Richard McPherson

The Truth About Nuclear Power, Ending War, Beginning World Development

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My own point of view has been tempered by people that started in the nuclear program with nuclear reactors during the Manhattan Project. I have been fortunate, or unfortunate, enough, depending on how you look at it, to be taught the history of all that, by them. I have been part of it since 1963. One of the biggest advantages I have is that I do not work for the government, I don't work for big business, I don't have to worry about a job, a paycheck, or getting advanced. I can talk about what is the best of the best that's available to us today—and for the needs of today, which in my opinion is both domestically and internationally, what we would generally refer to as "soft power," that all comes under the nexus of agriculture, water, and energy.

A Short History of Modular Reactors

But let's go back and talk about modular reactors and how we got to where we are today.

The first modular reactor was the one that was built in Idaho, between 1948 and 1953, for the first U.S. nuclear submarine, the *USS Nautilus*. Then Captain Hyman Rickover signed the contract in November of 1948 to design and build the first submarine reactor, called S1W. "S1W" stands for "Submarine, First Core Westinghouse." It went critical in March of 1953.

Then, the commercial side began with a Shippingport reactor that was not so much a modular design; more of it was built in place in Shippingport, Pennsylvania between 1954 and 1957. By that time, the floodgates were opened and all the utilities had to have their own reactors. There were plenty of reactor suppliers to choose from, because everybody wanted to design and build a nuclear reactor, although most of the information came out of the Navy or the Manhattan Project.

The first 1,000 MW reactor came about, about 1969. The Tennessee Valley Authority (TVA) built it. TVA should have known how to build it, because they participated in building the first ones during the Manhattan Project.

Fast forward to every utility had to have a reactor; they all started building their own, they all had a hand in them, and as a result we had a whole bunch of one-off reactors. The commercial industry was happy to provide them, because they're paying for them.

The Westinghouse Story

Along comes 1974, and things started changing. By 1974, the anti-nuclear community had put enough pressure on members of Congress to split up the Atomic Energy Commission into two parts. One became the Nuclear Regulatory Commission (NRC); the other became, at the time, the Energy Research and Development Administration (ERDA), three years later becoming the Department of Energy that we know today.

Westinghouse recognized that everybody was making a mistake, including them, by not manufacturing modular reactors. What's a modular reactor? A modular reactor is something that's made in a manufacturing facility somewhere, in the largest size possible that can be transported. It could be by truck, it could be by rail, but it has to be a combination of the two generally, especially by truck for the last few miles. In later life we built some special transporters.

The idea of a single reactor design, which we needed, and a modular design, which we needed, was born about 1975 at Westinghouse. It was logical for them to do that, because they'd been building reactors for the Navy since they signed that first contract in 1948 with Admiral Rickover. At the time, I was in the U.S. Navy, when I first got associated with the American Nuclear Society section in San Diego. My association with the commercial side of nuclear power started in 1975.

All of us were enamored of the idea that Westinghouse would come up with a single design, a modular design, a 600 MW design, and that now we were going to see what was happening in the '70s, can continue. A number of things happened in the late 1960s and early 1970s that changed things. The first thing that we saw, we saw from 1957 on and got a lot of growth in the late 1960s, ten years later, was the changes in public policy that had to do with the environment. We saw the Clean Water Act, we saw the Clean Air Act, then we saw what was intended for the government only, the 1969 Act, commonly called the 1970 National Environmental Policy Act (NEPA).

Coupled with that, the Atomic Energy Commission (AEC) started putting a burden on building new nuclear power plants. Westinghouse was not selling any AP600s, their modular reactor. In 1979, two things happened which helped burden down the commercial nuclear power industry from the new burdens that it had, of the NRC and all the new environmental rules. And that was, there was a movie that came out called *The China Syndrome.*

Right after the movie came out, the Three Mile Island accident happened. Three Mile Island was a valve that was stuck in open position, in a pressurized water reactor. One of my current partners was just coming on watch, in the morning, when it was happening. He comes into the control room, he looks around, he says, "I'm not relieving you until you find out what's going on here!" So, we know all about TMI. I was back there that week.

In a meeting one evening in a hotel room a few days later, everybody's asking around as to what do they think? Well, here were my words, and the place got instantly quiet. I said: "This is a really good deal." Dead silence, and now a whole bunch of senior people are looking at me. I said, "The reason it's a good deal is because what we're going to find out is that all of our physics calculations and other calculations are so conservative, that nothing really is going to happen—except we're going to have a ruined reactor and it's all going to stay inside the pressure vessel." Bottom line, in the long run, that's exactly what happened: There was nobody hurt, nobody got any kind of damage at all, despite all the reports to the contrary.

But the combination of things that occurred with changes in public policy, starting in 1957, that really got its biggest push around 1970—coupled with Three Mile Island and the movie *China Syndrome*—was the beginning of the end for the commercial nuclear power industry in the United States.

For about 20 years, Westinghouse tried to sell the AP600 pressurized water reactor. In 1993, Westinghouse decided that, "The reason we can't sell them is that they're only 600 MW; they need to be 1,000 MW." So, they came up with the AP1000. Instantly the AP600 became a 1,000 MW reactor. Almost three years go by and they can't sell it. So now they begin talking to other companies in the industry, and Westinghouse was working with Morrison-Knudsen, a company in Idaho, and it soon became public knowledge at Morrison-Knudsen and British Nuclear Fuels, Ltd. (BNFL) that they were going to buy Westinghouse Nuclear.

I knew senior people in both companies. I called a guy I knew in BNFL, I called somebody I knew in Morrison-Knudsen. I told them basically the same thing: "You're trying to buy this company thinking you're going to save your own companies, and it's not going to happen in either case." Both people—they didn't even know each other—assured me that senior management knew what they were doing. The deal was consummated and now Westinghouse belonged to BNFL and Morrison-Knudsen, headquartered in the UK.

Technology Transfer: Westinghouse to Toshiba to China

Time passes and we're now in 2006, a decade later. Suddenly Toshiba starts making noise about buying Westinghouse. Something about that didn't make sense to me. They bought Westinghouse. Six months later it was announced that China had a contract with Toshiba to buy a couple of AP1000 reactors. There was a great loss of American technology, paid for by taxpayers, rate payers and investors, that went to China starting in 2006. China had already prepositioned people over here, recruiting Americans to come to China to work on the design, the manufacturing, and the construction of the AP1000s in China. A friend of mine took a team over there for five years. Afterwards, he told me he made a mistake, but none of them knew it. The reason it was so easy for China to entice them to come over, was because there was no work for them in the United States. China was paying them well, letting them work in their chosen field. People who had 10-, 20-, 30-plus years of experience went to China.

So it's not just a simple case of a simple technology transfer from Toshiba and Westinghouse to China. They got the knowledge of thousands of Americans who went over there to work.

Fast forward to today: The situation today is dire. We have seen over the past less than a decade, the morphing of large reactors, the AP1000s. Everybody was happy in 2010 because we were going to build four AP1000s in the United States. Two of them in Georgia and two in South Carolina. Everybody was patting each other on the back about the nuclear renaissance.

NuScale and Small Modular Reactors

I had doubts; a bunch of us had doubts. Our doubts unfortunately turned into reality. The days of us building a bunch of large reactors are pretty much over. Too complex, too much time, too much money. There was a resurgence in looking at small modular reactors (SMRs): First, they're called small modular reactors, because they're less than 300 MW, which is a term that comes out of the IAEA in Vienna, Austria. If they're between 60 and 300 MW, they're called a small modular reactor; smaller than that, they're called a micro-reactor.

In 2000, Dr. José Reyes at Oregon State University got some money from the Department of Energy to design a small modular reactor. In 2007, he and Paul Lorenzini formed a company that we now know as NuScale Power in Corvallis, Oregon. They continued on with their design of the small modular reactor. The Nuclear Regulatory Commission is currently in the final stages of its review, and NuScale anticipates their first two units will be built for the Utah Associated Municipal Power Systems (UAMPS), a subdivision of the State of Utah, in 2029 and 2030 at the Idaho National Laboratory, here in Idaho.

Other people have jumped on the small modular reactor bandwagon: General Electric has one; Westinghouse is trying to have one; Babcock & Wilcox tried to have one. Then along came people more experienced in actually designing and building nuclear plants, and they've come up with what we call micro-reactors. One of them is a Dr. Paul Marotta, who was a designer of naval reactors for many years at Kaplan, upstate New York. There were no new designs for the Navy, and he was bored, so he quit and went on his own. He knew what was needed, and it was a micro-reactor, based on a technology that we already know about, called molten salt; he calls it the molten salt nuclear battery. You'll be able to put it in the ground, turn it on, and it will give you 10 MW for 10 years.

We have seen the small modular reactors, as we know them, being slowed down by the Nuclear Regulatory Commission and other people in this country. They may try to do the same thing with the micro-reactors, but the problem is the micro-reactors are so simple, so safe, that we're going to see an evolution of the micro-reactors, before we're going to see the small modular reactors. I know the NuScale design very well, because I was hired to bring in a team and be part of the team, that did all of their Design One reviews.

Eisenhower's 'Atoms for Peace' and the IAEA

I get involved with almost everybody's reactors one way or another, so I know what people are doing, I know about the technology. But I've also been involved in national security since 1963, representing the United States for four years at the IAEA in Vienna, Austria, because of the Chernobyl accident. Because of the Chernobyl accident, the Soviets went to Hans Blix in 1987 and they said, "Our people don't trust us." Hans Blix, who was Director General of the IAEA, went to Washington and said, "I need your help. We need to do something, and here's an opportunity." So the United States funded a six-nation group to be put together: the United States, the UK, Spain, the Soviet Union, Canada and Switzerland. I was picked to be the United States representative.

Our assigned task was to study nuclear fuel-cycle facilities, the environment, and public opinion as one subject. For all of us that were there, nuclear fuel-cycle facilities was very easy. The environment was pretty easy, also, because the IAEA had already done so much in looking at everything having to do with the environment.

Public opinion is where we actually spent more than 50% of our time and money and travel, because public opinion is what's caused us not to have what President Eisenhower offered back on December 8, 1953 in his "Atoms for Peace" address to the UN General Assembly. President Dwight Eisenhower offered the world the U.S. nuclear technology for prosperity and security for the world. We should all be enjoying that, worldwide, now. We should not have 800 million people without electricity and water; we should not have 2 billion people going hungry at night around the world. There is absolutely no technical reason why! It is all political. It is all greed. It is all people trying to have power over other people.

Technology-wise there is no reason why everybody in this world doesn't have clean water, doesn't have food, doesn't have basic medicines, doesn't have enough energy to do all of the above, plus make some sort of a living and have security.

Since I went back to work in 2016, I decided to devote my life to soft power and problems under the nexus of agriculture, water and energy. I knew, doing that firsthand, the solutions are out there.