The following information was generated from the Hazardous Substances Data Bank (HSDB), a database of the National Library of Medicine's TOXNET system (http://toxnet.nlm.nih.gov) on January 3, 2005.

Query: The chemical name was identified. The following terms were added from ChemIDplus: prowlp stompp penoxalin herbadox accotab
CAS Registry Number: 40487-42-1

NAME: PENDIMETHALIN
HSN: 6721
RN: 40487-42-1

HUMAN HEALTH EFFECTS:

HUMAN TOXICITY EXCERPTS:

SKIN, EYE AND RESPIRATORY IRRITATIONS:

PROBABLE ROUTES OF HUMAN EXPOSURE:
Exposure to pendimethalin will be primarily occupation via dermal contact and inhalation and ingestion of aerosols especially during mixing and application and by coming into contact with treated plants and soil. General population exposure is most likely to occur by ingestion of and dermal contact with contaminated water, including rain water. This is most likely to occur near agricultural areas during the growing season. (SRC) **PEER REVIEWED**

The concn of pendimethalin in the air of a warehouse was 0.0063 mg/cu m while that in the operations room was < 0.001 mg/cu m(1). Breathing zone air of eight pendimethalin applicators that were monitored during a workshift of at least eight hours did not contain detectible levels of the herbicide(1). [(1) Yeary RA, Leonard JA; ACS Symp Ser 522(Pesticides in Urban Environments): 275-81 (1993)]**PEER REVIEWED**

EMERGENCY MEDICAL TREATMENT:
EMERGENCY MEDICAL TREATMENT:

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LIFE SUPPORT:
  o This overview assumes that basic life support measures have been instituted.

CLINICAL EFFECTS:

0.2.1 SUMMARY OF EXPOSURE

0.2.1.1 ACUTE EXPOSURE

A) A SPECIFIC REVIEW on the clinical effects and treatment of individuals exposed to this agent HAS NOT YET BEEN PREPARED. The following pertains to the GENERAL EVALUATION and TREATMENT of individuals exposed to potentially toxic chemicals.

B) GENERAL EVALUATION -

  1) Exposed individuals should have a careful, thorough medical history and physical examination performed, looking for any abnormalities. Exposure to chemicals with a strong odor often results in such nonspecific symptoms as headache, dizziness, weakness, and nausea.

C) IRRITATION -

  1) Many chemicals cause irritation of the eyes, skin, and respiratory tract. In severe cases respiratory tract irritation can progress to ARDS/acute lung injury, which may be delayed in onset for up to 24 to 72 hours in some cases.

  2) Irritation or burns of the esophagus or gastrointestinal tract are also possible if caustic or irritant chemicals are ingested.

D) HYPERSENSITIVITY -

  1) A number of chemical agents produce an allergic hypersensitivity dermatitis or asthma with bronchospasm and wheezing with chronic exposure.

LABORATORY:

A) A number of chemicals produce abnormalities of the hematopoietic system, liver, and kidneys. Monitoring complete blood count, urinalysis, and liver and kidney function tests is suggested for patients with significant exposure.
B) If respiratory tract irritation or respiratory depression is evident, monitor arterial blood gases, chest x-ray, and pulmonary function tests.

TREATMENT OVERVIEW:

0.4.2 ORAL EXPOSURE

A) GASTRIC LAVAGE

1) Significant esophageal or gastrointestinal tract irritation or burns may occur following ingestion. The possible benefit of early removal of some ingested material by cautious gastric lavage must be weighed against potential complications of bleeding or perforation.

2) GASTRIC LAVAGE: Consider after ingestion of a potentially life-threatening amount of poison if it can be performed soon after ingestion (generally within 1 hour). Protect airway by placement in Trendelenburg and left lateral decubitus position or by endotracheal intubation. Control any seizures first.

   a) CONTRAINDICATIONS: Loss of airway protective reflexes or decreased level of consciousness in unintubated patients; following ingestion of corrosives; hydrocarbons (high aspiration potential); patients at risk of hemorrhage or gastrointestinal perforation; and trivial or non-toxic ingestion.

B) ACTIVATED CHARCOAL

1) Activated charcoal binds most toxic agents and can decrease their systemic absorption if administered soon after ingestion. In general, metals and acids are poorly bound and patients ingesting these materials will not likely benefit from activated charcoal administration.

   a) Activated charcoal should not be given to patients ingesting strong acidic or basic caustic chemicals. Activated charcoal is also of unproven value in patients ingesting irritant chemicals, where it may obscure endoscopic findings when the procedure is justified.

2) ACTIVATED CHARCOAL: Administer charcoal as a slurry (240 mL water/30 g charcoal). Usual dose: 25 to 100 g in adults/adolescents, 25 to 50 g in children (1 to 12 years), and 1 g/kg in infants less than 1 year old.

C) DILUTION -

1) Immediate dilution with milk or water may be of benefit in caustic or irritant chemical ingestions.

2) DILUTION: Immediately dilute with 4 to 8 ounces (120 to 240 mL) of water or milk (not to exceed 4 ounces/120 mL in a child).

D) IRRITATION -

1) Observe patients with ingestion carefully for the possible development of esophageal or gastrointestinal tract irritation or burns. If signs or symptoms of esophageal irritation or burns are present, consider endoscopy to determine the extent of injury.

E) OBSERVATION CRITERIA -

1) Carefully observe patients with ingestion exposure for the development of any systemic signs or symptoms and administer symptomatic treatment as necessary.
2) Patients symptomatic following exposure should be observed in a controlled setting until all signs and symptoms have fully resolved.

0.4.3 INHALATION EXPOSURE

A) DECONTAMINATION -
1) INHALATION: Move patient to fresh air. Monitor for respiratory distress. If cough or difficulty breathing develops, evaluate for respiratory tract irritation, bronchitis, or pneumonitis. Administer oxygen and assist ventilation as required. Treat bronchospasm with inhaled beta2 agonist and oral or parenteral corticosteroids.

B) IRRITATION -
1) Respiratory tract irritation, if severe, can progress to pulmonary edema which may be delayed in onset up to 24 to 72 hours after exposure in some cases.

C) ACUTE LUNG INJURY -
1) ACUTE LUNG INJURY: Maintain ventilation and oxygenation and evaluate with frequent arterial blood gas or pulse oximetry monitoring. Early use of PEEP and mechanical ventilation may be needed.

D) BRONCHOSPASM -
1) If bronchospasm and wheezing occur, consider treatment with inhaled sympathomimetic agents.

E) OBSERVATION CRITERIA -
1) Carefully observe patients with inhalation exposure for the development of any systemic signs or symptoms and administer symptomatic treatment as necessary.
2) Patients symptomatic following exposure should be observed in a controlled setting until all signs and symptoms have fully resolved.

0.4.4 EYE EXPOSURE

A) DECONTAMINATION: Irrigate exposed eyes with copious amounts of room temperature water for at least 15 minutes. If irritation, pain, swelling, lacrimation, or photophobia persist, the patient should be seen in a health care facility.

0.4.5 DERMAL EXPOSURE

A) OVERVIEW
1) DERMAL DECONTAMINATION -
a) DECONTAMINATION: Remove contaminated clothing and wash exposed area thoroughly with soap and water. A physician may need to examine the area if irritation or pain persists.
2) PESTICIDES -
a) DECONTAMINATION: Remove contaminated clothing and jewelry. Wash the skin, including hair and nails, vigorously; do repeated soap washings. Discard contaminated clothing.
3) IRRITATION -
a) Treat dermal irritation or burns with standard topical therapy. Patients developing dermal hypersensitivity reactions may require treatment with systemic or topical corticosteroids or antihistamines.
4) DERMAL ABSORPTION -
a) Some chemicals can produce systemic poisoning by absorption through intact skin. Carefully observe
patients with dermal exposure for the development of any systemic signs or symptoms and administer symptomatic treatment as necessary.

RANGE OF TOXICITY:
A) No specific range of toxicity can be established for the broad field of chemicals in general.

ANIMAL TOXICITY STUDIES:

NON-HUMAN TOXICITY EXCERPTS:


... Pendimethalin is generally considered to have a very low degree of toxicity to mammals and is degraded in the environment to products without significant adverse effects on organisms. [Amrur, M.O., J. Doull, C.D. Klaasen (eds). Casarett and Doull's Toxicology. 4th ed. New York, NY: Pergamon Press, 1991.881]**PEER REVIEWED**

Highly toxic to coldwater fish, highly to moderately toxic to warmwater fish, and highly to moderately toxic to freshwater invertebrates. [Purdue University; National Pesticide Information Retrieval System, Pendimethalin Fact Sheet No. 50 (1985)]**PEER REVIEWED**

The influence of pendimethalin, a preemergent herbicide, on phosphate solubilizing bacteria Pseudomonas striata inoculated to cowpea plants was studied in pot culture. Pendimethalin exerted inhibitory effects on nodulation, dry matter content of cowpea plants and population of phosphate solubilizing bacteria in the cowpea rhizosphere. However, it did not affect the phosphorus uptake by cowpea plants. Inoculation of Pseudomonas striata enhanced the nodulation, dry matter accumulation and P-uptake in cowpea plants either in the presence or absence of pendimethalin. There was no significant correlation between the number of phosphate solubilizing bacteria in the rhizosphere and P-uptake by the plants. [Alagawadi AR et al; Zentralbl Mikrobiol 145 (1): 57-60 (1990)]**PEER REVIEWED**

NON-HUMAN TOXICITY VALUES:

LD50 Albino rabbit dermal > 5000 mg/kg [Spencer, E. Y. Guide to the Chemicals Used in Crop Protection. 7th ed. Publication 1093. Research Institute, Agriculture Canada, Ottawa, Canada: Information Canada, 1982.441]**PEER REVIEWED**


LD50 Mouse (male) oral 1620 mg/kg [Hartley, D. and H. Kidd (eds.). The Agrochemicals Handbook. 2nd ed. Lechworth, Herts, England: The Royal


ECOTOXICITY VALUES:

LC50 Pimephales promelas (fathead minnow) 0.19 ug/l/96 hr (confidence limit 0.17-0.22 mg/l), flow-through bioassay with measured concentrations, 25.1 deg C, dissolved oxygen 7.4 mg/l, hardness 43.5 mg/l calcium carbonate, alkalinity 43.0 mg/l calcium carbonate, and pH 7.8. [Geiger D.L., D.J. Call, L.T. Brooke. (eds.). Acute Toxicities of Organic Chemicals to Fathead Minnows (Pimephales- Promelas). Vol. V. Superior WI: University of Wisconsin-Superior, 1990.249][**PEER REVIEWED**

EC50 Pimephales promelas (fathead minnow) 0.18 ug/l/96 hr (confidence limit is not available) flow-through bioassay with measured concentrations, 25.1 deg C, dissolved oxygen 7.4 mg/l, hardness 43.5 mg/l calcium carbonate, alkalinity 43.0 mg/l calcium carbonate, and pH 7.8. Effect: loss of equilibrium. [Geiger D.L., D.J. Call, L.T. Brooke. (eds.). Acute Toxicities of Organic Chemicals to Fathead Minnows (Pimephales- Promelas). Vol. V. Superior WI: University of Wisconsin-Superior, 1990.249][**PEER REVIEWED**

METABOLISM/PHARMACOKINETICS:

METABOLISM/METABOLITES:

The metabolism of the dinitroaniline herbicide pendimethalin was investigated in rats with emphasis on the identification of metabolites in tissues and urine. Royal Hart Wistar rats were administered a single oral dose of radiolabeled methyl labeled or ethyl labeled pendimethalin. Radioactivity was excreted rapidly both in urine and feces at dosage levels of 7.3 and 37 mg/kg of radiolabeled pendimethalin. After 96 hr, the residues were less than 0.3 ppm in all tissues except fat, which had a residue of 0.9 ppm. The major metabolic routes of pendimethalin involved hydroxylation of the 4-methyl and the N-1-ethyl group, oxidation of these alkyl groups to carboxylic acids, nitro reduction, cyclization, and conjugation based on the identification of the 12 metabolites in urine and tissues. Products of cyclization reactions giving rise to methylbenzimidazole carboxylic acids were unique to liver and kidney. All major metabolites retained both radioactive labels of pendimethalin, indicating that N-dealkylation of the isopentyl group was not significant. This investigation extends the knowledge on the fate of dinitroanilines in the rat and demonstrates that pendimethalin is metabolized by several major pathways. [Zulalian J; J Agri Food Chem 38 (8): 1743-54 (1990)][**PEER REVIEWED**

MECHANISM OF ACTION:

Selective herbicide, absorbed by the roots and leaves. Inhibits cell division and cell elongation. Affected plants die shortly after germination or following emergence from the soil. [Hartley, D. and H. Kidd
PHARMACOLOGY:

ENVIRONMENTAL FATE & EXPOSURE:

ENVIRONMENTAL FATE/EXPOSURE SUMMARY:

Pendimethalin will be released to the environment as a result of its use as a selective pre- or post-emergence herbicide for control of most annual grasses and several small-seeded annual broad-leaf weeds on a variety of grains, cotton and other crops, as well as on noncropland. When applied to soil, pendimethalin will adsorb strongly to soil, probably forming covalent bonds with soil components so that it is unextractable from the soil. A small amount of pendimethalin may volatilize from the soil surface, especially soon after application if the temperature is high. Loss appears to be unrelated to soil moisture content. A small amount of pendimethalin may also photodegrade on the soil surface. Both photolysis and volatilization losses will be reduced when the herbicide is incorporated into the soil. Pendimethalin degrades in soil by a process that is not completely understood and appears to be more chemical than biological and involves nitro group reduction and/or dealkylation. Degradation is faster under flooded, anaerobic conditions than under aerobic conditions. Pendimethalin's half-life in aerobic soil is 28-172 days. Dissipation in field studies in flooded rice fields have been as short as 3-7 days. Under ordinary agricultural use, pendimethalin would enter water associated with soil in runoff or after flooding as in rice production. It will strongly adsorb to soil particles and rapidly degrade. Little or no loss will occur from volatilization. The half-life of pendimethalin in water in a model ecosystem was < 2 days. While pendimethalin may undergo direct and sensitized photolysis in surface water, this does not appear to be a major degradation pathway. Pendimethalin will not bioconcentrate in aquatic organisms because of its rapid degradation in water and its metabolism in the aquatic organisms. When released in air during spraying, pendimethalin will occur in aerosols and be removed from the atmosphere by gravitational settling. It also partitions into tiny fog droplets and is removed from the atmosphere in rain. Vapor-phase pendimethalin reacts with photochemically-produced hydroxyl radicals, resulting in an estimated atmospheric half-life of 12.7 hr. Exposure to pendimethalin will be primarily occupation via dermal contact and inhalation and ingestion of aerosols especially during mixing and application and by coming into contact with treated plants and soil. General population exposure is most likely to occur by ingestion of and dermal contact with contaminated water, including rain water. (SRC) **PEER REVIEWED**

PROBABLE ROUTES OF HUMAN EXPOSURE:

Exposure to pendimethalin will be primarily occupation via dermal contact and inhalation and ingestion of aerosols especially during mixing and application and by coming into contact with treated plants and soil. General population exposure is most likely to occur by ingestion of and dermal contact with contaminated water, including rain water. This is most likely to occur near agricultural areas during the growing season. (SRC)
The concn of pendimethalin in the air of a warehouse was 0.0063 mg/cu m while that in the operations room was < 0.001 mg/cu m(1). Breathing zone air of eight pendimethalin applicators that were monitored during a workshift of at least eight hours did not contain detectible levels of the herbicide(1). [(1) Yeary RA, Leonard JA; ACS Symp Ser 522(Pesticides in Urban Environments): 275-81 (1993)]

ARTIFICIAL POLLUTION SOURCES:

Pendimethalin will be released to the environment as a result of its use as a selective pre- or post-emergence herbicide for control of most annual grasses and several small-seeded annual broad-leaf weeds on a variety of grains, cotton and other crops, as well as on noncropland(2,3,6). It is also used to control suckers on tobacco(2). It is one of the most commonly used pesticides in U.S. agricultural crop production with approximately 20-25 million pounds used in 1993(4). In 1982 and 1989, 2.9 and 12.5 million pounds of pendimethalin were used in US agriculture of which 1.6 and 6.6 million pounds were applied to soybeans for control of grasses(1,5). In its use, pendimethalin is generally applied to the soil surface and incorporated to a depth of 2-8 cm which places the herbicide at the root zone of germinating weeds and may reduce its dissipation(6).

ENVIRONMENTAL FATE:

The persistence of pendimethalin in different soil types as affected by rate of application and moisture regime was studied under greenhouse conditions with the use of bioassay and GLC. Pendimethalin was rapidly lost from the soil 20 to 50 days after application and slowly thereafter. Higher residual phytotoxicity was obtained in clay loam soil than in clay and fine sandy loam soils at 50 and 110 days. Herbicide residues were very minimal after 3 mo in all 3 soils. At rates higher than the recommended rate of application there was greater and more prolonged residual phytotoxicity. Higher residues in all sampling periods were likewise detected. Loss of pendimethalin under low soil water levels was very slow. Marked residual phytotoxicities were still apparent at 110 days with 4 day interval watering. Leaching is not a principal means of pendimethalin loss. The herbicide remained in the upper 5 cm soil layer even if water was applied at 100% field capacity daily. [Berayon BF, Mercado BL; Philipp Agric 66 (4): 367-78 (1983)]

Preemergence application of neburon-pendimethalin mixture (83591-04-2) (6 kg/ha of 60% neburon plus 6 l/ha of 330 g pendimethalin/l) controlled Viola arvensis and Stellaria media completely, and Galium aparine incompletely, and increased barley grain yield by 7.04%. Neburon remained mainly in the top 10 cm of soil, where its residues decreased from an initial 2.17 to 0.56 ppm of soil solids, at harvest. The decrease in
neburon was accompanied by an increase in neburon metabolites which may be hydrolyzed to 3,4-dichloroaniline, which reached 1 ppm at harvest time. Pendimethalin also was fixed in the top 10 cm of soil, where its residues decreased from 1.09 to 0.33 ppm at harvest time. [Deleu R et al; Theory Pract Use Soil Appl Herbicide Symp 163-9 (1981)]**PEER REVIEWED**

TERRESTRIAL FATE: When released in soil, pendimethalin will bind strongly to soil with the amount accumulating in tightly bound soil fractions increasing over 4 months(5). Pendimethalin exhibits low volatility in soil(6). Although some volatilization and photolysis losses may occur initially at the soil surface, these appear to be minor. Increased dissipation of pendimethalin in flooded soil is not due to increased volatilization. Persistence in soil is influenced by soil temperature, cultivation practices, soil type and moisture conditions(4). Anaerobic degradation of pendimethalin as in other dinitroaniline herbicides normally proceeds faster than aerobic degradation. The primary reaction observed is the reduction of a nitro group, followed in some cases by dealkylation (1,2). In contrast, dealkylation is normally the primary reaction under aerobic conditions(1,2). In a case of a related herbicide trifluralin, the redox potential had to be below a threshold value to initiate rapid degradation under flooded conditions(3) indicating that degradation in soil may be chemical, rather than microbiologically in nature(SRC). [(1) Probst GW et al; Dinitroanilines. In Herbicides, Chemistry, Degradation and Mode of Action Vol 1, Kearney PC &amp; Kaufman DD, eds, Marcel Dekker, NY pp. 473-85 (1975) (2) Smith RH et al; Chemosphere 11/12: 855-61 (1979) (3) Willis GH; J Environ Qual 3: 262-5 (1974) (4) Zimdal RL et al; Weed Sci 32: 408-12 (1984) (5) Nelson JE et al; Weed Sci 31: 69-75 (1983) (6) (5) Savage KE; Weed Sci 26: 465-71 (1978)]**PEER REVIEWED**

TERRESTRIAL FATE: The persistence of pendimethalin in sandy loam soil with moisture at 75% field capacity was 98 and 409 days at 30 and 10 deg C, respectively(2,3). At 25 deg C its half-life increased with decreasing soil moisture. In 7 different soils, the half-life varied from 72-172 days; generally the rate of loss was slower as the organic content of the soil increased(3). Pendimethalin's half-life in a sandy loam soil under Indian tropical conditions was reported to be 58-63 days(3). Pendimethalin's persisted in two Indian soils for > 6 months according to plant bioassay methods(4). The half-life of pendimethalin in Sharkey clay loam was 82 days (81 in sterile controls) at field capacity and 7 days in flooded soil (8 days in sterile controls(5). The half-life of pendimethalin in Sharkey clay loam were markedly different in an earlier study, 99 days at field capacity and 37 days in flooded soil(5). Autoclaving the soil did not have any effect on the dissipation rate under either moisture condition. This lack of response of autoclaving indicates that degradation may not be microbiological in nature. The degradation of another dinitroaniline, trifluralin, is related to redox potential and is thought to be electrochemical in nature(5). The effect of straw (increased organic matter), fungicides, pesticides, and insecticides applied singly, in combination, or in repeat applications on pendimethalin degradation in soil planted with barley was investigated in field experiments in Germany between 1979 and 1981(1). None of these factors had any significant effect and in all cases the half-life of pendimethalin in soil was somewhat under a month. In laboratory tests performed in 3 soils, a clay (pH 7.5, 1.3% organic matter), a clay loam (pH 8.0, 1.7% organic matter) and a sandy loam (pH 6.4, 1.3% organic matter), the half-lives of pendimethalin in soil were 42, 54, and 45 days, respectively, when incubated in the dark at
30 deg C and moisture at 75% field capacity (2). The half-life increased with decreasing temperature. The influence of soil moisture was small.


TERRESTRIAL FATE: Field studies were conducted in Crowley silt loam soil in Arkansas in which pendimethalin dissipation was monitored with duplicate bioassay under three management systems in both 1980 and 1981: a flush-irrigated system with subsequent flooding (lowland rice), frequent flush-irrigation without flooding (upland rice) and furrow irrigation (soybeans) (1). Only with the soybeans was the herbicide incorporated into the soil. Dissipation was most rapid with the lowland rice, intermediate in the upland rice, and slowest in the soybeans in both 1980 and 1981. Dissipation was greatest in the first two weeks and then declined more slowly. Except for soybeans in 1981, the pendimethalin half-lives ranged from 3-7 days. In the winter months with infrequent watering, degradation was extremely slow. However, only in the case of soybeans did potentially phytotoxic levels remain at the end of the growing season. A 54-day laboratory experiment in which pendimethalin was incubated at 25 deg C in the dark for 56 days in silt loam soil under different moisture conditions, namely, 30 kPa water content, continuously flooded, and alternately flooded and dried, resulted in the following mean half-lives at different application levels (moisture condition: half-lives at 0.1, 1.0, 2.0 ppm): 30 kPa water content: 72, 75, and 63 days; continuously flooded: 104, 76, and 60 days; and alternately flooded and dried: 25, 25 and 37 days(1). Results were variable, but half-lives were consistently shorter when the soil was alternately flooded and dried. [(1) Barrett MR, Lavy TL; J Environ Qual 12: 504-8 (1983)]**PEER REVIEWED**

TERRESTRIAL FATE: In field experiment in which the delay (0 to 7 days) in incorporating pendimethalin and other herbicides into soil was evaluated using a sorghum bioassay, generally 75% or more of the activity was recovered when pesticide incorporation was delayed 3 days or less(1). However when incorporation was delayed for 7 days, approximately 70% of the herbicide was lost. Losses in the experiments were believed to be due to volatilization and chemical destruction, rather than deep leaching. In one experiment where loss was excessive (about 70% when incorporated after 3 days), excessive rainfall was thought to have accelerated herbicide loss(1). After application of pendimethalin (340 mg active ingredient/sq m) to small field plots planted with Kentucky bluegrass, airborne loss of the herbicide was assessed by air sampling beginning immediately after application - two-hour air samples collected for the first two days and on days 4, 5 and 15(2,4). Airborne loss was 5% on the day of application. Diurnal variation in loss was most pronounced on day-1, correlating with solar radiation and canopy temperature. There was an initial period of rapid decline in daily airborne loss ending 5-7 days after application. This was followed by a period of slower decline for the remainder of the study. Estimated volatility losses were 6.1% and 13% for the first 2 and 5 days, respectively. Daily airborne losses were approximately 14, 5, and 1 mg/sq m on days 1, 5, and 15, respectively. The data support the conclusion that dislodgeable residues are most available for airborne loss. The half-life of pendimethalin sprayed on the soil surface outdoors was 4 days on Bosket silt loam and 6 days on Sharkey clay(3). Shading from

AQUATIC FATE: Under ordinary agricultural use, pendimethalin would enter water associated with soil in runoff or after flooding as in rice production. It will strongly adsorb to soil particles and rapidly degrade(1). 14C-Pendimethalin-treated soil (1 and 10 ppm) was added to a model ecosystem containing 16 L of water, 400 g of soil, snails, fish, algae, and daphnids and monitoring over 30 days(1). Total recovery was 95 and 97% at the two application rates indicating little volatilization or mineralization loss. Only 15 and 18% of the 14C-pendimethalin desorbed from the soil and that which reached the water rapidly degraded to polar metabolites. The radioactivity in the water reached a plateau after 13 days and did not decline until day-30. However, pendimethalin accounted for only 30% of the radioactivity on day-2, 3% on day-9 and < 1% after day-16. Of the 14-C remaining in soil, 68% was unextractable and assumed bound. Pendimethalin will not bioconcentrate in aquatic organisms(SRC) because of its rapid degradation in water and its metabolism in the organisms(1). [(1) Isensee AR, Dubey PS; Bull Environ Contam Toxicol 30: 239-44 (1983)]**PEER REVIEWED**

ATMOSPHERIC FATE: When released in air during spraying, pendimethalin will occur in aerosols and be removed from the atmosphere by gravitational settling. Based on its vapor pressure, it should exist largely as the vapor in the atmosphere(2). Vapor-phase pendimethalin reacts with photochemically-produced hydroxyl radicals, resulting in an estimated atmospheric half-life of 12.7 hr(1,SRC). [(1) Meylan WM, Howard PH; Chemosphere 26: 2293-9 (1993) (2) Bidleman TF Environ Sci Technol 22: 361-7 (1988)]**PEER REVIEWED**

ATMOSPHERIC FATE: Pendimethalin partitions into fog water in the atmosphere to an extent which is much greater than that which would dissolve into an ideal solution at equilibrium(1,2). The aqueous-phase enrichment is 1500-3200 times that which would be calculated from its Henry's Law constant(1,2). This discrepancy is thought to be because the temperature corrections to the Henry's Law constants are not factored in, the importance of the air-water interface of the tiny fog droplets have not been recognized, and the adsorption effect of colloidal organic carbon in the droplets have not been considered(1). [(1) Valsaraj KT et al; Atmos Environ 27A: 203-10 (1993) (2) Glotfelty DE et al; Nature 325: 602-5 (1987)]**PEER REVIEWED**

ENVIRONMENTAL BIODEGRADATION:
The persistence of pendimethalin was studied in non-flooded and flooded nonsterile and sterile sandy loam soil (0.35% organic carbon, pH 8.2%) at 30 deg C over 90 days(1). The degradation was first order with half-lives of 52.2 and 33.4 days in nonsterile nonflooded and flooded soil, respectively, and 66.9 and 44.9 days in sterile nonflooded and flooded soil, respectively(1). Therefore degradation is faster in flooded than in nonflooded soil. While the herbicide was more persistent in nonsterile than sterile soil, only 11-14% of the degradation over 90 days could be attributed to microbial activity. The formation of two major metabolites, N-(1-ethylpropyl)-3,4-dimethyl-2-nitrobenzene-1,6-diamine and
3,4-dimethyl-2,6-dinitroaniline indicate that under aerobic conditions N-dealkylation and reduction of the less hindered nitro groups are primary transformation mechanisms. The same products were formed when pendimethalin was incubated with enriched cultures of soil fungi(2). Under flooded conditions, the sole product was N-(1-ethylpropyl)-5,6-dimethyl-7-nitrobenzimidazole which is formed through the intermediate, 6-aminopendimethalin in the presence of a source of carbon(1). Presumably, the source of carbon is needed to supply the carbon atom on the benzimidazole ring(SRC). Statements were also made by the investigators without any supporting data that complete degradation of pendimethalin in flooded soil could occur in four and even one day, as a result of which short periods of excessive rainfall could cause unexpectedly rapid dissipation of pendimethalin and the formation of alternate degradation products(1). No discussion of possible mechanisms was presented for the comparable amounts of degradation in sterile soil. Another study involving the anaerobic degradation of 14C-pendimethalin in a soil suspension at a redox potential of -240 to -450 mv found that after 4 days, 85% of the recovered radioactivity was as the parent compound and 16% was a benzimidazole; a similar incubation of 13 days gave 88% and 9.5%, respectively(3). The radioactivity recoverable after 4 and 13 days was 45 and 22%, respectively. [(1) Kulshrestha G, Singh SB; Bull Environ Contam Toxicol 48: 269-74 (1992) (2) Singh SB, Kulshrestha G; J Environ Sci Health B26: 309-21 (1991) (3) Smith RH et al; Chemosphere 11/12: 855-61 (1979)]**PEER REVIEWED**

In a study of the persistence of pendimethalin residues on grass clipping composted by methods chosen to match those used by homeowners, pendimethalin residues declined slowly from 3.20 ppm after 1 week to < 0.01 ppm after 17 weeks(1). Therefore, the compost should be pesticide free when used the following growing season(1). [(1) Lemmon CR, Pylypiw HM Jr; Bull Environ Contam Toxicol 48: 409-415 (1992)]**PEER REVIEWED**

ENVIRONMENTAL ABIOTIC DEGRADATION:
The photodecomposition of pendimethalin in solution, as a thin film, and on soil surfaces under UV light and sunlight was investigated. Irradiation of pendimethalin in methanol yielded, in addition to the minor dealkylated product, the major products 2-amino-6-nitro-N-(1-ethylpropyl)-3,4-xylidine and 2-nitroso-6-nitro-3,4-xylidine. Pendimethalin degraded rapidly through reductive cyclization of a NO2 group and an adjacent N-ethylpropyl group to give a cyclized benzimidazole product. The photodecomposition of pendimethalin involves oxidative dealkylation, nitro reduction and cyclization. [Dureja P, Walia S; Pestic Sci 25 (2): 105-14 (1989)]**PEER REVIEWED**

Pendimethalin absorbs UV radiation > 290 nm (4,5) and may therefore undergo direct photolysis in the environment. While pendimethalin readily decomposed when irradiated in methanol at wavelengths > 250 nm to form a number of products, its decomposition in sunlight ( > 290 nm) is relatively slow, leading to N-dealkylation and arylmethyl oxidation(5). While acidity or alkalinity did not affect the rate of disappearance of pendimethalin, the pH of the media affected the products formed; at acid pH, N-dealkylation occurred, whereas at alkaline pH, a nitrate group was replaced by a hydroxyl group(5). On dry thin layer soil (Hagerstown clay loam) plates, pendimethalin underwent 9.9% photodecomposition following exposure to solar radiation for 7 days in July(1). Dark controls showed some loss due to volatilization(1). When pendimethalin was applied to a thin layer of Indian soil (1.68% organic carbon, pH 7.19) and exposed to
sunlight, for 7, 15 and 30 days, two metabolites were formed, one of which was identified as N-propyl-3,4-dimethyl-2,6-dinitroaniline (4). The same product was observed when pendimethalin was irradiated in the presence of acetone, a photosensitizer (4). When pendimethalin dissolved in water containing soil was exposed to radiation > 290 nm, a product was formed in which one of the nitro groups of the pendimethalin was reduced to an amino group (4). In laboratory experiments in which pendimethalin was applied to a thin-layer soil surface and exposed to UV light (peak 310 nm) in an environmental chamber for 24 hr (equivalent to 3-6 days in the field) at different degrees of soil moisture, no clearly discernable effect of irradiation, temperature and soil moisture was noted for pendimethalin persistence (3).


Pendimethalin has a vapor pressure of 3.0X10-5 mm Hg at 25 deg C (3) and therefore it should exist largely as the vapor in the atmosphere (2). Vapor-phase pendimethalin reacts with photochemically-produced hydroxyl radicals with a rate constant of 3.03X10-11 cu cm/molecule-s (1). Assuming a hydroxyl radical concn of 5X10+5 radicals/cu cm, the half-life of pendimethalin in the atmosphere would be 12.7 hr (SRC).


ENVIRONMENTAL BIOCONCENTRATION:
Using the log Kow of 5.18 (2), one would estimate a BCF of 5100 for pendimethalin using a recommended regression equation (2). While this would indicate that pendimethalin bioconcentrates in aquatic organisms (SRC), this is not the case because apparently it is metabolized in aquatic organisms (4). The BCF of pendimethalin in a sea nettle (Chrysaora quinquecirrha) was 0.42 after 16 hrs (3). 14C-pendimethalin-treated soil (1 and 10 ppm) was added to a model ecosystem containing 16 L of water 400 g of soil, snails, fish, algae, and daphnids and monitoring over 30 days (4). Snails reached their peak 14C level between days 7 and 15; while 50% of the radioactivity was pendimethalin on day-1, < 1% was so by day-15. Fish reached their peak 14C level on day-1 and thereafter levels declined parallelizing that of 14C in water. While 76% of the radioactivity was pendimethalin on day-1, this decreased to 22% by day-30. These data suggest that fish preferentially accumulated pendimethalin over more polar metabolites and degraded it more slowly than snails. Algae accumulated 14C slowly over the 30-day experiment and daphnia reached a 14C plateau between day-7 and day-15, but this depurated within 10 days in fresh water. The maximum 14C BCF (as pendimethalin) ranged from 190 (algae) to 312 (fish).


SOIL ADSORPTION/MOBILITY:
Pendimethalin is strongly adsorbed to soil organic matter and clay and does not leach (1). The selected Koc in the Pesticide Property database is 2400 (6). In studies in which 14C-pendimethalin was added to soil suspensions and incubated for 4 days, 55% of the radioactivity was
unextractable with methanol(7). In experiments in which 14C-ring-labeled pendimethalin was incubated in sandy loam soil (3.9% organic matter, pH 7.8) for 6 months, 15.3% was not extractable by acidified methanol(9). Accumulation in the more tightly bound soil fractions increased over 4 months. When 14C-ring-labeled-pendimethalin (52 mg/0.32 sq m) was applied to sandy agricultural and sandy forest soils in lysimeters (1 m depth, 60 cm diameter, respectively topped with winter wheat and leaf litter/grass) under outdoor conditions and leached at 1 m depth analyzed for radioactivity for 300 days, radioactivity was detected from three weeks onward to the end of the experiment(2). This radioactivity was neither the parent compound or carbon dioxide/carbonate, but rather water-soluble organic conversion products. After 300 days, 120-180 and 300-900 ug pendimethalin-equivalents had leached through the forest and agricultural soils, respectively. In another experiment in which pendimethalin (normal usage levels) was applied to outdoor lysimeters (1 sq m dia, 40 cm deep with 5 cm of peat moss/clay/sand on top and 35 cm of sand below) and watered with 440 mm over 51 days, < 1 ppb of pendimethalin was found in leachates collected over 37 days(4). Leaching studies using packed soil columns may underestimate herbicide movement in structured field soil that contain cracks, worm holes and roots(5). This was demonstrated for pendimethalin when 18-cm columns packed with Okoboji silty clay loam were irrigated with 63 cm of dilute calcium sulfate solution. While no pendimethalin leached through packed columns or those with simulated partial cracks (partial macropores), 0.14 to 0.78% of applied herbicide leached through a column with a continuous 6 mm macropore. The early arrival of pendimethalin in subsurface drains two days after application to test fields with loamy silt soil in Germany is consistent with fast flow through macropores (preferential flow), rather than equilibrium flow. This behavior occurred especially in autumn after application on dry loam silt soil(8). (1) Humburg NE et al; pp. 206-8 in Herbicide Handbook 6th ed Weed Society of America (1989) (2) Scheunert I et al; Sci Tot Environ 132: 361-9 (1993) (3) Mansour M et al; In: Mobility Degrad Xenobiot., Proc - Symp Pestic Chem 9th Delre AAM ed, Lucca, Italy: G Biagini pp. 421-9 (1993) (4) Odananaka Y et al; J Pestic Sci 19:1-10 (1994) (5) Czaraf GF et al; J Environ Qual 21: 110-5 (1992) (6) Wauchope RD et al; Rev Environ Contam Toxicol 123: 1-155 (1991) (7) Smith RH et al; Chemosphere 11/12: 855-61 (1979) (8) Traub-Eberhard U et al; Chemosphere 28: 273-84 (1994) (9) Nelson JE et al; Weed Sci 31: 69-75 (1983)]**PEER REVIEWED**

VOLATILIZATION FROM WATER/SOIL:
The Henry's Law constant for pendimethalin is 8.6(+/-5.4)X10^-7 atm-cu m/mol at 25 deg C(4), a value very different from that calculated from its vapor pressure, 3.0X10^-5 mm Hg(2), and water solubility, 0.275 ppm(2), which is 4.04X10^-5 atm-cu m/mol(SRC). Using the measured value of the Henry's Law constant one can estimate a volatilization half-life for pendimethalin of 72 days in a model river 1 m deep flowing at 1 m/s with a wind speed of 3 m/s(3,SRC). The volatilization half-life derived using the calculated Henry's Law constant is 1.7 days in a model river 1 m deep flowing at 1 m/s with a wind speed of 3 m/s(3,SRC). In a laboratory experiment, 35% of pendimethalin volatilized from an aqueous solution in 36 hr at 30 deg C(1) which is more in line with volatilization rates estimated using the calculated Henry's Law constant. The half-life of pendimethalin from distilled water in a static experiment was 3.85 days(5), and that from a glass plate in winter was 4.68 days(5). Pendimethalin readily volatilizes from leaf surfaces(1). (1) Pestemer W, Krasel G; pp 459-68 in Brighton Crop Protection Conf -Pests Dis Vol 2 (1992) (2) Humburg NE et al; pp. 206-8 in Herbicide Handbook 6th ed Weed
Volatilization loss of ring-labeled 14C-pendimethalin in 3 hr at 50 deg C with an air flow of 50 ml/min was measured for various soils at different moisture levels(1). The results were (soil, loss): Lakeland sand (0.5% organic matter, 7.0% soil moisture), 4%; Lakeland sand (0.5% organic matter, 15.3% soil moisture), 3%; Hagerstown clay loam (1.9% organic matter, 25.8% moisture), 3%; Littleton silt loam (5.2% organic matter, 25.0% moisture), 2%;(1). A laboratory study in which pendimethalin (0.5 ppm) volatilizing from dry, moist, and flooded Bosket sandy loam in a Petri dish was trapped on activated charcoal coated on the cover of the dish indicated that the amount of herbicide lost was very low at all moisture levels(2).

ENVIRONMENTAL WATER CONCENTRATIONS:

GROUNDWATER: Pendimethalin was detected in 14 of the 1405 wells sampled between 1984 and 1991 according to EPA's Pesticides in Ground Water Database(1). Twelve of the 776 wells sampled in Iowa contained levels between 0.020 and 0.900 ppb and 2 of the 124 wells sampled in Montana contained 0.02-0.05 ppb. No pendimethalin was found in wells sampled in California, Georgia, Mississippi, Nebraska, South Dakota or Texas. (1) USEPA; Pesticides in Ground Water Database. A compilation of monitoring studies: 1971-1991. A National summary. p. NS-163 (1992)

SURFACE WATER: Pendimethalin was detected in four rivers in the Lake Erie Basin(1). Levels were not reported. In 1985, preliminary sampling of four Michigan rivers found pendimethalin at 0.277 ug/L in 1 sample of the Pine River, 0.349 ug/L in 1 sample from the Clinton River and none from the Black and Belle Rivers. (2) Great Lakes Water Quality Board; An Inventory of Chemical Substances Identified in the Great Lakes Ecosystem Vol 1 Windsor, Ontario, Canada (1983) (2) Great Lakes Water Quality Board; 1987 Report on Great Lakes Water Quality, Appendix B Great Lakes Surveillance Vol 2, Windsor, Ontario, Canada (1989)

RAINFOG: The pendimethalin concn in two samples of California fogwater in 1985 was 1370 ng/L (Parlier, near Fresno - a fruit and citrus-growing area) and 3620 ng/L (Corcoran - a cotton growing area) (1). This represents a considerable enhancement, 3200 and 1500, respectively, over that which would be estimated from the air concentration and Henry's Law constant(1). The precipitation at two rural and 1 urban locality in Iowa was sampled during 10/87 and 9/90(2). Pendimethalin was found in 6 of 318 samples (1.9%) with median and maximum concentrations of 0.18 and 1.50 ug/L. In the spring and summer of 1985, pendimethalin was found in 3 of 25 samples of rain from Tiffin Ohio at levels of < 0.1 (2 samples) and 0.1-0.5 ug/L (1 sample) (3). No pendimethalin was found in rainwater from West Lafayette IN, Parsons WV, and Potsdam NY (3). Between June 1990 and August 1991, pendimethalin was found in 10 of 41 samples of rain from Schauinsland, Germany ranging from 0.099 - 0.260 ug/L, with a mean of 0.165 ug/L(3). It was not detected in 22 samples of rain from Deiselbach or 10 samples from Bensheim over a similar time period at a detection limit of 0.025 ug/L(3).
**EFFLUENT CONCENTRATIONS:**

Pendimethalin dissipation was studied following annual 1.7 kg ai/ha applications to 3 yr old Kentucky bluegrass turf growing on a Sharpsburg silty clay loam soil and an 85/15 by vol sand/Sharpsburg soil mixt in 150 cm deep rhizotron containers. Plant tissue, thatch, and soil were sampled periodically between application and 168 days after treatment. Soil and leachate were collected to monitor pendimethalin movement. Most of the herbicide appeared to remain within the turfgrass system. Pendimethalin concn was highest in plant tissue and thatch. The 4-hydroxymethyl pendimethalin metabolite was detected in turfgrass tissue up to 42 days after treatment. No pendimethalin was detected at the 30, 60, or 120 cm depths in the rhizotron containers. Traces (< 0.003 mg/kg) of pendimethalin detected in rhizotron leachate collected between 6 and 14 days after heavy rainfall (88 and 95 days after treatment, respectively) were attributed to gravitational displacement of soil colloids containing adsorbed herbicide. Pendimethalin application to established turfgrass would not appear to pose a high risk of groundwater contamination.


In German field trials, no pendimethalin was found in subsurface drain (av depth 80-110 cm) water in the spring/summer period(1). Following autumn applications, the maximum concn of pendimethalin in drain water was 0.7 ug/L(1). [(1) Traub-Eberhard U et al; Chemosphere 28: 273-84 (1994)]**PEER REVIEWED**

**SEDIMENT/SOIL CONCENTRATIONS:**

A review with 46 references of the performance and persistence of chlorsulfuron, chlortoluron, isoproturon, methabenzthiazuron, pendimethalin, terbutryn, and tri-allate. The persistence of all these herbicides decreases at higher temp and increased soil moisture content. Increased clay and organic matter content of soils increases their adsorption and thereby decreases leaching of most of these herbicides, as well as losses due to volatilization. [Eleftherohorinos IG; Zizaniologia 1 (4): 265-73 (1985)]**PEER REVIEWED**

**ATMOSPHERIC CONCENTRATIONS:**

The pendimethalin concn in two samples of interstitial air in fog in California in 1985 was 0.64 pg/L (Parlier, near Fresno - a fruit and citrus-growing area) and 3.6 pg/L (Corcoran - a cotton growing area)(1). [(1) Glotfelty DE et al; Nature 325: 602-5 (1987)]**PEER REVIEWED**

**FOOD SURVEY VALUES:**

Pendimethalin was not found in samples during FDA's 1993 regulatory monitoring program (12,751 samples)(1). [(1) Yess NJ et al; J AOAC International 76: 492-507 (1993)]**PEER REVIEWED**

**PLANT CONCENTRATIONS:**

After application of pendimethalin 60DG on irrigated and nonirrigated turfgrass field plots, the dislodgeable (detergent- stripped) pendimethalin residues on grass clippings were (concn irrigated (nonirrigated) plot in ug/sq cm @ time after application): 0.20 (0.40) @ 2 hr; 0.07 (0.24) @ 2 days; and 0.01 (0.03) at 7 days(1). In terms of percentages of nominal application rates, the dislodgeable residues for irrigated (nonirrigated) plots declined from 4.53% (9.21%), 2 hours after application, to 0.35% (0.75%) after 7 days(1). Pendimethalin completely volatilizes from leaf surfaces within 24 hr(2). [(1) Hurto KA, Prinster
ENVIRONMENTAL STANDARDS & REGULATIONS:

FIFRA REQUIREMENTS:
As the federal pesticide law FIFRA directs, EPA is conducting a comprehensive review of older pesticides to consider their health and environmental effects and make decisions about their future use. Under this pesticide reregistration program, EPA examines health and safety data for pesticide active ingredients initially registered before November 1, 1984, and determines whether they are eligible for reregistration. In addition, all pesticides must meet the new safety standard of the Food Quality Protection Act of 1996. Pendimethalin is found on List A, which contains most food use pesticides and consists of the 194 chemical cases (or 350 individual active ingredients) for which EPA issued registration standards prior to FIFRA, as amended in 1988. Case No: 0187; Pesticide type: herbicide; Registration Standard Date: 03/01/85; Case Status: RED Approved __/__; OPP has made a decision that some/all uses of the pesticide are eligible for reregistration, as reflected in a Reregistration Eligibility Decision (RED) document.; Active ingredient (AI): Pendimethalin; Data Call-in (DCI) Date(s): 09/04/90, 03/03/95, 10/13/95; AI Status: OPP has completed a Reregistration Eligibility Decision (RED) document for the case/AI. [USEPA/OPP; Status of Pesticides in Registration, Reregistration and Special Review p.141 (Spring, 1998) EPA 738-R-98-002]**QC REVIEWED**

Tolerances are established for the combined residues of the herbicide pendimethalin and its metabolite 4-((1-ethylpropyl) amino)-2-methyl-3,5-dinitrobenzyl alcohol in or on the following raw agricultural commodities: Beans, lima (dry, snap); Beans, forage; Beans, hay; Corn, fodder; Corn, forage; Corn, fresh (including sweet, kernel plus cob with husk removed); Corn, grain; Cottonseed; Peanuts; Peanut, hay; Peanut, forage; Potatoes; Rice, grain; Sorghum, fodder; Sorghum, forage; Sorghum, grain; Soybeans; Soybeans, forage; Soybeans, hay; and Sunflower, seeds. [40 CFR 180.361(a) (7/1/90)]**PEER REVIEWED**

Tolerances are established for the combined residues of the herbicide pendimethalin and its metabolite 4-((1-ethylpropyl) amino)-2-methyl-3,5-dinitrobenzyl alcohol and 3-((1-ethylpropyl)amino)-6-methyl-2,4-dinitrobenzyl alcohol in or on the following raw agricultural commodity: Peanut, hulls. [40 CFR 180.361(b) (7/1/90)]**PEER REVIEWED**

Tolerances with regional registration, as defined in 180.1(n), are established for the combined residues of the herbicide pendimethalin and its metabolite 4-((1-ethylpropyl)amino)-2-methyl-3,5-dinitrobenzyl alcohol in or on the following raw agricultural commodity: Garlic. [40 CFR 180.361(c) (7/1/90)]**PEER REVIEWED**

ACCEPTABLE DAILY INTAKES:
EPA Rfd= 0.04 mg/kg [USEPA/OPP; Health Effects Div Rfd/ADI Tracking Report p.44 (8/26/91)]**PEER REVIEWED**
STATE DRINKING WATER GUIDELINES:

(AZ) ARIZONA 280 ug/l [USEPA/Office of Water; Federal-State Toxicology and Risk Analysis Committee (FSTRAC). Summary of State and Federal Drinking Water Standards and Guidelines (11/93)]**QC REVIEWED**

(FL) FLORIDA 280 ug/l [USEPA/Office of Water; Federal-State Toxicology and Risk Analysis Committee (FSTRAC). Summary of State and Federal Drinking Water Standards and Guidelines (11/93)]**QC REVIEWED**

ALLOWABLE TOLERANCES:

Tolerances are established for the combined residues of the herbicide pendimethalin and its metabolite 4-((1-ethylpropyl)amino)-2-methyl-3,5-dinitrobenzyl alcohol in or on the following raw agricultural commodities: Beans, lima (dry, snap): 0.1 ppm; Beans, forage: 0.1 ppm; Beans, hay: 0.1 ppm; Corn, fodder: 0.1 ppm; Corn, forage: 0.1 ppm; Corn, fresh (including sweet, kernel plus cob with husk removed): 0.1 ppm; Corn, grain: 0.1 ppm; Cottonseed: 0.1 ppm; Peanuts: 0.1 ppm; Peanut, hay: 0.1 ppm; Peanut, forage: 0.1 ppm; Potatoes: 0.1 ppm; Rice, grain: 0.05 ppm; Sorghum, fodder: 0.1 ppm; Sorghum, forage: 0.1 ppm; Sorghum, grain: 0.1 ppm; Soybeans: 0.1 ppm; Soybeans, forage: 0.1 ppm; Soybeans, hay: 0.1 ppm; and Sunflower, seeds: 0.1 ppm. [40 CFR 180.361(a) (7/1/90)]**PEER REVIEWED**

Tolerances are established for the combined residues of the herbicide pendimethalin and its metabolite 4-((1-ethylpropyl)amino)-2-methyl-3,5-dinitrobenzyl alcohol and 3-((1-ethylpropyl)amino)-6-methyl-2,4-dinitrobenzyl alcohol in or on the following raw agricultural commodity: Peanut, hulls: 0.25 ppm. [40 CFR 180.361(b) (7/1/90)]**PEER REVIEWED**

Tolerances with regional registration, as defined in 180.1(n), are established for the combined residues of the herbicide pendimethalin and its metabolite 4-((1-ethylpropyl)amino)-2-methyl-3,5-dinitrobenzyl alcohol in or on the following raw agricultural commodity: Garlic: 0.1 ppm. [40 CFR 180.361(c) (7/1/90)]**PEER REVIEWED**

CHEMICAL/PHYSICAL PROPERTIES:

MOLECULAR FORMULA:

MOLECULAR WEIGHT:

COLOR/FORM:

ODOR:
Fruit-like [Purdue University; National Pesticide Information Retrieval
System, Pendimethalin Fact Sheet No. 50 (1985)]**PEER REVIEWED**

BOILING POINT:
330 deg C [Purdue University; National Pesticide Information Retrieval System, Pendimethalin Fact Sheet No. 50 (1985)]**PEER REVIEWED**

MELTING POINT:

CORROSIVITY:

DENSITY/SPECIFIC GRAVITY:

SOLUBILITIES:


Sol in aromatic and chlorinated hydrocarbon solvents. [Purdue University; National Pesticide Information Retrieval System, Pendimethalin Fact Sheet No. 50 (1985)]**PEER REVIEWED**

VAPOR PRESSURE:

OTHER CHEMICAL/PHYSICAL PROPERTIES:

The Henry’s Law constant = 8.6(+ or - 5.4)X10-7 atm-cu m/mol at 25 deg C [Fendinger NJ, Glotfelty DE; Environ Toxicol Chem 9: 731-5 (1990)]**PEER REVIEWED**

CHEMICAL SAFETY & HANDLING:

SKIN, EYE AND RESPIRATORY IRRITATIONS:
Solvent system in emulsifiable concentration may be irritating to skin and

FLASH POINT:

PROTECTIVE EQUIPMENT & CLOTHING:

PREVENTIVE MEASURES:

SRP: The scientific literature for the use of contact lenses in industry is conflicting. The benefit or detrimental effects of wearing contact lenses depend not only upon the substance, but also on factors including the form of the substance, characteristics and duration of the exposure, the uses of other eye protection equipment, and the hygiene of the lenses. However, there may be individual substances whose irritating or corrosive properties are such that the wearing of contact lenses would be harmful to the eye. In those specific cases, contact lenses should not be worn. In any event, the usual eye protection equipment should be worn even when contact lenses are in place. **QC REVIEWED**

STABILITY/SHELF LIFE:

STORAGE CONDITIONS:
Store above 40 deg F. Extended storage at temperatures less than 40 deg F can result in the formation of crystals on the bottom of the container. If crystallization does occur, store the container on its side at room temperature (70 deg F) and rock occasionally until crystals redissolve. Do not store near food or feed products. [Farm Chemicals Handbook 1991. Willoughby, OH: Meister, 1991.C254]**PEER REVIEWED**

DISPOSAL METHODS:
Group I Containers: Combustible containers from organic or metallo-organic pesticides (except organic mercury, lead, cadmium, or arsenic compounds) should be disposed of in pesticide incinerators or in specified landfill sites. /Organic or metallo-organic pesticides/ [40 CFR 165.9(a) (7/1/90)]**PEER REVIEWED**

Group II Containers: Non-combustible containers from organic or metallo-organic pesticides (except organic mercury, lead, cadmium, or arsenic compounds) must first be triple-rinsed. Containers that are in good condition may be returned to the manufacturer or formulator of the pesticide product, or to a drum reconditioner for reuse with the same type of pesticide product, if such reuse is legal under Department of
Transportation regulations (eg 49 CFR 173.28). Containers that are not to be reused should be punctured ... and transported to a scrap metal facility for recycling, disposal or burial in a designated landfill. /Organic or metallo-organic pesticides/ [40 CFR 165.9(b) (7/1/90)]**PEER REVIEWED**

OCCUPATIONAL EXPOSURE STANDARDS:

MANUFACTURING/USE INFORMATION:

MAJOR USES:  
Selective herbicide. Preemergence or postemergence in field corn; preemergence or postemergence incorporated use in potatoes; early postemergence use in rice; postemergence incorporated use in sorghum and preplant incorporated use in cotton, soybeans, tobacco, peanuts and sunflowers, controls most annual grasses and certain broadleaf weeds.  

GENERAL MANUFACTURING INFORMATION:

A mixture of 4-chloro-3,5-dinitro-o-xylene (0.61 mol), 3-pentaneamine (1.82 mols), and xylene (1,400 ml) is brought to reflux. After refluxing overnight, the reaction mixture is cooled and filtered. The precipitate is washed with petroleum ether. The filtrate and washings are combined, washed with 500 ml of 10% hydrochloric acid, and finally with 2 liters of water. The organic layer is separated and dried. Removal of the drying agent and the solvent leaves an orange oil which crystallizes with the addition of methanol. A yellow orange solid with meeting point of 56-57 deg C is collected in about 85% yield. [Sittig, M. (ed.) Pesticide Manufacturing and Toxic Materials Control Encyclopedia. Park Ridge, NJ: Noyes Data Corporation. 1980. 597]**PEER REVIEWED**

Damping-off caused by Rhizoctonia solani in cotton was increased in the field by the recommended rates of 11 soil herbicides. This increase was significant at p = 0.05, with all the herbicides, except for nitratin, trifluralin and linuron. Dinitroaniline herbicides (penoxalin, nitratin and dinitramine), at 50 ug/g sterilized sand, significantly increased cotton resistance to the pathogen. The relative disease indexes were 39.5, 29.7, and 40.5, respectively, while urea and triazine herbicides at the same rate, significantly decreased resistance; for example, relative disease index for fluometuron, linuron, tomilon, atrazine, and cyanazine were 204.9, 521.6, 289.2, 462.7, and 357.8, respectively. At 1 ug, trifluralin, atrazine, and bromofenoxim increased the cotton resistance; relative disease indexes were 8.1, 40.5, and 36.8, respectively. Thus, the effect of the herbicides on resistance depended on concn. The increase of the disease incidence by the herbicides under the field conditions might be due to a side effect of the cmpd on the soil microorganisms and soil microflora which could encourage potential pathogen. In addition, the possible microbial degradation products of the herbicides might affect the host susceptibility, hence the seedlings become less resistant to the pathogen. Other possibility would be that the degradation products of the herbicides might influence the pathogen virulence. [Khalifa MA S et al; Meded Pac Landbouwwet, Rijksuniv Gent 52 (3B): 1233-43 (1987)]**PEER REVIEWED**
FORMULATIONS/PREPARATIONS:

LABORATORY METHODS:

CLINICAL LABORATORY METHODS:
A method is presented for the analysis of trace amounts of dinitroaniline herbicides in tissue and excreta. The method employs extraction of the tissue or excreta with organic solvent, clean up by liq/liq partitioning or silica gel chromatography, and ultimate analysis by GC using ECD. Recoveries of > 80% were noted over the range 0.1-1.0 ug/g. [Edgerton TR et al; J Anal Toxicol 9 (1): 15-19 (1985)]**PEER REVIEWED**

ANALYTIC LABORATORY METHODS:
A method for the detection of ... pendimethalin ... in soils (and water) is described, based upon extraction with H2O or MeOH, concn (for the former solvent by reversed-phase solid extraction, for the latter by rotary evaporation), and analysis by HPLC (Hyposil ODS column, MeCN/H2O gradient elution, detection at 230 nm). Detection limits of 0.05 mg/kg are reported, with recoveries of 24-84 and 54-94% for H2O and MeOH extraction, respectively. Relative std deviations ranged 10-20%. [Michels K et al; Agribiol Res 44 (1): 37-48 (1991)]**PEER REVIEWED**

Pendimethalin ... residues were detected by a GC/MS data system equipped with a pulsed positive ion negative ion chemical ionization accessory. The following ions were monitored: pendimethalin, m/z 281- .... [Stout SJ, Steller WA; Biomed Mass Spectrom 11 (5): 207-10 (1984)]**PEER REVIEWED**

SPECIAL REFERENCES:

SYNONYMS AND IDENTIFIERS:

SYNONYMS:


Penoxalin **PEER REVIEWED**


FORMULATIONS/PREPARATIONS:


ADMINISTRATIVE INFORMATION:

HAZARDOUS SUBSTANCES DATABANK NUMBER: 6721

LAST REVISION DATE: 20030214

LAST REVIEW DATE: Reviewed by SRP on 9/14/1995

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Complete Update on 05/15/2001, 1 field added/edited/deleted.
Complete Update on 10/18/2000, 5 fields added/edited/deleted.
Field Update on 06/12/2000, 1 field added/edited/deleted.
Field Update on 06/12/2000, 1 field added/edited/deleted.
Field Update on 02/08/2000, 1 field added/edited/deleted.
Field Update on 02/02/2000, 1 field added/edited/deleted.
Field Update on 09/21/1999, 1 field added/edited/deleted.
Field Update on 08/26/1999, 1 field added/edited/deleted.
Field Update on 03/23/1999, 1 field added/edited/deleted.
Field Update on 06/03/1998, 1 field added/edited/deleted.
Field Update on 03/10/1998, 1 field added/edited/deleted.
Field Update on 11/01/1997, 1 field added/edited/deleted.
Complete Update on 02/28/1997, 1 field added/edited/deleted.
Complete Update on 02/03/1997, 1 field added/edited/deleted.
Complete Update on 05/14/1996, 1 field added/edited/deleted.
Complete Update on 03/25/1996, 20 fields added/edited/deleted.
Field Update on 02/01/1996, 1 field added/edited/deleted.
Field Update on 08/21/1995, 1 field added/edited/deleted.
Complete Update on 02/24/1994, 41 fields added/edited/deleted.