AKA 3: Nuclear Testing and Test Ban

Time: Thursday 9:30–13:00   Location: H 0112

AKA 3.1   Thu 9:30   H 0112
Experiences as an Observer of the CTBT On-Site-Inspection Exercise DE07 in Chernobyl — •Theo Köble — Fraunhofer-Institut Naturwissenschaftlich-Technische Trendanalysen, Appelsgarten 2, 53879 Euskirchen

The directed exercise DE07 took place in the Chernobyl exclusion zone in the Ukraine from 4. June 2007 to 14. June 2007. The aim of the exercise was to train several aspects of an On-Site-Inspection (OSI) to provide evidence of a forbidden nuclear weapons test in the context of the preparation of the Comprehensive Test Ban Treaty (CTBT). I had the opportunity to join the exercise as an observer.

25 experts from 22 state parties took part in the exercise. In addition 4 observers from 4 countries participated.

The aim of the directed exercise was to measure radioactivity levels in a simulated inspection area and to identify the nuclides. The following aspects of an OSI were trained: carborne and airborne gamma survey; environmental sampling and analysis in a field laboratory; safety of work, personal protection and decontamination; communication and navigation in the field; data preparation and data handling.

AKA 3.2   Thu 10:00   H 0112
Influence of natural lithospheric radioxenon background on CTBT-compliant subsurface noble gas samples — •Simon Hebel — Carl Friedrich von Weizsäcker-Center for Science and Peace Research, Hamburg, Germany

The verification regime of the Comprehensive Nuclear-Test-Ban Treaty (CTBT) requires, among other measures, the sampling of subsurface radioxenon in the vicinity of a suspected underground test site. Mixed with the contingent xenon yield of a nuclear explosion is the natural xenon content of the surrounding minerals. This background is caused by the decay of natural uranium and thorium occurrences. Spontaneous and induced fission have to be taken into account, the assessment of which requires detailed knowledge of the prevalent neutron spectrum generated by fission, alpha particles and cosmic radiation. The influence of the resulting xenon quantities and ratios on subsurface sample analysis can thus be evaluated.

AKA 3.3   Thu 10:30   H 0112
Modelling of Radionuclide Migration after Underground Nuclear Explosions by Barometric Pumping — •Robert Annewandter and Martin Kalinowski — Carl Friedrich von Weizsäcker-Centre for Science and Peace Research, Hamburg, Germany

During and shortly after a nuclear explosion several noble gas isotopes (^{131m}Xe, ^{133m}Xe, ^{133}Xe and ^{135}Xe) besides many other fission products are produced. If the explosion is emplaced underground for clandestine test purposes these isotopes, all other fission and activation products are injected into the surrounding rocks. Only the noble gases are able to migrate upwards to the surface through suitable pathways in a fractured permeable medium due to cyclical changes in barometric surface pressure. Possible pathways are cracks, faults or high-permability layers.

Times of arrival are much shorter than is expected by diffusion-process alone and may be of orders of magnitude more significant to allow verifying the *Comprehensive Nuclear Test Ban Treaty* (CTBT).

This work will calculate time of arrival and shifts in abundance of the radioxenons due to its different molecular diffusion lengths.

AKA 3.4   Thu 11:00   H 0112
Automated analysis of remote sensing data for comprehensive monitoring tasks in the context of nuclear safeguards — •Christian Danecke, Prashanth Reddy Marpu, and Irmgard Niemeyer — Institute for Mine-Surveying and Geodesy, Freiberg University of Mining and Technology (Technische Universität Bergakademie Freiberg), Germany

The quantity of remote sensing data as well as the quality is increasing with the satellite sensor developments and improvements. The field of treaty monitoring benefits from this, as non-verified activities can be spotted more easily. However, it poses new challenges with regard to image processing and data management.

We have developed a monitoring system for the Iran based on satellite imagery. The systems offers tools for data management and for automated image processing, such as object-based classification. New image data to be included will be preprocessed and the relevant information will be extracted from the image data. Both data and information will be stored in the database of the system. The user can easily query on image data and information via an interface.

AKA 3.5   Thu 11:30   H 0112
Application of the isotopic ratio based method for discrimination between nuclear tests and nuclear reactors on various data sets — •Jana Peters and Martin Kalinowski — Carl-Friedrich von Weizsäcker Center for Science and Peace Research, University of Hamburg, Germany

The monitoring of atmospheric radioxenon is a crucial element in the verification of the Comprehensive Nuclear-Test-Ban Treaty (CTBT). In order to discriminate between legitimate nuclear reactor emissions and nuclear explosions, the isotopic activity ratios can be used. Various data sets are used to demonstrate the discrimination capability of the isotopic radio method. These include daily and annual emission reports from nuclear power plants and atmospheric observations at various sites. Five air samples are of special interest. They were measuered a few days after the North Korean nuclear test in October 2006.

AKA 3.6   Thu 12:00   H 0112
Erkennung und Unterdrückung periodischer Störsignale für die Teststopp-Verifikation — •Felix Gorschlüter, Christoph Weber und Jürgen Altmann — Experimentelle Physik III, TU Dortmund, 44221 Dortmund

Das weltweite Sensornetz der CTBTO zur Überwachung des Atomwaffen-Teststopps erlaubt eine Ortung eines unterirdisch durchgeführten Tests bis auf ca. 20km mal 20km. Diese Genauigkeit reicht nicht dafür aus, mit einer Bohrung die Explosionskaverne zu treffen. Zu diesem Zweck versucht man, mit an der Erdoberfläche aufgestellten Geophonen die seismischen Signale von Rissen oder von Materialbrocken, die von der Decke des Hohlraums auf dessen Grund stürzen, zu detektieren. Da diese Signale extrem klein sind, werden sie oft durch Nebengeräusche überdeckt. Ausgehend von unserer Forschung über seismische und akustische Signale von Fahr- und Flugzeugen untersuchen wir, wie man periodische Störsignale unterdrücken kann. Dazu werden harmonische Linienserien in den Spektren identifiziert. Die Geräuschunterdrückung wird diskutiert.

AKA 3.7   Thu 12:30   H 0112
Global radioxenon emission inventory in support of CTBT monitoring — •Matthias Tuma and Martin Kalinowski — Carl Friedrich von Weizsäcker Centre for Science and Peace Research, Beim Schlump 83, 20144 Hamburg

The monitoring of atmospheric radioxenon is a crucial element in the verification of the Comprehensive Nuclear-Test-Ban Treaty (CTBT). However, each nuclear power reactor inevitably is a legitimate source of these radioactive fission gases. In order to support the interpretation of observed atmospheric concentrations, a global emission inventory of radioxenon as produced by nuclear power plants has been estimated. It derives generic emission strengths from a data set of quarterly and annual emission reports of European and North American nuclear power plants. These are in turn used to estimate emissions of reactors for which no data were available. The inventory provides values for continuous and pulse emissions for all four relevant radioxenon isotopes, utilizable as source terms in atmospheric transport models. Regional totals, isotopic ratios and batch emission characteristics are presented as well.