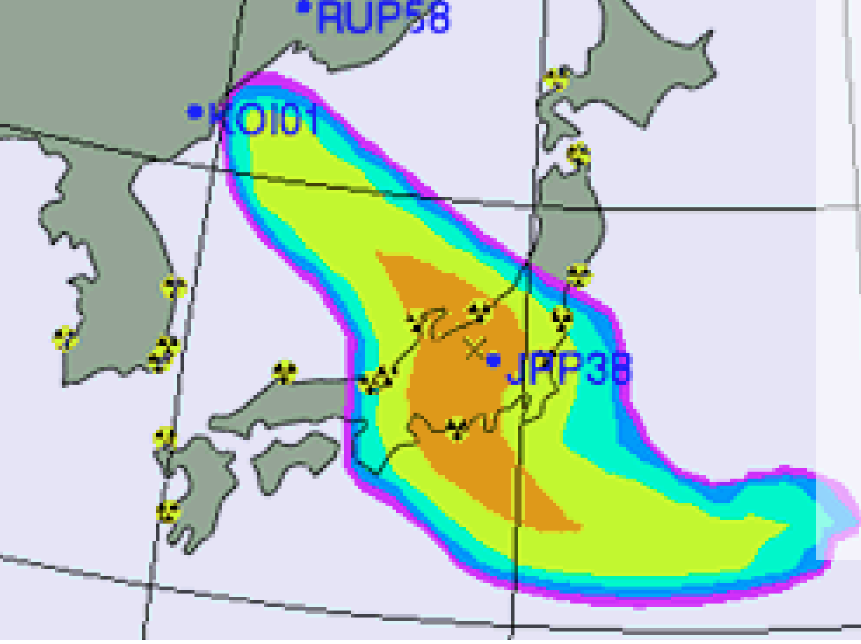
VERIFICATION SCIENCE

Detection of radioactive gases consistent with North Korean test underlines strength of CTBTO monitoring system



Forward Atmospheric Transport Modelling showed that the radionuclides could have come from the North Korean test site.

WHAT WAS DETECTED?

On 8 and 9 April 2013, significant quantities of airborne radioactivity were detected by the CTBTO's radionuclide station in Takasaki, Japan. Additional, smaller detections were made between 12 and 14 April by another station in Ussuriysk, Russia. The detections consisted of the radioactive noble gas xenon. The isotopes in question — xenon-131m and xenon-133 — are typical fission products of plutonium or uranium and therefore used as indicators of a nuclear explosion.

WHY COULD THE RADIOACTIVITY HAVE COME FROM THE DPRK NUCLEAR TEST SITE?

The detection of radioactivity at Takasaki was made 55 days after the announced nuclear test by North Korea on 12 February 2013. The station is located at around 1,000 kilometres, or 620 miles, from the North Korean test site. The noble gases that were detected provided us with information about the nature and timing of a nuclear event. By using atmospheric transport modelling (ATM), the calculation of the three-dimensional travel path of airborne particles or gases, the North Korean nuclear test site was found to be a possible source. "According to the Austrian Meteorological Agency, ZAMG, which performed high resolution ATM calculations, there is a perfect match with our models and the timing of the [12 February] event," CTBTO radionuclide expert Mika Nikkinen said.

In addition, CTBTO Member States in the region were consulted and helped to exclude other sources, such as a leak from a nuclear installation.

WHY WAS THE DETECTION MADE SO LONG AFTER THE ANNOUNCED NUCLEAR TEST?

The observations indicate that the radioactive gases had initially been contained in the test tunnel, and were released instantaneously around 7 April 2013 – for reasons unknown. A more usual scenario for underground nuclear explosions is that radioactive gases may gradually seep through cracks to the surface, a process known as venting, possibly leading to an earlier detection.

This was the case after the 2006 North Korean announced nuclear test, when traces of xenon-133 were detected two weeks later at a station in Yellowknife, Canada. Lassina Zerbo, Director of the International Data Centre explained: "The detections in 2006 and 2013, from which the Atmospheric Transport Modelling gave us an indication that they came from the Korean peninsula, say that we had one isotope in 2006 and two isotopes in 2013, with a higher concentration. This is probably because we have a station that is much closer to the peninsula or within the peninsula, that detected at a higher concentration, as opposed to 2006, where we had a detection 7,000 kilometres away from the potential source."

When the network is complete, half of the CTBTO's 80 planned radionuclide stations will be equipped to detect radioactive noble gases, in addition to radioactive particles. Of the 66 radionuclide stations installed so far, 30 have noble gas capabilities, compared to only 11 in 2006.

WHY COULD THE RADIOACTIVITY NOT HAVE COME FROM THE FUKUSHIMA POWER PLANT?

The combination and concentration of the two radionuclides that were detected by the Takasaki station were very different to what one would expect to see from Fukushima more than two years after the accident. ATM calculations also pointed to a source to the west of Takasaki, while Fukushima and other Japanese nuclear facilities in the area are predominantly east of the station.

WHAT DOES THE DETECTION SAY ABOUT THE DPRK'S NUCLEAR WEAPONS PROGRAMME?

"The detection doesn't indicate the type of fissile material used because nuclear fission happened a long time ago. In order to be able to distinguish between uranium and plutonium, it is preferable to have a good sample much earlier. With these detected xenon isotopes the difference in ratio between uranium and plutonium based fission is so small that the differentiation cannot be made after such a long time," Nikkinen said.