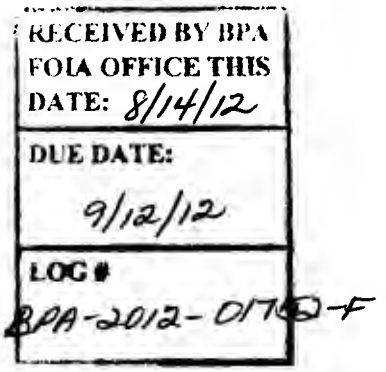
FOIA

From: russ.balvin@nucor.com
Sent: Tuesday, August 14, 2012 10:08 AM
To: FOIA
Subject: FOIA Request



The following is a New FOIA request:
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Description of Request: Structural drawings including material sizes and associated connections for the towers cited in the article at 'http://www.bpa.gov/corporate/BPANews/ArticleTemplate.cfm?ArticleId=article-20110525-01' in approximately paragraph 19 noted as one double circuit and three single circuit towers.
Preferred format: electronic drawing formats

Type of Requester: Business

I **Agree** to pay all applicable fees

Bonneville Power Administration

http://www.bpa.gov

BPA engineers build a better tower, saving millions

Transmission towers are so familiar, people rarely give them a second glance. But Bonneville Power Administration's structural engineers looked at them and asked: Can we build a better one?

It was an engineering quest that took them around the world and led them to invent new software that's the envy of the industry.

The result: new transmission towers that do more with less. They are stronger, but use less steel. They are sturdier, but cheaper. They are easier to assemble, but better withstand winds and storms. They will also cut the cost of modernizing BPA's grid.

This new double-circuit 500-kilovolt tower is put to the test at a facility in India. To see if it will hold up in extreme conditions, pressure is applied via dozens of cables at various angles.

On BPA's new McNary-John Day line alone, the designs are saving BPA as much as $300,000 per tower and a total of more than $11 million. On the new Central Ferry-Lower Monumental transmission line project, expected to begin this summer, savings will exceed $7 million.

The savings will grow quickly as BPA upgrades other transmission lines because each new tower costs less, goes up faster and new lines may need fewer towers per mile. These savings will flow to utilities and other BPA transmission customers, and from there to homeowners and businesses throughout the Northwest.

This new double-circuit 500-kilovolt tower is put to the test at a facility in India. To see if it

The mission to design a better tower began more than five years ago.

"When we started planning for the McNary-John Day line, we took another look at our existing designs and believed we could make them more efficient," explains Juan Nuño, civil engineer.

While most of the industry had routinely contracted out tower design, BPA pushed the engineering forward

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on its own.

will hold up in extreme conditions, pressure is applied via dozens of cables at various angles.

Taking tower design to new heights

"To most people, a tower is a tower," says David Hesse, structural engineer. "The industry hasn't invested in improving tower designs because, for the most part, the transmission infrastructure in the United States is decades old, and there isn't a lot of new construction. Much of the expertise in tower design is gone."

Much of the remaining expertise is at BPA.

"That's our niche," says Mike Staats, supervisory engineer. "We have a rich history of engineering, and a lot of expertise has been passed on along the way."

Engineers examined the steel shapes that make up each tower. They looked for ways to tweak angles here or moving braces there that took less steel but maintained the tower's structural integrity.

"The most challenging part in tower design is the infinite number of configurations. You can move a piece of steel in one place and end up with problems in another," says Structural Design Manager David O'Claire. "It's trial and error."

Engineers on their own might spend weeks or months to evaluate a single tower configuration. So Hesse – a self-taught software designer – developed a computer program to accelerate the process.

"In one day, we can look at a variety of different configurations," says Hesse of his Advanced Tower Analysis and Design System.

The cruciform shape of this tower footing is saving BPA millions. It's easier and cheaper to manufacture than the original design.

BPA had been using tower design software since the 1960s. Hesse started working on improvements in 1991. By 2005, he'd transformed it into a system coveted by utilities and private industries around the country. BPA has granted several requests from others to use the system.

The program analyzes whether a tower design can hold up to worst-case scenarios such as 100-mile per hour winds and heavy ice, or failure of the next tower along the power line. It also predicts the cost of the tower, helping engineers find a design as economical as it is strong.

The system helped BPA engineers find the best designs in days rather than months.

They developed one double circuit and three single-circuit designs the agency can use again and again. Less steel cuts the tower weight by about 20 percent. That saves BPA an average of $18,000 to $270,000 per tower – and more on the largest towers. That's about one-quarter of the total tower cost.

The newly designed towers make up all but 20 of the 380 towers on McNary-John Day line. The savings easily cancel out the $80,000 cost to design them.

Fewer and farther between

Five towers per mile of transmission line is the norm. But these new designs could change that.

"We designed the towers so that fewer are needed – only four per mile in some places," says Hesse. "The number of towers on McNary-John Day did not change because the new line is adjacent to another, and the tower positions need to match. But this will be an advantage in future transmission projects."

The new design will cut the number of towers on the Central Ferry-Lower Monumental line from 181 to 159 when construction begins this summer.

That's possible because – despite being lighter – the new towers are stronger. They also are cheaper to manufacture, transport and assemble. They can be more

efficiently constructed with helicopters.

"There are special rigging points so helicopters can lift them more easily. And because they weigh less, helicopters can lift the towers in one piece instead of two smaller sections," Hesse adds. Special helicopters known as Skycranes helped assemble some of these towers last summer.

More circuits, more savings

Nuño was the lead designer for a new double-circuit 500-kilovolt tower. Double-circuit towers are typically taller and require more steel than single-circuit towers because they support more weight. They also are more expensive.

While the majority of towers on McNary-John Day are single-circuit, fifteen double-circuit towers are needed where two lines intersect. Seven of the fifteen are the new design.

In the previous design, four massive "main legs" anchored the tower to the foundation. These legs were larger than a steel mill could produce, so a vendor had to fabricate them by welding two thick plates together to form a large angle.

"The fabrication required multiple processes in multiple locations. It wasn't very economical," says Nuño.

So the designers went to the drawing board. They replaced each large single angle in the old design with four smaller angles, bolted together in cross. The pieces of steel for the crosses are small enough for a steel mill to produce, taking a fraction of the previous time and cost.

"There are actually more pieces in the design now, but they are smaller and the tower weighs less overall," says Nuño.

The modification saved BPA nearly $300,000 on the biggest of these double-circuit towers on the McNary-John Day line.

Testing, testing

How do you know if a new tower will hold up? You build one and put it to the test.

Only a few places in the world test towers. Brazil is one – that's where BPA usually goes. But at nearly 200 feet tall and with very high loads, the new double-circuit tower was too big for Brazil's facility. So Nuño and a few other BPA employees traveled to India.

The tower was fabricated and constructed at the test site. Crews connected cables to it, then pushed and pulled on it from different directions, mimicking forces the tower might experience, such as high winds or heavy ice.

"We crossed our fingers, and it held," joked Nuño.

A helicopter hoists platforms for linemen during the construction of this single-circuit 500-kilovolt tower – one of hundreds on the McNary-John Day line saving BPA big bucks.

That tower, after making the journey from India, is now in its place on the McNary-John Day line. Construction on the line continues, and it is scheduled to be energized in February 2012.

BPA will use these new tower designs if it moves forward with other proposed transmission projects. More savings are in store.

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