

Chemical Hazards

Biological and synthetic chemicals are used in the horticulture industry for control of pests and to aid in production of quality plants. It is important to follow label instructions and safety precautions to avoid personal injury or environmental damage.

Pesticide Safety

Pesticides are chemical agents that control pests. The majority of pesticides are organic compounds that interfere with a **physiological process** in the target pest organism. For this reason, many of these compounds are also hazardous to humans.

The danger involved in handling pesticides does not depend exclusively on how toxic the pesticide is. The danger or **hazard** related to a pesticide is a function of the amount and type of exposure one has to the pesticide as well as its toxicity. A pesticide may be highly toxic, but present little hazard to the applicator if personal exposure is limited by using protective clothing, proper equipment and following other precautions.

Signal words are used to indicate how acutely toxic the product is to humans. **Acute toxicity** is an adverse effect (from exposure to a harmful substance) on animals or humans, whereby severe symptoms develop rapidly and lead quickly to a health crisis. The signal word is not based on the active ingredient alone, but on the contents of the formulated product. It reflects the hazard of any active ingredient, carrier, solvent, or inert ingredient.

The signal word indicates the risk of acute effects from four routes of exposure to a pesticide product (oral, dermal, inhalation, and eye) and is based on the one that poses the greatest risk. The signal word does not indicate the risk of delayed (**chronic**) or allergic effects.

- ▶ **DANGER** signals that the pesticide is highly toxic, and is likely to cause acute illness from oral, dermal, or inhalation exposure, or to cause severe eye or skin irritation.

- ▶ **WARNING** signals that the product is moderately toxic, and is somewhat likely to cause acute illness from exposure or that it is likely to cause moderate skin or eye irritation.
- ▶ **CAUTION** signals that the product is slightly toxic or relatively nontoxic, with only slight potential to cause acute illness from oral, dermal, or inhalation exposure; skin or eye irritation, if any, is likely to be slight.



Figure 19. Pesticide container with signal word.

Another way to measure the short-term poisoning potential, or acute toxicity, of a material is by using the **LD₅₀** or **LC₅₀** rating of a product. LD stands for “Lethal Dose” and LD₅₀ is the amount of a material, given all at once, that causes the death of 50% (one half) of a group of test animals. LC stands for “Lethal Concentration”; LC₅₀ values usually refer to the concentration of a chemical in air that causes death of 50% of test animals, but in environmental studies it can also mean the concentration of a chemical in water. Lower LD₅₀ and LC₅₀ numbers indicate a more highly toxic pesticide.

The LD₅₀ and LC₅₀ ratings can be used:

- ▶ As an aid in developing emergency procedures in case of a major spill or accident.

Toxicity Classes: Hodge and Sterner Scale

		Routes of Entry			Probable Lethal Dose for a 70 kg (150 lb) Person
		Oral LD ₅₀	Inhalation LC ₅₀	Dermal LD ₅₀	
Toxicity Rating / Commonly Used Term		mg/kg (single dose to rats)	ppm (exposure of rats for 4 hrs)	mg/kg (single application to skin of rabbits)	
1	Extremely toxic	1 or less	10 or less	5 or less	1 grain (a taste or a drop)
2	Highly toxic	1 – 50	10 – 100	5 – 43	4 ml (1 tsp)
3	Moderately toxic	50 – 500	100 – 1,000	44 – 340	30 ml (1 fl oz)
4	Slightly toxic	500 – 5,000	1,000 – 10,000	350 – 2,810	600 ml (1 pt)
5	Practically non-toxic	5,000 – 15,000	10,000 – 100,000	2,820 – 22,590	1 liter (1 qt)
6	Relatively harmless	15,000 or more	100,000 or more	22,600 or more	More than 1 liter (1 qt)

Adapted from Canadian Centre for Occupational Health and Safety, www.ccohs.ca

Figure 20. Toxicity classes chart.

- ▶ To help develop guidelines for the use of appropriate safety clothing and equipment.
- ▶ For the development of transportation regulations.
- ▶ As an aid in establishing occupation exposure limits.
- ▶ As a part of the information on Safety Data Sheets.

Remember, these ratings are only ball park figures for lethal toxicity comparison. They say nothing about levels at which other acutely toxic, but nonlethal, effects might occur. See the toxicity class chart above for probable dosage ranges affecting humans.

Worker Protection Standards

The regulations of the 1992 Worker Protection Standard (WPS), administered by the Environmental Protection Agency (EPA) apply to all farms, forests, nurseries, greenhouses and retail establishments where pesticides are used in the production and maintenance of agricultural plants. The regulations are intended to protect workers and pesticide

handlers from exposure to pesticides, mitigate exposures that occur, and inform employees about hazards of pesticides. The WPS contains requirements for pesticide safety training, notification of pesticide applications, use of personal protective equipment, restricted entry intervals following pesticide application, decontamination supplies (water, soap and single use towels), and emergency medical assistance. A pesticide safety training program

AGRICULTURAL USE REQUIREMENTS

Use this product only in accordance with its labeling and with the Worker Protection Standard, 40 CFR part 170. This Standard contains requirements for the protection of agricultural workers on farms, forests, nurseries, and greenhouses, and handlers of agricultural pesticides. It contains requirements for training, decontamination, notification, and emergency assistance. It also contains specific instructions and exceptions pertaining to the statements on this label about personal protective equipment (PPE), and restricted-entry interval. The requirements in this box only apply to uses of this product that are covered by the Worker Protection Standard.

Do not enter or allow worker entry into treated areas during restricted entry interval (REI) of 12 hours. **Exception: if the product is soil-injected or soil-incorporated, the Worker Protection Standard, under certain circumstances, allows workers to enter the treated area if there will be no contact with anything that has been treated.**

PPE required for early entry to treated areas that is permitted under the Worker Protection Standard and that involves contact with anything that has been treated, such as plants, soil, or water is:

- Coveralls
- Waterproof gloves
- Shoes and socks

Figure 21. WPS statement on a pesticide label.

for all workers who come in contact with pesticide treated plants is also one of the requirements of the WPS.

Every person who applies or is exposed to pesticides on the job must receive basic safety training prior to their use. Safety precautions are listed on the label; the label is a guide to the safe handling and proper use of a pesticide. Always read the label before using any pesticide; it is illegal to use a pesticide product in any manner inconsistent with its label.

The WPS requires that a label specify the type of **personal protective equipment** (PPE) required when using the pesticide. The label also specifies first aid, cleanup and disposal procedures after chemical use. Personal hygiene, laundering pesticide contaminated clothing, and signs and symptoms of pesticide poisoning should be basic components of pesticide safety training.

It is vital that all employees have a thorough knowledge of the use and safety precautions of any chemicals they use or are exposed to on the job. Information from chemical labels and **Safety Data Sheets** must be kept in a convenient place and available for reference in case of emergencies. The **Florida Right-to-Know Law**, F.S. 442, declared that employees have an inherent right to know about toxic substances in the workplace in order to make



Figure 22. Accessible safety data sheets.

more knowledgeable and reasoned decisions with respect to the continued personal costs of employment and the need for corrective action. The law requires employers to give notice to each employee of the toxic substances involved in her or his employment that may endanger or cause death to the employee or members of the employee's family.

Chemical Storage

Fertilizers can alter or degrade the environment if not handled properly. Nutrients such as nitrogen (N) and phosphorus (P) in fertilizers can lead to the excessive growth of algae and noxious plants in estuaries, lakes, and streams.

Take care to prevent the contamination of nearby groundwater and surface water by storing fertilizer in an area that is protected from rainfall. Always store nitrate based fertilizers separately from solvents, fuels, and pesticides, since nitrate fertilizers are oxidants and can accelerate a fire. Ideally, fertilizer should be stored in a concrete building with a metal or other flame resistant roof.

When loading fertilizer into application equipment, make sure it is done in an area away from wells or surface waterbodies. A concrete or asphalt pad with rainfall protection is ideal, as it permits the easy recovery of spilled material. If this is not feasible, loading at random locations in the field can prevent a buildup of nutrients in one location. Fertilizers contaminated with pesticides may damage plants or generate hazardous wastes.

Clean up spilled fertilizer materials immediately; the collected material may be applied as a fertilizer. At fixed sites, cleaning can occur by sweeping or vacuuming (or with a shovel or loader for large spills), or by washing down the loading area to a containment basin specifically designed to permit the recovery and reuse of the wash water. Wash water generated should be collected and applied to the target crop. Discharging this wash water to waterbodies, wetlands, storm drains, or septic systems is illegal.

Pesticides must be stored in properly constructed and maintained areas to prevent problems or an expensive cleanup in the event of an accident. The best way to minimize storage problems is to minimize the amount of pesticides stored. Purchasing small amounts that can be used quickly is the best approach. Follow these general guidelines to store pesticides properly:

- ▶ Design and build pesticide storage structures to keep pesticides secure and isolated from the surrounding environment.
- ▶ Store pesticides in a concrete or metal structure with a leakproof roof and lockable door.
- ▶ Keep pesticides in a separate facility; or at least in a locked area separate from areas used to store other materials, especially fertilizers, feed, and seed.
- ▶ Do not store pesticides near flammable materials, hot work (welding, grinding), or in shop areas.
- ▶ Do not allow smoking in pesticide storage areas.
- ▶ Clearly identify pesticide storage areas.

Store personal protective equipment (PPE) in an area it is easily accessible in an emergency, but not in the pesticide storage area (since that may make it unavailable during an emergency). Check the label and the Safety Data Sheet (SDS) to determine the required safety equipment for each chemical used in the operation. Keep a written pesticide inventory and the SDS file for the chemicals on site in a separate location.



Figure 23. Pesticide door signage.

Chemical Spills

There are times during the course of chemical use, including gasoline and paint, when accidental spills occur. In such cases, prompt cleanup is essential to reduce hazards to workers, the general public and the environment.

Clean up spills as soon as possible.

Unmanaged spills may quickly move into surface waters and injure plants and animals. It is essential to be prepared for major or minor spills. The sooner a spill is contained, absorbed, and disposed, the less chance there is that it will cause harm. Always use the appropriate personal protective equipment as indicated on the SDS and the label for a chemical. In addition, follow the four steps below:

- 1) **CONTROL actively spilling or leaking materials** by setting the container upright, plugging leak(s), or shutting the valve.
- 2) **CONTAIN the spilled material** using barriers and absorbent material. For small spills, use kitty litter, vermiculite, shredded newspaper, absorbent pillows, clean sand, or pads. Use dikes to direct large spills away from drainage ditches, storm drains, ponds, sinkholes, or woods. Commercial absorbents specifically designed to soak up spilled materials can also be used. These types of products allow the absorbed material to be diluted into the spray mixture and applied as usable pesticide.
- 3) **COLLECT spilled material**, absorbents, and leaking containers and place them in a secure, properly labeled container. Some contaminated materials could require disposal as hazardous waste.
- 4) **STORE the containers of spilled material until they can be applied as a pesticide** or appropriately disposed. Small liquid spills may be cleaned up by using an absorbent such as cat litter, diluting it with soil, and then applying the absorbent to the target site as a pesticide in accordance with the label instructions.

Comply with all applicable federal, state, and local regulations regarding spill response training for employees, spill reporting requirements, spill containment, and cleanup. Keep spill cleanup equipment available when handling pesticides or their containers.

Accidental release of a pesticide covered by certain state and federal laws needs to be reported if the spill quantity exceeds the **reportable quantity** of active ingredient specified in the law (see SDS sheet). Very few of the pesticides routinely used in turf

management are covered under these requirements. However, workers should be familiar with the reporting requirements for any chemical used in landscape, nursery or greenhouse production and maintenance. The penalty is not in reporting a spill; it is in failing to report a spill.

It is important to contain spills and get them cleaned up as quickly and safely as possible. Having a good emergency spill kit on hand can help accomplish this task properly and minimize additional risks. When evaluating spill kits, make sure the right size is available for the type of spill anticipated. It may be necessary to have more than one kit in order to address all issues. When more than one kit is available, make sure each is labeled and stored to allow easy identification of the one needed in an emergency. The kit should also be easy to grab and transport to the location of the spill.

Emergency spill kits should contain personal protective equipment (PPE) like protective gloves, eye goggles, a breathing mask and other items that will help keep those who are cleaning a spill safe throughout the process. They should also contain safety signs to prevent people from coming into the area. Hazard tape can be placed around the spill to ensure people do not accidentally walk or drive through it. This will help ensure everyone is kept safe while cleaning up any type of spill.

To clean up minor spills:

- ▶ Keep people away from spilled chemicals.
- ▶ Protect the area from traffic.
- ▶ Do not leave unless someone is there to confine the spill.
- ▶ Use appropriate personal protective equipment.
- ▶ Confine the spill with the use of sand, soil, sawdust, mulch or any absorbent material.
- ▶ Shovel all material into a leak proof container for disposal.
- ▶ Dispose as you would excess pesticides according to label directions.
- ▶ Do not flood the area with water because this will spread the chemical.

BMPS for Pesticide Storage and Disposal

The following BMPs should be used for storing and disposing of pesticides:

- ▶ Maintain and follow labels on all pesticide containers.
- ▶ Store pesticides only in their original containers or make sure the new containers are properly labeled.
- ▶ Store similar pesticides together; for example, store herbicides with herbicides, and insecticides with insecticides.
- ▶ Store dry pesticides above liquids.
- ▶ Keep containers closed tightly.
- ▶ Inspect inventory frequently and watch for damaged containers.
- ▶ Store separately any pesticides that may be flammable.
- ▶ Limit the amount of inventory, and purchase only the amounts needed.
- ▶ **Triple rinse**, puncture, and crush empty containers. Clean all visible chemical from the container, including the container cap and cap threads. Follow the label directions for container disposal.
- ▶ Apply unused chemical mixtures or rinsate to a legal target at or below the label rate, or save it to use as make-up water for later applications of compatible materials.

- ▶ Work carefully and thoroughly until the area is completely cleaned up.
 - In the event of major spills:
 - ▶ Remain calm, keep people away, and contain the spill if possible.
 - ▶ Call Chemtrec, the local fire department, and state pesticide authorities for help.
 - ▶ If the spill is on a state highway, call the highway patrol or state highway department.
 - ▶ If the spill is on a county road or a city street, call the county sheriff or the city police.
- Chemtrec** stands for Chemical Transportation Emergency Center, a public service of the American Chemistry Council. Chemtrec provides immediate advice for those at the scene of emergencies; it is a 24-hour hazardous materials communications center. Information about the Chemtrec emergency call center is available at www.chemtrec.org.

EMERGENCY REPORTING TELEPHONE NUMBERS

For Ambulance, Fire, or Police

Dial 911

State Warning Point

24 hours Toll-Free • 1 (800) 320-0519

Florida Division of Emergency Management

(850) 815-4000

National Response Center

24 hours Toll-Free • 1 (800) 424-8802

(Federal law requires that anyone who releases into the environment a reportable quantity of a hazardous substance [including oil when water is or may be affected], or a material identified as a marine pollutant, must immediately notify the NRC).

FDEP Emergency Response

Jacksonville (904) 256-1700	West Palm Beach (561) 681-6767	Tampa (813) 470-5954	Pensacola (850) 595-8300
Orlando (407) 897-4100	Ft. Myers (239) 344-5600	Tallahassee (850) 245-2010	

HELP LINE TELEPHONE NUMBERS

(For chemical hazard information)

CHEMTREC Hotline (Emergency only)

24 hours Toll-Free • 1 (800) 424-9300

American Association of Poison Control Centers

Emergency • Information • Prevention
800-222-1222 or www.PoisonHelp.org

Public Law 96-510 and Public Law 92-5000 (CERCLA) require immediate notification of the appropriate U.S. governmental agency when oil or hazardous substances are discharged. The law states, "Any such person who fails to notify immediately such agency of such discharge shall, upon conviction, be fined not more than \$10,000 or imprisoned for not more than one year, or both." Under Chapters 376 and 403, Florida Statutes (F.S.):

- ▶ Any owner or operator of a facility who has knowledge of any release of a hazardous substance from a facility in a quantity equal to or exceeding the reportable quantity (see the SDS sheet) in a 24-hour period shall immediately notify the State Warning Point.
- ▶ The owner or operator having a discharge of petroleum products exceeding 25 gallons on a pervious surface (or any amount in a waterbody) must report such discharge to the Florida Department of Environmental Protection or the State Warning Point.

You will need the following information when reporting chemical spills:

- ▶ Name, address, and telephone number of person reporting.
- ▶ Name, address, and telephone number of person responsible for the discharge or release, if known.
- ▶ Date and time of the discharge or release.
- ▶ Type or name of the substance discharged or released.
- ▶ Estimated amount of the discharge or release.
- ▶ Location or address of the discharge or release.
- ▶ Source and cause of the discharge or release.
- ▶ Size and characteristics of the area affected by the discharge or release.
- ▶ Containment and cleanup actions taken to date.
- ▶ Other persons or agencies contacted.

Hazard Communication System

In 2003, the United Nations (UN) adopted the **Globally Harmonized System** of Classification and Labeling of Chemicals (GHS). The GHS includes criteria for the classification of health, physical and environmental hazards. It also specifies what information should be included on labels of hazardous chemicals as well as safety data sheets. One of the objectives of the work on the Globally Harmonized System (GHS) was the development of a harmonized **hazard communication system** (HCS), including labeling, safety data sheets and easily understandable symbols, based on classification criteria developed for the GHS.

The new labeling requirements outlined in the revised **OSHA Hazard Communication Standard** require each label to contain pictograms to alert users of the chemical hazard to which they may be exposed. Labels may have one or multiple pictograms depending on the chemical substance. The environmental pictogram is nonmandatory under the revised OSHA standard as environmental risks fall under the responsibility of the Environmental Protection Agency. Illustrations of pictograms and descriptions of associated hazards follow on the next page. From the top clockwise and to the center, each pictogram represents the following hazards:

- ▶ **Flame:** flammables, pyrophorics, self-heating, emits flammable gas, self-reactive, organic peroxides.
- ▶ **Human Health Hazards:** carcinogen, mutagenicity, reproductive toxicity, respiratory sensitizer, target organ toxicity, aspiration toxicity.
- ▶ **Flame Over Circle:** oxidizers.
- ▶ **Corrosion:** skin corrosion, burns, eye damage, corrosive to metals.
- ▶ **Exploding Bomb:** explosives, self-reactives, organic peroxides.
- ▶ **Gas Cylinder:** gasses under pressure.
- ▶ **Skull and Crossbones:** acute toxicity (fatal or toxic).

- ▶ **Exclamation Point:** irritant (skin and eye), skin sensitizer, acute toxicity, narcotic effects, respiratory tract irritant, hazardous to ozone layer.
- ▶ **Environmental (non-mandatory):** aquatic toxicity.

Production Area Safety

There can be a lot of traffic in the nursery/greenhouse production area. Plants are coming in from the field, trailers or modules are being moved, employees are going to and from work, and general traffic from associated people may be high. Some of the most important precautions in the production area are:

- ▶ Always be on the lookout for people or vehicles.
- ▶ Don't go too fast! Go even slower on rough or slick spots.
- ▶ Slow down when making a turn. On short turns, look to the rear to make sure that the towing vehicle does not hit the towed equipment.
- ▶ Never spin a tractor around by using one brake.
- ▶ Both brakes should be used when stopping a heavy load. If only one is used, the direction will be changed and if moving fast enough, the rig could jackknife and cause a serious accident.
- ▶ Before moving any load, make sure that no one is in the path of transport or under the trailer working on it.
- ▶ Do not drive close to fences, trees, ditches, vehicles, buildings, or other obstacles.



Figure 24. Hazard Communication Standard pictograms.

Constantly scan the area in all directions for hazards.

- ▶ Do not operate a tractor from anywhere other than the driver's seat.
- ▶ Do not allow anyone to ride on a tractor other than the driver.
- ▶ Be very careful when hitching to a trailer. Use a safety hitch pin and always be sure the device used to keep the pin secure is in place.
- ▶ Never mount or dismount a tractor while it is moving.
- ▶ Do not stand on the ground and start a tractor.
- ▶ When stopping a tractor, set the brakes. Before dismounting, shift the transmission into a low gear and wait until the engine has completely stopped turning.
- ▶ If a tractor has a ROPS (rollover protective structure or roll bar), fasten the seat belt while in operation.