people think the [1974] test was on the order of 6 to 8 kilotons." Expressing a widely held view, Wallace says that if shock waves from the recent Indian test were "well coupled" to surrounding rock, "you're going to be pushing 20 kilotons at most for the 11 May test."

Park agrees. He says that if the early readings available for the 11 May seismic signal—from 4.7 Richter magnitude on the IMS network to 5.1 for IRIS's Nilore station and 5.4 on the Geological Survey system—are scaled to the qualities of rock under India's test site, they "lead to an estimate of 20 to 25 kilotons, and really more like 20" for the 11 May explosion. Allowing for geological anomalies, many seismic experts consider the upper bound to be 30 kilotons or so. Others note that it's standard to assume a factor of 2 uncertainty in such calculations, leading to an upper bound of 40 kilotons.

Although Pakistan has published no official estimates, U.S. analysts conclude from seismic data that its first bomb test on 28 May was a bit smaller than India's first. And the final Pakistani blast on 30 May appears to have been a great deal smaller, according to Los Alamos's Hartse. He says it appears to have been in the range of 1 to 5 kilotons. Nilore, unfortunately, reported no data for these explosions because that station, based at Pakistan's nuclear research center, was presumably disconnected from the network 2 hours before Pakistan began testing. (It's now back on line.) India's nuclear experts, according to Sikka, calculated from their local seismic data that the first and second Pakistani explosions had yields of 5 to 10 kilotons and 2 to 4 kilotons, respectively.

India's second round of tests, on 13 May, presents more of a puzzle. According to Sikka, India simultaneously detonated two "low-yield" devices of 0.3 and 0.5 kiloton in vertical shafts. He says that "only regional seismic recorders and closeup arrays have picked up this 13 May signal." He promised that the local seismic data "will soon be released."

International experts will be eager to see those data, because their instruments picked up no signals at all. Wallace, for example, says he searched through 6 hours of records on either side of the announced zero hour, and the blast "simply isn't there." Many experts believe that some signal ought to have appeared at Nilore, which was running and reporting small earth tremors at the time. Indeed, Hartse estimates that an explosion in the range of "tens of tons" would have been detected. Others, like Wallace and Park, allow a bigger margin of error, saying the maximum blast that might have escaped detection would have been about 100 tons.

Terry Hawkins, acting director of Los Alamos's nonproliferation and international security division, says he has examined photos of the 13 May test hole released by India. The small mound of sand over ground zero indicates a "very, very low yield," he says, suggestive of a hydrodynamic test powered by chemical explosives. Such tests can provide critical information on how bomb components may perform in a nuclear explosion, but they are not considered to be nuclear tests. Sikka responds that "without the knowledge of the depth of the blast, it is highly unscientific to come to such a conclusion."

Indian officials offer some theories for why seismic sensors might have missed the 13 May tests and made the earlier round of explosions look small. Sikka suggests that because several explosions took place simultaneously in both tests, the seismic waves may have interfered with one another, diminishing their apparent magnitude. He also suggests that unspecified geological irregularities could have interfered with signal transmission. And the second round of tests, Indian officials have said, took place in a "sand dune," which muffled the shock. Another Indian expert suggests that other techniques could have been used to diminish the signal. But Hartse says an 800-ton blast would certainly have been visible even in sand, and others say they can see no reason why India would have wanted to muffle the explosion.

The only way to resolve the debate about blast yields may be through independent studies of the bomb test sites. These might provide a clear indication of just how well the seismic watchdog performed. But at the moment, neither India nor Pakistan is ready to invite such inspections.

–Eliot Marshall

With reporting by Pallava Bagla in New Delhi.

CABINET APPOINTMENT

Los Alamos Ally Gets Top DOE Post

Ending months of speculation, President Bill Clinton last week said he would nominate U.S. United Nations Ambassador Bill Richardson to succeed Federico Peña as head of the Department of Energy (DOE). The move would put a former seven-term congressman whose district included DOE's oldest weapons lab at the helm of the $16.6 billion department. Richard Holbrooke, a former State Department official, was named to replace Richardson.

Richardson, 51, is expected to win easy—although not necessarily swift—confirmation by the Senate. "He's well respected on both sides of the aisle," says one Republican staffer.

DIANA WALKER / GAMMA LIAISON

Friendly boss. Richardson's New Mexico district included DOE weapons lab.

While a legislator, Richardson served as a self-appointed troubleshooter, negotiating with foreign leaders from hot spots around the globe—experience that served as a good apprenticeship for the U.N. job, which he took 18 months ago. "He's bright, he's very active, and I think he'll be very successful," says one senior DOE official familiar with the ambassador.

He is also popular at DOE's Los Alamos National Laboratory. "We love him," says lab spokesperson Jim Danneskiold. While in Congress, Richardson represented the New Mexico district that includes Los Alamos, the largest employer in the northern part of the state. "I'm truly delighted," adds Los Alamos director John Browne, who notes that Richardson has "superb insight" into the lab's science, energy, and nuclear weapons programs. Although he did not serve on defense or DOE oversight panels, Richardson worked closely with lab officials on economic development issues.

Richardson wasted no time in backing DOE's most prominent effort, the $4-billion-plus stockpile stewardship program. "The department's ability to maintain a safe and reliable stockpile" is the key to securing a Comprehensive Test Ban Treaty, he said at a White House ceremony on 18 June, adding that Los Alamos must play a leading role in cleaning up the nuclear waste from the Cold War. Clinton praised Richardson's "extensive, firsthand experience" on energy issues, adding that national security and economic growth "will require the greatest energy from our labs, from our scientists and technology, and from an Energy Department that can work clearly with the private sector."

If confirmed, Richardson would be the second Hispanic in a row to hold the post. Peña leaves office at the end of the month, and DOE Deputy Secretary Betsy Moler is expected to run the department until Richardson is confirmed, a process that could take months. Moler was in line for the top job before Peña, transportation secretary during Clinton's first term, was nominated in January 1997. She was also regarded as a leading contender after Peña announced in April that he would be stepping down.

–Andrew Lawler