

IAEA Project on Decay Data for Monitoring Applications

Paraskevi (Vivian) Dimitriou
Institute of Nuclear and Particle Physics
N.C.S.R “Demokritos”
Athens, Greece

Comprehensive (Nuclear-)Test-Ban-Treaty Organization Preparatory Commission

- Established in 1996 (Vienna) – HQ at Vienna International Center
- *Interim* organization whose aim is to make the necessary preparations for the effective implementation of the CTBT banning nuclear explosions
- Once the CTBT verification regime is set-up and the Treaty enters into force then CTBTO will be responsible for its implementation
- 184 Signatory member-states

Radionuclide monitoring stations and laboratories:

- Monitoring stations collect radionuclide particulate samples and gas samples (Xe isolated) and measure them with detectors
- Thousands of accumulated spectra are analyzed daily at International Monitoring System at CTBTO HQs

On-site inspections:

- Collect soil samples and send to Radionuclide laboratories for analysis

Global verification regime:

- International Monitoring System: 321 monitoring stations (seismic, infra-acoustic, ultra-sound, radionuclide: 80, noble gases: 40)
- 16 radionuclide laboratories
- International Data Center (collects data from IMS)
- On-site inspections

Nuclear Data Needs:

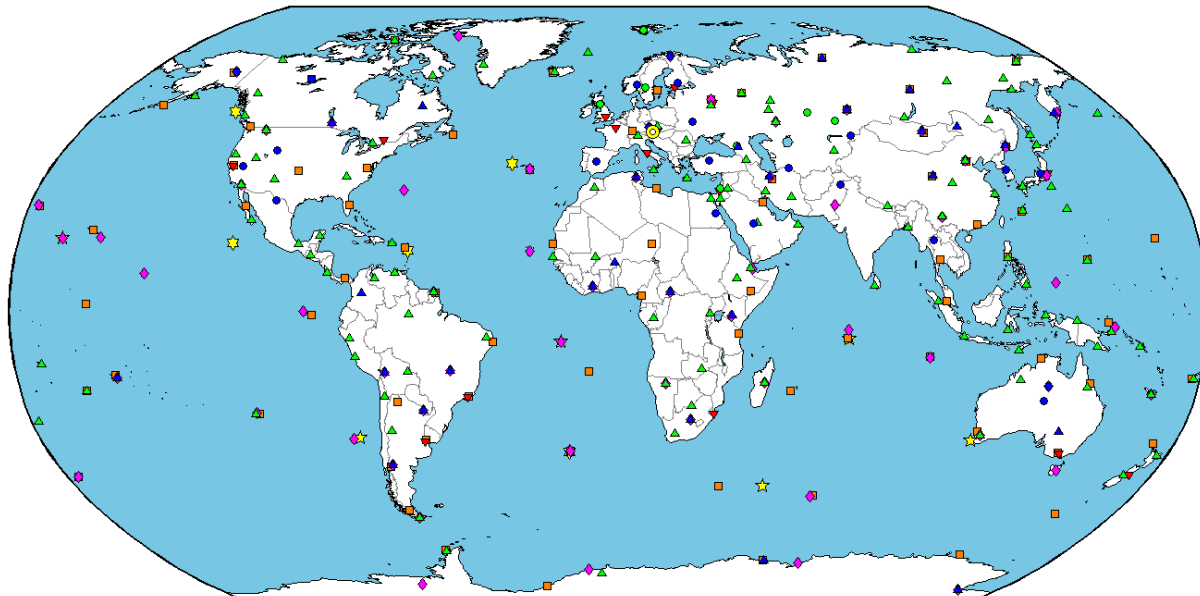
- *Databases:* in-house based on ENSDF, DDEP, etc
- *Software:* in-house software for analysis of gamma-ray spectra, MC simulation codes for noble gas detection

Nuclear Data for Monitoring Applications

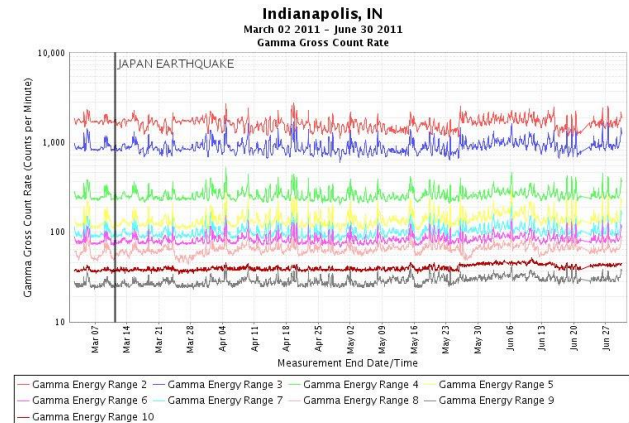
An IAEA Project to create a library of decay data for radionuclides relevant to the Comprehensive Test-Ban-Treaty Organization Preparatory Commission (CTBTO)

CTBT Radionuclides:
From nuclear weapons
(fission & activation products)

INTERNATIONAL MONITORING SYSTEM



- ◆ Primary Seismic Array
- Auxiliary Seismic Array
- ◆ Infrasound Array
- ★ Hydroacoustic Station
- Radionuclide Station
- ▲ Primary Seismic 3C Station
- ▲ Auxiliary Seismic 3C Station
- ★ T-Phase Station
- ▼ Radionuclide Laboratory
- International Data Centre CTBTO Preparatory Commission



IAEA Project: Evaluation of decay data for monitoring applications

- Duration: 2019 – 2022
- Product: online decay data library
- Output: publication in peer-reviewed journal

Participants

Jun Chen, NSCL, MSU

Paraskevi Dimitriou, NCSR “Demokritos”

Tibor Kibedi, Australian National University

Filip Kondev, Argonne National Laboratory (*Technical Coordinator*)

Alan Nichols, Surrey University

Alexander Negret, IFIN-HH

Sorin Pascu, IFIN-HH

Balraj Singh, McMaster University

Jagdish Tuli, University of Berkeley

Goal: Adopted decay data

- Evaluation procedures and guidelines clearly outlined (based on ENSDF)
- All quantities evaluated: $T_{1/2}$, E , E_{γ} , I_{γ} , δ , IB, NR
- ENSDF format - codes
- Review system
- Derivative data:
 - Atomic Radiation Data: BrIccEmis
 - Beta spectra: BetaShape

Meetings

- Kick-off meeting: IAEA, 6-8 May 2019
- 1st Virtual Meeting: 12 May 2020
- 2nd Virtual Meeting: 25-27 Aug. 2020
- 3rd Virtual Meeting: 16 November 2020
- Next Virtual Meeting: 17 December 2020

Priority nuclides

Radionuclides	Half-Life	Decay mode
Zr-95	64d	B-
Nb-95	35d	B-
Zr-97	17h	B-
Mo-99	66h	B-
Ru-103	39 1/4d	B-
Rh-105	35 1/3h	B-
Ru-106	373 3/5d	B-
Cd-115m	44 3/5d	B-,IT
Cd-115	53 1/2h	B-

Not exclusively for
CTBTO but for
broader use in
environmental
monitoring

Ce-143	33h	B-
Ce-144	284 8/9d	B-
Nd-147	11d	B-
Nb-97	72.1 m	B-
Rh-106	30.07 s	B-
Te-127	9.35 h	B-
I-132	2.295 h	B-
Pr-143	13.57 d	B-
Pr-144	17.28 m	B-

Data needs:

42 fission products

42 activation products

Xe isotopes (noble gas detection)

Top Priority:

30 fission products + 3 Xe isotopes

Status:

Half of the evaluations completed

Reviews underway

All material (evaluated files, articles, reviews, guidelines, meeting presentations and reports) available in shared repository

Some financial support provided

News

- As of January 2021 re-joining the Nuclear Data Section (IAEA)
- Responsible for NSDD
- NSDD Meeting 2021: either online or face-to-face or both