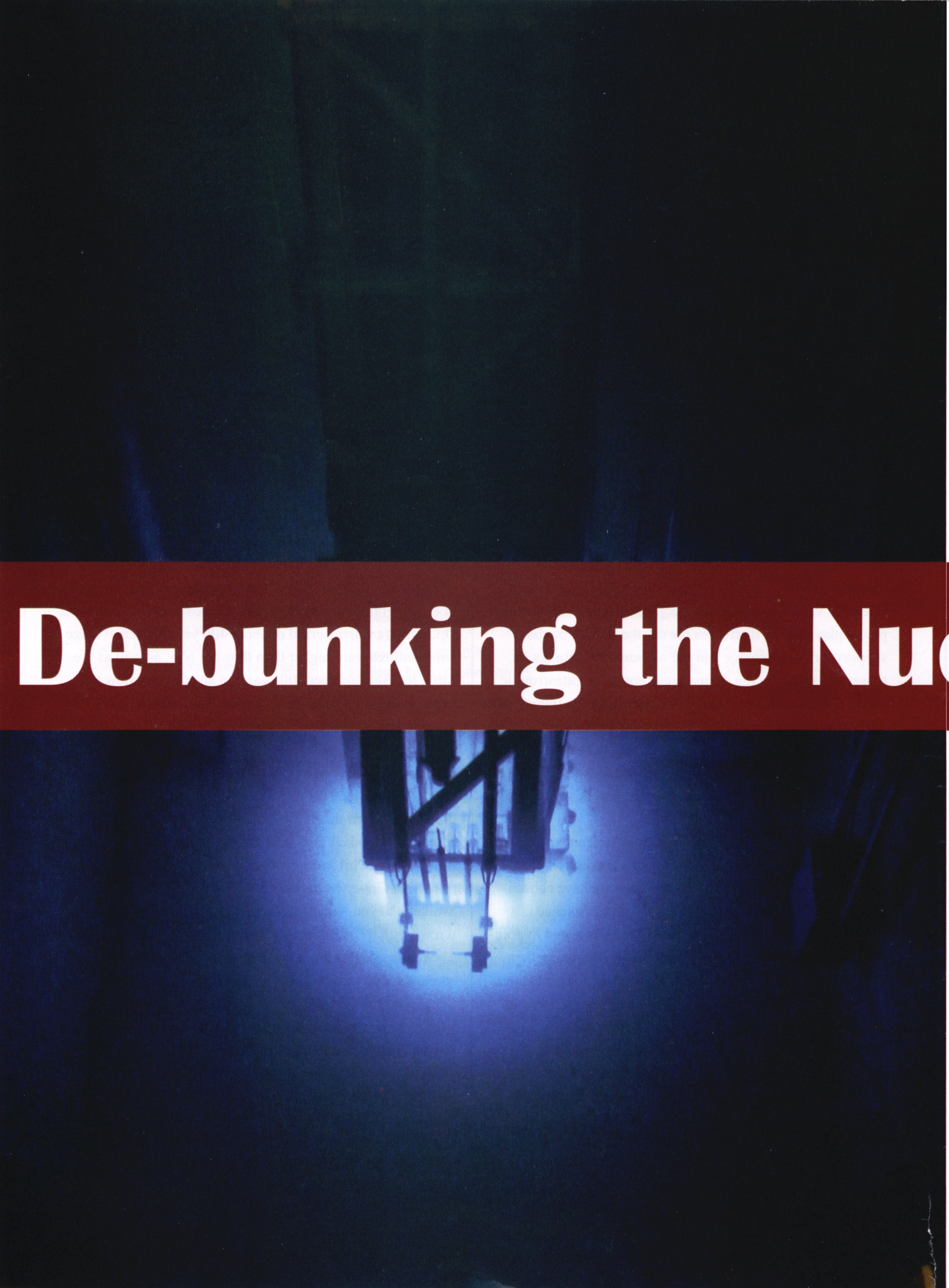
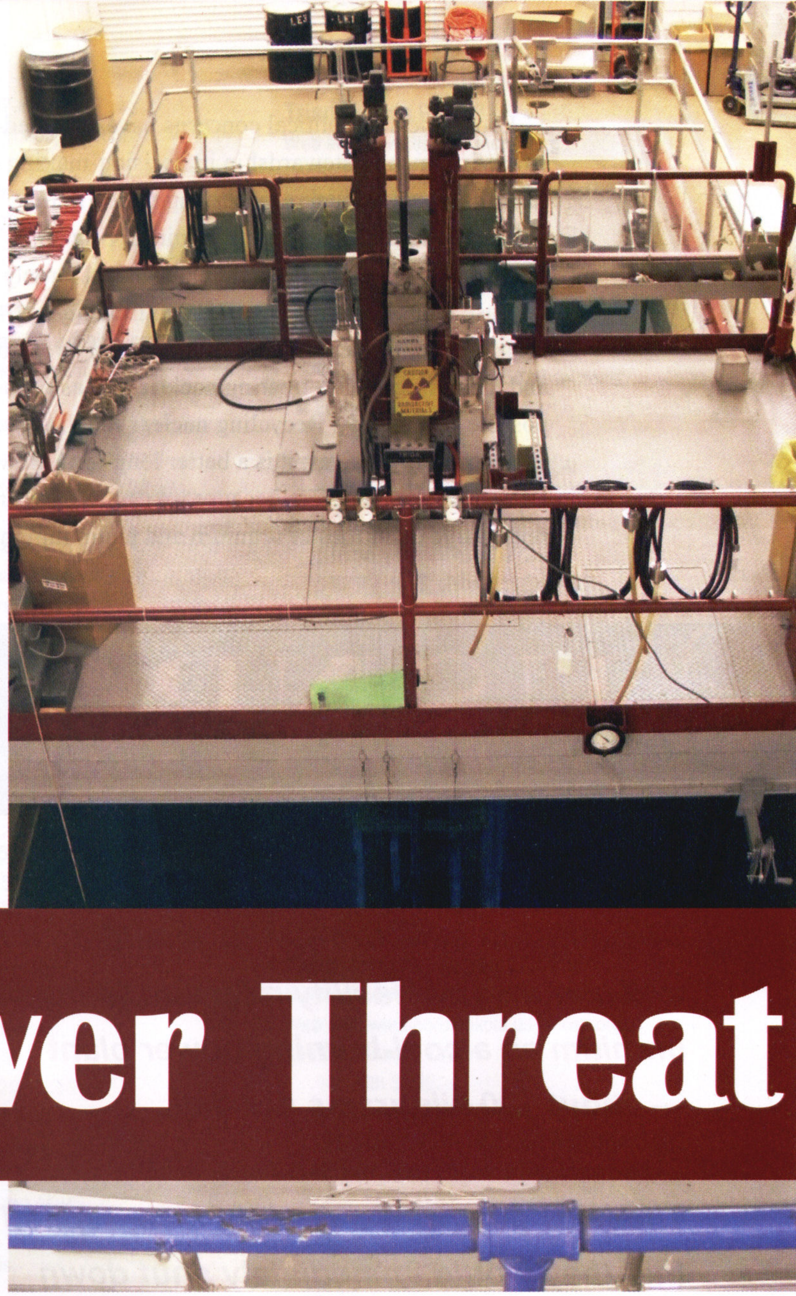


De-bunking the Nuclear Power Threat

By Don Wall, Ph.D.

There are two take-home messages that I endeavor to communicate to the guests who visit the nuclear reactor facility at Washington State University: it's clean, and it's safe. Most visitors leave persuaded that a clean energy solution is already available to our nation, and that decisions should be based on facts, evidence and data, not misinformation and fearful imaginings. A really good picture might be worth thousands of words, but there is no picture or big enough pile of words that is more convincing than actually watching a nuclear reactor quietly generate tremendous amounts of energy.



It's clean.

Most people know that nuclear plants do not emit CO_2 into the atmosphere during operation, because the fission process does not produce CO_2. But what about the radioactive waste? The waste issue is much more of a political problem than a scientific or engineering problem. Broadly speaking, used nuclear reactor fuel contains two types of radioactive materials, the heavy elements such as uranium and plutonium, and fission products — dozens of different-sized pieces of the fissioned uranium atom. Most fission products are short-lived and transform into stable elements on the hours-to-days-to-weeks time scale. A few fission products are more persistent, mainly strontium-90, cesium-137, technetium-99 and iodine-129. In a nuclear fuel recycling system, the strontium-90 and cesium-137 can be separated and packaged, gradually losing toxicity over the course of a few hundred years, as opposed to tens of thousands (or more) years for the unfissioned plutonium and other heavy elements. The technetium and iodine fractions, which last much longer, can be separately packaged and subjected to nuclear transmutation, i.e. irradiate them in a nuclear reactor to transform them into stable, non-toxic materials.

I know it seems counterintuitive, but it is true. Fission products could be disposed in the Waste Isolation Pilot Plant in New Mexico, which would require a revision of the law that regulates the type of waste than can go into the WIPP, but it is a technologically sound solution. The long-lived heavy elements can be extracted from the used fuel and blended back into fresh fuel, supplying energy through fission, and would be simultaneously rendered into short-lived fission products. Estimates of the exact percentage vary, but recycling used nuclear fuel can reduce the volume of waste by about 95 to 99 percent, and the timeline for the toxicity of the waste products can be significantly shortened. Our friends and neighbors in Nevada should find that fact particularly compelling.

Economic and political concerns have superseded environmental stewardship in decision-making regarding nuclear fuel reprocessing policy in this country. Unlike France and the United Kingdom, the U.S. does not recycle spent nuclear fuel largely because it has been less expensive to mine the uranium ore, fabricate it into fuel, use it in a reactor, and then discard it — treating nuclear fuel as a disposable commodity. Recycling nuclear fuel has two significant advantages: it is a better long-term stewardship of our resources because we can recover and reuse large quantities of uranium and plutonium that remain in the fuel after removal from the reactor, and recycling can significantly reduce the amount of waste, both in terms of volume and long-term radiological toxicity.

I once asked a Nuclear Regulatory Commission auditor what he would do if I told him that our facility releases as much uranium as a coal-burning power plant — about 100 kilograms per day.

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I once asked a Nuclear Regulatory Commission auditor what he would do if I told him that our facility releases as much uranium as a coal-burning power plant — about 100 kilograms per day. Coal can contain significant amounts of uranium, a few parts per million — about the same as granite. A typical coal plant that burns ten thousand tons of coal per day liberates about one hundred kilograms of uranium per day, either up the smokestack and into the atmosphere, or in the ash that gets dumped into a landfill. Ironically, the energy content of the uranium in the coal is greater than the energy yielded by burning the coal. The NRC guy, with a straight face, replied that they would immediately shut down any nuclear facility that released that much uranium into the environment.

What about safety?

Here are some statistics, without the lies and damned lies. How many people in the U.S. have died due to radiation exposure in or around nuclear power plants in the last 50 years? None. How many people were hurt at Three Mile Island — the worst type of accident that could happen at a U.S. nuclear plant? Zero. TMI showed that the containment systems worked, even at that early stage of development of nuclear power. Nuclear plants in the U.S. have been improved tremendously in the 29 years since the TMI accident.

What about Chernobyl? I would not want to live near a Russian RBMK reactor, and neither should you. The RBMK design used at Chernobyl was known to be unstable, we knew it, and the Russians knew it too. But the safety culture in the USSR was nothing like the safety culture here — there are no reactors in the U.S. that have the instability that was a known characteristic of the RBMK reactors.

All U.S. reactors share an important safety characteristic, i.e. they are engineered to become less reactive as they heat up, creating a negative feedback mechanism that limits reactor power and makes their behavior stable. The RBMK reactor did the opposite — it became more reactive as it got hotter, leading to more fission and more heat generation — each providing a positive feedback that caused instability and an extremely rapid power increase, with disastrous results. *There are no reactors in the U.S. that have the RBMK-type of instability — U.S. regulation forbids licensing a reactor with that characteristic.*

Here at WSU we are developing better methods to improve the efficacy of nuclear fuel recycling, making it more efficient and more proliferation resistant, while reducing the waste volumes and drastically shortening the time during which the wastes remain hazardous. The research is fascinating and useful, and solutions to the research problems are reasonably straightforward. After all, nuclear chemistry is not rocket science.