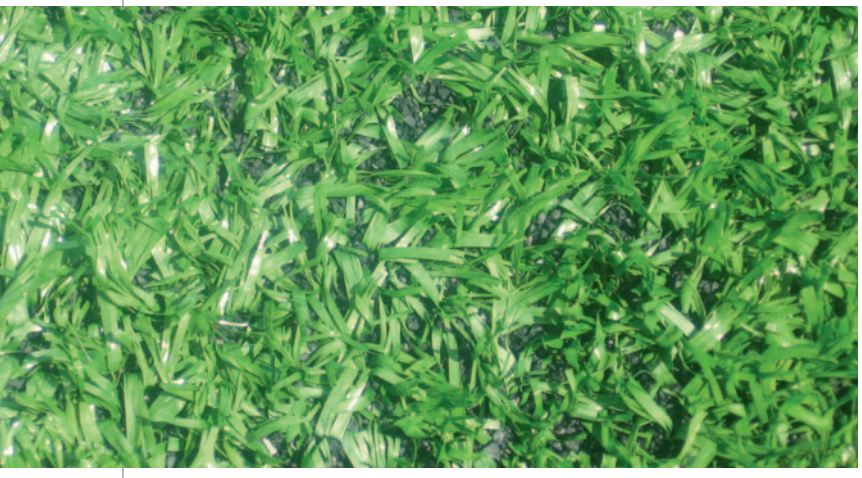
By Eric Schroder

Just the facts:
update on science and synthetic systems

DESPITE THE HEADSHAKES displayed by many sports turf managers around the country when synthetic playing surfaces come up in conversation, it is a fact that professionals should view synthetics as valuable assets in providing safe playing surfaces for their athletes.

As Bob Campbell, CSFM, former president of the Sports Turf Managers Association, said in a recent interview in this magazine, "We have to adapt and accept changes to survive and grow as a profession. We have to be part of it or be left behind."



For those readers currently maintaining synthetic fields or who are anticipating doing so in the near future, *SportsTurf* here attempts to provide summaries of the latest scientific information available on several topics of interest. Simply reading headlines might give you the impression that athletes on synthetic fields can spontaneously combust from high temperatures, contract a killer disease from a turf burn, or poison themselves with a face full of recycled rubber. Many media reports are driven by environmental and parent groups; we will provide info from the latest research and hear from some of the major players in the synthetic industry regarding three issues: high field temperatures, MRSA infections, and toxicity. [Editor's note: Later this year we will address the actual installation process, what problems are being encountered, and best practices to avoid them.]

Heat

In conditions of high humidity and high heat, synthetic turf surface temperatures can become hot. While manufacturers of new infill materials are touting the reduced temperatures their products produce versus crumb rubber, there is nothing in the research literature that suggests much can be done about these temps. Anecdotally, plenty of sports turf managers are irrigating their surfaces before play (and hearing about it from taxpayers who expected no water use on synthetic grass), while others recommend misting the athletes on hot days.

The latest science on the topic comes from the International Society for Horticultural Science's 2nd International Conference on Turfgrass Science and Management for Sports Fields, held in Beijing last year. Dr. Andy McNitt, grad student Tom Serensits, and Penn State's go-to turf assistant, Dianne Petrunak, produced "Temperature Amelioration of Synthetic Turf Surfaces Through Irrigation" (http://www.actahort.org/books/783/783_59.htm). Here's the abstract:

"Researchers have found that the surface temperatures of synthetic turf are significantly higher than natural turfgrass surfaces when exposed to sunlight. Reports indicate the surface temperatures of traditional synthetic turf can be as much as 35-60°C higher than natural turfgrass surface temperatures. Surface temperatures of infill synthetic turf systems have been reported to be as high as 93°C on a day when air temperatures were 37°C. Researchers have concluded that the heat transfer from the surface to the sole of an athlete's foot is significant enough to contribute to greater physiological stress that may result in serious heat related health problems.

"The objective of this study was to evaluate various methods of reducing the surface temperature of synthetic turf surfaces. Various irrigation and tarping regimes were used in an effort to reduce surface temperature. Infill was also amended with calcined clay in an effort to increase the water holding capacity and potential evaporative cooling of the infill media. Many of the regimes tested were initially very successful in lowering surface temperature to that of natural turfgrass; however, these low temperatures could not be maintained for periods of time equal to the length of standard sporting events, although synthetic turf surfaces receiving irrigation did measure lower in surface temperature after 3 hours compared to unirrigated synthetic turf surfaces."

Another study, published last December, "Environmental Effects of Synthetic Turf Athletic Fields," by the engineering, landscape architecture and environmental science firm Milone & MacBroom, found that "On hot sunny days, surface temp of the fibers was 40-50 degrees hotter than ambient [means "surrounding"] temp; air temp at 2 inches above surface or under cloud cover was near ambient. Crumb rubber was only a few degrees

hotter than ambient. Watering the field had a short-term effect." (http://www.miloneandmacbroom.com/downloads/MMI%20Syn%20Turf%20Study_Bristol_McDermott.pdf)

"Right now there is no effective and economically feasible way to lower the surface temperature of infilled synthetic turf," says Dr. McNitt. "Many are working on lots of ideas but I don't think anyone has solved it yet." [Editor's note: Dr. McNitt maintains a research plot of various manufacturers' infill synthetic surfaces; see http://cropsoil.psu.edu/mcnitt/Infill.cfm for details of his research to date.]

"This is one issue that the industry is working hard to address," says Rick Doyle, president of the Synthetic Turf Council (STC). "Great strides have already been made through the introduction of new fibers and infills that produce significant reductions in heat absorption. I think you will see further improvements in this area in the coming year."

Darren Gill, director of marketing for FieldTurf, says, "While an artificial turf surface is warmer at the base, it isn't any warmer at the key levels which could lead to heat stroke. This conclusion can be supported by the data that has been collected at the NCAA and high school levels, as we have seen a reduction of heat stress injuries on artificial turf. For clients who have a concern over the field temperature, we do recommend misting the field with some water."

Toxicity

Despite a growing body of scientific evidence to the contrary, some parents, environmental groups, and a few in the medical community continue to loudly voice concerns about synthetic turf's safety. Do these fields contain lead or other carcinogens that can be ingested by kids or other users? they ask. Has enough research been done?

There have been several local threats on banning installations until more research is in; meanwhile, the synthetic turf community continues to point to answers from science that show there are no health issues for anyone playing on their fields. Or playgrounds, since the First Family's White House playset sits on recycled tires.

Current research has shown turf fibers (on new generation of fields rather than original AstroTurf products) are lead-free, do not leach, and that crumb rubber infill is neither ingestible nor inhalable. Both the states of New Jersey and New York cycled through the concerns and questions and arrived at "Let them play" decisions. Other states, including California and Connecticut, are currently testing.

Synthetic system manufacturers also point across the Atlantic, where Europeans have been playing on artificial turf longer than we have here; studies there have found no health risks. As Darren Gill, director of marketing for FieldTurf, wrote in a recent newspaper column, "Simply put, since the industry's early installs 15 years ago, no illness has ever been shown to be related to play on artificial turf."

The latest scientific report we found is from the New York Department of Environmental Conservation and Department of Health, released May 29, 2009. This study concluded that crumb rubber material used in synthetic turf fields poses no significant environmental threat to air or water quality and poses no significant health concerns (http://www.dec.ny.gov/chemical/8792.html). Major conclusions included:

- There is no significant threat from chemicals leaching into surface water and groundwater. While some chemicals can be released from crumb rubber over time, they are in small concentrations and are reduced by absorption, degradation and dilution, resulting in no significant impact on groundwater or surface water.
- Lead concentrations in crumb rubber are well below federal hazard standards for lead in soil and do not represent a significant source of lead exposure.
- Levels of chemicals in the air at synthetic turf fields do not raise a significant health concern.

New York state scientists conducted lab tests on crumb rubber samples obtained from manufacturers and conducted tests at synthetic fields. They tested for leaching, exposure to acid rain and acid digestion, exposed samples to a range of temperatures to observe impacts, assessed chemical particle sizes for their potential to move through soil and air, collected soil samples at wells down-gradient from existing synthetic turf fields and measured air samples upwind and downwind of such fields.

Environment and Human Health, Inc. (EHHI) is an example of an organization that is concerned with these issues. This nonprofit is "dedicated to protecting human health from environmental harms through research, education and the promotion of sound public policy." Its members include doctors, public health professionals and policy experts.

EHHI teamed with the Connecticut Agricultural Experiment Station (CAES) to determine the chemicals released into the air and water under ambient conditions. One set of experiments tested the leaching potential of the metals from samples of tire crumbs and one sample from commercial rubber mulch. A second set of experiments tested the chemicals released from crumb rubber and commercial rubber mulch. CAES said the study conclusively demonstrated that the tire crumbs and tire mulch release chemical compounds into the air and ground water, constituting a chemical exposure for humans and the environment. They also concluded that "There are still data gaps that need to be filled in and additional studies are warranted."

However, the Connecticut Department of Public Health (CDPH) responded to this study by stating their review "does not find any reason to stop installation of these fields. Currently there are no federal or state limits on the installation of crumb rubber-based turf fields. Therefore, it is up to towns to make a case-by-case decision on whether artificial turf is the right choice for a particular setting. While we see no health evidence to stop installations, DPH acknowledges that much of the information is very recent and this area is rapidly evolving. Additionally, the potential exposures and risks have not been fully characterized. DPH recommends that towns consider these uncertainties as part of the array of issues evaluated when deciding whether to install artificial turf fields (e.g., cost, maintenance, public acceptability)."

Concerns about the exposure of children to excessive levels of lead in synthetic turf were raised after the metal was detected on some playing fields in New Jersey several years ago. In April 2008, the US Consumer Product Safety Commission (CPSC) agreed to investigate artificial turf fields to evaluate the risk. They evaluated many school and government-owned athletic fields, and although some older fields were found to contain lead, the commission concluded that young children are not at risk of lead poisoning as a result of synthetic turf (http://www.cpsc.gov/cpscpub/prerel/prhtml08/08348.html).

STC's Doyle says, "We are pleased to see that recent studies conducted by independent environmental firms on behalf of state agencies validate the safety of synthetic turf and crumb rubber. We've always relied on science to support our statements of safety."

MRSA

Outbreaks of skin infections associated with sports teams caused by *Staphylococcus aureus* bacteria that are resistant to many antibiotics have been increasing, according to public health officials. These resistant strains of ''staph'' are known as MRSA.

Studies have been conducted on whether staph can live in the synthetic turf environment. In published reports (Kazakova et al. 2005) and (Begier et al. 2004) said two possible risk factors for contracting a MRSA infection from synthetic turf fields were a) an increased risk for skin abrasions and other injuries leading to open wounds and b) whether the fields themselves harbor the bacteria. These two studies were conducted with football teams to determine the relationship between synthetic turf and MRSA infections and both concluded that skin abrasions and turf burns caused by synthetic turf provide a means of access for the MRSA infection. However, in both cases it was found that physical contact (due to position played), body shaving, equipment sharing, and poor sanitary practices in the locker rooms and training facilities facilitate the transmission of the disease.

Penn State's Dr. McNitt said in a 2007 report that no MRSA was found on any bulk samples he took from synthetic turf fields throughout Pennsylvania. He did find staph on blocking pads, weight equipment, stretching tables, and used towels, in addition to the hands of five randomly tested individuals.

The McNitt study concluded that "These infilled systems are not a hospitable environment for microbial activity. They tend to be dry and exposed to outdoor temperatures, which fluctuate rapidly. Plus, the infill media itself contains zinc and sulfur, both of which are known to inhibit microbial growth."

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Audubon International recognizes STMA member

WITH MY BACKGROUND IN MANICURING GOLF COURSES, I am used to the environment being a consideration. Protecting it is expected of you and your maintenance program. Once I accepted the position for superintendent of grounds at St. Mary's College of Maryland, with responsibility for overseeing the college's roadways, grounds, beds and seven sports fields, I thought it would be an easy transition. I quickly realized, however, that there is a difference between golf course maintenance and maintaining sports fields—a very big difference. I not only have the turf to worry about, but also the soil chemistry and moisture for the baseball field skin area, field conditions for playability, learning about titanium oxide and calcium carbonate from sports field paints, and, most important, the safeness of the fields for athletic play.

The St. Mary's College of Maryland grounds crew and I have met these challenges. We were recently rewarded for our environmentally sound grounds plan by Audubon International with certification in Environmental Planning from the Audubon Cooperative Sanctuary Program (ACSP). The college is the first in Maryland to receive this certification. The international program is designed to help preserve and enhance the environmental quality of properties.

Once I got my sports turf management program in place, I thought about how I could make a difference by using more environmentally friendly maintenance practices on the athletic fields and campus grounds. At first this was a bit tough since I had no program to guide me. I wanted to come up with a plan that would be good for the environment and our athletic field program as well.

I first talked to my direct supervisor, Derek Thornton, who is assistant vice president of campus operations. He was 100 percent behind my efforts. I then talked to the assistant athletic director and head soccer coach, Herb Gainey, who helped me by setting up a plan and setting an example for the other coaches to follow by rotating his goal area to all four sides of the fields when teams were practicing on them. He also had every team member do warm-up exercises off the playing surface. He had his team walk the stadium field and practice fields after games to repair damaged areas and pick up any litter. This was the start of my program.

Environmentally sound sport fields are often rare. We have several sports fields located near or on a historic site that is part of the campus. To put an environmental plan into action with these considerations was challenging but rewarding. My first step was to take a hard look at the natural landscape within our sports field complexes. Our baseball field was designed by Paul Zwaska, formerly with the Baltimore Orioles and now the general manager at Beacon Athletics. The Hawk's Nest, which opened in 2001, has the nostalgic feel of a ball park in the early 1900s. The dugout is built of timber, and native plantings surround most of the backdrop and sides of the park. We have transplanted 17 Crape Myrtle trees and 67 Abelias from areas under construction to the ball field to add color and shade for fans watching games. We are in the final phase this year of planting a buffer zone of native Black Eyed Susan's for a distinctive look behind the outfield fence in a grassy meadow that captures nutrients from the water that drains from the ball field and parking lots.

We have in place a good integrated pest management program for the sports fields as well as water management programs that we check daily. We also topdress some of the sports fields and events lawns with compost from organic material waste that we collect from the campus and sports fields. We apply it about an inch deep. This helps nourish nutrients and soil moisture. We use wetting agents to keep irrigation efficient. Regular checks are made for broken heads, leaks, and to ensure that irrigation heads are running efficiently and watering only the turf and not the skin area or warning track of baseball or running track of the stadium fields. We also use turf growth regulators to help cover areas with lateral turf growth movement and reduce mowing, which in turn helps reduce our carbon footprint.

The baseball field is planted primarily in bluegrass and ryegrass,

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Left: Part of St. Mary's wildlife habitat, part of the buffer management program for the storm water pond. **Middle:** From left: George Lancaster, James Dyson, Steve Gregory, Kevin Duffy, Eric Reed, Cheryl Krumke, Chris McKay, Rick Thompson and Superintendent of Grounds Kevin Mercer. **Right:** Campus green space called Admissions Field features recycled sports field turf and is used for Frisbee golf, recreation, and intramurals.



Left: St. Mary's College Hawk's Nest baseball field. **Middle:** Transplanted Crape Myrtle trees. **Right:** Natural area with native plantings and Red Chewing fescue that water drains to from the sports fields.

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but will be converted to a warm season turf in the near future to reduce the need for fungicide applications. The rest of the college's sports fields, practice fields and the stadium field are planted with Riviera bermudagrass. This is the perfect choice for us because of the tightness of the plant. The playability is right on the mark. The plant responds well to early green-up from cold winters.

For sustainability, Riviera holds up extremely well to drought and excessive play, which our multi-use stadium field gets, having five sports teams on it throughout the year. Other bermudagrasses may offer the same toughness, but Riviera takes very little water usage for establishment. Bermuda sprigs, for example, take a lot of water for growth, which isn't water efficient if water conservation is a consideration in your organization.

The college has two practice fields that grew in completely on native soil in a 6-week period. The athletic department was holding practices three times a day on them by the seventh week. The water used was only to dampen the soil. Watering was done twice a day, early in the morning and early in the evening for 3 minutes a zone. We increased the watering after germination to 5 minutes a zone until grow-in was completed. Sprigging the field was too expensive and not cost-effective. Watering also wasn't as efficient as we would have liked.

Another idea for sustainability occurred to me in the construction phase of two practice fields. We had the drainage for both of the fields run into a natural area filled with native trees and red chewing fescue to collect any nutrient runoff that might occur. This acts not only as a buffer zone, but waters our native plantings and allows water to eventually seep back into the groundwater table.

The renovation of the college's stadium field included resurfacing the field with Riviera. I didn't want to blast the field with herbicides, so I specified that the contractors strip off the old Vamont Bermuda sod. We installed 16 quick couplers to irrigate the field from a storm water pond to recycle nutrients back into the newly laid sod or green space. We then incorporated a buffer zone of wild flowers and red chewing fescue around the perimeter of the storm water pond. This also acts as a natural habitat for wildlife.

As mentioned earlier, these efforts are required for Audubon certification. Each environmental assessment plan can and may be different from another sports turf manager's, but this is how we learn from each other and create a networking plan with our STMA local or national associations. Have fun and share your opinions. We all want to know and learn from each other. Together, and as a team, we can make a difference. Remember, we can only lead tomorrow if we show by example today. ■

Kevin Mercer is superintendent of grounds and turfgrass manager at St. Mary's College of Maryland, St. Mary's City.

Sustainability ideas for sports fields

The following is a checklist of sustainability ideas for sports field complexes. All are required for Audubon ACSP certification:

Wildlife Habitat

Note wildlife habitat around your sports field and keep it protected, free of pesticides and maintenance. Put up signage to identify wildlife or add bird houses, milkweed plants and butterfly bushes to attract wildlife. Make sure you manage all your buffer areas correctly.

Turfgrass Management

Take simple steps to make your sports field more sustainable. Have soil tested yearly. Use organic fertilizers. Get your field on an aerification and verti-cutting program to allow water and nutrients for plant uptake. Check your fields dally for damage, stress, disease pressure and nutrient needs. Rotate goal areas when practice sessions are heavy.

Resource Management

Ensure that your shop uses federal- or state-approved fire lockers with secondary containment for pesticides, paints, oil, aerosols, gasoline and storage for used oil, antifreeze and florescent light bulbs. Use waste oil heaters to burn waste oil to heat your shop. Make sure your crew knows how to respond to any spills safely and correctly. Use energy performance-enhancing light bulbs, sensors, LED exits signs and so on. Use water-saving technology for the interior and exterior of your sports field complex. Use signs to direct people to recycling receptacles placed throughout the sports field complex and have recycling dumpsters in place. Use electric utility vehicles and mowers. Use Hybrid model vehicles for road use. Start a compost pile and get it tested for its carbon and nitrogen ratio. Use pervious surfaces for sidewalks and parking lots to allow water to seep back into the water table. Use mulch around trees and shrubs to help water efficiently.

Outreach and Education

Get your local Boy or Girl Scout Club and community involved with planting native wildflowers, plants or trees in locations where wildlife habitats are desired and where energy performance for buildings can be increased by shading sunlight and blocking wind. Have Scouts pick up trash within your complex as part of their service project.

Water Management

Make sure you check soil moisture regularly. Ensure that you aren't wasting water from sprinkler heads that throw water on skin areas of baseball or softball fields or warning tracks. Update your control box with evapotranspiration equipment to reduce over watering. Use wetting agents in localized dry spots to help keep these areas efficient with hand watering. Check your system for leaks, broken heads and uniformity on a regular schedule.

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Dr. McNitt's latest MRSA research study, "Survival of *Staphylococcus aureus* on Synthetic Turf," was completed in December 2008 and co-funded by the Pennsylvania Turfgrass Council and the Synthetic Turf Council (http://www.syntheticturfcouncil.org/associations/7632/files/Staph%20report-FINAL-McNitt%2012-19-08.pdf). The study included one indoor and three outdoor sites. It concluded:

"Under non-extreme temperature and very limited light conditions present during the indoor portion of this study, *S. aureus* survived on both synthetic and natural turfgrass for multiple days. However, the bacteria do not appear to thrive under these conditions as the numbers of surviving bacteria decrease significantly with time. *S. aureus* survival seems to be greatest on the fibers compared to the crumb rubber infill. Commercially available antimicrobial treatments as well as detergent significantly decreased the survival rate of *S. aureus* present on these surfaces indoors although every experimental unit inoculated tested positive for the presence of *S. aureus* for the first 4 hours and a number were still positive 9 days after inoculation. Commercially available detergent and the cationic surfactant SportsClean applied around the time of inoculation resulted in no live bacteria detected after 24 hours.

"When *S. aureus* is applied to outdoor surfaces under conditions of higher temperatures in the presence of UV light, the bacterial survival rate was much lower. It is difficult to draw conclusions regarding the effectiveness of various treatments in an outdoor environment because the bacteria do not appear to survive very long under these conditions whether treatments were applied or not, but both detergent and fabric softener applied to the surface around the time of bacterial inoculation seem to reduce *S. aureus* survival somewhat. However, exposures to UV light and higher temperature seem to be the most effective disinfectant under the conditions of this experiment. It should be noted that *S. aureus* survival rate on a common turfgrass species used for athletic fields in the Northern United States was comparable to the survival rate on synthetic turf when no disinfectants were applied."

"Andy has shown that synthetic turf is not a breeding ground for dangerous microbes," says Doug Schattinger, president of Pioneer Athletics, which markets a system to treat synthetic surfaces to fight staph transmission. "In fact, an athlete is no more likely to be exposed to staph on a synthetic turf field than in many different areas throughout the athletic environment. What is unique about synthetic turf, however, is that unlike grass, an athletic program can treat the playing surface to help prevent the transmission of staph and MRSA. I am hopeful that Andy will be able to expand on his research in future studies." ■