Medical isotope producers and the CTBTO join forces to reduce radioxenon emissions

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The nuclear test monitoring agency, CTBTO, joins forces with a Belgium producer of radioelements for nuclear medicine to reduce radioactive noble gas emissions. By reducing the amount of radioactive xenon released in the production of isotopes for nuclear medicine, it will help the world's nuclear test-ban monitors to focus on detecting atomic explosions.

Experts at the Preparatory Commission for the Comprehensive Nuclear-Test-Ban Treaty Organization (CTBTO) are detecting frequently radioactive xenon as they monitor the globe for signals of nuclear explosions.

Emissions are being registered at many locations. And the points of origin are potentially increasing. For the CTBTO, it is not a good trend: "If you have more emissions than you anticipate, then you have a problem," says Lassina Zerbo, incoming Executive Secretary of the CTBTO and Director of the International Data Centre (IDC).

Certain isotopes of the noble gas xenon – called radioxenon in its radioactive forms – are like the DNA of a nuclear explosion: They provide forensic evidence for analysts. For North Korea's announced nuclear tests over the past seven years, CTBTO teams worked together to track airborne xenon isotopes through the International Monitoring System (IMS). When completed, the IMS will include stations capable of detecting radioxenon. Today it registers about 18,000 samples of xenon a year.

Xenon Sources Expanding

Monitoring scientists cite an unlikely source for xenon emissions—facilities that produce lifesaving medicines. Radioxenon is a by-product whose releases can be controlled but not curbed entirely during production. The plants make radioactive isotopes used in nuclear medicine worldwide—for more than 30 million diagnostic procedures a year. Production facilities are operated in about 10 countries today, with most producers in Europe, North America and Australia. But production is projected to expand this decade. In Asia, for example, by about 10% a year, says Yudi Imardjamoto, CEO of Indonesia's facility in Serpong.

High Stake Challenges

Why are medical sources of radioxenon raising such concerns? They do not pose any health risk, but the readings from these emissions look similar to those of a nuclear explosion. At last week's CTBT: Science and Technology 2013 conference, a special panel was dedicated to this issue. CTBTO radionuclide expert Mika Nikkinen explained that the impact on IMS stations varies strongly, with up to 400 detections per year at one station and only a single one at others.

For analysts, the picture can get complicated—the ultra-sensitive IMS detects radioxenon from many locations worldwide nearly every day. Stakes are high: Multiple civil sources of radioxenon could mask signals from a nuclear explosion. "The job in the IMS to measure for nuclear explosions will become more difficult," says Ted Bowyer, Manager of the Nuclear Explosion Monitoring & Policy Program at the USA's Pacific Northwest National Laboratory (PNNL), who spoke of "fogs of xenon over North America and Europe".

Twin Goals

To meet the xenon challenge, global efforts target twin goals: Improved xenon monitoring and lower emissions. Increasingly producers are looking at different methods to achieve reductions.

In an important development last week, Belgium-based the Institute for Radioelements (IRE) signed a pledge to cooperate with the CTBTO to mitigate the effects of noble gas emissions. IRE is a major worldwide producer of radioelements used for diagnoses and therapeutics in nuclear medicine.

Lassina Zerbo and Jean-Michel Vanderhofstadt, Managing Director, Institute for Radioelements, signed a pledge to cooperate to mitigate xenon emissions for test-ban verification.

For IRE, it's a noble cause. Their cooperation is voluntary and will help the world's nuclear test-ban monitors to focus on detecting atomic explosions.

Through its voluntary contributions, the European Union (EU) supports the development of the mitigation systems, that will be used by IRE and for other joint CTBTO campaigns—in Japan, Kuwait, Indonesia, and elsewhere—to set-up automated detection systems to record and report background levels of radioxenon at more locations. See press release on the latest EU contribution. At SnT2013, the EU also sponsored the "EU Star Award for best presentation on verification topic", which was awarded to Johan Camps from the Belgian Nuclear Research Centre (SCK CEN) on his work to test radioxenon mitigation methods at the IRE.

At Indonesia's Serpong facility, a monitoring system was installed with CTBTO and USA support to improve xenon measurements of stack emissions. Better detection is only part of the answer. One way forward is to lower emissions during the isotope production process. It's the

biggest impact producers can have for controlling emissions, says Judah Friese, a radiochemist at PNNL.

Sustained Global Collaboration

Leaders from the world's largest producers of medical isotopes, such as IRE, increasingly support CTBTO initiatives. Joint work seeks to establish a voluntary threshold for xenon emissions, and to improve scientific understanding of background levels in the air.

Ultimately, cooperation benefits bigger goals. "Our prime responsibility is verifying the Test- Ban Treaty and it is all about collaboration," says Lassina Zerbo. "The noble gas background measurement is an important factor. It is one of the important measures that give the nuclear nature of a test."

Provided by Preparatory Commission for the Comprehensive Nuclear-Test-Ban Treaty Organization

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