N. Korean nuclear test could be tricky to detect

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North Korea has vowed to carry out a third nuclear test, but scientists and concerned foreign governments may have a tough time verifying the actions of the reclusive state.

One critical question is whether North Korea uses uranium or plutonium. North Korea's 2006 and 2009 tests involved plutonium, so a uranium detonation would prove that Kim Jong-Un's regime has opened an additional way to make bombs.

After foreign detection of its 2006 test, North Korea carried out its 2009 explosion deep underground, which gave scientists far less information. Most observers expect North Korea to be even more careful this time.

Some 270 stations and laboratories around the world monitor seismic and other activity under the Comprehensive Test Ban Treaty Organization, making up about 80 percent of the total envisioned under the 1996 UN treaty.

EARTHQUAKE DETECTION: Seismic monitoring is the most effective and quickest way to detect a nuclear test. Seismic waves travel about eight kilometers (five miles) per second.

Seismic detention put the May 25, 2009, test at around 4.5 magnitude with an explosive yield of a few kilotons, well below that of the nuclear bombs which the United States dropped on Japan in 1945. North Korea's 2006 test was detected at magnitude 4.1.

URANIUM OR PLUTONIUM?: Both uranium and plutonium can be used in nuclear weapons. The United States devastated Hiroshima with a uranium bomb and Nagasaki with a plutonium bomb.

North Korea's nuclear program was historically based on plutonium, but the regime disclosed in November 2010 to visiting US scientists that it was operating a uranium enrichment plant.

Experts have speculated that North Korea may have decided on a third test in hopes of trying out its uranium program or that it may simultaneously use both methods. But if North Korea prevents leakage, it may be impossible to know for sure.

A successful test with highly enriched uranium would alarm North Korea's adversaries as it is much easier to conceal work with uranium than with plutonium, which requires a reactor to produce the chemical element.

RADIONUCLIDE SIGNALS: This extremely sensitive technique, which could be crucial in determining the nature of a North Korean test, allows scientists to examine material that has seeped out of the ground or been released in the air.

Scientists use instruments that "sniff" fission products of the explosive material and then use modeling to determine the origin of the radionuclides and predict where the nuclear plume may be headed.

Two weeks after the 2006 test, the isotope Xenon-133 was detected across the Pacific Ocean in the northern Canadian city of Yellowknife. But the North Koreans were successful in 2009 in sealing off the test site.

INFRASOUND DETECTORS and HYDROACOUSTIC

TECHNOLOGY: Undetectable to the human ear, infrasound waves have frequencies between 0.01 and 10 Hz. They are typically produced by explosions in the atmosphere but can also come from underground explosions.

A very small infrasound signal was detected following the 2009 North Korea test, but none in 2006.

Hydroacoustic technology can be used to detect nuclear explosions in or near bodies of water by tracking sound waves.

Global monitors can detect an in-water explosion as small as one ton (0.001 kiloton) across most of the world's oceans.

US PLANES, SATELLITES

The US Air Force was first tasked in 1947 with monitoring atomic explosions worldwide. Nearly 1,000 personnel work at the Air Force Technical Applications Center, based in Florida near the Kennedy Space Center.

AFTAC operates a WC-135 aircraft for detecting radioactive debris that could come from nuclear explosions. The plane flies to the location of the debris plume and collects particulates for laboratory analysis.

The United States also uses satellites to detect potential nuclear explosions in space or in the atmosphere—a capacity that is not part of the Comprehensive Test Ban Treaty Organization.

Satellites can collect data on electromagnetic pulses, optical flashes and nuclear radiation.