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Solve the Problem First

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No amount of clever programming can properly bandage the deficiency of poorly defined requirements. According to Andrae Rauch, P.E., having worked on software development for many automation projects, the key to success is having clearly defined objectives for the control system program. Tasks such as writing software, removing faulty code, and making final adjustments are necessary, but secondary. John Johnson put it best when he stated, "First, solve the problem. Then, write the code." Recently, TJCAA had the opportunity to put this into practice for the Sacramento Regional County Sanitation District (Regional San).

Regional San recently lined five emergency storage basins at its EchoWater Resource Recovery Facility in Elk Grove, California. The newly lined basins cover 77 acres and have a capacity of 310 million gallons. At the same time, Regional San added 61 monitors, strategically positioned along the perimeter and on pedestals within the basins, to provide wash water for cleaning, disinfecting and odor control. The monitors were installed to change the labor-intensive task of maintaining the basins into one that could be done with the touch of a button from the convenience of the control room. Of the 61 monitors, 34 were designed and installed with two-axis motorized motion control and a motorized valve actuator for remote control of each basin's wash process.

If you are like me, when you hear the word "monitor" you immediately think of the computer screen on your desk, or possibly a loudspeaker next to a musician, or in rare cases, an Asian lizard.

And like me, you would be wrong in this case. These monitors are permanently mounted spray nozzles used to direct a large flow of water as shown here.

Basin Wash Water Applied by a Remote-Controlled Monitor

The monitors at this facility deliver 2,000 gallons per minute of chlorinated effluent at 130 pounds per square inch. They can rotate horizontally 170 to 350 degrees, depending on install location, and can lift and lower vertically 70 degrees.

So, what was the problem that needed solving?

At that time, the objectives of the Emergency Storage Basins Washdown System were not clearly defined, and the simplistic solution did not meet the facility's needs. The monitor axis servo controllers were error prone, the automatic wash supervisory program was not reasonably fault tolerant, and some key features were not accessible by the plant's control system. To make matters worse, the monitor axis movement was unreliable and sometimes crashed into

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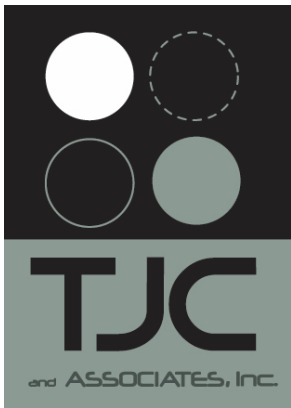
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the physical limits, causing mechanical damage to the monitors. Enthusiasm to continue the project was waning, but Regional San was unable to use the new system and continued maintaining the basins using labor-intensive methods.

TJCAA was providing control systems programming services at the facility around this time, for an unrelated project, and Regional San contracted with TJCAA to take over the washdown system programming. After becoming familiar with the system, TJCAA documented Regional San's list of issues and expectations. Together, we identified 23 objectives for the control system and decided to perform an assessment of the problematic monitor axis controllers.

So, solve the problem first, and then write the code.

It can be challenging to clearly define all the objectives at the beginning of a complex, unfamiliar control systems automation project. Deficiencies in system objectives are often uncovered during implementation and testing. Regional San had a better idea of how they wanted the washdown system to function after finding out what they did not like about their current system.

And now, back to problem solving.

With the objectives in place, TJCAA worked through the expected challenges of implementation and then wrote the code. A manufacturer software update was found and confirmed suitable for use with the problematic washdown system axis motion controllers. After installing the updates, TJCAA continued with development of a software function block to define the horizontal and vertical motion limits for each monitor and validate all motion commands against

the limits, preventing the monitors from overdriving the software limits.

We automated the wash control for each basin with customizable movements for each monitor's axis and provided the ability for plant operations to

Application Testing With Multiple Monitors

reschedule the monitor sequence as required from the control room. We switched the pump station control application from pressure control to monitor control and synchronized it with the monitor valve operation. We tested and demonstrated the system and trained the facility maintenance staff.

EchoWater Resource Recovery Facility Civil Engineer, Rigoberto Guizar, summarized the experience this way.

> "The original control application program from the contractor was basic, and once Regional San users started using it, a list of needs and wants for the system was created. Regional San entered into an agreement with TJCAA specifi-

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cally for Andrae's services to improve, optimize, and include safeguards in the programming of the washdown system. Andrae ended up reprogramming the system and was able to very efficiently implement all the needs and wants, as well as the safeguards in the programming, to allow seamless operation of the washdown pumping station and the washdown system.

Andrae's responsiveness, professionalism, and programming efficiency quickly gave Regional San the ability to operate the washdown system in a more efficient way. The end result is the Regional San can now effectively clean the basins in fully automated mode."

The staff at Regional San were great to work with and embraced the "solve the problem, then write the code" process. The Control Systems Programming group at TJCAA works on a variety of projects and is always ready to "solve the problem and then write the code." Give us a call.

One Happy Programmer

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