical-resistant

[9] Available: https://www.epa.gov/pesticide-science-and-assessing-pesticide-risks/occupational-pesticide-handler-exposure-data

gloves). All occupational handler combined dermal and inhalation risk estimates were above the LOC of 1,000; MOEs range from 1,600 to 500,000.

Note on flagger scenarios: The Agency matches quantitative occupational exposure assessment with appropriate characterization of exposure potential. While HED presents quantitative risk estimates for human flaggers where appropriate, agricultural aviation has changed dramatically over the past two decades. According the 2012 National Agricultural Aviation Association (NAAA) survey of their membership, the use of GPS for swath guidance in agricultural aviation has grown steadily from the mid 1990's. Over the same time period, the use of human flaggers for aerial pesticide applications has decreased steadily from ~15% in the late 1990's to only 1% in the most recent (2012) NAAA survey. The Agency will continue to monitor all available information sources to best assess and characterize the exposure potential for human flaggers in agricultural aerial applications.

Note on aerial applicator scenario: HED has no data to assess exposures to pilots using open cockpits. The only data available is for exposure during aerial applications (covering both airplanes and helicopters) of liquid formulations to pilots in enclosed cockpits (data from AHETF) and of granule formulations in enclosed cockpits (data from PHED). Therefore, risks to pilots are assessed using the engineering control (enclosed cockpits) and baseline attire (long-sleeve shirt, long pants, shoes, and socks); use of the data in this fashion is consistent with the Agency's Worker Protection Standard (WPS) stipulations for engineering controls, which says label-required PPE for applicators can be reduced when using an enclosed cockpit (40 CFR 170.607(f)(3)) as well as a provision regarding use of gloves for aerial applications (40 CFR 170.607(f)(1)), which says pilots are not required to wear protective gloves for the duration of the application, unless gloves are otherwise required for pilots on the pesticide product labeling. With this level of protection, there are no risk estimates of concern for applicators.

Note on mixing/loading liquid formulation scenarios: A 2019 study by the AHETF measured dermal and inhalation exposure for workers who loaded liquid pesticides using closed systems such as gravity feed, container breach, and suction/extraction systems. After analyzing the exposure monitoring data, the AHETF observed that exposures were higher than expected and subsequently identified that, when using suction/extraction systems, removing and handling chemical extraction probes without rinsing them prior to removal from the pesticide container had the potential to result in high exposures via direct exposure to the liquid concentrate. The AHETF therefore submitted to the Agency a dataset that excludes monitoring of those workers who handled unrinsed chemical extraction probes and recommended that the Agency take additional regulatory actions to ensure workers do not remove and handle chemical extraction probes still coated with the concentrated liquid formulation.

The Agency agreed with the AHETF proposal, recognizing that handling of unrinsed chemical extraction probes is inconsistent with the exposure reduction principles of closed systems. Closed loading systems are an engineering control designed to prevent direct contact between users and the pesticide formulation, thereby reducing exposures. According to EPA's Worker Protection Standard (WPS), a closed system must remove the pesticide from its original container and transfer the pesticide product through connecting hoses, pipes and couplings that are sufficiently tight to prevent exposure of handlers to the pesticide product, except for the negligible escape associated with normal operation of the system [40 CFR § 170.607(d)(2)(i)]. However, in addition to considerations regarding closed systems, given the high exposure potential from this activity, the Agency is requiring revisions to

applicable product label instructions to restrict handling un-rinsed extraction probes and conducting stakeholder outreach and revising worker training modules to ensure that users of suction/extraction systems rinse the chemical extraction probes within the pesticide container prior to their removal so that they are not exposed to the concentrated liquid formulation.

Table 11.1.1. Occupational Handler Non-Cancer Exposure and Risk Estimates for Fluindapyr.

Exposure Scenario	Crop or Target	Dermal Unit Exposure (µg/lb ai)[1]	Inhalation Unit Exposure (µg/lb ai)[1]	Maximum Application Rate (lb ai/A unless indicated)[2]	Area Treated or Amount Handled Daily (Acres unless indicated)[3]	Dermal	Inhalation	Total		
						Dose (mg/kg/day)[4]	MOE[5]	Dose (mg/kg/day)[6]	MOE[7]	MOE[8]
Mixer/Loader										
Liquid, Aerial, Broadcast	Soybean (Field crop, high-acreage)	37.6 [SL/G]	0.219 [No-R]	0.11	1,200	0.0122	2,500	0.000419	72,000	2,400
Liquid, Chemigation, Broadcast		37.6 [SL/G]	0.219 [No-R]		350	0.00357	8,400	0.000122	250,000	8,100
Liquid, Groundboom, Broadcast		37.6 [SL/G]	0.219 [No-R]		200	0.00204	15,000	0.0000699	430,000	14,000
Liquid, Chemigation, Broadcast	Sod	37.6 [SL/G]	0.219 [No-R]	0.27	350 acres	0.00875	3,400	0.0003	100,000	3,300
Liquid, Groundboom, Broadcast		37.6 [SL/G]	0.219 [No-R]		80 acres	0.002	15,000	0.0000686	440,000	15,000
Liquid, Groundboom, Broadcast	Landscaping, turf (lawns, athletic fields, parks, etc.)	37.6 [SL/G]	0.219 [No-R]		5 acres	0.000125	240,000	0.00000429	7,000,000	230,000
Applicator										
Spray (all starting formulations), Aerial, Broadcast	Soybean (Field crop, high-acreage)	2.08 [EC/G]	0.0049 [EC/No-R]	0.11	1,200 acres	0.000678	44,000	0.00000938	3,200,000	43,000
Spray (all starting formulations), Groundboom, Broadcast		16.1 [SL/G]	0.34 [No-R]		200 acres	0.000872	34,000	0.000108	280,000	30,000
Spray (all starting formulations), Groundboom, Broadcast	Landscaping, turf (lawns, athletic fields, parks, etc.)	16.1 [SL/G]	0.34 [No-R]	0.27	5 acres	0.0000535	560,000	0.00000665	4,500,000	500,000

Table 11.1.1. Occupational Handler Non-Cancer Exposure and Risk Estimates for Fluindapyr.

Exposure Scenario	Crop or Target	Dermal Unit Exposure (µg/lb ai)[1]	Inhalation Unit Exposure (µg/lb ai)[1]	Maximum Application Rate (lb ai/A unless indicated)[2]	Area Treated or Amount Handled Daily (Acres unless indicated)[3]	Dermal	Inhalation	Total		
						Dose (mg/kg/day)[4]	MOE[5]	Dose (mg/kg/day)[6]	MOE[7]	MOE[8]
Spray (all starting formulations), Groundboom, Broadcast	Sod	16.1 [SL/G]	0.34 [No-R]		80 acres	0.000857	35,000	0.000106	280,000	31,000
Flagger										
Spray (all starting formulations), Aerial, Broadcast	Soybean (Field crop, high-acreage)	12 [SL/G]	0.202 [No-R]	0.11	350 acres	0.00114	26000	0.000113	270,000	24,000
Mixer/Loader/Applicator										
Liquid, Backpack, Broadcast	Landscaping, turf (lawns, athletic fields, parks, etc.)	30,500 [SL/G]	69.1 [No-R]	0.0063 lb ai/gal	40 gallons	0.0189	1,600	0.000252	120,000	1,600
Liquid, Backpack, Spot		8,260 [SL/G]	2.58 [No-R]	0.0063 lb ai/gal	40 gallons	0.00512	5,900	0.00000942	3,200,000	5,900
Liquid, Manually-pressurized Handwand, Broadcast		430 [SL/G]	23.6 [No-R]	0.0063 lb ai/gal	40 gallons	0.000266	110,000	0.0000862	350,000	84,000
Liquid, Mechanically-pressurized Handgun, Broadcast		880 [SL/G]	1.9 [No-R]	0.27	5 acres	0.00293	10,000	0.0000372	810,000	9,900

1. Based on the "Occupational Pesticide Handler Unit Exposure Surrogate Reference Table" (https://www.epa.gov/pesticide-science-and-assessing-pesticide-risks/occupational-pesticide-handler-exposure-data); Level of PPE: Baseline attire (long pants, socks, shoes, and long-sleeved shirt), PPE (SL/G = baseline attire + addition of chemical resistant gloves)
2. Based on proposed labels (See Table 4.1).
3. Exposure Science Advisory Council Policy #9.2.
4. Dermal Dose = Dermal Unit Exposure (µg/lb ai) × Conversion Factor (0.001 mg/µg) × Application Rate (lb ai/acre or gal) × Area Treated or Amount Handled (A or gal/day) × DAF (17%) ÷ BW (69 kg).
5. Dermal MOE = Dermal NOAEL (30 mg/kg/day) ÷ Dermal Dose (mg/kg/day).
6. Inhalation Dose = Inhalation Unit Exposure (µg/lb ai) × Conversion Factor (0.001 mg/µg) × Application Rate (lb ai/acre or gal) × Area Treated or Amount Handled (A or gal/day) ÷ BW (69 kg).
7. Inhalation MOE = Inhalation NOAEL (30 mg/kg/day) ÷ Inhalation Dose (mg/kg/day).
8. Total MOE = NOAEL (30 mg/kg/day) ÷ Dermal Dose + Inhalation Dose.

8.2 Occupational Post-application Exposure/Risk Estimates

HED uses the term post-application to describe exposures that occur when individuals are present in an environment that has been previously treated with a pesticide (also referred to as re-entry exposure). Such exposures may occur when workers enter previously treated areas to perform job functions, including activities related to crop production, such as scouting for pests or harvesting. Post-application exposure levels vary over time and depend on such things as the type of activity, the nature of the crop or target that was treated, the type of pesticide application, and the chemical's degradation properties. In addition, the timing of pesticide applications, relative to harvest activities, can greatly reduce the potential for post-application exposure.

8.2.1 Occupational Post-application Inhalation Exposure/Risk Estimates

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 FIFRA Scientific Advisory Panel (SAP) in December 2009, and received the SAP's final report on March 2, 2010[10]. The Agency has evaluated the SAP report and has developed a Volatilization Screening Tool and a subsequent Volatilization Screening Analysis (*Human Health Bystander Screening Level Analysis: Volatilization of Conventional Pesticides*[11]). During Registration Review, the Agency will utilize this analysis to determine if data (i.e., flux studies, route-specific inhalation toxicological studies) or further analysis is required for fluindapyr.

Although a quantitative occupational post-application inhalation exposure assessment was not performed, an inhalation exposure assessment was performed for occupational/commercial handlers. Handler exposure resulting from application of pesticides outdoors is likely to result in higher exposure than post-application exposure, and all of the occupational handler scenarios resulted in inhalation risk estimates that were not of concern at baseline (i.e., all inhalation MOEs without a respirator ≥ the LOC). Therefore, it is expected that these handler inhalation exposure estimates would be protective of most occupational post-application inhalation exposure scenarios.

8.2.2 Occupational Post-application Dermal Exposure/Risk Estimates

Occupational Post-application Dermal Exposure Data and Assumptions

A series of assumptions and exposure factors served as the basis for completing the occupational post-application risk assessments. Each assumption and factor are detailed below on an individual basis.

Exposure Duration: HED classifies exposures from 1 to 30 days as short-term and exposures 30 days to six months as intermediate-term. For fluindapyr, based on the proposed uses and label directions (i.e., multiple applications per season and minimum RTI of 7 days), short- and intermediate-term exposures are expected.

[10] http://archive.epa.gov/scipoly/sap/meetings/web/pdf/120309meetingminutes.pdf
[11] https://www.regulations.gov/document/EPA-HQ-OPP-2014-0219-0002

Transfer Coefficients: It is the policy of HED to use the best available data to assess post-application exposure. Sources of generic post-application data, used as surrogate data in the absence of chemical-specific data, are derived from ARTF exposure monitoring studies, and, as proprietary data, are subject to the data protection provisions of FIFRA. The standard values recommended for use in predicting post-application exposure that are used in this assessment, known as "transfer coefficients", are presented in the ExpoSAC Policy 3[12]" which, along with additional information about the ARTF data, can be found at the Agency website[13].

Application Rate: Maximum application rates for all proposed uses are shown in Table 4.1.

Exposure Time: The average occupational workday is assumed to be 8 hours.

Dislodgeable Foliar Residue: Chemical-specific dislodgeable foliar residue data have not been submitted for fluindapyr. Therefore, for the proposed soybean use, this assessment uses HED's default assumption that 25% of the application is available for transfer on day 0 following the application and the residues dissipate at a rate of 10% each following day.

Turf Transferrable Residues: Chemical-specific TTR data is available for fluindapyr (MRID 51970301). The TTR study was reviewed and found to be acceptable for risk assessment for fluindapyr. See below for summary (Table 8.2.2.1).

Table 8.2.2.1. Summary of Regression Analysis Results for TTR Data Used on Occupational Dermal Post-Application Analysis. (MRID 51970301).

Statistic	Region/State CA
Application Rate (lb ai/A)	0.27
Measured Average Day 0 Residue (µg/cm^2)	0.0172
Predicted Day 0 Residue (µg/cm^2)	0.014
Slope	-0.145
Half-Life (days)	4.8
R^2	0.9316

Occupational Post-application Non-Cancer Dermal Exposure and Risk Estimate Equations

The algorithms used to estimate non-cancer exposure and dose for occupational post-application workers can be found in Appendix A.

Occupational Post-application Non-Cancer Dermal Risk Estimates

A recently completed occupational and residential exposure and risk assessment evaluated the use of fluindapyr on soybeans under the same application parameters (e.g. rate method) as the proposed use on soybeans; the occupational post-application exposure and risk estimates for soybeans indicated that short- and intermediate-term MOEs are not of concern on day of application. The results of the existing occupational exposure assessment conducted on soybeans remain valid and unchanged (L.

[12] Available: https://www.epa.gov/pesticide-science-and-assessing-pesticide-risks/occupational-pesticide-handler-exposure-data

[13] Available: https://www.epa.gov/pesticide-science-and-assessing-pesticide-risks/occupational-pesticide-handler-exposure-data

Bacon, E. Lang, D455860, 10/27/2020). The MOEs from the proposed soybean use are presented below.

Chemical-specific TTR data was used to calculate post-application exposures from contact with treated turf in sod farms. All post-application scenarios resulted in dermal risk estimates greater than the LOC of 1,000 on day 0; MOEs = 16,000.

Table 8.2.2.2. Occupational Post-application Non-Cancer Exposure and Risk Estimates for Fluindapyr.

Crop/Site	Activities	Transfer Coefficient (cm^2/hr)	Residue (ug/cm^2)[1]	Dermal Dose (mg/kg/day)[2]	MOE[3]
Sod	Maintenance	6,700	0.014[4]	0.002	16,000
	Harvesting, Slab				
	Transplanting/Planting				
Soybean	Scouting	1,100	0.31	0.007	4,500
	Weeding, Hand	70		0.0004	70,000

1 Residue Calculations: DFR = Application Rate (lb ai/A) × F × $(1\text{-}D)^t$ × 4.54E8 µg/lb × 2.47E-8 $acre/cm^2$; where F = 0.25 and D = 0.10 per day; TTR = Application Rate (lb ai/A) × F × $(1\text{-}D)^t$ × 4.54E8 µg/lb × 2.47E-8 $acre/cm^2$; where F = 0.1 and D = 0.10 per day.

2 Daily Dermal Dose = [DFR (µg/cm^2) × Transfer Coefficient × 0.001 mg/µg × 8 hr/day × dermal absorption (14%)] ¸ BW (69 kg).

3 MOE = POD (mg/kg/day) / Daily Dermal Dose. Daily Dermal Dose = [DFR (µg/cm^2) × TC × 0.001 mg/µg × 8 hr/day × dermal absorption factor (14%)] ¸ BW (69 kg).

4 TTR chemical-specific study (MRID: 51970301).

Restricted Entry Interval

The REI specified on the product labels are based on the acute toxicity of fluindapyr. Fluindapyr is classified as Toxicity Category III via the dermal route and Toxicity Category IV for skin and eye irritation potential. It is a moderate skin sensitizer. Under 40 CFR 156.208 (c) (2) (iii), ai's classified as Acute III or IV for acute dermal, eye irritation and primary skin irritation are assigned a 12-hour REI. Furthermore, the short- and intermediate-term post-application risk estimates were not a concern on day 0 (12 hours following application) for all post-application activities. Therefore, the [156 subpart K] Worker Protection Statement interim REI of 12 hours is adequate to protect agricultural workers from post-application exposures to fluindapyr.

Appendix A. Summary of Occupational and Residential Non-cancer Algorithms

Residential Non-cancer Post-application Algorithms

Post-application Dermal Exposure Algorithm – Physical Activities on Turf

Exposure resulting from contacting previously treated turf while performing physical activities is calculated as shown below. Residential post-application exposure assessment must include calculation of exposure on the day of application. Therefore, though an assessment can present exposures for any day "t" following the application, it must include "day 0" exposure.

$$E = TTRt * CF1 * TC * ET$$

where:

- E = exposure (mg/day);
- TTR_t = turf transferable residue on day t (µg/cm^2);
- CF1 = weight unit conversion factor (0.001 mg/µg);
- TC = transfer coefficient (cm^2/hr); and
- ET = exposure time (hr/day).

If chemical-specific TTR data are available, then surface residues from the day of application should be used (assume that individuals could be exposed to residues immediately after application). However, if data are not available, then TTR_t can be calculated using the following formula:

$$TTR_t = AR * F * (1\text{-}FD)_t * CF2 * CF3$$

where:

- TTR_t = turf transferable residue on day t (µg/cm^2);
- AR = application rate (lbs ai/ft^2 or lb ai/acre);
- F = fraction of ai as transferable residue following application (unitless);
- FD = fraction of residue that dissipates daily (unitless);
- t = post-application day on which exposure is being assessed;
- CF2 = weight unit conversion factor (4.54 x 10^8 µg/lb); and
- CF3 = area unit conversion factor (1.08 x 10^{-3} ft^2/ cm^2 or 2.47 x 10^{-8} acre/cm^2).

Dermal absorbed doses are calculated as:

$$D = \frac{E * AF}{BW}$$

where:

- D = dose (mg/kg-day);
- E = exposure (mg/day);
- AF = absorption factor (dermal); and
- BW = body weight (kg).

Table A.1.: Turf (Physical Activities) -- Inputs for Residential Post-application Dermal Exposure				
Algorithm Notation	**Exposure Factor (units)**			**Point Estimate(s)**
AR	Application rate (mass active ingredient per unit area)			0.27
F	Fraction of AR as TTR following application (if chemical-specific data is unavailable)		L/WP/WDG	0.01
			Granules	0.002
F_D	Daily residue dissipation (if chemical-specific data is unavailable) (fraction)		L/WP/WDG	0.1
			Granules	0.1
TC	Transfer Coefficient (cm^2/hr)	L/WP/WDG	Adults	180,000
			Children 1 < 2 years old	49,000
		Granules	Adults	200,000
			Children 1 < 2 years old	54,000
ET	Exposure Time (hours per day)		Adults	1.5
			Children 1 < 2 years old	1.5
BW	Body Weight (kg)		Adults	80
			Children 1 < 2 years old	11
L/WP/WDG = Liquids/Wettable Powders/Water-dispersible Granules				

Post-application Hand-to-Mouth Exposure Algorithm– Physical Activities on Turf

Exposure from hand-to-mouth activity is calculated as follows (based on the algorithm utilized in the SHEDS-Multimedia model):

$$E = [HR * (F_M * SA_H) * (ET * N\_Replen) * (1- (1- SE)^{(Freq\_HtM/N\text{-}Replen)})]$$

where:

E = exposure (mg/day);
HR = hand residue loading (mg/cm^2);
FM = fraction hand surface area mouthed / event (fraction/event);
SAH = typical surface area of one hand (cm^2);
ET = exposure time (hr/day);
N Replen = number of replenishment intervals per hour (intervals/hour);
SE = saliva extraction factor (i.e., mouthing removal efficiency); and
Freq HtM = number of hand-to-mouth contacts events per hour (events/hour).

and

$$HR = \frac{Fai_{hands} * DE}{SA_H * 2}$$

where:

HR = hand residue loading (mg/cm^2);
Fai_{hands} = fraction ai on hands compared to total surface residue from dermal transfer coefficient study (unitless);
DE = dermal exposure (mg); and
SA_H = typical surface area of one hand (cm^2).

Dose, normalized to body weight, is calculated as:

$$D = \frac{E}{BW}$$

where:

D = dose (mg/kg-day);
E = exposure (mg/day); and
BW = body weight (kg).

Table A.2.: Turf (Physical Activities) – Inputs for Residential Post-application Hand-to-Mouth Exposure			
Algorithm Notation	**Exposure Factor (units)**		**Point Estimate(s)**
Fai_{hands}	Fraction of ai on hands from dermal transfer coefficient study (unitless)	Liquid formulations	0.06
		Granular formulations	0.027
DE	Dermal exposure (mg)		Calculated
SA_H	Typical surface area of one hand (cm^2), children 1 < 2 years old		150
AR	Application rate (mass active ingredient per unit area)		0.27
HR	Residue available on the hands (mg/cm^2)		Calculated via (DE * Fai_{hands})/SA_H
F_M	Fraction hand surface area mouthed (fraction/event)		0.127
N_Replen	Replenishment intervals per hour (intervals/hr)		4
ET	Exposure time (hrs/day)		1.5
SE	Saliva extraction factor (unitless)		0.48
Freq_HtM	Hand-to-mouth events per hour (events/hr)		13.9
BW	Body Weight (kg)	Children 1 < 2 years old	11

Post-application Object-to-Mouth Exposure Algorithm– Physical Activities on Turf

Exposure from object-to-mouth activity is calculated as follows (based on the algorithm utilized in SHEDS-Multimedia):

$$E = [OR * CF1 * SAM_O * (ET * N\_Replen) * (1 - (1 - SE_O)^{(Freq\_OtM/N\_Replen)})]$$

where:

E = exposure (mg/day);
OR = chemical residue loading on the object on day "t" (ug/cm^2);
CF1 = weight unit conversion factor (0.001 mg/µg);
SAM_O = area of the object surface that is mouthed (cm^2/event);
ET = exposure time (hr/day);

N_Replen = number of replenishment intervals per hour (intervals/hour);
SE_O = saliva extraction factor (i.e., mouthing removal efficiency); and
Freq_OtM = number of object-to-mouth contact events per hour (events/hour).

and

$$OR = AR * F_O * CF2 * CF3$$

where:

OR = chemical residue loading on the object (µg/cm^2);
AR = application rate (lbs ai/ft^2 or lb ai/acre);
F_O = fraction of residue available on the object (unitless);
CF2 = weight unit conversion factor (4.54 x 10^8 µg/lb); and
CF3 = area unit conversion factor (1.08 x 10^{-3} ft^2/cm^2 or 2.47 x 10^{-8} acre/cm^2).

Dose, normalized to body weight, is calculated as:

$$D = \frac{E}{BW}$$

where:

D = dose (mg/kg-day);
E = exposure (mg/day); and
BW = body weight (kg).

Table A.3.: Turf (Physical Activities) – Inputs for Residential Post-application Object-to-Mouth Exposure

Algorithm Notation	Exposure Factor (units)		Point Estimate(s)
AR	Application rate (to turf) (mass active ingredient per unit area)		0.27
F_O	Fraction of AR as OR following application [1]		0.01
SAM_O	Surface area of object mouthed (cm^2/event)		10
N_Replen	Replenishment intervals per hour (intervals/hour)		4
SE_O	Saliva extraction factor (fraction)		0.48
ET	Exposure time (hours per day)		1.5
Freq_OtM	Object-to-mouth events per hour (events/hr)		8.8
BW	Body Weight (kg)	Children 1 < 2 years old	11

[1] This SOP assumes that all of the residue on the turf could be transferred to the object (e.g., object residue is equal to turf transferable residue).

Post-application Incidental Soil Ingestion Exposure Algorithm– Physical Activities on Turf

Exposure from incidental soil ingestion is calculated as follows:

$$E = SRt * SIgR * CF1$$

where:

E = exposure (mg/day);
SRt = soil residue on day "t" (µg/g);
SIgR = ingestion rate of soil (mg/day); and
CF1 = weight unit conversion factor (1 x 10^{-6} g/µg).

and

$$SRt = AR * FS * (1-F_D)^t * CF2 * CF3 * CF4$$

where:

SR_t = soil residue on day "t" (µg/g);
AR = application rate (lbs ai/ft^2 or lb ai/acre);
FS = fraction of ai available in uppermost cm of soil (fraction/cm);
F_D = fraction of residue that dissipates daily (unitless);
T = post-application day on which exposure is being assessed;
CF2 = weight unit conversion factor (4.54 x 10^8 µg/lb);
CF3 = area unit conversion factor (1.08 x 10^{-3} ft^2/cm^2 or 2.47 x 10^{-8} acre/cm^2); and
CF4 = soil volume to weight unit conversion factor (0.67 cm^3/g soil).

Dose, normalized to body weight, are calculated as:

$$D = \frac{E}{BW}$$

where:

D = dose (mg/kg-day);
E = exposure (mg/day); and
BW = body weight (kg).

Table A.4.: Turf (Physical Activities) – Inputs for Residential Post-application Incidental Soil Ingestion Exposure

Algorithm Notation	Exposure Factor (units)		Point Estimate(s)
AR	Application rate (mass active ingredient per unit area)		0.27
FS	Fraction of AR available in uppermost 1 cm of soil (unitless)		1
F_D	Daily residue dissipation (fraction)		0.1
SIgR	Soil ingestion rate (mg/day)		50
BW	Body weight (kg)	Children 1 < 2 years old	11

Post-application Dermal Exposure Algorithm – Mowing

Exposure resulting from contacting previously treated turf while mowing is calculated as follows:

$$E = TTRt * CF1 * TC * ET$$

where:

E = exposure (mg/day);
TTR_t = turf transferable residue on day "t" (µg/cm^2);
CF1 = weight unit conversion factor (0.001 mg/µg);
TC = transfer coefficient (cm^2/hr); and
ET = exposure time (hr/day).

and

$$TTRt = AR * F_{AR} * (1-F_D)^t * CF2 * CF3$$

where:

TTR_t = turf transferable residue on day "t" (µg/cm^2);
AR = application rate (lbs ai/ft^2 or lb ai/acre);
F_{AR} = fraction of ai retained on turf (unitless);
F_D = fraction of residue that dissipates daily (unitless);
t = post-application day on which exposure is being assessed;
CF2 = weight unit conversion factor (4.54 x 10^8 µg/lb); and
CF3 = area unit conversion factor (1.08 x 10^{-3} ft^2/cm^2 or 2.47 x 10^{-8} acre/cm^2).

Absorbed dose, normalized to body weight, are calculated as:

$$D = \frac{E * AF}{BW}$$

where:

D = dose (mg/kg-day);
E = exposure (mg/day);
AF = absorption factor (dermal); and
BW = body weight (kg).

Table A.5.: Turf (Mowing) – Inputs for Residential Post-application Dermal Exposure

Algorithm Notation	Exposure Factor (units)		Point Estimate(s)
AR	Application rate mass active ingredient per unit area		0.27
F_{AR}	Fraction of AR as TTR following application	L/WP/WDG	0.01
		Granules	0.002
F_D	Daily residue dissipation	L/WP/WDG	0.1
		Granules	0.1
TC	Transfer Coefficient (cm^2/hr)	Adult	5,500
		Children 11 < 16 years old	4,500
ET	Exposure time (hours per day)		1

Table A.5.: Turf (Mowing) – Inputs for Residential Post-application Dermal Exposure			
BW	Body Weight (kg)	Adults	80
		Children 11 < 16 years old	57
L/WP/WDG = liquid/wettable powder/water dispersible granule			

Occupational Non-cancer Handler Algorithms

Potential daily exposures for occupational handlers are calculated using the following formulas:

$$E=UE * AR * A * 0.001\ mg/ug$$

where:

E = exposure (mg ai/day),
UE = unit exposure (µg ai/lb ai),
AR = maximum application rate according to proposed label (lb ai A or lb ai/gal), and
A = area treated or amount handled (e.g., A/day, gal/day).

The daily doses are calculated using the following formula:

$$ADD= \frac{E * AF}{BW}$$

where:

ADD = average daily dose absorbed in a given scenario (mg ai/kg/day),
E = exposure (mg ai/day),
AF = absorption factor (dermal and/or inhalation), and
BW = body weight (kg).

Margin of Exposure: Non-cancer risk estimates for each application handler scenario are calculated using a Margin of Exposure (MOE), which is a ratio of the toxicological endpoint to the daily dose of concern. The daily dermal and inhalation dose received by occupational handlers are compared to the appropriate POD (i.e., NOAEL) to assess the risk to occupational handlers for each exposure route. All MOE values are calculated using the following formula:

$$MOE= \frac{POD}{ADD}$$

where:

MOE = margin of exposure: value used by HED to represent risk estimates (unitless),
POD = point of departure (mg/kg/day), and
ADD = average daily dose absorbed in a given scenario (mg ai/kg/day).

Occupational Non-cancer Post-application Algorithms

Potential daily exposures for occupational post-application workers are calculated using the following formulas:

$$DFR_t = AR * F * (1-D)^t * \left(4.54E8 \frac{ug}{lb}\right) * \left(2.47E\text{-}8 \frac{A}{cm^2}\right)$$

where:

DFR_t	=	dislodgeable foliage residue on day "t" (µg/cm^2),
AR	=	application rate (lb ai/acre),
F	=	fraction of ai retained on foliage or 25% (unitless),
D	=	fraction of residue that dissipates daily or 10% (unitless), and
t	=	number of days after application day (days).

$$E = TC * DFR_t * ET * 0.001 \frac{mg}{ug}$$

where:

E	=	exposure (mg ai/day),
TC	=	transfer coefficient (cm^2/hr),
DFR_t	=	dislodgeable foliar residue on day “t” (µg/cm^2), and
ET	=	exposure time (hours/day).

The daily doses are calculated using the following formula:

$$ADD = \frac{E * AF}{BW}$$

where:

ADD	=	average daily dose absorbed in a given scenario (mg ai/kg/day),
E	=	exposure (mg ai/day),
AF	=	absorption factor (dermal and/or inhalation), and
BW	=	body weight (kg).

Margin of Exposure: Non-cancer risk estimates for each scenario are calculated using a Margin of Exposure (MOE), which is a ratio of the toxicological endpoint to the daily dose of concern. The daily dermal dose received by occupational post-application workers is compared to the appropriate POD (i.e., NOAEL) to assess the risk to occupational post-application workers. All MOE values are calculated using the following formula:

$$MOE = \frac{POD}{ADD}$$

where:

MOE = margin of exposure: value used by HED to represent risk estimates (unitless),
POD = point of departure (mg/kg/day), and
ADD = average daily dose absorbed in a given scenario (mg ai/kg/day).

Appendix B. Summary of New Turf Transferrable Residue Study

MRID 51970301 (TG00484683)

This study was designed to establish a dissipation curve for F9944-74 T&O SC of the active ingredient fluindapyr on turf. The study was conducted in three geographical locations during the 2021 growing season: Germansville, PA (EPA Region 3), Lenexa, KS (EPA Region 7), and Porterville, CA (EPA Region 9). Three applications were made at a target rate of 0.27 lb ai/A/application, for a total target rate of 0.81 lb ai/A. Actual application rates were 0.262-0.273 lb ai/A/application (97-101% of target), for a total application rate of 0.804-0.815 lb ai/A. The test substance was applied using a CO_2 backpack sprayer in Pennsylvania and Kansas, and in California, a tractor-mounted boom sprayer was used. Spray volumes ranged from 88-107 gallons per acre (GPA).

Residues were sampled using the Modified California Roller technique. TTR samples were collected before each application, immediately after each application (after the spray had dried) and at 2-3, 5, 6-7, 14, 21-22, 27-28, and 34-35 days after the last application. At each sampling interval, three replicate TTR samples were collected from the treated plot and one sample was collected from the control plot. Field fortified samples were prepared at two levels (22.5, and 225 µg/cloth; equivalent to 0.00404 and 0.0404 µg/cm^2) before each of the three application events for each site, to evaluate the stability of the field samples during shipping and storage.

TTR samples were analyzed for residues of fluindapyr using a liquid chromatography with tandem mass spectrometry detection (LC-MS/MS). The limit of quantification (LOQ) in this study was defined as the concentration of fluindapyr on the cloth which equates to 0.0030 µg/mL in extraction solvent (i.e., 0.300 µg/cloth or 0.00269 µg/cm^2 for method verification and procedural recovery fortifications and 2.25 µg/cloth or 0.000404 ug/cm^2 for field samples). Concurrent fortification samples utilized a smaller size of cloth than field samples; therefore, this resulted in different calculated LOQ values expressed as ug/cloth. The Limit of Detection (LOD) was 1/3 the LOQ (0.1 µg/cloth for method verification and procedural recovery fortifications and 0.75 µg/cloth for field samples; equivalent to 0.0000179 µg/cm^2 and 0.000135 µg/cm^2 respectively). The maximum length of frozen storage from sample collection/preparation to extraction for analysis was 160 days for the treated TTR samples and 175 days for field-fortified cloth samples.

The study report provided TTRs in µg/cloth (which can be converted to µg/cm^2, based on a 5,574 cm^2 surface area of the cloth in contact with the turf) without correction for field fortification recovery. HED corrected the reported fluindapyr residue values using the field fortification recoveries. Correction factors were applied based on site-specific average recoveries at each level, using the average of the fortification levels as the midpoint for determining which correction factor to apply. At all sites, fluindapyr residues ≤0.0222 µg/cm^2 were corrected for the average low level field fortification recovery (99% for the PA site, 100% for the KS site, and 98% for the CA site) and residues >0.0222 µg/cm^2 were corrected for the average high level field fortification recovery (98% for the PA site, 99% for the KS site, and 96% for the CA site).

At the PA site, average fluindapyr TTR values were highest 2.9 hours after the second application (0DAT2). Fluindapyr residues (and percent of application rate) averaged 0.0191 µg/cm^2 (0.65%) after the first application and 0.0146 µg/cm^2 (0.48%) after the third application. Residues declined to

0.00388 µg/cm^2 by 6 days after application 3 (6DAT3) and were not detected by 14 days after application 3 (14DAT3).

At the KS site, average fluindapyr TTR values were highest 1 hour after the third application (0DAT3). Fluindapyr residues (and percent of application rate) averaged 0.0186 µg/cm^2 (0.62%) after the first application and 0.0241 µg/cm^2 (0.79%) after the third application. Residues declined to 0.000426 µg/cm^2 by 14 days after application 3 (14 DAT3) and were not detected by 21 days after application 3 (21DAT3).

At the CA site, average fluindapyr TTR values were highest 6.4 hours after the third application (0DAT3). Fluindapyr residues (and percent of application rate) averaged 0.0143 µg/cm^2 (0.47%) after the first application and 0.0172 µg/cm^2 (0.57%) after the third application. Residues declined to 0.000187 µg/cm^2 by approximately 35 days after application 3 (35DAT3).

Dissipation curves for fluindapyr TTR values were not provided in the study report.

HED generated dissipation curves for fluindapyr using default first-order dissipation kinetics. The linear regression analyses was conducted using the natural logarithm of the average TTR values collected immediately after the last application through the first interval in which all residues were <LOQ (14DAT3 at the PA site, 21DAT3 at the KS site, and 28DAT3 at the CA site). Based on linear regression of the natural log transformed data, calculated half-lives for fluindapyr in turf were 3.6 days (r^2 = 0.847) for the PA site, 3.8 days (r^2 = 0.898) for the KS site, and 4.8 days (r^2 = 0.932) for the CA site.

Conclusions: The study is acceptable, since it only has minor deficiencies, and meets most of the guideline requirements.

Table B.1. Summary of TTR Values & Regression Analysis Results for MRID 51970301.

Pennsylvania MRID #51970301	
Application Rate (lb ai/A)	0.27
Measured Average Day 0 Residue (µg/cm^2)	0.0146
Predicted Day 0 Residue (µg/cm^2)	0.011
Slope	-0.192
Half-Life (days)	3.6
R^2	0.847
Kansas MRID #51970301	
Application Rate (lb ai/A)	0.27
Measured Average Day 0 Residue (µg/cm^2)	0.0241
Predicted Day 0 Residue (µg/cm^2)	0.011
Slope	-0.184
Half-Life (days)	3.8
R^2	0.898

Table B.1. Summary of TTR Values & Regression Analysis Results for MRID 51970301.	
California MRID #51970301	
Application Rate (lb ai/A)	0.27
Measured Average Day 0 Residue (µg/cm^2)	0.0172
Predicted Day 0 Residue (µg/cm^2)	0.014
Slope	-0.145
Half-Life (days)	4.8
R^2	0.932