Verification science

The network of the International Monitoring System with its associated communications infrastructure and the International Data Centre was designed by a Group of Scientific Experts at the Conference on Disarmament in Geneva to be fully capable of monitoring compliance with the Treaty. New research and improved communications technology continuously strengthens and refines the detection capabilities of the IMS. This column introduces some of the latest developments in the field of verification science.

Testing high volume air samplers under severe environmental conditions

Of the four verification technologies used by the International Monitoring System, it is the radionuclide monitoring technology that provides definite proof that an event was of a nuclear origin. The radionuclide component of the IMS consists of 80 radionuclide particulate stations, 40 co-located noble gas stations and 16 radionuclide laboratories.

The operating principle of a radionuclide particulate station is straightforward. A large amount of air is passed through an air sampler – at least 500 m³/h over a period of 24 hours – and the particulate matter is collected on a filter. The filter is then measured with a high purity germanium detector to produce a gamma-ray spectrum. This allows the analysis of airborne radioactivity.

To ensure global coverage, some of the IMS radionuclide stations are located in very remote areas, where climatic conditions will have a considerable effect on operation. In particular, stations located at high latitudes (the arctic and sub-arctic regions and Antarctica) may face a number of problems which could disrupt operation or damage the sampling system. For example, ice crystals may enter into the air sampling system during snowfall, in particular in conditions of drifting snow. Fog droplets may also enter the system and freeze inside the sampler. The air intake may clog up due to ice riming, high winds, or prevailing medium high winds.

To develop solutions to these problems, the Preparatory Commission is carrying out a number of studies on the behaviour of air samplers under severe, polar conditions. In 2002, a modified air sampler was tested in a climatic wind tunnel in Vienna, Austria, with the aim of identifying environmental conditions leading to ice riming on the air inlet and the subsequent clogging of the system, or to the entry of snow and ice particles into the system (Fig 1).

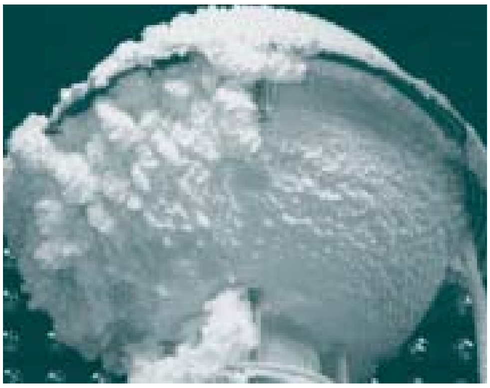

FIGURE 1: ICE RIMING DURING THE WIND TUNNEL TESTS IN VIENNA (AUSTRIA)

However, environmental parameters can be controlled within a wind tunnel, allowing somewhat predictable results, which is not the case under natural conditions. To test performance in these conditions, the same air sampler utilised for the wind tunnel test has been installed at Sonnblick, around 50 km south of Salzburg, Austria, at an altitude of 3000m (Fig. 2). A series of tests are being carried out between March 2003 and May 2004. As was done in the wind tunnel tests, different inlet configurations are being tested as well. The goal of the tests is to develop implementable technical solutions to minimise the consequences of adverse weather conditions. But it will be possible to install air samplers which are likely to meet operational requirements at environmentally difficult polar stations only once the results of the study are available. ■

FIGURE 2: ICE RIMING UNDER NATURAL ENVIRONMENTAL CONDITIONS AT SONNBLICK (AUSTRIA)