Product Safety Assessment

Florasulam

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Select a Topic:
Names
Product Overview
Manufacture of Product
Product Description
Product Uses & Regulatory Information
Exposure Potential
Health Information
Environmental Information
Physical Hazard Information
Additional Information
References

Names
• CAS No. 145701-23-1
• Florasulam
• DERBY® herbicide
• BOXER® herbicide
• MUSTANG® herbicide
• N-(2,6-difluorophenyl)-8-fluoro-5-methoxy(1,2,4)triazolo(1,5c)pyrimidine-2-sulfonamide

Although much of the information in this document relates to the registration and sale of florasulam in the United States of America a number of other countries around the world, many of which are also member nations of the OECD (Organization for Economic Co-Operation and Development) have registered florasulam products. For further details consult the relevant country-specific Product Label, Safety Data Sheet, or Contact Us.

Product Overview
• Florasulam is the common name for the active ingredient in a family of triazolopyrimidine sulfonanilide-based herbicides marketed by Dow AgroSciences LLC, a wholly owned subsidiary of the Dow Chemical Company. These products are formulated as liquid concentrates and wettable granules. Florasulam is a systemic herbicide that internally disrupts plant growth resulting in weed death.¹ For further details, see Product Description.
• Florasulam is a broadleaf herbicide registered for use on wheat, barley, oats, rye, and triticale (wheat-rye hybrid).² For further details, see the relevant country-specific Product Label and Product Uses.
• In the U.S., florasulam is currently registered and sold for agricultural use only. Workers could be exposed to florasulam during manufacturing or formulating operations or during herbicide application in the field. Consumers could be exposed to traces of florasulam as residues on cereal grains or in drinking water; however, based on long-term risk-assessment calculations, florasulam has been deemed safe to the general public by the U.S. Environmental Protection Agency (EPA).³ For further details, see Exposure Potential.
• Eye contact may cause slight temporary irritation. Prolonged skin contact is essentially nonirritating. Repeated skin contact may cause irritation with local redness, but is unlikely to

¹ Trademark of The Dow Chemical Company (“Dow”) or an affiliated company of Dow
result in absorption of harmful amounts. No adverse effects are anticipated from inhalation exposure. For further details, see **Health Information**.

- Florasulam breaks down quickly in soil and water by microbial degradation, but based on stringent OECD test guidelines, this material cannot be considered as readily biodegradable. If released to the environment, it would not persist and would be removed by wastewater-treatment facilities. The potential for groundwater contamination by florasulam is low because of its low use rates, short soil half-life, and the limited soil mobility observed in field studies. Florasulam is practically nontoxic to birds on a dietary basis. For further details, see **Environmental Information** or **Product Label**.

- Florasulam herbicide formulations are stable under normal storage and handling conditions. Avoid extreme temperatures. Avoid contact with strong bases, acids, or oxidizing materials. Consult the **Product Label** for specific use and storage information. For further details, see **Physical Hazard Information**.

**Back to top**

**Manufacture of Product**

- **Capacity** – Dow AgroSciences LLC manufactures florasulam at facilities in Midland, MI USA and formulates products at various facilities around the world, including the U.S. and France.

- **Process** – Florasulam is made using a complex proprietary reaction scheme. The structure of florasulam is shown below.

![Florasulam Structure](image)

**Back to top**

**Product Description**

Florasulam is the common name for N-(2,6-difluorophenyl)-8-fluoro-5-methoxy(1,2,4)-triazolo-(1,5c)pyrimidine-2-sulfonamide, the active ingredient in a family of selective herbicides marketed by Dow AgroSciences LLC, a wholly owned subsidiary of The Dow Chemical Company. Florasulam is a highly active herbicide, meaning only a small amount of active ingredient is needed compared to traditional products. Florasulam products are usually formulated as liquid concentrates or wettable granules to be dispersed in water in the field or applied to foliage as a spray. Florasulam is absorbed by the foliage or roots of plants. It is a systemic herbicide, meaning it disrupts the internal growth processes of established weeds resulting in plant death 2 to 8 weeks following application. In the U.S., some florasulam products are marketed by Syngenta Crop Protection under the trade name ORION® herbicide. Florasulam products are also marketed as BOXER® herbicide, SPECTRUM® A herbicide, DERBY® herbicide, and BENCHMARK® A herbicide. Florasulam also a component of STARANE® XL herbicide, HUNTER® herbicide, CONCLUDE® herbicide, MUSTANG® herbicide, PRIMUS® herbicide, KANTOR® herbicide, and HIKER® herbicide.

**Back to top**

**Product Uses & Regulatory Information**

Florasulam is a highly-selective broadleaf herbicide. It controls major established broadleaf weeds without harming cereal crops, grassland, and turf. It is applied as a single application at rates as low as 0.00446 pounds (2 grams) of active ingredient per acre per growing season.
Florasulam products are registered for use in cereals (wheat, barley, oats, rye, and triticale) in many countries around the world, almost all of which are member nations of the OECD. These include Australia, Austria, Belarus, Belgium, Bulgaria, Canada, China, Croatia, Czech Republic, Denmark, Egypt, Estonia, Ethiopia, Finland, France, Germany, Greece, Hungary, Ireland, Israel, Italy, Japan, Kenya, Kazakhstan, Latvia, Lithuania, Macedonia, Morocco, Netherlands Norway, Pakistan, Poland, Romania, Russian Federation, Slovakia, South Africa, Spain, Sweden, Switzerland, Tanzania, Turkey, Ukraine, United Kingdom and the United States. Florasulam is also registered for use in turf, corn, and pastures in some countries.

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

Exposure Potential

Florasulam is used in the production of commercial herbicides. Based on the uses for florasulam, the public could be exposed through:

- **Workplace exposure** – Exposure can occur in facilities that manufacture or formulate florasulam. Those working with florasulam in manufacturing 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 could be exposed while mixing or applying herbicide in the field. Applicators are expected to follow label precautions, including wearing personal protective equipment appropriate to the application method. See Health Information and Product Label.

- **Consumer exposure to products containing florasulam** – In the U.S., florasulam is registered for agricultural use only. Consumers could possibly be exposed to traces of florasulam as residues in cereal grains or drinking water. The EPA performed dietary exposure and risk assessments using conservative estimates of florasulam concentrations in drinking water and on cereal crops. These calculations showed that the estimated level of exposure for the general population is several orders of magnitudes lower than the maximum determined safe level. The determined safe level is calculated from data obtained from laboratory animal exposure test results. 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. Florasulam breaks down quickly in soil and water by microbial degradation. If released to the environment, it would not persist and would be removed by wastewater-treatment facilities. The potential for groundwater contamination is low because of its low use rates, short soil half-life, and the limited mobility in soil observed in field studies. Florasulam is highly toxic to aquatic organisms on an acute basis. Sweep up or absorb small spills with sand or soil and place the recovered material in a suitable container for disposal. See Environmental, Health, and Physical Hazard Information.

- **Large release** – Industrial spills or releases are infrequent and generally contained. If a large spill does occur, dike the area to contain the spill and contact Dow AgroSciences LLC at 800-992-5994 for assistance. Consult the relevant country-specific Product Label or Safety Data Sheet for more detailed information about protective equipment and procedures. See Environmental, Health, and Physical Hazard Information.

- **In case of fire** – Keep people away. Isolate the fire and deny unnecessary entry. If possible, fight the fire from a protected location or safe distance. Immediately withdraw all personnel from the area in case of rising sound from a venting safety device or discoloration of the container. Contain fire water run-off if possible to minimize the potential for environmental damage. Toxic, irritating gases may be formed under fire conditions. Firefighters should wear positive-pressure, self-contained breathing apparatus (SCBA) and protective firefighting
clothing. Use foam, carbon-dioxide, or dry-chemical extinguishers to fight the fire. Foam systems are preferred because uncontrolled water can spread possible contamination. Follow emergency procedures carefully. Consult the country-specific Product Label and Safety Data Sheet for specific firefighting measures. Follow emergency procedures carefully. See Environmental, Health, and Physical Hazard Information.

- **Emergency Response Information** – In case of an emergency such as poisoning, product spillage, or fire associated with a Dow AgroSciences LLC product in the United States call 800-992-5994 (more information is available at www.dowagro.com/company/contact/index.htm). For emergencies outside the U.S., access www.dowagro.com/products/ for a list of country sites or contact pages for relevant information.

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

**Health Information**

Researchers use animal studies to define the potential for a pesticide to cause harmful effects to human health. These tests are carried out using doses high enough to cause toxicity (poisoning). Effects seen at toxic doses in animals are unlikely to occur after short-term, low-level exposure in humans. The level of exposure must be considered to estimate the risks of harmful effects.

Health information for products containing florasulam is summarized on the relevant Safety Data Sheet or Product Label. It is important to note that health risks associated with individual products may vary based on their formulation or intended use. These products may also contain other components or additives that have additional health risks. The country-specific Safety Data Sheet or Product Label is the preferred source for specific health information. An overview of health information below is primarily directed at the active ingredient florasulam.

**Eye contact** – Eye contact may cause slight temporary irritation. Solid or dust may cause irritation or corneal injury due to mechanical action.

**Skin contact** – Prolonged contact is essentially nonirritating. Repeated contact may cause slight irritation with local redness, but is unlikely to result in absorption of harmful amounts.

**Inhalation** – When used according to label directions, no adverse effects are anticipated from prolonged exposure to vapor.

**Ingestion** – This material has very low toxicity if swallowed. Swallowing small amounts incidental to normal handling operations is not likely to cause injury.

**Repeated exposure** – In animal testing, effects have been reported on the kidney.

**Cancer and birth defect information** – Florasulam did not cause cancer in laboratory animals. It did not cause birth defects or other toxic effects in the fetus even at doses that caused toxic effects in the mother.

For more information, see the country-specific Product Label or Safety Data Sheet.

**Environmental Information**

Florasulam displays herbicidal activity at very low application rates, resulting in low environmental impact. The bioconcentration potential (tendency to accumulate in the food chain) is low. Based on test guidelines, florasulam cannot be considered to be readily biodegradable. However, it has been shown to break down quickly in soil and water systems by microbial degradation. If released
to the environment, it would not persist and would be removed by wastewater-treatment facilities. The potential for groundwater contamination is low because of its low use rates, short soil half-life, and the limited soil mobility observed in field studies.

Florasulam is highly toxic to aquatic organisms on an acute basis, slightly toxic to birds on an acute basis (large, single dose), and practically nontoxic to birds on a dietary basis.

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

**Physical Hazard Information**

Florasulam herbicide formulations are stable under normal storage and handling conditions, but can decompose at elevated temperatures. Generation of gas during decomposition can cause rapid pressure build-up in closed systems. Toxic gases may be released. Store this material in the original container in a dry location. Avoid contact with strong bases, acids, or oxidizing materials. Consult the Product Label for specific use and storage information.

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

**Additional Information**

- Contact Us ([www.dowagro.com/company/contact/index.htm](http://www.dowagro.com/company/contact/index.htm))

For more business information about florasulam, visit the DowAgrosciences LLC web site at [www.dowagro.com/](http://www.dowagro.com/).

**References**

NOTICES:

As part of its 2015 Sustainability Goals, Dow has committed to make publicly available safety assessments for its products globally. This product safety assessment is intended to give general information about the chemical (or categories of chemicals) addressed. It is not intended to provide an in-depth discussion of health and safety information. Additional information is available through the relevant Safety Data Sheet, which should be consulted before use of the chemical. This product safety assessment does not replace required communication documents such as the Safety Data Sheet.

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Back to top

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