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Research Reactors a Safety Challenge

By WILLIAM J. BROAD

In Cambridge, Mass., at the Massachusetts Institute of Technology, a nuclear reactor emits an eerie blue glow 24 hours a day, 7 days a week. Its fuel is 93 percent uranium 235 — the high-purity uranium it takes to energize an atom bomb and exactly what the West fears that Tehran wants to produce.

The facility at M.I.T. is just one of some 130 civilian research reactors around the globe that use highly enriched uranium. Nuclear experts say that running them takes tons of bomb-grade fuel, enough to build many hundreds of nuclear warheads. And most are lightly guarded.

That is only one of the challenges that President Obama and dozens of world leaders have been struggling with during a nuclear security summit meeting held in Washington on Monday and Tuesday. The agenda aims at bolstering safeguards on the world's nuclear arms, as well as a range of sensitive materials and sites, like the M.I.T. reactor.

"We must ensure that terrorists never acquire a nuclear weapon," Mr. Obama told cheering crowds in Prague a year ago. "So today I am announcing a new international effort to secure all vulnerable nuclear material around the world within four years. We will set new standards, expand our cooperation with Russia, pursue new partnerships to lock down these sensitive materials."

The research reactors are seen by Mr. Obama and his aides as particularly vulnerable to terrorist attack, and therefore particularly difficult to secure in four years.

Typically, the civilian sites employ few of the standard military protections, like barbed wire, checkpoints, camouflage, heavily armed guards and antiaircraft guns. Instead, they tend to encourage easy use by university, industry and other researchers. The M.I.T. Nuclear Reactor Laboratory, for instance, welcomes college and high school students and gives public tours. It is currently working with General Electric and Hitachi to see if the small reactor can produce medical isotopes for Boston-area hospitals.

“We’re quite optimistic we can supply a niche market,” David Moncton, director of the M.I.T. reactor, said in an interview. Research reactors that run on highly enriched uranium are in part a legacy of the cold-war ambitions of Washington and Moscow to promote atoms for peace. They were offered by the two superpowers as prizes to woo client states. Today, nations are trying to control and diminish the threat of terrorist theft by enhancing site security, shutting down obsolete reactors and replacing the bomb-grade fuel with low-enriched varieties.

Earlier this year, for example, experts from the National Nuclear Security Administration in Washington conducted a sensitive operation in Chile to remove highly enriched fuel from two research reactors. But an 8.8 magnitude earthquake struck amid the delicate endeavor, throwing Chile into chaos and forcing the nuclear teams to improvise on how to remove the crated fuel.

The summit meeting intends to accelerate such efforts by creating a surge of financial and technical support that will push Mr. Obama’s four-year plan over the finish line.

But nuclear specialists warn that the president’s goal is not only daunting (some call it “mission impossible”) but has now achieved such a high profile that world leaders might end up simply throwing money at the problems instead of pursuing long-range solutions like ending civil commerce in highly enriched uranium. At worst, they say, the meeting could reinforce the dangerous status quo.

“I’m concerned that the summit might be moving in the wrong direction,” said Alexander Glaser, a nuclear specialist at the Woodrow Wilson School of Public and International Affairs at Princeton. “If you have events and deadlines, it’s easier to spend millions on a security system rather than qualifying a new reactor fuel.”

Relatively easy security enhancements at reactor sites include adding fuel vaults, motion detectors, security cameras, steel doors, magnetic locks and central alarms. The process of switching to a reactor fuel that has little or no bomb use is difficult, costly and time consuming. But in the end it offers a more fundamental fix, virtually eliminating the risk of diverting reactor fuel to make bombs.

The M.I.T. reactor illustrates the potential difficulty of switching to a new reactor fuel. For decades, federal officials have talked about replacing its bomb-grade fuel with a safer variety. But, until recently, the costly process never got much attention or financing.

Dr. Moncton of M.I.T. said the planned switch to low-enriched fuel had recently slipped to 2015 from 2014. But that was no real danger, he added, because the terrorist risk was essentially zero.

“They couldn’t make a bomb” from the reactor’s limited fuel supply, he said in the interview. “But we believe in the global issue and want to do our part to get it out of the civilian sector.”

A common rationale for low security at research reactors is that the amount of fuel is often too small to make a bomb. However, nuclear experts worry that two or three thefts would yield enough and that some sites have more than enough material to make a weapon.

As a class, research reactors serve mainly as factories for the production of the subatomic particles known as neutrons, which are used for scientific experiments and various types of nuclear production. By contrast, power reactors tend to be much larger and their high heats are typically used to spin turbines and make electricity.

The cores of research reactors emit an eerie blue glow known as Cherenkov radiation, after the Russian scientist who first explained its origins. It occurs when charged particles zip through cooling water, emitting bursts of harmless light.

Matthew Bunn, a nuclear expert at the Belfer Center for Science and International Affairs at Harvard, said in the most recent edition of his annual report, “Securing the Bomb,” published Monday, that security arrangements for research reactors tend to be “remarkably modest.” Among the typical problems: no armed guards, no background checks, no security requirements and no fences with intrusion alarms.

Last year, Congressional investigators reported another problem: foreign resistance to security upgrades. One unnamed country, they noted, has refused multiple federal offers for nine years.

Some nuclear specialists have accused the federal government of dragging its feet on fuel conversions at domestic reactors. In early 2008, the Natural Resources Defense Council, an environmental group that tracks nuclear issues, petitioned the Nuclear Regulatory Commission to set a date by which it would no longer license the civilian use of highly enriched uranium. “The high national security risks,” the group argued, “clearly outweigh the benefits.”

Among other things, the group argued that such a move would set a good example for other countries. Early this year, the commission denied the petition.

“We urge President Obama to seek a global ban on the commercial use of highly enriched uranium,” said Thomas B. Cochran, a nuclear expert at the council. “Until then, securing and reducing the global stocks of this material should be a top priority for world leaders — and for this summit.”

Most of the world’s research reactors that are fueled with bomb-grade uranium are located in Russia and, according to nuclear experts, Moscow has resisted pressure from Washington to

convert them to low-enriched fuel.

Indeed, outside St. Petersburg, a new research reactor is being built that is meant to run on highly enriched uranium, to the dismay of American officials.

“Nobody ever talks about it,” said Dr. Glaser of Princeton. “It’s quite a significant reactor, a lot of uranium.” He called it “a significant blow to the conversion efforts.”

Dr. Glaser added that whether Mr. Obama and his aides can persuade Russia to change its position on the use of highly enriched uranium is “probably one of the key questions for the summit.”