

US Coast Guard personnel to power plants.

University reactors, despite being about 600 times smaller than commercial reactors, also operate under NRC guidelines. They, too, have tightened security, stationing armed guards at reactor sites.

At the same time, the heightened security is increasing the number of false alarms. For example, in October a threat against the Three Mile Island nuclear power plant in Pennsylvania led to the closure of two nearby airports for four hours. As resources become stretched, government authorities worry they won't be able to meet the demand for increased security. Some state officials, such as Governor George Ryan of Illinois, are trying to get emergency spending bills passed to help pay for protecting their state's nuclear power plants. Meserve agrees that money could soon be a problem, "In the longer term, it's a serious question for power plant operators and other critical infrastructure assets over who will pay."

Another worry for commercial reactor operators is whether a hostile and fearful public climate will dash plans to extend the lifetime of existing nuclear power plants. "We feel that nuclear still has a future, and we believe that we have proved ourselves to the NRC... that we can meet their security and operating standards," says Tom Shiel from Duke Energy.

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IAEA Calls for Tighter Security Worldwide

Mohamed ElBaradei, director general of the International Atomic Energy Agency, is calling on the world to tighten security at civilian nuclear plants to avoid their being targeted by terrorists. The September attacks on the US were a "wake-up call," he told the United Nations General Assembly in New York. Some nuclear regulatory bodies are already tightening security—for example, by putting fighter aircraft on patrol near reactors. France has installed missiles at its Cap de la Hague nuclear reprocessing plant. And Germany's Environment Minister Jürgen Trittin may close his country's nuclear reactors if the risks from attack are deemed too high by a security review panel.

But theft of nuclear material, not terrorist attacks on reactors, still poses the greatest danger, the IAEA warns (see PHYSICS TODAY, July 2001, page 29). Twice earlier this year, terrorists were caught spying on a Russian nuclear storage site, Russia's military nuclear security head Igor Volynkin said on television, according to the IAEA Web site. And in April, 600 grams of highly enriched uranium with a black-market value of \$1.5 million was recovered in Colombia. Instead of creating an atomic bomb, a terrorist group might simply attach radioactive material to a conventional weapon to make a "dirty bomb." The effects of the resulting radioactive contamination could be devastating. Even relatively small amounts of radioactive material can cause serious problems. In 1987, Brazilian scavengers stole a 20-gram capsule of cesium-137 and sold it to a scrap yard in the city of Goiânia. Nearly 250 people became sick and another 110 000 will have to be monitored for the rest of their lives. "The deadliness of handling intensely radioactive material can no longer be seen as an effective deterrent," says Abel Gonzalez, the IAEA's director of radiation and waste safety. IAEA officials have initiated a thorough review of the organization's activities and are considering creating a fund to help countries protect against nuclear terrorism. "There have been two nuclear shocks to the world already—the Chernobyl accident and the IAEA's discovery of Iraq's clandestine nuclear weapons program," says ElBaradei. "It will be vital that we do all in our power to prevent a third."

In some cases, employees of nuclear facilities are suspect. In Pakistan this October, physicists Bashiruddin Mahmood and Chaudry Abdul Majeed, past members of the Pakistan Atomic Energy Commission, were taken into "protective custody" by the government amid fears about their close links with the Taliban. Says ElBaradei, "These are unconventional threats that require unconventional responses."

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CERN Grapples with LHC Cost Hike

Nobody doubts that the Large Hadron Collider (LHC) being built at CERN is technically robust or that it will produce spectacular science once it starts smashing protons together. But the project is in trouble financially: Managers at CERN, which straddles the border of France and Switzerland, revealed in September that costs have crept 850 million Swiss francs (roughly \$514 million) above the allotted 2.6 billion Swiss francs. Now they are scrambling to come up with a plan to pay the extra price.

CERN faults the original budget for not having any contingency. "When the LHC was approved in 1996," says Roger Cashmore, the lab's director of research for collider programs, "[the governing] council gave us, as an extra present, a 900 million Swiss franc budget cut, so it was a very tough deal that we struck—to build a new high-tech accelerator with a cut to personnel and money." (See PHYSICS TODAY, February 1997, page 58.)

▶ Cutbacks, loans, project slowdown, and new money could all contribute to paying the extra costs of the Large Hadron Collider and to restoring CERN's reputation.

The size and suddenness of the price hike came as a shock, say CERN scientists and council members, who represent the lab's 20 member states. CERN management "didn't take the tight budget seriously enough. This is

proved because they started new programs. They don't have the mentality of doing things at cost," says council vice president Hermann Schunck, from Germany's research ministry. "How did they get into this without warning us earlier?" asks British delegate Ian Halliday, head of the UK's Particle Physics and Astronomy Research Council.

Indeed, many high-energy physicists and policy-makers worry that the LHC overruns reflect badly on the

field and could have ripple effects on other current and future high-energy projects. "What CERN has blown over the past few months is

CERN STAFF ASSOCIATION



WHEN THE BUDGET for the Large Hadron Collider was being set a few years ago, CERN staff members warned that it was draconian.