UNDATED

HED Chapter

PENDIMETHALIN

In this document, which is for use in EPA's development of the pendimethalin Reregistration Eligibility Decision Document (RED), HED presents the results of its risk characterization of the potential human health effects of dietary, and occupational and residential exposure to pendimethalin. Included is a discussion of the product chemistry, toxicology, and residue chemistry data that have been submitted as well as HED's recommendations for risk reduction and mitigation. At the present time, there are no Office of Water drinking water regulations or Health Advisories for pendimethalin; thus, this risk characterization does not include ingestion of pendimethalin contaminated drinking water or any exposures to pendimethalin contaminated ground or surface water. However, if upon completion of the Ecological Fate and Effects Division Chapter for the RED a concern is opened this may change.

change.

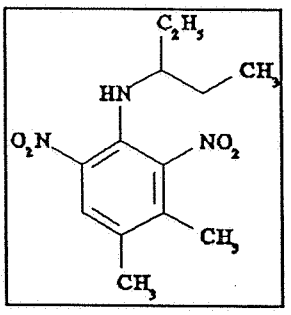
I. SCIENCE ASSESSMENT

A. PHYSICAL AND CHEMICAL PROPERTIES ASSESSMENT

All pertinent data requirements are satisfied for the 90% T and the pendimethalin TGAI; however additional product-specific data (physical/chemical properties) are outstanding for the 86.8% and 60% FIs. Provided that the Registrant submits the data required in the attached data summary tables for the 86.8% and the 60% FIs (Appendix 1, Product Chemistry Data Summary), and either certifies that the suppliers of beginning materials and the manufacturing processes for the pendimethalin technical product and MPs have not changed since the last comprehensive product chemistry review or submits complete updated product chemistry data packages, HED has no objections to the reregistration of pendimethalin with respect to product chemistry data requirements.

1. Description of Chemical

Pendimethalin [N-(1-ethylpropyl)-3,4-dimethyl-2,6-dinitrobenzenamine] is a selective herbicide registered for control of broadleaf weeds and grassy weed species.



Empirical Formula:	$C_{13}H_{19}N_3O_4$
Molecular Weight:	281.3
CAS Registry No.:	40487-42-1
Shaughnessy No.:	108501

2. Identification of Active Ingredient

Pendimethalin is an orange-yellow crystalline solid with a melting point of 54-58 C. It is soluble in chlorinated hydrocarbons and aromatic solvents such as methylene chloride, acetone, and xylene, but only soluble in water at <0.5 ppm at 20 C. Pendimethalin is stable under acidic and alkaline conditions.

3. Manufacturing-Use Products

A search of the Reference Files System (REFS) conducted 9/14/95 identified three pendimethalin manufacturing-use products (MPs) registered to American Cyanamid Company under Shaughnessy No. 108501: the 90% technical (T; EPA Reg. No. 241-245), and the 86.8% and 60% formulation intermediates (FIs; EPA Reg. Nos. 241-291 and 241-281, respectively). Only the American Cyanamid 90% T, and 86.8% and 60% FIs are subject to a reregistration eligibility decision.

4. Regulatory Background

The Pendimethalin Reregistration Standard dated 7/20/84 and Guidance Document dated 3/85 required additional data for the American Cyanamid 90% T. The Pendimethalin

3

Reregistration Standard Update dated 3/19/90 required additional data concerning GLNs 62-2 and 62-3 for the 90% T. As was Agency policy at that time, data pertaining to the 86.8% and 60% FIs were not reviewed in the Update because the products were registered after the Guidance Document was issued. Data concerning the FIs have since been evaluated by either the HED's Chemistry Branch or Registration Division (RD).

In addition because pendimethalin contains dinitroanilines, a discussion of the potential for formation of nitrosamines and analysis of the 90% T for the presence of nitrosamines formed during manufacture and storage of the product was required. Submitted data indicate that no volatile nitrosamines are present (<0.5 ppm) and that total nonvolatile nitrosamines are present at less than 100 ppm. The Agency had previously determined that concentrations of N-nitroso-pendimethalin below 135 ppm were required to maintain the associated upper risk below $1x10^{-6}$ (45 FR 49600).

The current status of the product chemistry data requirements for American Cyanamid pendimethalin products is presented in the attached data summary tables (Appendix 1, Product Chemistry Data Summary). Refer to these tables for a listing of the outstanding product chemistry data requirements.

B. HUMAN HEALTH ASSESSMENT

1. Hazard/Dose-Response Assessment

The toxicology data base for pendimethalin is adequate and will support reregistration eligibility. There are not data gaps at this time.

a. Acute Toxicity

The table below summarizes the results of acute toxicity studies on Pendimethalin and the toxicity categories for the different routes of administration:

Table 1. Acute Toxicity Values of Technical Pendimethalin

TEST	RESULT	CATEGORY
Oral LD_{50} in rat (MRID 00026657)	LD_{50}(M) = 1250 mg/kg LD_{50}(F) = 1050 mg/kg	III
Dermal LD_{50} in rabbit (MRID 00026657)	LD_{50} > 5000 mg/kg	IV
Inhalation LC_{50} in rat (MRID 00073342)	LC_{50} > 320 mg/L (nominal concentration)	IV

4

Eye irritation in rabbit[a] (MRID 00026657)	Slight conjunctival irritation	III
Dermal irritation in rabbit[a] (MRID 00026657)	No irritation	IV
Dermal sensitization[a] (MRID 00153767)	Nonsensitizing	N/A

a Not required for the Technical Grade Active Ingredient; presented for informational purposes.

b. Subchronic Toxicity

Feeding Studies in Rats: In a 30-day feeding study in rats (MRID 000106754), pendimethalin technical (98.7%) was administered to groups of 10 males and 10 females RH Wistar rats in the diet at levels of 0, 800, 1,600 or 3,200 ppm (corresponding to 0, 80, 160, or 320 mg/kg/day). Urine was darker than controls in the 1,600 and 3,200 ppm groups. At 3,200 ppm there appeared to be increased liver weight. **The LOEL is 3,200 ppm (320 mg/kg/day) based on increased liver weight. The NOEL is 1,600 ppm (160 mg/kg/day).** Although this study is classified as Supplementary it provides useful information.

In a 13-week feeding study in rats (MRID 00156081), AC 92,553 (pendimethalin, 92.1%, Lot #AC3528-129-1) was administered to groups of 30 male and 30 female Charles River CD(SD)BR rats in the diet at levels of 0, 100, 500, or 5,000 ppm (corresponding to 0, 10, 50, or 500 mg/kg/day). At 5,000 ppm, rats displayed a dark yellow discoloration of the urine and yellow discoloration of abdominal fat. Body weight gain and food consumption were decreased. The hematocrit and hemoglobin levels were decreased and the number of platelets slightly increased in males. There was an increase in pale or mottled livers in males and dark red thyroids in both sexes at 5,000 ppm. The absolute weight of the liver was increased in males and females. Diffuse hypertrophy of the liver was also observed. **The LOEL is 5,000 ppm (500 mg/kg/day) based on decreased body weight gain and food consumption, decreased hematocrit and hemoglobin with an increase in platelets in males, increased liver weight, red thyroids, and hypertrophy of the liver. The NOEL is 500 ppm (50 mg/kg/day).**

In a second 13-week feeding study in rats (MRID 00059468), AC 92,553 technical (pendimethalin) was administered to groups of 25 male Long-Evans rats in the diet at levels of 0, 25, 50, 100, 500, or 2,500 ppm (corresponding to 0, 2.5, 5.0, 10.0, 50.0, or 250 mg/kg/day). The 2,500 ppm group was raised to 5,000 ppm (500 mg/kg/day) from week 8-13. There were no adverse effects noted with respect to mortality, body weight and gross and microscopic examination of mammary glands. **The LOEL was not determined. The**

5

NOEL was greater than 2,500 ppm (250 mg/kg/day). Although this study is classified as Supplementary it provides useful information.

In a third 13-week study in rats (MRID 00059469), AC 92,553 technical pendimethalin was administered to Sprague-Dawley rats in the diet at 0 or 2,500 ppm (corresponding to 0 or 250 mg/kg/day). There were no adverse effects noted with respect to mortality, body weight and gross and microscopic examination of the mammary gland. **The LOEL was not determined. The NOEL was greater than 2,500 ppm (250 mg/kg/day).** Although this study is classified as Supplementary it provides useful information.

In a special 92-day thyroid function feeding study (MRID 42054601), AC 92,553 (pendimethalin, 92.6%, Lot #AC5213-72A) was administered to groups of 80 male CD[Crl:CD(SD)] rats at dose levels of 0, 100, or 5,000 ppm (corresponding to 0, 4.98, or 245.4 mg/kg/day) for 28 days. Groups of 20 male rats were sacrificed at 15, 29, 57 and 92 days. At 100 ppm there was decreased total T_4, rT_3, total free T_4 and increased percent T_3, increased follicular cell height and decreased area occupied by colloid. At 5,000 ppm there were decreased body weight and food consumption compared to controls, increased thyroid weight, decreased total T_4, total T_3, rT_3, total free T_4 and [^{125}I]-T_4 to transthyretin bonding, increased percent free T_4, percent free T_3 and [^{125}I]-T_4 to albumin binding, increased follicular cell height and decreased area occupied by colloid and ultrastructural thyroid changes. Most parameters were reversible after treatment subsided except for decreased body weight. **The LOEL was 100 ppm (4.98 mg/kg/day) based on thyroid effects. The NOEL was less than 100 ppm (4.98 mg/kg/day).**

In a special 56-day feeding study to determine thyroid function (MRID 43135001), groups of 65-70 (5-15 per sacrifice time) male Crl:CD(SD) rats were treated at dose levels of 0, 500 or 5000 ppm (0, 31 or 292 mg/kg/day) of AC 92,553 (pendimethalin, 92.6%, Lot #AC5213-72A) in the diet for 28 days. A recovery period of up to 28 days was employed. There were no deaths or clinical signs of toxicity during or after the treatment period at either dose. At 500 ppm there was decreased total T_4 (38%), rT_3 (25%) and total free T_4 (28%) and increased percent free T_3 (13%), increased follicular cell height (40%) and decreased area occupied by colloid (51%) during treatment. At 5000 ppm, body weight (8%), body weight gain (29%) and food consumption (15%) were decreased compared to controls during the treatment period. Thyroid changes during treatment with 5000 ppm included: increased absolute (15%) and relative (23%) thyroid weight; decreased total T_4 (74%), total T_3 (25%), rT_3 (36%), total free T_4 (40%), and [^{125}I]-T_4 to transthyretrin binding; increased percent free T_4 (117%), percent free T_3 (26%) and [^{125}I]-T_4 to albumin binding; increased follicular cell height (75%) and decreased area occupied by colloid (45%); ultrastructural thyroid changes were consistent with mild to moderate TSH stimulation except for the accumulation of dense-bodies in the cytoplasm which may be reaction products of AC 92,553. Most parameters were reversible after treatment subsided except for a slight decreased body weight compared to controls (7%) at 5000 ppm. There were no changes in TSH, total free T_3 or diameter of

follicular cells. **The LOEL was 500 ppm (31 mg/kg/day) based on thyroid effects. The NOEL could not be determined.**

In a special 14-day feeding study to determine thyroid function (MRID 43135003), AC 92,553 (pendimethalin, 92.6%, Lot #AC5213-72A) was administered in the diet to groups of 10 male Crl:CD(SD) rats at dose levels of 0, 100 or 5,000 ppm (corresponding to 0, 10 or 500 mg/kg/day). At 5000 ppm AC 92, 533 for 14 days, TSH was increased and T_4 and T_3 were decreased. No treatment related effects were observed for rT_3 levels, thyroid weight, ^{131}I uptake in MIT, DIT or T_4. There was a significant increase of ^{131}I uptake by the thyroid of rats in the 5000 ppm group and an increase in incorporation of ^{131}I in T_3. Total T_3 and T_4 levels in the thyroid were not affected by treatment at 5,000 ppm. **The LOEL is 5,000 ppm (500 mg/kg/day) based on thyroid effects. The NOEL is 100 ppm (10 mg/kg/day).**

In a second special 14-day feeding study to determine biliary excretion and hepatic metabolism, AC 92,553 (pendimethalin, 92.98%, Lot #AC6539-77A) was administered to groups of 10 male Crl:CD(SD) rats at dose levels of 0, 100, or 5,000 ppm (corresponding to 0, 10, or 500 mg/kg/day). Ingestion of 5,000 ppm produced decreases in serum T_3 and T_4 with a compensatory increase in TSH. Also increased were liver weight, bile flow and cumulative biliary excretion of ^{125} I-T_4 with a slight increase in T_4-glucuronytransferase activity detected by generation of ^{125} I-T_4 glucuronide from ^{125} I-T_4 in vitro by hepatic microsomes. The increase in enzyme activity was also demonstrated in vivo by a significant increase in biliary excretion of ^{125} I-T_4-glucuronide. **The LOEL is 5,000 ppm (500 mg/kg/day) based on thyroid effects. The NOEL is 100 ppm (10 mg/kg/day).**

Feeding Studies in Dogs: In a 90-day feeding study (MRID 00026672), pendimethalin was administered to groups of 8 dogs at dose levels of 0, 62.5, 250 or 1,000 mg/kg/day. Body weight loss was apparent at 250 and 1,000 mg/kg/day. **The LOEL is 250 mg/kg/day based on body weight loss. The NOEL is 62.5 mg/kg/day.** Although this study is classified as Supplementary it provides useful information.

In a 30-day feeding study in dogs (MRID 000106754) AC 92,553 technical (pendimethalin, 98.7%) was administered to groups of 2 male and 2 female beagles in the diet at dose levels of 0, 0.625% or 1.25% (corresponding to 0, 125 or 250 mg/kg/day). A third test group received 5% in the diet (corresponding to 1,000 mg/kg/day) for 30 days. The protocol was changed so that dogs received the compound by gelatin capsule from days 17 to 30. Food consumption and body weight were decreased in all treated groups compared to controls. **The LOEL was 125 mg/kg/day based on decreases in body weight and food consumption. The NOEL could not be determined.** Although this study is classified as Supplementary it provides useful information.

Feeding Study in Mice: In a 30-day feeding study in mice (MRID 000106754), pendimethalin technical (98.7%) was administered to groups of 10 male and 10 female CF-1 mice in the

diet at levels of 0, 500, 1,000 or 2,000 ppm (corresponding to 0, 75, 150 or 300 mg/kg/day). There were no adverse effects with respect to mortality, body weight, food consumption and organ weight. **The LOEL was not determined. The NOEL is greater than 2,000 ppm (300 mg/kg/day).** Although this study is classified as Supplementary it provides useful information.

Dermal Study in Rabbits: In a 21-day dermal toxicity study (MRID 00026663), AC 92,553 (pendimethalin) was dermally applied to the back of 3 or 4 New Zealand white rabbits/group at dose levels of 0, 250, 500 or 1000 mg/kg/day. There were no adverse effects with respect to mortality, food and water intake, hematology, urinalysis and gross and microscopic pathology. **The systemic LOEL was not determined. The systemic NOEL is greater than 1000 mg/kg/day.**

c. Chronic Toxicity/Carcinogenicity

Feeding Studies in Rats: In a 2-year study in rats (MRID 40174401), AC 92,533 (pendimethalin, 91.9%, Lot #AC3528-129-1), was administered to groups of 55 male and 55 female Crl:CD(SD)BR rats in the diet at levels of 0, 100, 500 or 5,000 ppm (corresponding to 0, 5, 25, or 250 mg/kg/day). Ten rats/sex/group were interim sacrificed as 12 months. At 5,000 ppm, survival in males was slightly decreased and body weight gain was decreased. There was decreased food consumption, increased gamma glutamyl transferase and cholesterol, increase in liver weight and/or liver body and/or brain weight ratios, generalized icterus, dark adipose tissue in females, diffusely dark thyroids, follicular cell hyperplasia of the thyroid. At 500 ppm there was pigmentation of thyroid follicular cells in males and females. **The LOEL is 5000 ppm (250 mg/kg/day) based on decreased survival, body weight gain and food consumption, increased gamma glutamyl transferase and cholesterol, increase in absolute and/or relative liver weight, generalized icterus, dark adipose tissue in females, diffusely dark thyroids and follicular cell hyperplasia of the thyroid. The NOEL is 500 ppm (25 mg/kg/day). There are thyroid follicular cell adenoma at 500 ppm 250 mg/kg/day.**

In a second 2-year feeding study in rats (MRID 42027802), AC 92,533 (pendimethalin, 92.6%, Lot #AC5213-72A) was administered to groups of 125 male Sprague-Dawley (Crl:CD(SD)BR) at dose levels of 0, 1250, 2500, 3750, or 5000 ppm (corresponding to 0, 51, 103, 154, and 213 mg/kg/day). Fifteen rats/group were interim sacrificed at 1, 13, 26, 39 and 52 days. There was decreased colloid and increased cysts of the thyroid follicular cells and an increase in liver weight at 1250 ppm and above. At 2500 ppm and above there was increased pigment and hypertrophy of follicular cells, increased thyroid weight and an increase in eosinophilic and basophilic foci of cellular alteration, hepatocellular enlargement and hepatocellular intracytoplasmic inclusions. There was a decrease in body weight gain at 3750 ppm and above and hyperplasia of follicular cells. At 5000 ppm GGT and total cholesterol were increased and there was an increase in thyroid follicular adenomas. The

8

LOEL is less than or equal to 1250 ppm (≤51 mg/kg/day) based on non-neoplastic thyroid follicular cell changes and increased liver weight. The NOEL was not determined.

Feeding Study in Mice: In an 18-month feeding study in mice (MRID 40909901), AC 92,533 (pendimethalin, 92.6%, Lot #AC5218-72A) was administered to groups of 65 male and 65 female Charles River CD-1 mice at dose levels of 100, 500, or 5,000 ppm (corresponding to 12.3, 62.3 and 622.1 mg/kg/day in males and 15.6, 78.3 and 806.9 mg/kg/day in females). There were 2 control groups consisting of 65 mice/sex each. Ten mice/sex were sacrificed at 12 months in 1 control and all treated groups. (One control group only consisted of 55 mice/sex.) At 5,000 ppm there was increased mortality in females, decreased body weight in females, increased absolute thyroid, liver and gall bladder weights and/or relative body and brain weight ratios in males and females and amyloidosis in males. **The LOEL is 5,000 ppm (622.1 mg/kg/day [M]; 806.99 mg/kg/day [F]) based on mortality, body weight decrease, organ weight changes and amyloidosis. The NOEL is 500 ppm (62.3 mg/kg/day [M]; 78.3 mg/kg/day [F]).**

Oral Study in Dogs: In a 2-year oral study in dogs (MRID 00058657, **TO GET**), AC 92,533 (pendimethalin, 91.4%, Lot #77-02) was administered via capsule to groups of 4/sex beagle dogs at dose levels of 0, 12.5, 50 or 200 mg/kg/day. At a later time, additional liver slides were prepared from fixed tissue and stained using the Gomori's and Hall's method to evaluate lesions observed in this organ. Slight pigment accumulation (probably chemical) in hepatocytes is observed in the 50 and 200 mg/kg/day doses and is considered of no toxicologic concern. **The NOEL is 200 mg/kg/day with no LOEL established.**

d. Developmental Toxicity

Oral Study in Rats: Pendimethalin (94.2% a.i.) was administered in corn oil to groups of 30 mated Sprague-Dawley CD strain rats by gavage at daily dose levels of 0, 125, 250, or 500 mg/kg/day from gestation day 6 through 15 (MRID 00025752). Females were observed for signs of toxicity, and body weights were measured during gestation. Animals were sacrificed on gestation day 21 and reproductive observations were made and uteri were examined for live fetuses and intra-uterine deaths. Fetuses were weighed, sexed, and examined for external, visceral and skeletal alterations. There were no maternal or developmental effects noted at any dose level tested, and based on these results, the **NOELs for developmental and maternal toxicity are ≥500 mg/kg/day (highest dose tested).** Although this study is classified as Supplementary, when considered in conjunction with the rabbit developmental toxicity study (MRID 00117444) it will satisfy guideline requirement §83-3. It is not upgradable because an adequate dose range may not have been tested.

Oral Study in Rabbits: Pendimethalin was administered in corn oil to groups of 20 artificially inseminated New Zealand White strain rabbits by gavage at dose levels of 0, 15, 30, or 60

mg/kg/day from gestation day 6 through 18 (MRID 00117444). Females were observed for signs of toxicity, and body weights were measured during gestation. Animals were sacrificed on gestation day 29 and reproductive observations were made and uteri were examined for live fetuses and intra-uterine deaths. Fetuses were weighed, sexed, and examined for external, visceral and skeletal alterations. **No maternal toxicity was reported at doses ≤60 mg/kg/day (highest dose tested). However, the range-finding study indicated that doses ≥ 125 mg/kg/day were associated with increased mortality** (3/5, 5/5 and 4/5 in the 125, 250, and 500 mg/kg/day, respectively compared with 0/5 in the control group). A slight increase in the mean incidence of skeletal anomalies in the mid- and high-dose groups which consisted of findings of less than twelve pairs of ribs (0/111, 1/118 and 4/107 fetuses in the control, mid-, and high-dose groups, respectively, not statistically significant) and/or missing or incompletely ossified vertebrae (0/111, 1/118 and 7/107 fetuses in the control, mid and high dose groups, respectively). No individual litter data or historical control data were available in the report to support a conclusion regarding the significance of these alterations. **A developmental toxicity NOEL could not be determined from this study.** Although this study is Supplementary and does not satisfy §83-3 guideline requirements for a rabbit developmental toxicity study, it is upgradable pending receipt of individual litter data (fetal alterations) and historical control data. **If, however, the additional data indicates the lack of any developmental or maternal effects at any dose, an additional developmental study (species to be determined) may be required.**

e. Reproductive Toxicity

Feeding Studies in Rats: In a 2-generation reproduction study (MRID 417252203), AC 92,533 (pendimethalin, 92.6%, Lot #AC5213-72A) was administered to groups of 25 male and 25 female Sprague-Dawley derived OFA-SD (IOPS-CAW) rats at dose levels of 0, 500, 2500 or 5000 ppm (corresponding to 0, 34, 172 and 346 mg/kg/day) in males and 0, 43, 216, 436 mg/kg/day in females). There were no clinical signs or changes in organ weight data. There was a minimal (5%) decrease in body weight gain and food consumption (possibly due to palatability) at 2500 ppm. At 5000 ppm the decrease in body weight gain was as high as 20 %. **The LOEL for parental effects is 5000 ppm (346 and 436 mg/kg/day, in males and females) based on weight gain and food consumption depression. The NOEL for parental effects is 2500 ppm (172 and 216 mg/kg/day, in males and females, respectively).** There were decreased pup weights during much of lactation at 5000 ppm. **The LOEL for reproductive effects is 5000 ppm (346 and 436 mg/kg/day in males and female, respectively). The NOEL for reproductive effects is 2500 ppm (172 and 216 mg/kg/day, in males and females, respectively).**

In a 3-generation reproduction study (MRIDs 00026671, 0040304, 00059470) AC 92,533 technical (pendimethalin) was administered to groups of 10 male and 20 female Long-Evans rats at dose levels of 0, 500 or 5000 ppm (corresponding to 0, 25 and 250 mg/kg/day). At 5000 ppm there was a decrease in body weights in male and female parental animals. **The**

LOEL for parental toxicity is 5000 ppm (250 mg/kg/day) based on decreased body weights. The NOEL for parental toxicity is 500 ppm (25 mg/kg/day). Pup body weight gain was decreased during lactation. There were possible decreases in pups born alive and pup survival. **The LOEL for reproductive toxicity is 5000 ppm (250 mg/kg/day) based on pup body weight gain and possible decreased pups born alive and pup survival . The NOEL for reproductive toxicity is 500 ppm (25 mg/kg/day).**

f. Mutagenicity

There are acceptable studies to satisfy the initial mutagenicity testing requirements for all three categories (gene mutations, structural chromosomal aberrations, and other genotoxic effects). The positive Salmonella results in one study indicated that pendimethalin may have potential genotoxic activity. Subsequent assays for germ cell effects (Chinese hamster ovary cells and rat testicular cells) and additional Salmonella assays, submitted to address this concern, were all negative. No other mutagenicity studies are required at this time.

In a reverse gene mutation assay in bacteria (MRID 00153768), strains (TA1535, TA1537, TA1538, TA98, TA100) of S. typhimurium were exposed to AC 92,533 (pendimethalin, 92.2%, Lot #AC3528-129-1) at concentrations of 50, 158, 500, 1581 or 5000 μg/plate in the presence and absence of mammalian hamster S9. Subsequent tests with TA98, TA1538 and TA100 used dose levels of 250, 500, 1000, 3000 or 5000 μg/plate. AC 92,533 was tested up to the limit dose of 5000 μg/plate. A precipitate was formed at 5000 μg/plate. The positive controls did induce the appropriate responses in the corresponding strains. **This study was considered positive since there was evidence of a 2-fold dose-related increase in the number of induced mutant colonies over background at all doses from 50 to 5000 μg/plate.**

In a *Salmonella*/microsome plate incorporation assay and in an *Escherichia coli* WP2(uvrA) reverse mutation assay (MRID 43177801), strains TA98, TA100, TA1535, TA1537, TA1538 and WP2(uvrA) were exposed to pendimethalin at concentrations of 25, 50, 100 250, 500 and 750 μg/plate, with and without exogenous metabolic activation. Preparations for metabolic activation were made from Aroclor 1254 induced male Sprague-Dawley rat livers. The test material was delivered in DMSO. No cytotoxicity was seen at any concentration of pendimethalin tested. The upper concentration was limited by test material solubility (a precipitate was observed at concentrations of 750 μg/plate and above). Positive and vehicle control values were appropriate. **There was no evidence of an increase number of mutant colonies over solvent control values at any concentration of pendimethalin tested, either with or without S9 mix.**

In a *Salmonella*/microsome plate incorporation and disk assay and in an *Escherichia coli* WP2(uvrA) reserve mutation assay (MRID 43135005), strains TA98, TA100, TA1535, TA1537, and WP2(uvrA) were exposed to pendimethalin (90.7% , Lot #AC8088-149) at 50,

11

158, 500, 1581 and 5000 μg/plate or 1000 μg/paper disk/plate, with and without exogenous metabolic activation. Preparations for metabolic activation were made from Aroclor 1254 induced male rat livers. The test material was delivered in DMSO. Cytogenetic determinations were not made or discussed in this study. The highest concentration was limited by solubility (a precipitate was seen at 1581 and 5000 μg/plate). Positive and vehicle controls were appropriate. **There was no evidence of induced mutant colonies over background vehicle control values at any concentration of pendimethalin tested in any strain with or without S9 mix.**

In a *Salmonella*/microsome plate incorporation and disk assay and in an *Escherichia coli* WP2(uvrA) reverse mutation assay (MRID 43135006), strains TA98, TA100, TA1535, TA1537, TA1538, and WP2(uvrA) were exposed to pendimethalin (99.5%, Lot #AC5042-52F) at concentrations of 50, 100, 250, 500, and 750 μg/plate without exogenous metabolic activation and to the same concentrations plus an additional concentration of 25 μg/plate with exogenous metabolic activation. A confirmatory assay tested concentrations of 25, 50, 100, 250, 500 and 750 μg/plate both with and without S9 mix. Preparations for metabolic activation were made from Aroclor 1254 induced male rat livers. The test material was delivered in DMSO. No cytogenicity was seen at any concentration tested up to 5000 μg/plate. The upper concentration tested was limited by solubility of the test material. Positive and vehicle control values were appropriate. **No evidence of a mutagenic response was seen at any dose in any strain with or without S9 mix in either assay.**

In a forward mutation study (MRID 43177802) at the HGPRT locus in Chinese hamster ovary CHO-K1-BH4 cells in culture, cells were exposed to pendimethalin (90.9%, Lot #AC5042-37D) at concentrations of 1, 5, 7.5, 10, 20, 30, 40, and 50 μg/ml in the absence of an exogenous metabolic activation system and to 10, 25, 50, 75, 100, 125, 150, and 175 μg/ml in the presence of an exogenous metabolic activation system (S9-mix). Preparations for metabolic activation were made from Aroclor 1254 induced male Sprague-Dawley rat liver. The test material was delivered in DMSO. Cytotoxicity was unacceptably high at 30, 40 and 50 μg/ml in the absence of S9 mix and at 150, 150, and 175 μg/ml with S9 mix; therefore, mutagenicity was not evaluated at these concentrations. A yellow precipitate was seen at concentrations $\geq$50 μg/ml. Positive, negative, and vehicle control values were appropriate. **There was no evidence of induced mutant colonies over background either with or without S9 mix at any concentration evaluated in this study.**

In a chromosomal aberration study (MRID 00153770), Chinese hamster ovary (CHO) cells were exposed to AC 92,533 (pendimethalin, 92.2%, Lot #AC3528-129-1) at dose levels ranging from 5 to 25 μg/plate with or without rat liver S9 and at 12.5 to 100 μg/ml with rat liver S9. **There was no induction of chromosomal aberrations in CHO cells at dose levels of up to 25 μg/plate without S9 and up to 100 μg/ml with S9.**

12

In a mouse micronucleus study (MRID 42027801), AC 92,533 (pendimethalin, 92.98%, Lot #AC6539-77A) was administered to 5 male and 5 female ICR mice by gavage at dose levels of 313,625 or 1250 mg/kg. Administration of AC 92,533 did not cause a significant increase in the frequency of micronucleated polychromatic erythrocytes (MPEs) in bone marrow cells harvested 24, 48, or 72 hours posttreatment. Deaths and other signs of compound toxicity were seen in high-dose males and females. although there was no evidence of a cytotoxic effect on the target organ (bone marrow cells), the findings of overt toxicity at 1250 mg/kg (80% of the LD_{50}) clearly indicated that the maximum tolerated dose was achieved. Therefore, **AC 92,533 was adequately tested and found to be nonclastogenic in the mouse micronucleus assay.**

In an alkaline elution assay (MRID 43135007), three rats per dose per sacrifice time were given single i.p. doses of pendimethalin (90.7%, Lot #AC8088-149) at 1250, 2500 or 5000 mg/kg/body weight. (The alkaline elution assay detects DNA single strand breaks and DNA/DNA and DNA/protein crosslinks). The test compound was delivered in corn oil. Testicular cells were harvested 2, 6 and 24 hours after treatment. At the 6 hr sacrifice time, all rats receiving 2500 or 5000 mg/kg were lethargic while those receiving 1250 mg/kg appeared normal. At 24 hr, rats receiving 5000 mg/kg appeared lethargic and ungroomed with dehydrated intestinal tissue while all other rats at lower doses appeared normal. No testicular cell cytotoxicity as measured by trypan blue exclusion was evident at any test material dost or sacrifice time. All positive and vehicle control rats appeared normal at all sacrifice times and no testicular cytotoxicity was seen. **There was no evidence of DNA single strand break induction or DNA/DNA or DNA/protein crosslink formation at any dose or sacrifice time.**

g. Metabolism

In a metabolism study (MRID 00046275), when [^{14}C]pendimethalin was administered to rats, about 70% of the radioactivity was excreted in the feces and 20% in the urine within 24 hours. The excretion of radioactivity in the urine peaked at 6 to 12 hours wherein 11.2% of the dose was excreted. The maximum residual radioactivity in the tissues was found in the 6-hour samples (except for fat at 12 hours). The levels of radioactivity detected in liver, kidney, muscle, fat, and blood at 6 hours were 29.8, 16.9, 1.3, 12.2, and 5.4 ppm, respectively. Within 96 hours, the radioactivity found in the tissues was 0.3 ppm or less, except for fat which was 0.9 ppm. The major portion of the radioactivity that was excreted in the feces was identified as the parent compound. Pendimethalin is metabolized in rats mainly through oxidation of the 4-methyl group attached to the benzene ring as well as oxidation of the alkyl side chain of the N-substituted dinitroaniline compound. Pendimethalin is rapidly eliminated from the body with 70% being excreted in the feces primarily unchanged as parent compound and 20% in the urine within 24 hours. It is mainly metabolized through oxidation of the 4-methyl group on the benzene ring and the alkyl side chain.

h. Toxicological Endpoints of Concern Identified for Use in Risk Assessment

The Health Effects Division's Toxicological Endpoint Selection Committee (TESC), Cancer Peer Review Committee (CPRC) and Reference Dose Committee (RfD Committee) considered the toxicity data available for pendimethalin. Based upon a review of the toxicology database for pendimethalin, toxicology endpoints and dose levels of concern have been identified for use in risk assessments corresponding to the categories below (TES report date 1/17/96, CPRC report date 7/24/92, RfD report date 2/6/96).

RfD: The HED RfD/Peer Review Committee established the RfD for pendimethalin at 0.1 mg/kg/day (meeting dated 1/5/96). An uncertainty factor (UF) of 100 was used. The NOEL from the special 14-day rat thyroid study is 100 ppm (10 mg/kg/day). The LOEL of 500 ppm (31 mg/kg/day), was based on thyroid hormonal effects.

Cancer Classification and Basis: The chemical has been classified as a **"Group C"**, possible human carcinogen, "based on statistically significant increased trend and pairwise comparison between the high dose group and controls for thyroid follicular cell adenomas in male and female rats". For the purpose of risk assessment, the RfD approach will be used for quantification of chronic human risk (HED report dated July 24, 1992). The RfD committee (meetings dated 11/20/95 and 1/5/96) determined that the hypothesis that thyroid tumors associated with pendimethalin are due to a thyroid-pituitary imbalance can be supported.

Acute Dietary: There are no toxicologic endpoints of concern for acute dietary risk. Therefore, this risk assessment is not required.

Short Term Occupational and Residential (one to seven days): In a special 56-day feeding study to determine thyroid function (MRID 43135001), groups of 65-70 (5-15 per sacrifice time) male Crl:CD(SD) rats were treated at dose levels of 0, 500 or 5000 ppm (0, 31 or 292 mg/kg/day) of AC 92,553 (pendimethalin, 92.6%, Lot #AC5213-72A) in the diet for 28 days. A recovery period of up to 28 days was employed. **The LOEL is 500 ppm (31 mg/kg/day) based on thyroid effects. The NOEL could not be determined.** In a special 14-day feeding study to determine thyroid function (MRID 43135003), AC 92,553 (pendimethalin, 92.6%, Lot #AC5213-72A) was administered in the diet to groups of 10 male Crl:CD(SD) rats at dose levels of 0, 100 or 5,000 ppm (corresponding to 0, 10 or 500 mg/kg/day). **The LOEL is 5,000 ppm (500 mg/kg/day) based on thyroid effects. The NOEL is 100 ppm (10 mg/kg/day).**

The endpoint and dose for use in risk assessment is the NOEL of 10 mg/kg/day from the second study. The LOEL taken from the first study is 31 mg/kg/day based on thyroid hormonal effects occurring as early as day 3. A 10 % dermal absorption factor should be

used. **Comments about studies and/or endpoint:** Although there is a dermal study it was determined that it was not appropriate for this risk assessment since thyroid hormone endpoints were not evaluated. **This risk assessment is required.**

Intermediate Term Occupational and Residential (one week to several months): The studies and effects are same as for Short Term Dermal Occupational of Residential Exposure. **The endpoint and dose for use in risk assessment is the NOEL of 10 mg/kg/day from the second study.** The LOEL taken from the first study is 31 mg/kg/day based on thyroid hormonal effects occurring as early as day 3. A 10 % dermal absorption factor should be used. **Comments about studies and/or endpoint:** Although there is a dermal study it was determined that it was not appropriate for this risk assessment since thyroid hormone endpoints were not evaluated. **This risk assessment is required.**

Chronic Occupational or Residential Exposure (90 Days or more): The studies and effects are same as for Short Term Dermal Occupational of Residential Exposure. **The endpoint and dose for use in risk assessment is the NOEL of 10 mg/kg/day from the second study.** The LOEL taken from the first study is 31 mg/kg/day based on thyroid hormonal effects occurring as early as day 3. A 10 % dermal absorption factor should be used. **Comments about studies and/or endpoint:** This is the same NOEL used for the RfD.Although there is a dermal study it was determined that it was not appropriate for this risk assessment since thyroid hormone endpoints were not evaluated and it was only 28 days duration. **This risk assessment is required.**

Inhalation Occupational or Residential Exposure: Based on the LC_{50} of greater than 320 mg/L, pendimethalin is placed in Tox. Cat IV. Therefore, inhalation exposure should be considered only if it is greater than 5 % of the dermal exposure. If it is greater that 5 % inhalation exposure (50 % absorption factor) should be added to the dermal exposure (10 % absorption factor). The NOEL to use for comparison is 10 mg/kg/day from the 14-day special thyroid study. The LOEL from the special 28-day rat special study is 31 mg/kg/day based on thyroid hormonal effects occurring as early as day 3. **This risk assessment is required only if inhalation exposure is greater that 5% of the dermal exposure.**

Dermal Absorption: There were no dermal absorption studies and no appropriate toxicity studies available to allow an estimation of the dermal absorption by a route to route comparison of toxicity. However, structurally related chemicals: oryzalin, trifluralin and ethalfluralin have dermal absorption studies (in monkeys) indicating that absorption is 2.3%, ~1%, and 2.8% percent, respectively. The solubilities (water) for pendimethalin and related chemicals, oryzalin, ethalflualin and trifluralin are similar: 0.5 ppm, 2.5 ppm, 0.3 ppm and < 1 ppm, respectively. Therefore, for risk characterization purposes, it is estimated that absorption for pendimethalin will be **no greater than 10%.**

i. Incidence Reports

A search in the Office of Pesticide Programs' Incident Data System (2/28/96) indicated 12 reports with 3 of these involving 5 humans (the remainder concern fish, wildlife or domestic animals). The symptoms included signs of systemic illness: vomiting, diarrhea, chills and shakiness. Three people were hospitalized when they were exposed to a mixture of pesticides including pendimethalin and nitrogen. The data base does not indicate the associated use patterns or activities in which the poisoned individuals were involved.

The California Pesticide Illness Surveillance Program for 1982-1992 contained six reports. In three the effects were systemic (vomiting, diarrhea, etc.), two had skin effects, and one involved eye effects.

Pendimethalin ranked 41st on a list of the top 200 active ingredients for which the National Pesticide Telecommunications Network (NPTN) received calls during 1982-1991. There were 682 calls, with 91 concerning human poisoning due to pendimethalin. HED has requested more details on the NPTN reports for review.

2. Exposure Assessment

a. Registered Uses

i. Agricultural food/feed

Pendimethalin [N-(1-ethylpropyl)-3,4-dimethyl-2,6-dinitrobenzenamine] is a herbicide registered for use on numerous food/feed crops. Pendimethalin is manufactured by American Cyanamid Co. under the trade names Pentagon®, Prowl®, Pursuit®, and Squadron®. Formulations registered for food/feed uses include emulsifiable concentrates (EC), soluble concentrates/liquid (SC/L), Granulars (G) and water dispersable granules (WDG) or dry flowables (DF). Pendimethalin is applied to soil as preplant, preemergence, and postemergence applications, including at layby, with ground or aerial equipment.

A REFs search conducted 9/14/95 indicated that there are eight pendimethalin end-use products (EPs) with food/feed uses registered to American Cyanamid Co. These EPs are presented in Table 2 below.

Table 2. End-Use Products Registered to American Cyanamid Co.

EPA Reg. No.	Acceptance Date	Formulation Class	Product Name
241-243	7/95	4 lb/gal EC	Prowl® Herbicide
241-244	2/87	3 lb/gal EC	Prowl® 3E Herbicide
241-268	7/95	60% WDG	Pentagon® DG Herbicide
241-297	2/91	2 lb/gal SC/L	Squadron® Herbicide
241-315	1/93	2.7 lb/gal EC	Pursuit® Plus Herbicide
241-327	2/95	2 lb/gal SC/L	Squadron® Herbicide
241-331	10/95	3 lb/gal EC	Pursuit® Plus EC Herbicide
241-337*	5/95	3.3 lb/gal EC	Prowl® 3.3 EC Herbicide

* Including SLN Nos. ID930012, MT930003, NV920004, NY940003, OR930001, OR930002, UT920004, WA920015, WA920034, WY920005.

ii. Agricultural and Residential non-food

Products containing pendimethalin are intended for both occupational and homeowner uses. Pendimethalin is used on landscape and grounds plantings, ornamentals, turfgrass (residential, golf-course, landscape, and sod-farms). Homeowners use pendimethalin to control weeds on lawns, including spot treatment. Treatments are also made to homeowner lawns, landscape and grounds and golf courses by commercial applicators/sprayers. Large scale applications of pendimethalin are made to ornamental crops. Other ways of applying pendimethalin include backpack sprayer, low pressure hand wand (spot treatment), ground boom, or broadcast spreader.

b. Dietary Exposure

i. Residue Chemistry Regulatory Background

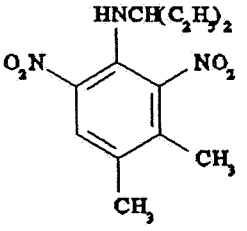
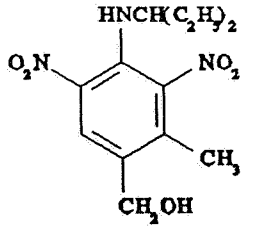
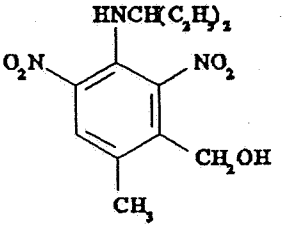
The Pendimethalin Guidance Document was issued 3/85. Pendimethalin was the subject of a Reregistration Standard Update issued 4/13/90. These documents summarized regulatory conclusions regarding the available residue chemistry data. The 1990 Update specified that additional data were required for reregistration purposes. Several submissions of data have been received since the Update. The information contained in this document outlines the current Residue Chemistry Science Assessments with respect to the reregistration of pendimethalin.

Tolerances of 0.1 ppm (except 0.05 ppm for rice grain) are established for the combined residues of pendimethalin [N-(1-ethylpropyl)-3,4-dimethyl-2,6-dinitrobenzenamine] and its metabolite 4-[(1-ethylpropyl)amino]-2-methyl-3,5-dinitrobenzyl alcohol in/on beans, corn

17

(field and fresh), cottonseed, onions (dry bulb), peanuts, potatoes, grain sorghum, soybeans, sugarcane, and sunflower seeds [40 CFR §180.361(a)]. A tolerance of 0.25 ppm has been established for the combined residues of pendimethalin and its metabolites 4-[(1-ethylpropyl)amino]-2-methyl-3,5-dinitrobenzyl alcohol and 3-[(1-ethylpropyl)amino]-6-methyl-2,4-dinitrobenzyl alcohol in/on peanut hulls [40 CFR §180.361(b)]. A tolerance with regional registration of 0.1 ppm has been established for the combined residues of pendimethalin and its metabolite 4-[(1-ethylpropyl)amino]-2-methyl-3,5-dinitrobenzyl alcohol in/on garlic [40 CFR §180.361(c)]. The molecular structures of pendimethalin and currently regulated metabolites are depicted in Table 3 below.

Table 3. Chemical names and structures of pendimethalin and its metabolites.

Common/Chemical Names	Structures
Pendimethalin N-(1-ethylpropyl)-3,4-dimethyl-2,6-dinitrobenzenamine	
3,5-Dinitrobenzyl alcohol metabolite 4-[(1-ethylpropyl)amino]-2-methyl-3,5-dinitrobenzyl alcohol	
2,4-Dinitrobenzyl alcohol metabolite 3-[(1-ethylpropyl)amino]-6-methyl-2,4-dinitrobenzyl alcohol	

The Agency has recently updated the Livestock Feeds Table [Pesticide Assessment Guidelines, Subdivision O, Residue Chemistry, Table II (September, 1995)]. Additional residue data are now required for some commodities as a result of changes in Table II; these

18

data requirements have been incorporated into this document. These new data requirements will be imposed at the issuance of the Pendimethalin RED but should not impinge on the reregistration eligibility decision for pendimethalin. The need for additional tolerances and for revisions to exposure/risk assessments will be determined upon receipt of the required residue chemistry data.

ii. Summary of Science Findings

GLN 171-4 (a): Plant Metabolism

The qualitative nature of the residue in plants is understood based on adequate studies conducted with [^{14}C]pendimethalin on potatoes and sweet corn. The results of these studies are supported by additional corn, cotton, dry bean, lima bean, peanut, potato, red table beet, rice, snapbean, soybean, sugarcane, and wheat metabolism data. Pendimethalin *per se* and its 3,5-dinitrobenzyl alcohol metabolite are the residues of concern.

The current tolerance expressions specify the combined residues of pendimethalin and its 3,5-dinitrobenzyl alcohol metabolite and, for peanut hulls, the 2,4-dinitrobenzyl alcohol metabolite as well.

GLN 171-4 (b): Animal Metabolism

Adequate goat and poultry metabolism studies are available. The Agency has determined that there is no reasonable expectation of finite pendimethalin residues of concern in animal commodities (40 CFR §180.6(a)(3)). No additional animal metabolism, analytical methods, storage stability, and magnitude of the residue data are required. Tolerances for pendimethalin residues of concern in livestock commodities are not needed.

GLN 171-4 (c) and (d): Residue Analytical Methods-Plants and Animals

Adequate methods are available for data collection and tolerance enforcement. Methods I through IV in PAM Vol. II are gas chromatography/electron capture (GC/ECD) methods. Methods used for data collection are essentially the same as the PAM Vol. II methods.

Radiovalidation data using samples from the potato metabolism study remain outstanding and are considered confirmatory.

The FDA PESTDATA database dated 1/94 (PAM Volume I, Appendix I) indicates that pendimethalin is completely recovered (>80%) by Multiresidue Methods Section 302 (Luke method; Protocol D) and 303 (Mills, Onley, Gaither method; Protocol E, nonfatty), and partially recovered (50-80%) by Multiresidue Method Section 304 (Mills fatty food method; Protocol E, fatty).

GLN 171-4 (e): Storage Stability

HED concludes that available storage stability data on almonds (representative of oilseeds), alfalfa seed (representative of non-oily seeds), onions, potatoes, soybean forage and hay, wheat straw, and alfalfa forage and hay adequately support the plant magnitude of the residue data. No additional storage stability data are required.

GLN 171-4 (k): Magnitude of the Residue in Plants

The reregistration requirements for magnitude of the residue in/on beans (succulent and dry); bean forage; bean fodder; corn stover (fodder); corn forage; field corn; pop corn; sweet corn (K+CWHR); cottonseed; garlic; onions (dry bulb); peanuts; peanut hay; potatoes; rice grain; rice straw; sorghum stover (fodder); sorghum forage; grain sorghum; soybeans; soybean forage; soybean hay; sugarcane; and sunflower seeds have been satisfied. Tobacco magnitude of the residue remain outstanding and are considered confirmatory.

Pendimethalin residue data requirements for cotton gin byproducts which result from changes in the Livestock Feeds Table (Table II (September, 1995)) should be imposed at this time. However, this requirement should not impinge on the reregistration eligibility decision for pendimethalin. The need for additional tolerances and revisions to the exposure/risk assessments will be made upon receipt and evaluation of required data.

GLN 171-4 (l): Magnitude of the Residue in Processed Food/Feed

Adequate data are available to demonstrate that pendimethalin residues of concern do not concentrate in commodities derived from corn, cottonseed, peanuts, potatoes, soybeans, sugarcane, and sunflower seeds. Rice processing data remain outstanding and are considered confirmatory.

GLN 171-4 (j): Magnitude of the Residue in Meat, Milk, Poultry, and Eggs

The Agency has determined that there is no reasonable expectation of finite pendimethalin residues of concern in animal commodities (40 CFR §180.6(a)(3)). Therefore, livestock feeding studies and tolerances on livestock commodities are not required.

GLNs 165-1 and 165-2: Confined/Field Rotational Crops

The available confined rotational crop study is not adequate. A new confined rotational crop study is required. This, however, will not preclude the reregistration of pendimethalin.

c. Occupational and Residential Exposure

An occupational and/or residential exposure assessment is required for an active ingredient if (1) certain toxicological criteria are triggered and (2) there is potential exposure to handlers (mixers, loaders, applicators, etc.) during use or to persons entering treated sites after application is complete.

Handler (Mixer/Loader/Applicator) Exposures and Assumptions

HED has determined that there is potential exposure to persons handling pendimethalin. Handler exposures may occur to:

- Occupational handlers involved in food, feed, fiber, ornamental, turf, rights-of-way and other noncrop treatments, and

- Homeowner handlers making applications to residential turf.

No handler exposure studies were conducted by the Registrant for pendimethalin.

HED has determined that there is potential exposure to mixers, loaders, applicators, and other handlers during usual use-patterns associated with pendimethalin. Based on the use patterns and potential exposures described above, thirteen major exposure scenarios were identified for pendimethalin: (1a) mixing/loading water-dispersible granulars (dry flowables) for rights-of-way sprayers; (1b) mixing/loading water-dispersible granulars (dry flowables) for groundboom applications; (2) mixing/loading wettable powders (water soluble packets) for groundboom application (**Note:** all currently registered wettable powder end-use products are packaged in water soluble packets); (3) loading granulars for solid-broadcast applications; (4a) mixing/loading liquid for aerial applications and irrigation systems (the mixer/loader scenario for aerial and irrigation applications were combined since they use the same mixing/loading techniques and similar acres treated and application rates); (4b) mixing/loading liquid formulations for rights-of-way spraying; (4c) mixing/loading liquid formulations for groundboom applications or to impregnate dry bulk fertilizer. (**Note:** impregnating dry bulk fertilizer is included in this scenario since the daily amount of liquid formulation handled would be approximately the same as the amount handled to support groundboom applications); (5) applying as a spray with aerial (fixed wing) equipment; (6) applying as a spray with rights-of-way equipment; (7) applying as a spray with groundboom equipment; (8) applying granulars with a tractor-drawn broadcast spreader; (9) flagging during aerial spray application; (10) mixing/loading/applying as a spray with backpack sprayer; (11) mixing/loading/applying with a low-pressure handwand sprayer; (12) mixing/loading/applying with a push-type granular broadcast spreader; and (13) mixing/loading/applying using a high-volume turf sprayer (similar to those used for turfgrass applications by commercial handlers).

21

Daily dermal exposure is calculated using the following formula:

Daily Exposure (mg ai/day) =

Unit Exposure (mg ai/lb ai) x Use Rate (lb ai/A) x Daily Area Treated (A/day)

The dermal absorption value (10%) was applied to the Daily Dermal Exposure to find the Daily Dermal Dose.

Absorbed Daily Dermal Dose is calculated using the following formula:

Absorbed Daily Dermal Dose (mg ai/kg bw/day) =

Unit Exposure (mg ai/lb ai) x Use (lb ai/A) x Daily Acres Treated (A/day) / Body Wt (kg) x 0.10 (dermal absorption rate)

The following assumptions were made regarding the area treated:

For aerial applications: 800 acres per day (upper-end estimate for field corn, soybeans, and grain sorghum);

For groundboom applications: 80 acres per day;

For rights-of-way applications: 10 acres per day;

For spot treatments using backpack and low-pressure handwand sprayers: 1,000 square feet per day by homeowner applicators and one acre per day by commercial applicators; and

For residential turf applications: one acre per day by homeowner applicators using a broadcast spreader and eight acres per day by commercial applicators using high-volume turf sprayers.

Other assumptions regarding worker exposure include the following:

- Commercial handlers would be expected to have short- and intermediate-term exposures whereas homeowner handlers would be expected to have only short-term exposures. However, since the toxicological endpoint is the same for short-term and intermediate-term exposures, the exposures and risks are represented in the same tables.

- Aerial applicators are in enclosed cockpits (there are no data available for the open cockpit scenario).

- Wettable powder formulations are contained in water-soluble packaging (all currently registered wettable powder products are in water soluble packaging).

Table 4. Exposure Scenario Descriptions for Uses of Pendimethalin

Exposure Scenario (Number)	Data Source	Standard Assumptions[a] (8-hr work day)	Comments[b]
Mixer/Loader Exposure			
Mixing Water Dispersible Granulars (Dry Flowables) (1a and 1b)	PHED V1.1	80 acres groundboom, and 10 acres rights-of-way	**Baseline:** "Best Available" grades: Hands grades A,B,C, dermal acceptable grades. Hands = 7 replicates; Dermal = 16 to 26 replicates. **Low confidence in dermal data.** PHED data used for baseline, no protection factors (PFs) were necessary.
Mixing Wettable Powders (Water Soluble Packets) (2)	PHED V1.1	80 acres groundboom	**Baseline:** "Best Available" grades: Hands, dermal all grades. Hands = 5 replicates; Dermal = 6 to 15 replicates. **Low confidence in dermal data.** PHED data used for baseline, no PFs were necessary.
Loading Granulars (3)	PHED V1.1	80 acres solid broadcast	**Baseline:** "Best Available" grades: Hands all grades and dermal and inhalation acceptable grades. Hands = 10 replicates; Dermal = 29 to 36 replicates; Inhalation = 58 replicates. **Low confidence in dermal data and high confidence for inhalation data.** PHED data used for baseline, no PFs were necessary.
Mixing Liquid (E.C.) (4a, b, and c)	PHED V1.1	80 acres groundboom, 800 acres aerial, and 10 acres rights-of-way	**Baseline:** "Best Available" grades: Hands, dermal acceptable grades. Hands = 53 replicates; Dermal = 25 to 122 replicates. **High confidence in dermal data.** PPE: "Best Available" grades: Hands and dermal acceptable grades. Hands = 59 replicates; Dermal = 25 to 122 replicates. **High confidence in dermal data.** PHED data used for baseline and PPE, no PFs were necessary.
Applicator Exposure			
Aerial equipment--enclosed cockpit (liquids) (5)	PHED V1.1	800 acres for fixed-wing	**Baseline:** "Best Available" grades: Hands acceptable grades, dermal grades A,B,C. Hands = 34 replicates; Dermal = 24 to 48 replicates. **Medium confidence in dermal data.** PHED data used for baseline, no PFs were necessary.
Rights-of-Way (6)	PHED V1.1	10 acres	**Baseline:** "Best Available" grades: Hands, dermal, acceptable grades. Hands = 16 replicates; Dermal = 16 (no head data) replicates. **Low (only because of no head data) confidence in dermal data.** PHED data used for baseline, no PFs were necessary.
Groundboom (7)	PHED V1.1	80 acres	**Baseline:** "Best Available" grades: Hands, dermal acceptable grades. Hands = 29 replicates; Dermal = 32 to 42 replicates. **High confidence in dermal data.** PHED data used for baseline, no PFs were necessary.
Solid Broadcast Spreader (tractor drawn) (8)	PHED V1.1	80 acres	**Baseline:** "Best Available" grades: Hands, dermal, and inhalation acceptable grades. Hands = 5 replicates; Dermal = 4 to 5 replicates; Inhalation = 5 replicates. **Low confidence in dermal and inhalation data.** PHED data used for baseline, no PFs were necessary.
Flagger			

Exposure Scenario (Number)	Data Source	Standard Assumptions[a] (8-hr work day)	Comments[b]
Liquids (9)	PHED V1.1	800 acres	**Baseline:** "Best Available" grades: Hands, dermal acceptable grades. Hands = 16 replicates; Dermal = 16 to 18 replicates. **High confidence in dermal data.** PHED data used for baseline, no PFs were necessary.
Mixer/Loader Applicator			
Backpack Sprayer (spot treatment) (10)	PHED V1.1	Homeowner: 1,000ft^2; Occupational: 1 acre	**Baseline:** "Best Available" grades: Hands and dermal grades A,B,C. Hands = 11 replicates; Dermal = 9 to 11 replicates. **Low confidence in dermal data.** PHED data used for baseline was derived from single layer clothing and chemical resistant gloves; a 90% PF was used to remove the chemical resistant gloves to simulate a no glove scenario.
Low Pressure Handwand (11)	PHED V1.1	Homeowner: 1,000ft^2; Occupational: 1 acre	**Baseline:** "Best Available" grades: Hands, dermal all grades. Hands = 70 replicates; Dermal = 25 to 96 replicates. **Low confidence in both dermal data.** **PPE:** "Best Available" grades: Hands acceptable grades, dermal all grades. Hands = 15 replicates; Dermal = 25 to 96 replicates. **Low confidence in dermal data.** PHED data used for baseline and PPE values, no PFs were necessary.
Residential Broadcast Spreader (12)	PHED V1.1	1 acre	**Baseline:** "Best Available" grades: Hands and dermal grades A,B,C. Hands = 15 replicates; Dermal = 15 (no head data) replicates. **Low (no head data) confidence in dermal data.** PHED data used for baseline, no PF were necessary.
High Volume Turf Sprayer (13)	PHED V1.1	8 acres	**Baseline:** "Best Available" grades: Hands and dermal all grades. Hands = 14 replicates; Dermal = 14 (no head data) replicates. **Low confidence in dermal data.** PHED data used for baseline was derived from single layer clothing and chemical resistant gloves; a 90% PF was used to remove the chemical resistant gloves to simulate a no glove scenario.

a Standard Assumptions based on an 8-hour work day as estimated by HED. BEAD data were not available.

b "Best Available" grades are defined by HED SOP for meeting Subdivision U Guidelines. Best available grades are assigned as follows: matrices with grades A and B data and a minimum of 15 replicates; if not available, then grades A, B, and C data and a minimum of 15 replicates; if not available, then all data regardless of the quality and number of replicates. Data confidence are assigned as follows:

High = grades A and B and 15 or more replicates per body part
Medium = grades A, B, and C and 15 or more replicates per body part
Low = grades A, B, C, D, and E or any combination of grades with less than 15 replicates

Postapplication Exposures and Assumptions

HED has determined that there is potential exposure to persons entering treated sites after application is complete. Post-application exposures may occur to:

- Agricultural workers following applications to commercial or research food, feed, fiber, ornamental, forestry, and turf crops during routine crop-production tasks, such as planting, transplanting, incorporation, cultivation, hoeing, scouting, thinning, and harvesting;

- Mowers and other golf-course maintenance workers following applications to turfgrass on golf courses;

- Landscape and grounds maintenance workers following applications to commercial landscape plantings;

- Workers following applications in rights-of-way and other noncrop areas; and

- Persons, including children, following applications to residential turf or ornamental plantings.

No chemical-specific postapplication studies have been conducted by the Registrant for pendimethalin. In lieu of such studies, EPA has used a registrant-submitted published study as surrogate data. This study (Hurto and Prinster, 1992) compared foliar dislodgeable residues (FDRs) for five different chemicals. The study does not meet guideline requirements, but is the best available source of data with which to evaluate post-application exposure and risk. Based on the FDR data from the study, EPA has developed reasonable worst-case estimates to assess the post-application exposure and risk for three representative post-application scenarios: (1) toddler exposure to residential turf, (2) maintenance worker exposure to golf course turf, and (3) harvesting turfgrass from a sod farm. These post-application exposure and risk assessments follow.

EPA has determined that the following post-application exposure and risk scenarios, based on the surrogate FDR data, are representative worst-case exposure and risk assessments for other pendimethalin post-application scenarios:

- post-application exposure to workers harvesting turfgrass from sod farms is representative of worst-case post-application exposures to other agricultural workers following pendimethalin applications to commercial or research food, feed, fiber, ornamental, forestry, and turf crops.

- post-application exposure to golf-course maintenance workers is representative of worst-case post-application exposures to landscape and grounds maintenance workers in commercial landscape plantings and in rights-of way and other non-crop areas.

- post-application exposures to toddlers on residential turf is representative of worst-case post-application exposures to other persons following pendimethalin applications on turf at residential sites and at parks and recreation areas.

Surrogate Postapplication Data and Derived REIs

RESIDENTIAL TURF

Table 5 presents the MOEs for residential turf ranging from the day of application (two hours after treatment) to three days after application when the MOE exceeded 100 for the maximum application rate. The transfer coefficient (Tc) was estimated by OREB based on the reasonable worst-case activity of toddlers (3-6 yrs, 17 kg--Exposure Factors Handbook, U.S. EPA, 1990) playing on turf 4 hours per day. The surrogate pendimethalin FDR data from Hurto and Prinster 1992 were chosen by EPA as the best available surrogate data for residential turf. The surrogate FDR data in the published study are assumed to represent an application rate of 1.0 lb ai/A. The minimum and maximum rates for the residential turf are 1.0 and 3.0 lb ai/A respectively (EPA Reg. No. 241-340). An adjustment (i.e., normalization to the maximum application rate of 3.0 lb ai/A) was made to the surrogate FDR data in these REI calculations.

27

Table 5: Restricted-Entry Intervals for Residential Turf[a]

Crops	DAT	FDR ($\mu g/cm^2$)[b]		Daily Absorbed Dose (mg/kg/day)[c]		MOE[d]	
		Min	Max	Min	Max	Min	Max
Residential Turf	2-hrs	0.4	1.2	0.09	0.28	111	36
	1	0.28	0.84	NA	0.20	NA	50
	2	0.24	0.72	NA	0.17	NA	59
	3	0.12	0.36	NA	0.08	NA	125

NA Previous MOE exceeded 100.

[a] Tc of 10,000 (cm^2/hr) is based on OREB's best estimate.

[b] Published pendimethalin-specific FDR data (monitored at 1.0 lb ai/acre) for turf where 2 HAT and 1, 2, 3 DAT the FDR values are 0.4, 0.28, 0.24, and 0.12 $\mu g/cm^2$, respectively (Hurto and Prinster 1992).

[c] Daily Absorbed Dose (mg/kg/day) = [[((normalized FDR ($\mu g/cm^2$) * T_c(cm^2/hr))/1,000 unit conv.) * 4 hrs/day]/17 kg] * 0.1 (dermal absorption).

[d] MOE = NOEL (10 mg/kg/day)/Daily Absorbed Dose (mg/kg/day).

GOLF COURSE TURF

Table 6 presents the MOEs for golf course workers at the day of application (2-hrs after treatment). The transfer coefficient (Tc) was estimated by OREB based on the reasonable worse-case tasks of routine golf-course turf maintenance. The surrogate pendimethalin FDR data from Hurto and Prinster 1992 were chosen by EPA as the best available surrogate data for the golf course turf. The surrogate FDR data in the published study are assumed to represent an application rate of 1.0 lb ai/A. The maximum rate for the golf course turf (EPA Reg. No. 241-340) is 3.0 lb ai/A. An adjustment (i.e., normalization to the 3.0 lb ai/A application rate) was made to the surrogate FDR data in these REI calculations.

28

Table 6: Restricted-Entry Intervals for Golf Course Turf[a]

Crops	DAT	FDR ($\mu g/cm^2$)[b]	Daily Absorbed Dose (mg/kg/day)[c]	MOE[d]
Golf Course (Turf)	2-hrs	1.2	0.007	1,429

[a] Tc of 500 (cm^2/hr) is based on OREB's best estimate.

[b] Published pendimethalin-specific FDR data (monitored at 1.0 lb ai/acre) for turf where 2 HAT the FDR value is 0.4 $\mu g/cm^2$. (Hurto and Prinster 1992).

[c] Daily Absorbed Dose (mg/kg/day) = [[(((normalized FDR ($\mu g/cm^2$) * T_c(cm^2/hr))/1,000 unit conv.) * 8 hrs/day]/70 kg] * 0.1 (dermal absorption).

[d] MOE = NOEL (10 mg/kg/day)/Daily Absorbed Dose (mg/kg/day).

SOD FARM TURF:

Table 7 presents the MOEs for sod farm workers ranging from the day of application (two hours after treatment) to three days after application when the MOE exceeded 100. The transfer coefficient (Tc) was estimated by OREB based on the reasonable worse-case tasks of harvesting sod. The surrogate pendimethalin FDR data from Hurto and Prinster 1992 were chosen by EPA as the best available surrogate data for the sod farm turf. The surrogate FDR data in the published study are assumed to represent an application rate of 1.0 lb ai/A. The maximum rate for the sod farm turf is 3.0 lb ai/A (EPA Reg. No. 241-340). An adjustment (i.e., normalization to the 3.0 lb ai/A application rate) was made to the surrogate FDR data in these REI calculations.

EPA notes that the maximum application rate for certain ornamental-crop uses (EPA Reg. No. 241-340) is 3.96 lb ai/A. However, the post-application exposures to workers harvesting or transplanting ornamentals are likely to be lower than the estimated post-application exposures to workers harvesting turf from sod farms. In the absence of chemical-specific data, EPA estimates that harvesting sod represents the reasonable worse-case estimate for post-application exposures to ornamental crops, as well as other food, feed, fiber, and turf crops.

Table 7: Restricted-Entry Intervals for Sod Farm Turf[a]

Crops	DAT	FDR ($\mu g/cm^2$)[b]	Daily Absorbed Dose (mg/kg/day)[c]	MOE[d]
Sod Farm (Turf)	2-hrs	1.2	0.14	71
	1	0.84	0.096	104

[a] Tc of 10,000 (cm^2/hr) is based on OREB's best estimate.

[b] Published pendimethalin-specific FDR data (monitored at 1.0 lb ai/acre) for turf where 2 HAT and 1 DAT the FDR values are 0.4 and 0.28 $\mu g/cm^2$, respectively. (Hurto and Prinster 1992).

[c] Daily Absorbed Dose (mg/kg/day) = [[(((normalized FDR ($\mu g/cm^2$) * T_c(cm^2/hr))/1,000 unit conv.) * 8 hrs/day]/70 kg] * 0.1 (dermal absorption).

[d] MOE = NOEL (10 mg/kg/day)/Daily Absorbed Dose (mg/kg/day).

3. Risk Characterization

a. Dietary Risk

Food uses evaluated in the Dietary Risk Evaluation System (DRES) analysis were the published uses of pendimethalin listed in 40 CFR § 180.361 and the Tolerance Index System (TIS). The analysis used tolerance level residues for commodities with registered pendimethalin tolerances.

Reassessed Tolerances:

In the Product and Residue Chemistry Chapter of the Reregistration Eligibility Document (B. Cropp-Kohlligian, 12/12/95), HED recommended that tolerances for residues of pendimethalin on rice be increased from 0.05 ppm to 0.1 ppm due to the analytical method's limit of quantification for the combined residues of pendimethalin and its 3,5-dinitrobenzyl alcohol metabolite. In the same memo, HED recommended that the tolerance for onions (dry bulb) be applied to shallots (dry bulb only).

In the DRES analysis, both rice and dry bulb shallots were included at these recommended tolerance levels. See Table 1 within Attachment 3, Dietary Risk Assessment, for all the commodities and tolerances included in this analysis.

Results

In order to estimate a worst case chronic dietary risk from uses being supported in reregistration, tolerance level residues were used in the analysis to calculate a Theoretical Maximum Residue Contribution (TMRC). These exposure estimates were then compared to the RfD for pendimethalin for chronic dietary risk. See Tables 2 and 3 within Attachment 3, Dietary Risk Assessment, for a summary of the TMRCs and percentages of the RfD.

Chronic Exposure from Pendimethalin for Reregistration

The Theoretical Maximum Residue Contribution (TMRC) for the overall U.S. population from all currently published tolerances are listed below. See also Table 3 within Attachment 3, Dietary Risk Assessment.

Subgroup	Exposure(mg/kg/day)	% Reference Dose
U.S. population	0.000418	0.42
Non-Nursing Infants	0.001393	1.39

The DRES analysis for the published uses and reassessed tolerances of pendimethalin indicate that the overall U.S. population would receive 0.42 percent of the RfD and the highest subgroup, non-nursing infants, would receive 1.39 percent of the RfD. Therefore, the chronic dietary risk posed from pendimethalin is not of concern for the reregistration scenario.

b. Occupational and Residential Risk

Tables 8 and 9 below show the estimated exposure and risks for individuals handling pendimethalin in both residential and occupational settings. Estimated unit dermal exposure values (mg/kg/lb ai) for each task were obtained from the Pesticide Handler's Exposure Database (PHED), Version 1.1. The unit exposure value was used to find the absorbed daily dose and a corresponding margin of exposure (MOE) for each use, based on the short- and intermediate-term (10 mg/kg/day) endpoint of concern (equations used to find daily exposures are presented in the previous section on occupational and residential exposure assessment). Risks are presented in terms of the Margin of Exposure (MOE), described below. The Toxicology Endpoint Selection Document for pendimethalin (dated July 25, 1996) specified that NO risk assessment was required for inhalation exposure unless the inhalation exposure represents more than five percent of the dermal exposure. In these cases the inhalation exposures, adjusted by a 50 percent absorption factor, were added to the absorbed dermal dose and footnoted. The inhalation exposure was greater then five percent of the dermal exposure for only two scenarios -- Scenarios 3 and 8.

MOEs from short- and intermediate-term exposures were calculated using the following formula:

MOE = NOEL / Absorbed Daily Dermal Dose

For pendimethalin, an MOE value of at least 100 is considered adequate.

le 8. Short-' nd Intermediate-Term Exposure of Pendimethalin

Exposure Scenario (Scen. #)	Baseline Dermal Unit Exposure[a] (mg/lb ai)	Application Rate[b] (lb ai/acre)	Daily Acres Treated[c]	Daily Dermal Exposure[d] (mg/day)
Mixer/Loader Exposure				
Mixing/Loading Water Dispersible Granulars (Dry Flowables) for Rights-of-Way Spraying (1a)	0.07	3.96	10	2.8
Mixing/Loading Water Dispersible Granulars (Dry Flowables) for Groundboom Applications (1b)		3.96	80	22.2
Mixing/Loading Wettable Powders (water soluble packets) for Groundboom Applications and for Impregnating Dry Bulk Fertilizer (2)	0.02 (Wtr. sol. pk.)	3.0	80	4.8
Loading Granulars for Solid Broadcast Applications (3)	0.008	3.0	80	1.9
Mixing/Loading Liquid for Aerial Applications and Irrigation Systems (4a)	2.9	1.98	800	4,594
Mixing/Loading Liquid for Rights-of-Way Spraying (4b)		4.0	10	116
Mixing/Loading Liquid for Groundboom Applications (4c)		1.98	80	459
Applicator Exposure				
Aerial-Fixed Wing - enclosed cockpit (liquid) (5)	0.005	1.98	800	7.9
Rights-of-Way (6)	1.2	4.0	10	48
Groundboom Tractor (7)	0.015	3.96	80	4.8
Solid Broadcast Spreader (tractor drawn) (8)	0.01	3.0	80	2.4
Flagger				
Flagging (liquid) (9)	0.01	1.98	800	15.8
Mixer/Loader/Applicator				
Backpack (spot treatment) (10)	2.6	3.96	(H) 1,000ft^2 (O) 1.0	(H) 0.24 (O) 10.3
Low Pressure Handwand (spot treatment) (11)	103.8	3.96	(H) 1,000ft^2 (O) 1.0	(H) 9.4 (O) 411
Residential Broadcast Spreader (12)	2.9	3.0	1.0	8.7
High Volume Turf Sprayer (13)	0.77	3.0	8	18.5

Baseline dermal unit exposures represent long pants, long sleeve shirts, no gloves, open mixing/loading, enclosed cockpit (open cockpit data are not available), and open cab tractor.
Application rates were derived from the following labels (EPA Reg. Nos.): E.C. 241-337 and 241-305, Granular 538-188, WDG 10404-52, 241-340, and 241-268 (CA only), WP 538-195 (water soluble packets only).
Values represent the area [(H) = homeowner, (O) = occupational] which can be used in a single day to complete treatments for each exposure scenario of concern.
Daily dermal exposure (mg/day) = Exposure (mg/lb ai) * Max. Appl. Rate (lb ai/acre) * Max. Treated (acres).

le 9: Short-Term and Intermediate-Term Risk of Pendimethalin

Exposure Scenario (Scen. #)	Baseline Daily Dermal Dose (mg/kg/day)[a]	Baseline Daily Absorbed Dermal Dose (mg/kg/day)[b]	Baseline Dermal MOE[c]	Risk Mitigation Measure				
				Additional PPE[d]				
				Dermal Unit Exposure (mg/lb ai)	Daily Dermal Exposure (mg/day)	Daily Dermal Dose (mg/kg/day)	Daily Dermal Absorbed Dose (mg/kg/day)[b]	Dermal MOE[c]
Mixer/Loader Risk								
Mixing/Loading Water Dispersible Granulars (Dry Flowables) for Rights-of-Way Spraying (1a)	0.040	0.004	2,500	NA	NA	NA	NA	NA
Mixing/Loading Water Dispersible Granulars (Dry Flowables) for Groundboom Application (1b)	0.32	0.032	313		NA	NA	NA	NA
Mixing/Loading Wettable Powders (Water Soluble Packets) for Groundboom Applications and for Impregnating Dry Bulk Fertilizer (2)	0.069	0.007	1,429		NA	NA	NA	NA
Loading Granulars for Solid Broadcast Applications (3)	0.033 (e)	0.006 (f)	1,667 (g)		NA	NA	NA	NA
Mixing/Loading Liquid for Aerial Applications and Irrigation Systems (4a)	65.6	6.56	1.5	0.04	63.4	0.91	0.091	110
Mixing/Loading Liquid for Rights-of-Way Spraying (4b)	1.7	0.17	59		1.6	0.023	0.0003	33333
Mixing/Loading Liquid for Groundboom Applications (4c)	6.6	0.66	15		6.3	0.09	0.009	1,111
Applicator Risk								
Aerial-Fixed Wing - enclosed cockpit (liquid) (5)	0.11	0.011	909	NA	NA	NA	NA	NA
Rights-of-Way (6)	0.69	0.069	145	NA	NA	NA	NA	NA
Groundboom Tractor (7)	0.069	0.007	1,429	NA	NA	NA	NA	NA
Solid Broadcast Spreader (tractor drawn) (8)	0.038 (e)	0.005 (f)	2,000 (g)	NA	NA	NA	NA	NA
Flagger Risk								
Flagging (liquid) (9)	0.23	0.023	435	NA	NA	NA	NA	NA

Exposure Scenario (Scen. #)	Baseline Daily Dermal Dose (mg/kg/day)[a]	Baseline Daily Absorbed Dermal Dose (mg/kg/day)[b]	Baseline Dermal MOE[c]	Risk Mitigation Measure				
				Additional PPE[d]				
				Dermal Unit Exposure (mg/lb ai)	Daily Dermal Exposure (mg/day)	Daily Dermal Dose (mg/kg/day)	Daily Dermal Absorbed Dose (mg/kg/day)[b]	Dermal MOE[c]
Mixer/Loader/Applicator								
Backpack Sprayer (10)	(H) 0.003 (O) 0.15	(H) 0.0003 (O) 0.015	(H) 33,333 (O) 667	NA	NA	NA	NA	NA
Low Pressure Handwand (11)	(H) 0.13 (O) 5.9	(H) 0.013 (O) 0.59	(H) 769 (O) 17	(O) 4.1	(O) 16.2	(O) 0.23	(O) 0.023	(O) 435
Residential Broadcast Spreader (12)	0.12	0.012	833	NA	NA	NA	NA	NA
High Volume Turf Sprayer (13)	0.26	0.026	385	NA	NA	NA	NA	NA

Not applicable since previous MOE was over 100.
Daily dermal dose = daily dermal exposure/70 kg.
Absorbed dermal dose = daily dermal dose * dermal absorption rate (10.0 percent).
Short-term and intermediate-term dermal MOE = NOEL (10.0 mg/kg/day) / daily absorbed dermal dose.
Additional PPE = for Scenario 4a, b, c = Single layer of clothing and chemical resistant gloves.
for Scenario 11 = Single layer of clothing and chemical resistant gloves.
The baseline inhalation exposure represents greater than 5 percent of the baseline dermal exposure, therefore, the inhalation dose is included as part of the dermal dose. The unit inhalation exposure values for scenarios 3 and 8 are 1.7 µg/lb ai and 1.2 µg/lb ai, respectively.
The daily absorbed dose (mg/kg/day) for scenarios 3 and 8 are calculated as follows: [daily dermal dose (mg/kg/day) * 10 percent dermal absorption] + [inhalation dose (mg/kg/day) * 50 percent inhalation absorption].
Total MOE for scenarios 3 and 8 include both the dermal and inhalation routes of exposure because the inhalation exposure represents greater than 5 percent of the dermal exposure.

Handler Risk Summary

Exposure and risk for the short- and intermediate-term uses of pendimethalin are summarized in Tables 8 and 9. Short- and intermediate-term risk was calculated using the 10 mg/kg/day endpoint. Exposure estimates are based on the best available exposure data derived from the Pesticide Handlers Exposure Database (PHED V1.1), which varied in quality from high confidence data to low confidence data (see Table 4 for a description of the confidence level associated with exposure data).

Short- and Intermediate-term Risk

The calculations indicate that the MOEs for short- and intermediate-term exposures for handlers wearing baseline attire (long-sleeve shirt, long pants, shoes, and socks) are over 100 for all but the following use scenarios: (4a, b, c) mixing/loading liquid formulations for aerial application and irrigation systems (baseline MOE is 1.5), mixing/loading liquids for rights-of-way application (baseline MOE is 59), mixing/loading liquids for groundboom application (baseline MOE is 15), and occupational mixing, loading, and applying using low-pressure handwand equipment (spot treatment) (baseline MOE is 17). The risks to these handlers in these scenarios are reduced to an adequate level (MOEs are all above 100) when handlers wear chemical-resistant gloves in addition to baseline attire.

Risk From Postapplication Exposures

Exposures following applications to commercial or research food, feed, fiber, turf, and ornamental crops may be mitigated by restricted-entry intervals (REIs). REIs allow sufficient time to pass for residues to dissipate to levels that result in adequate MOEs for entering workers who contact treated surfaces. However, restricted-entry intervals are generally not feasible as a mitigation measure for post-application residential exposures and occupational exposures in noncrop areas (such as rights-of-ways), or in turf- and ornamental-plant settings such as parks and landscape plantings.

Post Application Risk Summary

There are no pendimethalin-specific post-application exposure data available at this time. These chemical-specific data are necessary for HED to establish permanent restricted-entry intervals since a short- and intermediate-term endpoint of concern has been identified. In lieu of chemical-specific exposure studies, EPA has used published data from a non-guideline study which was submitted by the registrant as surrogate data, and reasonable worst-case estimates to assess the post-application exposure and risk in three key post-application scenarios, which represent worst case risks for all other crops and uses. The post-application risk assessment indicates that:

- MOEs are greater than 100 on the day following applications of pendimethalin on sod farm turfgrass. This scenario represents the reasonable worse-case post-application risks for commercial and research food, feed, fiber, ornamental, forestry, and other turf crop uses.

- MOEs are greater than 100 at two hours following applications of pendimethalin on golf courses. This scenario represents the reasonable worse-case post-application risks for uses on golf courses, commercial landscape plantings, rights-of-way, and other non-crop areas.

- MOEs are greater than 100 (1) at two hours following applications of pendimethalin at the one pound per acre rate at residential sites and (2) on the third day following applications of pendimethalin at the three pound per acre rate at residential sites. These scenarios represent the reasonable worse-case post-application risks for turf uses at residential sites and in parks and recreation areas.

The Agency HED has concluded that the following characteristics of other pendimethalin uses indicate an **increased level of concern** for post-application exposures in certain settings.

Most applications to ornamentals and turf are to established plants and are often broadcast over the entire ornamental and turf foliage, thus increasing potential exposure risk from foliar contact with such treated foliage;

Workers entering turf and ornamental production (commercial or research) areas following pendimethalin applications may perform hand-labor tasks such as transplanting, harvesting, weeding, or pruning. For these crops, the timing of applications make hand labor activities likely following pendimethalin applications.

Persons, including children, may be exposed to treated turfgrass (lawns) at residential sites frequently and for relatively long periods of time.

4. HED Recommendations for Risk Mitigation/Reduction

a. Tolerance Reassessment Summary

Tolerances for pendimethalin residues are currently expressed in terms of the combined residues of pendimethalin and its metabolite 4-[(1-ethylpropyl)amino]-2-methyl-3,5-dinitrobenzyl alcohol [§180.361(a and c)] and, for peanut hulls only, in terms of the parent and aforementioned metabolite plus the metabolite 3-[(1-ethylpropyl)amino]-6-methyl-2,4-dinitrobenzyl alcohol [40 CFR §180.361(b)].

A summary of the pendimethalin tolerance reassessment and recommended modifications in commodity definitions are presented in Table 10.

Tolerances Listed Under 40 CFR §180.361(a)

Adequate data are available to reassess the established tolerances for pendimethalin residues in/on beans; bean forage; bean fodder; corn fodder; corn forage; corn grain; sweet corn; cottonseed; onions (dry bulb); peanuts; peanut hay; potatoes; sorghum fodder; sorghum forage; grain sorghum; soybeans; soybean forage; soybean hay; sugarcane; and sunflower seeds. [Note: Some commodity definitions must be corrected. See Table 6 for details.]

The tolerance for pendimethalin residues in/on peanut forage should be revoked since peanut forage is no longer considered to be a significant feed item according to the Livestock Feeds Table (Table II (September 1995)).

Available rice field trial data are deemed adequate to support the reregistration of pendimethalin for use on rice. The currently established tolerance on rice grain should be increased from 0.05 ppm to 0.1 ppm. A processing study on rice grain is outstanding.

Tolerances Needed Under 40 CFR §180.361(a)

Available rice field trial data are deemed adequate to support the reregistration of pendimethalin for use on rice. A tolerance for pendimethalin residues of concern in/on rice straw must be established. Available data indicate that a tolerance of 0.1 ppm would be appropriate.

As a result of changes in the Livestock Feeds Table (Table II (September 1995)), the Agency currently considers cotton gin byproducts a raw agricultural commodity (RAC). Data depicting pendimethalin residues of concern in/on cotton gin byproducts resulting from the maximum registered use of pendimethalin to cotton are hereby required. On receipt of the required cotton gin byproducts data, the need for tolerances for pendimethalin residues of concern will be determined.

Tolerances Listed Under 40 CFR §180.361(b)

The tolerance for residues in/on peanut hulls should be revoked since peanut hulls is no longer considered a significant feed item according to the Livestock Feeds Table (Table II (September 1995)).

Tolerances Listed Under 40 CFR §180.361(c)

HED concludes that available garlic magnitude of the residue data from field trials conducted in CA and OR are adequate to support a national registration for the use of pendimethalin on garlic and recommends that the currently established tolerance with regional registrations for pendimethalin residue of concern in/on garlic should be changed to a tolerance without regional registrations at the same level (0.1 ppm) and listed under 40 CFR §180.361(a).

Table 10. Tolerance Reassessment Summary for Pendimethalin.

Commodity	Current Tolerance (ppm)	Tolerance Reassessment (ppm)	Comment/*Correct Commodity Definition*
Tolerances listed under 40 CFR §180.361(a):			
Beans, lima (dry,snap)	0.1	0.1	*Beans, succulent and dry*
Beans, forage	0.1	0.1	
Beans, hay	0.1	0.1	
Corn, fodder	0.1	0.1	*Corn, stover*
Corn, forage	0.1	0.1	
Corn, grain	0.1	0.1	*Corn, field* and *Corn, pop*
Corn, fresh (including sweet, K+CWHR)	0.1	0.1	*Corn, sweet (K+CWHR)*
Cottonseed	0.1	0.1	*Cotton, undelinted seed*
Onions, dry bulb	0.1	0.1	
Peanuts	0.1	0.1	
Peanut, hay	0.1	0.1	
Peanut, forage	0.1	Revoke	No longer listed in Livestock Feeds Table (Table II (September 1995)) as a significant feed item
Potatoes	0.1	0.1	
Rice, grain	0.05	0.1	The tolerance level must be increased to the analytical method's limit of quantitation (LOQ) for the combined residues of pendimethalin and its 3,5-dinitrobenzyl alcohol metabolite
Sorghum, fodder	0.1	0.1	*Sorghum, stover*
Sorghum, forage	0.1	0.1	
Sorghum, grain	0.1	0.1	
Soybeans	0.1	0.1	
Soybeans, forage	0.1	0.1	
Soybeans, hay	0.1	0.1	
Sugarcane	0.1	0.1	
Sunflower, seeds	0.1	0.1	

Commodity	Current Tolerance (ppm)	Tolerance Reassessment (ppm)	Comment/*Correct Commodity Definition*
Tolerances needed under 40 CFR §180.361(a):			
Cotton, gin byproducts	None	TBD*	Residue data are required.
Rice, straw	None	0.1	
Tolerances listed under 40 CFR §180.361(b):			
Peanut, hulls	0.25	Revoke	No longer listed in Livestock Feeds Table (Table II (September 1995)) as a significant feed item
Tolerances listed under 40 CFR §180.361(c):			
Garlic	0.1	0.1	HED hereby recommends that this tolerance should be listed under 40 CFR §180.361(a)

* TBD = To be determined. Reassessment of tolerance(s) cannot be made at this time because residue data are required.

b. CODEX Harmonization

There are no established or proposed Codex MRLs for pendimethalin residues. Therefore, there are no questions of compatibility with respect to Codex MRLs and U.S. tolerances.

c. Occupational/Residential Labeling Rationale

HED is recommending measures to mitigate risk for both handler and post-application exposure scenarios. See Section IV for rationale, and Section V for recommended labeling language.

NOTE TO SRRD: HED completed the following sections based on recommended risk-reductions measures.

The Worker Protection Standard (WPS)

Scope of the WPS

40

The 1992 Worker Protection Standard for Agricultural Pesticides (WPS) established certain worker-protection requirements (personal protective equipment, restricted-entry intervals, etc.) to be specified on the label of all products that contain uses within the scope of the WPS. Uses within the scope of the WPS include all commercial (non-homeowner) and research uses on farms, forests, nurseries, and greenhouses to produce agricultural plants (including food, feed, and fiber plants, trees, turf grass, flowers, shrubs, ornamentals, and seedlings). Uses within scope include not only uses on plants, but also uses on the soil or planting medium in which the plants are (or will be) grown.

At this time some of the registered uses of pendimethalin are within the scope of the Worker Protection Standard for Agricultural Pesticides (WPS). Uses that are outside the scope of the WPS include use:

- on plants that are in ornamental gardens, parks, golf courses, and public or private lawns and grounds and that are intended only for decorative or environmental benefit. (However, pesticides used on sod farms ARE covered by the WPS).
- in a manner not directly related to the production of agricultural plants, including, for example, control of vegetation along rights-of-way and in other noncrop areas.

Personal Protective Equipment/Engineering Controls for Handlers

For each end-use product, PPE requirements for pesticide handlers are set during reregistration in one of two ways:

1. If EPA determines that no regulatory action must be taken as the result of the acute effects or other adverse effects of an active ingredient, the PPE for pesticide handlers will be based on the acute toxicity of the end-use product. For occupational-use products, PPE must be established using the process described in PR Notice 93-7 or more recent EPA guidelines.

2. If EPA determines that regulatory action on an active ingredient must be taken as the result of very high acute toxicity or to certain other adverse effects, such as allergic effects or delayed effects (cancer, developmental toxicity, reproductive effects, etc.):

- *In the RED for that active ingredient, EPA may establish minimum or "baseline" handler PPE requirements that pertain to all or most end-use products containing that active ingredient.*
- *These minimum PPE requirements must be compared with the PPE that would be designated on the basis of the acute toxicity of the end-use product.*
- *The more stringent choice for each type of PPE (i.e., bodywear, hand protection, footwear, eyewear, etc.) must be placed on the label of the end-use product.*

Personal protective equipment requirements usually are set by specifying one or more pre-established PPE units -- sets of items that are almost always required together. For example, if chemical-resistant gloves are required, then long-sleeve shirts, long pants, socks, and shoes are assumed and are also included in the required minimum attire. If the requirement is for two layers of body protection (coveralls over a long- or short-sleeve shirt and long or short pants), the minimum must also include (for all handlers) chemical-resistant footwear and chemical-resistant headgear for overhead exposures and (for mixers, loaders, and persons cleaning equipment) chemical-resistant aprons.

Occupational-Use Products

HED has determined that regulatory action regarding the establishment of active-ingredient-based minimum PPE requirements for occupational handlers must be taken for pendimethalin for certain handler use-situations. The MOE's were less than 100 for certain occupational handler (mixers, loaders, and applicators) use-scenarios, unless chemical-resistant gloves were used in addition to the baseline protection of long-sleeve shirt, long pants, shoes, and socks. HED is requiring active-ingredient-based protections for occupational handlers of pendimethalin in these exposure situations: (1) mixing and loading emulsifiable concentrate formulations and (2) mixing, loading, and applying using low-pressure handwand equipment.

EPA notes that the exposure and risk assessment for aerial applications is based on the use of enclosed cockpits, since that is the only data available at this time. However, since MOEs for aerial application are relatively high, EPA has determined that imposing engineering control requirements (enclosed cockpits) for aerial application is not warranted. Therefore, open cockpits will be acceptable for use in applying pendimethalin.

Since wettable powder formulations are currently contained in water-soluble packaging and HED's exposure and risk assessments were based on that assumption, HED will require wettable powder formulations of pendimethalin to be contained in water-soluble packaging. If the Registrant intends to register any wettable powder product not contained in water-soluble packaging, HED must first conduct an exposure risk assessment to determine if mitigation measures such as PPE would be necessary.

WPS and NonWPS Uses: Since potential handler exposure is similar for WPS and nonWPS uses, there is only one set of active-ingredient-based minimum (baseline) PPE requirements for occupational uses of pendimethalin (specified in Section V). These requirements must be followed in the labeling of all pendimethalin end-use products intended primarily for occupational use.

Homeowner-Use Products

42

HED is not establishing minimum (baseline) handler PPE for pendimethalin end-use products that are intended primarily for homeowner use, because the HED has determined that the exposure by such handlers do not warrant such risk mitigation measures.

Postapplication/Entry Restrictions

Occupational-Use Products (WPS Uses)

Restricted-Entry Interval:

Under the Worker Protection Standard (WPS), interim restricted-entry intervals (REI's) for all uses within the scope of the WPS are based on the acute toxicity of the active ingredient. The toxicity categories of the active ingredient for acute dermal toxicity, eye irritation potential, and skin irritation potential are used to determine the interim WPS REI. If one or more of the three acute toxicity effects are in toxicity category I, the interim WPS REI is established at 48 hours. If none of the acute toxicity effects are in category I, but one or more of the three is classified as category II, the interim WPS REI is established at 24 hours. If none of the three acute toxicity effects are in category I or II, the interim WPS REI is established at 12 hours. A 48-hour REI is increased to 72 hours when an organophosphate pesticide is applied outdoors in arid areas. In addition, the WPS specifically retains two types of REI's established by the Agency prior to the promulgation of the WPS: (1) product-specific REI's established on the basis of adequate data, and (2) interim REI's that are longer than those that would be established under the WPS.

During the reregistration process, EPA considers all relevant product-specific information to decide whether there is reason to shorten or lengthen the previously established REI.

By default, PR Notice 93-7 specifies a 12 hour interim REI currently in effect. EPA notes that the 12-hour interim WPS REI was established because data indicated that pendimethalin was in toxicity category III/IV for acute dermal toxicity, skin irritation potential, and eye irritation potential.

During the reregistration process, ~~HED~~ the Agency has determined that the REI established under the WPS should be changed for some uses due to:

-the identification of short- and intermediate-term toxicological endpoints of concern,
-the potential for postapplication worker exposure in certain crops and certain settings,
-an absence of acceptable pendimethalin-specific exposure data for all use sites and scenarios, and

43

-the findings of HED's analysis of potential post-application exposure risk using surrogate data and reasonable worst-case assumptions.

EPA is establishing a 24-hour REI on food, feed, fiber, ornamental, forestry, and turfgrass crops grown for commercial or research purposes. This REI is based on the representative worst-case post-application risk assessment for workers harvesting turf on sod farms.

Early-Entry PPE:

The WPS establishes very specific restrictions on entry by workers to areas that remain under a restricted-entry interval, if the entry involves contact with treated surfaces. Among those restrictions are a prohibition of routine entry to perform hand labor tasks and a requirement that personal protective equipment be worn. Under the WPS, these personal protective equipment requirements for persons who must enter areas that remain under a restricted-entry interval are based on the acute toxicity category of the active ingredient.

During the reregistration process, EPA considers all relevant product-specific information to decide whether there is reason to set personal protective equipment requirements that differ from those set through the WPS.

The RED requirements for early-entry PPE are set in one of two ways:

1. *If EPA determines that no regulatory action must be taken as the result of the acute effects or other adverse effects of an active ingredient, it establishes the early-entry PPE requirements on the basis of the acute dermal toxicity category, skin irritation potential category, and eye irritation potential category of the active ingredient.*

2. *If EPA determines that regulatory action on an active ingredient must be taken as the result of very high acute toxicity or to certain other adverse effects, such as allergic effects or delayed effects (cancer, developmental toxicity, reproductive effects), it may establish early-entry PPE requirements that are more stringent than would be established otherwise.*

The PPE for dermal protection required for early entry, based on the acute toxicity categories, non-acute toxicological endpoints, and the potential for post-application dermal exposure, is coveralls, chemical resistant gloves, and shoes plus socks. Since pendimethalin is classified as toxicity category III for eye irritation potential, no protective eyewear is required.

WPS Notification Statement:

Under the WPS, the labels of some pesticide products must require employers to notify workers about pesticide-treated areas orally as well as by posting of the treated areas. The reregistrationprocess also may decide that a product requires this type of "double notification."

The Agency ~~HED~~ has determined that double notification is not required for pendimethalin end-use products.

Occupational-Use Products (NonWPS Uses)

The Agency ~~HED~~ is establishing entry restrictions for certain nonWPS occupational commercial uses of pendimethalin, such as uses on golf courses, on commercial landscape plantings, in rights-of-way, and on other non-crop areas. This is based on the post-application risk assessment for golf-course maintenance workers. For specific requirements, refer to Section V of this document.

The Agency ~~HED~~ is also establishing entry restrictions for nonWPS occupational uses of pendimethalin at residential sites and at parks and recreation areas. This is based on the post-application risk assessment for toddlers on residential turf. For specific requirements, refer to Section V of this document.

NOTE: THIS PRESUMES THAT A REDUCTION IN THE MAXIMUM APPLICATION RATE TO 1 POUND ACTIVE INGREDIENT PER ACRE ON RESIDENTIAL AND RECREATION-AREA TURFGRASS IS PRACTICAL AND FEASIBLE.

Change note

Homeowner-Use Products

Agency ~~HED~~ is also establishing entry restrictions for homeowner uses of pendimethalin at residential sites. This is based on the post-application risk assessment for toddlers on residential turf. For specific requirements, refer to Section V of this document.

NOTE: THIS PRESUMES THAT A REDUCTION IN THE MAXIMUM APPLICATION RATE TO 1 POUND ACTIVE INGREDIENT PER ACRE ON RESIDENTIAL AND RECREATION-AREA TURFGRASS IS PRACTICAL AND FEASIBLE.

Change note

Other Labeling Requirements

The Agency is also requiring other use and safety information to be placed on the labeling of all end-use products containing pendimethalin. For the specific labeling statements, refer to Section V of this document.

45

d. Occupational and Residential Labeling Requirements

Labeling Requirements for End-Use Products

PPE/Engineering Control Requirements for Pesticide Handlers

For **sole-active-ingredient** end-use products that contain pendimethalin, the product labeling must be revised to adopt the handler personal protective equipment/engineering control requirements set forth in this section. Any conflicting PPE requirements on the current labeling must be removed.

For **multiple-active-ingredient** end-use products that contain pendimethalin, the handler personal protective equipment/engineering control requirements set forth in this section must be compared to the requirements on the current labeling and the more protective must be retained. For guidance on which requirements are considered more protective, see PR Notice 93-7.

Products Intended Primarily for Occupational Use (WPS and nonWPS)

Minimum (Baseline) PPE/Engineering Control Requirements

HED is establishing minimum (baseline) engineering controls for occupational uses of pendimethalin end-use products formulated as wettable powders. All wettable powder formulations must be contained in water-soluble packaging.

HED is establishing minimum (baseline) personal protective equipment (PPE) requirements for some occupational uses of pendimethalin end-use products. The minimum (baseline) PPE for occupational uses of pendimethalin end-use products are:

For emulsifiable concentrate formulations:
"Mixers and loaders must wear:
-- long-sleeved shirt and long pants,
-- chemical-resistant gloves*, and
-- shoes plus socks."

* For the glove statement, use the statement established for pendimethalin through the instructions in Supplement Three of PR Notice 93-7.

For water-dispersible granule, wettable powder, and emulsifiable concentrate formulations whose use directions reasonably permit application using hand-held sprayers:

"Commercial Handlers (mixers, loaders, and applicators) who apply this product using hand-held equipment or hoses (not including hoses attached to truck-mounted equipment) must wear:
-- long-sleeved shirt and long pants,
-- chemical-resistant gloves*, and
-- shoes plus socks."

* For the glove statement, use the statement established for pendimethalin through the instructions in Supplement Three of PR Notice 93-7.

Determining PPE Requirements for End-use Product Labels

The PPE that would be established on the basis of the acute toxicity category of the end-use product must be compared to the active-ingredient-based minimum (baseline) personal protective equipment specified above. The more protective PPE must be placed on the product labeling. For guidance on which PPE is considered more protective, see PR Notice 93-7.

Placement in Labeling

The personal protective equipment requirements must be placed on the end-use product labeling in the location specified in PR Notice 93-7, and the format and language of the PPE requirements must be the same as is specified in PR Notice 93-7.

Products Intended Primarily for Homeowner Use

Minimum (baseline) PPE Requirements

HED is not establishing active-ingredient-based minimum (baseline) handler PPE for pendimethalin end-use products that are intended primarily for homeowner use.

Determining PPE Requirements for End-Use Product Labels

Any necessary PPE for each pendimethalin end-use product intended primarily for homeowner use will be established on the basis of the end-use product's acute toxicity category.

Placement in Labeling

The personal protective equipment requirements, if any, must be placed on the end-use product labeling immediately following the precautionary statements in the labeling section "Hazards to Humans (and domestic animals)."

47

Entry Restrictions

For **sole-active-ingredient** end-use products that contain pendimethalin the product labeling must be revised to adopt the entry restrictions set forth in this section. Any conflicting entry restrictions on the current labeling must be removed.

For **multiple-active-ingredient** end-use products that contain pendimethalin the entry restrictions set forth in this section must be compared to the entry restrictions on the current labeling and the more protective must be retained. A specific time period in hours or days is considered more protective than "sprays have dried" or "dusts have settled."

Products Intended Primarily for Occupational Use

WPS Uses

Restricted-entry interval:

A 24-hour restricted-entry interval (REI) is required for uses on food, feed, fiber, ornamental, forestry, and turf crops within the scope of the WPS on all pendimethalin end-use products.

"Exception: if the product is soil-injected or soil-incorporated, the Worker Protection Standard, under certain circumstances, allows workers to enter the treated area if there will be no contact with anything that has been treated."

Early-entry personal protective equipment (PPE):

The PPE required for early entry is:

-- coveralls,
-- chemical-resistant gloves, and
-- shoes plus socks,

Placement in labeling:

The REI and PPE required for early entry must be inserted into the standardized REI statement required by Supplement Three of PR Notice 93-7.

NonWPS uses

Entry restrictions:

The Agency is establishing the following entry restrictions for nonWPS occupational uses of pendimethalin end-use products: NOTE: This presumes the registrant reduces the maximum application rate for turf at residential sites and parks and recreation areas to one pound active ingredient per acre.

For liquid applications:

"Do not enter or allow others to enter the treated area until sprays have dried."

For dry applications:

"Do not enter or allow others to enter the treated area until dusts have settled."

Placement in labeling:

If WPS uses are also on label -- Follow the instructions in PR Notice 93-7 for establishing a Non-Agricultural Use Requirements box, and place the appropriate nonWPS entry restrictions in that box.

If no WPS uses are on the label -- Place the appropriate nonWPS entry restrictions in the Directions for Use, under the heading "Entry Restrictions."

Products Intended Primarily for Homeowner Use

Entry restrictions:

The Agency is establishing the following entry restrictions for all homeowner uses of pendimethalin end-use products: NOTE: This presumes the registrant reduce the maximum application rates for residential sites to one pound active ingredient per acre.

For liquid applications:

"Do not allow people or pets to touch treated plants until the sprays have dried."

For dry applications:

"Do not allow people or pets to enter the treated area until dusts have settled."

Placement in labeling:

Place the appropriate entry restrictions in the Directions for Use, under the heading "Entry Restrictions."

Other Labeling Requirements

Products Intended Primarily for Occupational Use

The Agency is requiring the following labeling statements to be located on all end-use products containing pendimethalin that are intended primarily for occupational use.

Application Restrictions

"Do not apply this product in a way that will contact workers or other persons, either directly or through drift. Only protected handlers may be in the area during application."

Engineering Controls

"When handlers use closed systems, enclosed cabs, or aircraft in a manner that meets the requirements listed in the Worker Protection Standard (WPS) for agricultural pesticides (40 CFR 170.240(d)(4-6), the handler PPE requirements may be reduced or modified as specified in the WPS."

User Safety Requirements

1. {Registrant: add the following statements if coveralls are required for pesticide handlers on the end-use product label:}

> Discard clothing or other absorbent materials that have been drenched or heavily contaminated with this product's concentrate. Do not reuse them.

2. {Registrant: add the following statement always:}

> Follow manufacturer's instructions for cleaning/maintaining PPE. If no such instructions for washables, use detergent and hot water. Keep and wash PPE separately from other laundry.

User Safety Recommendations

50

- "Users should wash hands before eating, drinking, chewing gum, using tobacco, or using the toilet."
- "Users should remove clothing immediately if pesticide gets inside. Then wash thoroughly and put on clean clothing."
- "Users should remove PPE immediately after handling this product. Wash the outside of gloves before removing. As soon as possible, wash thoroughly and change into clean clothing."

Products Intended Primarily for Home Use

Application Restrictions

"Do not apply this product in a way that will contact any person or pet, either directly or through drift. Keep people and pets out of the area during application."

User Safety Recommendations

- "Users should wash hands before eating, drinking, chewing gum, using tobacco, or using the toilet."
- "Users should remove clothing immediately if pesticide gets inside. Then wash thoroughly and put on clean clothing."

e. Required Occupational/Residential Exposure Studies and Recommendations

Required Handler Studies

No chemical-specific handler exposure data for pendimethalin exists and HED has low confidence in the data available for several pendimethalin use scenarios. Additional handler exposure studies are required. Requirements for such studies are addressed in Subdivision U of the Pesticide Assessment Guidelines. The required studies are for dermal exposure (Guideline 231) and are necessary to provide data on mixers, loaders, and applicators for:

- high-volume turf sprayer applications with WP/WDG/liquid formulations;
- low-pressure handwand applications with WDG/liquid formulations;

57

- backpack sprayer applications with WDG/liquid formulations; and
- rights-of-way applications with WDG/liquid formulations.

HED notes that the Registrant is a member of the Outdoor Residential Exposure Task Force (ORETF) and that some of the required data for applications to turf is being developed by the Task Force. Such studies may be reserved at this time pending the completion of the ORETF studies.

Required Postapplication Studies

There are no pendimethalin-specific post-application exposure data available at this time. These chemical-specific data are necessary for HED to establish permanent restricted-entry intervals since a short- and intermediate-term endpoint of concern has been identified. The Registrant must submit postapplication exposure studies. Requirements for such postapplication exposure studies are addressed by Subdivision K of the Pesticide Assessment Guidelines. Data are required to support the use of pendimethalin on the following crop groups/use sites:

- Food, feed, and fiber crops: (transplanting and weeding tobacco);
- Ornamental crops (harvesting/transplanting woody ornamentals);
- Residential turfgrass; and
- Sod-farm turfgrass (harvesting).

Requirements for postapplication/reentry exposure studies are addressed by Subdivision K of the Pesticide Assessment Guidelines. The required data include:

Guidelines:

132-1(a) Foliar Residue Dissipation, if applicable
132-1(b) Soil Residue Dissipation
*133-3 Postapplication Dermal Passive Dosimetry Exposure

*Guideline 133-3 may be reserved at this time pending completion of the databases on agricultural and residential postapplication/reentry exposure currently being developed by the Agricultural Reentry Task Force and the ORETF since the Registrant is a member of the ORETF.

f. Required Product and Residue Chemistry Data and Recommendations

Product Chemistry

All pertinent data requirements are satisfied for the 90% T and the pendimethalin TGAI; however additional product-specific data (physical/chemical properties) are

52

outstanding for the 86.8% and 60% FIs (Appendix 1, Product Chemistry Data Summary). Provided that the Registrant submits the data required in the attached data summary tables for the 86.8% and the 60% FIs, and either certifies that the suppliers of beginning materials and the manufacturing processes for the pendimethalin technical product and MPs have not changed since the last comprehensive product chemistry review or submits complete updated product chemistry data packages, HED has no objections to the reregistration of pendimethalin with respect to product chemistry data requirements.

Residue Chemistry

Radiovalidation data using samples from the potato metabolism study remain outstanding and are considered confirmatory. Tobacco magnitude of the residue remain outstanding and are considered confirmatory.

Pendimethalin residue data requirements for cotton gin byproducts which result from changes in the Livestock Feeds Table (Table II (September, 1995)) should be imposed at this time. However, this requirement should not impinge on the reregistration eligibility decision for pendimethalin. The need for additional tolerances and revisions to the exposure/risk assessments will be made upon receipt and evaluation of the required data.

Rice processing data remain outstanding and are considered confirmatory.

The available confined rotational crop study is not adequate. A new confined rotational crop study is required. This, however, will not preclude the reregistration of pendimethalin.

Appendices
1. Product Chemistry Data Summary
2. Residue Chemistry Science Assessments for the Reregistration of Pendimethalin

Attachments
1. Hazard Assessment
2. Product and Residue Chemistry Assessments
3. Dietary Exposure Analysis
4. Occupational and Residential Exposure Assessments7