Cookin’ with M.J.
Vice President For Research M.J. Solleau

Working on Ways to Keep Clean Water Flowing

It is hard to convince people that Florida has a water problem. There are lakes everywhere. Rivers and springs grace the state with their beauty and bounty of wildlife. And for six months of the year it rains every day, sometimes at rates of multiple inches per hour. A closer look starts to reveal some trouble in paradise. Lake Jesup is a good example. The water is green, its bottom covered in muck. Remainst of fishing camps can still be found on the lake’s shores, a testament to the not-too-distant past in which Jesup was a crystal clear haven for bass. The elimination of a critical channel from the St. Johns River into Lake Jesup, the introduction of untold amounts of treated sewage from neighboring cities and the building of dikes to prevent seasonal flooding of adjacent lowlands have combined to make Lake Jesup second only to Lake Apopka in pollution.

Pure stormwater now rushes off rooftops and down asphalt roads, carrying the waste and grime of civilization into our lakes and rivers. Wetlands have been drained and filled and, in some cases, rivers channelled to speed the runoff that is no longer held back by natural vegetation. Uplands that once sifted stormwater through cleansing sands and helped fill our aquifer with clean water now are paved over with rooftops and roads. Uh oh, I’m starting to betray my ‘tree hugger’ mentality. I had better change the subject! For the moment let’s put aside the issue of soiling our surface water. After all, the state of Florida sits atop a wonderful aquifer. From time to time the aquifer penetrates the surface to produce beautiful crystal clear streams of cool, clean water. Nature provides a wonderful bounty for our consumption, use and recreation! If only it were so. We have passed the point of harvesting nature’s bounty of clean water. We now mine the aquifer, removing water at a rate greater than it is replenished. 

We are rapidly reaching the point where our ability to absorb a net increase of 700 people per day in Florida will come to an end. When that happens, the building industry, now second only to tourism in Florida’s economy, will be adversely affected as will a multitude of other initiatives we have cultivated to diversify our economy.

But here is some good news. UCF has been working on this problem for decades. Our skilled graduates are working in the public and private sectors to ways to ensure future generations will have access to the clean and plentiful resources we take for granted. Our faculty-scholars in water treatment and water management and their students are developing better ways to clean ground and surface water, model and manage stormwater, model surface and subsurface water resources and apply breakthroughs in basic science (such as nanoparticles) to this important issue.

As a metropolitan research university, we take great pride in working with government, community and industry to solve problems in our region, state and nation. This publication gives a sampling of the expertise our faculty and partners are contributing toward ensuring an abundant and sustainable supply of clean water for our region and state.

Cheers! MJS
mjs@mail.ucf.edu

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**Water, Water Everywhere...**

But is it really?

**THE UNITED NATIONS** has declared the global shortage of water a crisis, and scientists are even forecasting the day when there will be no water left on Earth. But why is this? And is there enough to drink? For a long time, it was believed that there was a lot of water on Earth, but it was not evenly distributed. The majority of the world's freshwater is tied up in glaciers and ice caps, leaving a very small percentage of potential potable water from the start. The groundwater, lakes and rivers that provide the most reliable sources of drinking water are subject to vast fluctuations in availability. With varying weather patterns and the unpredictable impact of natural disasters, many regions of the world alternate between a plentiful supply and scarcity.

In Florida, nearly 90 percent of drinking water comes from aquifers or groupings of saturated, permeable material such as rocks or sand that easily give up the water to wells and springs. The aquifers are recharged by rainfall, and the erratic dispersal of precipitation combined with the state's explosive growth have put a strain on this basic supply.

Taylor and fellow researchers have been studying methods of treating water from traditional as well as alternative sources for more than 30 years. They are known throughout the world for their expertise in membrane technology:  

Taylor maintains that proper treatment can make water from any source suitable for human consumption. In fact, he and Scalpeta, Seal, professor of mechanical, materials and aerospace engineering and UCF's nanoinitiative coordinator, received funding from the National Science Foundation to compare oxide nanoparticles with membrane separation systems for the purification of water suitable for use in emergency situations such as Hurricane Katrina.

Taylor, John Dett and Andrew Randall, faculty in the Department of Civil and Environmental Engineering, have received the bulk of their research funding for projects focused on removing pathogens, chemical carcinogens and other toxic substances from ground, surface and saline water sources and then integrating those blended waters successfully in our distribution systems. That integration might sound simple, but a troubling event in Tucson, Arizona, in the mid-1990s shows otherwise. Like most Florida cities, Tucson had for decades used only groundwater for drinking water supply. To facilitate a transition to surface water, officials there constructed a surface water plant capable of treating 125 million gallons of water transferred from the Colorado River via open canal every day. What they didn't anticipate was the disruption of equilibrium between the surface water and the chemical and biological deposits on pipes used for distribution.

Hence the water emitted from the new system was rust colored and smelled foul. Citizens complained about clothes washed in the water being tinged red and many refused to drink it. What happened? A chemical imbalance that resulted from sending water from a new source (surface water) through pipes that had balanced themselves to a different type of water (groundwater).

Taylor warns that Florida's efforts to use sources other than aquifers for potable water could have similar consequences if proper steps aren't taken to properly integrate the water into distribution systems.  

**THE NEED** for potable water at critical times is growing. In fact, one of the leading reasons for people to get every drop from every possible source – even overhead. UCF has taken the lead in studying the often overlooked area of stormwater use and reuse.

Established in 2002, UCF's Stormwater Management Academy, the only one of its kind in the United States, is dedicated to increasing government and public awareness of the many benefits of stormwater reuse, serving as a leading source for stormwater management research and providing the most innovative education and training programs in the nation.

While most people are familiar with the use of stormwater in irrigation, many don't realize the extent to which the water that falls from the sky affects all other water uses, including the production of clean drinking water. In what stormwater researchers refer to as "pointless personal pollution," everyday activities from driving a car to washing the grass to walking the dog result in the deposition of pollution on the natural water supply. Combine these factors with the influx of development and there is a critical need to address the quality of stormwater runoff. "Urban development causes significant changes in patterns of stormwater flow from land into receiving waters, which can consequently affect water quality when runoff carries sediment or other pollutants into streams, wetlands, lakes or into groundwater," said Martin Wanielista, academy director.

For that reason, pollution and sediment control are major problems being investigated by the academy today.  

With its home at one of the fastest-developing universities in the nation, the academy has focused on protecting the university's natural resources by keeping stormwater discharge rates and volume at the same levels after development as they were before. One way they have done this is with the I-2 Water System, a pioneering technology that provides water for irrigation or reuse based on environmental and meteorological sensors, used to distribute water from different sources such as stormwater, reclaimed water (treated sewage) and groundwater. In addition to innovative irrigation techniques, the academy is incorporating specialized projects such as the construction of the campus' first green roof.

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Another low-impact development technique used by UCF is pervious concrete. According to the United States Environmental Protection Agency, stormwater runoff can send as much as 90 percent of the pollutants – such as oil and other hydrocarbon liquids found on the surface of traditional parking lots – directly into rivers and streams. Previous concrete has been recognized by the EPA as a best management practice to address this environmental concern. The open cell structure of pervious concrete breaks down many of the pollutants that seep from parked cars, while allowing for three to eight gallons of water per minute to pass through each square foot. The Stormwater Academy is serving as a pervious concrete demonstration site and plans to pave lab parking areas with it next year. The innovative new technologies being developed by the Stormwater Management Academy are, as a result, ensuring the protection and enhancement of valuable groundwater supplies for both present and future generations.

马丁·瓦尼亚里斯塔

**Stormwater Academy Studies What Many Overlook: Rain**

As the first university in Florida to install a “green” roof on a major building, UCF is reaping a bevy of benefits and making some significant water-saving discoveries.  

The roof on UCF’s Student Union uses a special soil that stayed dry for much longer than expected, reducing the need for irrigation and saving the water collected from rainfall for other uses, said Martin Wanielista, director of the UCF Arboretum and a leader in the installation of the roof last spring.

The soil needed to be exceptionally lightweight and capable of tolerating intense sunlight. Quigley said a combination of organic matter, shredded recycled tires and heat-treated shales (think of popcorn) did the trick. “This combination won’t break down and won’t get real heavy when saturated,” Quigley said. “It’s great for plant roots.”

The 1500-square-foot roof has been awash in sunflowers, coral honeysuckles and blanket flowers since its installation. The green roof is expected to cut the energy costs of that section of the building by about 50 percent and extend the life of the roof from 20 to 50 years.

The State Department of Environmental Protection provided UCF with a grant of about $12,000 to create and maintain and study the effects of the green roof, which covers half of the roof of the Student Union expansion.

The other half is a standard roof that will be used as a comparison for temperatures, water runoff levels and the continued life of green roof.

UCF plans to install more green roofs which should help the university accomplish its goal of reducing storm-water runoff on campus so it is less than before the land was developed, said Martin Wanielista, director of the Stormwater Management Academy and the overall leader of the Student Union project.

Martin·瓦尼亚里斯塔

**Green Roof Saves Stormwater**

Martin Wanielista said Martin Wanielista
Faculty Profile:

Fidelia “Ola” Nnadi, Department of Civil and Environmental Engineering

Fidelia “Ola” Nnadi specializes in water resources engineering and environmental hydraulics with applications to civil, agricultural, industrial and environmental systems. Her research interests include stormwater management in both urban and rural areas; development of forecasting tools that predict the fate and transport of trace contaminants using Global Information Systems, applicable to surface water and groundwater; wetland conservation, associated with its morphology, hydrodynamics, sedimentation and water quality; and environmental control of pollutants in aquatic systems.

What do you see as Florida’s biggest water-related challenge in the next decade?

Florida’s biggest water-related challenge can be addressed with the question, “Will Florida have adequate potable water for its citizens by the year 2025?” The answer to this question remains for ALL to address. There is a need for the consumers, the stakeholders and researchers alike to work together to address the question.

Does Florida’s water supply problem affect your research? If so, how?

My research focuses on managing the available water resources. The water quality aspect is of concern, thus, providing more challenges to study.

Is there anything you would recommend everyone do to help conserve water?

Florida Water Management Districts have comprehensive public awareness and education programs. There is no point in reinventing the wheel. My recommendation is that these programs be encouraged to get to the grass roots through public awareness efforts.

Any additional comments?

We all know the saying “Charity begins at home”; therefore, if everybody makes a conscious effort to protect and conserve the water resources within our locale, then the global effect will become a reality.

Bottled vs. Tap

Is drinking bottled water any better for you than what comes out of the tap?

According to a study conducted by UCF’s Environmental Systems Engineering Institute in 2002, the answer is a resounding, “No.”

The researchers examined 10 water samples – five from bottled water and five from municipal sources across Central Florida. After running a variety of chemical and biological tests, the researchers concluded that although both types of water met state and federal water quality regulations, the biological water quality was better in municipal waters than in bottled waters. Two of the bottled waters had high bacterial counts while the municipal water was, in general, harder, with more salt and other residual and organic content.

“Both supplies meet U.S. Environmental Protection Agency regulations, but the fact is, municipal water is monitored more frequently than bottled water, and since bottled water is more costly, I drink tap water regularly” said James Barb Abney.

The corresponding price for bottled water is $2.20 – or 10,000 times more. While the cost of municipal water averages 2.5 cents a pound, the fact is, municipal water is monitored more frequently than bottled water, and since bottled water is more costly, I drink tap water regularly,” said James Barb Abney.

Any additional comments?

We all know the saying “Charity begins at home”; therefore, if everybody makes a conscious effort to protect and conserve the water resources within our locale, then the global effect will become a reality.
CHAMPS Lab Helps Warn about Water at Its Fiercest

IMAGES FROM HURRICANE KATRINA and the Asian tsunami left the world with an indelible imprint of the destructive power of water at its most ferocious. A UCF engineer who has spent his career studying storm surges has developed a model to help predict, with unparalleled accuracy, what areas will be hit by a major storm and with how much water.

In related efforts, Hagen and the students are part of a program created to improve the national system for forecasting winds, waves and storm surges related to hurricanes. The goal of that project, which received $5 million from the National Oceanographic Partnership Program, is to generate real-time, probabilistic storm surge evaluations for the United States East Coast and Gulf of Mexico based on potential hurricane tracks. The results will help government agencies issue more accurate emergency advisories during storms. UCF’s partners in that effort include the universities of Miami and Florida, the U.S. Army Corps of Engineers, the National Oceanic and Atmospheric Administration/Atlantic Oceanographic and Meteorological Laboratory Hurricane Research Division and Oceanweather Inc.

Hagen and his students also collaborate with the National Weather Service Southeast River Forecast Center in Peachtree City, Georgia, on real-time forecasting for coastal rivers. The National Oceanic and Atmospheric Administration Office of Hydrologic Development is funding the CHAMPS Lab to develop a real-time forecasting system model for the St. Johns River.

For more information on the storm surge predictions, go to http://www.champs.cecs.ucf.edu/.

Scott Hagen

Professor Proposes Sustainable Landscaping for Florida Lakes and Gardens

Local Business Brings Lakes Back to Life

A WINTER PARK BIOTECHNOLOGY company with ties to UCF has developed a unique process for restoring the natural balance of polluted lakes at rapid speeds, with minimal land requirements and without the harmful byproducts of traditional techniques.

Through the use of a multi-patented technology, AquaFiber Technologies Corporation is able to remove harmful levels of phosphorus, nitrogen, carbon, calcium, sulfur, iron, lead, mercury, arsenic, selenium and other elements from tainted ground and surface water up to 1,000 times more effectively than natural or other constructed wetlands techniques.

AquaFiber was co-founded by G. Thomas Bland, Jr., a former adjunct faculty member in UCF’s College of Business Administration and a recently inducted member of that college’s Hall of Fame.

Bland said the company was started out of a concern for the ever-worsening state of the world’s surface waters.

During the past two years, AquaFiber has been demonstrating its remediation technology on Lake Apopka, once dubbed Florida’s most polluted large lake. The St. John’s River Water Management District has been working on restoring the lake for the past 20 years. While the efforts have significantly improved the water quality and clarity, they required the purchase of more than 35,000 acres of former farmland along the lakeshore to reduce the amount of phosphorous and pesticide run-off entering the water and the re-flooding of nearly 7,500 acres to instigate wetland restoration. AquaFiber believes it could remove all the lake’s phosphorous in just 10 years, using as little as 45 acres of land.

Currently, with two 500-foot long filtering channels located on 1/10 of an acre of land, AquaFiber has been able to produce potable quality water from Lake Apopka and remove hundreds of pounds of undesirable nutrients. The system is estimated to be able to treat up to 10 million gallons of water per acre of land utilized. The secret lies in the patented oxygenation process, periphyton algae and expertise in the floway process.

“‘Our technology can treat the volume of an entire lake every 30 days using an area equivalent to one percent of the area of the lake,’’ Bland.

While the company is currently focusing on perfecting and demonstrating its technology at the Lake Apopka site, plans call for contracting with municipalities and developers worldwide.

– Joth Arr Byz and Kevin Foller

Martin Guigley

While utility companies and municipalities are quick to warn Floridians of the penalties for irrigating too frequently, a UCF researcher is asking why the region’s landscaping doesn’t have better advantage of the climate that exists here.

Martin Guigley, director of UCF’s Arborium and a professor of urban landscape ecology, says Central Florida’s two primary landscaping concerns are the need for shade and the conservation of rainwater.

“People come to Florida for the year-round sunshine, but aside from sports activity, outdoor living here requires shade,” he says. And with the torrential rainstorms during the summer months, some method for collecting and reusing runoff water is essential. Design themes beyond the popular Mediterranean concept are needed to take advantage of Florida’s unique subtropical monsoon climate, he says.

“Florida is not like California,” Guigley says. “There are some beautiful plants in the Mediterranean climates that can’t handle our hot, humid July.”

Guigley advocates a return to some classical design themes that both conserve and beautify. “Around the globe there are many beautiful, functional old-world inspirations for comfortable and sustainable constructed landscapes in monsoon and Mediterranean climates,” he said.

While trees, planted closely enough together so that they touch, can provide shade – a structure such as a colonnade or pergola, often covered with vines, is necessary for rain shelter. Such features are common in hot–weather regions and examples are plentiful in old-world architecture.

What people tend to think about less is the collection and storage of rainwater. While storing water during months of plenty for use during the ensuing drought is a strategy adopted by ancient societies, the concept has not been seen as a need in modern U.S. design.

Quigley would like to see such pools become desired features of Central Florida homes and offices. Water can be harnessed from rooftops and higher elevation areas into stone-paved or tiled pools and held until it is needed for irrigation when it can either be pumped out or drained into holding tanks. During the dry season the pool areas are purely decorative.

Another concept that is growing in popularity across the country is the rain garden. These are depressed areas dug into the ground to collect water runoff and slowly filter it through a variety of roots and soils. While the water is usually allowed to gently absorb into the surrounding landscape rather than the nearest sewer, such options provide attractive, inexpensive alternatives to traditional design that can ultimately end up saving valuable natural resources, Guigley says.

For more information, contact Quigley at mquigley@mail.ucf.edu.

Martin Guigley

UCF Research

UCF Research

Scott Hagen, an associate professor of Civil and Environmental Engineering, and his team of graduate students developed a model that divides an area stretching from the mid-Atlantic to the U.S. East Coast and through the Gulf of Mexico and Caribbean Sea into thousands of triangular elements. Real-time data, depths and water velocities are regularly calculated for each reference point, allowing for the effect of currents and rising and falling tides.

Because of the last two record-breaking hurricane seasons, the researchers started studying potential storm impacts on Florida coastal cities. In a recent test, the team found that a Category 4 storm could cause a surge of as much as 25 feet in parts of Tampa Bay.

“We’ll never have a flood up to our rooftops as much as 25 feet in Tampa Bay. That’s what you saw in New Orleans.”

That’s Scott Hagen and Mike Salisbury of Fort Pierce.

Graduate students working with Hagen are known as the CHAMPS Lab.

Hydroscience Analysis, Modeling and Predictive Simulations Laboratory, which is known as the CHAMPS Lab.

Hagen said cities will have to balance their risks of storm surges with the costs of fortifying sea walls and levees when they decide how much protection they want to add. They also need to consider the gradually rising sea level, he said.

“Usually, we’d say if we have a 99.5 percent confidence level that it’s not going to fail, we’re going to feel pretty good,” Hagen said. “We can live with that year in and year out, but there’s still that one-half percent chance, and that’s what you saw in New Orleans.”

Graduate students working with Hagen are Peter Bacopoulos of Daytona Beach, David Conger of Orange Park, Yoji Endo of Tokyo and Mike Salisbury of Fort Pierce.

“In related efforts, Hagen and the students are part of a program created to improve the national system for forecasting winds, waves and storm surges related to hurricanes. The goal of that project, which received $5 million from the National Oceanographic Partnership Program, is to generate real-time, probabilistic storm surge evaluations for the United States East Coast and Gulf of Mexico based on potential hurricane tracks. The results will help government agencies issue more accurate emergency advisories during storms. UCF’s partners in that effort include the universities of Miami and Florida, the U.S. Army Corps of Engineers, the National Oceanic and Atmospheric Administration/Atlantic Oceanographic and Meteorological Laboratory Hurricane Research Division and Oceanweather Inc.

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For more information on the storm surge predictions, go to http://www.champs.cecs.ucf.edu/.

UCF Research

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### [WATER-RELATED RESEARCH AT UCF](#)

**RESEARCH** | PROJECT/TITLE | DESCRIPTION | AGENCIES |
--- | --- | --- | --- |
**[ENERGY EFFICIENCY]** | Gable, R. R. (PI) | Translational Microalgae Power | National Renewable Energy Lab |
| | Shrewsberry, P. D. (PI) | Photosynthetic/photovoltaic water splitting for hydrogen production using photo-catalysts containing thin-film cell catalysts | Research Institute of Innovative Technology |
| | Shrewsberry, P. D. (PI) | Photosynthetic/photovoltaic water splitting for hydrogen production using photo-catalysts containing thin-film cell catalysts | Research Institute of Innovative Technology |
| **[ENVIRONMENTAL TECHNOLOGY]** | Su, Yuan (PI) | Greenhouse technologies for building and building heating, cooling, and water quality control in urban environments | Southwest Research Innovations, Inc. |
| | Hampton, Michael E. (PI) | Biogas from manure | National Renewable Energy Lab |
| | Wanielista, Martin P. (PI) | Surface and Groundwater Modeling of Florida’s Coastal Aquifers | South Florida Water Management District |
| | Robinson, D. O. (PI) | Two-group study of bottle feeding in the marine iguana | University of Florida |
| **[CONSERVATION/BIOLOGICAL IMPACTS]** | Ehrlich, Lawrence (PI) | Falmouth Tracking Station June 2014 | Caribbean Conservation Corporation |
| | Farooqui, John, (PI) | Assessment of Rare and Listed Reptiles, Amphibians, and Birds in the Brevard County Marsh | St. Johns River Water Management District |
| | Su, Sufang, Beatrice, Stephen, Giou | Development of water quality models for prediction and control | Marine Environmental Commission |
| | Hagen, Scott (PI) | Water Quality Analysis for St. Johns River | St. Johns River Water Management District |
| | Novik, Frantis, (PI) | Regional Water Quality Protection Project: City of Kissimmee | City of Kissimmee |
| | Simms, Mark (PI) | Agricultural and Environmental Feasibility Analysis of Clean Water Act (CWA) Permit Applications for St. Johns River Water Management District | St. Johns River Water Management District |
| **[WASTEWATER AND SOLID WASTE TREATMENT]** | Wallwater, Linda (PI) | Impacts of Water Reuse on the Eastern Oyster, Crassostrea virginica, in Shallow-Water Estuaries and Aquatic Biotic Communities of the United States | Florida Sea Grant College Program |
| | Wallwater, Linda (PI) | Water Reuse: Reducing the Risk of a Disease Invasion of Gulf Stream Salmon (Salmo salar) - Mediterranean Sea through Research, Outreach, and Education | National Fish and Wildlife Foundation |
| | Wallwater, Linda (PI) | Reduction of Enteric Pathogen Outbreaks in Florida’s Aquaculture Industry | St. Johns River Water Management District |
| | Menz, Will (PI) | Development of a cost-effective, highly efficient means of removing nitrogen and phosphorus from wastewater | Florida Department of Environmental Protection |
| **[MEMBRANE TECHNOLOGY]** | Seagle, Gary (PI) | Development of cost-effective, high-quality membrane systems for industrial processes | University of Florida |
| | Seagle, Gary (PI) | Development of cost-effective, high-quality membrane systems for industrial processes | University of Florida |
| **[WATER MANAGEMENT]** | Taylor, James S. (PI) | Control in a Changing Water Environment | American Water Works Association |
| **[STORM SURGE PREDICTION]** | Wanielista, Martin P. (PI) | Hydrologic Balance: Econ River Basin Study | St. Johns River Water Management District |
| | Wanielista, Martin P. (PI) | Hydrologic Balance: Econ River Basin Study | St. Johns River Water Management District |
| | Wanielista, Martin P. (PI) | Hydrologic Balance: Econ River Basin Study | St. Johns River Water Management District |

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For more information on any of these projects, visit [www.research.ucf.edu](http://www.research.ucf.edu)
ABOUT THE COMPANY: Reiss Environmental, Inc. (REI) provides water and wastewater professional engineering services to clients locally, nationally and abroad. The firm specializes in water processing solutions by using its in-depth knowledge of conventional and advanced treatment processes, membrane piloting and treatment, process optimization, water chemistry, and regulatory requirements.

SPECIFIC AREAS OF TECHNOLOGY EXPERTISE:
• Regulatory compliance/permitting effectiveness
• Water quality, chemistry and treatment
• Advanced water treatment processes
• Membrane treatment
• Pilot study facilitation
• Master planning
• Water/Wastewater treatment preliminary and final design
• Reclaimed water implementation
• Hydraulic modeling/GIS conversion

TECHNOLOGY AND ITS IMPACT:
Advanced water and wastewater treatment plays an important role not only in protecting and preserving natural water resources but also in exploring alternative water supplies to meet future water demands. In particular, advanced water/wastewater treatment processes assist in improving the quality of potable drinking water and wastewater treatment. Increased groundwater withdrawals and improper disposal of wastewater produced every day could impact water bodies (such as lakes, springs, and wetlands), wildlife and other important environmental resources.

While at one time, only approximately one percent of the earth’s water was available for drinking, advanced water treatment expertise and technologies have expanded this availability. Exploration of alternative water supplies, including brackish groundwater, brackish surface water and seawater, is necessary for meeting future water demands. These alternative water sources must be treated in order to remove minerals, such as salt, to produce potable water. Pressure-drive membrane processes including reverse osmosis and nanofiltration are used for this purpose.

THE FUTURE OF THIS INDUSTRY:
The future will be shaped by increased global demand for water resources, scarcity of natural resources, continued industry consolidation, increased public health awareness, the need to meet regulatory requirements, and increased municipal privatization and industrial outsourcing. These industrial trends will demand professionals in the field to focus on issues such as greater water reuse, new and improved treatment technologies, conservation and more efficient usage of valuable natural resources to provide cost-effective treatment solutions and address regulatory requirements.

DEPARTMENT SPECIALTY:
The department is responsible for the development of applied technologies in support of the nation’s vision for exploration. The applied technology directorate specializes in mid-level technology readiness level development activities in the areas of launch vehicle and spacecraft processing and also develops technologies required for future long-duration human missions to the moon and Mars.

THE SCIENCE SURROUNDING ENVIRONMENTAL CLEANUP:
The science surrounding environmental cleanup is relatively young and immature. We are only now beginning to understand the complexities surrounding the removal and treatment of specific contaminants in an aquifer or surface water system. Therefore, there is significant growth and research potential in this field. With a huge decline in student enrollment in the environmental engineering field over the last five years within the U.S., employment opportunities in the future should be excellent for those who are seeking this degree now.

These technologies, in order of development, include the use of ultrasound within a zero-valent iron permeable treatment barrier, a deep barrier replacement technique, emulsified zero-valent iron for solvent or metals cleanup, emulsified zero-valent metal for soil remediation and several emerging technologies aimed at removing polychlorinated biphenyls from either natural media or structural components. All of these technologies have the ability to impact a large sector of the public by minimizing or eliminating potential health hazards from drinking water resources.

NAME: Jacqueline Quinn
TITLE/COMPANY: Environmental Engineer, Technology Implementation Directorate, Applied Sciences Division, NASA Kennedy Space Center
EDUCATION:
Ph.D. Environmental Engineering, University of Central Florida
M.S., Environmental Engineering, University of Central Florida
B.C.E., Environmental Engineering, Georgia Institute of Technology
Q & A with JAMES TAYLOR

SINCE 1975, PROFESSOR JAMES TAYLOR has conducted water treatment research that has been awarded more than $10 million in grants. He is the director of UCF’s Environmental Systems Engineering Institute, leader of the UCF Membrane Focus Group and holds the Alexander Chair for Civil and Environmental Engineering. He is recognized worldwide for his expertise in drinking water treatment.

Q: The United Nations is calling the suffering and loss of life associated with clean water shortages a crisis. Florida Gov. Jeb Bush has used the same term to describe the depletion of Florida’s natural water supplies. Can you briefly describe the problem?

Florida has historically used groundwater for drinking water supply, and today 92 percent of our drinking water supply comes from the ground such that we are taking water from the ground faster than it is naturally being restored. Hence, we are mining groundwater in Florida. We have to use conservation, alternate water sources and re-use to meet our future water needs. Consequently, new technologies will have to be developed and implemented to successfully integrate drinking waters produced from alternate sources into our current supply.

Q: What do Floridians in particular need to know regarding the availability of clean water?

That technology is available to make any source of water as clean as needed. The question is not quantity but what is the cost for producing the quality that is currently required, and that will be required in the future.

Q: What changes can we expect to see in water availability in the next decade? The next 25 years?

We can expect to see drinking water produced from surface waters, such as the St. Johns River and the associated lakes, and the Atlantic and associated brackish waters, integrated into our supplies. Correspondingly, the water requirements will increase, and the impact of using alternate sources and better technology will require the cost to increase.

Q: Will the purchase of drinking water become a given?

It is what we do now. The cost of drinking water will increase and the sources (surface, ocean, brackish, wastewater, stormwater) for drinking water will increase. As the cost increases it is highly likely that more private companies will begin to supply water to consumers or utilities, hence, purchase at a higher cost is a given.

Q: How is the research being conducted at UCF helping to alleviate these water issues?

At UCF, we are optimizing existing processes for developing new technology to treat alternate water sources and meet the ever-tightening regulations for drinking water. The integration of nanotechnology into existing methods of water treatment offers tremendous potential for improving water supply, water quality and water treatment. For example, the combination of oxide nanoparticles can help control biological growth on surfaces. Using such nanoparticles on membrane surfaces or the surfaces of pipes transporting water from the water plant to the consumers can reduce or eliminate membrane fouling and microbiological regrowth or release of opportunistic pathogens or problem organisms in distribution systems. The potential of this technology is nearly unlimited.

“Florida has historically used groundwater for drinking water supply, and today 92 percent of our drinking water supply comes from the ground such that we are taking water from the ground faster than it is naturally being restored. Hence, we are mining groundwater in Florida. We have to use conservation, alternate water sources and re-use to meet our future water needs.”

James Taylor
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