Product Safety Assessment
Benfluralin

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Select a Topic:

Names

- CAS No. 1861-40-1
- Benfluralin
- Benefin
- N-Butyl-N-ethyl-α,α,α-trifluoro-2,6-dinitro-p-toluidine
- BALAN® herbicide
- TEAM® Pro specialty herbicide

Much of the information in this document relates to the registration and sale of benfluralin products in the United States of America. For details applicable to other geographies, consult the relevant Product Label, Safety Data Sheet or Contact Us.

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Product Overview

- Benfluralin, or benefin, is the common name for the active ingredient in several preemergent herbicides registered to Dow AgroSciences LLC, a subsidiary of The Dow Chemical Company. For further details, see Product Description.
- Benfluralin is a yellow- to orange-colored crystalline solid at room temperature with an aromatic odor.[1] For further details, see Product Description.
- Benfluralin herbicides are registered to control grasses and other small-seeded broadleaf weed species. It is used on residential and commercial turf. Benfluralin can also be used on alfalfa, clover, birdsfoot trefoil, lettuce, non-bearing fruit and nut trees, nonbearing berries and vineyards, ornamentals, noncropland areas, fence rows/hedgerows, and Christmas tree plantations.[2] For further details, see the relevant Product Label and Product Uses.
- Workers could be exposed to benfluralin during manufacturing or formulating operations or during herbicide application in the field or on turf. Based on current use patterns, short- and immediate-term exposures to applicators for crop or noncrop uses are not of concern based on EPA evaluations. Consumers could be exposed to benfluralin when using plant or lawn-care products containing it or following applications on ornamental plants or residential lawns, at golf courses, parks, or other grassy areas.[3,4] For further details, see Exposure Potential.
- Eye contact with benfluralin may cause irritation with possible corneal injury. Effects may be delayed. Brief skin contact may cause moderate irritation with local redness. Prolonged or repeated skin contact may cause drying or flaking, but is not likely to result in absorption of harmful amounts. No adverse effects are anticipated from small amounts ingested or absorbed

during normal handling. Prolonged excessive exposure to dust may be harmful if inhaled. In animal testing, repeated exposure to excessive doses has caused effects on the kidney, liver, and skin.[5] For further details, see Health Information or the Safety Data Sheet.

- Benfluralin herbicide is highly toxic to aquatic organisms on an acute basis, but nontoxic to birds. Its bioconcentration potential is high. It biodegrades at a moderate rate and binds to soil and sediments. Benfluralin would not be expected to persist in the environment and would be removed by common wastewater-treatment processes.[6,7] For further details, see Environmental Information or Product Label.
- Benfluralin herbicides are stable under normal storage and use conditions. Avoid temperatures above 70°C (158°F) and avoid contact with strong oxidizers.[8] Consult the Product Label for specific use and storage information. For further details, see Physical Hazard Information.

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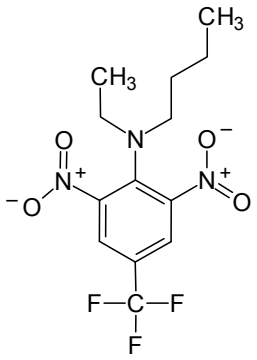
Manufacture of Product [9]

- **Usage** – In 2006 the estimated annual usage of benfluralin was 480 metric kilotonnes (~ 1 million pounds). Most was used on commercial and residential turf.
- **Process** – Benfluralin is produced using a complex and proprietary process. The structure of benfluralin is shown below.



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Product Description[10]

Benfluralin, or benefin, is the common name for N-butyl-N-ethyl-α,α,α-trifluoro-2,6-dinitro-p-toluidine, the active ingredient in several preemergent herbicides registered to Dow AgroScience LLC, a subsidiary of The Dow Chemical Company. Benfluralin is a yellow- to orange-colored crystalline solid at room temperature with an aromatic odor. It can be formulated as an emulsifiable concentrate, soluble concentrate/liquid, water-dispersible granules, granules, and crystalline solids. Benfluralin formulations are sold under the name Benfluralin 600 WG herbicide and the trade name BALAN® herbicides and are combined with trifluralin in the product TEAM® Pro specialty herbicide.

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Product Uses[11,12]

Benfluralin is used to control grasses and other small seeded broadleaf weed species. It is registered by the U.S. Environmental Protection Agency (EPA) for the following applications:

- Residential and commercial turf
- Crops – alfalfa, clover, birdsfoot trefoil, lettuce
- Nonbearing fruit and nut trees, berries, and vineyards
- Ornamentals

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- Christmas tree plantations
- Noncropland areas

Benfluralin products are also registered for use globally. Countries with registrations include Belgium, France, Italy, Spain and the United States.

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Exposure Potential[13,14]

Benfluralin is used in the production of commercial and residential herbicides. Based on the uses for benfluralin, the public could potentially be exposed through:

- **Workplace exposure** – Exposure could occur in facilities that manufacture or formulate products containing benfluralin. Those working with benfluralin in these operations could be exposed during maintenance, sampling, testing, or other procedures. Each facility should have a thorough training program for employees and appropriate work processes and safety equipment in place to limit exposure. Agricultural workers, roadside-maintenance workers, greens keepers, and others using benfluralin could be exposed while applying herbicides in the field. Applicators are expected to follow label precautions, including wearing personal protective equipment that is appropriate to the application method. See Health Information and Product Label.
- **Consumer exposure to products containing benfluralin** – Consumers could be exposed to benfluralin when using lawn-care products containing it or following applications at golf courses, parks, or other grassy areas. Consumers could be exposed to traces of benfluralin by consumption of residues in food and/or drinking water. The U.S. Environmental Protection Agency (EPA) has performed dietary risk assessment analyses to determine the safety of the public with respect to combined dietary and nondietary exposures to benfluralin and concluded they are not of concern.[15] See Health Information.
- **Environmental releases** – In the event of a spill, the focus is on containing the spill to prevent contamination of soil, ditches, sewers, waterways, or groundwater. Sweep up small releases with a broom and dispose of properly. If released to water, benfluralin is likely to bind to sediments. If exposed to sunlight, it photodegrades. Benfluralin biodegrades moderately in soil and sediments but will not persist in the environment. Benfluralin is highly toxic to aquatic organisms, but nontoxic to birds and honeybees. This description provides a general overview; please consult the relevant Safety Data Sheet or Product Label for more information about protective equipment and procedures. See Environmental, Health, and Physical Hazard Information.
- **Large release** – Industrial spills or releases are infrequent and generally contained. If a large spill does occur, contain the material and keep it out of waterways. Isolate the area. Personnel engaged in clean up of spills must wear appropriate protective equipment. Consult the relevant Safety Data Sheet or Product Label for more detailed information about protective equipment and procedures.
- **In case of fire** – Use water fog or spray, carbon-dioxide or dry-chemical extinguishers, or foam to fight the fire. Toxic and irritating gases and fumes will be formed in fire. Stay upwind of the fire. Firefighters should wear positive-pressure, self-contained breathing apparatus (SCBA) and protective firefighting clothing. If possible contain the fire water to minimize the potential for environmental damage. Follow emergency procedures carefully. Consult the Product Label and Safety Data Sheet for specific firefighting measures. See Environmental, Health, and Physical Hazard Information.
- **Emergency response information** – In the case of an emergency such as poisoning, product spillage, or fire associated with a Dow AgroSciences product in the United States call **800-992-5994** (more information is available at www.dowagro.com/rc/response/na.htm). For emergencies outside the U.S., access www.dowagro.com/re/response/index.htm for a list of country sites or contact pages for relevant information.

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Health Information[16,17]

Laboratory Testing – Before pesticides are registered by the U.S. Environmental Protection Agency (EPA), they must undergo testing for short-term (acute) and long-term (chronic) health effects. Laboratory animals are purposely fed doses high enough to cause toxic effects. These tests help scientists determine how chemicals might affect humans, domestic animals, or wildlife in cases of overexposure. Pesticide products used according to label directions are unlikely to cause toxic effects. The amount of pesticide that people and pets may be exposed to is low compared to the doses fed to laboratory animals.

Health information for benfluralin products is summarized on the relevant Safety Data Sheets. It is important to note that health risks associated with individual products may vary based on their formulation or intended use. The Safety Data Sheet is the preferred source for specific health information. These formulations may contain components or additives that have additional health risks. An overview of health information for benfluralin technical product appears below.

Eye contact – Eye contact with benfluralin products may result in severe irritation with slight corneal injury. Contact may cause pain disproportionate to the level of irritation to eye tissues. Effects may be delayed. Dust may cause irritation on injury due to mechanical action.

Skin contact – Brief contact may cause moderate irritation with local redness. Effects may be delayed. Prolonged or repeated skin contact may cause drying or flaking. Prolonged skin contact is unlikely to result in absorption of harmful amounts as benfluralin is poorly absorbed through the skin. Allergic skin reactions have been reported in animal testing.

Inhalation – Prolonged excessive exposure to dust may be harmful if inhaled.

Ingestion – This material has very low toxicity if swallowed. Swallowing small amounts incidental to normal handling operations is not likely to cause injury. In animal testing, repeated exposure to excessive doses has caused effects on the kidney, liver, and skin.

Other – Benfluralin is classified as “not likely” to be a human carcinogen by the U.S. EPA.

For more information, see the relevant Product Label or Safety Data Sheet.

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Environmental Information[18,19]

If released to water, benfluralin is likely to bind to sediments. If exposed to sunlight, it photodegrades. Benfluralin biodegrades at a moderate rate in soil and sediments and will not persist in the environment. Benfluralin is not expected to leach into groundwater, based on its low mobility in soil.

Benfluralin is practically nontoxic to honeybees and birds on an acute basis. However, it is very highly toxic to aquatic organisms on an acute basis.

For more information, see the relevant Product Label or Safety Data Sheet.

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Physical Hazard Information[20]

Benfluralin products are stable under normal storage and use conditions. Avoid contact with strong oxidizers.

Under fire conditions smoke may contain original material in addition to combustion products of varying composition that may be toxic and/or irritating. Combustion products may include and are

not limited to nitrogen oxides, fluorinated hydrocarbons, carbon monoxide and carbon dioxide. Consult the Product Label for specific use and storage information.

For more information, see the relevant Product Label or Safety Data Sheet.

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Regulatory Information

Regulations may exist that govern the manufacture, sale, transportation, use, and/or disposal of benfluralin. These regulations may vary by city, state, country, or geographic region. Information may be found by consulting the relevant Product Label, Safety Data Sheet, or Contact Us.

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Additional Information

- Safety Data Sheets and product labels (www.dowagro.com/label/index.htm)
- Contact Us (www.dowagro.com/contact/index.htm)
- *TEAM® Pro Specialty Herbicide Infosheet,* Dow AgroSciences LLC, Label Code: T01-085-004 (www.dowagro.com/label/index.htm)
- *EPA R.E.D. Fact Sheet: Benfluralin,* U.S. Environmental Protection Agency, Office of Prevention, Pesticides and Toxic Substances, July 31, 2004 (www.epa.gov/oppsrrd1/REDs/factsheets/benfluralin_fs.pdf)
- *EPA Reregistration Eligibility Decision for Benfluralin,* U.S. Environmental Protection Agency, Office of Prevention, Pesticides and Toxic Substances, July 2004 (www.epa.gov/oppsrrd1/REDs/benfluralin_red.pdf)

For more business information about benfluralin, visit the Dow AgroSciences LLC website at www.dowagro.com/.

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References

[1] *Benefin Technical Herbicide Material Safety Data Sheet*, The Dow Chemical Company, September 8, 2009, pages 1 and 4.
[2] "R.E.D. Facts: Benfluralin," Special Review and Reregistration Division, Office of Prevention, Pesticides and Toxic Substances, U.S. Environmental Protection Agency, EPA 738-F-04-007, July 2004, page 1.
[3] "R.E.D. Facts: Benfluralin," Special Review and Reregistration Division, Office of Prevention, Pesticides and Toxic Substances, U.S. Environmental Protection Agency, EPA 738-F-04-007, July 2004, pages 1 and 3.
[4] "Reregistration Eligibility Decision (RED): Benfluralin," Special Review and Reregistration Division, Office of Prevention, Pesticides and Toxic Substances, U.S. Environmental Protection Agency, EPA 738-F-04-007, July 2004, pages 1–3 and 11–31.
[5] *Benefin Technical Herbicide Material Safety Data Sheet*, The Dow Chemical Company, September 8, 2009, pages 1–2 and 5.
[6] *Benefin Technical Herbicide Material Safety Data Sheet*, The Dow Chemical Company, September 8, 2009, pages 5–6.
[7] "Reregistration Eligibility Decision (RED): Benfluralin," Special Review and Reregistration Division, Office of Prevention, Pesticides and Toxic Substances, U.S. Environmental Protection Agency, EPA 738-F-04-007, July 2004, pages 32–50.
[8] *Benefin Technical Herbicide Material Safety Data Sheet*, The Dow Chemical Company, September 8, 2009, pages 4–5.

[9] "Reregistration Eligibility Decision (RED): Benfluralin," Special Review and Reregistration Division, Office of Prevention, Pesticides and Toxic Substances, U.S. Environmental Protection Agency, EPA 738-F-04-007, July 2004, page 1.
[10] *Benefin Technical Herbicide Material Safety Data Sheet*, The Dow Chemical Company, September 8, 2009, pages 1 and 4.
[11] "R.E.D. Facts: Benfluralin," Special Review and Reregistration Division, Office of Prevention, Pesticides and Toxic Substances, U.S. Environmental Protection Agency, EPA 738-F-04-007, July 2004, page 1.
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[13] "R.E.D. Facts: Benfluralin," Special Review and Reregistration Division, Office of Prevention, Pesticides and Toxic Substances, U.S. Environmental Protection Agency, EPA 738-F-04-007, July 2004, pages 2–3.
[14] *Benefin Technical Herbicide Material Safety Data Sheet*, The Dow Chemical Company, September 8, 2009, pages 2–3.
[15] "Reregistration Eligibility Decision (RED): Benfluralin," Special Review and Reregistration Division, Office of Prevention, Pesticides and Toxic Substances, U.S. Environmental Protection Agency, EPA 738-F-04-007, July 2004, page 20.
[16] *Benefin Technical Herbicide Material Safety Data Sheet*, The Dow Chemical Company, September 8, 2009, pages 1–2.
[17] "Reregistration Eligibility Decision (RED): Benfluralin," Special Review and Reregistration Division, Office of Prevention, Pesticides and Toxic Substances, U.S. Environmental Protection Agency, EPA 738-F-04-007, July 2004, pages 11–31.
[18] *Benefin Technical Herbicide Material Safety Data Sheet*, The Dow Chemical Company, September 8, 2009, pages 4–5.
[19] "Reregistration Eligibility Decision (RED): Benfluralin," Special Review and Reregistration Division, Office of Prevention, Pesticides and Toxic Substances, U.S. Environmental Protection Agency, EPA 738-F-04-007, July 2004, pages 32–50.
[20] *Benefin Technical Herbicide Material Safety Data Sheet*, The Dow Chemical Company, September 8, 2009, pages 4–5.

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NOTICES:

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