

Growing Old Together: Capital Planning

by Jim Cunningham



Operating wastewater facilities used to be rather ordinary, and somewhat predictable, with a curve ball only thrown in once in a while. As the plants in our state have grown older and further away from their last influx of major funding, each day brings new and unexpected operating challenges. As with all mechanical equipment, there is a finite useful life. Failures are to be expected once you have gone beyond this period.

The airline industry has great knowledge about useful life, and in a proactive response, the Federal Aviation Administration (FAA) sets strict maintenance limits for equipment based on experience. Often, fatal accidents trigger intense evaluations, yielding directives for an increased level of mechanical component attention. Almost all small, single-engine aircraft, such as small Cessnas, have engine limits of typically 2,000 hours for major overhauls. In addition, each year the plane must go through an intense annual inspection to evaluate its safe operating conditions. The plane is grounded until any problems are repaired.

In contrast to the aviation industry, the treatment facility industry simply has no mandatory rebuild or replacement requirements. We often push wastewater equipment to a failure point. Fortunately we were not hovering at 30,000 feet; however, some critical equipment failures have caused serious environmental damage and public health risks, resulting in large regulatory fines. As plants approach the end of their mechanical useful life, there will be more and more unexpected failures that keep the facility managers

and staff very busy. If municipalities are slow to fund replacements, the environment can be at risk as a result of critical equipment crashes. It's not if, it's when! Can you scientifically predict when critical equipment will fail? I have been fortunate enough to have been involved—from construction in the '70s until now—with several of the same facilities. My friend Ken Skibinski was actually in charge of a similar plant, which was constructed at the same time, designed by the same engineer (Stearns and Wheler), and had the same construction contractor. It is truly amazing that, within a year or two of each other, these two plants have had similar equipment failures. I almost hate to ask Ken what he is replacing now because I know I will be facing similar tasks soon. These plants are a great example of expected useful life. Not only are Ken and I growing old together, so are our plants. How did we ever get into this dilemma together?

There was a strong environmental movement in the early '70s at about the time Ken and I graduated from high school. The timing was perfect, as we both entered college with environmental related goals with the vision of being future protectors of the environment. What a noble thing to do—and perhaps even graduate and get a real job someday. Saving the environment—and getting paid—sounded good. Little did we know that at about the same time the federal government was about to enact the 1972 Clean Water Act, providing funding nationwide for new wastewater infrastructure and environmental protection facilities. It took a few years to get the program up and running, but to Ken and I, it meant that there

would be a plethora of environmental jobs when we graduated from college.

Upon graduating we both became gainfully employed in water pollution control facilities as entry level operators while, at the same time, new plants were springing up in nearly every community. In the early '80s, as construction was in full gear, Ken landed the manager position in Herkimer, New York, and I landed the manager position in Clinton, New York. Both are 4A facilities. I remember driving with Ken to Syracuse University to attend the Department of Environmental Conservation-approved IA program, now a 4A. I recall us talking about how excited we were at managing two brand-new plants with all the latest bells and whistles and pumps and grinders—to turn dirty water into clean water for everyone to use and enjoy over and over. We refer to it as PEW, previously enjoyed water. I played in a band, and we even had a song that we called “The Sludge Puppy Blues”: “The shine of the moon on the sludge lagoons makes my thoughts turn to you. The hum of the rotors, the sound of the motors, scum pumps all singing in tune. As I often do, I'm thinking of you, and I see such a beautiful sight...” Well, it just didn't get any better than that: fresh grads with great jobs protecting the environment with no end to the fun in sight. The 1972 Clean Water Act funded 87.5 percent of the cost, or even more than that if the design could be considered innovative. So the local municipal share of the cost was very small. What a deal! A facility such as this was a huge asset for only 12.5 percent of the cost plus interest on the bonds over 30

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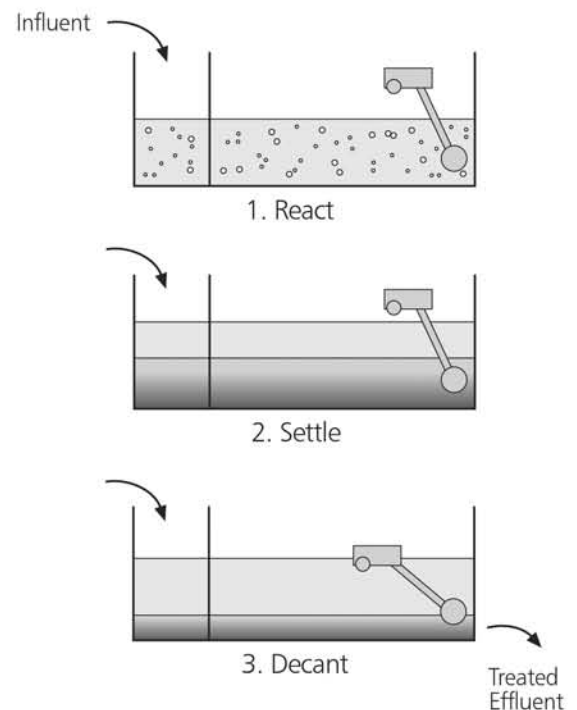
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years—very affordable. At the time even the New York State Department of Environmental Conservation funded 50 percent of the operations and maintenance costs. How cool was that! I had a great environmental job and a good friend with a similar plant nearby. The mayor and his board were happy with the plant's affordability. (The mayor was even re-elected using as his platform the great job he was doing cleaning up the local waters.)

Many times over the years Ken has reminded me that all good things must come to an end, and in response, I have often told him that he needed to get his head out of the methane. But he was correct—I hate to admit it—and it began with the elimination of the 50 percent operation and maintenance aid that the state gave out. I do have to give the engineering firm credit for writing specifications for very good equipment that has lasted over 25 years at these plants. I have observed in my short 30 years of managing wastewater facilities, that some design firms have specified equipment that has not lasted even five years. Well, these plants looked like they would last 100 years or more! Who would have thought that back when the Clean Water Act was funding the construction of these facilities that their useful life might run out before Ken and I could find a good location to retire and hum the sludge puppy blues? We did not have an equivalent of the FAA to tell us how long they should last and mandate an overhaul. I often tell my municipal boards, "Look, if you drove your car continuously at 55 miles per hour like we operate our water reclamation plants, in 30 years you would have 14.5 million miles on the odometer." It paints a quick picture of the fact that any car running at design speed for that long would not only need new wiper blades, tires, and brakes, but I suspect the engine would have been repaired and/or replaced many times. So why should it be such a big surprise when the wastewater facility is in need of so much repair and replacement after 30 years of continuous service? Municipal boards often look shocked because they are still paying down the original bonds to build the facilities in some cases, and no funding is in sight for their replacement. It is extremely difficult to swallow when, in some New York communities, industry and jobs have diminished, lowering wastewater revenues. And it is difficult for the plant to adapt, as the plant is a fixed asset with many fixed operating costs. For example, it often takes a large cap-

ital investment to downsize the aeration blowers to meet the now lower loads from the loss of industry.

How long should your system hold up? Wastewater plants are made up of major structures, mechanical equipment, and electrical components. European wastewater facilities have several hundred years of observations to indicate we might expect the useful life of a facility to be. Typically structures that are designed soundly and maintained properly should last over 100 years. Ken and I know we are going to be retired by then, perhaps even pushing up compost. So there is not a big concern for the replacement of the structures at this time, but it should create future jobs for our grandchildren when the next clean water act kicks in. Well-designed and maintained electrical components, conduits, wires, and switch gear should last over 40 years, but new electrical codes or increased loads often drive their replacement prior to the 40-year mark. I have observed several older wastewater treatment plants with electrical equipment that was 60 years old and doing very well. But wastewater plants often have corrosive gasses that penetrate even the best conduits and slowly oxidize components. Mechanical equipment's useful life is the shortest—30 years may be about all she's got. Well, shoot Ken—our equipment is shot before we get put out to pasture. Thought you were going to cruise until then, didn't you? Now the band is singing, "scum pumps all *squeaking* in tune."

It seems that most of the facilities funded by the 1972 Clean Water Act are getting near the time to replace their mechanical equipment. The costs will shock you if you have not priced good-quality, continuous-duty equipment lately. Both Ken and I have been replacing mechanical components in the last few years at an ever-increasing pace.

What can you expect to be paying once it happens to you? Let's assume your 87.5 percent government-funded plant cost \$10 million in the 1970s, and you paid locally \$1.25 million plus interest. Typically, around 30 percent of the plant's cost falls into the mechanical equipment category. Before Ken can find his slide rule (you old poop), I can tell you that 30 years ago the cost of the mechanical equipment was around \$3 million. We're finding that, over the last 30 years, equipment costs have risen nearly five times. (In 1974 Ken's Jaguar was \$10,000; his new one today was well over \$50,000.) Assuming you paid \$3 million for your mechanical equipment in 1972, today the replacement cost would be \$15 million. (Ken, do you want to start an equipment business?) Let's see: the local community after funding in 1972 took out bonds for \$1.25 million, and now we're looking at new 2005 bonds without funding at \$15 million. It would have been much easier to retire by now rather than have to explain the potential for a sizeable rate increase to the board. I guess the environmental college should have had a few courses on what happens when funding stops and you're trying to



Mechanical equipment's useful life typically does not exceed 30 years as seen by this digester cover that is in need of replacement after 25 years of service.

Photo credit: Jim Cunningham



Photo credit: Jim Cunningham

This equipment runs 24 hours a day, 365 days a year, without rest.

keep pipes and pumps going beyond 15 million miles. (Ken, you can't keep your finger in the hole until you retire. I'll put my finger in it, and you go lobby for a new clean water act.) In reality all of the mechanical equipment does not fail at the same time, thank goodness, so you can budget for it over time. Ken and I spend many hours these days evaluating equipment and planning capital budget estimates to present to our boards for funding. Getting the boards to understand the issues we're facing takes a lot of work, but Ken and I both see it as an important part of our jobs and our responsibility to the environment we protect.

A new clean water act sure would be nice, but if your running out of fingers to plug holes, here are some suggestions that might help ease the pain:

1) How long is your equipment really going to last—a month, a year, five years? If you take a scientific approach, you'll get a much better feel for time remaining and a document to go to the board with to support your case for adequate funding. If you're like Ken and I, what doesn't move gets painted. So from the outside much of the old equipment looks like new, and that is very deceiving, especially when observed for funding by board members.

Have your equipment evaluated by technicians who specialize in equipment condition assessments for such things as pipe and pump metal thickness, thermographic observations, internal observations (your colonoscopy is overdue, Ken), and instrument analysis for rotordynamics, resonance, frequency, system modeling, and strain gauge testing.

2) Develop a list of critical, as opposed to

noncritical equipment, and set realistic replacement times with costs that you will present with every budget. It's important to keep showing the board the status of your plant's needs at every opportunity. Use your technical evaluation to support your list, and get at least three vendors (Ken and Jim Inc. Equipment Company) to show your board that you're on top of timing and costs.

3) Let the board know that if specific critical equipment does not function, it will affect the users and the environment, and give the board specific information about what the potential regulatory fines might be if you go out of compliance.

4) Set up an open house for the public to visit your plant, so they can see how equipment intensive the plant is. (Hide your slide rule, Ken.)

5) When you're talking about any increase, try to stay away from a percentage, like "sewer rates will go up five percent." Calculate the actual typical user cost in dollars, and present it in the actual dollars it might be increased to. Five percent might just be five dollars per person per year, and after visiting the plant and understanding the complexity of the system, most rate payers would approve that small cost if they knew that they were helping to maintain clean water. (Get the environmental movement moving in your community!)

6) Most important, you need a champion! Perhaps the mayor or one of the board members would help the board to understand your realistic needs. Develop a scientific critical and noncritical list, including what may break and what a schedule of realistic timing and costs might be. You can only get your champion to understand your plant's

condition by getting that person into the facility and showing them why ongoing replacement needs to be budgeted.

7) When you're purchasing new equipment, look at the whole-life cost for the equipment and systems. Often a simple change in technology can add up to huge savings in power, chemicals, or maintenance over a 20-year life, as opposed to the old equipment. In my experience, boards will approve a cost savings project every time if you present the information in a scientific manner.

8) Encourage your children to enter the environmental field and contribute to the retirement system, so Ken and I, who are growing old together along with our water treatment plants, can retire some day. You can bet we will be lobbying for a new clean water act.

Jim Cunningham, president of New Water Technologies Inc., has been in the environmental management profession for over 30 years in New York, with responsibilities for over \$300 million in water and wastewater infrastructure. He has been the owner of three environmental businesses holding U.S. patents for new water related technologies, produced in New York and used throughout the world. He has experience throughout the United States, Europe, the Middle East, and South America, managing industrial and municipal water and wastewater treatment facilities ranging in size from 1 to 80 million gallons per day. He has taught water and wastewater courses at Syracuse University and SUNY Morrisville, as well as having provided training for the NYSDEC. He is a former chair of the central chapter of the New York Water Environment Association and has received awards from the New York Water Environment Association and the U.S. Environmental Protection Agency for outstanding facility management.

