



THE NUCLEAR NEWS INTERVIEW

## David Lochbaum: Comments from a nuclear engineer with the Union of Concerned Scientists

**D**avid Lochbaum is the director of the Nuclear Safety Project for the Union of Concerned Scientists, an organization that some in the nuclear power industry perceive to be antinuclear. Not so, says Lochbaum, who joined UCS in 1996 as its nuclear safety engineer. Lochbaum claims that UCS is neutral on the technology, but that nuclear plants need to be operated more safely.

In its recent report, “Nuclear Power in a Warming World,” UCS assessed what it called nuclear power’s key problems, and offered recommendations to “strengthen nuclear plant safety, better protect facilities against sabotage and attack, ensure the safe disposal of nuclear waste, and minimize the risk that nuclear power will help more nations and terrorists acquire nuclear weapons.” The report also evaluated new reactor designs. The report, which Lochbaum coauthored, is available at UCS’s Web site at [www.ucsusa.org](http://www.ucsusa.org).

After graduating from the University of Tennessee in 1979 with a degree in nuclear engineering, Lochbaum went to work in the nuclear power industry. He started at the Hatch plant, then moved on to the Browns Ferry plant, and then decided to leave plant life to work as an industry consultant, which he did for 14 years.

Lochbaum became a consultant, he said, because there were limited job opportunities at nuclear plants. “When I worked in the industry, I saw that if I was good at something, I pretty much plateaued early because my boss didn’t want me to leave to work somewhere else.” So he became a consultant, which allowed him to work on new startup nuclear plants and try different things, and it offered him quick outs because his job contracts were finite. “If it didn’t work out and I didn’t burn any bridges, I could go to work somewhere else when the contract was up,” he said.

*UCS keeps its eye on the industry and the NRC, pointing out what it sees as flaws in the way nuclear plants are run and how they are regulated.*



**Lochbaum:** “The answer is yes, the world can survive without nuclear power.”

Lochbaum enjoyed this nomadic existence. He had always wanted to “travel around and see different parts of the country and try out different jobs. Being a contractor seemed like a good way for me to do that.” He admits, too, that the pay as a consultant was better than working directly for the plants.

But then the constant traveling got old—11 months out of the year were spent on the road—and he realized it was time to settle down in one place. The job of nuclear safety engineer at UCS became available and he decided to pursue it because it meshed with his desire to keep the spotlight on plant problems. At the time, in 1996,

it looked as if the nuclear power industry was fading in the United States. Zion and Big Rock Point were about to be retired. The question that UCS was asking itself was whether it needed another nuclear safety engineer at all. The organization’s board decided that nuclear power was likely to be around for a while, and so Lochbaum was hired. Now years later, through the organization’s Nuclear Safety Project, which is devoted to nuclear power issues, Lochbaum has been keeping a close eye on the industry.

UCS is a science-based nonprofit group that works “for a healthy environment and a safer world,” according to its Web site. The site also notes that UCS combines independent scientific research and citizen action to develop innovative and practical solutions and to secure responsible changes in government policy, corporate practices, and consumer choices.

The interview with Lochbaum, which was pursued at the suggestion of *NN*’s Editorial Advisory Committee, was conducted by *NN* Senior Editor Rick Michal.

*What was your motivation for changing from a reactor engineering consultant working in the industry to an advocate for UCS?*

In 1992, I was working as a consultant at the Susquehanna plant. A colleague and I identified a problem with the cooling system for the spent fuel pool. We raised the issue internally, but nothing was done to fix it. So we took our concerns to the Nuclear Regulatory Commission. We were very public in what we did. We felt that if we were going to raise a safety issue, it couldn't be done anonymously. As a result, we started getting calls from colleagues all around the country saying that since our careers were "toast," would we mind taking on their safety issues and championing them. I didn't realize how many people out there had those kinds of issues until I started getting those calls. So, that was the genesis of my focus on plant safety issues.

*Were you still in demand as a consultant after that?*

I was. For three years after that, I still worked in the industry and had no problems getting jobs. People who had known me prior to the incident didn't look at me badly afterward. In fact, I was brought into the Salem plant to look at the spent fuel pool, the reason being that no one would give it a tougher scrubbing than me. In some respects, the Susquehanna issue helped me get consulting jobs.

Ultimately, when the UCS job opened in 1996, I found out that the organization wasn't antinuclear but was consistent with what I wanted to do, which was to promote nuclear safety. When I interviewed with UCS, it was evident that no one there was happy that plants were being retired or were shutting down for safety reasons. At the time, Zion and Big Rock Point were just about retired, and Millstone and Haddam Neck had been shut down because of regulatory problems. But instead of being satisfied, the UCS people were asking questions such as, "How can we make sure these plants are safely restarted?"

The reason for those questions was that UCS realized that fewer nuclear plants would probably mean that coal-fired plants would be brought out of retirement to meet the electricity demand. Fossil fuel plants have bad implications for global warming, clean air, and the other goals of UCS. The fact that UCS's intentions were similar to mine—in that nuclear power, if we're going to have it, has to be safe—allowed me to seriously contemplate the job and ultimately take it.

*With the world's population projected to increase to about 9 billion people by 2040, do you believe that the planet can survive without nuclear power?*

The answer is yes, the world can survive without nuclear power, and the irony of your question shows why it can be done. The irony is in nuclear power's history itself. Nuclear power was used for the first time to make electricity during a simple test to light up lightbulbs in December 1951 in Arco, Idaho. In just over 50 years, the technology went from four 75-watt lightbulbs to more than 100 nuclear power reactors in the United States and well over 400 worldwide. If we were to look forward for that same 50-year time frame, the technologies that UCS promotes—such as renewables—could make the same kind of growth as nuclear power did in the past 50 years. It would

take policy actions to accomplish that growth, of course. But keep in mind that nuclear power wouldn't have grown like it did if left to its own. There were some policy decisions early on that guided it along its path. With similar guidance, renewables could have similar growth. If goals are set, then the technologies can go from the drawing board to people's backyards to meet those goals. That, then, would build the infrastructure and allow the costs to come down. Then the new technologies would no longer need governmental support because the open marketplace would allow things to happen.

*Is there a mistake waiting to happen in the nuclear industry that could sidetrack the renaissance?*

We hope not, but I think there are some problems. Davis-Besse and some other plants have shown that the industry still has some homework to do. I'm more optimistic that the problems can be fixed. It's in everybody's best interest to fix them.

*A recent report from UCS says that nuclear power is less safe and more costly than it should be. Why does UCS say that?*

A few years ago at a Department of Energy meeting, I made a presentation titled "Little M&O leads to large O&M." M&O is management and oversight, and O&M is operating and maintenance costs. Looking at Davis-Besse, Millstone, and Salem—the plants that had regulatory problems that caused them to be shut down for long periods—the fact that they were shut down in the first place reflected the number of problems that had to be fixed. For years their safety levels were less than they should have been. In addition, their costs were higher than necessary because no revenue was being generated during the year-plus periods when they were shut down. Plus, their purses had to be open to pay for the

army of workers that had to come in and fix all of the accumulated safety problems. If things had been done right all along—through proper plant management and effective NRC oversight—those safety-level erosions and high costs of recovery would have been avoided.

*Has UCS felt that the industry focuses on the bottom line for the near term instead of looking at the longer term?*

**I'm more optimistic that the problems can be fixed. It's in everybody's best interest to fix them.**

Generally, yes. The first big report I wrote for UCS was in 1998, called "The Good, the Bad, and the Ugly." We looked at 10 plants very closely over about a 14-month period. We developed a safety scorecard that ranked and rated performance. In that report, we recognized that the safety scorecard was going to be biased toward the negative because people don't report successes—instead, they have to report problems. We recognized that if we applied the same scorecard to our 10 plants from a relative basis, there might be some meaningful insights.

The report found that the plant that scored at the top of our safety scorecard was Surry, which also was the lowest-cost electricity producer at that time among the nation's entire fleet. We didn't know how the plant achieved the low electricity prices, but one of the ways it might have done so was by taking safety shortcuts. But Surry didn't do that. They were the best on our safety scorecard and they were also the lowest-cost electricity producer. We saw that Surry achieved those results by very aggressively looking for problems, not only at their own sites but also by learning from sister plants. And, more often than not, they very effectively fixed those problems the right way the first time. By doing that, they were able to achieve good safety scores and were also able to achieve very good financial results. Surprises are costly. When a plant reacts to a problem that it didn't anticipate, generally it's doing that at a higher premium than if it had built problem mitigation into a business plan and had more control over it.

With that lesson, it was harder to figure out why the plants at the bottom of the list—those that weren't doing well from both the safety and financial standpoints—were there in the first place. If the Surry model suggests that both can be achieved, why not do that? That experience and those lessons are the foundation for the statement

in the recent report about nuclear being less safe and more costly than it needs to be.

*According to UCS's recent report, the United States has strong safety regulations, but the Nuclear Regulatory Commission is not a good safety organization. The NRC has countered by saying that UCS was using old data for that report. How do you respond to that?*

It's interesting that when the NRC uses the same data for things such as risk studies, they're fine, but when we use them, they're obsolete.

The first year I was at UCS, I went through some old files, and one of the things that struck me was that very seldom did UCS intervene or go to Congress complaining that the energy safety regulations were inadequate and needed to be expanded. Most often, UCS was saying that the regulations were adequate but that one or more plants weren't meeting them. And UCS was trying to get the NRC—or get Congress to force the NRC—to enforce the regulations that were on the books. During my own tenure at UCS, it's been pretty much the same. It seems to be a recurring problem.

But I don't want to be too disparaging of the NRC because there are times they can enforce the regulations. Right now, for example, I think they're doing a great job at the Palo Verde plant, where there were problems with the cooling water piping. In that case, the NRC found that the plant was putting so many chemicals in the cooling water that some of them wouldn't dissolve. This had been going on for years, and the plant's response was to clean the piping rather than figure out what the problem was and fix it. The plant was in a state of denial until the NRC got involved. Now there seems to be a big turnaround, and the plant is fixing problems rather than protesting them. I think the NRC has done a good job on that. I just wish it were more the rule than the exception.

*Some antinuclear groups say that the NRC is too much of an advocate of the industry. How does UCS feel?*

I hear that claim, but I don't buy it. UCS looked at the event at Davis-Besse in 2002 with the hole in the reactor head. We looked at the transcripts of the NRC inspector general's interviews of the agency's staff as to why it happened. One thing that came out was that while the NRC's staff felt there were problems at the plant before the reactor head incident, the NRC's senior managers felt they needed absolute proof of a safety problem before they could act. Absolute proof is a very high standard and a notion that needs to be fixed within the agency. The bottom line is that while the senior managers decided not to listen to their staff, no one will ever build a stronger cir-

cumstantial case than the one the staff built. The staff had applied five safety criteria and determined that Davis-Besse didn't meet four of them and likely didn't meet the fifth one either. Yet that wasn't enough to shut the plant down for safety reasons. The NRC needs to fix that flaw before a major accident happens.

*Are you saying that management is the problem at the NRC?*

I think it has to do with some complacency, as in, "It's been more than 25 years since we melted one down, so we must know what we're doing now." Several years ago I read a book about NASA's *Challenger* disaster. The book describes "the normalization of deviance," which means that if there is a nagging problem and it comes up often enough, the fact that it occurs without catastrophe can delude technical societies into believing it is normal. In

NASA's case, there had been nine prior shuttle flights that had O-ring burn-through. NASA knew it was happening, but the fact that it had never led to the loss of a shuttle left the agency thinking that fixing the problem could be delayed. It wasn't an urgent matter to deal with, but the lesson was learned after *Challenger* came down.

Looking at the NRC, they're dealing with a bunch of low-probability, high-consequence events. So, when is it time to react? For example, the agency is dealing with some fire protection issues, but it's unlikely there will be a fire. If there is a fire, however, then all of these problems they've known about will come into play.

I think part of the problem with the NRC is that they're trying to do risk-informed regulation where they rely more and more on probabilistic risk assessments (PRA). But what's missing from the PRAs for plant sites is a higher-risk component. If that component were part of the PRA program, it would help the agency deal with compensatory actions until problems are solved.

At the plant level, this never happens. Instead, the plants use software programs to keep track of when a piece of equipment is out of service or when a diesel generator is going to be taken down for maintenance. They know whether steps make risks higher or lower. The NRC is dealing with the same kinds of issues but isn't applying the same kinds of tools. Therefore, they're not getting the same kinds of results.

*In UCS's opinion, has the NRC been in an improvement mode?*

I think there is improvement. The NRC

has made enough progress over the past 10 years to lead me to believe that I'm not just banging my head against the wall. UCS is not going to say that it wouldn't have happened but for us, but I think we did contribute to it. It leads us to believe that if we continue to highlight the problems, it will lead to better things tomorrow.

I can give examples where UCS wasn't involved and where we were. The first example: The NRC implemented the Maintenance Rule in 1998 without UCS's involvement. That rule basically forced plant owners to do better risk assessments in order to take advantage of all the benefits the rule provided. The better risk assessments

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are largely responsible for the reduction of forced outages and safety system actuations. That was a very good thing done by the NRC.

The second example: UCS did have a role in bringing about the reactor oversight process (ROP). It's not perfect, but it's much better than the old Systematic Assessment of Licensee Performance Program. One of the things I like about the ROP is that it's a work in progress. The NRC has built in a mechanism to get feedback from inspectors, the industry, and others so that the ROP can constantly get better. Those kinds of things lead me to believe that dealing with the NRC is not a hopeless endeavor.

*How does UCS view federal standards for securing nuclear facilities?*

There are many good things, and still some things we'd like to see fixed. On the plus side, the NRC's Design Basis Threat rule that went into effect in January last year increased the frequency of the force-on-force tests from about once every eight years to about once every three years, which is a good thing. It made a modest increase in the capabilities of what plants are defending against. Another big improvement was in the background checks done on workers. Background checks are now completed before work badges are issued. That process has been sped up to about three days, as opposed to six months in the past. In addition to that, every five years the background check is revisited to make sure the person is the trustworthy, reliable individual who was hired. In the old days, it

was done once and it was never revisited unless the person was involved in a shooting or something like that. But the NRC needs to do a better job of protecting against the insider threat. The military applies a two-person rule that lessens the chance of sabotage and theft. The NRC should apply that same two-person rule for vital areas of nuclear power plants, but with one change: Monitored security cameras could be the second person.

*What is UCS's position on the proposed spent fuel repository at Yucca Mountain?*

We have intentionally not weighed in on Yucca Mountain. Pragmatically, one more vote on either side of the issue isn't going to change the outcome. We did contemplate coming out and saying that the next nuclear facility license in the United States should be for a repository—whether or not it's Yucca Mountain is left for others to decide. Initially, we were thinking that the repository license should happen before the licensing of another nuclear power plant, but ultimately we couldn't defend that. There are more than 100 reactors operating each day without a repository, so why couldn't 110 be operated?

UCS feels that interim storage pools and dry casks for spent fuel could be used safely and securely for at least another 50 years. Of course, we would like the industry to follow up on the National Academy of Sciences' study to accelerate the transfer of spent fuel from pools into dry casks that are stored on site. The spent fuel that remains in the pool can then be spread out to give the operators as much time as possible to re-

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*Does UCS support the idea of centralized spent fuel storage sites?*

A couple of years ago there was a bill introduced in the U.S. House to provide centralized interim storage, and Congress asked the American Physical Society to look into it. We said we would support a bill if it resulted in fewer sites with spent fuel than there are today. This means that the bill would have to result in the removal of spent fuel from Yankee Rowe, Zion, Maine Yankee, and other permanently shut down plants. But if it resulted in just the creation of centralized sites, in addition to what we already have today, and none are taken off

the table, then that doesn't make sense, because we would end up creating more problems than we already have.

*Of all the new reactor designs, UCS endorses only one, the Evolutionary Pressurized water Reactor. Why?*

We haven't endorsed it. It's just that when we reviewed new reactor designs, the EPR came out on top. We have gotten calls from some utilities that were considering building non-EPR reactors, saying, "You need to go back and check your math because the design we want to use is just as good." We've entertained those thoughts, but nobody has yet persuaded us that our analysis is wrong. The thing we like about the EPR is that because of its design, a lot more things have to go wrong for a large-scale accident to happen. The EPR design has four safety trains, any one of which is enough to do the job. It would be very difficult for an event to take out all four. In addition, even if the safety systems weren't able to prevent the reactor from overheating, the design has a core meltdown mitigation-type system, which none of the other designs has. The EPR is the one that seems to be the most advanced in terms of protecting the public should the unforeseeable occur.

*Why is UCS against spent fuel reprocessing? Reprocessing would lead to an almost endless supply of nuclear fuel, and the plutonium from the process ultimately could be burned in fast reactors.*

There are two parts that cause concern. First is that the reprocessing of our existing

spent fuel to extract the plutonium has been a pathway for the United States and others to develop atomic warheads, so there is the proliferation problem. The second part is that in order to make reprocessing work, the best way

is to use the plutonium fuel in fast reactors and not in contemporary reactors. The experience is that everybody who has tried fast reactors—the United States and the international community—has not been successful at it. The margin of error is so small that most people haven't been able to make them work. Their reliability is low and their costs are high because they require a lot of care and attention. It just seems that undertaking an increased proliferation risk along with an accompanying reliability hit is not the way to go.

*But how would the hundreds of new power reactors needed for the world's expanding population be fueled without reprocessing?*

Researchers should be looking at developing a reactor that can be commercially viable using low- or non-enriched fuel. One of our board members is Richard Garwin, who has long pointed out that there is enough uranium in seawater—and if it were feasible to extract it—that there would be no need to reprocess and no need to mine low-grade ores. What he has repeatedly urged Congress and the DOE to do is to study that question and get the answer. If it's not viable, then fine, it would give the pro-recycling side more ammunition for building reprocessing centers and enrichment facilities. But if it were commercially viable, then there would be no need to go down the recycling pathway. We haven't done the research, however, so we don't know.

*Reprocessing would be part of the DOE's Global Nuclear Energy Partnership. Apart from that aspect of it, what does UCS feel about other parts of GNEP, such as the concept of reactor states and fuel states?*

GNEP is not a concept, it's a public relations campaign where the Department of Energy says one thing and does another. GNEP, on paper, calls for reactor states and fuel states. Yet the DOE's representatives circle the globe like Monte Hall from "Let's Make a Deal" and accept whatever arrangements—reactors in "fuel" states and fuel cycle facilities in "reactor" states—that it takes to drum up support for the game.

*Ultimately, as a nuclear engineer, do you believe in the promise and potential of nuclear power?*

Yes, I do. But I think the concern is that it hasn't lived up to that promise, which is that for a relatively small amount of material, a lot of energy can be extracted. In some respects, that's also the peril. If we don't manage all of that energy, then we have a problem and very quickly.

My personal view, and one of the reasons I came to UCS, is that we kept seeing the industry learning the same lessons over and over again. I worked at Brown's Ferry and it was shut down for many years, trying to get out of some management problems. PECO went through that with Peach Bottom being shut down because of an operator sleeping in the control room. Salem has gone through extended shutdowns a couple of times, and so has Turkey Point. Our technology is good, but our management ability is not. We are just not able to avoid the pitfalls that put us into these long regulatory distress periods. It doesn't seem like we're able to mature past it or figure out the answers to it. I think that because of it, people are going to look to other power sources. Unless we change how we manage this technology so it can be done more effectively, we will be taking ourselves out of the game. **NW**