

## THE BEST TURF TIPS OF 1996

One of the most popular annual features of the Education Conference is the Best Turf Tips. This year, 10 of the Green Section's agronomists reported on some of the helpful ideas and ingenious innovations they came across while visiting golf course superintendents in every part of the country during 1995. The Turf Tips appear throughout this issue.

# THE MAGIC OF SULFUR

*Water has more influence on golf turf than any other single factor.*

by PATRICK M. O'BRIEN

**T**HE OCEAN COURSE at Kiawah Island, famous for hosting the 1991 Ryder Cup matches, has something new — a sulfurous generator to help improve their irrigation water. The Ocean Course is located along a two-and-a-half-mile stretch of beach-front next to the Atlantic Ocean. The deep well water, which is supplemented by effluent and recycled water for irrigation, has a strong taste of the sea. The bicarbonates are more than 1,000 parts per million, the soluble salts are more than 1,500 parts per million, and the SAR is extremely high. George Frye, Director of Golf Course Maintenance, says, "It is a worst-case scenario to irrigate the turf with this poor-quality well water." The well water

accounts for approximately 75% of the total irrigation water.

### Effects of Poor Water Quality

Before using the sulfurous generator, the turf at The Ocean Course was difficult to manage. To negate the effects of poor water, Frye relied on frequent applications of gypsum, sul-po-mag, ammonium sulfate, and other soil amendments. Despite this intensive soil amendment program, sodic soil conditions developed and turf quality suffered.

As time progressed, Frye's problems, and not his turf, continued to grow. Typically, elevated sodium levels in the soil restrict root uptake of water and nutrients and, if high enough, can

cause direct injury to the roots. To complicate matters further, high sodium levels can displace mineral and organic colloids and can lead to anaerobic conditions.

### A Solution to Improve Water Quality: Use of the Sulfurous Generator

Always an innovator, Frye learned about a machine, the sulfurous generator, that was being used to improve water quality in agricultural situations and decided to try it at The Ocean Course. The key components of a sulfurous generator are a sulfur storage hopper, oxidizing chamber, blower, and absorption tower. Pure elemental sulfur flakes are burned between 950

*The sulfurous generator oxidizes elemental sulfur that chemically alters poor-quality irrigation water.*



and 1100 degrees Fahrenheit in an oxidizing chamber. As combustion occurs, sulfur dioxide gas is produced and is blown into the bottom of the absorption chamber to mix with the well water entering the top. A packing area in the middle of the absorption chamber is the site where the sulfurous acid production occurs. Once produced, the sulfurous acid flows into the lower section of the tower and is introduced back into the irrigation holding pond as an aqueous solution. Both the equipment and chemical processes of this technology are internationally patented. Frye's sulfurous generator model manufactures up to 70 gallons of product per minute.

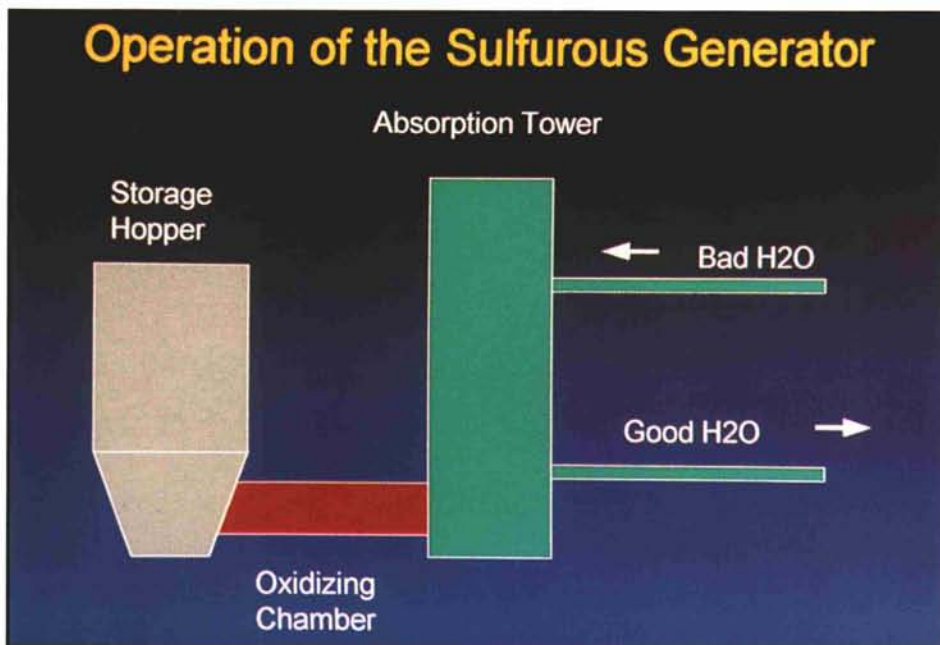
### Safety and Costs

One main advantage of this technology is that the acidifying product is made on-site and no handling is required by any of the maintenance staff, except the loading of the elemental sulfur into the hopper. The only MSDS sheet that is necessary for OSHA requirements is for the 99.9% pure elemental sulfur itself. A dust mask and goggles are used by the worker when loading the flake sulfur into the hopper. Since the sulfurous generator creates heat at the oxidizing chamber, severe burns can occur if touched, but shields reduce this exposure. Sulfur dioxide gas fumes can cause eye, nose, and throat irritation upon direct exposure. Careful development by the inventors of the sulfurous generator, including research work carried out with NASA, Johnson Space Center, has led to a clean filtration process. Automatic controls are also available to maintain correct water pH ranges in the irrigation ponds.

The sulfurous generator is very economical to operate. During the growing season, approximately 850,000 gallons of water are pumped daily. With this well water, the sulfurous generator operates continuously and uses approximately 1.5 tons of elemental sulfur weekly. With elemental sulfur costs at \$130 per ton, the elemental sulfur cost per day is about \$32.50.

### Effect of Treated Water on Turf and Soil

George Frye gives the sulfurous generator his highest praise after using it one full season. Fertilizer and pesticide costs have been reduced by 33 percent. The transformation of the elemental sulfur to sulfurous acid in the irrigation



The key components of a sulfurous generator: sulfur storage hopper, oxidizing chamber, and absorption tower.

## Results at The Ocean Course

Property	Serious Problem	Before	After
Bicarbonate Sodium	>600 ppm	1146	239
Boron	>70 ppm	580	41
SAR Ratio	> 4 ppm	5.5	2.12
	> 9 meq/l	101	22

Water quality results before and after treatment with the sulfurous generator.

water is the key to better golf turf and soil conditions. The irrigation water quality at The Ocean Course has been improved significantly by this "sulfated" water, as bicarbonates have been reduced from more than 1,000 ppm to 239 ppm, sodium from 1,500 ppm to 410 ppm, and the SAR value from 100 meq/l to 22 meq/l. The pH of the irrigation water has also been reduced from 8.9 to a more desirable 7.0. Another benefit of this equipment is the reduction of algae and fungal growth in both the irrigation holding pond and turf.

George Frye continues to utilize his soil amendment program and careful irrigation practices, but at a reduced intensity. "With the improved water, I would estimate our water consumption has been reduced by 15% and our turf management efficiency has improved," a happy Frye says. George now no longer walks the fine line between disaster and success with his golf turf at The Ocean Course.

PATRICK O'BRIEN is director of the USGA Green Section's Southeastern Region.