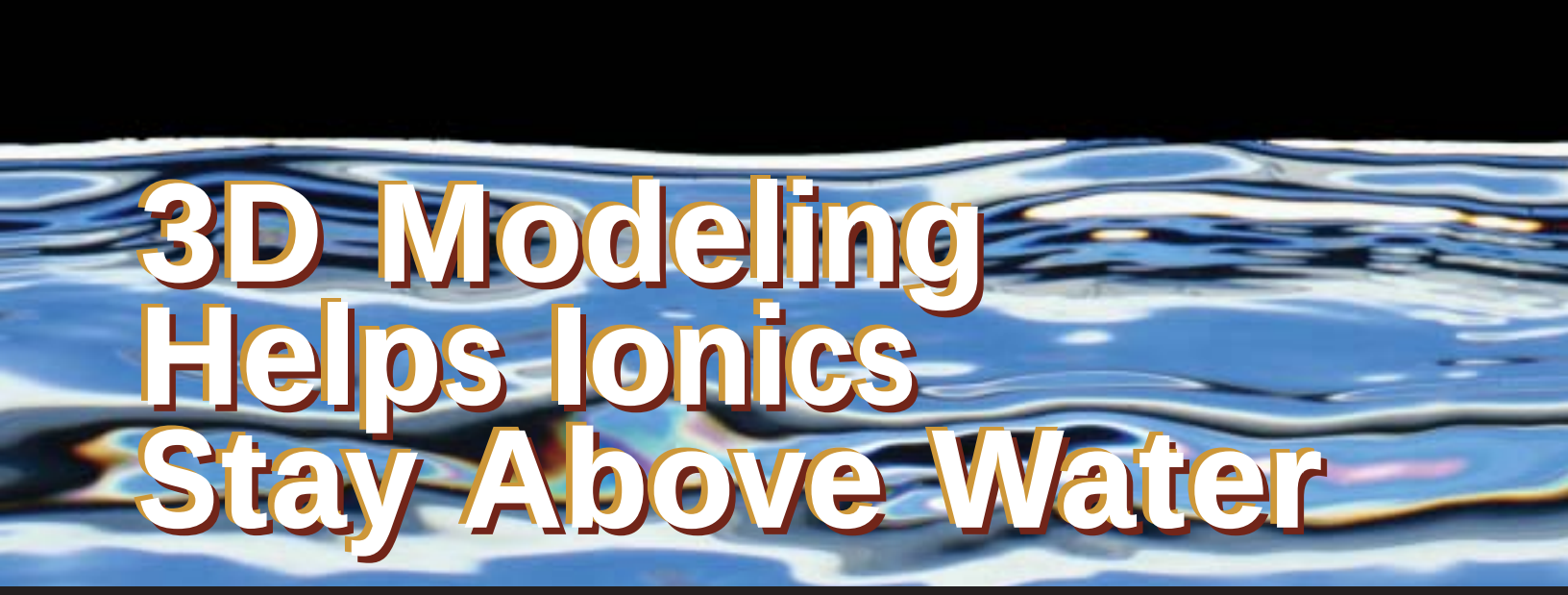


3D Modeling Helps Ionics Stay Above Water

Ionics designs desalination plants more quickly and with greater accuracy—slashing design time by two-thirds—using Bentley® AutoPLANT™. The company is a world leader in desalination plant engineering.

Ionics, Incorporated, is a global separations technology company specializing in membranes used for purification, concentration, treatment and analysis of water, including wastewater and ultrapure water. Ionics is involved in both the manufacturing and sales of these membranes, as well as related equipment and services.

The Watertown, Massachusetts, company was contracted to install the desalination system at a nuclear power plant in Uljin, Korea. The client was the Korea Power and Engineering Company. The utility needed the system to remove minerals from the plant's wastewater, which was required for disposal. Korea Power chose the Ionics EDR 2020® System, a newer Ionics product using a unique electro dialysis reversal (EDR) membrane technology.

EDR is unique because it prevents membranes and other surfaces from becoming scaled or fouled over time. Scaling can result from organic and inorganic substances being present in the water, and is a limitation of most electro dialysis-based water desalination processes. The EDR system works by reversing the electrical current and exchanging the fresh water product with the concentrate wastewater streams within the membrane stack several times per hour.

The system that Korea Power ordered called for a two-pass design in which two EDR 2020 units operate sequentially. In this configuration, wastewater flows into the first unit where it is treated, then moves into the second unit for further treatment. This particular system was required to treat the wastewater at a rate of 72 cubic meters per hour.

Although the EDR 2020 has a compact footprint, the main design challenge on this project was fitting two such units, and all the associated piping, into the space allocated for the system.

"The area we had to work in was 27 feet by 33 feet, which was pretty tight," says Brian Healy, Design Manager at Ionics. "In that space, we had to place the two units, connect the incoming side to feed pumps and cartridge filters, and bring the treated water out into their existing rack piping. Because we had to incorporate a substantial amount of equipment into the existing space, interference was a concern."

"With 3D modeling, we spend less time and get a better end product. Process industry-specific 3D modeling software such as Bentley AutoPLANT is a big help to our business."

—Brian Healy, design manager, Ionics, Incorporated

2D Muddies the Waters

In the past, the system's configuration would have been laid out using 2D drawings, created either on a drawing board or with a CAD system. According to Healy, it was difficult to detect interferences when working from 2D drawings.

"The 2D drawings of piping layouts didn't necessarily indicate the placement of equipment or structural steel, for example, so when you're flipping back and forth between drawings from the different disciplines, it's easy to miss an interference," he explains.

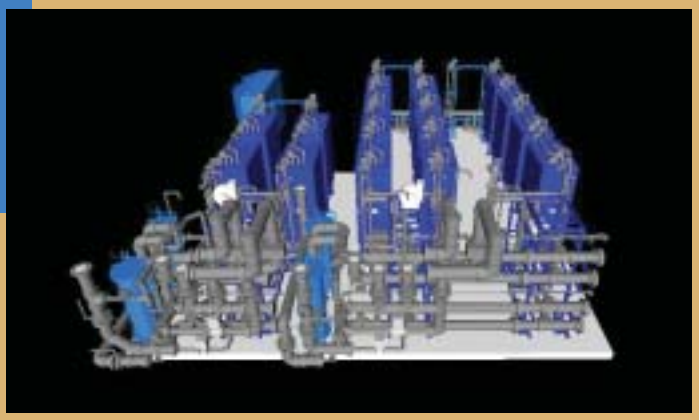
There were other problems with 2D as well, including the difficulty in ensuring accuracy in the documentation.

"Different draftsmen created the different views, so it was possible that there would be mistakes, such as elevations on two adjacent drawings not matching up," Healy says. Errors in drawings, if undetected, caused delays and often added costs during construction.

Another limitation of using 2D was the time it took to design a system this way.

"Each drawing had to be produced independently of all the others," says Healy. "If I created a plan view of an area, I had to start the elevation view of the same area on a blank sheet. This was the most time-consuming part of the project."

After the drawings were done, someone had to go through them all to create a bill of materials for the project. For a relatively simple installation such as the one for Korea Power, this would have taken two days. Healy estimates that if they had done the Korea Power project using 2D, total design time would have been approximately 720 total hours.

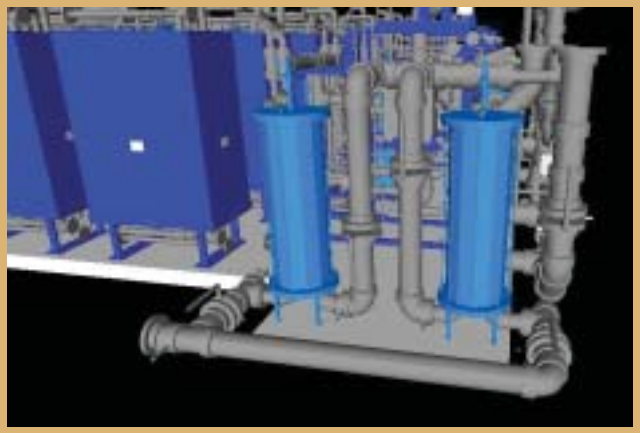


Sifting Out Impurities with 3D

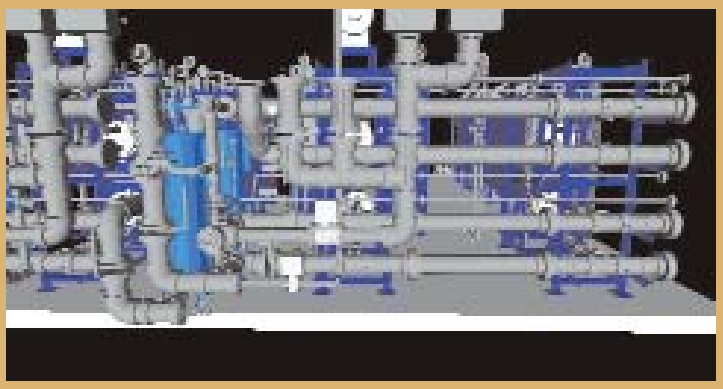
The desire to design desalination installations faster and more accurately led Ionics to investigate 3D modeling software. At first, they considered general purpose programs such as Pro/ENGINEER® but realized they would have to do too much customization to make them effective.

Then they found Bentley® AutoPLANT®, a 3D modeling program created specifically for plant design. AutoPLANT, which runs as an add-on to AutoCAD®, provides full 3D modeling capabilities, as well as the ability to store material specifications and other plant intelligence in an associative database.

"We chose this program because it is tailored to the process industry, so it provides features that speed this type of design work," Healy says. "For example, the software lets you route pipe by drawing just a single line. It then applies the correct pipe specifications to the line by accessing the information from the database. The software also knows to break a line when you place an elbow or a tee, for instance, because of the intelligence associated with those items."



Fitting the system into the plant



Korea Power supplied Ionics with an AutoCAD file showing the layout of the area where the desalination system would be placed, which was imported into AutoPLANT. Before starting any modeling, Ionics first created a database for the project by entering specifications for all the components that would be used. Then, working from a piping and instrumentation diagram produced jointly by Ionics and Korea Power, one designer and one engineer began the process of modeling the desalination system in 3D.

An AutoPLANT model of the EDR 2020 had already been created, so placing these units into the model was a simple matter of selecting the object from the library and dropping two copies into the appropriate locations in the layout.

When those were in place, the next step was routing the interconnecting piping for the system. The designer included elevations as he worked, routing a pipe 20 feet horizontally, for example, then up 10 feet, and then horizontally another 20 feet. The system supplied the specifications for the PVC pipe according to the earlier entries in the database. One key benefit of working this way was the ability to visualize the piping arrangement.

"It was much easier to see how things stacked up in the third dimension," says Healy. "That allowed us to clearly see when we had an interference. It also enabled us to create a more efficient design. This is definitely a more compact system because we used 3D."

The deliverables for this job were fully dimensioned orthographic drawings showing plans, elevations and section views. All drawings were generated from the 3D model, and this is where the majority of the time was saved on this project.

"After creating the model, we automatically generated all those views very quickly," says Healy. "Not only was this faster than creating each one individually, but it was also more accurate, since every drawing is a view of the model. Once we made sure there were no interferences or other problems in the model, we were certain that all the drawings were accurate, as well."

AutoPLANT also generated the bill of materials automatically from the database that was populated while the drawings were being created. This task took only 10 minutes.

"Using Bentley AutoPLANT 3D modeling software on this project allowed us to create a more compact design than we could have with 2D, and the design phase was completed in much less time."

—Brian Healy, design manager,
Ionics, Incorporated

Crystal Clear Waters Ahead

The installation of the system went very well. Thanks to the accuracy of the model and the resulting drawings, no interferences or other serious problems occurred.

The system met Korea Power's specifications, delivering treated water with the mineral content of 20 mg/l total dissolved solids, a pH of 6.4 and conductivity of 76 ms/cm. The incoming water consisted of 2,000 mg/l total dissolved solids with a pH of 7.3, and conductivity of 2,869 ms/cm.

On this project, the use of 3D modeling resulted in a very compact configuration for the desalination system and ensured a trouble-free installation. These results were achieved with about one-third as many design hours for a total design time of only 242 hours.

"With 3D modeling, we spend less time and get a better end product," says Healy. "Process industry-specific 3D modeling software such as Bentley AutoPLANT is a big help to our business."

If the project was designed in 2D, total design time would have been approximately 720 total hours. However, using Bentley AutoPLANT, total design time for this project was only 242 hours.

Ionics, Incorporated has sold or installed more than 3,000 desalination systems, more than any company in the world. The company also supplies products for water disinfection, and offers products and services for water quality monitoring. Ionics has more than 2100 employees worldwide.

For more information on Bentley please contact us.

1-800-BENTLEY

www.bentley.com

BENTLEY