AGA 5: Verification and Detection

Zeit: Freitag 10:30–13:30 　　　　　　　　　　　　　　　　　　Raum: VMP 9 HS

AGA 5.1　Fr 10:30　VMP 9 HS

Detectability of unreported nuclear reprocessing analysed by atmospheric krypton-85 modelling — •OLE ROSS[1,4], ROBERT ANNEWANDTER[1], JOHANN FEICHTER[2], SEBASTIAN RAST[2], K. HEINKE SCHLÜNZEN[3], and MARTIN B. KALINOWSKI[1] — [1]Carl Friedrich v. Weizsäcker Centre for Science and Peace Research, University of Hamburg — [2]Max Planck Institute for Meteorology, Hamburg — [3]Meteorological Institute, University of Hamburg — [4]International Max Planck Research School on Earth System Modelling

As project within the German support programme to IAEA Safeguards the detectability of additional ^{85}Kr sources using atmospheric transport modelling was investigated. ^{85}Kr is released into the air during reprocessing of spent nuclear fuel rods. Therefore it can possibly be used as indicator for the detection of undeclared plutonium separation. First, the global ^{85}Kr background produced by known reprocessing facilities from 1971 until 2006 was simulated with the atmospheric general circulation model ECHAM5. Based on the background study, the detection sensitivity to a set of arbitrarily specified source locations is analysed with a lagrangian particle dispersion model. This, in combination with the location specific background variability simulated by the global model, is giving first benchmarks on the capability of using ^{85}Kr for IAEA Safeguards on the NPT based on the Additional Protocol and its possible contribution for the verification of a future Fissile Material Cut-off Treaty.

AGA 5.2　Fr 11:00　VMP 9 HS

Kr-85 signatures for various plutonium production schemes — •PAUL STANOSZEK — Carl Friedrich von Weizsäcker-Centre for Science and Peace research

Kr-85 is considered to be the best atmospheric indicator of unreported weapon-grade material production. This fact is based on the half-life of 10.76 years of Kr-85 and its chemical inactivity, which makes it even detectable after extended periods of cooling time. Kr-85 is produced as fission product during nuclear reactor operation and remains in the fuel until reprocessing starts. In order to determine the detectability of plutonium production the Kr-85 source term has to be assessed. The important issue of this presentation is the question on the minimum signal that an inspector can expect under the assumption that a proliferator minimizes his Kr-85 generation in order to circumvent a Kr-85 detection. A further assumption is that for nuclear weapon production a burn-up of typically around 2 MWd/kg is used. In addition, if clandestine plutonium production takes place, the source term might be used to estimate the amount of separated plutonium. The methodology of this study is based on a linkage between MCNPX and MATLAB. All results for actinide concentrations and Kr-85 are evaluated for different enrichments of U-235 and compared to known literature data. The Kr-85 source term per kilogram plutonium depends on the enrichments. As a result the lowest Kr-85 source term is found for depleted uranium.

AGA 5.3　Fr 11:30　VMP 9 HS

Detectibility of Krypton-85 Sources — •ROBERT ANNEWANDTER and OLE ROSS — C.F.v.Weizsäcker-Centre for Science and Peace Research, Hamburg, Germany

The lagrangian particle dispersion model HYSPLIT was used to determine the detectability of globally distributed krypton-85 sources regarding the variability of its background concentration calculated by Ole Ross with ECHAM 5.

Results on minimal detectable releases and their distance to source will be presented.

This work is part of a project showing Krypton-85 tracers applicable for remote monitoring purposes of nuclear facilities based on the Additional Protocol of the Non-Proliferation Treaty.

AGA 5.4　Fr 12:00　VMP 9 HS

Bestimmung des Detektionsvermögens des IMS Infraschallnetzwerks — •LARS CERANNA — Bundesanstalt für Geowissenschaften und Rohstoffe, Hannover

Basierend auf der Auswertung der verfügbaren Detektionslisten aller Infraschallstationen des Internationalen Monitorsystems (IMS) zur Verifikation des Comprehensive Nuclear-Test-Ban Treaty (CTBT) konnten eindeutig die vorherrschenden stratosphärischen Winde als bestimmender Faktor für die Registrierung kohärenter Signale identifiziert werden. An nahezu allen Stationen werden mehr als 85 % aller Detektionen im Frequenzbereich zwischen 0.2 und 2 Hz dem stratosphärischen Wellenleiter zugeordnet. Dabei zeigt sich deutlich die saisonale Variation zwischen vorherrschenden westlichen und östlichen Richtungen.

Diese Beobachtungen des zeitlich veränderlichen Detektionsvermögens des IMS Infraschallnetzwerks lassen sich auch mit synthetischen Vorhersagen vergleichen. Zur Modellierung werden aktuelle Wind- und Temperaturprofile verwendet sowie stationsabhängige Relationen für das lokale Windrauschen. Insgesamt lässt sich das Detektionsvermögen zwischen 0.2 und 2 Hz für atmosphärische Explosionen an Hand der Simulationen mit einer Stärke von etwa 500 t TNT-Äquivalent zu jeder Jahreszeit abschätzen, wobei mindestens zwei Infraschallarrays Signale registrieren. Diese Abschätzung kann wiederum mit Hilfe so genannter ground-truth Ereignisse verifiziert werden.

AGA 5.5　Fr 12:30　VMP 9 HS

Testing of portal monitor methods to discover illicit trafficking of anthropogenic radioactivity in operational field use — •ALEXANDER RAMSEGER ET AL. — Carl Friedrich von Weizsäcker Centre for Science and Peace Research

The goal of this project is the detection of illicit trafficking radioactive substances. These substances have a high risk potential in their intentional or careless use.

The detection systems used up to now are not sensitive enough to discover all relevant nuclides (false negative) and have a high false alarm rate (false positive). By an improved gamma spectrometric analysis as well as an active detection with neutron radiation, the false alarm rate could be minimised and the amount of detected substances increased. The first step is to determine the improvement potential regarding measurement methods and analytical algorithms. The most promising methods and algorithms should be developed and than tested.

At the Hamburg harbour first measurements were conducted to compare gamma spectrometric detectors with an already installed portal monitor system for gamma rate measurements of containers. The average distance of the detectors (portal monitor as well as gamma spectrometric detectors) to the containers depended on the traffic lane of the lorry carrying the container through the portal monitor but was in average about 2 meters.

The results of these measurements, which are presented in this talk, are a first basis for further search of improvements.

AGA 5.6　Fr 13:00　VMP 9 HS

Erkennung und Unterdrückung von Störsignal-Linien in akustischen und seismischen Spektren — FELIX GORSCHLÜTER und •JÜRGEN ALTMANN — Experimentelle Physik III, TU Dortmund, 44221 Dortmund

Zur Nah-Ortung der Kaverne einer unterirdischen Kernwaffenexplosion (im Rahmen der Teststopp-Überwachung) müssen schwache seismische Signale nachgewiesen werden, die von periodischen Quellen überlagert sein können (Motoren, Industrie). Zur Abtrennung suchen wir in den komplexen Fourier-Spektren die daher stammenden Linien. Aus den stärksten drei Werten werden die Parameter Frequenz, Phase und Amplitude mittels nicht-linearer Anpassung ermittelt. Für alle Linien wird nacheinander das dazugehörige Ein-Linien-Spektrum abgezogen. Die Leistungsfähigkeit beim Finden schwacher, nicht-periodischer Ereignisse wird mit synthetischen Spektren in Abhängigkeit vom Rauschen ermittelt. Wir überprüfen die Trennfähigkeit an akustischen und seismischen Messungen von Hubschraubern.