facilities.

• 70-50 footcandles (standard) for Class A or below-minor-league baseball franchises.

• 30 footcandles for recreational participation lighting and smaller athletic facilities where there are less than 2,000 spectators, and the mounting structures are located less than 80 feet from the area to be lighted.

On some athletic field, notably baseball and softball, there are two levels of lighting—one for the infield and one for the outfield. A major league stadium may be 300 footcandles infield and 200 footcandles outfield. The newest minimum standards for minor league baseball are 100 footcandles infield and 70 footcandles outfield for AAA and AA levels. All other levels are 70 footcandles for the infield and 50 footcandles for the outfield. Little League has upgrade its recommended lighting levels for tournament sites from 30/20 to 50/30. Recreational lighting is 30/20.

Uniformity Of Lighting Levels

The other factor in determining good lighting quality is the uniformity ratio, which establishes the "smoothness" of lighting. Uniformity is based upon the comparison of the darkest location to the brightest location of the area to be lighted.

Recreational and participant requirements are met with a 3:1 ratio. When the facility requires 50-plus-footcandle lighting, it should have a uniformity ratio of 2:1 or better.

The newest AAA baseball lighting level requirements of 100 footcandles in the infield has a 1.2:1 uniformity ratio. Generally speaking, a uniformity ratio of 3:1 is necessary for smaller facilities and recreational facilities, while 2:1 is acceptable for larger facilities.

Once lighting and uniformity levels are established, lighting design for a facility can proceed. However, but there are two other primary factors to consider: economics and environment.

Economics

Sports lighting has use has grown and improved steadily since the first fields were lighted in the 1930s. Initially, the objective was to provide sufficient light for players to see and participate in the game. The major cost producers were power and the number of floodlights required. Major League stadiums, for example, required more than 1,000 floodlights, even before the advent of television.

All this changed with the introduction of the metal halide lamp. A rule of thumb for conversion from 1,500-watt incandescent lamps to 1,500-watt metal halide lamps is twice the light level with half the number of flood lights.

The other benefit of the metal halide lamp is the increase in lamp life. Incandescent lamps are frequently run above their average voltage to get more light and reduce the number of floodlights. This results in lamp lives from 300 to 600 hours. The lamp replacement cycle varies, but is usually less than five years. Metal halide, 1,500-watt lamps last 3,000 hours—translating to lamp life of 25 to 50 years. For sports lighting systems where the annual usage is around 100 hours, the lamps may never require replacement

The metal halide lamp requires a ballast. A well-designed ballast, operated within its design temperature, can last 100,000 hours. The manufacturer will guarantee the ballast for a minimum of

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Field Lighting: Illuminating Experiences

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five years. The reduction in systems power and maintenance cost has been a bonanza for municipal park and recreation departments that are short on funds.

One notable trend with economic ramifications in sports lighting is the packaged system. Sports lighting system suppliers offer standard systems to suit fields of various shape and sizes. All the necessary equipment and installation instructions are provided. A reduction in overall cost is realized through this system design approach, which integrates poles, floodlights, crossarms, and wiring into a package. This eliminates "duplication" that might result if the pieces were bought separately and enables the contractor to install the system in less than two days, providing that direct-burial poles are used.

At this point, it's important to address a major issue facing the sport lighting industry. Several major suppliers of sports lighting have created definitions utilized in lighting design that are contrary to existing lighting standards. Until recently, the accepted definition of the lighting industry's standard were established by the Illuminating Engineering Society of North America. Now there are several standards, which once again have significant economic ramifications.

SPORTS LIGHTING SYSTEM SUPPLIERS OFFER STANDARD SYSTEMS TO SUIT FIELDS OF VARIOUS SHAPE AND SIZES.

This confusion can be both illustrated and remedied very easily by addressing two items that are vital to establishing a design criteria:

1. In determining the lumen (light) output of a lamp, calculations should be based upon the established lumen output of the lamp manufacturer *after* 100 hours of operation. This is critical because there is a greater lumen loss in the first 100 hours than in the next 2,900 hours. Therefore, to measure light levels attained *in the initial hours of operation is a gross distortion of the lighting levels at which the system will operate during the majority of the life of the system.* Calculations should be based on the manufacturer's published lumen output after 40 percent of the life expectancy of the lamp. This is called "Maintained Footcandles" by lighting industry standards, but not all sports lighting manufacturers follow this definition. That makes it necessary to define terms such as "maintained" and "initial" by stating that design calculations should be based upon lumen output at a specified time in of the life span of the lamp.

2. In some sports, notably baseball, softball, and tennis, the playing areas include spaces outside the actual playing area. Therefore, the entire area to be covered in the design should be spelled out. And again, the I.E.S. standards call for a baseball area to include territory outside of the actual playing area, both the infield and the outfield. Though it may be decided in recreational facilities, as an example, that this is overlighting, some clearly understandable definition of the area to be lighted should be applied.

There are several things happening to improve sports lighting systems. For example, metal halide lamps are being designed specifically for sports lighting. This has resulted in greater efficiency and higher light output. The 1,650-watt metal halide lamp uses 10 percent more power, but reduces floodlight requirement 20 percent, compared to 1,500-watt lamps. Other lamp improvements increase the lamp life and are useful for high-use systems. Newer types of lamps being designed produce higher floodlight efficiency and better beam control.

Environment

"Spill light" into adjacent properties from lighted ball fields is a continuing problem. Many sports, particularly baseball and softball, require some light above the height of the pole. Without this light, a ball hit high over second base will only be lighted by the reflected light off the field, which is usually very low. Although sports lighting systems are being designed to minimize the problem, it will never disappear completely. Pole locations, aiming, and control features all help alleviate spill light.

Floodlights are being designed for reduced "spill light" into adjacent property and lower brightness for the players. Other innovations have been used to alleviate various problems. Special lamp shields, for example, were used on the infield poles for the new Camden Yards Stadium in Baltimore, home of the Orioles. The shields reduced glare for the outfield players, making it easier to follow the ball.

BEAR IN MIND THAT A LIGHTED SPORTS FIELD IS 1,000 TIMES BRIGHTER THAN A RESIDENTIAL NEIGHBORHOOD.

Computer-aided design makes it possible to calculate the light level on the ball from any direction and location within the playing area. Lighting designs can now address the visibility of the ball from any player location. The reduction of visibility due to floodlight brightness can also be estimated, but at present time no specific visibility standards exist. Computer programs exist that could make these calculations once the parameters are established.

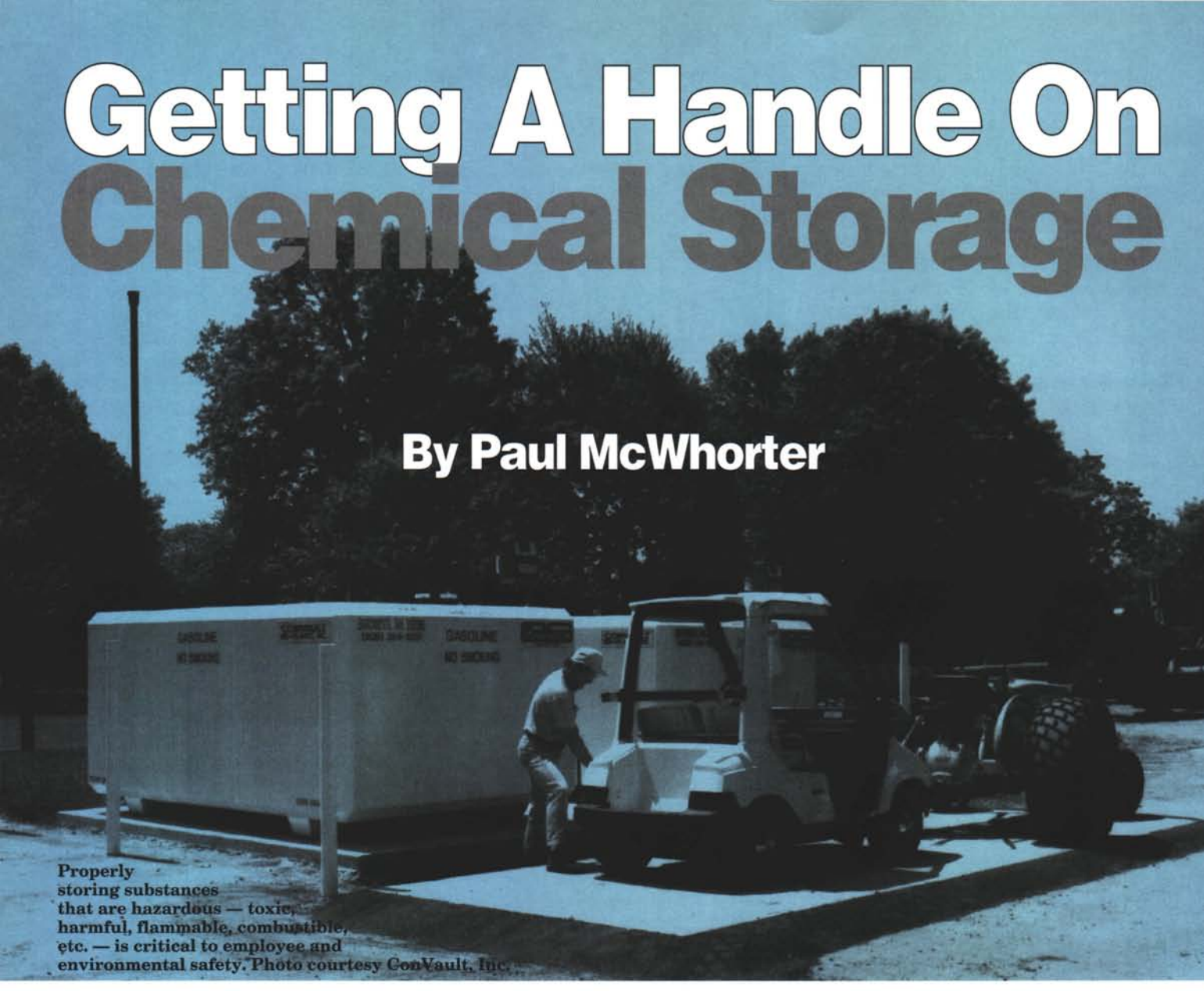
Bear in mind, however, that a lighted sports field is *1,000 times brighter* than a residential neighborhood and at least *30 times brighter* than a well-lighted commercial parking lot. That makes the very presence of a ball field in a residential setting a problem. And there is no single answer to it—the best solutions to the problem come from knowing the location of surrounding homes and solving stray light problems individually.

Developments in sports lighting will surely continue. The push will come from sport lighting system manufacturers, complimented by recommendations from the Illuminating Engineering Society Sports Lighting Committee. The result will be better visibility for the players and fans, without inconveniencing surrounding communities, so that sports action can continue after the sun goes down. ❑

Editor's Note: Chuck Lindstrom is the president of Universal Sports Lighting, Inc., based in Lincoln, IL.

Getting A Handle On Chemical Storage

By Paul McWhorter



Properly storing substances that are hazardous — toxic, harmful, flammable, combustible, etc. — is critical to employee and environmental safety. Photo courtesy ConVault, Inc.

Hazardous chemicals pose a time-honored challenge to mankind — how to safely deal with vital, yet potentially dangerous tools. To complicate matters, as we've learned to harness hazardous chemicals, our ongoing use of them requires outside monitoring to insure that use reflects adherence to their original purpose, while avoiding damage to mankind and the environment.

This particular development—the need to monitor—has created sometimes conflicting laws, as well as overlapping jurisdictional disputes. In the dichotomy of regulation, normally the federal government establishes general standards, which states and local governments must document as having met. These local entities then frequently apply a "stricter" interpretation of the overall guideline to ensure that local, geographical, population base, climatic, and additional pertinent factors anticipate proper safeguards.

Since 1970, the United States Environmental Protection Agency has taken the leadership role in propagating guidelines relative to storing substances that are hazardous—toxic, harmful, flammable, combustible, etc. These guidelines are traditionally presented to the governor of each state, who must respond on a timeline to the EPA with a written plan for the safe protection of his or her constituents. Parallelling these efforts are those registered by National Fire Code authorities, the U.S. Coast Guard (on those sites adjacent to navigable waterways), and OSHA, which protects employees who work in areas potentially exposed to hazardous chemicals.

State governors normally assemble an appropriate state resource group within their jurisdictions comprised of state fire authorities, water resource managers, air quality management district representatives, building code authorities, and third-party verification authorities (such as Underwriters' Laboratories). This group provides a plan for the ongoing monitoring of hazardous chemicals, which includes site installation guidelines and operations procedures, which must be both followed and documented.

The plan is then submitted to the governor's office, which refers it to the state's justice (legal) department to insure that all plans are written to comply with the federal measure. The

reviewed and revised plan is resubmitted to the governor, who then forwards it to the EPA. The agency, in turn, analyzes the plan and returns it to the governor for implementation or revision.

To say the least, the regulatory cycle is complex, particularly for the owner/user of any hazardous chemical container. In addition to the overwhelming amount of federal, state, and local legislation looms the omnipresent liability factor should any catastrophic event (spill, overfill, fire, leak, etc.) occur. Furthermore, the hazardous materials container market is not suited to manufacturers who are short-term players—they produce containers that have been improperly engineered, possibly untested by reputable third parties, and infringe on patents maintained by legitimate container producers.

So how does the end-user know what to buy? The answer is using "common sense" purchasing practices that apply to the balance of a person's business. *Any* capital investment that can impact an owner/operator's current and future *liability* and virtual existence must be approached in a practical manner, with the caveat, "Let the buyer beware," firmly in mind.

Two parallel tracks can be utilized in the screening and purchasing process:

1. Consult owner/operators who are storing chemicals locally.

2. Consult local regulatory offices who will guide you in making safe and permitted selection.

End users with experience and local regulatory officials are usually helpful in advising prospective buyers of drawbacks in certain designs. They can often help answer questions and address criteria regarding:

- Whether or not the container is patented (an indication of both innovation and proper engineering practices).
- Whether the chemical is hazardous in its normal state or generates hazardous vapor (as monitored by agencies such as the California Air Resources Board) which should be recovered during the maintenance of the container.
- Designs with inherent flaws, such as top-heavy units that could topple during seismic activity and seamed units that present a long-term settling effect, potential leakage, and more frequent inspections that unseamed units.
- Tanks that are susceptible to ultraviolet rays and brittling effects caused by exposure to sunlight.

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Storage

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The final consideration in the decision-making process for hazardous chemical containers concerns manufacturers' warranties and insurability of the container/installation itself. Warranties for tanks that are naked polyethylene, steel, or vaulted (steel or polyethylene tanks within a secondary containment bladder to contain primary vessel leaks and entombed monolithically in a six-inch concrete encasement for maximum protection) range from *no warranty* to 30-year warranties. The product's design usually dictates the warranty factors, as well as the properties of the chemical to be contained.

The rational for warranting a container is based on the longevity of a unit under normal conditions. For example, polyethylene may not corrode when exposed to chemicals, but might very well brittle and crack within two years due to sunlight effects. Therefore, the warranty might be set for 18 months. In addition, proper site preparation is generally a condition of a warranty—improper installation methods will void most warranties. An example of a longer term warranty might include seven years for citric acid, when stored in vaulted chemical container.

Insurance premiums are naturally adjustable to the type of chemical and medium for storage. Therefore, a mild chemical stored in a maximum-designed vault would generate a lower premium than lethal acid stored in a poly tank exposed to direct sunlight. Obtaining insurance coverage can be required by lending institutions that hold a mortgage interest in the owner/operator's property. The trend has been for banking firms to both recognize and enforce substantial insurance coverage for owner/operators who are required or want to store hazardous chemicals on their properties. The ability to maintain and repair a tank that suffers a catastrophic event is another factor in the amount of premium paid by the owner/operator.

Legislative efforts to improve and refine the regulation of chemical storage are ongoing and move quickly. Buyers must stay abreast of upgrades and changes within the regulatory community.

Legislative efforts to improve and refine the regulation of chemical storage are ongoing and move quickly. Buyers must stay abreast of upgrades and changes within the regulatory community. Thankfully, many designs offer the option of retrofitting to comply with new and stricter guidelines by separating the primary vessel from ancillary merchandise such as pumps, vents, etc.

Proper investigation of storing hazardous chemicals is a never-ending process, which ultimately prevents problems and, in the worst case, human and environmental tragedies. Those who recognize the eternal need for monitoring these factors are most productive, anticipate problems before they happen, and in doing so provide the safest working environment for themselves and their employees. Such efforts are generally appreciated and respected by regulators, courts, staff members, and even competitors. ❑

Editor's Note: Paul McWhorter is vice president of ConVault, Inc., headquartered in Denair, CA. ChemVault is a division of the company.

PRESIDENT-ELECT'S MESSAGE

Sports Turf Managers Association

By Greg Petry

STMA: An Investment Decision

When it comes time to pay membership dues, questions seem to mount faster than they can be answered. Do the benefits and services you receive as an STMA member outweigh the dues? With today's tight economy, how can you justify paying dues, much less volunteering time?

These are tough questions. Here are some answers.

STMA is shaping the future of the sports turf industry. We have more than 600 members committed to increasing the quality of care for sports turf and sports turf facilities. As the leader in "promoting better and safer sports turf areas," STMA assists you in your quest to become a better sports turf "professional."

It may be a bit philosophical, but to "unravel the secrets of the universe" you must become involved. We all have "comfort zones." Venturing outside of those zones can provoke anxiety—feelings that we may fail. Just remember that, in retrospect, it is usually the things we *haven't* done, rather than those we *have* done, that we most regret.

We need to take steps outside our comfort zones. Take on new challenges. The results will be personal and professional growth, as well as a strengthened organization.

Together, we must understand the role of STMA. That role is to focus outward as well as inward, not only developing new services for existing members, but also enhancing the image of the sports turf professional.

Yes, these are hard times. Justifying membership in STMA is a matter of decision making. We're talking about a return on your dollar.

How does that translate?

I'll never forget my visit to Jack Murphy Stadium in San Diego. Steve Wightman answered every question I asked—even questions I thought may have been dumb. After the tour, I really had the feeling that Steve was truly interested in my personal success.

I would never have met someone like Steve had I not joined STMA. Other members have also helped me grow professionally including Steve Cockerham, the late Harry Gill, Mark Hodnick, Henry Indyk, Ken Kurtz, Ken Mrock, Mike Schiller, and Doc Watson to name a few. I encourage you to make contacts and form friendships to help build your career. I directly attribute my salary level, career development, and success on the job to my involvement with STMA.

As an STMA member, I have opportunities to learn new techniques, increase my knowledge, and sharpen my skills. That's a direct return on my membership dollar.

As an STMA member, I have opportunities to learn new techniques, increase my knowledge, and sharpen my skills. That's a *direct* return on my membership dollar. I believe you'll find STMA membership provides a direct return on *yours*, and I hope you will participate in our association's activities as we embark on 1993. ❑

STMA CHAPTER NEWS

Chesapeake Chapter: STMA—The Chesapeake Chapter will hold their annual meeting at Festival Hall in Baltimore, MD, in conjunction with "Turfgrass 93," presented by the Maryland Turfgrass Council. "Turfgrass 93" is a three-day event, running January 6-8. A special sports turf session will be conducted on the afternoon of January 20, during which the Chesapeake Chapter: STMA's annual meeting will take place.

The annual banquet will be held on January 7, as part of a cruise departing from Baltimore Harbor.

For additional information on "Turfgrass 93," the meeting, the chapter, and its programs, contact Ray Flood at (301) 405-3320.

Iowa Sports Turf Managers Association— The Iowa Sports Turf Managers Association annual meeting will be held at 8 a.m. on January 20 at the Des Moines Convention Center, Des Moines, IA, in conjunction with the Iowa Turfgrass Conference.

The conference is a three-day event, from January 18 to 20, with both general sessions and concurrent educational sessions targeted specifically for golf course, lawn care, and sports turf and grounds professionals. Registration opens each morning at 7 a.m.

On January 18, workshops run from 8:45 a.m. to 4 p.m., with the grand opening of the trade show scheduled from 4 to 7 p.m. Monday workshops include two six-hour sessions: "Basic Turfgrass Management" and "Preparing for the Pesticide Certification Exam" and eight three-hour workshops: "Current Issues, with instructors Thomas Delany, director of state government affairs, Professional Lawn Care Association of America, and Mona Hood, executive director, Iowa Alliance of Environmental Concerns;" "Soils and Fertilizer;" "Golf Course Irrigation;" "Landscape Irrigation;" "Working With Weather;" "Sports Turf, with instructors Larry Leuthold, extension turfgrass specialist, Kansas State University, and Zac Reicher, extension turfgrass specialist, Purdue University;" and "Diseases of Turfgrasses on the Golf Course."

On January 19, the Pesticide Certification Exam will be held from 9 a.m. to 3 p.m. The morning is devoted to general sessions, beginning at 8 a.m. General Session I will include an Iowa State University Update and a new products introduction. General Session II will include "Issues Facing Turfgrass

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Managers in the Future," and "Pesticides and Human Health." The trade show opens at 11:30 a.m. The special Sports Turf and Grounds sessions will include "Sec Taylor Stadium Renovations;" "Weed Control on Sports Fields;" "Nitrogen Fertilizer Programs for Sports Turf;" "Soil Compaction Research Update;" and "Relationship Between IHSA and Turfgrass Managers," conducted by Dave Harty of the Iowa High School Athletic Association.

On January 20, the trade show is open and concurrent sessions will be conducted. The Sports Turf morning sessions include: "ISTMA Annual Membership Meeting;" "Legislative Issues for Public Grounds;" "Sports Turf Calendars, conducted by Roc Gaussoin;" "Potassium—An Essential Nutrient, conducted by Dr. Nick Christians;" and "Irrigation Installation on Sports Fields." The afternoon Grounds Maintenance Sessions include: "Landscape Development at the Casey's General Store Headquarters;" "Low Maintenance Grasses;" "Grounds Maintenance at Grinnell College;" and "Large Tree Decline in the Landscape."

For information on this meeting, the Iowa Chapter, its goals and activities, contact Gary Peterson at (515) 792-6433.

STMA Florida Chapter #1: An all-day event is scheduled for January 13, with STMA of Florida and Regal Chemical Company. C.E.U.s (Continuing Education Units) will be issued. Further details will be announced soon.

For information on the South Florida Chapter, or for details on meetings and chapter activities, contact John Mascaro (305) 938-7477 or Ed Birch (305) 938-0217.

Midwest Chapter: STMA— For information on the Midwest Chapter and chapter activities, contact Mike Trigg, Waukegan Park District, (708) 360-4750.

Colorado Chapter Sports Turf Managers Association— Plans are progressing for the annual meeting and banquet, which will be held December 30 at Mile High Stadium. Tickets for that night's Denver Nuggets Basketball Game will be available. This meeting will serve as a review of the past year's events and a kick-off for 1993 activities. For further details on the annual meeting, contact Mark Leasure of the Colorado Springs Sky Sox at (719) 338-0381, or Bill Whirty.

For information about the chapter and its activities, contact Bill Whirty at (303) 221-6660.

Carolina Chapter: STMA— Planning sessions continue for the Carolina Chapter as newly elected president, Joe Wilson, works with the board to outline future events.

For information on the Carolina Chapter and its activities, contact Marc Farha (facility manager of the Charlotte Knights) at (704) 332-3746.

New England Chapter: STMA— The New England Chapter STMA committees are planning for two major education events in 1993. The board is ironing out final details on the chapter bylaws and developing guidelines for membership categories within the chapter. Those interested in participating or seeking details on the chapter and its activities, contact Mary Owen, University of Massachusetts Cooperative Extension System at (508) 831-1225. ❑

STMA CONFERENCE AND EXHIBITION SCHEDULE

Saturday, December 12

2-6 p.m.—Early Registration.
6-8 p.m.—Welcome Reception.

Sunday, December 13

8:45-9 a.m.—"Welcome," STMA President Gil Landry, Ph.D., University of Georgia.
9-10 a.m.—"Sports Turf—and Then Some," George Toma, Kansas City Royals.
10-11 a.m.—"Perspectives on Athletic Field Expectations," from an athletic director, athlete, and grounds superintendent point-of-view.
11 a.m.-12 p.m.—STMA Annual Meeting
11 a.m.-5 p.m.—Exhibits Open.

Concurrent Workshops

1:30-3:30 p.m.—Workshop I: "ABCs of Soils," A.J. Powell, University of Kentucky, Chuck Dixon, Turf Diagnostics & Design.
1:30-3:30 p.m.—Workshop II: "Preparation of a Realistic Budget," Greg Petry, Waukegan, IL, Park District; Richard Caton, Ph.D. Turfcon.
9:15-10:30 p.m.—Exhibit Hall Reception.

Monday, December 14

8-11 a.m.—Session I:
"Basic Turfgrass Management," Clark Throsell, Ph.D., Purdue University.
"Turfgrass Traffic Tolerance," Steve Cockerham, University of California, Riverside.
"Turfgrass Water Management," Clark Throsell, Ph.D., Purdue University.
"Turfgrass Nutrition," Bruce Augustine, Ph.D. Lesco, Inc.
"Athletic Field Reconstruction," Henry Indyk, Ph.D., Turfcon.
8-11 a.m.—Session II:
"Innovations from the Industry," Larry Perotti, Sharp Brothers Seed Co.
"Maintenance of Athletic Fields on a Low Budget," A.J. Powell, Ph.D., University of Kentucky.
8-11 a.m.—Session III:
"Cool Season Weed Control," Dave Minner, Ph.D., University of Missouri.
"Warm Season Weed Control," Eugene Mayer, O.M. Scott & Sons Company.
"Seed Priming and Pregermination," Virginia Kanikeberg, Jacklin Seed Company.
11 a.m-5 p.m.—Exhibits Open.
12-1:30 p.m.—President's Lunch

Concurrent Workshops

2-4 p.m.—Workshop III: "STMA Chapter Development and Management," Ray Flood, Landscape Tech III; Mike Trigg, Waukegan, IL, Park District; Greg Petry, Waukegan, IL, Park District.
2-4 p.m.—Workshop IV: Tips from the Pros," Steve Wightman, Jack Murphy Stadium; Dale Getz, Notre Dame University; Tom Lujan, Mile High Stadium; Jesse Cuevas, Rosenblatt Stadium; George Toma, Kansas City Royals.
5:15-6 p.m.—STMA Exhibitor Meeting.
6-7 p.m.— Pre-Banquet Cocktail Reception.
7-9 p.m. STMA Awards Banquet.

Tuesday, December 15

8-8:45 a.m.—"Athletic Shoes and the Turf Surface," Kathleen O'Dell, Nike, Inc.
8:45-9:30 a.m.—"Effective Communication," Richard Caton, Ph.D., Turfcon.
9:30-10:30 a.m.—Turf Industry Publishers/Editors, "The Future of Sports Turf," Matt Trulio, *sportsTURF*; Jerry Roche, *Landscape Management*; Harry Cline, *Western Turf Management.*
10:30-11 a.m.—Memorabilia, Raffle, and Silent Auction Announcements.
11:30 a.m.-12:30 p.m.—Tour of the Hoosier Dome.
11 a.m.-1 p.m.—Exhibits Open/Festival Closing.
1-3:30 p.m.—Exhibitor Move-Out.
6:30-9:15 p.m.—National Federation of State High School Associations. ❑

Inside Flotation Tires

By Ross M. Fischer

Years ago, walking gingerly was the only way to cross a wet, grassy area without damaging the surface. Today, the human foot can do more damage to a damp sports field than an 8,000-pound tractor equipped with proper flotation tires. These rubber "tools" combat the age-old problems of soil compaction and rutting on sports fields, golf courses, and other turf areas around the country.

Flotation tires were developed during World War II. The United States military continually had problems with transporting vehicles across swamps and marshes. The military turned to the Goodyear Tire and Rubber Company for a solution. Goodyear, in turn, came up with the flotation tire, a large, low-pressure tire that disperses vehicle weight over a greater ground surface, thereby reducing compaction and rutting and enabling a vehicle to virtually "float" across the ground's surface. Since the air pressure in the tire itself is low, the tires are "softer" and don't "slice into" the ground, which further reduces compaction and rutting.

At the time, these tires were developed, available, and used only for military applications. Use and production of the products ended with World War II.

The problem of soil compaction, however, didn't end and was especially evident on sod farms and other areas of agriculture. In Monticello, IN, McCord Terra Tire Sales began offering flotation "Terra Tires" as an after-market option, and within a short period of time their popularity jumped. A variety of equipment now comes *standard* with some type of high-flotation Terra Tire.

Another option today, which improves the versatility of a piece of equipment, is increasing the size of its flotation tires beyond those supplied by the manufacturer. The most important benefit derived from making this change is increasing tire-to-ground-surface contact inches. This distributes vehicle weight over an even larger area, reducing pounds per square inch to the soil. The result is less compaction, less surface disturbance, and less rutting. Increased ground contact area, flexibility, and low inflation pressure of the tires combine for high-energy absorption and reduced rolling assistance because the tires penetrate the ground less. This translates to increased fuel efficiency and reduced fatigue on equipment and the operator.

Dual-wheel assemblies have also been used to combat compaction and ground disturbance. However, the weight of a flotation tire and rim is less than that of a dual-wheel assembly. As for maintenance, flotation tires require nothing out of the ordinary (although they do require special wheels). ❑

Editor's Note: Ross M. Fischer is the president of McCord Terra Tire Sales in Monticello, IN.

sportsTURF

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Equipment

AERATORS, LAKE

AERATION INDUSTRIES, CHASKA, MN
AEROMIX/AQUASCAPE TECH., MINNEAPOLIS, MN
AIRLAKE AERATION, LAKEVILLE, MN
AIR-O-LATOR, KANSAS CITY, MO
AQUAMASTER, KIEL, WI
AQUASCAPE TECHNOLOGIES, MINNEAPOLIS, MN
BAREBO INC, EMMAUS, PA
ECOPAK, SAN LUIS OBISPO, CA
FLEXALON, INC., SAN LUIS OBISPO, CA
KASCO MARINE, INC. LAKELAND, MN
LAKE AID SYSTEMS, BISMARK ND
RAIN JET DIV HARDIE, LAGUNA NIGUEL, CA
R.C. SHEAFFERS COMPANY, SANDWICH, IL
TORO COMPANY, MINNEAPOLIS, MN

AERATORS, SOIL

CLASSEN MANUFACTURING, NORFOLK, NE
CUSHMAN/RANSOMES, LINCOLN, NE
DABRO/SOLEX CORP., DIXON, CA
DEDOES INDUSTRIES, INC, OSSINEKE, MI
EMREX INC., TUNKHANNOCK, PA
FELDMAN ENGR & MFG, SHEBOYGAN FLL, WI
FLOYD-MCKAY AEROFIER CO., DUNN NC
GREAT PLAINS MFG. INC., ASSARIA, KS
GREENCARE INTL., HUNTINGTON BEACH, CA
HAHN, INC., EVANSVILLE, IN
HOLLAND EQUIPMENT, ONTARIO, CANADA
JACOBSON/TEXTRON, RACINE, WI
JOHN DEERE IND. EQUIP CO, MOLINE, IL
LAND PRIDE, ASSARIA, KS
LESCO, ROCKY RIVER, OH
NATURE-GRO CORP., PACOIMA, CA
OLATHE MFG CO, INDUST AIRPORT, KS
RANSOMES INC, ELM GROVE, WI
SISIS EQUIP LTD., MACCLESFIELD, ENGLAND
SNAPPER POWER EQUIPMENT, ,C DONOUGH, GA
STEINER TURF EQUIPMENT, ORRVILLE, OH
TERRACARE, PARDEEVILLE, WI
TORO COMPANY, MINNEAPOLIS, MN
TURF-TEC INTERNATIONAL, NORTH MIAMI, FL
VERTI-DRAIN USA, SCRANTON, PA
YEAGER FORD TRACTOR, HILLSBORO, OR

BASEPATH GROOMER

BANNERMAN LTD., ONTARIO, CANADA
CUSHMAN/RANSOMES, LINCOLN, NE
DIAMOND DEMON, ST. LOUIS, MO
FUERST BROTHERS, GIBSON CITY, IL
GANDY CO., OWATONNA, MN
GLENMAC-HARLEY DIV., JAMESTOWN, ND
JOHN DEERE, MOLINE, IL
KROMER CO., MOUND, MN
METROTURF INC., FARMINGTON, MN
PIONEER MFG. CO., CLEVELAND, OH
SMITHCO INC., WAYNE, PA
TOMARK SPORTS, INC., CORONA, CA
TORO, CO., MINNEAPOLIS, MN
YORK RAKES, UNADILLIA, NY

BLADE SHARPENERS

BELL TURF EQUIP., SAN JOSE, CA
FOLEY UNITED, MINNEAPOLIS, MN
J.L.G & CO., GAHANNA, OH
MOWING MACHINE GRINDERS & REELS, ANDALUSIA, AL
NEARY MFG INC., ELK RIVER, MN
REELSHARP USA, DARIEN, CT

BLOWERS, LEAF/LITTER

AGRIMETAL, WICKHAM QUEBEC, CANADA
ATWATER STRONG, ATWATER, OH
BEAIRD-POULAN, SHREVEPORT, LA
BILLY GOAT INDUSTRIES, LEES SUMMIT, MO
BUNTON MFG CO, LOUISVILLE, KY
GIANT-VAC, S. WINDHAM, CT
GREEN MACHINE, LONG BEACH, CA
HOFFCO INC., RICHMOND, IN
JACOBSEN/TEXTRON, RACINE, WI
JOHN DEERE IND. EQUIP CO., MOLINE, IL
KUBOTA, COMPTON, CA
LESCO, ROCKY RIVER, OH
MARUYAMA U.S. INC., REDMOND, WA
OLATHE MFG CO., INDUST AIRPORT, KS
PARKER SWEEPER, SPRINGFIELD, OH
SIMPLICITY MFG, WEST ORANGE, NJ