program included a spring starter, a summer general purpose application, and a late-fall winterizer. Urea was applied as needed for a quick boost of nitrogen. Surrounding areas that aren't maintained make spring preemergence herbicide application necessary.

Genoa is located 15 miles east of Toledo. Because the weather is unpredictable, changing quickly and drastically through "lake effects," maintenance timing must be flexible.

Since aeration equipment must be rented, core aeration is done once a year for all fields. The cores are mat-dragged back into the soil profile.

Currently, a rotary rider mower is used one to three times a week to keep the infield turf cut "a shade" under two inches. The outfield field turf is cut at two to 2-1/2 inches. Clippings are usually left on the field, but the mower can vacuum and catch if necessary. Still another goal for the athletic department is to switch to a reel mower, but that probably in the yet-to-be-defined Stage III.

To keep weed control at a minimum, a soil sterilant is used in the stone sections around the fence lines and behind the backdrop and dugouts, keeping the material two to three feet away from the grass. After the scoreboard and press box are in place, Thompson plans to cement the areas behind the backstop and dugouts to eliminate even this need for weed control. A string trimmer is used as necessary on weeds in the "chemical-free" zone.

The bullpens and five skinned areas on the field are edged and manicured as needed. Each day, the home plate batter's box and pitcher's mound are tamped and the artificial turf of the on-deck circles and areas in front of the dugouts is swept.

Thompson also maintains a plot of replacement sod on a section of farmland provided by a student's parent. This plot was started at the same time as the field renovation, using the same seed and maintenance practices. The plot continues to receive the same care as the field.

Money remains tight, and more is needed for completing Phase II. The field belongs to the high school and the community itself, Thompson asserts, and can be viewed as an asset for both the community and its children. He adds that while they're asking everyone to participate financially, this is a "one-time deal," and that they don't want people to feel they'll be asked to contribute every year.

"All contributors receive a thank-you letter and their names in the programs for the ball games during the first year," he says. "We've established different levels of donations, designated as RBI, single, double, triple, and grand slam. We'll acknowledge those who have given support by listing them under the appropriate category on a permanent, plexiglass-covered billboard attached to the press box.

"Our immediate goal is to host the Ohio state districts and regionals at our complex by 1995," he concludes. "But the greatest achievement for the whole community well be the sense of pride and life-long memories that playing on a top-notch field will give our athletes." ❑

Editor's Note: Bob Tracinski is the manager of public relations for the John Deere Company in Raleigh, NC, and public relations chairman for the national Sports Turf Managers Association.

The Beam Clay Baseball Diamond of the Year Award is sponsored jointly by Beam Clay, the Sports Turf Managers Association, and sportsTURF magazine in recognition of excellence and professionalism in maintaining safe, professional-quality diamonds. Winning diamonds are named in the professional, college, and high school/municipal/park categories.

continued on page 22

Diamond of the Year, *continued from page 21*

ABOUT THE JUDGES

Every year, four judges from the ranks of Major League Baseball groundskeeping carefully review Diamond of the Year entries from around the country to select winners in the professional, college, and high school/municipal categories. To reach their decisions, the judges review photographs and written descriptions, including the history and maintenance practices of each field.

Selecting Diamond of the Year winners is a labor of love. It's time-consuming pursuit conducted by four different, top-notch professionals, representing Major League Baseball's four divisions each year. Here's a look at this year's judges.

Tom Lujan, Mile High Stadium, Denver, CO – *National League West*

Home to Major League Baseball's Colorado Rockies, the National Football League Denver Broncos and the Colorado Foxes professional soccer team, Mile High Stadium sees more than its share of unpredictable weather each year. Braving it all is Field Manager Tom Lujan, who celebrates his 18th season at the facility this year. Lujan, who tutored under former Mile High Field Manager Steve Wightman, now with San Diego Jack Murphy Stadium, grew up in the Denver area and developed an early interest in field maintenance. After high school, he applied with the Denver Parks and Recreation Department and was "lucky enough" to be assigned to Mile High Stadium. Gradually, he worked his way up the ranks to his current position, where he puts in 70 to 80 hours a week.

Lujan considers himself truly fortunate to have worked under Wightman. That early influence led him to seek advice from some of sports turf management's best minds and talents, including Dr. Kent Kurtz, Barney Baron, formerly with Candlestick Park, NFL turf consultant George Toma, the late Harry Gil, STMA founder and long-time Milwaukee Stadium field manager, and more recently Dr. Jim Watson with the Toro Company.

The challenge is what attracts Lujan to the job. "You have to look at the overall schedule for the entire year, and make sure that the field is the best it can be for each event, and that it's ready on time," he explains. "Working around the weather and events schedule is a real challenge, and I thrive on that."

For those looking to "make the jump" to the big leagues, Lujan suggests first getting an education in horticulture. However, he notes, there is no substitute for experience.

"Get internships in as many places as you can, and learn about the hands-on part of the job," he advises. "Without the hands-on experience, it's going to be hard to get that top position."

Brian Nofziger, Angel Stadium, Anaheim, CA – *American League West*

When the California Angels are playing a home stand, Anaheim Stadium Lead Groundskeeper Brian Nofziger and his crew don't balk at putting in 12- and 13-hour days. During football season, when the Rams call the stadium home, the schedule is less hectic and fewer hours are required.

Nofziger started at the stadium full-time in 1973, after getting out of the military. During high school, he had worked for the Angels as a bat boy and in the clubhouse, and a friend helped him land a part-time position with the grounds crew in 1972. He worked under head groundskeeper Joe Verdi until Verdi retired and he was promoted.

Nofziger cites Verdi as an early mentor, as well as Ray Reyes, who's been with the stadium since it opened, and retired stadium superintendent Don Marshall. He continues to read widely on sports turf management techniques and attends seminars when possible.

Changeover from one sport to another poses the greatest challenge for Nofziger. "We had one real doozy in 1983, when we had David Bowie one week night, a college game on Saturday, the Rams on Sunday, and the Angels on Tuesday night," he recalls.

Sports have always been a part of Nofziger's life, which he sees as a tremendous advantage in is profession. "You have to really like sports because there are a lot of hours involved with this job," he says.

For those hopeful professional sports turf managers on the rise, Nofziger recommend heavy doses of both "book learning" and on-the-job training. And enthusiasm is a must.

"You're not going to get rich doing this," he asserts, "so you better love what you're doing."

Alan Sigwardt, Joe Robbie Stadium, Miami, FL – *National League East*

Though he's been head groundskeeper at Joe Robbie Stadium for a little more than a year, Alan Sigwardt brings approximately 12 years of experience to his position. Sigwardt, who managed the field at Sun Devil Stadium in Tempe, AZ, for two years, worked his way up through minor league baseball training facilities including those of the Milwaukee Brewers, Angels, and Chicago Cubs. He credits NFL Turf Consultant George Toma and the late Harry Gil with helping him grow into the job.

"I called George once a few years back for advice, and he called me back and helped me out," Sigwardt recalls. "We've kept in touch ever since, and he's been like a father to me. I worked with him at last year's Superbowl in Atlanta, and I'll work with him again on this year's Superbowl at Joe Robbie.

"I also worked under Harry Gil, and he was like a father to me, too," he adds. "Harry really took me under his wing."

Joe Robbie is home of the NFL Miami Dolphins and Major League Baseball Florida Marlins. In addition, the venue hosts events from rock concerts to motocross. The pressure, says Sigwardt, is constant.

"I think we had four *Monday Night Football* games here last year," he explains. "You look at Don Shula and the Dolphins, a class organization, and the Marlins and their owner and coaches, and they're another class organization. There's quite a legacy here at Joe Robbie, and every event is big. Both teams demand the best. The pressure is on us, as a grounds crew, to keep everyone happy. But the best thing about this work is that if you work hard, you can walk out and actually see your accomplishments. Not all jobs are like that."

Dedication to the profession, says Sigwardt is the key to success. "The best thing you can do is always ask questions, and *look around*. It's the same everywhere — the budget, equipment, and supplies aren't there. When you're fighting your way up, you have to overcome those odds. If you want to sit around and make excuses why the field isn't in shape, you'll never make it. In terms of supplies, budget, staff and equipment, it gets a little easier at this level. But then, there's a lot more pressure."

Gary Vandenberg,
Milwaukee County Stadium

Milwaukee, WI – *American League East*

Gary Vandenberg, director of grounds for Milwaukee County Stadium, didn't start out as a sports turf manager. Before joining the crew in 1981, he worked as a golf course superintendent. Vandenberg holds a bachelor's degree in soil science from the University of Wisconsin at Fond Du Lac.

At Milwaukee County Stadium, Vandenberg worked under head groundskeeper Harry Gil for nearly 10 years, and credits Gil for showing him "the ropes" of baseball field maintenance. As an assistant golf course superintendent, he recalls, he learned under the tutelage of superintendent John Zahn before becoming a superintendent himself.

Vandenberg became director of grounds in 1991. When the Milwaukee Brewers baseball team is in town, he and his crew put in 80 to 100 hours a week on the field. The venue also hosts four NFL Green Bay Packer games, in addition to concerts and other events.

"The biggest challenge, day-in and day-out, is the weather," says Vandenberg. "You might have rain coming in, and the umpires will be wondering what to do, the managers will be wondering whether or not to warm up their pitchers, and everybody will be looking to you for answers."

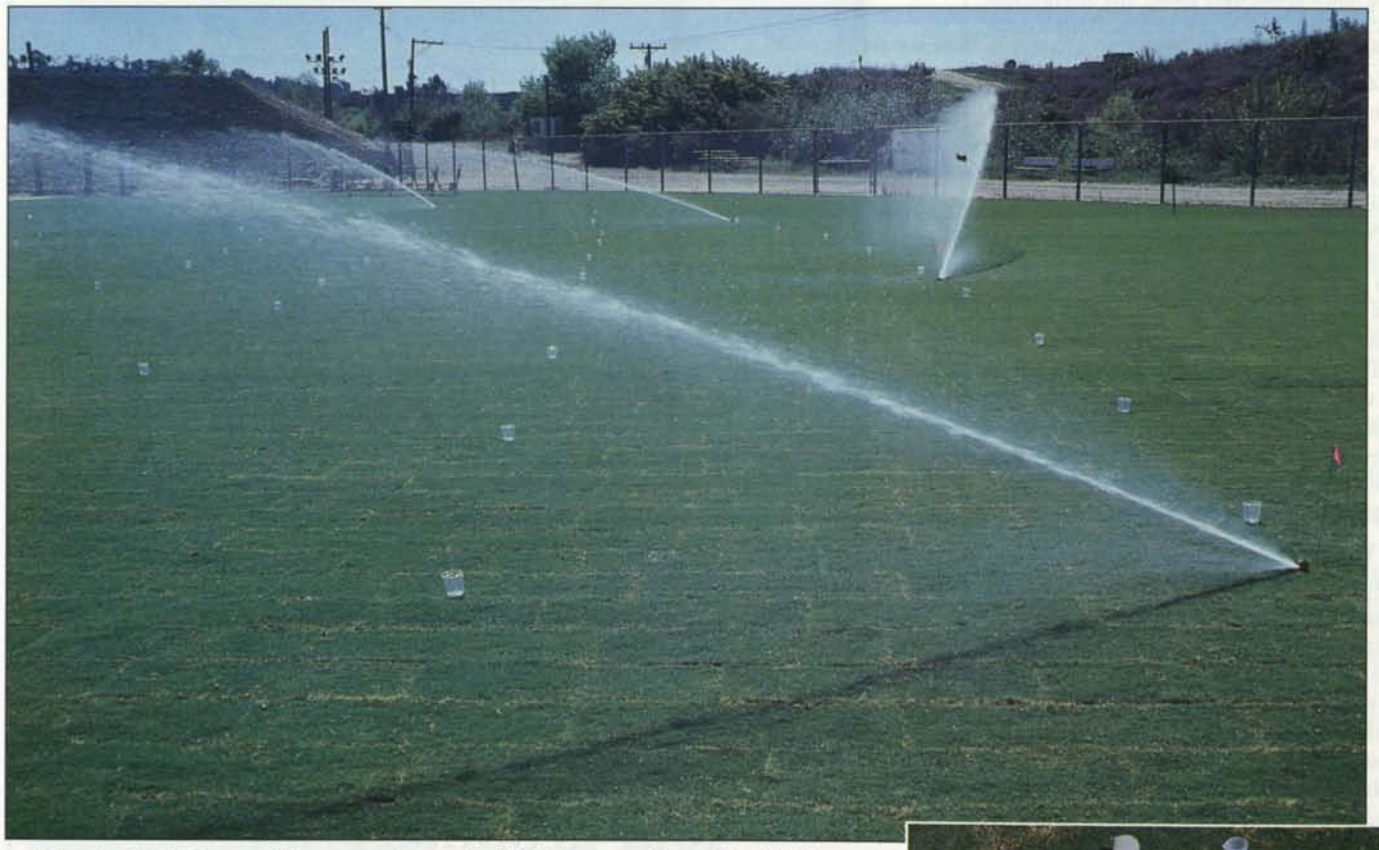
Vandenberg professes a passion for baseball, which makes his job ideal. "Since I was never good enough to play it, the next best thing is watching it," he admits. "I never get tired of watching baseball, which is a good thing in this business."

Desire is one of the main roads to becoming a successful sports turf manager at the professional level, Vandenberg observes. "You've got to be patient, persistent, and you have to put in your time," he emphasizes. "And you've also got to be a little lucky." ❑

– Matthew Trulio

Irrigation Efficiency:

ATTENTION PAYS



A typical grid layout for a catch-can test. Photo courtesy: David Shaw, University of California Cooperative Extension.

By Kurt Mengel

Catch-can water audit tools include identical collection vessels, a ruler or graduated cylinder, tape measure for spacing between heads and grid layout, calculator, and a pitot tube for testing head pressure.

The goal of good irrigation management is to supply turf with the correct amount of water at the proper time. In areas where water costs are high and supplies are limited, and there is a demand for high-quality turf and landscapes, the irrigation system must be maintained for peak performance.

Among the most important concepts in securing an efficient irrigation system are:

- Irrigation systems should be designed and maintained to distribute water as uniformly as possible.
- Irrigation systems should be operated long enough to apply a depth of water equal to the needs of the landscape.
- Irrigation systems should be managed for minimal runoff.

If these three basic concepts are not met, turf will display dry spots, wet spots or both. The results are loss of plant material or the application of more water than is needed. Either way, it ends up costing more money to maintain the landscape.

There is an easy procedure you can use to audit the performance of an irrigation system called a catch-can test. With information derived from this catch-can test, you can be even more effective in managing the system. The audit will help you identify problem areas so that they can be corrected.

The irrigation audit will measure two important variables: distribution uniformity and precipitation rate. Distribution uniformity (DU) is a measure of how evenly the system is distributing water. Precipitation rate (PR) represents the depth of water delivered to an area in a given length of time. Precipitation rates are measured in inches of water per hour. Gauging these variables provides data used to calculate irrigation schedules.

While there are several methods for testing the precipitation rate of an irrigation system, there is only one practical way to measure distribution uniformity — the catch-can test.

Calculating Distribution Uniformity

The objective of the catch-can test is to obtain a representative sample of the true application rate and distribution uniformity of a sprinkler system. If a sprinkler system was truly 100 percent uniform in its water application, then a single catch can could be placed anywhere within the sprinkler pattern and consistently capture equal amounts of irrigation water.

However, since no irrigation system is 100 percent uniform, additional cans (usually 20 or more) need to be used to achieve accurate results. The layout of the containers can be in a grid, a radial or even a random pattern. A grid layout lends itself to easy catch-can data collection and identification of problem areas.

Your first task in performing a catch-can test is to collect the catch cans. With recycling efforts today, this should not be a problem. Coffee cans work great, but any container with straight sides will do. Straight sides are important for accurate precipitation rate calculations. All of the containers in the grid should be of the same configuration (all tuna cans, all coffee cans, etc.).

The grid pattern is the easiest and most practical layout for your cans. For the most meaningful data, do not spread the cans more than 10 feet apart. If you recognize excessively wet or dry areas, place a catch can there, even if it doesn't fall into the grid. The results may surprise you. Remember, for accurate precipitation rate information, use cans or containers with straight sides. This makes the calculation of inches per hour very easy.

If testing an area controlled by one valve, the testing procedure is straightforward. Large areas irrigated with two or more stations can be tested at the same time, as long as the sprinkler type and spacing are similar. If stations have different characteristics, test their coverage area separately.

Lay out your cans in a grid at a maximum of 10-foot intervals — it's crucial to keep the spacing at 10 feet or less. Run the stations long enough to catch at least a 1/2 inch of water. Run times should be equal for overlapping stations. Try and conduct your audit under real-time conditions, so that operating pressures match "normal" conditions.

Measure the depth of water in each can either with a rule or a graduated cylinder and record them on a sprinkler evaluation data sheet. Recording the data in a grid pattern representing the layout of the catch cans will help easily identify wet and dry spots.

Next, summarize your data. To do this, you must determine the average depth of water in all catch cans and then calculate the average of the lower 25 percent of the readings.

The distribution uniformity is then calculated by dividing the average of the lower 25 percent by the overall average of the catch can readings, or:

$$DU = \frac{\text{Average of the low quarter}}{\text{Average of all}} \times 100 \text{ (for a percentage)}$$

With a good design and modern equipment, systems should attain an 85 percent DU. Decreasing uniformity rates indicate a problem with the system and the resulting increased amounts of applied

continued on page 26

Irrigation Efficiency

continued from page 25

irrigation water to adequately cover dry spots and maintain turf quality. Problems to look for include:

- Improper operating pressures
- Poor spacing of heads
- Sprinkler head tilt
- Mixed equipment types
- Mismatched precipitation rates on a zone
- Broken equipment
- Misalignment of equipment
- Wind drift
- Improper installation
- Altered conditions after installation, like plant material interfering with spray patterns, etc.

Making a Match

One of the more frequent problems contributing to low DU is precipitation rates that are not matched. Generally, PRs more than 1.0 inches per hour are considered high; 0.5 to 1.0 moderate; and less than 0.5 low. Low precipitation rates are useful when designing for slopes and soil conditions conducive to runoff and/or erosion.

Fixed spray heads and bubbler systems typically have high PRs. Impact rotor and gear rotor systems generally have low to medium PRs. Manufacturers' catalogues usually list precipitation rates for their products used in triangular and square spacing designs. Spacing is typically 50 to 60 percent of the diameter of the sprinkler's throw.

An irrigation system that utilizes sprinkler heads with identical PRs is said to have a "matched" precipitation rate. With proper system design, matched PRs minimize excessively wet and dry areas in the landscape.

Because manufacturers market fixed spray heads with matched PRs, their use in rectangular areas is relatively straightforward. Odd-shaped areas and strips require more design creativity and frequently require more valves.

Rotor heads also have incorporated the concept of matched PRs. They achieve this by using different-sized nozzles to match the sprinkler arc. The selection of nozzles for these rotor heads to secure matched PRs is the same in principle as nozzle selection for fixed-spray heads.

For heads with similar radius of throw, as the arc increases so should the flow rate. For example, if the flow rate of a quarter-circle head is 1 gallon per minute (GPM), the half-circle should be 2 GPM and the full-circle should be 4 GPM.

Bear in mind that if you alter or vary the throw radius of rotor or impact sprinkler heads on the same valve, you will be changing the precipitation rate. As the radius decreases, the same amount of water is covering a smaller area. Therefore, the precipitation rate goes up.

With fixed-spray heads, reducing the radius reduces the amount of water dispensed from the head. Therefore, the PR is reduced. Since the spacing was not changed, the uniformity of water distribution clearly would not be as good. Be careful when adjusting the radius of throw of heads. Your carefully-matched PR may no longer be accurate.

Pressure-compensating devices may be useful in improving matched PRs because they are designed to ensure that the same amount of water comes out of the sprinkler heads within a given pressure range. This may be particularly helpful on long laterals and in areas where elevation varies significantly. It may be in your best interest to further investigate the use of pressure-compensating devices.

Calculating Precipitation Rates

The precipitation rate of the system is determined by finding the average depth of water in the catch cans. Assuming that the catch cans have straight sides, the following formula may be used:

$$\text{PR in inches per hour} = \frac{\text{Average depth in inches} \times 60}{\text{Test time in minutes}}$$

The precipitation rate and distribution uniformity of an irrigation system are required to calculate proper irrigation schedules. Together, the PR and DU tell us how long it will take to apply the needed amount of water to the driest areas.

The catch-can audit is an invaluable tool to continually monitor a sprinkler system's efficiency and effectiveness. Identifying and correcting problems with this technique will help sports turf managers save resources and money. ❑

Editor's note: Kurt Mengel is the owner of Kurt Mengel Landscaping in San Diego, CA.

Information in this article was adapted from Landscape Irrigation System Evaluation and Scheduling for Southern California *by David Shaw and Paul Zellman of the University of California Cooperative Extension.*

Safe and Secure: Proper Pesticide Storage

By Sarah H. Bundschuh

Pesticides should be stored in a location where natural runoff from the area will not contaminate residential sites, streams, ponds, groundwater, crops, other buildings and feedlots.

Unsafe pesticide storage practices are a leading contributor to pesticide contamination of the environment, as well as human and animal pesticide exposures and poisonings. In many cases, the exposed individuals are non-users of the products. It is the responsibility of those involved with these chemicals to ensure that accidents are prevented by storing pesticides in a safe and proper manner.

Several states have clear guidelines for pesticide storage. However, many do not. Prior to storing pesticides, you should contact your state Department of Agriculture, cooperative extension service and local fire department for regulations that affect pesticide storage in your state.

Three objectives must be met when storing pesticides in any quantity. You must:

1. Protect employees from exposure;
2. Protect the public, including humans, livestock, pets and wildlife, from exposure;
3. Protect the environment from contamination.

Protecting Your Employees

The pesticide storage room should only be used for storing pesticides. Weighing chemicals, reading labels and MSDS's, etc. should be done in other designated areas outside of the pesticide storage room.

A work area should be set up adjacent to the pesticide storage room for employees to prepare for applications and complete paperwork after applications. This area should include a desk, pesticide label manuals, a catalog of pesticide Material Safety Data Sheets (MSDS) and application record forms to be completed for each application. Personal protective equipment, including spray suits, face shields, safety glasses, chemical-resistant gloves, rubber aprons, spray boots and respirators, should be kept here. Never store personal protective equipment in the pesticide storage room.

Measuring of pesticide products should be done in a fill area after the person performing the fill has been fully clothed in the personal protective equipment recommended for the pesticide(s) he or she is handling. A sink equipped with a foot pedal for turning water on and off should be located in the fill area. This sink should be used for cleaning personal protective equipment after contact with the pesticides. The foot pedal will prevent the exposure of unprotected hands to pesticide residues that can be left on faucet handles.

An eye wash and emergency shower should be set up immediately outside the pesticide storage room in case of an accidental exposure.

The most important factor in protecting employees from pesticide exposure is proper and thorough training. Employees must be trained to read and use the information contained on labels and MSDS's. They must be trained on the proper techniques for using personal protective equipment, the eye wash and emergency shower and the spill kit. Training must also include the hazards associated with pesticides and how all employees can protect themselves from these hazards.

Protecting the Public

Access to the pesticide storage area should be limited to designated trained employees. The door(s) should be locked at all times, except when the area is under the direct supervision of one of these designated employees.

A durable, prominent, legible sign must be affixed to each door identifying the area as a pesticide storage area. The sign must display the word PESTICIDES. When a highly toxic pesticide is present, the word POISON and the skull-and-crossbones must be added to the sign. A NO SMOKING sign should also be mounted on the door. If you are in an area where a significant portion of the population

continued on page 28

Chemical Log
continued from page 27

does not speak English, it is wise to have these signs in the predominant second language, as well as English.

Protecting the Environment

Any release of a pesticide that is not in accordance with label directions can potentially cause environmental contamination. The greatest risk of environmental contamination results when a fire, tornado or other natural disaster strikes a pesticide storage facility. Consider how a disaster like this could affect the facility and the environment when choosing a location and designing your storage facility.

Pesticide storage areas and mixing/loading sites should be located at least 150 feet from wells, streams, ponds and ditches. They should be located in an area that is not subject to flooding. Pesticides should be stored in a location where natural runoff from the area will not contaminate residential sites, streams, ponds, groundwater, crops, other buildings and feedlots. If possible, they should be stored downwind and isolated from local residences.

Regulations have been proposed at the federal level to require secondary containment for pesticide storage facilities and mixing/loading sites. These regulations are at least two years away. An example of secondary containment would be a watertight, low-permeability concrete floor surrounded by a 4- to 6-inch-high concrete retaining wall around the perimeter of the storage facility and the mixing/loading site.

The purpose of secondary containment is to allow for all releases of pesticides at these sites to be captured and reused or disposed of according to label directions. The goal is to prevent any pesticide released at the storage and/or mixing/loading site from leaving the area and contaminating the environment. Secondary containment will offer a facility owner significant savings in the event of a pesticide release that otherwise might have moved into the surrounding soil, streams and ponds, requiring very costly clean-up.

If you store large quantities of pesticides, the best option for storage is a detached, single-story, non-combustible structure. If you store moderate quantities of pesticides, you can store them in a first-story corner room of an existing facility. This room should have a door that opens to the outside of the building. If you store very small quantities of pesticides, these can be stored in a fireproof cabinet that can be locked. The cabinet should be located in a well ventilated room with direct access to the outside.

The pesticide storage room should only be used for storing pesticides. Weighing chemicals, reading labels and MSDS's, etc. should be done in other designated areas outside of the pesticide storage room.

For storage of moderate to large quantities of pesticides, the storage area should be constructed of concrete block walls, a sealed concrete floor and metal shelves. Windows and skylights should be avoided to prevent security risks and potential product damage from sunlight exposure.

Any drains located in the storage facility must empty into a containment basin for capture and disposal according to state and federal regulations. There must be a "lip" at all doors to prevent any spilled product from seeping out beneath the door. Electrical fixtures should be dust and explosion proof.

The pesticide storage room should be well ventilated such that ventilation automatically initiates once the door is opened. The fan(s) and vent panel(s) should allow for complete air exchange a minimum of six times per hour.

Temperatures within the storage area should be maintained between 40 and 100 degrees F to prevent damage to the pesticide products.

The pesticide storage room should have adequate lighting to allow for ready identification of pesticide containers.

The various types of pesticides should be stored separately (i.e. herbicides, insecticides, fungicides, etc.). Dry formulations should be stored on shelves above liquid formulations to prevent contamination in case of a container leak. Pesticide containers should be stored off the floor to prevent deleterious contact with moisture.

Pesticides should be stored in their original and labeled containers. These should be stored with the labels clearly visible for accurate identification, and they should be inspected regularly for any damage that could cause a pesticide release.

Inventory control is very important when storing pesticides. Keep a current inventory list of pesticide names and quantities at all times. Date all pesticide containers when they are entered into inventory and use the oldest container first. Try to buy only the quantity of product you will use in one season. Oftentimes, pesticide re-salers will ask you to try a small amount of a new product. Accept the product only if the re-saler agrees to take back any you do not use.

A spill kit should be located outside the pesticide storage room. This kit should include absorptive material such as vermiculite, activated charcoal or cat litter, a drum with a lid for storing the contaminated material, a shovel, and personal protective equipment including a spray suit, rubber apron, rubber boots, chemical-resistant gloves and eye protection. Designate the spill kit "EMERGENCY USE ONLY" and do not allow workers to take items from the kit for other purposes.

How does your pesticide storage facility rate? Are your pesticide storage practices meeting the three objectives: protecting employees, the public and the environment from contamination?

If not, you need to develop a step-by-step plan addressing the most critical needs first, followed by additional needs. Then, put this plan into action. Develop a budget that will allow you to meet the goals within a reasonable time frame.

Information on the proper storage of pesticides in your state is available at your cooperative extension service, state Department of Agriculture and your local fire department. ❑

Sarah Bundschuh is a professional trainer and safety consultant for the horticulture industry in Atlanta, GA.