



# ***Golf and the Environment: Guidelines for the 21<sup>st</sup> Century***

***The United States Air Force  
Golf course Environmental  
Management (GEM) Handbook***

***January 2008***

**Pesticides & Pollution  
Prevention Section**

This Handbook is a slightly revised version of the 2006 Comprehensive Golf course Environmental Management (GEM) Planning booklet written and copyrighted by William H. Bushman/Ecodesigns.

**San Antonio, Texas**



*Combine the natural beauty of Kauai with Jack Nicklaus' design expertise and you get the awesome Kiele Course.*

## **Environmental Compatibility Categories**

Many diverse and complex aspects of golf course management have been revealed through the literature search conducted to compile this study. In order to simplify the process, these aspects have been summarized into eight main topics and incorporated into five distinct environmental compatibility categories.

- Planning & Compliance
- Operations & Maintenance
- Water Resource Management
- Conservation
- Pesticides & Pollution Prevention

The environmental compatibility quotient (ECQ) checklists have been compiled from several sources (Audubon International, 2000) (AFCEE, 2001) (Smart, et al, 1999). The ECQ checklists represent the best method currently available to determine the actual relative environmental compatibility of a golf course's management practices. The ECQ checklists can be completed through interviews with the golf manager and the golf course superintendent, a professional examination of the course's golf course management process, and review of the available environmental or planning documents.



*This pesticide mixing area is regularly inundated by rainfall.*

## **Pesticides & Pollution Prevention**

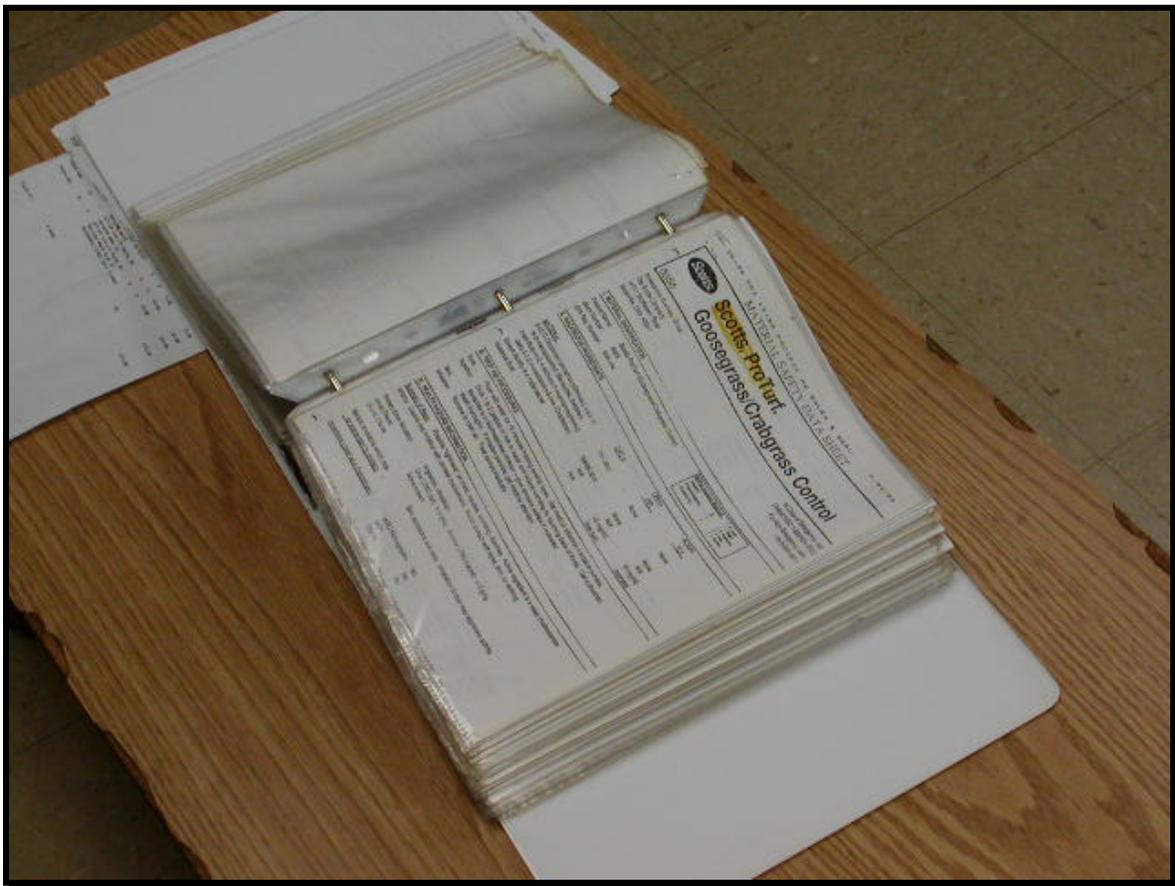
“The golf industry has come a long way since the heavy chemical application era of the 1950s and ‘60s. Most of the standard procedures of those days have been abandoned, in part through government regulation, in part because more efficient (and less toxic) chemicals have been developed. There’s something of a back-to-nature movement afoot among superintendents. The result is healthier turfgrass, greater diversity of plant material, increase biodiversity on the course, and less-poisonous runoff into the surrounding environment” (Klein, 1996).

The Federal Insecticide, Fungicide, and Rodenticide Act of 1947, or FIFRA, 1970, amended 1988, is the primary regulator for pesticide use on golf courses in the United States. “This act seeks to protect humans and the environment by providing for the controlled use of pesticides” (Kammel, et al, undated). Pesticides are defined as any substance intended for “preventing, destroying, repelling or mitigating any pest,” and substances intended for “use as a plant regulator, defoliant, or desiccant” (FIFRA § 2 (u), 7 U.S.C. § 136(u), 1997). “A pesticide may only be used as specified by the pesticide label and application of a pesticide other than as directed by the label is a FIFRA violation” (White, 2005). In addition, “All pesticides must be registered by the U.S. Environmental Protection Agency before they are allowed on the open market. However, registration does not ensure that

pesticide formulations have been tested adequately for health and environmental effects” (TNRCC, 1999).

Once they have been applied to turf, “pesticides are subject to many forces operating within the natural environment. Some are caused naturally like wind-induced drift, runoff, volatilization, and absorption” (Turgeon, 1980), whereas others “are a result of maintenance practices like mixing and handling and accumulation in clippings” (Schumann, et al, 1998).

“Other problems associated with pesticide use include direct contamination of storm drains with pesticide runoff, drift from lawn applications, unknown effects when chemicals combine (synergist effects), possible resistance to the chemicals by pests, and the killing of beneficial non-target species, including the pest’s natural predators. Pesticides can directly enter the groundwater system through spills around a poorly cased well, back-siphonage into domestic wells during spray tank/container filling, or improper disposal of pesticide containers” (TNRCC, 1999).



*A Material Safety Data Sheet, or an MSDS, must be readily available for all potentially harmful products anywhere on the golf course property.*

In maintaining golf courses for today's golfers, "pesticides and fertilizers are used only on certain portions of the golf course. The rest of the property often consists of natural areas not maintained with turf care products. These areas can provide a home for wildlife, and include a diverse variety of native plants and trees" (GCSAA, 1999). "Ecologically sensible use of biocides in golf course management should emphasize localized application of highly specialized toxins that act quickly, effectively, and which are then naturally and quickly degraded" (Smart and Peacock, 2000).

According to Hurzdan (1996), "Despite exhaustive research that has clearly established that properly selected and applied golf course fertilizers will not contaminate groundwater. Nearly the first reason given in opposition to a golf course project is that applied fertilizer will pollute the groundwater-or runoff of chemicals will kill fish in nearby water bodies, or massive bird kills occur as a result of golf course pesticides". Hurzdan (1996) continues "This is hogwash -pure urban legend - with no routine basis in fact, as isolated and unusual as lightning strikes, but at every environmental hearing these accusations are made."

"Next to having satisfied golf customers, complying with today's regulatory requirements has become the most important element for the golf course manager. Nearly every aspect of the business of growing high quality turf has come under the scrutiny of the regulator. Several articles in the turfgrass trade literature suggest that chemical management of turfgrass will not be a source of surface water or groundwater contamination if appropriate management practices are followed" (Balough and Walker, 1992).

### **Future complications**

No action since the elimination of diazinon use on golf courses has had the potential to affect the use of pesticides by golf course managers more than the Food Quality Protection Act of 1996. Under the Act, which addresses safety based on residue levels on food, the U. S. EPA must reassess all existing pesticide tolerances (more than 9,700) within the next ten years. The primary concern for superintendents is how the act determines risk and a hint that the Act will try to eliminate all of the organophosphates. Rather than quantifying risk one chemical at a time, the act will group related chemicals together and calculates their risk as a "family". For example, organophosphates such as popular Malathion, chlorpyrifos, and Orthene will be counted together. The same for carbamates and B1/B2 carcinogens that include most of the fungicides used on golf courses. Recently, Dursban, the trade name for chlorpyrifos, a long-time multi-purpose pesticide, was removed from the shelves for most users. Also on tap for the future, are lower application rates, lower frequencies of treatment, and longer time periods between applications (U.S. EPA, 2000).

The key result will be how the U. S. EPA will interpret those risks and apply them to golf course products. Eventually labeled use of some of these important pesticides on golf courses will be removed from many of the higher risk chemicals effectively limiting golf course managers' choices. Repercussions and impacts of the act are still being quantified and are expected to be significant. About the only

way superintendents can cope with these sweeping changes is to utilize natural pest control mechanisms whenever possible. "Healthy turfgrass is a powerful ally against infestations and integrated pest management programs are essential to the environmentally sound operation of the modern golf course" (Hock and Thomas, 1999).

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

Integrated pest management involves using a variety of management measures to keep turfgrass pest populations below levels that are economically and aesthetically damaging, without creating a hazard to people and the environment (Mackay, 2002). In August 1996, Congress declared that federal agencies "shall use IPM techniques in carrying out pest management activities and shall promote IPM through procurement and regulatory policies and other activities" (7 U.S.C. § 136r-l, August 3, 1996). One of the primary goals of IPM is to minimize pesticide use and dependency on chemicals, thereby lessening their impact on the plant ecosystem and the environment (Chaltas, 1987). One of the ironic realities of the golf course management business has always been that the good superintendents always employed IPM, but rarely, if ever, used the name or documented their regular, intuitive thought processes or pest management planning on paper. According to Audubon International (Mackay, 2002), the "basic components of Integrated Pest Management include:

- Employing sound cultural practices to promote plant health
- Scouting and monitoring potential pest populations and their environment
- Selecting thresholds for acceptable and unacceptable levels of pest injury
- Accurately identifying the problem and choosing the best management strategies
- Educating personnel about various management strategies
- Proper timing and spot treatment for cultural, biological, or chemical methods
- Evaluating the results and keeping records"

### **Pesticides & pollution prevention action items**

- Integrate management practices with appropriate regulatory requirements and procedures
- Create and maintain an attractive golf course facility that requires minimal outside chemical or fertilizer inputs
- Reduce total chemical loads by use of Integrated Pest Management, economic thresholds, alternate pest control options, and fertility testing
- Guarantee safe, healthy, and enjoyable experience for golfers while ensuring long-term success
- Properly store and handle all potentially harmful products to minimize employee exposure
- Increase training and involvement of staff on integrated pest management procedures
- Compile written pest profiles of common pest species
- Employ practices that eliminate or avoid the potential for polluting the environment and harming employees, customers, or the community

- Guarantee that the golf course facility will not allow chemicals, fertilizers, detergents, or petroleum products they use to migrate outside their property boundaries
- Increase number of trained scouts on staff
- Create and utilize a comprehensive pollution prevention plan for all aspects of the golf course and its facilities
- Regularly provide training for all employees on the specifics of pollution prevention and how they can help
- Completely cover equipment refueling area
- Insist on a pesticide facility that is at least safe and functional, if not state of the art
- Ensure compliance with appropriate pesticide regulatory requirements and procedures
- Minimize pesticide damage to non-target or desirable species

## Pesticides & Pollution Prevention Environmental Compatibility Quotient Checklist

<b><i>Pesticides &amp; Pollution Prevention</i></b>				
#	Environmental Compatibility Indicator	Yes	Partial	No
1	Are there minimally maintained, natural areas, no spray zones, and buffer areas around water features or sensitive landscapes and have they been communicated to equipment operators and pesticide applicators?			
2	A spill containment kit is readily available and spill containment procedures are in place?			
3	Does the chemical storage area have a sealed metal or concrete floor and are all pesticides handled over an impermeable surface?			
4	Does the chemical storage area have a lip along the edges to contain spills?			
5	Are liquid products stored below dry products and are dry materials stored on pallets or shelves to keep them off the floor?			
6	Are equipment or vehicle wash and wastewater kept from making direct contact with surface water?			
7	Is equipment cleaned with compressed air on part of the course instead of or prior to washing at a designated wash rack where pollution prevention measures are employed?			
8	Are gasoline, motor oil, brake and transmission fluid, solvents, and other chemicals used to operate or maintain equipment and vehicles prevented from directly or indirectly entering water bodies?			
9	Does the fuel storage/delivery area comply with local, state, federal, or other applicable regulations?			
10	Are written records maintained of all applications of pesticides to include: - the pest and treatment type (preventative/curative); - the location (specific playing area) of each pesticide used; - the area (SF/SM) and quantity of each pesticide used; - the chemical or common name of the active ingredient(s); - the date, location, or purpose of the application?			

**Pesticides & Pollution Prevention Checklist (continued).**

#	Environmental Compatibility Indicator	Yes	Partial	No
11	Is there a map of the course's "hot spots" that may require regular or special care or attention?			
12	Are there trained scouts on staff other than the superintendent to monitor turf and plant health and pest problems?			
13	Are there scouting forms utilized and are they collected and organized into a report or guide for use in future pest control decisions?			
14	Is there an established aesthetic or functional threshold for insects, fungal diseases, and weeds for all managed areas that may possibly reduce pesticide and fertilizer inputs?			
15	Are current copies of all Material Safety Data Sheets (MSDS) for all chemicals used anywhere on the golf course property maintained and readily available?			
16	Are chemical applicator(s) encouraged to apply for regular training to maintain currency?			
17	Is the chemical storage structure/area locked, well-ventilated, fire resistant and is access limited to appropriate personnel?			
18	Are records of pest treatments and their effectiveness maintained and used to guide future pest control decisions?			
19	Are golfers adequately notified in the pro shop and on the first and tenth tees about the day's planned or recently completed spraying of any chemical or fertilizer?			
20	Are there written pest profiles for common regional pests along with alternative potential control measures readily available?			
<b>Totals</b>				

## Environmental Compatibility Quotient Summary & Scoring Scale

<b>ENVIRONMENTAL COMPATIBILITY QUOTIENT SUMMARY</b>			
Environmental Compatibility Category	Yes	Partial	No
<b>Planning &amp; Compliance</b>			
<b>Operations &amp; Maintenance</b>			
<b>Water Resource Management</b>			
<b>Conservation</b>			
<b>Pesticides &amp; Pollution Prevention</b>			
<b>Totals</b>			

- Key to checklist responses

- **Yes** = Practice is complete or ongoing and can be verified
- **Partial** = Practice has been initiated but needs improvement or completion
- **No** = Practice is not in place

<b>ENVIRONMENTAL COMPATIBILITY QUOTIENT SCORING SCALE</b>	
Total Yes or Partial Responses	Environmental Compatibility Level
<b>86-100%</b>	<b>Advanced (Green)</b>
<b>70-85%</b>	<b>Showing progress (Yellow)</b>
<b>69% or less</b>	<b>Just started (Red)</b>



**Air Force Center for Engineering & the Environment  
Technical Directorate  
Natural Infrastructure Division**

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Please visit our Golf course Environmental Management (GEM) Program website:  
**<http://www.afcee.brooks.af.mil/ec/golf/>**.