THE *NUCLEAR NEWS* INTERVIEW

Chuck Goodnight: Employment issues of today and tomorrow

The people employed at nuclear plants in the future may be the ones now working at auto and aircraft plants.

Construction of new nuclear plants is the current buzz in the industry. As next-generation reactor designs move from drawing board to the construction stage in the near future, the industry's existing fleet of plants will keep operating for decades. Where will the workers for all those plants come from?

Chuck Goodnight has been investigating personnel issues at nuclear power plants for more than 10 years. As president of Goodnight Consulting, in Vienna, Va., he has focused on employee attrition and retirements, and the effects of those changes. His company has been in business since 2001, but Goodnight has been an industry consultant since 1990. He started his nuclear career in 1984 working for the departments of Defense and Energy.

Goodnight talked about manpower issues with Rick Michal, *Nuclear News* Senior Editor.

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The manpower issue in the nuclear industry has been talked about for a long time. In fact, Nuclear News *did an article on it titled "Nuclear employment: More people needed" back in November 1981. Is there anything new about the issue that should draw the industry's attention?*

There are two items that could be highlighted. The first is that there is a potential to keep more people working in nuclear plants by increasing the maximum allowable working age. A lot of companies still have strict age limits for retirement, but in reality, some people don't want to retire at age 65 and are mentally and physically fit for five or ten more years of service. If an engineer is 75 years old, for example, and is fit and wants to work, I think he or she should be allowed to work. I'm not sure how to define that future age boundary, but in cases where companies have forced retirements, they may be hindering their own efforts to retain needed skill sets.

The second issue that needs to be taken under consideration is new plant construction. There is a lot of energy and dialogue by the industry and the Bush administration in that regard. I think we're going to see some mixed results related to that effort. On one hand, once new construction begins, it's going to create an age of growth in the industry, a revival of what happened in the 1970s and 1980s when many plants were being built at the same time. On the other hand, new employees hired by the industry during that time may be attracted to work only at new plants. That means the existing operating plants may be at risk of losing some of the people they've worked so hard to attract. I think the industry has to be careful as it looks at new plant construction—in an era when the industry is saying it is running out of people, a sudden increase in demand will make the problem worse.

Is there an industry effort to address the new construction issue?

I am currently working on a project through EPRI [Electric Power Research Institute] on new plant staffing, but there is no dialogue about where the people will come from to work in those plants. Saying that, I am optimistic. We live in a country with a large population and a significant educational infrastructure. In an era where the auto and airline industries may be trending downward, thousands of people with skills may be looking for jobs. As the demand for power increases and more power plants are built, including nuclear plants, I'm comfortable that we're going to find a way to operate them.

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In general, how has the industry responded to the manpower problem?

The industry's response has been slow. There are some companies that are preparing for staffing issues with an appropriate and well-paced approach. But across the industry, most companies are focusing only on their daily operating and safety concerns. The staffing issue is real, however, and they know it's coming, even though it keeps getting put on the back burner.

Which companies are being proactive on the issue?

The Tennessee Valley Authority [TVA] has been the most aggressive. TVA began about five or six years ago to look at its nuclear plant staffing requirements. The people involved in the process did such a good job within the nuclear division of TVA that they were promoted to the corporate level. They have become the key personnel in doing what is called "work force planning," which is projecting what the personnel needs will be for all of TVA's nuclear, fossil, and hydro plants. I would say that TVA is the industry's leader in this area.

Will others in the industry beat a path to TVA's door?

Some of them already have. The people at TVA have been very generous in going around to industry organizations like the Nuclear Energy Institute [NEI], the Institute of Nuclear Power Operations [INPO], and even the International Atomic Energy Agency [IAEA], in Austria, and publicly sharing their approach.

You mentioned the IAEA. Is the manpower issue worldwide?

It is. The reason is that the development and construction of nuclear power plants worldwide has occurred within a fairly tight time frame, from the mid-1960s to the mid- to late 1980s. Except for a few examples here and there around the world, most nuclear plants were built in that time frame. For example, the French and German plants were all built in that same time frame. With the 20- to 30-year career expectancies in these countries, the same as in the United States, they end up with the same problem that we have.

Other countries, too, are experiencing manpower issues. In Brazil, for example, there are only two plants, Angra-1 and -2. One was built in the 1980s by Westinghouse and the other in the 1990s by Siemens. One has a set of documents in English, the other in German, in a country that speaks Portuguese. They are very concerned and active in trying to figure out how they are going to operate those two plants and a third one [Angra-3] they have started to build, because they don't have an infrastructure of nuclear engineering programs, or a nuclear navy, or any of those types of sources.

What is wrong with a company waiting to hire new personnel until the need is there?

In a word, risk. That is not a term the nuclear industry likes to use, because it has negative connotations. The risk is that a problem can arise and an adequate number of people with the requisite skills won't be available to deal with it. I don't believe this equates to safety risk, of course. I think that safety is always going to be a priority and the nuclear industry is not going to lose its handle on safety. But what I would expect is that a company that has not hired enough people at the right time might end up where its nuclear plant would have to lower the power level, or extend an outage, or lower its capacity factor. All of these things relate to a potential increase in costs. The plant is going to be producing less power but will have essentially the same O&M [operating and maintenance] costs, and the revenue will be reduced.

Another thing that is likely to happen is that there will be an increased regulatory scrutiny of the plant. That, too, would cost the company additional dollars in order to respond to that increased scrutiny.

Why wouldn't safety be affected by a shortage of manpower?

Having been in the industry for so long, my feeling is that nuclear and personnel safety override everything that is done in the industry, absolutely, even to the extent of losing money. On a given day, if a plant is not safe to operate due to a condition or due to a personnel error, the first thing that management is going to do is shut down the plant, or reduce power, or do whatever is necessary to minimize or eliminate a safety risk. From a nuclear safety perspective, plant management would take the financial hit before it would ever allow a nuclear safety issue to arise.

How are utilities addressing knowledge loss that will occur because of attrition and retirements?

The term the industry is using is "knowledge retention." I call attrition and knowledge retention the two sides of a double-edged sword. It's one thing to lose people, but it's another to capture the knowledge they have before they leave. There is a lot of talk about this concept by the industry's institutional organizations—INPO, EPRI, NEI, and the IAEA—but not many nuclear companies have formalized an approach for addressing it. The few approaches I have seen are fairly consistent in that they have five major elements.

The first element is to determine where the key skill or knowledge areas are. For example, a systems engineer is needed in order to support a reactor coolant pump. It's a specific skill set that the plant needs to maintain, as opposed to someone who can do database management in support of the information technology organization—because database management is not necessarily a nuclear skill. The second element is to identify the expected attrition rate in those skill areas. The third element is to determine what knowledge in a specific key area has already been documented, and the fourth is to then develop a program to capture the balance of the undocumented information. For example, if 80 percent of the information about a particular task or activity is documented, then the other 20 percent is in some engineer's brain. The fifth element is one of the hardest parts, and that is to integrate newly captured information into existing documents, procedures, and training programs.

What areas of the plant are going to be most affected by attrition and retirements?

From our surveys, as well as my work with clients, it's clear that the first and largest area is maintenance. This includes all of the maintenance craft skills—me-

chanical, electrical, and instrumentation and control technicians. The second largest group—almost the same size—is the engineering area. Those two together—maintenance and engineering—are expected to make up about half of all the attrition in the near term. These are skill sets that don't come about through a new hire who has gone through a training program. These are areas that take recruiting, hiring, training, time in the field, and retention efforts to get people up to speed and able to do the job independently. In most cases, it takes three to five years for a maintenance technician or an engineer to be able to work independently and be trusted to do all the things that are appropriate within that job skill.

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If it takes three to five years to train in the maintenance and engineering areas, but only X number of nuclear companies are focusing on filling the void, then something has to give, correct?

Exactly, and that's my big fear. However, there are still sources of personnel beyond the usual method of hiring people out of college. For example, as I referenced earlier, other industries can be tapped, such as auto manufacturing, airline manufacturing, and airline operations. All of them have significant numbers of maintenance personnel and engineers. If the auto industry's financial data keep trending down, I would expect a lot of people will be available who have extensive experience—up to 15 years of maintenance or engineering experience on mechanical, electrical, and electronic systems. The nuclear industry may be able to hire these people and not require them to have three to five years of training to ready them for work. You're right, though, something has to give. The nuclear industry doesn't have the lead-time to hire people off the street and get them fully trained before existing employees start leaving through attrition and retirement.

According to statistics you've compiled, 40 percent of the workers who retire from the industry in the coming years won't be replaced. How will plants compensate for those losses?

In discussion with my clients, they've told me it will be through a combination of three approaches. One is through process improvements, and the second is by adding new technology. For example, operators now can use Palm Pilot–type devices to take readings and record information. The third approach is through the reduction of work scope for nonsafety-related activities.

Are people today coming to the nuclear industry from other particular industries?

Not really. New workers are still largely coming right from college. The industry is also producing some of its own. By that I mean that it's still common for operations staff to be hired either out of high school or from a vocational school, without four years of college. The industry then trains them internally through accredited training programs. Another source, although it's not as large as it used to be, is the nuclear Navy. People will enlist and work for several years in the Navy and decide they don't like the travel or the environment. They want to stabilize their lives, and since they're experienced in nuclear operations systems in naval propulsion, it makes them great candidates with a lot of training already behind them.

Regarding colleges, people are not necessarily schooled as four-year degreed students. There are some new programs developed by universities and community colleges in coordination with individual nuclear companies to specifically attract and train prospective employees and then work them into the hiring process. These people would be considered technical staff, such as technicians, mechanics, and nondegreed engineers. FirstEnergy Nuclear Operating Company in Ohio and STP Nuclear Operating Company in Texas are doing this with community colleges in those states. There are other programs that are similar around the country, too.

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How did you become interested in the manpower issue?

I've been interested in it for the past four years. Prior to that, staffing levels at nuclear plants were decreasing consistently, but then four years ago, they started to flatten out. I wanted to know what was going on to drive that change. As I researched it, I found that as the plants were getting to what I call a "comfortable" staffing level, they were soon going to be losing employees to retirement. A lot of plants are now reaching 20 to 30 years of operation, and the people who started those plants are nearing the end of their careers. That means a retirement cliff is coming. As the industry processes license renewals and plants add another 20 years of operating life, their focus is going to have to be turned toward finding enough people to operate the plants. These dynamics are what drove my interest in this issue.

What is a retirement cliff?

It's a massing of potential retirements in a short period of time. When a company's expected number of retirements is plotted over a short period, the "cliff" forms as the curve becomes more vertical. If the curve becomes exponential, then the cliff becomes obvious.

Since 1997, the employment level of the nuclear power industry in the United States has been reduced by 20 percent. Why?

Initially, a lot of the employment reduction was the result of planning, and much of it began with contractors. Back in the 1980s, when the companies came out of their "construction organization" approach and began to take the plants into operation, the first people to be downsized were contractors. But once the plants got to the point of looking at how to operate more efficiently from a cost standpoint, they realized that personnel was about 70–75 percent of the nonfuel O&M costs. They determined that staffing issues were a big part of their total costs. The consequent staffing reduction became the next step.

Coincidentally, the industry has consolidated within the past five years or so. It went from more than 40 operating nuclear companies to 25. Instead of a few fleets of nuclear plants, there are now many fleets. These fleets have realized economies of scale and have taken advantage of standardizing best practices within their different

plants. This has allowed them to reduce staffing even further.

What about hard numbers for employees in the industry—today as compared with 1997, for example?

I've never had total industry staffing numbers because I've never had access to 100 percent of the industry's data. However, I typically get information from 70–75 percent of the industry, so I feel comfortable making a calculation on an average plant perspective. From that view, in 1997 the average single-unit plant had just over 900 employees. By comparison, it had 798 employees in 2004.

For two-unit plants, in 1997 the average was almost 1500 employees, compared with 1116 employees in 2004. These numbers include on-site personnel, as well as long-term contractors, security guards, and corporate employees supporting the nuclear programs.

Looking at single-unit plants as opposed to multi-unit plants, do attrition rates and hiring expectations vary?

The attrition rates vary, but not by much. The difference is only about one percentage point higher at multi-unit sites compared with single-unit sites. Obviously, that translates into a different number of people because a multi-unit plant has a larger staff, but as a percentage it's about the same. The hiring expectations vary significantly though, but it seems to be based more on company plans and goals than on the number of reactors at a site.

With regard to new employees, what have you found as far as their enjoying their careers in the industry?

If you are asking me if these new employees will stay around, the results are mixed. Several companies I've worked with have had good retention rates for new hires, while others have not been able to keep even half of them for more than two or three years. These companies will bring in a group of 10 or 15 engineers, all college graduates with engineering degrees, and after two or three years there are no more than five of those 15 left. I'm not sure if it's a company issue, or regional, or if it's the industry itself.

But by and large, the retention issue for new workers is clearly a problem, one that may be tied to developing a more positive image for the industry. It may be that the industry has to get down to the elementary school level to reach out to students who may one day become the work force. Nuclear power should be promoted as exciting and fulfilling, as well as safe and reliable. By the time these students get to high school or college, they will be better informed about whether nuclear is something they want to pursue as a career. NN