

# POLLUTION PREVENTION

# Golf Courses Best Management Practices



Provided by:

Pinellas County Department of Environmental Management

Pollution Prevention and Resource Recovery Program

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# Pinellas County Department of Environmental Management's

## V I S I O N

*The Department of Environmental Management:  
Leadership Dedicated to a Sustainable Natural and Urban  
Environment in Pinellas County for  
Present and Future Generations.*

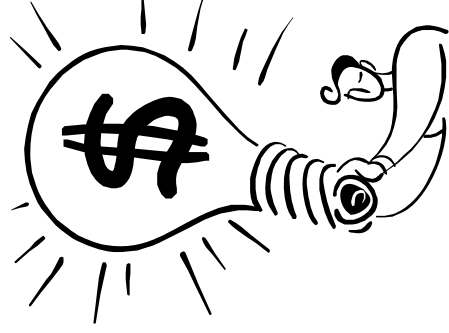


# About this Manual

This manual is designed to assist golf course superintendents and staff with pest and turf management in an environmentally sound manner. The inefficient use of raw materials and resources can result in excessive waste. Through proper education and training, businesses can minimize waste in Pinellas County, while improving their economic viability.

Manuals are developed by the Pollution Prevention and Resource Recovery (P2R2) Section of the Pinellas County Department of Environmental Management, a non-regulatory program that provides waste reduction technical assistance. Program staff provide information on new technologies, process modifications, substitute products, and current industry-specific Best Management Practices (BMPs). Staff can assist businesses in their efforts to protect our county's environmental resources, comply with regulatory requirements, while improving efficiency, profitability, and competitiveness.

As a Pinellas County business, no fees are charged for using the Pollution Prevention Program's services. On-site waste reduction assistance is available by contacting program staff at (727) 464-4761.



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## ***Introduction***

Golf courses are often criticized for adversely affecting the environment, but a well-managed, properly irrigated golf course can benefit the environment and the surrounding community in a variety of ways. Studies have shown that turfgrass absorbs ozone, carbon dioxide, and hydrogen fluoride. Components of smog may also be filtered, but this is not proven. Studies have not been published on the potential benefits of turfgrass on the reduction of global climate warming pollutants (Balogh and Walker, 1992), but turfgrass helps cool the atmosphere by absorbing warm air.

Course vegetation (shrubs, trees, etc.) produces oxygen as part of the plant's natural processes and removes pollutants from the air, rainfall, and irrigation water. The vegetation absorbs noise, helps recharge groundwater supplies by slowing runoff, prevents soil erosion, and provides a habitat for wildlife.

***In addition, properly designed and operated golf courses...***

- ▶ Provide visually appealing “green space” for urban settings
- ▶ Provide a use for wastewater by irrigating with reclaimed water
- ▶ Becomes an attractive and ecologically sound cover for old landfills, abandoned sites, etc.
- ▶ Encourage recreational activities on or near the course (jogging, walking, birdwatching, fishing, etc.)
- ▶ Provide jobs
- ▶ Add value to the surrounding land

Federal, state and local environmental regulations require that waste streams from turf maintenance operations are properly managed. With new golf courses opening around the world every day, public concern usually include the use of turf chemicals, water/soil quality impacts and the use of nutrient-rich irrigation water.

Best Management Practices (BMPs) and new technologies are available that offer course management staff an opportunity to reduce wastes while saving money and improving efficiency.

***Waste reduction practices can:***

- ▶ Reduce the use of chemicals
- ▶ Minimize the expense of waste disposal
- ▶ Reduce the exposure of workers and the general public to hazardous and toxic materials
- ▶ Reduce the threat of product liability
- ▶ Maximize compliance with environmental regulations and requirements
- ▶ Minimize impacts on the environment

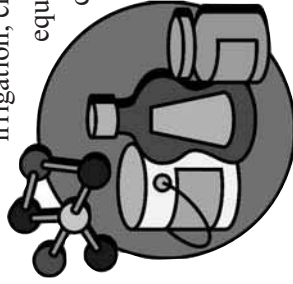
By practicing waste minimization you can improve your bottom line while increasing your business' competitive ability.

### ***What is pollution prevention?***

Pollution Prevention (P2) is the **reduction** or **elimination** of pollutants or wastes at the source. The idea behind pollution prevention is to avoid producing the waste in the first place. If the waste is not produced, then you don't have to worry about storage or disposal problems. Having less waste means a better environment for all of us.

### ***Wastes Associated With Golf Courses***

Waste can result from golf course operations such as pesticide use, irrigation, chemical storage, chemical mixing and loading, and equipment maintenance. The maintenance of a golf course requires the use of a considerable quantity of chemicals from pesticides and herbicides to fertilizers. All of these chemicals can cause water quality problems if runoff water is not properly managed.



Volatilization and air transport may be the primary means of widespread dispersion of pesticides in the environment (Balogh and Walker, 1992). Solvents such as xylene and aromatic petroleum derivatives have been used heavily on golf courses as pesticide carriers. During application, vaporization and particulate drift may occur, creating a potential to pollute through precipitation deposition.

Some wastes from golf course operations may be classified as hazardous by federal or state regulations and others, while not necessarily hazardous, could damage the environment if not handled properly. Whatever characteristic of the waste, all waste represents loss of resources and loss of money.

### ***Types of wastes from golf course operations could include:***

- ▶ Nitrogen and phosphorous-rich runoff to ponds and waterways
- ▶ Expired chemicals (fertilizers, paints, pesticides, etc.)

- ▶ Waste chemicals from mixing/loading operations
- ▶ Used oils, antifreeze, oil filters, and other shop-related waste from equipment maintenance

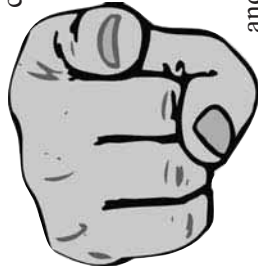
The most effective way to minimize the losses associated with waste is to avoid producing the waste in the first place.

***Waste reduction techniques include:***

- ▶ Improved operation and maintenance
- ▶ Use of new technologies
- ▶ Use of non-toxic or less toxic substitute chemicals
- ▶ Inventory management
- ▶ Water and chemical conservation
- ▶ Production process modification
- ▶ On-site recovery, recycling, and reuse

***What can you do?***

Turf care or maintenance programs present a number of avenues for contamination of the environment. Often safety issues are involved as well since materials which present long-term environmental threats may present more immediate health hazards.



Many pollution prevention practices are low-cost and low-risk alternatives to help minimize waste and the resulting disposal costs. Most of the approaches are based on common sense and do not require sophisticated technology. This manual contains some ideas to get you started. Your business may already be using pollution prevention practices without realizing it!



***Keep It Clean!***

Poor housekeeping results in spills. This may double your expense by making you pay to replace lost material and also for its treatment and disposal. It can also lead to accidents and worker injury. Good housekeeping is one of the easiest and least expensive way to reduce waste.

*Here are some tips:*

► **Keep your facility work areas clean and your floors dry.** Sweep floors and use dry or damp clean-up techniques (preferably dry). For example, use absorbent material for spills. If necessary, use a very small volume of water for final cleanup. This material should then be disposed of properly.

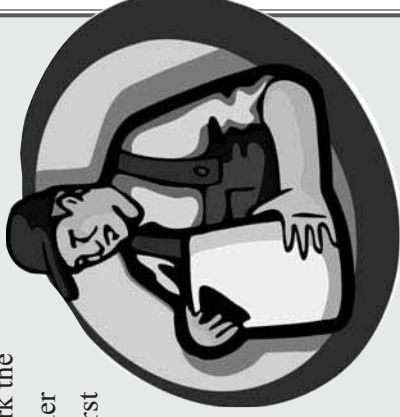
► **Practice good inventory control.** Mark the purchase date on containers so that older materials are used up first (“first in, first out” policy).

► **Keep all containers closed and properly labeled.** Uncovered containers can add to product losses from evaporation and spillage. Don’t forget the risk of hazardous air emissions.

► **Practice preventative maintenance to avoid future losses.** Inspect containers and equipment for leaks weekly.

► **Keep storage and work areas clean and well organized.**

► **Do not mix hazardous chemicals with non-hazardous chemicals.** Waste streams should be kept separate. Otherwise all of the waste will have to be treated as a hazardous waste. This can be very expensive.



*In The Clubhouse*

- Check plumbing for leaks monthly
- Shut off air conditioning units when clubhouse is not in use or raise the thermostat
- Use air-cooled systems instead of water-cooled systems where feasible

*Locker Rooms and Restrooms*

- Encourage water conservation
- Repair leaking toilets, faucets, and showers. If an entire toilet unit must be replaced, consider water-saving models.
- Consider installing timer or automatic faucets

- ▶ Install water-saving shower heads and fixtures
- ▶ Retrofit toilets to reduce the water used in flushing. Displacement devices and water-saving diaphragms are available.

### ***Course Maintenance***

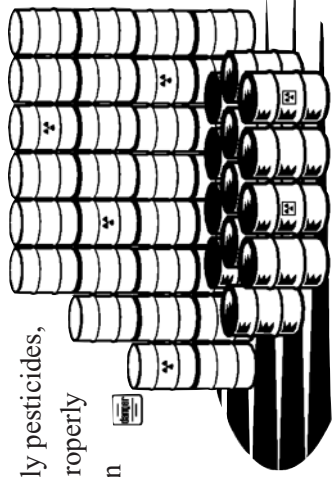
#### ***Construction and Monitoring***

Simulation and computer software models are important monitoring components of golf course management. Discuss with your industry associations currently available models to assist you in developing cost-effective water, pesticide and nutrient management practices that are environmentally sound. Current models are available that simulate nutrient transport, surface runoff, erosion, and chemical leaching.

If you are constructing a golf course, consult with local biologists, conservation experts, the county extension service, and other local organizations. Construction can destroy wildlife habitats and food sources. With reclamation and consultation of wildlife experts, these losses may be minimized. In fact, you may actually attract new species.

#### ***Chemical Storage***

Turf maintenance chemicals, especially pesticides, can cause environmental damage if improperly managed. Consideration should be given to containment of accidental releases, ventilation and employee safety.



***Consider these suggestions for storage of hazardous materials:***

- ▶ **Store on an impervious (sealed) surface**, i.e. resists infiltration or corrosion by the stored materials.
- ▶ **Store under cover**, whether indoors or outdoors, to keep out the rain. Check with the local Fire Department on fire code regulations regarding chemical storage.

- ▶ **Provide some type of secondary containment** that will hold up to 110% of the largest container stored in the area. This area should be able to catch and contain any leaks or spills.
- ▶ **Label waste containers properly**, including contents and date of generation for any hazardous wastes.

**HAZARDOUS WASTE  
 (or NON-HAZARDOUS WASTE)**  
**FEDERAL LAW PROHIBITS IMPROPER DISPOSAL**  
**If found, please contact the nearest police  
 or public safety authority or the U.S. EPA**  
 <type of waste>  
 <your business' name and address  
 and manifest document number>  
 <accumulation start date>  
 (the date when waste was first put in the drum)  
 <federal waste code numbers>

- ▶ **Make sure drums are easily accessible** but not stored in high traffic areas where they can be easily knocked over.
- ▶ **Be sure containers are properly sealed.** Regularly check for any signs of leaks, rust, etc.

### **Chemical Mixing and Loading**

Large concentrations of pesticides can build up in areas where these chemicals are regularly handled. Provisions must be made for managing water used in rinsing containers and application equipment. Spills are the usual source of chemical wastes in these areas. Small but frequently repeated spills in mixing and loading areas can pollute groundwaters, surface waters, and soils. Spills also represent lost products and money. Clean-up costs for pesticide contamination can be extremely expensive.

#### **You can prevent soil and water contamination by:**

- ▶ Preventing pesticide spills
- ▶ Preventing repeated small spills in one location
- ▶ Cleaning up any spill immediately

Typical causes of contamination in mixing/loading areas include leaking nozzles and hoses, valves left open, overflowing tanks, frequent spilling of pesticides, and cleaning of spray equipment.

Proper planning for a mixing and loading site is very important. A mixing and loading site that is not designed or constructed properly may require expensive reconstruction.

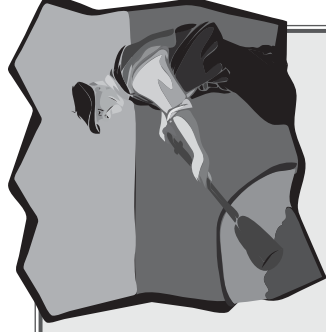
Before building, be familiar with available guidelines. The document, *Natural Resources Conservation Service Interim Conservation Practice Standard Agrichemical Handling Facility* discusses design, construction and operation of a fixed chemical mixing center and can be found at: <http://www.dep.state.fl.us/water/nonpoint/docs/nonpoint/nrcs703a.pdf>

**Listed below are just a few important planning considerations:**

- ▶ Locate the site as far as possible from unprotected groundwater wells and areas where runoff may carry spilled pesticides into surface water bodies.
- ▶ Use an impervious surface for mixing and loading, such as concrete. Steel or pesticide-resistant synthetics may also be used.
- ▶ A roof with adequate overhang over a permanent mixing/loading slab prevents runoff of hazardous pesticides.
- ▶ Plant vegetation to provide a buffer zone between a mixing/loading area and sensitive areas, such as wells, groundwater recharge areas, sinkholes, and surface waters.

**Excess Product and Mixtures**

- ▶ Contact the supplier or manufacturer to determine if excess product can be returned, or arrange for disposal with a licensed hazardous waste contractor.
- ▶ Excess mixture that is left over in the spray tank should be used on an appropriate site. It usually cannot be stored.
- ▶ Measure and calibrate carefully to avoid generating excess mixture.



## ***Empty Containers and Liners***

- ▶ Containers or liners that held pesticides listed as hazardous wastes must be empty before disposal. (These containers or liners must meet the definition of “empty” as defined in 49 CFR Part 261 of the Codes of Federal Regulations).
- ▶ Triple-rinse containers with water only or power wash to remove the pesticide.
- ▶ After triple-rinsing or power washing, punch holes in the pesticide containers to prevent reuse.
- ▶ Follow directions on the label for container disposal. Where recycling facilities are available, recycle containers at a pesticide container recycling facility, not at a general recycling facility.

## ***Underground Storage Tanks***

Underground Storage Tanks (USTs) are frequently used by golf courses for gasoline and petroleum product storage. While underground storage may help prevent explosions or fires, leaking USTs are a common cause of groundwater contamination. Cleanup can be very expensive, making prevention of USTs leaks and spills the best strategy.

***If your course has underground storage tanks, prevent costly cleanup by:***

- ▶ Checking for leaks weekly
- ▶ Performing tightness testing weekly
- ▶ Periodic monitoring of surrounding soils (e.g. monitor wells)
- ▶ Inventory control

Remember that storage tanks, if 500 gallons or greater in capacity, whether above ground or underground, must be registered with the Pinellas County Health Department, 4175 East Bay Drive, Clearwater, Florida 33764, (727) 538-7277, <http://www.pinellashealth.com/enviroengineering/location.asp>

## ***Equipment Maintenance***

Maintenance of turf care equipment and other vehicles creates a number of waste streams including used oils, used antifreeze, oil filters and other shop-related waste. Waste water from vehicle or equipment washing operations is another waste stream. If properly managed these wastes can be easily and

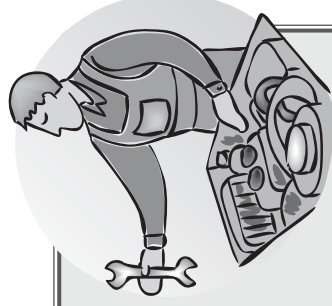
economically disposed of in compliance with all regulations and opportunities for contamination of the environment will be greatly minimized.

**Consider these lawn care equipment tips:**

1. Avoid spilling gasoline or allowing evaporation. Even small amounts of gasoline evaporate and contribute to the ground level ozone or “smog” problem.

- ▶ Use an easy-to-handle gasoline container size so you can pour slowly and smoothly.
- ▶ Use a spout or funnel when pouring gasoline into the equipment.
- ▶ Avoid overfilling the lawn equipment gas tank. Special nozzles with an automatic stop device keep the gasoline from pouring until the nozzle is inserted into the tank, stopping flow when the tank is full, and sealing the container when the nozzle is removed from the equipment gas tank. These inexpensive nozzles are available at most hardware stores.
- ▶ Close the gasoline container cap or spout and vent hole after pouring. Also remember to recap the equipment gas tank.
- ▶ Try to transport and store the gasoline container and power equipment out of direct sunlight and in a cool place.

2. Maintain and use your equipment properly. Properly maintained equipment will run cleaner, perform better, and last longer.



- ▶ Change oil as indicated in the owner’s manual.
- ▶ Regularly clean or replace air filters.
- ▶ Use the correct oil for the temperature (30W oil is recommended for summer temperatures). If operating two-stroke equipment, use the proper fuel/oil mixture.
- ▶ Get periodic tune-ups.
- ▶ Keep blades sharp and the underside of mowers clean.
- ▶ Winter-proof equipment each fall: empty all fuel, drain and replace oil (if used), check the air cleaner, clean the engine, and complete routine maintenance requirements of manufacturer.

- ▶ Reduce or eliminate solvent use by determining whether cleaning is really necessary.
- ▶ Use a multi-purpose solvent to reduce the types of hazardous waste that needs to be managed.
- ▶ Find less hazardous substitutes for solvents, such as citrus-based, water-based or detergent-based cleaners.
- ▶ Keep used oil and other vehicle fluids segregated from solvent wastes and carburetor cleaner.
- ▶ Label waste containers clearly to prevent contamination of non-hazardous wastes.
- ▶ Contract with approved recycling services for used antifreeze, lead acid batteries, used oil and oil filters.

3. Consider cleaner options and dispose of equipment properly. New, cleaner gasoline equipment is entering the market. Ask a dealer about these. Older equipment, because of the high emissions, should be disposed of at a local scrapper or recycler, instead of selling or giving away the equipment for use.

4. Reduce mowing time. Mowing less directly reduces emissions.

- ▶ Keep mower blades sharp, the underside of the deck clean, and cut grass efficiently to reduce running time.
- ▶ Choose low maintenance turfgrasses or grass/flower seed mixes which grow slowly and require less mowing. Check with University of Florida IFAS Pinellas County Extension (727) 582-2100 or a local lawn and garden center about appropriate grasses in Pinellas County.
- ▶ Decrease your green area by planting additional trees, shrubs and native wildflowers and plants that require little to no maintenance after planting.

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### ***Leaching***

Management of golf course turfgrasses is a science. Environmental conditions (such as climate, soil conditions and moisture levels) are involved that can promote pests and disease. These same factors can affect the degree to which nutrients and pesticides leach out of the soil.

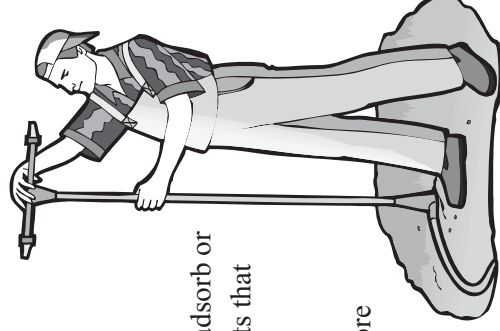
Soils that have smaller, flatter particle sizes - like clay - have more surface area and chemical charge. Pesticides or fertilizers tend to bind or adsorb to this larger surface area. Thus, all other factors being equal, soils with some clay particles are more likely to tie-up pesticides and fertilizers, potentially reducing the amount that can move into the groundwater. Sandy soils, with larger particles and less surface area, are likely to have more potential for leaching. However, by adding organic matter, the surface area can be increased, improving soil water retention and chemical adsorption.

**Soil moisture** can also affect leaching. Generally, dry soils will have more capacity or space for water than wet soils. Excessive irrigation or rainfall can increase the risk of chemical movement through the soil profile into groundwater or transportation by runoff water into surface water bodies.

Pesticide and fertilizer **binding properties** affect leaching as well. Some products are more likely to adsorb or bind to soil particles than others. In general, products that bind more tend to leach less.

**Persistence** describes how long products last before they are broken down. While lasting longer in the soil may be more effective, it also has more time to leach into groundwater. Persistence is determined by several factors, but principally by how the product degrades. Some products degrade faster in sunlight (photochemical degradation), some in water (chemical degradation), and others through the action of soil microbes (microbial degradation). Some products may even enter a gaseous state (volatilization).

**Solubility** is defined as the ability of a chemical to dissolve in water. The solubility of a pesticide must be considered in conjunction with the other factors. Less soluble chemicals may move slowly through the soil.



**Specific Gravity** compares the weight of a material to that of water and can have an impact on leachability. Lighter materials float on the surface of the water table and heavier materials sink.

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### ***Nutrient Management***

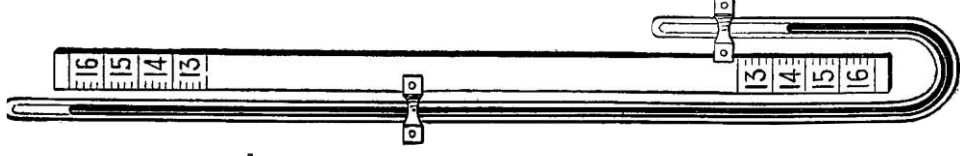
Nutrient management operations include fertilizing fairways and greens. Many courses base fertilizer application frequency, timing, and amount on annual soil analysis results, professional judgement, and the advice of the fertilizer supply company representatives. Soil testing can assess phosphorous and potassium needs. In established turfgrasses, testing every 1 to 3 years, depending on soil type and texture, can aid in reducing nutrient runoff or leaching.

The major wastes from fertilizer use are empty fertilizer bags and nitrogen and phosphorous contamination of surface and groundwater. Empty fertilizer bags are considered non-hazardous solid waste.

Nitrogen and phosphorous contamination can best be observed in golf course water hazards where signs of eutrophication (nutrient over-enrichment) include excessive algae growth. Rapid draining greens and a shallow water table facilitate leaching and nutrient loss to groundwater. Nitrogen surface water runoff can cause eutrophication of surface waters and groundwater contamination. Volatilization of nitrogen during fertilizer application may play a role in acid deposition and partial depletion of stratospheric ozone by nitrogen oxides. Surface applied urea fertilizers, animal wastes, and municipal wastes may cause volatile losses of ammonia or nitric oxide compounds to the atmosphere.

### ***Pollution Prevention Options for Nutrient Management***

Nitrogen is an important component of all plant proteins. Turfgrasses receive most of this nutrient through applied fertilizers that must be properly applied and managed in turf environments to avoid runoff. Proper application and management includes adjusting the rate and form of product



according to the soil type and expected rainfall or irrigation. Strategic landscaping can also reduce the potential for nutrient runoff into water supplies. The following recommendations may be helpful to incorporate into routine course nutrient maintenance:

- ▶ Plant a vegetative buffer around lakes, streams, and ponds to reduce the nutrient loading to waterways. Using native shrubs and groundcover eliminates the need for fertilizer and irrigation, once the vegetation is established.
- ▶ Maintain a thatch layer in your turfgrass to reduce potential nutrient movement.
- ▶ Leave grass clippings and leaves when possible and compost in low-maintenance areas of the course.
- ▶ Use slow-release nitrogen formulation to reduce the potential for nitrogen leaching and runoff into water bodies.
- ▶ Use less fertilizer.
- ▶ Use very little or no phosphorous.
- ▶ Determine existing conditions with available soil and irrigation water test data.
- ▶ Apply fertilizer periodically rather than all at once.
- ▶ Prepare a comprehensive Nutrient Management Program for course maintenance staff.
- ▶ Apply fertilizer near time of maximum plant uptake.
- ▶ Time fertilizer application to minimize leaching from rainfall or irrigation. Irrigate after fertilization to reduce volatilization. Do not over-water. One inch of water per week is a rule of thumb for most grasses.
- ▶ Iron can be used as an alternative to nitrogen on grasses that are not nitrogen deficient to give that healthy green appearance.
- ▶ Conserve water.

Using waste water and sludge to substitute for chemical fertilizers helps reduce solid waste levels and nutrient discharges from wastewater treatment plants. Odors, health concerns and public perception associated with waste-water/sludge use can be overcome through public outreach and treatment technologies. Pathogenic organism removal is achieved through disinfection

or biological treatment. The odor and weed seeds from sludge use can be significantly minimized by using heat-dried or composted sludge.

### ***Pesticide Management***

Insecticides, herbicides, fungicides, and fertilizers are tools that help ensure a healthy turf. Pesticides are used to limit the damage from insects, weeds, and plant diseases. When used properly, they are unlikely to run off into surface water or seep into groundwater.

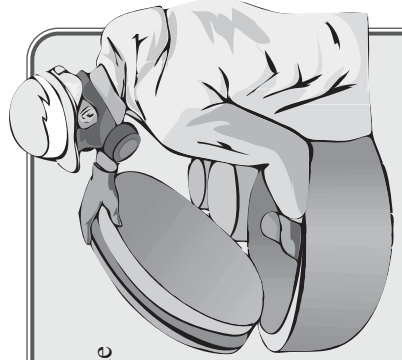
Wastes from pesticide use include empty containers, runoff, volatilization emissions, and effects on non-target areas or species. These wastes can be minimized through the following practices:

- ▶ Visually inspect greens daily for signs of disease or infestation.
- ▶ Identify the specific pest to be controlled and choose the least toxic pesticide available.
- ▶ Avoid using broad-spectrum insecticides.
- ▶ Use low mobility, high absorption, low persistence pesticides.
- ▶ Spot treat with pesticides on a green-by-green basis only when insect damage is evident.
- ▶ Use native shrubs to minimize the use of biocides.
- ▶ Apply fungicides only when climactic conditions are favorable for fungal growth.
- ▶ Purchase only the amount of pesticide needed for the immediate future.
- ▶ Minimize container waste by using formulations packaged in water-soluble packages.
- ▶ Read labels carefully to ensure proper and safe mixing, use, and storage.
- ▶ Mix pesticides carefully, using only recommended amounts. Avoid mixing excess quantities.
- ▶ When pesticides must be mixed, conduct a compatibility test before adding pesticides to tanks. Follow label instructions.
- ▶ Inspect and calibrate spraying equipment frequently to ensure proper mixing and application. Replace leaking hoses, fittings, and nozzles.

- ▶ Keep records of pesticide use, application rate, and application dates.
- ▶ Clean up all spills and leaks immediately. Keep clean-up supplies such as containment drums, kitty litter, shovel, broom, and dustpan in storage areas.
- ▶ Spilled pesticides can be handled as a product, rather than a waste, if label instructions are followed.
- ▶ Aerate turfgrass.
- ▶ Follow recommended mowing techniques to maintain a healthy pest-resistant lawn.
- ▶ Work with the University of Florida IFAS Pinellas County Extension.

### **Chemigation Equipment**

*If you use chemigation equipment:*



- ▶ Properly calibrate equipment.
- ▶ Flush injection equipment to prevent pesticide accumulation.
- ▶ Prevent runoff of mixture.
- ▶ Use anti-backsiphoning devices to reduce potential contamination of water supplies during irrigation.
- ▶ Flush irrigation system after pesticide injection.
- ▶ Periodically check equipment for application to intended target.

### **Rinse Waters**

*Minimize rinse waters by implementing the following management practices:*

- ▶ Wash out equipment only when necessary.
- ▶ Collect rinse water to make a mixture of the same or a compatible pesticide. The pesticide-containing water is not a waste if it is used as a pesticide. However, if not used, it may contain pesticides that would be regulated as hazardous waste.

▶ If rinse waters are reused, those containing pesticides regulated as hazardous wastes should be used within 90 days. Longer than 90 day storage requires notifying the Florida Department of Environmental Protection (FDEP) and a permit is required.

### **Pesticide Storage**

#### *When storing pesticides:*

- ▶ Storage facilities should be dry and well-ventilated with proper fire protection equipment.
- ▶ Clearly label and segregate containers.
- ▶ Store containers off the ground in an area where there is no possibility of flooding.
- ▶ Avoid storing pesticides that no longer will be used. When possible, return them to the manufacturer for relabeling or reprocessing.

Pest problems on golf courses can be detected during on-going monitoring. Maintaining written records of practices and monitoring results can assist you in your evaluation of management actions.

### ***Integrated Pest Management (IPM)***

Rising chemical costs, pest resistance to pesticides, and environmental concerns are primary incentives for Integrated Pest Management (IPM).

IPM involves treating pest and turf problems during ideal times in the most effective and environmentally sound manner available.

Through a combination of chemical, cultural, and biological control practices, IPM can be used to protect course turfgrass.

Integrated Pest Management can

have an important role in protecting the

environment by minimizing pesticide use on golf courses. Benefits include:



- ▶ Fewer pests and more beneficial populations
- ▶ Reduced pesticide costs
- ▶ Reduced liability for hazardous wastes
- ▶ Reduced potential for soil or water contamination

### ***Turf IPM Program***

Cultural practices that promote healthy turf reduce the potential for pests. Some practices modify microclimate while others disrupt host-pest relationships. IPM practices could include:

- ▶ Selecting turf suited for the climate area and conditions (heavy vs. light traffic)
- ▶ Preparing the site before planting to provide adequate drainage and promote healthy root growth
- ▶ Changing irrigation patterns
- ▶ Adjusting pH for grass cultivation
- ▶ Physically removing weeds
- ▶ Clearing underbrush to permit better air movement
- ▶ Planting warm season grasses in early summer and cool season grasses in the fall
- ▶ Applying fertilizers based on soil tests
- ▶ Watering in the morning to reduce the potential for water evaporation and fungal growth. The soil should be wet to a 6 inch depth once a week.
- ▶ Mowing only when plants are dry and only removing 1/3 of the leaf tip each mowing
- ▶ Applying soil or sand to level turf to break down thatch or to fill aeration holes
- ▶ Identifying pests accurately, then using pesticide only where needed
- ▶ Applying insecticidal soaps, sulphur-based fungicides/miticides, petroleum oil, and, if necessary, pyrethrin/rotenone combinations for more environmentally sound pest control

Non-chemical options for pests and disease include biological control agents, use of traps and attractants, natural pest predators, use of pest and disease resistant turfgrass, use of growth regulators, and modification of pest and disease habitat.

Biological controls such as microorganisms, endophytic fungi, nematodes and parasitoids have been used to control pests and disease. Microorganisms have been successfully used to control some grubs, sod webworms, and other insect pests. Other organisms such as parasitic wasps have shown success in controlling grub, chinch bug and mole cricket populations.

Endophytic fungi have been used to improve growth and disease resistance for several grass species. The grass actually acts as a host for the fungi.

### ***Natural Predators***

Natural predators of soft-bodied turfgrass pests include arthropods, mites, and various types of birds. Unfortunately, pesticides applied for pests harm the beneficial predators. Long-term use of pesticides eliminates beneficial predators and parasites, potentially increasing detrimental turfgrass pest populations. If chemical control is needed, timing of application is necessary to reduce the effects on natural predators.

### ***Traps and Attractants***

Traps and attractants have been developed for Japanese beetles. Sex attractants have been identified for armyworms, webworms and cutworms. Baits containing growth inhibitors and other biocides are effective in eliminating some pests, particularly colonial insects such as ants and termites.



If a biocide or growth inhibitor is not used, traps and attractants may be better utilized for monitoring pest populations because they increase populations and may cause an increase in damage to an area, more than would naturally occur if the pests were not guided by attractants.

### ***Pest and Disease-Tolerant Turfgrass***

Much research is being conducted to develop grasses more resistant to disease and pests. Improved grasses have shown resistance to insect damage, brown patch, powdery mildew, and several rusts. More research is needed on resistant varieties of perennial turfgrass. Further information is available through University of Florida IFAS Pinellas County Extension (727) 582-2100,

<http://coop.co.pinellas.fl.us>, or your Superintendents Association. (For further information on integrated pest management, read Ch. 5, Development of Integrated Management Systems for Turfgrass, from the book *Golf Course Management and Construction* by Balogh and Walker.)

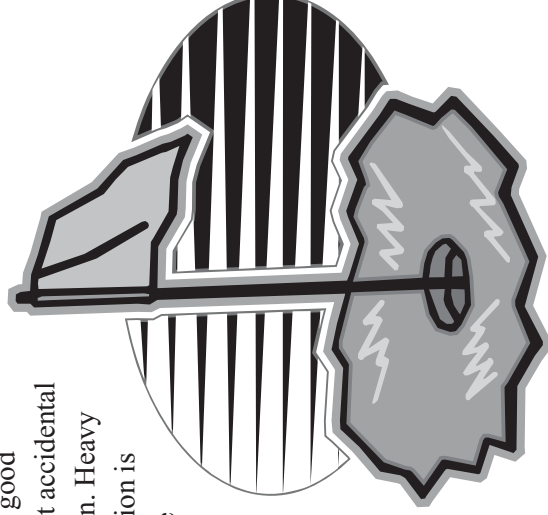
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## ***Runoff***

Surface water features such as ponds, lakes, and streams are an integral part of many golf courses. They not only provide an irrigation water source and a habitat for wildlife, but also add challenging obstacles to the course.

Protecting surface waters requires good planning by turf managers to prevent accidental pesticide and fertilizer contamination. Heavy rainfall soon after chemical application is the most common reason for surface water contamination.

Heavy rainfall can move the pesticide or fertilizer into surface waters because it has remained on the surface and not yet had a chance to be adsorbed by the soil, used by the plant, or broken down in the soil. Sloping terrain, thin turf, and poorly drained or compacted soils can also contribute to potential chemical movement into surface waters.



The United States Golf Association (USGA) sponsored research to determine the impact of several pesticides and fertilizers on groundwater and surface water. Please refer to the USGA web site: <http://www.usga.org/green/> for research results. Research indicates that when pesticides and fertilizers are properly used, potential for movement into groundwater is minimal. Each product needs to be carefully evaluated to assess product characteristics, site conditions, and environmental factors.

Newer, more advanced application equipment, lower pesticide usage rates, pesticides that degrade faster in the environment, and greater awareness of turf managers to the application of chemicals have reduced the potential for surface water contamination.

### ***Wetlands***

Wetlands have several important functions to our community. Not only do wetlands protect our surface and groundwaters, they also control pollution while recharging our aquifers. Wetlands are a habitat for fish and wildlife and provide community recreation areas.

***If your course is adjacent to wetlands:***



- ▶ Limit fertilizer application in areas adjacent to wetlands
- ▶ Use slow-release fertilizers
- ▶ Practice IPM
- ▶ Prevent chemical transport to wetlands by ensuring drainage systems do not empty directly into wetlands without some treatment. Buffer strips aid in preventing runoff.
- ▶ Prevent runoff and drift from irrigation systems
- ▶ Avoid stormwater runoff from impervious surfaces such as parking lots

### ***What to do with Hazardous Waste***

- ▶ **Keep all records of hazardous waste handled** on site for at least three (3) years. This includes amounts purchased, stored, reused, and hauled away.
- ▶ **Hazardous waste should be shipped out by a properly permitted hauler** to an EPA approved treatment, storage, and disposal facility. Check for all the proper local, state, and federal licenses. Contact the Pollution Prevention and Resource Recovery (P2R2) Program for a list of approved haulers.

► **The facility generating the waste should obtain an EPA identification number** from the address below, unless officially classified as a “Conditionally Exempt Small Quantity Generator.”

**Florida Department of Environmental Protection**  
**Southwest District**  
**Hazardous Waste Management**  
**3804 Coconut Palm Dr.**  
**Tampa, FL 33619-8318**  
**(813) 744-6100**

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### ***References Cited***

Sources of the information in this publication included the Florida Department of Environmental Protection document, *A Guide on Hazardous Waste Management for Florida's Agricultural Pesticide Users* and the book, *Golf Course Management & Construction Environmental Issues* Copyright 1992, James C. Balogh and William J. Walker, Lewis Publishers, Chelsea, MI, 951 pp. ISBN 0873717422.

## **Resources**

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### ***Assistance Centers and Information Sources***

#### ***Pinellas County***

Department of Environmental Management,  
Pollution Prevention Resource Recovery (P2R2)  
Program: .....(727) 464-4761  
Air Quality Division: .....(727) 464-4422  
Utilities/Solid Waste: .....(727) 464-7500

#### ***State of Florida***

Department of Environmental Protection  
Main Switchboard: .....(813) 632-7600  
Hazardous Waste Compliance Assistance Program: .....(800) 741-4337  
Florida Small Business Assistance Program: .....(800) 722-7457  
Pollution Prevention Information Clearinghouse: .....(202) 566-0799  
Earth 911 for Community Assistance: .....(877) 327-4911  
Southern Waste Information Exchange (SWIX): .....(800) 441-7949

***United States***

Environmental Protection Agency

Region IV, Atlanta: .....(404) 562-9900  
Small Business Assistance Ombudsman:.....(800) 368-5888  
Waste Reduction Resource Center: .....(800) 476-8686  
Education and Outreach: .....(800) 241-1754  
RCRA/Superfund Hotline:.....(800) 424-9346  
Occupational Safety and Health Administration (OSHA): (813) 626-1177  
Recycling Hotline: .....(800) 732-9253

***Additional assistance is also available through the following resources:***

Golf Course Superintendents Association of America.....(800) 472-7878  
1421 Research Park Drive ..... Fax: (785) 832-3643  
Lawrence, KS 66049-3859 .....<http://www.golfsuper.com>  
United States Golf Association .....(908) 234-2300  
P.O. Box 708 .....Fax: (908) 234-9687  
Far Hills, NJ 07931 .....<http://www.usga.org>  
Florida State Golf Association .....(813) 632-FSGA (3742)  
8875 Hidden River Parkway, Suite 110 .....Fax: (813) 910-2129  
Tampa, FL 33637  
Florida Golf Course Superintendents Association.....(800) 732-6053  
1760 NW Pine Lake Dr. ....(772) 692-9349  
Stuart, FL 34994.....Fax: (772) 692-9654

The P2R2 Program can provide additional resources regarding project funding, energy efficiency, product/equipment technology, and technical assistance. For information, contact our program at (727) 464-4761.

The P2R2 Section was developed to minimize the amount of liquid, solid, and gaseous pollution as well as energy and water consumption within Pinellas County.

If you are interested in the economic and environmental benefits of reducing wastes in your business, please contact the P2R2 Section at (727) 464-4761.



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The **P2R2** Section's mission is to minimize the amount of liquid, solid and gaseous pollution as well as energy & water consumption within Pinellas County.



For additional information, please contact the Pinellas County Department of Environmental Management Pollution Prevention and Resource Recovery Program at **(727) 464-4761**.

**Pinellas County Department of Environmental Management**

512 S. Ft. Harrison Avenue  
Clearwater, FL 33756



[www.pinellascounty.org/environment](http://www.pinellascounty.org/environment)



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(727) 464-4761/TDD-Text Phone (727) 464-4062