Guardians of the Great Lakes

By Judy Jepson

If a life-threatening contaminant were introduced into the City of Milwaukee's water distribution system, either accidentally or intentionally, would the chances of finding the source of the contamination using traditional methods "come too late?" In much the same manner, is the security of the Great Lakes in jeopardy, and if so, what measures can be taken to prevent a disaster and who would be in charge?

While questions and concerns such as these are not something most of us think about too often, this is exactly what's on the minds of some of the scientists and researchers at the Great Lakes WATER Institute in Milwaukee.

From the outside, the building that's home to the Great Lakes WATER (Wisconsin Aquatic Technology and Environmental Research) Institute—located on approximately 10 acres of land on Milwaukee's inner harbor at the east end of Greenfield Avenue—has few distinguishing characteristics to set it apart from other structures in the area. Once inside, however, a totally unique story begins to unfold.

According to institute director and senior scientist, J. Val Klump, J.D., Ph.D., "The WATER Institute engages in a broad range of research initiatives and studies related to the well-being of the Great Lakes ecosystem and their importance as the largest freshwater resource on the planet. Our goal is to obtain a thorough understanding of how this vast and complex system operates, and enhance our ability to preserve and protect this priceless resource for the future of Wisconsin and the nation."

The Great Lakes WATER Institute is a University of Wisconsin System research facility administered by the Graduate School of the University of Wisconsin-Milwaukee. Located on UWM's "harbor campus," the institute is the largest U.S. academic institution of its kind in the Great Lakes region, with 70 scientists, research associates, support staff and students. The University System purchased the property in the early 1970s, and the institute—formerly known as the Center for Great Lakes Studies, organized in 1967—moved into the building in the late 70s. (The building was originally constructed by Allen-Bradley, in 1965, for the manufacture of ceramic tile.) The site is now a modern research center with state-of-the-art laboratories and 1,300 feet of deep-water harbor frontage equipped to berth and service research vessels as large as 250 feet. New programs in freshwater science are constantly being developed for graduate and undergraduate students.

Dr. Klump explained that, "The Great Lakes WATER Institute is the umbrella organization for a number of research centers within the institute. There's the Center for Great Lakes Studies, which is a loose affiliation of faculty and scientists interested in doing Great Lakes research. The Great Lakes Aquaculture Center is a cooperative program with the U.S. Department of Agriculture through what's known as their Agriculture Research Services (ARS) and we have an agreement with them to establish a federal university joint program in aquaculture in the Great Lakes."

"We also have the National Institute of Environmental Health Sciences (NIEHS) Marine and Freshwater Biomedical Science Center, an organization that uses aquatic organisms to look at human health and toxicological issues. And, we have some large grants, one from the Department of Defense for the Center for Water Security."

"There are two units of the Wisconsin Department of Natural Resources at the institute—their Lake Michigan Fisheries Management Unit and some of their Law Enforcement people (wardens) have space here. They..."
manage and protect commercial and recreational fish harvest. The Wisconsin Sea Grant Program, headquartered in Madison, has an advisory service office here. And we serve as homeport for the U.S Environmental Protection Agency's Research Vessel, the Lake Guardian, which is the largest research vessel on the Great Lakes. In addition, we’re the Great Lakes coordination office for the National Oceanic Atmospheric Administration (NOAA) National Undersea Research Program. Although this program is relatively small, it supports some of our underwater robotics effort and research. Other partnerships include the Milwaukee Metropolitan Sewerage District, Pier Wisconsin and the John G. Shedd Aquarium.

For the casual observer, probably one of the institute's more intriguing aspects is their research vessel, the RV Neeskay, which was originally an army T-boat that did time in Korea. The ship provides year-round access to the lakes and a fully functional research platform and floating laboratory. Dr. Klump pointed out that the Neeskay is 53-years-old and they're "launching a campaign to replace her. We're trying to raise about $10 million to build a new research vessel with significantly more capacity and capability than the current one."

One of the research projects underway at the institute by assistant scientist Sandra McEIlgan, centers around beach contamination and swimming issues in the Milwaukee area and the Great Lakes. "Part of the research deals with the sources of contamination and where the bacteria, which are used as the water quality indicator, are coming from—finding the source has been a difficult thing to tease out," Dr. Klump said. However, a new technique using DNA fingerprinting has helped change that. "You can now use DNA fingerprinting to say these organisms came from seagulls, these are from human sources, these are from wildlife sources and these are from agricultural sources. This gives you an idea of where to go to attempt to solve the problem and see how extensive it is."

The institute's Shaw associate scientist Thomas Consi, Ph.D., whose interest lies in marine robotics, is designing instruments that help scientists get more and better data out of the lake, enabling them to do things not previously possible. He's presently creating an apparatus for looking at small currents on the bottom of the lake. "People are very interested in this because things like zebra mussels live on the bottom and they feed by filter feeding so they create currents; the small currents on the bottom are important because they're involved with the transport of nutrients and other materials," Dr. Consi explained.

"I'm also involved with engineering students from the UWM College of Engineering on marine related technology projects. Right now I'm working with a group of students on a small, computerized boat that could be the forerunner of a remote sampling boat, so if there's bad weather you can use the remote controlled boat instead of actually going out on the lake. I also have a group of students who are part of a project called the
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UWM ROV (remotely operated vehicle) Team. This is an international competition and every year teams from colleges and high schools build ROVs for competition.

ROVs are used at the institute for a number of research projects. They can search the lake bottom and send pictures to a site above, and they can collect data and conduct experiments. ROVs and remotely operated sensing devices can be extremely helpful in water security issues, Dr. Klump added. “We could use them like an aquatic bloodhound to sniff out places where plumes of contamination might be.”

The aquaculture aspect of the institute deals with research on raising food and Dr. Klump recently hosted visitors interested in discussing the possibility of urban fish gardening. Dr. Klump pointed out that significant progress has been made on the subject of raising fish indoors. “We now have the opportunity of actually bringing the raising of food into an urban setting, it doesn’t have to be an ideal outdoor environment for raising fish. We’re also doing research to change the breeding time of some fish from spring to a different month. Eventually, you can have fish in different tanks that spawn in different months so if you’re a fish farmer—you have a continuous food supply.”

Huge tanks at the institute contain fish of various ages, sizes and varieties, with lake sturgeon a species that’s an important focus for researchers. One favorite is a huge 15-year-old sturgeon, raised from an egg, affectionately referred to as “Porkchop” (it’s their only fish that’s ever been named). “Wisconsin has the largest and healthiest population of lake sturgeon in North America, and in the world,” Dr. Klump explained. “The scientists here have been working with sturgeons for over 20 years and are world experts. We surgically implant radio tags and sonic tags in some of them and then release them into the wild—we can track their movement with aircraft.”

Another scientist at the institute is engaged in research focusing on the extent of contamination in harbor sediments. Harbors are considered the initial catchall for all the debris that flows into the system. “Many harbors around the Great Lakes are contaminated,” Dr. Klump said. “To figure out how to clean up an area like that you have to map the contamination in the sediment and it’s difficult and expensive to do that.” Tim Grundl, a professor in the department of geosciences, has done work at the institute to develop a technique whereby a probe with a fiber optic laser is inserted into the sediment; the probe illuminates the sediment and causes it to fluoresce. A profile of what this contamination looks like is available in just a matter of minutes. This new procedure is not only faster than present methods it’s also less expensive and has a promising future.

Shaw assistant scientist Rebecca Klap is looking at the impact of some of the new class of contaminants, such as pharmaceuticals, health care products, perfumes, fragrances, caffeine and other items that survive the city’s treatment process. Cholesterol drugs,
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hormone and birth control pills, acetaminophen and caffeine are effective in our bodies because they don’t decompose and that characteristic allows them to survive the sewage treatment process and end up in the lake. Dr. Klump emphasized that if you have leftover medicine, the worst thing you can do is flush it down the toilet where it will end up in Lake Michigan. Instead, hang onto them until state authorities have implemented a pharmaceutical waste collection program similar to the “Clean Sweep” program for household waste, hopefully within the next few months.

Dr. Klump further pointed out that finding a solution to many of the problems they deal with is not easy. “With some of the issues, a lot of work goes into identifying the source of the problem. And in some instances, there is no ready solution. For instance, the zebra mussels that invaded the Great Lakes are here to stay. And there’s a possibility they’ll eventually invade all the inland water from here to California. Is there a solution? Probably not, we’re just going to have to learn to live with them.”

“Regarding the problems with beach closings—we’ve identified that storm water can be a major source of contamination in beaches. Even though you may have a great sewer system, if your storm water discharges onto a beach, and many do, a lot of those storm sewers contain fecal bacteria from a variety of sources. While we haven’t solved the problem, knowing the source can help towards trying to solve it.”

Along the same lines there are problems with respect to certain kinds of pollution that are coming off farm fields, urban parking lots, city streets, etc. “We know those represent a problem and there IS something we can do about them—we can encourage better non-point source control.” Dr. Klump pointed out, however, that when trying to solve a pollution problem it’s a lot easier to go after the Milwaukee Metropolitan Sewage District than to convince 150 farmers they have to keep their cows out of the creek; or tell city owners they shouldn’t fertilize their lawns because the runoff might go into the storm sewer; or convince people we should use less road salt in winter—it’s a lot of little things that add up. “We need to do a better job of controlling non-point source pollution and educating people on a number of issues including the fact that storm drains don’t go through the treatment process, so anything that goes into a storm drain goes right into Lake Michigan.”

In summation, Dr. Klump pointed out the importance of the Great Lakes to our national economy and to the world. “There are 40 million North Americans that live in this big industrial area, it contains nearly 20 percent of the world’s surface fresh water, but it’s a surprisingly fragile system in that these are largely closed bodies of water so that whatever goes into them...stays there pretty much indefinitely.”

For more information on the work of the Great Lakes WATER Institute, or if you would like to contribute financially to the institute’s grant funding or to the replacement of the Neesway, contact Dr. Val Klump at 414/382-1700.

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