PREPARING
FOR THE
IMPROBABLE

also inside
Allies on the Job
Think of It as LEED for Infrastructure
Port of Call: Los Angeles
Safety and Reliability

In power generation, few words carry more weight.

These critical concepts apply to every type of plant in every location, every project on every unit. But Mother Nature throws curveballs that make us look at every decision in a new light. After every natural disaster, we all focus tighter on being prepared.

Whether you’re looking at new ways to reinforce your nuclear plant, as we discuss on page 11 of this issue, thinking about how to increase efficiency at your gas-fired generation station or considering system upgrades at your coal unit, Burns & McDonnell has experience with every aspect of power generation.

We’ll help you take the next steps that get you where you need to go — safely and reliably.

Ray Kowalik
President
Energy
What’s Sustainable?

Sustainability permeates everything we do today — at work, at home, on our commutes. At Burns & McDonnell, we understand that sustainability is important to you, our clients and partners. That’s why we’re making it easier for you to find how sustainability affects every topic we write about in Benchmark. Look for the leaf icon throughout the publication to see how our work is contributing to sustainability on all fronts.

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### Technical Q&A: Pump Specs and Procurement

**Q:** What factors need to be considered when selecting the right pumps for a facility?

**A:** Each facility is designed to meet specific needs, so the things to consider when choosing the right pump can vary widely. However, there are a few key considerations facility operators must mull before delving deeper into the process.

First, consider operating conditions for the pump. The flow and head, or pressure, will determine whether a dynamic or positive-displacement pump will be needed. Next, review other physical aspects — the fluid being pumped, vapor pressure of the fluid (net positive suction head) and required horsepower — to further refine what specific type of pump could perform as needed for the facility.

Experience can also play a significant role in determining which pump is ultimately chosen. If a facility operator prefers a particular original equipment manufacturer (OEM), that can push the service into a certain pump type based on what the OEM makes. Similarly, a bad experience with an OEM can influence the decision to explore alternatives.

In some cases, facility operators could consider the possibility of retrofitting a pump, which would require a separate evaluation to consider whether the pump would be capable of handling the material being pumped.

Determining the right pump can be a lengthy, multistep process that must factor in future growth and potential industry changes. To help, Process Industry Practices, a consortium that collates its members’ standards into best practices based on industry, released PIP REEP006 Pump Selection Guidelines in October 2013. The guidelines look at all of these factors in a flowchart and work the user down to a list of a few pump types that would work in the required service. The guidelines also describe the pros and cons of each type to help the user better define the proper pump.

For more information, contact Jay Zaffino, 832-389-5730.

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### How It Works

#### Biological Treatment of Selenium

Selenium poses one of the world’s conundrums. It was identified in the 1950s as an essential nutrient when consumed in trace amounts. However, it is toxic at higher concentrations and capable of causing myriad health problems for humans and wildlife. It is particularly problematic for aquatic animals, because it bioaccumulates and enters the food chain.

Selenium has become a significant regulatory concern in the fossil fuel and mining industries. In the 1970s, the U.S. Environmental Protection Agency began regulating it, setting the maximum contaminant level for water in the parts per billion. As knowledge of the chemical characteristics, fate in the environment and analysis has improved, the regulatory control has become increasingly stringent.

"Many of our clients are concerned about regulatory liabilities associated with selenium," says Brian Foy, industrial water/wastewater director in the Burns & McDonnell Water Group. "The tightening regulatory environment is forcing organizations to consider improvements to wastewater and stormwater management systems."

As a natural element, selenium cannot be destroyed. The effectiveness of physical, chemical and biological treatment options is dependent on the selenium state, which also affects mobility and toxicity in the environment. Biological treatment is promising because it converts selenium to a less toxic form, concentrating the dissolved selenium as a solid. Both mechanical and natural treatment systems have been used to biologically reduce selenium in water.

Biological treatment of selenium works by bacteria using selenate and selenite as electron acceptors. Dissolved selenium is reduced to elemental selenium, which becomes associated with the microorganisms and can be removed from water using gravity settling and/or filtration.

"Biological treatment of selenium provides a cost-competitive option to meet regulatory limits," Foy says. "While biological treatment is not feasible for every project, it has proved to be a useful tool in protecting the environment while balancing the cost of regulatory compliance."

For more information, contact Brian Foy, 816-822-3039.

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**[START UP]**
Building on Success
Scott Clark Pursues ‘Giant Step Forward’ for Dallas-Fort Worth and Raleigh, N.C.

Ever since he was a kid, Scott Clark has been building things. Growing up he spent much of his time restoring classic cars with his dad — everything from Model As to Studebakers to Jaguars. These days he tinkers with his 1957 Indian motorcycle or the 1972 Datsun 240Z he’s rebuilding with his 17-year-old son, Callen.

Since being named general manager of Burns & McDonnell offices in Dallas, Fort Worth and Raleigh, N.C., in January, Clark is now building something quite different — three regional offices.

While continuing his role as national practice leader for the firm’s OnSite Energy & Power Group, Clark now manages regional employee-owners working within the Environmental Studies & Permitting, Construction/Design-Build, Global Facilities, Business & Technology Services, and Transmission & Distribution groups.

Building a Career
After graduating in 1987 from Texas Tech University with a bachelor’s degree in mechanical engineering, Clark began his career at General Dynamics (now Lockheed Martin) working on the F-16, F-22 and A-12 programs.

In 1991 he joined Carter & Burgess, a Fort Worth-based consulting engineering company. During his 19 years there he worked alongside Burns & McDonnell on projects at the University of Texas and the University of Chicago, and on master plan implementation for Thermal Energy Corp. (TECO).

“In working with Burns & McDonnell, I gained a high regard for the firm’s capabilities,” Clark says. “After being invited to visit the corporate office, I was impressed with everything I learned about the culture and the ownership model.”

In January 2010 Clark and Jon Schwartz joined Burns & McDonnell. Together they opened the firm’s Fort Worth office — in the game room of Clark’s home, equipped only with two cell phones, two laptops and a printer. Since then Schwartz has become regional manager for OnSite Energy & Power in Fort Worth, where Clark now oversees 58 employee-owners occupying an entire floor of an office building. Clark also manages another 36 people in Dallas and 26 in Raleigh.

Building on Success
Clark assumed responsibility for the DFW office from Leslie Duke, senior vice president and general manager of the Burns & McDonnell Houston office. Duke says Clark’s leadership skills and experience made the transition an easy one.

“What makes Scott such an incredible leader is that he knows how to build a business locally, regionally and nationally,” Duke says. “He rebuilt a business, and his people respected him enough to follow him. It’s an amazing and unique quality that’s hard to come by.”

During his early days as general manager, Clark met in small groups with all employee-owners in the DFW and Raleigh offices, gathering input for a strategic plan to guide the remainder of the year.

“I’m listening, learning and challenging each of our employee-owners to take a giant step forward,” Clark says. “I’m encouraging everyone to add more value to the company.”

Building Respect
Even as Clark’s responsibilities continue to build, he remains committed to strong relationships. His work with TECO endures, now for Burns & McDonnell on the West Cooling Tower Replacement project.

“He’s very knowledgeable, personable, and he takes the job very seriously,” says Steve Swinson, TECO president and CEO. “He does a great job of listening, organizing and moving forward in a methodical way. He’s very honest and straightforward and acts like he’s a part of your organization.”

When he’s not on the job building relationships or in his garage building motors, Clark can be found at the race track, where he races a vintage open-wheel car — and often wins. In addition to his son, Callen, his cheering section includes his wife, Jana, and his 14-year-old daughter, Jessie.

Contact Scott at 817-840-1233.

Scott “does a great job of listening, organizing and moving forward in a methodical way. He’s very honest and straightforward and acts like he’s a part of your organization.”
WATER WORKS IN THE SOUTHEAST

WAYNE HAYNIE Expands Water Services into the Region with a Focus on Talented Recruits and Building Supply for the Future
Wayne Haynie’s colleagues know him as a business builder in the Southeast, where he has launched the next phase of his engineering career to expand Burns & McDonnell’s water practice in the region.

His first step was to recruit two talented regional engineers who had the experience to help him take aim at projects that would differentiate Burns & McDonnell and build its regional portfolio of successful clients.

After successfully integrating with a publicly traded mega firm, Haynie was looking for a place where clients are a high priority, and where he could build a staff of rising stars who fit into the Burns & McDonnell employee-owned culture. He joined the company in 2012 as the Southeast regional water practice manager. “There is something about the energy and enthusiasm here that makes it such an easy fit for me,” Haynie says.

Haynie is building on 30 years of experience as an environmental design engineer and utility operations manager. He also brings project management and operational experience for municipal and industrial clients.

“The most rewarding thing about my work is helping co-workers achieve success and job satisfaction. I get a lot of joy out of that day to day,” he says.

Water for the Region

Georgia has already implemented significant water conservation measures, and planning for permanent supply growth is in the works, including expanding reservoir capacity. Economic recovery and job creation are tied to a stable water supply.

“Creating that stable water supply will keep Georgia and surrounding states competitive,” Haynie says. “Without diligently addressing this issue, the Southeast could lose new job creation opportunities.”

That makes expansion in the Southeast a natural step for the Burns & McDonnell water practice, which has provided service to municipal clients since the company’s founding in 1898.

“It takes a unique individual to build a practice from scratch,” says Ron Coker, senior vice president over the firm’s water practice. “Wayne is a great recruiter, mentor and leader for our staff, and a trusted adviser to his clients, qualities that are essential to building Burns & McDonnell’s Southeastern presence.”

“Wayne has provided creativity and vision that continues to place us on the cutting edge as a water/wastewater service provider.”

Local Perspective

A Georgia native, Haynie grew up hearing relatives talk about people who “gotten out” of the Georgia Institute of Technology and done well. “You don’t simply graduate from Georgia Tech,” Haynie says. “You ‘get out’, like you’ve been in jail. It’s part of the lore.”

Civil engineering competed for his attention with football, track, cross-country and courting Marie, the high school sweetheart whom he later married.

“When I realized a 2-minute half-mile wasn’t going to put bread on the table, I had to let college athletics go,” he says. “Concentrating on water and infrastructure seemed noble and practical.”

Much of what is now metro Atlanta in the 1960s didn’t have water and sewer systems, including Haynie’s grandparents’ homes in rural Gwinnett County. Summers spent running to an outhouse helped him appreciate the value of improving water and sewer access.

After graduating from Georgia Tech, Haynie grew into a water engineer and manager for local governments and a regional consulting firm in metro Atlanta. His career led him to manage the practice that designed and oversaw construction for the miles of deep tunnels required to solve Atlanta’s combined sewer overflow challenges.

Making Clients Successful

Haynie also takes pride in his track record of building strong teams of professionals. “He is a teacher, a natural-born recruiter, and his experience across the Southeast is unparalleled,” says Arnold Olender, vice president of the Burns & McDonnell Atlanta office. “Part of Wayne’s appeal is that he knows how to connect to clients and build trust. He brings out the best in our people, the client’s staff and subcontractors alike.”

As Haynie builds his staff, he is also developing a strong platform for success in the Southeast. He started with work for the Newton County Water & Sewerage Authority in Covington, Ga.

“Wayne has been a guiding force in our most recent growth period, a period of time that saw the authority developing from a small rural water and wastewater utility to the larger and more progressive utility that it is today,” says Mike Hopkins, executive director of the authority. “Wayne has brought more than just creativity and vision that continues to place us on the cutting edge as a water/wastewater service provider.”

Haynie’s team is now working on the planning and conceptual design for projects associated with the combined sewer overflow program for Chattanooga, Tenn. The estimated $250 million project provides a path forward for the aging sewer system after a settlement with regulators.

“Similar to Atlanta, Kansas City, Mo., and Kansas City, Kan., the city of Chattanooga has experienced water quality problems in its major waterway, the Tennessee River, for many years,” Haynie says. “Our Southeastern team is dedicated to bringing creative, innovative solutions to move the city and its system into the future.”

Contact Wayne at 770-510-4520.
Allies on the Job

Partnership with OG&E Fosters Trust, Communication, Value — and Success
Relationships mean something. Whether they’re financial, professional or personal, working together can produce positive results.

When such relationships build into an alliance — as they have for Oklahoma Gas & Electric (OG&E) and Burns & McDonnell — the bond grows even stronger.

“Whenever you just ‘work’ for a client, you go in and you do a job and you’re done,” says Josh Evans, the Burns & McDonnell client coordinator for work with OG&E. “When you’ve reached the level of what we call an alliance partner, you’re in it for the long haul. You’re in it together.”

What started formally in 2008 with a collection of projects worth $100,000 has escalated into an entire portfolio — power plants, transmission lines, control centers, processing plants, environmental permitting, remediation, facilities and more — with total installed costs of alliance projects exceeding $1 billion.

“Burns & McDonnell has proved they can do the job,” says Phil Crissup, vice president of Utility Technical Support at OG&E. “I’m proud to have the opportunity to work with Burns & McDonnell because the values of the two companies are so similar — both always strive to perform safely and professionally.”

The companies work together on projects of all sizes, from retrofits to permitting, design, new construction, commissioning and beyond. The partners are familiar enough that when OG&E needs professionals, Burns & McDonnell is ready to go.

“We’re one group pulling toward a common goal,” says Chris Sanders, manager of engineering and planning for OG&E’s Muskogee Power Plant, where Burns & McDonnell has completed several projects and is scheduled for several more. “It’s great, because we don’t have to bring everybody up to speed like it’s a brand-new project.”

Clearing Communication
Like many relationships, this partnership is strengthened by communication — clear, honest, frequent and productive communication.

At the Muskogee Power Plant, OG&E has been upgrading its original, 1970s-era controls. These are the analog levers and switches and circuits that turn operators’ decisions into rotations for banks of 7,000-horsepower fans, ignite lines of 4,000-degree burners and otherwise manage a unit that generates 567 megawatts of electricity, enough to power 50,000 homes.

No small task.

But Burns & McDonnell engineers had done this before, on another unit at the plant. And had worked on similar jobs at other OG&E plants. And were familiar with other components within the plant and others like it, because they’d been working alongside OG&E personnel at this and other sites.

The partners talk, compare notes and call one another when checking settings on a reference junction at another plant — connections that keep outages, change orders and startup times to a minimum, which helps keep output at the maximum.

“That’s what you do when you’re on the same team,” says Dan Perry, who works in Power Supply Services for OG&E. “You improve as you go along. Things get better and better. We find something, take care of it quick and move ahead.”

Steve Thornhill, a department manager in the Environmental Studies & Permitting Group at Burns & McDonnell, has worked on nearly a
dozen projects through the alliance. Whether it's a minor study on a retrofit or a routing plan for more than 100 miles of transmission lines from Seminole to Muskogee, Okla., he enjoys being able to apply past knowledge to current projects.

He and his fellow employee-owners come to know what the utility expects on projects, what schedules are favored and what report formats are preferred. And that means the task at hand — not bureaucratic approvals or paperwork or anything else — is the clear focus.

"For them, a lot of their projects are on short timelines," Thornhill says. "They call you, you pick up the phone, and you're rolling."

Building Trust

That was the case last year, as OG&E dealt with the unexpected: a release of electrical insulating oil from a utility-owned substation in Fort Smith, Ark.

Based on past work through the partnership on environmental, energy, transmission, construction, permitting and other projects, OG&E didn't hesitate to call Burns & McDonnell for help cleaning up. When that call came in, environmental professionals hit the road from the Burns & McDonnell headquarters in Kansas City, Mo.

"We were on our way within 24 hours," says David Langford, vice president of the firm's Environmental Group.

During the next seven months, Burns & McDonnell professionals oversaw initial emergency-response activities, performed maintenance work, devised technical plans and compiled reports for regulators, services deemed "well-integrated, seamless and timely" by Ken Raymond, OG&E's leader on the project.

"Their professional conduct throughout the entire project was greatly appreciated and not unlike those of other Burns & McDonnell personnel I've had the pleasure of working with," says Raymond, who works in OG&E Electric Services.

In this way, the partnership reaches across internal business units, creating transparent ways of doing business.

"Whenever your work spans multiple practice areas, you're able to better understand the client's needs," Langford says. "It's multiple points of contact between the two organizations. It's not a one-off, or one point of contact. It's not narrow. They don't need to go to five different companies to get this help. They can go to one place."

Chad Wolfe, a project manager in the Burns & McDonnell Global Facilities Group in Oklahoma City, welcomes the opportunities — and challenges — the partnership addresses.

Take the utility's Metro Service Center, inside a 1970s-era warehouse in Oklahoma City. While the property was originally developed by another company to store oilfield drilling equipment, it was purchased by OG&E and converted into space for offices and other uses, enduring a number of rearrangements, renovations and additions along the way.

A year ago, when OG&E needed someone to assess structural conditions, devise plans and complete major upgrades, Wolfe's team didn't hesitate.

Much.

"We definitely thought twice," Wolfe says with a chuckle, acknowledging the complexities inherent in a project with so many variables. "But for OG&E, we're willing to take on these types of projects that we wouldn't otherwise do. Because they're a known client and they're known well, the risk profile looks different."

So does the result. Wolfe noted the team was able to engage construction personnel from day one, to infuse the design project with viable means and methods for constructability, key components for boosting project value and controlling costs on the anticipated $5 million job.

"We're really partners walking through this process," Wolfe says. "Rather than having a traditional relationship, where they're holding their cards and we're holding ours and just trying to navigate all that, it's more of a partnership situation: This is difficult, and we're going to figure this out together."

Boosting Performance

Such trust isn't automatic. It's earned, built over time and through consistent returns.

The alliance grew out of OG&E's search — through an open, qualifications-based bidding process — to identify a provider of full-service engineering services. The utility and Burns & McDonnell signed the formal agreement on Sept. 10, 2008, outlining...
responsibilities and expectations for the business relationship, one that already had been building through earlier collaborations. The partnership would take “working together” to a new level. Leaders from both companies would meet quarterly to discuss past performance, current needs and future projections. They’d establish benchmarks and track an established set of mutual metrics. Feedback would help build on successes and minimize setbacks.

The approach has worked. By forming a strong foundation — one supported by facts, fortified by results and confirmed with detailed measurements — the two companies focus on continued improvements resulting in mutual benefits.

“With every project and every client you have a learning curve,” says Joey Mashek, business development manager for the Energy Group at Burns & McDonnell. “With OG&E, it’s established. We all know the expectations from day one.”

High expectations are not unusual.

Consider Windspeed, a project to build 120 miles of 345-kV overhead transmission lines to carry wind-generated electricity. In 2006, the partners worked together to come up with a plan for designing, permitting, completing and energizing the line within what would then be an unprecedented time window: two years.

The team delivered.

“I’ve driven down almost every county road in Oklahoma — three times,” recalls Jamie Precht, a senior environmental scientist who evaluated more than 5,000 routing options for Windspeed. “We looked at structures, houses, schools, wetlands, everything.”

Her work joined efforts from dozens of other professionals on the job, all working closely with their OG&E partners to not only meet expectations but surpass them. Jeff Chastain, a project manager in the Construction/Design-Build Group at Burns & McDonnell in Oklahoma City, smiles when he reflects on the coordinated effort that has become a standard.

“The success of that project was second to none,” Chastain says. “It was done in record time and ahead of schedule. That shows what we can do, working together.”

**Posting Results**

Chastain notes that the Windspeed project led to more work: During 2013, he found himself on OG&E projects involving three new substations and two new transmission lines.

“Keeping them in the know on everything that is going on — good or bad — is what continues to grow the relationship,” Chastain says. “We want to get to a point that we can cover anything that OG&E or its subsidiaries can throw at us.”

At Burns & McDonnell, seven of the firm’s 11 internal divisions already contribute to projects through the alliance partnership. Evans, who coordinates the alliance with OG&E while managing the Burns & McDonnell office in Oklahoma City, is confident the arrangement will endure and eventually tap into even more capabilities.

“Every project has its challenges,” Evans says. “No project is perfect. And if people aren’t willing to work together, the project fails. But if you have a team that’s open to communication and works together to find solutions, then you’re going to end up successful.”

*For more information, contact Josh Evans, 405-200-0301.*
PREPARING FOR THE IMPOSSIBLE

Nuclear community goes above and beyond-design-basis to strengthen safety measures
Catastrophic damage at the Fukushima Dai-ichi nuclear facility in Japan provided the world’s nuclear community with valuable lessons.

The challenges faced by operators during the 2011 earthquake and subsequent tsunami were beyond any previously faced at a commercial nuclear reactor.

The disaster prompted the U.S. Nuclear Regulatory Commission (NRC) to take action, requiring new strategies for mitigating problems beyond reactor design capabilities for U.S. nuclear facilities.

Those strategies include beyond-design backup measures for loss of power during natural disasters, ensuring reliable hardened containment vents and enhancing spent fuel pool (SFP) instrumentation.

All of these were major problems in the Fukushima disaster, says Bob Arteaga, Electrical Department manager in the Nuclear Group at Burns & McDonnell.

Operators nationwide have until the end of 2016 to upgrade facilities that are already designed to handle the worst natural disasters.

"Even with all of the safeguards designed and built based on worst-case scenarios, the Fukushima plant couldn’t sustain operations amid the water from the tsunami — it took everything with it," says Roman Estrada, the design engineering manager at Nebraska Public Power District’s (NPPD) Cooper Nuclear Station in Brownville, Neb.

His plant is working with Burns & McDonnell to upgrade the Cooper facility that sits on the Missouri River about two hours north of Kansas City, Mo.

**Beyond-Design Strategies**
Following the Fukushima disaster, an NRC task force conducted a systematic review of its regulations and processes then developed a comprehensive set of safety enhancement recommendations.

On March 11, 2011, a magnitude 9.0 earthquake struck off the coast of Japan. The quake triggered a tsunami packing 45-foot waves that crashed ashore east of the Oshika Peninsula of Tohoku and traveled nearly 10 miles inland. More than 15,000 people died as a result of the natural disaster.

Following the earthquake, Tokyo Electric Power Co.’s nuclear reactors shut down as designed and safety systems kicked in to provide cooling and long-term protection for the nuclear reactors.

But the tsunami was beyond anything imaginable — three times greater than the facility’s design basis. Massive uncontrollable flooding crippled even the backup diesel generators, leading to a complete loss of power.

With severe damage, a loss of off-site power and the inability to generate power on-site, operators used the installed plant batteries to control the plant systems. But they were not designed for long-term, continuous operation without recharging.

As the batteries began to fail, operators lost the ability to control reactor cooling. Repositioning the valves to manually control cooling wasn’t feasible because high radiation levels prevented access.

As cooling systems malfunctioned, three reactors experienced melting of the reactor fuel and subsequent hydrogen explosions. The explosions severely damaged the units, blowing the walls and roofs off the reactor buildings. After the explosion, thousands of people were evacuated from the surrounding area to prevent radiation exposure. No one died in the nuclear incident and subsequent radiation exposure.

Japanese regulators ordered the facility to be decommissioned, as Fukushima became the largest nuclear incident since the 1986 disaster in Chernobyl, Ukraine.
The regulatory commission approved the recommendations and ordered all U.S. facilities to comply with the enhancements based on lessons learned at Fukushima. “In the face of beyond-design-basis external events, the goal is to stretch safety measures to respond specifically to an extended loss of power, worst-case seismic events, severe flooding and loss of access to the ultimate heat sink, which provides an unlimited supply of water to nuclear reactors to cool vital systems and containment,” says W. Larry Stendebach, senior client manager for the Burns & McDonnell Nuclear Group.

The purpose of these measures is to mitigate fuel damage in the reactor and SFP of an affected nuclear facility.

One of the main requirements is for plants to fulfill key safety functions for core cooling, containment integrity and the SFP. Plants must now implement a three-phase approach for mitigating such beyond-design-basis events.

The first phase requires the use of installed equipment and resources to maintain or restore core cooling, containment and SFP cooling. The transition phase requires plant operators to provide portable, on-site equipment and consumables to maintain or restore these functions until they can be handled with off-site equipment. In the final phase, operators must secure resources necessary to sustain the functions indefinitely.

Carrying Out Safety Enhancements
The U.S. is the world’s largest producer of nuclear power, accounting for more than 30 percent of nuclear-generated electricity worldwide.

Cooper Nuclear Station is among 104 nuclear reactors nationwide installing systems to meet the latest NRC requirements. Cooper staff are building an arsenal of beyond-design resources such as fire trucks, pumps, diesel engines and an on-site helicopter pad for equipment delivery from a regional resource center in Phoenix.

Burns & McDonnell, the plant’s engineer of choice, is handling several projects, including designing and building new SFP instrumentation and brainstorming ideas for handling improbable catastrophes.

“Their team is essentially an outreach of me and our team here,” says NPPD’s Estrada. “We have full confidence in their quality engineers, who are responsive, committed and knowledgeable about every facet of our plant.”

Burns & McDonnell has 4,500 professionals, including a dedicated unit with nuclear specialties and experience.

“They carry a lot of experience and credibility and have the ability to go right after a problem and provide innovative ideas and solutions,” says John Patterson, director of nuclear projects at the Callaway Energy Center in Fulton, Mo. Ameren, Callaway’s owner, has hired the Burns & McDonnell team for various nuclear-related projects.

TIMELINE OF EVENTS

March 11, 2011
A magnitude 9.0 earthquake strikes off the coast of Japan, generating a 45-foot tsunami that submerges the Fukushima Dai-ichi nuclear power plant.

March 18, 2011
NRC shares details of Fukushima incident with U.S. nuclear power plants and reminds operators of post-9/11 requirements for additional emergency equipment.

April 1, 2011
NRC forms task force to examine lessons learned from the Fukushima incident.

April 29, 2011
NRC inspectors begin examining severe accident management procedures and training at U.S. nuclear power plants.

May 11, 2011
NRC requires nuclear power plants to provide information on post-9/11 emergency equipment, as well as how the plants ensure strategies to use the equipment remain effective over time.

May 20, 2011
NRC reports all U.S. nuclear power plants have appropriate post-9/11 emergency equipment and procedures in place.
The group has built strong working relationships and a reputation for proficiency in nuclear projects.

“Our clients appreciate our depth of understanding of nuclear power — the plant, the procedures, the requirements and the day-to-day needs of operating a nuclear facility,” Stendebach says. “Our people have lived it, working directly for and in plants around the country.”

**Putting Safeguards in Place**

At the Cooper facility, Burns & McDonnell is designing improvements to the SFP instrumentation that currently monitors normal and slightly off-normal conditions. During the Fukushima event, remote readings of SFP water levels were not available, and plant operators could not get close enough to verify water levels because of high radiation.

“We have to be able to read it when it’s been shaken up and the radiation levels are off the scale,” Estrada says. “That’s the level of worst-case scenario we are preparing for.”

Planned improvements include remote indication capabilities with a backup channel for monitoring. The system’s components also have internal and external batteries and a portable DC power source. Operators can remotely control where the equipment draws power.

“Another safeguard will be a hardened pipe vent system to release hydrogen,” Arteaga says. “While all systems have designed-in ventilation, the NRC wants to see them streamlined, preventing the buildup of hydrogen in the reactor vessel, which is what led to the hydrogen explosions at Fukushima.”

The upgraded ventilation is more robust, allowing for venting on multiple occasions in two places and allowing it to be triggered remotely if necessary.

Flooding was another key issue at Fukushima, and it’s a realistic potential threat for the Cooper plant and a neighboring plant, Fort Calhoun Station.

In 2013, the Nebraska plants were surrounded by floodwaters from the Missouri River after record water releases from dams normally used to prevent flooding. While neither plant was at risk for a Fukushima-type disaster, these plants must now prepare strategies to mitigate a scenario worse than what actually occurred: complete submergence of the plant due to cascading dam failures.

“All of these safeguards give the NRC confidence that licensed plants are maintaining the highest level of public health and safety as well as common defense and security.”

“A concern for us would be what if a dam breaks upriver,” Estrada says. “What would we do if we were totally underwater? Could we put a barge on the river and run power off it? Could we put something on the roof?”

These are among the many options Burns & McDonnell is analyzing for the Cooper plant and providing viable options to handle the improbable what-if.

For more information, contact W. Larry Stendebach, 816-363-7283, or Bob Arteaga, 816-363-7283.

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**July 12, 2011**
The NRC’s task force issues a report on lessons learned from Fukushima. The task force determined U.S. plants are operating safely yet recommended 12 strategies for enhancing reactor safety.

**Sept. 9, 2011**
Commission hears report recommending the immediate implementation of six of the 12 task force strategies for U.S. nuclear power plants to enhance safety.

**Oct. 3, 2011**
NRC staff proposes three-phase approach for prioritizing the task force recommendations.

**Oct. 18, 2011**
Commission approves proposal for implementing recommendations by the end of 2016.

**Dec. 15, 2011**
Commission approves proposed three-phase approach to prioritizing the implementation of recommendations.

**March 12, 2012**
The first regulatory requirements for the nation’s 104 reactors are set, based on lessons learned at the Fukushima Dai-ichi facility. NRC issues three orders requiring nuclear plants to implement safety enhancements related to mitigation strategies for loss of power during natural disasters, ensuring reliable hardened containment vents and enhancing spent fuel pool instrumentation.
The Daniel Boone Bridge carries Interstate 64 traffic across the Missouri River between St. Louis County and booming suburbs in St. Charles County. The original span, built in the 1930s, delivers three tight lanes of westbound traffic and is a commuting bottleneck.

The Missouri Department of Transportation (MoDOT) chose a design-build approach with a budget of $117 million to develop a four-lane replacement bridge to pair with an adjacent four-lane, 1980s-era span. MoDOT encouraged bidders to offer project enhancements within the budget. The bid by a joint venture of Walsh Construction Co. and Alberici Construction Co., with Burns & McDonnell as designer, won the job in July 2012. “Our design provided more improvements at a lower cost than the competition, and a much faster delivery schedule than MoDOT anticipated,” says Kevin Eisenbeis, Burns & McDonnell design manager on the project.

Among the enhancements, the bid included adding a fourth westbound lane for 2.4 miles, which will alleviate congestion, and raising the Spirit of St. Louis Boulevard overpass to correct a vertical clearance problem. “We jacked the bridge up 24 inches,” says Jeff Mues, a Burns & McDonnell department manager in Transportation. “Getting standard vertical clearance was important for safety.”

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The new Boone Bridge will be 2,615 feet long, with a navigation span of 510 feet. “That is the longest parallel flange, steel-plate girder span on the Missouri River,” says Mike Carroll, a Burns & McDonnell associate structural engineer. “Burns & McDonnell has designed more Missouri River bridges than any other consultant, so we had a really good feel for what was economical and the best layout here.”

That helped during the accelerated schedule. Design work was completed in nine months, allowing steel orders to be submitted with enough lead time to keep the contractors on schedule.

“The foundations for the new bridge are impressive as well,” Carroll says. “They have up to 11-foot-diameter drilled shafts, socketed into limestone. The foundations are designed to resist seismic and barge impact loads, even if a major flood and scouring event were to occur.”

Construction on the new bridge is expected to be complete in late 2014. Eastbound traffic will shift to the new bridge, allowing for rehabilitation work on the 1980s span. When that is complete in late 2015, westbound traffic will shift to the 1980s bridge, and the 1930s bridge will be demolished.

For more information, contact Jeff Mues, 314-682-1535, or Mike Carroll, 816-276-1587.
In recent years the Hawaii Air National Guard (HIANG) transitioned to modern, fifth-generation F-22 Raptor jets for the 19th and 199th Fighter Squadrons. Replacing 1960s-vintage facilities was in order for the beddown, with sustainability at the forefront of planning.

"With Hawaii being what and where it is, there was a desire to make it as cost-effectively sustainable as possible," says Mark Zimmerman, Burns & McDonnell project manager.

Beginning from a blank page and a charrette involving pilots and maintainers who will use the facility, the design and construction have gone even further. The combined squadron operations facility and aircraft maintenance unit hangar has achieved Platinum certification under the U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED) program. “This is for a functional facility constructed within its budget while implementing industry-leading sustainable features,” Zimmerman says. “It is the first Air National Guard facility to receive LEED Platinum certification.”

Photovoltaic (PV) panels on the roof, in combination with solar panel-covered parking shade structures, offset more than 75 percent of the building's energy. Solar water heating accounts for more than 50 percent of the hot water load. "The high cost of electricity on the island, plus abundant sunshine, made those feasible," says Carrie Bradley, senior sustainability specialist. "PV systems are often too expensive to install and carry an unfavorable payback. In this case, it made sense."

The grounds highlight native Hawaiian landscaping materials. Infiltration basins along the taxiway, using recycled concrete from demolition, cut stormwater runoff almost in half.

Water conservation was also reflected through the use of ultra-low-flow plumbing fixtures, which reduce water use 55 percent compared with typical code-compliant fixtures.

These individual features culminate in a facility that provides exceptional compliance with the government’s Energy Policy Act, exceeding the mandated 40 percent savings with help from high-efficiency HVAC systems, controls, a superior building envelope and smart metering.

For more information, contact Mark Zimmerman, 816-822-3847.
Think of It as LEED for Infrastructure

New Envision™ Sustainability Rating System Focuses on Water, Power, Transportation and Industrial Projects

Since 2000, owners desiring “green” buildings have had the U.S. Green Building Council’s Leadership in Energy and Environmental Design (LEED) certification system to guide their efforts. But those responsible for water reclamation plants, power substations, bridges and industrial facilities have been largely on their own — until now.

A new program designed for infrastructure is making it easier for municipalities and utilities to evaluate and publicly demonstrate project sustainability. Known as Envision™, the tool includes a process for evaluating projects using standardized criteria.

“The demand for more sustainable infrastructure is growing. But professionals who attempted to apply LEED principles to these projects found it was often inadequate,” says Doug Dietrich of the Burns & McDonnell Strategic Initiatives Group. “Envision fills that gap.”

The program was introduced in 2012 by the Institute for Sustainable Infrastructure (ISI), a nonprofit founded by the American Society of Civil Engineers, American Public Works Association and American Council of Engineering Companies.

Burns & McDonnell is a charter member of ISI and only the second firm worldwide to have 150 professionals credentialed to guide clients in the use of Envision. “Now that the word is out, that number is continuing to grow. We now have credentialed Envision professionals nationwide representing all disciplines: civil, structural, mechanical and electrical engineering; the environmental sciences; architecture; and construction management,” Dietrich says.

What’s in It for You?

The Envision program bears many similarities to LEED, including its professional accreditation process and points-based awards — bronze to platinum — for projects that seek certification. It considers not only a project’s environmental impact, but also its life cycle economic and community quality of life contributions.

All these things can be of value to organizations facing opposition to their projects.

“Sustainable design has not historically been associated with electrical utilities, whose substations and transmission lines tend to have large environmental footprints,” says Will Kirby, a civil engineer in the Burns & McDonnell Transmission & Distribution Group. “But in reality, many already include sustainable solutions in their projects.

“Envision will help them tweak their designs, if needed, and allow them to be recognized for their sustainable design features.”

Envision also addresses elements of the planning and site selection process related to community stakeholder outreach, helping organizations make decisions that stand the test of time.

“The process might identify opportunities to improve a habitat that a transmission line passes through,” Kirby says. Cities under a consent decree to remove combined sewer overflows may use the same process to find affordable, eco-friendly ways to keep stormwater out of the sewer system.

Increasing Awareness

With the first Envision-guided projects winding their way through the certification process, Dietrich believes now is a good time for municipalities and public agencies to pilot the rating tool.

“As we saw with LEED, the early projects that are certified benefit from a considerable amount of press,” he said.

Ultimately, it’s not the plaques or publicity that matter. “The real value of Envision — and one reason more professionals are adopting it — is that it enables organizations to be more transparent to their shareholders, voters and ratepayers,” Dietrich says. “When people see and become part of the process, they better understand how and why decisions are made. And the support for sustainability grows.”

For more information, contact Doug Dietrich, 816-627-6040.

A comprehensive guide to Envision can be reviewed on the ISI website at http://sustainableinfrastructure.org/faq/envision/ratingsystemstructure.cfm. The site also offers downloadable presentations at http://sustainableinfrastructure.org/downloads/index.cfm.
The Port of Los Angeles is a busy place. It’s the busiest place for goods coming into the United States, handling approximately 175 million metric tons of cargo annually. Together, the Port of Los Angeles and neighboring Port of Long Beach receive 70 percent of U.S. imports from China and 40 percent of all goods coming into the United States by sea.

As such, the ships coming and going use a significant amount of fuel — fuel that creates a significant amount of greenhouse gas emissions if left idling while loading and unloading. With California’s strict air emissions regulations, continuously running the ships’ diesel engines is not an option.

In response, ships are now connected to the electric power grid at the port and the engines are shut down while crews continue loading and unloading — a practice referred to as alternative maritime or shore-to-ship power.

“Alternative maritime power helps solve the air emissions problem, but it’s putting a strain on the port’s power supply that wasn’t designed to support that level of demand,” says Matt Wartian, Burns & McDonnell regional business development director. “We’re already looking ahead and anticipate doubling, or even tripling, electricity consumption over the next decade as alternative maritime power use increases, cargo volume grows, and terminals shift from human-operated to automated and electrified cargo handling equipment.”

**Energizing the Future**

With that kind of growth in demand comes a higher potential for strained energy and reduced reliability and stability. As a landlord port overseeing 7,500 acres, 43 miles of waterfront and 24 cargo terminals, the Port of Los Angeles is committed to taking a leadership role in energy management.

Burns & McDonnell is developing the Energy Management Action Plan (E-MAP) for the Port of Los Angeles that will serve as the basis for future strategies at the port, and potentially at ports nationwide. Initially, the plan calls for a high-level review of energy demand and use, current issues, growth, and potential issues and opportunities.

In addition, Burns & McDonnell is exploring on-site energy supply options, such as microgrids and fuel cells, which can provide distributed energy sources that operate independently of the larger grid.

**“We’re focused on five energy pillars: energy resiliency, availability, reliability, sustainability and efficiency,” Wartian says. “From there we’ll develop a strategy for improving energy management and information at each port. We will use that document as the basis for moving the whole process forward.”**

**A National Issue**

Reliable power isn’t just a concern for West Coast ports. Destructive weather, such as Hurricane Sandy in 2012 and snow and ice storms the Northeast is prone to, can also disable the power supply to East Coast ports.

“It’s critical that we find a way to manage the increased demand on our grid now before we experience a catastrophic failure,” says Carter Atkins, environmental specialist and E-MAP project manager for the Port of Los Angeles. “If we can find a model that works and share that knowledge with ports around the country, it will help protect a vital part of our economy.”

Part of the effort to develop strategies for improving energy management at ports is developing recovery programs and conducting studies to implement them — from short-term actions in the present to long-term planning for future upgrades. The Port of Los Angeles already is investing approximately $3 billion in capital improvements this decade to enhance efficiencies and prepare terminals to handle larger ships needing more power.

“The sizes of vessels will continue to grow substantially as shipping lines focus on reducing shipping costs, and competition between East Coast and West Coast ports for cargo handling business will increase with the opening of the expanded Panama Canal in 2015,” Wartian says. “Ports will really begin using energy management planning to provide secure, reliable and competitive services to their clients.”

For more information, contact Matt Wartian, 858-320-2945.
Plugged in to Power

Delivering reliable electrical power for the communities you serve is no easy task. Providing that power from plants that are safe for your employees and your community is paramount.

Burns & McDonnell has been working at the source of power for more than a century, helping our clients maintain safety and reliability. That's important to us, because we aren't successful until you are.