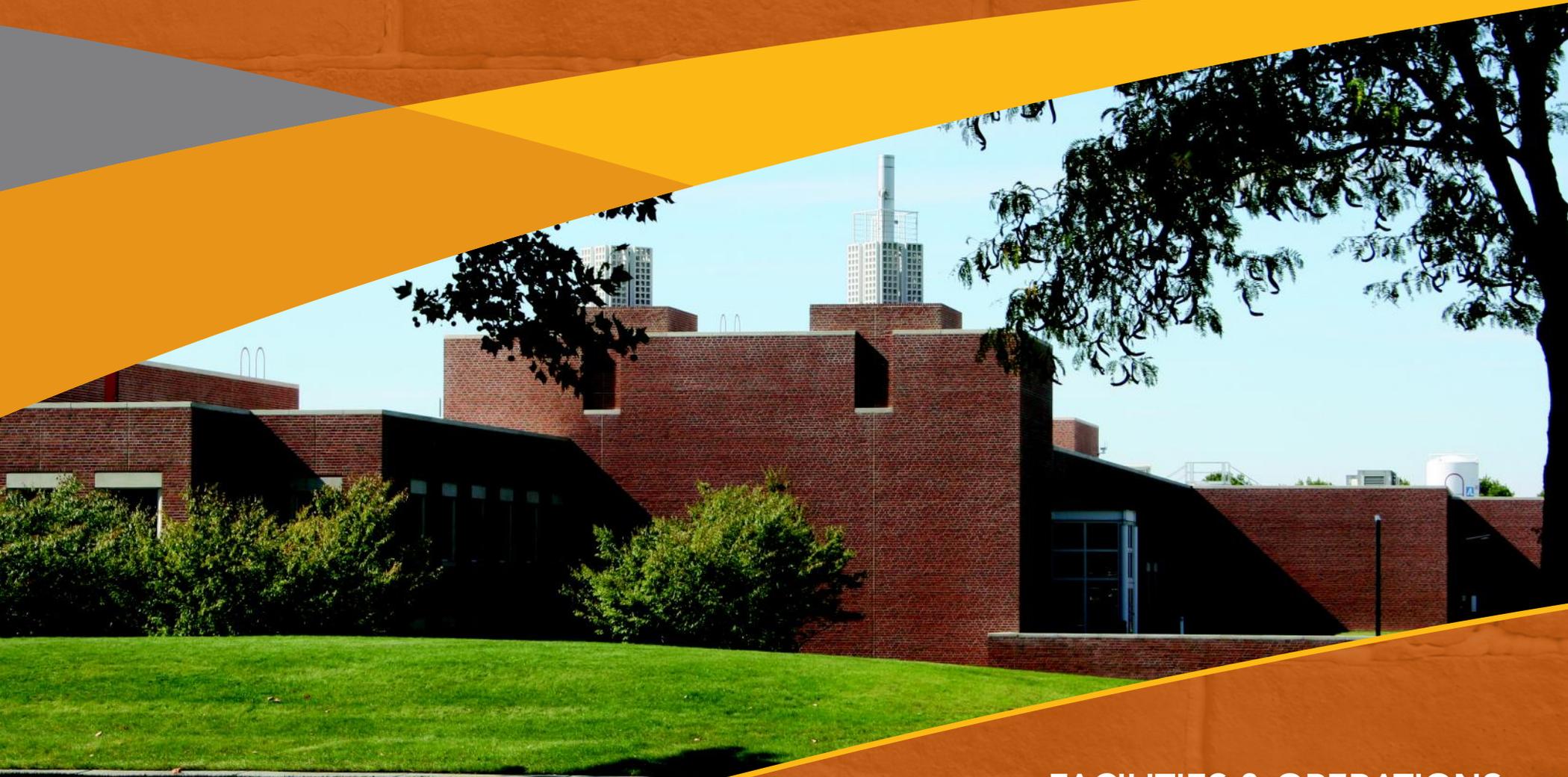


Building a Sustainable Future



Pacific Northwest
NATIONAL LABORATORY



FACILITIES & OPERATIONS



A Laboratory on a Mission

...to meet the needs of the present without compromising the future.

On the cover: The William R. Wiley Environmental Molecular Sciences Laboratory, a 200,000 square foot national scientific user facility.

On this page: The Environmental Technology Building and National Security Building house more than 650 staff members.

Pacific Northwest National Laboratory (PNNL) is in the midst of the largest transformation and construction project in its 43-year history.

In its early days, PNNL brought nuclear science and engineering expertise to the Department of Energy's (DOE) Hanford Site focusing on designing reactors, fabricating reactor fuel, and protecting the environment.

Today, PNNL is a multifaceted DOE Office of Science (DOE-SC) laboratory focused on delivering scientific solutions for energy, national security, and the environment. PNNL provides science, technology, and leadership to strengthen U.S. scientific foundations for innovation, increase U.S. energy capacity

and reduce dependence on imported oil, prevent and counter acts of terrorism and the proliferation of weapons of mass destruction, reduce environmental effects of human activity, and create sustainable systems.

As PNNL's mission evolves, so will the campus. This will be accomplished by delivering performance results in safe, secure, mission-ready facilities, that sustain our reputation of excellence both in existing and new facilities.

To accomplish this goal, DOE approved the Capability Replacement Laboratory project to propel PNNL's campus into becoming a world-leading national laboratory.

“The Facilities & Operations organization is dedicated to safely and sustainably building, operating, and securing the research campus of today and our campus of the future. All our actions and activities represent our core values of safety, teamwork, accountability, integrity, and respect, and will help assure that the Laboratory is ready to meet the mission of the U.S. Department of Energy.”

*– Larry Maples, Director,
Facilities & Operations*

Transition, Renovation, and Transformation

Transition

To accomplish the goals of the Capability Replacement Laboratory project, one of the first transitions is vacating much of the Hanford Site's 300 Area. This project is responsible for ensuring that PNNL safely and cost-effectively builds nearly 350,000 square feet of modern laboratories and relocates nearly 1000 staff members. New laboratories include the Physical Sciences, Computational Sciences, and Biological Sciences facilities, which will house capabilities in materials science and technology, radiation detection, and ultra-trace analysis research.

Part of the future campus also includes the joint PNNL and Washington State University

Bioproducts, Engineering, and Sciences Laboratory. This laboratory will lead research to produce techniques to convert agricultural byproducts and other sources of biomass into more efficient and less expensive sources of alternative fuels and chemicals.

The DOE's Environmental Management (EM) contractor is in charge of the demolition of the targeted 300 Area facilities. This process involves excavating and safely removing radioactive and chemically contaminated waste materials, and restoring the landscape through site backfill, grading, and revegetation.

"PNNL Operations staff are actively engaged in the day-to-day demolition activities in the 300 Area. We participate in daily planning meetings with the EM contractor to coordinate activities that minimally affect PNNL operations. In addition, PNNL Operations staff are conducting their own air sampling analysis to ensure the safety of PNNL staff still working in the 300 Area."

—Larry Kuga, Senior Engineer



Federal Energy and Water Management Awards. The awards recognized the contributions made toward the efficient use of energy in the federal sector.



Renovation

PNNL conserves energy and improves efficiency in its buildings. By investing in revitalization projects, the Laboratory looks for ways to implement energy efficiency opportunities. Some of these improvements include:

- Retrofitting facilities with new, more efficient system designs, such as lighting systems, air compressor systems, motor and pump systems, and heating systems
- Auditing facilities to identify future energy projects and replace inefficient equipment
- Fine-tuning heating, ventilation, and air conditioning (HVAC) systems
- Reprogramming heating and cooling systems to shut down based on outdoor temperatures
- Developing metering plans to evaluate buildings that currently do not have metered data
- Implementing variable-frequency drives on motors.

As part of the Capability Replacement Laboratory project, PNNL will retain four facilities in the 300 Area—Buildings 325, 331, 318, and 350—for up to 20 years. The Radiochemical Processing Laboratory, or Building 325, is one of PNNL's three strategic user facilities and is an anchor facility for environmental clean-up and the beneficial use of radioactive materials. The Radiochemical Processing Laboratory is undergoing renovation and revitalization to ensure it is mission ready to support long-term laboratory missions and to upgrade nuclear safety basis.



The Radiochemical Processing Laboratory, or Building 325, is one of four facilities in the 300 Area that will be retained as part of the Capability Replacement Laboratory project.



Transformation

The Capability Replacement Laboratory project propels PNNL's campus into a world-leading national laboratory. The Physical Science Facility, Biological Sciences Facility, and the Computational Sciences Facility are being constructed using the concepts and principles of sustainable design to ensure that the impacts and benefits to people, profit, and planet are well planned and balanced.

All new facilities on the PNNL campus will be Leadership in Energy and Environmental Design (LEED) certified. LEED promotes a whole-building approach to sustainability by recognizing performance in water conservation, energy efficiency, materials selection, sustainable site development, and indoor environmental quality. In addition, PNNL has nine LEED Accredited Professionals who have the knowledge and understanding of proper building practices, LEED principles, and the LEED rating system.

Although the Biological Sciences and Computational Sciences facilities originally were planned as separate buildings, these two facilities will be combined to allow the Biological Sciences Facility to benefit from the heat generated in the computing areas in the Computational Sciences Facility through heat recovery systems.

The Physical Sciences Facility will strive to promote a healthy and productive work environment by maximizing daylight and views in the office area and providing occupancy-based lighting controls. This facility also will be designed to minimize water use by improving the efficiency of the building fixtures and equipment.

The Bioproducts, Engineering, and Sciences Laboratory used Washington State University

Sustainable guidelines, which tracks sustainability during design through the LEED scorecard. The facility is not registered officially through the U.S. Green Building Council, however it was tracked as LEED Silver at the conclusion of the design phase. The facility uses day lighting strategies along with high-performance glazing. In addition, its exterior consists of tilt-up insulated concrete panels, which contain recycled content.

“The success that the Capability Replacement Laboratory project has, with regards to sustainability, will be realized because of the forethought during the initial project inception.”

– Gary Watkins, Architect



The Bioproducts, Engineering, and Sciences Laboratory will create a portfolio of biobased products and fuels that will help reduce the nation's dependence on foreign petroleum and its carbon footprint of energy use.

Gateway to Great Innovation

PNNL research scientists seek out in-house opportunities to test and deploy new energy technologies by partnering with Facilities and Operations staff.

These in-house technologies include:

- The Whole Building Diagnostician software, which tracks overall building energy use
- Wireless building control for HVAC systems
- Wireless temperature sensors
- Building Performance Measurement and Diagnostics
- Reflector-compact fluorescent lights (R-CFLs)
- Fuel cells
- Environmental Design Guide for Engineers (EDGE) software, which provides information about more than 250 opportunities to incorporate sustainable design into projects
- GridWise™, which involves new energy technologies designed to improve grid efficiency and reliability.

An example of this unique partnership was in 2003, when researchers, building occupants, and building management met to find ways to improve energy efficiency. By working together, improvements resulted in the building achieving ENERGY STAR status. These improvements included lowering water heater temperature, implementing night setback for lighting, installing motion sensors for lighting in common areas, and replacing inefficient exterior lights with more energy-efficient light bulbs.

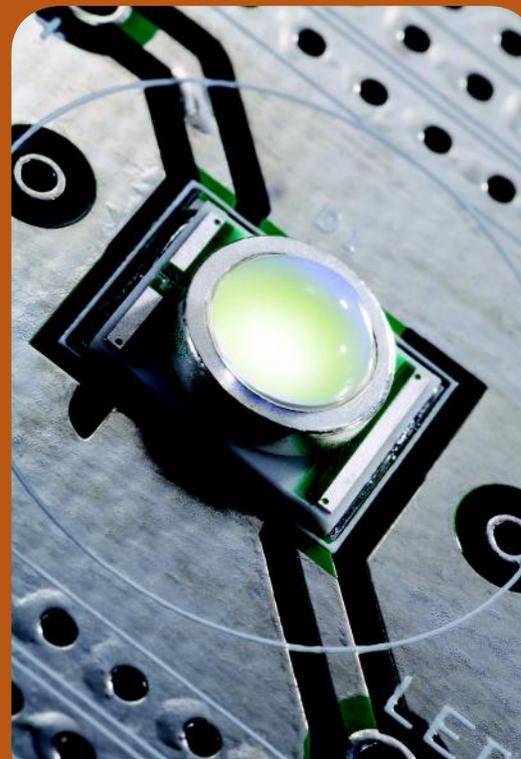
“Our research staff and our Facilities and Operations staff have a unique relationship. By using the Laboratory’s facilities as a testbed, we are able to test, refine, and incorporate our own science and technology.”

– William Sandusky, Manager

“As a result of our success with the R-CFLs, we currently are looking at other opportunities for applying LEDs throughout the campus.”

– Jeff McCullough, Engineer

The Department of Energy soon will release the first ever ENERGY STAR criteria—developed by PNNL—for LEDs.



A System of Sustainability

PNNL is committed to implementing Start Clean/Stay Clean principles whereby research and operations are planned and conducted to maintain or improve the Laboratory's facilities, minimize waste, and reduce environmental impacts. For example, systems and tools are being implemented to reduce excess chemicals, samples, and property; prevent future accumulation of excess materials; and minimize contamination of facilities.

Environmental Management

PNNL is a recognized leader for its innovative and sustainable environmental operation, and it is committed to providing a safe and healthy working environment for all staff; protecting the general public and the environment from unacceptable environmental, safety and health risks; and operating in a manner that protects and restores the environment. In support of this, PNNL's Environmental Management System (EMS) helps to achieve and demonstrate environmental excellence by assessing and controlling the Laboratory's environmental impacts.

The Environmental Protection Agency's (EPA) Performance Track program is the gold standard for facility-based environmental performance. The program encourages achievement of beyond-

compliance environmental excellence and continual improvement. The Laboratory's membership since 2004 demonstrates our commitment to protecting the public and the environment.

The Laboratory's uses the International Standardization for Organization (ISO 14001) EMS as a tool to manage, control, and measure environmental impacts. PNNL's outstanding environmental compliance record and its ISO 14001 EMS are instrumental in Performance Track membership.

Pollution Prevention

Pollution prevention is the cornerstone of PNNL's EMS. The program looks for in-house opportunities for resource conservation, recycling, and energy efficiency. Some of these opportunities include the Office Product Exchange, Excess Material and Redeployment Services, environmentally preferable purchasing, posting unwanted items on DOE's Nationwide Materials Exchange, and donating equipment and furniture to local schools.

Through PNNL's chemical redistribution program—ChemAgain—surplus chemical products are placed back in productive use by redistributing them to others who can use them either onsite or offsite. PNNL works with local

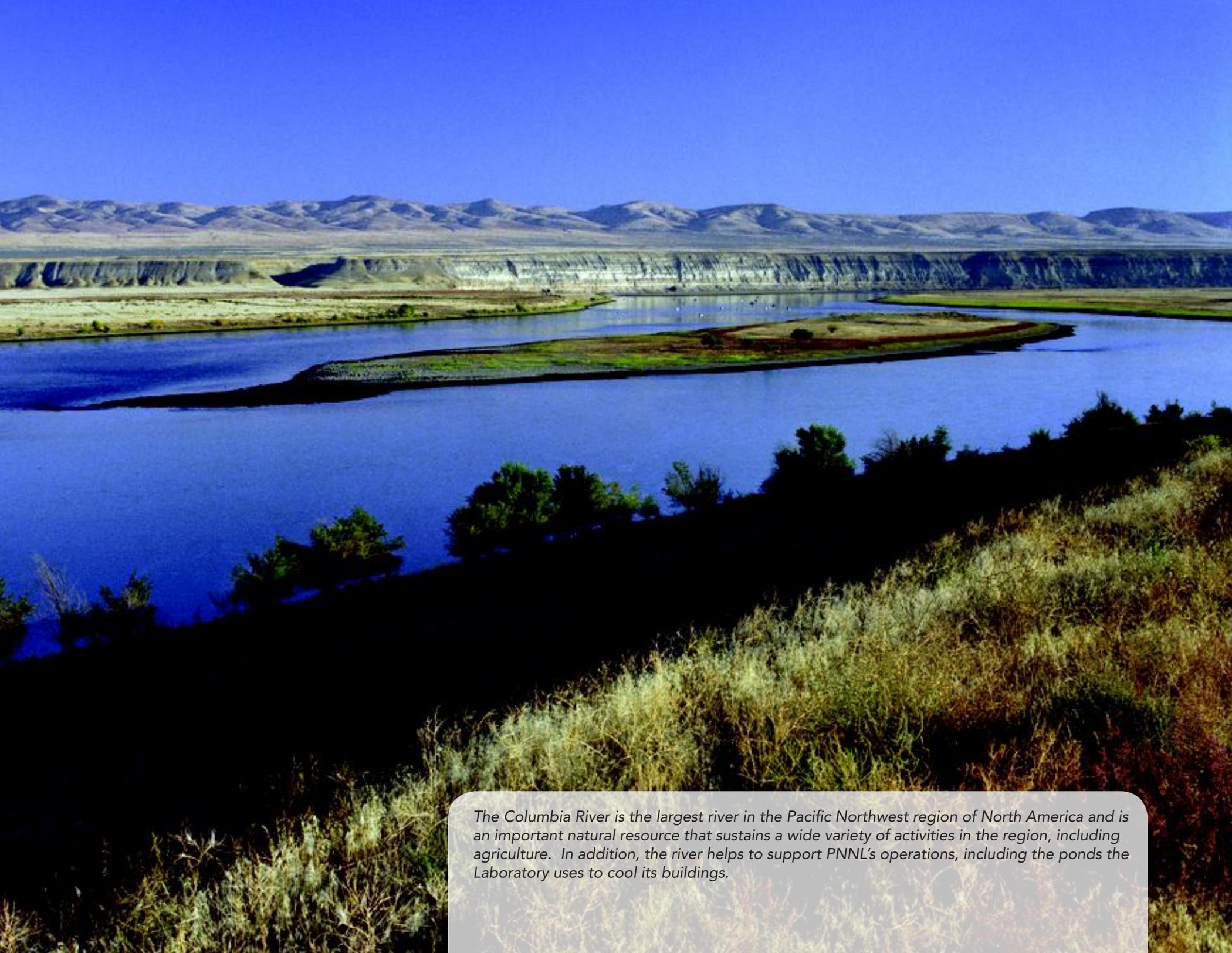
regulators to adhere to the state standards for chemical disposal. Since opening in September 2007, approximately 821 chemicals have been redistributed avoiding \$838,000 in costs.

"The Pollution Prevention program at PNNL provides a wide range of pollution prevention services from operating the office waste recycling program to providing technical assistance to laboratory researchers."

—Kami Lowry, Program Manager



**DOE Award for Best in Class
for "Using the EMS to Improve
Chemical Management"**



The Columbia River is the largest river in the Pacific Northwest region of North America and is an important natural resource that sustains a wide variety of activities in the region, including agriculture. In addition, the river helps to support PNNL's operations, including the ponds the Laboratory uses to cool its buildings.

Honoring Our Natural Assets

Much of southeastern Washington, where the PNNL campus is located, is a shrub-steppe environment. This unique environment of the Columbia River corridor includes a semi-arid landscape. Although arid, this area provides a major habitat for diverse populations of plants and animals such as mule deer, elk, coyotes, badgers, and bobcats.

PNNL's Ecological Monitoring and Compliance Project collects data and information on the Hanford Site and identifies sensitive habitats and species to assure compliance with legal and regulatory requirements for natural resources.

PNNL is a good steward of the approximately 362 acres on campus. PNNL leases nearly 100 acres of its land for farming. Included in this contract for farming is a requirement to use best industry practices wherein the farmer monitors moisture content in the soil and irrigates only when necessary.

In 1965, Laboratory Director Sherwood Fawcett requested that 575 Sycamore trees be planted around the edge of the property. Later, Laboratory Director Ron Paul requested an additional 500 trees be planted. The trees were planted partially as windbreaks, but mostly for their innate beauty and the great contribution they make to improve the quality of our environment. Today, "Sherwood's Forest," as it is known, is a well recognized asset to the campus.

Another example of how PNNL is making good use of its land is by allowing approximately 50 staff members each year to maintain garden plots to grow flowers, vegetables, and herbs. Mower clippings and mulch from campus grounds are recycled and reused in this garden as well. When these trees were pruned recently, PNNL used most of the wood chips for vegetation and dust control and donated some to the City of Richland for vegetation control along bike and foot paths.

A common hazard in this area is the tumbleweed. Following windstorms, large numbers of tumbleweeds invade the campus, block access to entrances, and present a fire hazard. In the past, it would take the Grounds Management staff at PNNL three weeks to collect and dispose of them. Today, tumbleweeds are baled before transporting to the landfill. What used to take three weeks to clean up, now takes just one day.



“Baling tumbleweeds and other bulky weeds has significantly reduced both landfill space and the time it takes for our grounds crew to rid the campus of these hazards.”

– Don Cox, Teamster



Fueling Alternatives

PNNL is committed to using environmentally friendly energy sources. The Laboratory partners regularly with government, educational, and commercial institutions to share opportunities for energy efficiency. In 2006, the Laboratory helped bring the first public and government use Ethanol-85 and Biodiesel-5 station to eastern Washington.

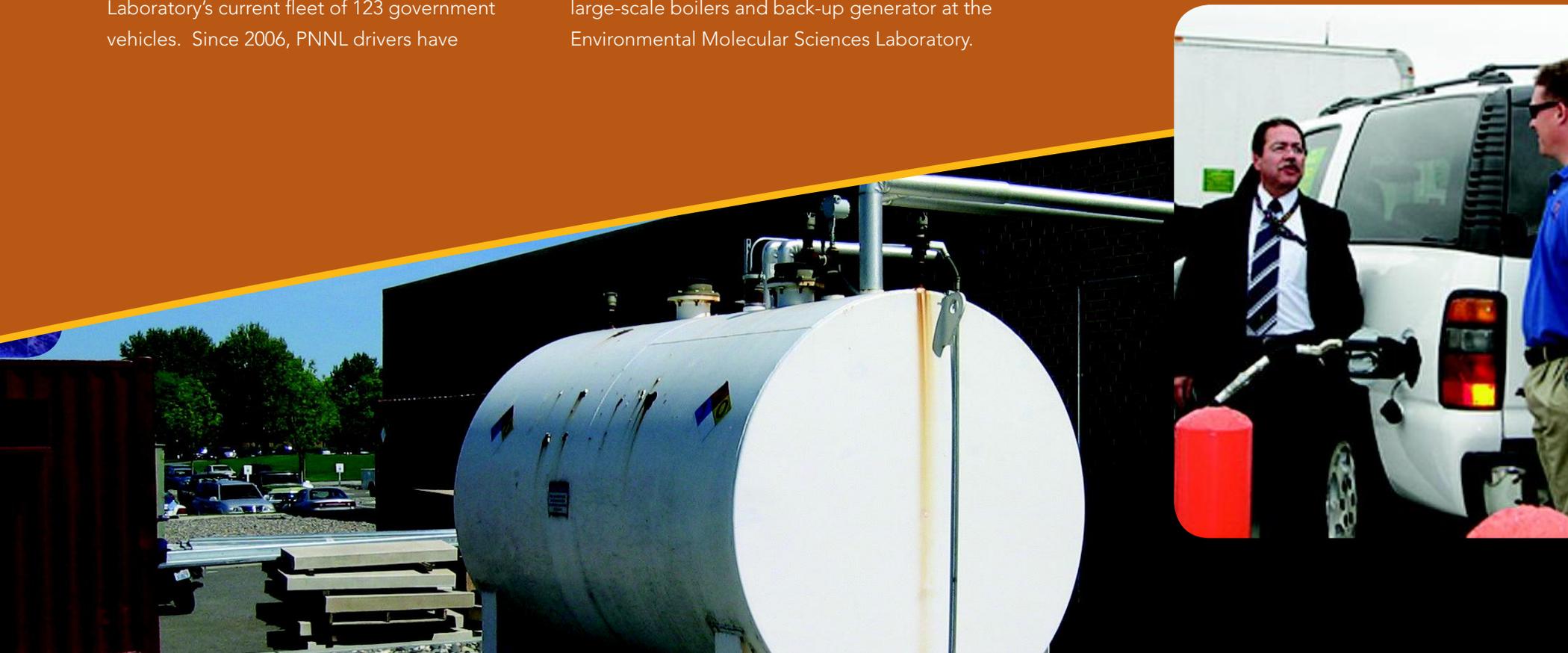
The biofuel at this fuel station contains less toxins, sulfur, and carcinogens, and is used by the 27 alternative fuel/flex fuel vehicles in the Laboratory's current fleet of 123 government vehicles. Since 2006, PNNL drivers have

increased their use of biofuels by almost 400 percent. In the coming years, the Laboratory plans to increase use of this station by purchasing new vehicles that use alternative fuels and replacing its gasoline-only vehicles with higher fuel efficiency vehicles. PNNL will begin using hybrid and plug-in hybrid vehicles as they become available.

In 2006, PNNL became the first laboratory to use biofuel on such a large scale. Biodiesel became the alternative fuel source to power the large-scale boilers and back-up generator at the Environmental Molecular Sciences Laboratory.

“The Laboratory cultivated a relationship with Connell Oil and through that relationship, PNNL was able to provide our area with the first public accessible E85 fuel station in eastern Washington.”

– Hipolito Velez, Jr., Fleet Manager



Resource Use and Efficiency

Conservation and efficiency improvement are important parts of PNNL's energy and water plan. Through a proactive energy and water management program, PNNL has reduced its energy consumption per square foot by 21.7 percent since 2003, and has made water conservation and energy efficiency key elements of its Facility Energy Management Plan (FEMP).

Through FEMP, the Laboratory transfers skills, knowledge, and solutions of energy management and resource activities gained

through working directly with agencies and DOE offices so that information can be shared with all agencies.

PNNL research staff work closely with Facility and Operations staff to provide expertise in implementing new and emerging energy efficiency technologies as part of laboratory operations. They provide technical support regarding renewable power purchases, which allows the Laboratory to meet mandated energy reduction goals.

“To successfully market the sustainable design and development capability, we need to ‘walk the talk,’ setting the example for future clients on our own campus.”

– Kim Fowler, Engineer



DOE Pollution Prevention Star Award for “PNNL Pollution Prevention Activities” – Three consecutive years.

Energy Efficiency

PNNL has improved its energy efficiency significantly by developing and expanding the use of energy-efficient technologies. As a result, PNNL became the first DOE Office of Science laboratory to have three facilities designated as ENERGY STAR.

Through a major energy improvement project, PNNL transferred a more energy-efficient design for recessed can and compact fluorescent lights to the marketplace. Through this project, PNNL identified problems with existing reflector-compact fluorescent lights (R-CFLs) and developed technical production specifications. Since then, DOE has adopted the Laboratory's testing requirements in the ENERGY STAR criteria for R-CFLs.

Other energy improvements have included installing occupancy sensors to control lighting, distributing WattStopper motion sensor power plug strip technology, solar heating systems, and solar-powered parking lot lights.

In an effort to further reduce its energy use, streetlights on the PNNL campus soon will be retrofitted with light-emitting diodes, or LEDs. LEDs operate with more efficiency, longer operating life, less cost, and less environmental impact.

PNNL continues to diversify energy supplies. In addition to renewable energy technologies that will be implemented in the new facilities, PNNL's main Richland campus now uses 12.7 percent power from renewable sources, which includes six percent from local wind power. Since 2006, PNNL's Marine Sciences Laboratory in Sequim, Washington, has derived 100 percent of its power from local landfill gas combustion generation.

At PNNL's 200,000 square foot Environmental Molecular Sciences Laboratory (EMSL), significant energy costs were avoided despite its energy-intensive supercomputers. The heat from these supercomputers is harnessed to help heat the facility. Energy use also was reduced by cleaning its roof regularly to increase solar reflectance, which can reduce the roof temperature up to 35 degrees over time.

The EMSL uses natural gas to heat its large boilers, which heat the laboratory throughout the fall and winter. However, in the summer, when the need for heat is minimal, only five percent of the boilers' heating capacity is needed, which is extremely inefficient. Therefore, smaller, more efficient natural gas boilers were installed for use in warmer months, which reduced the overall energy by more than six percent.

“The energy efficiency technologies incorporated into the EMSL, with the help of \$1M in Bonneville Power Administration funding, not only saved considerable energy and money, but we have also realized additional savings by retro-commissioning the building and by applying cutting edge R&D diagnostic capabilities for our building equipment.”

– Marc Berman, Facility Energy Manager

“The installation of these small boilers has given EMSL the greatest energy savings during the past 3-4 years.”

– Ken McMullin, EMSL Building Manager



Water Conservation

PNNL is dedicated to a long-term commitment to manage water resources wisely and initiated a water management plan in 2004, which is updated annually.

PNNL Grounds Management applies science to its landscaping challenges by reducing the Laboratory's water use with the latest technology to compile data on the watering systems, monitor soil moisture, and fertilize with only required chemicals. Since 2003, the Laboratory has reduced its river water use by more than 35 percent on the PNNL campus. PNNL predicts a further reduction in irrigation water use on the landscape surrounding the new facilities by using water-efficient irrigation, weather-based irrigation control, and planting a mix of native plants.

Water used for PNNL facilities was reduced by installing low-flow urinals, automatic infrared sink faucets, and infrared flushometers; replacing

single-pass equipment cooling with more efficient technologies; and by conducting staff outreach and education.

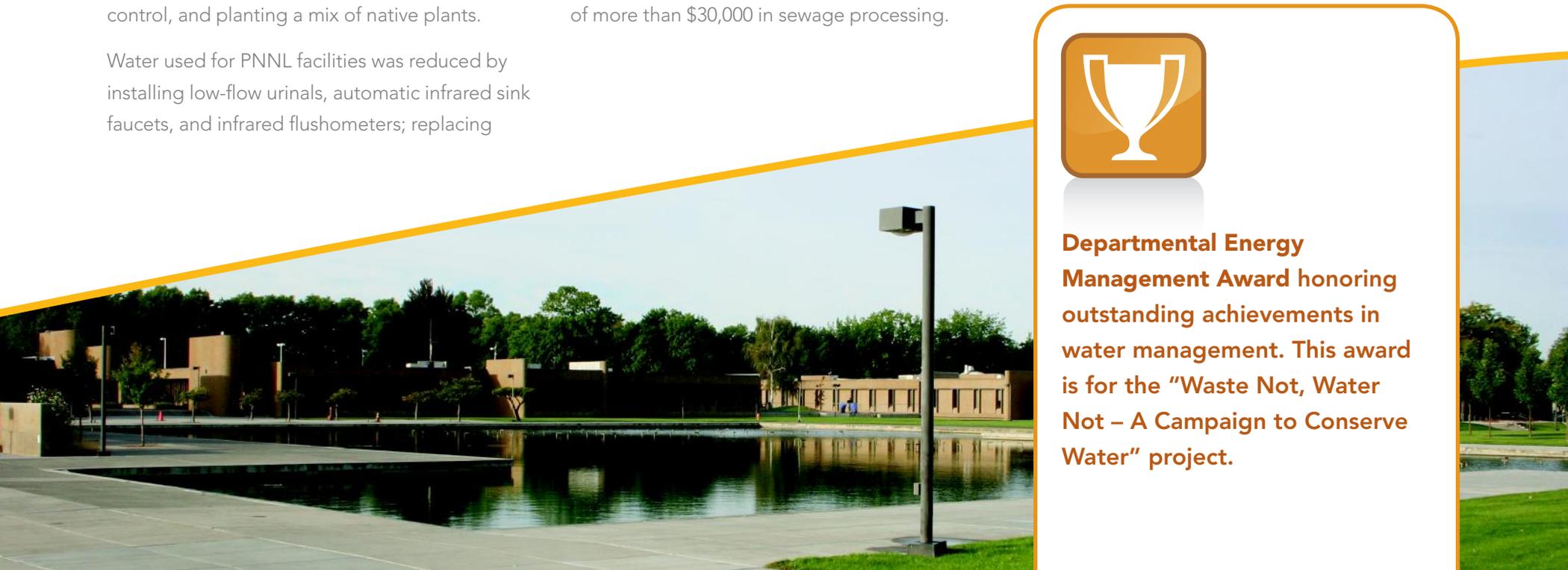
One major change in the cooling system was the process for managing ponds used to cool campus buildings. The water from these ponds runs in a closed-loop system through the chillers used for air conditioning, which means water replacement can add up easily to one million gallons a day during hot weather. In the past, the warm water was pumped to the Richland City sewer. Today, the water is cleaned and the irrigation system realigned to allow the water to drain into the campus irrigation system. By reusing the cooling water, a savings was achieved of more than \$30,000 in sewage processing.

“Is there a better way? This question winds it’s way through everything we do on the Laboratory Campus grounds. Experimentation is our motto, results are our guide.”

– Jeff Lettau, Grounds Manager



Departmental Energy Management Award honoring outstanding achievements in water management. This award is for the “Waste Not, Water Not – A Campaign to Conserve Water” project.



The Next Challenge – PNNL's Future Campus

With the realization of the Campus Master Plan, this will be PNNL's future campus in 2015. PNNL plans to diversify its energy supply by reviewing new cost-effective purchases of an even broader diversification of renewable energy resources and evaluating and implementing the use of off-grid generation systems (e.g., fuel cells, microturbines, wind energy systems, and solar).



Awards

United States Presidential Award for Leadership in Federal Energy Management.

The ChemAgain program won the Office of Science "Best in Class" award and the DOE "P2 Star Honorable Mention" award.

DOE Award for Best in Class for "Using the EMS to Improve Chemical Management."

DOE Pollution Prevention Star Award for "PNNL Pollution Prevention Activities" – Three consecutive years.

Departmental Energy Management Award honoring outstanding achievements in water management. This award is for the "Waste Not, Water Not-A Campaign to Conserve Water" project.

Federal Energy and Water Management Awards. The awards recognized the contributions made toward the efficient use of energy in the federal sector.

White House Closing the Circle Award.

Federal Electronics Challenge (FEC) Silver Award for its program to reuse and redistribute electronic equipment.

Federal Laboratory Consortium (FLC) Award for Reflector Compact Fluorescent Lamps.

Additional information

Pacific Northwest National Laboratory

<http://www.pnl.gov/>

ENERGY STAR

<http://www.energystar.gov/>

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