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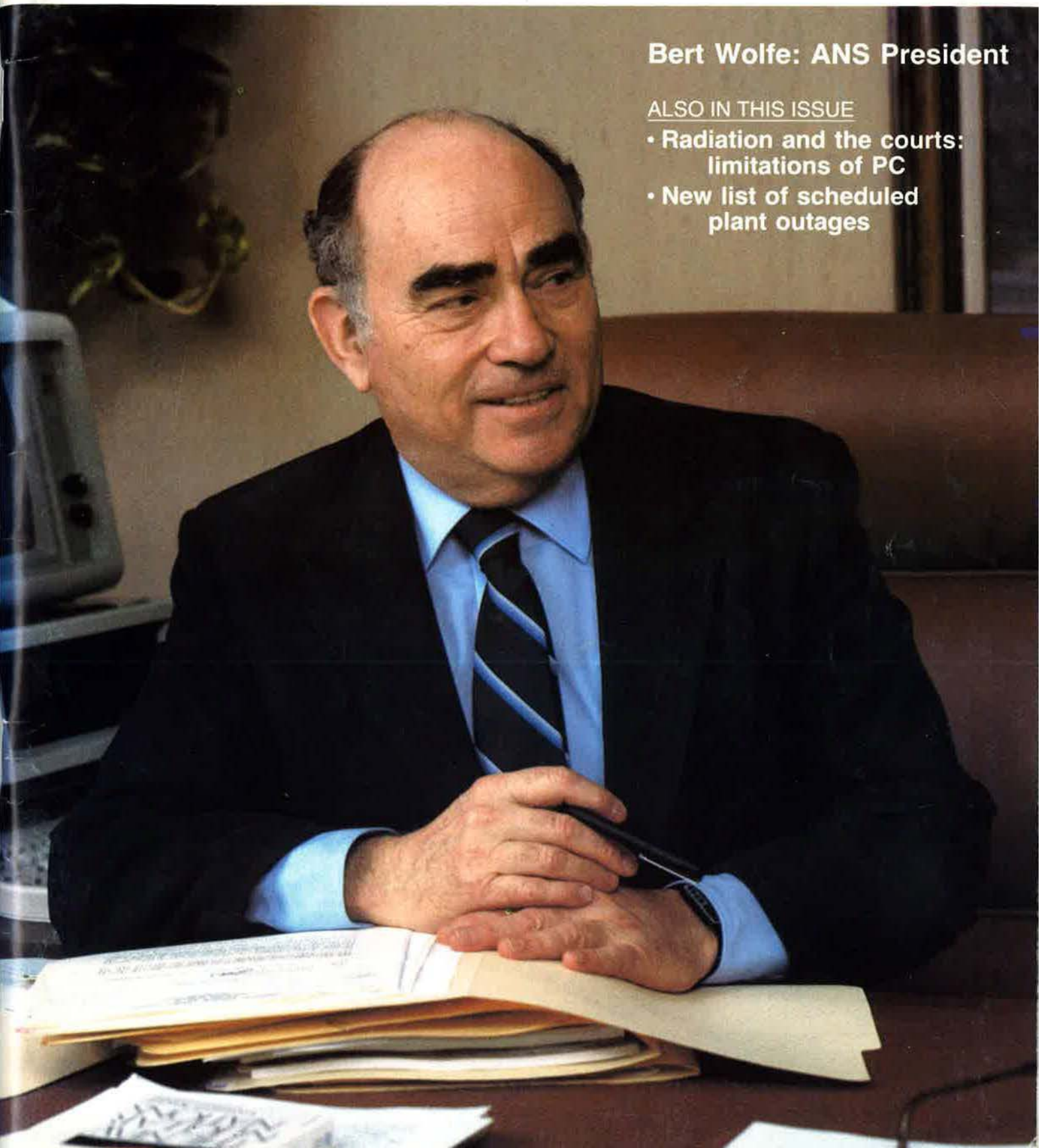

Bert Wolfe: ANS President

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Bert Wolfe: Company man, Society man

The nuclear industry is a relatively young one, and in the United States this has meant that most people working in the field have moved from job to job as the industry has changed, matured, and been reshaped by market forces. Thus, it is rare to find a member of the American Nuclear Society who has spent virtually his entire nuclear career with one company. One such member is new ANS president Bertram Wolfe, who, with the exception of a two-year stint with Battelle and Westinghouse, has spent his whole nuclear career—spanning some 30 years—with one company: NSSS vendor General Electric Company.

His career certainly has not been unidimensional, however. From early reactor physics and reactor design, to breeder reactor engineering, to fuel reprocessing, to advanced reactor development, to reactor fuel supply and waste management, Bert has worked on it all, from the very beginnings of commercial reactor development, to the current stalemate in industry growth. And he looks ahead to the revitalization of the nuclear industry in the United States. For Bert Wolfe, being a company man has meant being there through it all.

In the beginning

Bert was born June 26, 1927, in the Bronx, New York, where his father, Paul, worked as an accountant and attorney, and mother, Sally, worked as a housewife. Bert's brother, Harvey, was born three years later. Harvey, also an attorney, now lives in Scarsdale, N.Y. Bert's father died last year, but his mother still lives in New York.

Bert attended public grammar schools and then entered the Bronx High School of Science. He explains: "I almost went to Townsend Harris, but they closed it down. In both schools, you had to take a test to be admitted, and Townsend Harris was the one that emphasized the humanities more than the sciences. I think if I had gone there, I probably would have been a lawyer like the rest of my family. But I went to Bronx Science, and that's where I became interested in physics and math."

Bert graduated from high school in 1945, and, with World War II still going on, enlisted in the Navy. But while he was home on boot leave, he says, the war ended. Then, he recalls, "the Navy didn't know what to do with us. We had joined for the duration, but we had joined a special program for electronics training, and after the war was over, the Navy wanted us to enlist for the full four years.

"So, for a while, we had a very interesting assignment. We had to be in our barracks at 6 a.m. when they took roll call. Then we ate, played ball, ate lunch, and went on liberty at 4 p.m. We just had to be back in the barracks by 6 a.m. the next day. That was the whole duty, except once a week they herded us into a big lecture hall and told us how great it would be to stay in the Navy for four more years.

"Finally, after someone—not me—who had a lawyer for a father sued the Navy, they said they would send us to school or allow us to go to the discharge center closest to home and wait our turn to get discharged. So I decided to stay and go to the school, since I was interested in the electronics training and it was the first time I'd ever been away from home. We went down to Gulfport, Miss. I remember going to the zoo in New Orleans on Christmas Day, and it was sunny, about 80 degrees; I never thought there could be a Christmas Day like that."

Bert stayed in the Navy for one year, and was discharged in 1946. Then it was time to return to pursuing an education. Notes Bert: "When I graduated from Bronx Science, I applied to half a dozen schools, and I was accepted at all of them, but five of the six stated that if I went into the service, I'd have to reapply. Except for Princeton. Princeton sent me a very nice letter—I still remember it with gratitude—saying that I was now a member of the Princeton family, and that if I was privileged to serve in the armed forces, I would still be part of the family when I came back. I thought that was real class. When I was discharged from the Navy, I contacted them, they admitted me, and I went to Princeton."

Bert studied physics at Princeton. "There were a lot of the giants of academia there," he recalls. "In fact, we had Einstein on the campus at the time, and he'd lecture every now and then. Also, John Wheeler was there, and Ruby Sherr, and Art Whiteman, a math professor who really spurred me on." Upon graduation in 1950, he was elected to Phi Beta Kappa and Sigma Xi, and received the Schuichi Kusaha Prize in Physics, which is awarded yearly at Princeton.

One summer—June 1949—during his Princeton years, when he was spending the weekend at his parents' summer home near a lake in upstate New York,

his mother mentioned that there was a very nice girl working at a camp near there, and Bert scoffed, "I know your girls. I'm not interested." Later he went down to the lake to go swimming, and met Leila Ann Katz, who was watching over some of the campers. They talked, and arranged to go out that night. And his mother said, "See, that was the girl." Bert and Lee became engaged a year later, and were married on December 23, 1950.

After graduation from Princeton, Bert entered graduate school at Cornell University. There, he says, "there was just a panoply of famous people—some famous then and some famous since—and it was very, very informal, so you got to know your professors intimately. Hans Bethe was there, and Robert Wilson, who later ran FermiLab, and Phil Morrison, who's now at MIT. I did my thesis with Professors John Dewire and Al Silverman, both very inspirational people."

Bert studied high-energy physics at Cornell. He says he was fascinated with physics at the time and looked at that subject as a good background for a technical career. "I figured if you could get through four years at Cornell and get a PhD in nuclear physics, you were ready for anything," he explains.

He did his thesis work—on mesons—on what was then a very high energy synchrotron, the 300-million-electron-volt machine at Cornell. He recalls: "It was a large synchrotron for the time, but already they were building the next one, which was to be 1 billion electron volts, and they were going to put the new one in a circle around the old one, and use the electrical coils of the old one as part of the electrical system of the new one, so that once they started the new one, the old one would be gone. But they promised everybody that they would not shut down the old one until the new one was operating at the same energy level, so that you could just transfer your experiments. However, I never did believe it. So the last year I was there, I got an agreement that I could use the synchrotron to finish my thesis during the summer of 1954. I told Lee good-bye, took a cot to the laboratory, and ran experiments day and night for five or six weeks. In fact, I got so much data that Al Silverman came by one day, looked over the data, and thought I was making it up. It was the last thesis ever done on the old synchrotron. When I was finished, it was shut down, and everyone at Cornell had to go to Brookhaven National Laboratory to finish their theses because it was quite a while before the new machine at Cornell began working."

Going to work

After obtaining his PhD in 1954, Bert went to work, but not in nuclear physics. He accepted a job with Eastman Kodak, in Rochester, N.Y., which was reasonably close to home. At Eastman Kodak, he did infrared detector development in Kodak's Naval ordnance laboratory.

Over the next year, he decided that he wanted to get back into nuclear work, rather than continue with the solid-state physics work at Eastman Kodak. General Electric Company had just started a new commercial nuclear power business, and a friend suggested that this would be a good time to join GE and get into a brand new field. Bert joined GE's Atomic Power Equipment Department, in Schenectady, N.Y., in mid-1955.

"I remember interviewing for that job," he recalls. "The interviewer asked me about myself, and I said I was very smart but that I really didn't know anything about nuclear reactors. That was what GE was going to have to teach me. And the interviewer said, 'Don't worry, we have the world's experts here at GE, and they'll really teach you.' So I came to GE, anxious to meet all these experts who were going to instruct me in reactor physics, but they didn't show up. I saw a lot of mechanical and chemical engineers, but no nuclear reactor experts. Then, after I'd been there about a month, I was assigned to do the physics work on the Engineering Test Reactor, which GE was building for the Atomic Energy Commission at Idaho Falls, Ida. Again I looked for these experts. I found a few people who were greener than I, but no experts, and I became the leader of the core physics group. Every night I'd go home and study until 3 o'clock in the morning reading Soodak and Campbell and Glasstone and Edlund to understand the subject—I never did find those GE experts. And I never learned so quickly in my life. It's just amazing what you can learn from textbooks and what you can accomplish when someone hands you the responsibility."

There was a little chaos during that early period at GE, Bert recalls. A few months into the project, Bert discovered that the physics calculations that had been done previously using a brand new computer code were wrong, because the wrong boundary conditions had been put into the code. They had to be redone. "Things were different in those days," Bert says. "We were using a new, complicated two-dimensional diffusion code, which was called the Cuthill code—named after Mrs. Cuthill, who worked at the Naval Institute in Washington. The only computer available to us was a big Univac at GE's appliance manufacturing plant in Louisville, Ky. So we'd travel down to Louisville by train on Friday evening, and they would let us use the computer from midnight until 7 a.m. on weekends. We would put the data in, and while the computer was grinding out the numbers, we would wander around and watch refrigerators being made. Every once in a while, we would have to call Mrs. Cuthill—at 2 or 3 o'clock in the morning—when we ran into a bug. She was just amazingly understanding as we tried to work things out over the telephone, a delightful person with whom to work."

The ETR physics work was completed in 1956, and Bert remembers having to defend it before the Advisory Committee on Reactor Safeguards, on which sat such notables as Edward Teller and Harvey Brooks. By this time, the inexperienced reactor physicists were veterans, and the review went well.

The person leading the effort for the ETR—though Bert notes that his job wasn't defined that way—was Sol Levy (who later founded S. Levy, Inc.). Bert says, "He's the one who made the Engineering Test Reactor a success. It was really an adventure, and it was a great success."

San Jose

In 1956, after Bert had been with GE for a year, and after he had bought a house because GE had assured him that the department would stay in Schenectady, GE decided to move its nuclear business to San Jose, California. So, reluctantly—telling themselves they'd stay for a year—Bert, Lee, and new baby Sarah moved to northern California.

"San Jose was just a small town then," Bert notes. "This was orchard land. Every spring, blossom time tours were conducted—a bus went out to all the orchards. And now this area is more populated than San Francisco."

The facility for the nuclear department was originally a motor plant that GE was planning to shut down. Then, in 1956, a strike at Westinghouse shut down all of that company's plants, and suddenly the GE motor plant began to make money. It was finally shut down a few years ago, and, until then, the nuclear department shared the site with the plant.

With the transfer to San Jose, Bert became manager of special reactor physics with GE, and was responsible for the physics on all of GE's special reactors—the swimming pool reactor, the radiation effects reactor, and the General Electric Test Reactor, built at Vallecitos, which was the first private test reactor in the world. "All involved new technology and were big projects then," Bert comments. "At that time, one could really accomplish things in a relatively short time. I'm not sure we met all of the procedures of today, but our reactors were safe, they were successful, and they were economic. In retrospect, at least, it was an exciting and self-fulfilling period. I remember that the Vallecitos test reactor went a little over budget—we thought it was going to cost $5 million and it cost us $5.2 million. We were quite upset about that. Someone asked me a few years ago what I thought it would cost to build today, and my guess is that it would probably be about $200 million—or

more—to reproduce it. It started up as a 30-MW reactor, and then it was increased to 60 MW before we shut it down a few years ago."

In 1960, when Karl Cohen started up the Advanced Engineering group at GE, Bert joined the group, moving from physics to advanced engineering. Bert says the group looked at all sorts of reactors, such as heavy-water reactors, organic-cooled reactors, heavy-water-moderated organic-cooled reactors, heavy-water-moderated sodium-cooled reactors, beryllium- and graphite-moderated gas reactors, and so on. They evaluated many designs, but concluded that the real future was in the breeder reactor, and so, working with the AEC, in 1959 GE began work on the commercial breeder reactor development program.

One of the crucial questions at the time about breeder safety concerned its very fast response—a small error could cause the reactor to heat up very quickly. Then GE scientist Paul Greebler discovered in 1960 that large commercial power breeder reactors could be designed so as to have substantial negative Doppler effect. (This discovery was independently duplicated at about the same time by Dick Nicholson, then of Atomic Power Development Associates.) The Doppler effect involves an increase in the parasitic or wasteful absorption of neutrons as fuel is heated up. Thus, in an accident situation, as fuel is heated, the parasitic absorption would tend to shut the reactor down; this inherent effect does not depend on geometry, but only on the temperature of the fuel. This discovery by Greebler and Nicholson made possible a quantum leap in the safety design of fast breeder reactors.

The discovery also made it possible to consider practical fast breeders that used plutonium-uranium oxide ceramic fuel, which did not expand predictably with temperature. Experimenting with the oxide fuel rather than metallic fuel, GE researchers showed burnup potentials of up to 100 000 MWd/ton, at a time when the metal fuel was operating for only 10 000 MWd/ton. Today, Bert notes, researchers at Argonne National Laboratory have made progress developing a long-burnup metal fuel for the breeder, and so now there is the possibility that the world may turn back to metal fuel. For 25 years, however, oxide fuel remained the preferred choice.

To prove that the Doppler effect was a real safety effect for breeder reactors, it was necessary to demonstrate it in an actual reactor. This led to the development of a test vehicle, a new breeder test reactor known as SEFOR, the Southwest Experimental Fast Oxide Reactor. It didn't actually breed, but it was a fast reactor and was designed to have all the physics characteristics of a breeder. The SEFOR project was a cooperative one, with participation by the AEC, 17 U.S. utilities, and Germany's Kernforschungszentrum Karlsruhe, with General Electric in charge.

Bert served as manager of the project. As he explains: "It was finally organized and started in 1963. It was supposed to be finished by 1969, and it was. The test program was supposed to be run between 1969 and 1973, and it was. It did everything it was supposed to do. Except it was supposed to be built for $15 million, and again we were very disappointed when it cost us $15.5 million."

Commenting on the success of the first test, Bert has written: "I would make two observations about the test results. The first was that Paul's precalculated results agreed so well with the tests that had the predictions not been widely distributed beforehand, one would be suspicious that they had been normalized to the results afterwards. A second observation has to do with the test program itself. Those of us in the SEFOR project were continually describing what would happen during the test when a rapid excursion would increase the power level of the reactor from a few watts to 20 000 megawatts in a few seconds. Our description was, of course, that the instruments would rapidly move, the Doppler effect would shut the reactor down, and the reactor would scram. Otherwise, every-

Wedding day: December 23, 1950

Bert, Lee, and a friend in the early '50s

In California in 1958: Bert, Lee, daughter Sarah, and son Don

thing else would operate normally, and there would be no external indications of the test.

"I was in the control room during the first prompt critical burst, and the tests went exactly as predicted. However, I must say that at the final countdown I noticed that a number of people in the control room were edging toward the door. . . ."

Time out

By the time SEFOR went critical, however, Bert was feeling a little restless. When he got an offer in 1969 to join Battelle Northwest Laboratories as associate director under Fred Albaugh, it seemed too good an opportunity to pass up. So, packing up the family, children kicking and screaming (two sons, Donald and William, had been added to the family by then), Bert moved to Richland, Wash.

Within six months, however, because of a new government law on not-for-profit organizations, Battelle was forced to divest itself of the Fast Flux Test Facility and other nuclear work. The government asked Westinghouse to take over as contractor, and Bert suddenly found himself working for his old rival, becoming a vice president in the technical department of what was then known as WADCO and ultimately became the Hanford Engineering Development Laboratory.

"I guess because I was relatively new with each organization," he explains, "I was the only person in management that all three parties—the AEC, Battelle, and Westinghouse—would talk to. So I found myself playing a key role in the transition. I reported to Walt Esselman, who is now with the Electric Power Research Institute, and he in turn reported to John Taylor, now also with EPRI."

During the period of transition, Bert led a high-level team from Bechtel, Westinghouse, Atomic International, and WADCO. With the help of Tom Nemzel, who headed the AEC office in Richland, the team finally came up with the basic FFTF design that was accepted, so that the project could officially start.

Then, in 1971, GE went through another reorganization, and Karl Cohen moved to head the new strategic planning operation. Comments Bert: "George Stathakis [then in charge of the nuclear division] called me and made an outstanding offer for me to take over the Advanced Technology Department from Karl. While I said that I was very busy and very happy and just didn't know that I could consider it, in truth I was very anxious to get back to GE—Westinghouse treated me great, but I had my roots with GE."

So, the family moved back to the San Jose area, children kicking and screaming again—"You're not taking us back to all that crime and dope," Bert recalls them saying—and Bert became general manager of the Advanced Technology Department.

Notes Bert about his return to GE: "I learned then that your past can come back. I had left GE when SEFOR went critical, and when I came back, we were just going into the test programs. I really had to live with the past. But we had spent a lot of time and effort to make that reactor a complete success, and when I came back and had to live with it, I was glad of all the effort. I think one of the problems of the nuclear business is that our efforts sometimes take so long that the people who start things aren't the ones who finish them and have to live with them. That's particularly the case today with our schedules getting so long. So I think there's something to be said for getting the schedules and the commitment consistent with one person's ability to stay on the job and see it through."

A problem at Morris

In the mid-1970s, GE was building a fuel reprocessing plant at Morris, Ill. When it began running into problems, George Stathakis called Bert in and asked him to take over the Morris project. Bert says he answered that he was a physicist, and that Morris was a chemical engineering problem, but Stathakis was unconvinced. "George was an outstanding guy," Bert notes, "just the nicest person you'd ever want to work for. Whenever he wanted you to do something, he would ask you nicely to do it. But you could tell sometimes when he asked you that he didn't want you to say no. And it was clear to me that despite my lack of qualifications, he very much wanted me to do that job. I think he wanted someone he trusted that had some broad technical sense and interest. I didn't think I had much choice; I agreed to take on the Morris operation."

Bert became the general manager of the Fuel Recovery and Irradiation Department in mid-1974. The Morris plant was due to come on line in January 1975, and even though people on the project were working 20-hour days, Bert concluded that there simply was no way the plant could begin operation in January—the best that could be hoped for was maybe June 1975.

In early 1975, Bert, with company vice president Ed Hood's support, initiated a high-level company audit of the Morris operation, and the audit conclusion was that there were some major flaws in the plant, and that the plant would never be able to operate without major changes. The AEC revoked the license, and Bert's next task was to tell all the utilities that had contracted with GE for spent-fuel services that the plant would never operate and that alternatives would have to be considered. Noted Bert: "Some utilities had extra fuel storage capacity at their plants, but some—like Wisconsin Electric Power—did not, so we designed, licensed, and built new racks in the storage pool at Morris that would let us go from 100 tons to 700 tons of storage. Somehow, nobody opposed us—the storage expansion was licensed by the Nuclear Regulatory Commission in a year. I think if we tried to do it today, we'd have so many intervenors there would be 5 to 10 years of worthless delay before we could do it. But we did get it licensed—there was cooperation all around—and we got racks built so we could actually take fuel from Wisconsin Electric Power by the beginning of 1976. And Morris is still the only away-from-reactor spent-fuel storage operation in the country.

"When we concluded that Morris would not work as planned, I went around to all the utilities expecting to reprocess at Morris to tell them that the facility would not operate as a reprocessing facility. There were some stormy sessions, but I think there was general appreciation of the fact that, throughout it all, the company played it very straight. We were all unhappy with the outcome. Still, no utility had to shut down its plants, and I think we provided early warning and perspective to utilities on the events to come in the back end of

the fuel cycle. Despite the turbulent times, I developed close friendships with some of the utility executives, and the friendships have endured to today."

Today—and in the future

In 1978, Bert became vice president of Nuclear Energy Programs, a division set up to figure out what the future for the nuclear industry actually would be. It was becoming evident, Bert says, that there were not going to be any more reactor orders in the United States for some time, and GE began looking at the maintenance and fuel supply side of the reactor business. In 1981, plant maintenance and fuel supply at GE was split off from the reactor construction business, dividing the nuclear division into two components. Bert was given the task of developing the fuel supply and services functions into a stand-alone business. In 1983, as the services and fuel businesses grew, GE again reorganized, and Bert became head of the Nuclear Technologies and Fuel Division, a position he still holds. This division combines all the fuel development and supply work with the advanced reactor work—the breeder, the advanced boiling water reactor, the gas reactor, and space reactors.

Bert is a professional engineer in the state of California, and in 1980 was elected to the National Academy of Engineering. He is well-known as a spokesman for nuclear energy who is able to face directly nuclear energy's problems and limitations and also its critics. For more than a decade, he has participated in lectures, seminars, and round-table discussions at universities, church groups, and political and civic organizations, and has appeared on television and radio talk shows and debates. He is also a frequent writer about nuclear power.

Bert is optimistic about the long-range future of nuclear energy. "Today, there is surplus capacity in the U.S. utility industry," he notes, "but in the 1990s, utilities will have to provide new capacity not only for the growing electrical needs of the country, but also to replace aging generation plants. In this country, there is the choice between nuclear and coal. Assuming we solve our institutional problems, I believe we'll use both, with an ever-growing appreciation of the nuclear advantage.

"More fundamental is the fact that two-thirds of world energy use is today supplied by oil and gas and three-quarters of the world's petroleum is in the Mideast. In the next decade—some say in only four or five years—we'll have the OPEC problem again, only in spades. In the first part of the next century, we'll have a world population that will have increased from five billion to eight billion people, at the same time that even the Mideast oil production capacity will start to decline. Nuclear power will be one of the few sources that can expand, and I believe it is likely to become bigger and more important than most people today can even contemplate. What we've started here will be vital to the nation and to the world in the future. If doing the right thing for the future provides a sense of fulfillment, then, despite our present difficulties, those working in the nuclear field should have a great sense of inner satisfaction."

The Wolfes at home

These days, all the Wolfe children have left home. Daughter Sarah, now 31, is a manager at Calma, which sells equipment to help companies with computer-aided design. She and her husband are expecting their first child in August, so Bert and Lee are looking forward to becoming grandparents.

Older son Don, now 29, is a psychologist working in private practice in La Jolla, Calif. The younger son, Bill, just completed his first year at the University of California at Long Beach. Left at home with Lee and Bert is Penny, the family puppy.

Working with ANS

Bert joined ANS in 1956, and was elected a Fellow in 1970. He served on the Board of Directors in 1974–77. He also served on the ANS Finance Committee in 1974–77, and as chairman of that committee in 1976–77. He was a member of the Planning Committee in 1977–80, serving as chairman in 1978–80. He was the general chairman of the 1979 Winter Meeting in San Francisco, and a member of the NEED Committee, 1981–82. He is also a charter member and past president of the ANS Northern California Section.

In the future, Bert sees ANS as recognizing that it is going to have to change to accommodate the nuclear industry in the phase it is now in—that of taking care of the operating reactors rather than building any new ones. He says the Society must concentrate on making contributions to that phase. "The membership is clearly going to move toward people more involved in operation and support of the reactors rather than in the deeply theoretical," he says. "On the other hand, we want to remain a place where new theoretical ideas can be advanced and also be a forum for advanced reac-

(left) The Wolfes in 1977 at Sarah's college graduation; from left, Don, Bill, Bert, Sarah, and Lee; (right) Lee and Bert last year in Spain

tors—the advanced light-water reactors, the new gas reactor concepts, and the advanced breeders—that will become, I think, the vehicles on which the nuclear industry will ride in the future. We should also be a focal point where ideas can be aired and discussed for new technological approaches and new ways for nuclear technologies to be employed and advanced.

"Finally, the Society should provide a means for its members to participate in those areas where technical and social considerations meld. We in the nuclear energy field should be concerned about finding means to minimize the possibility of nuclear weapons proliferation and nuclear terrorism. And we should continue in the lead in our search to make our reactors ever more reliable and safe. We shouldn't leave such valid concerns in the hands of the antinukes, who will use them as tools to shut down nuclear power.

"We also have to continue our public education program. ANS is a credible society because our program is based on technology and technical expertise—we're not a commercial or political organization. ANS represents technical people and workers in the field, and our public education program is headed by Lynn Wallis, a health physicist. We want to continue our public education work and find out ways to enhance it.

"One other area where we need to work is the standards area. We've had an ambivalent attitude on standards the last several years. There was a feeling that we had moved too quickly in developing new standards and that standards, some not useful, were coming out too often, so we backed off. For the past few years, we've moved very slowly in the standards area. I've just appointed John Crowley, of United Engineers and Constructors Inc., to head the Standards Committee, and have appointed John Ward, from Management Analysis Company, to be vice chairman. They have a specific charter—to advise us on what we should be doing in the standards area—whether we should now be tidying up our standards, or reaching out to develop more standards, or trying to do both. We have to look at standards in terms of the new situation rather than the old. We are fortunate to have people like Crowley and Ward, who are willing to put in the time, and whose companies will support them."

Yes, ANS is fortunate to have people like Crowley and Ward. It is also fortunate to have people like Bert Wolfe on board—people who have been with the industry through good times and bad, who have seen it mature and change, who can see the good that has been done and the good that remains to be done—and who have a good company behind them that will support their ANS activities.—*Nancy Zacha Godlewski*