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CTBTO
PREPARATORY COMMISSION

National Data Centre Preparedness Exercise (NPE) 2019 Scenario Design and Expert Technical Analysis

J. Ole Ross[1], Giuseppe Ottaviano[2], Antonietta Rizzo[2],
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O4.1-636

ORAL PRESENTATION

BGR Bundesanstalt für Geowissenschaften und Rohstoffe

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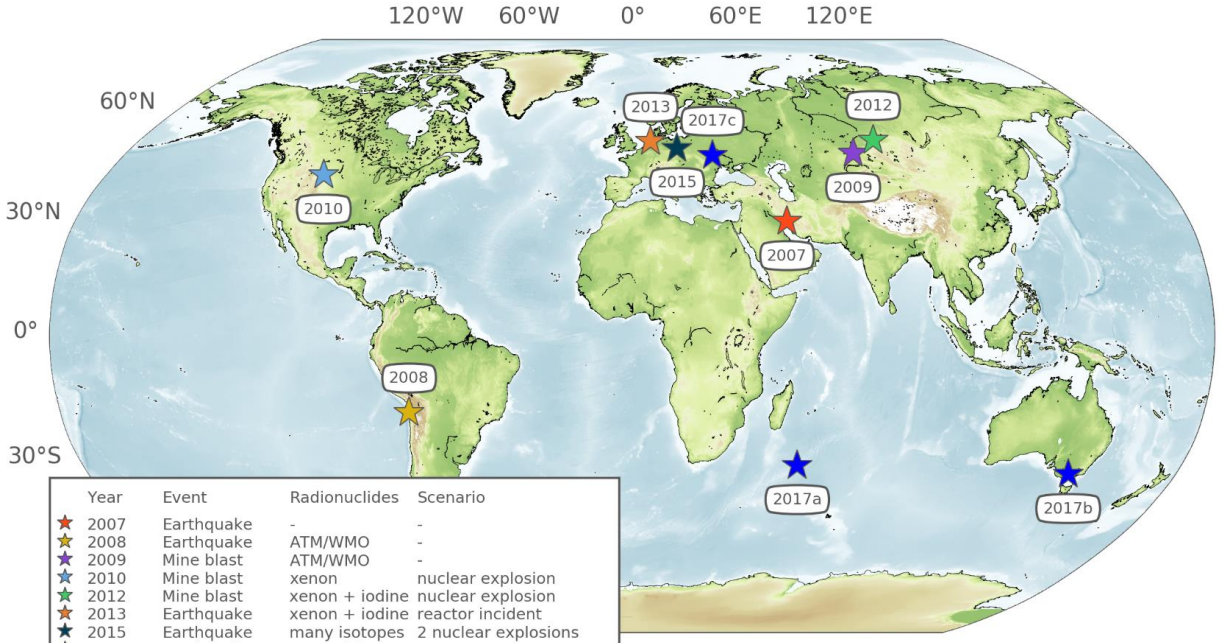
NPE history



	Year	Event	Radionuclides	Scenario
★	2007	Earthquake	-	-
★	2008	Earthquake	ATM/WMO	-
★	2009	Mine blast	ATM/WMO	-
★	2010	Mine blast	xenon	nuclear explosion
★	2012	Mine blast	xenon + iodine	nuclear explosion
★	2013	Earthquake	xenon + iodine	reactor incident
★	2015	Earthquake	many isotopes	2 nuclear explosions
★	2017a	Earthquake	xenon (γ)	-
★	2017b	-	xenon (β/γ)	-
★	2017c	Explosion	particulate	-

NPE are partially simulated scenarios of potentially CTBT relevant events and cases

(often real waveform events combined with simulated RN evidence)

NPE shall test and improve

- Analysis procedures
- Data products
- Communication routines between experts
- Bringing together different types of information …
- … and scientists from various disciplines

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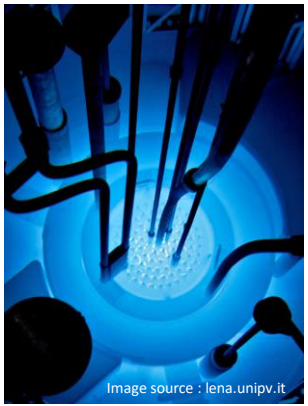
Scenario NPE 2019 – An Italian-German collaboration

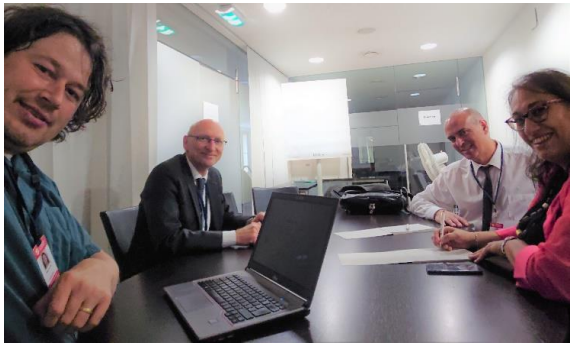
Colleagues from ENEA, Bologna:

- Scenario Storyline
- Radionuclide source terms
- RRR design

BGR, Hannover, German NDC:

- Seismic event selection
- Forward ATM for RN concentrations
- ETA request and additional seismic data
- Organizational issues and website





Initial announcement by fictitious alpine state Raetia :

- Accident at TRIGA reactor, Pavia, morning of 30th July 2019
- Small release of radioactive isotopes expected
- Local monitoring in place, no hazardous level
- No radiological protection measures required

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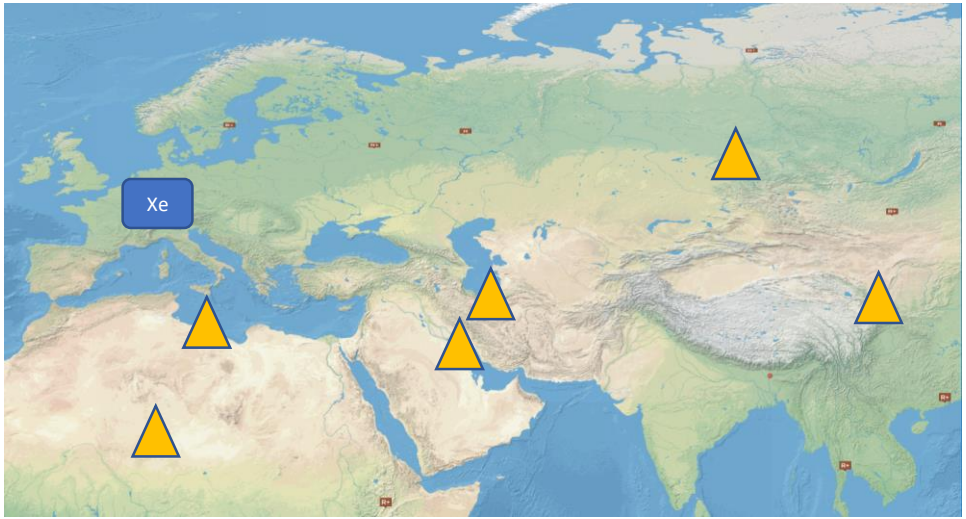
Particulate RN detections

After the announced reactor accident there were widespread particulate radionuclide detections reported of

Ba-140, La-140, Cs-134, Cs-137

At stations
RN 41, 40, 48, 36, 55, 21



Noble Gas RN detections

At DEX33
Xe-133, Xe-135,
Xe-133m, Xe-131m

Concentrations were delivered in a RRR like format

```
This is a NPE2019 RRR with simulated concentrations, not an IDC generated.

                    Particulate Version

                  Creation Date: 2019/08/15 10:50:00
               Sample Arrival Time: 2019/08/8 23:50:00
    Time difference from receipt of raw data to report creation: 203 hours

SAMPLE INFORMATION ========================================================

Station ID:          KWP40              Detector ID:         KWP40_009
Authenticated:       NO

Station Location: Kuwait City, Kuwait.
Detector Description: Detector #1, in Kuwait City, Kuwait.

Sample ID:                    5252508          Sample Geometry:     DISC50MMX5
Sample Quantity:      14569.80 m3       Sample Type:         Particulate
```

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Need for Expert Technical Analysis (ETA)

Neighbour state EASTRIA's situation

- Mistrust against neighbour state
- National measurements of untypical particulates and xenon activity concentrations
- Particulates somehow consistent with IMS measuremnets and maybe with a release from TRIGA reactor
- Xenon origin questionable, not totally consistent with DEX33 measurements
- No suspicious SHI event in REB
- Need for assistance and help → **ETA**

Protocol to the CTBT Part I section E

20.

IDC … shall include the following services:…

*(c) Assisting individual States Parties, at their request and at no cost for reasonable efforts, with **expert technical analysis** of International Monitoring System data and other **relevant data** provided by the requesting State Party, in order to help the State Party concerned to **identify the source of specific events**. The output of any such technical analysis shall be considered a product of the requesting State Party, but shall be available to all States Parties.*

Inspired by series of Expert Meetings on Special Studies and Expert Technical Analysis 2018 / 2019

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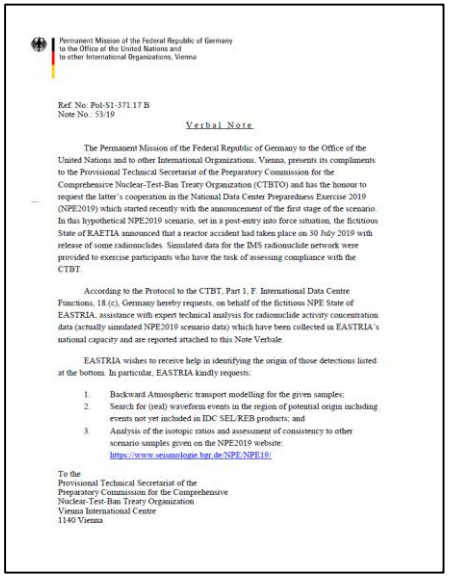

Permanent Mission of the Federal Republic of Germany
to the Office of the United Nations and
to other International Organizations, Vienna

Ref. No: Pol-S1-371.17 B
Note No.: 53/19

Verbal Note

The Permanent Mission of the Federal Republic of Germany to the Office of the United Nations and to other International Organizations, Vienna, presents its compliments to the Provisional Technical Secretariat of the Preparatory Commission for the Comprehensive Nuclear-Test-Ban Treaty Organization (CTBTO) and has the honour to request the latter's cooperation in the National Data Center Preparedness Exercise 2019 (NPE2019) which started recently with the announcement of the first stage of the scenario. In this hypothetical NPE2019 scenario, set in a post-entry into force situation, the fictitious State of RAETIA announced that a reactor accident had taken place on 30 July 2019 with release of some radionuclides. Simulated data for the IMS radionuclide network were provided to exercise participants who have the task of assessing compliance with the CTBT.

According to the Protocol to the CTBT, Part 1, F. International Data Centre Functions, 1B (c), Germany hereby requests, on behalf of the fictitious NPE State of EASTRIA, assistance with expert technical analysis for radionuclide activity concentration data (actually simulated NPE2019 scenario data) which have been collected in EASTRIA's national capacity and are reported attached to this Note Verbale.

EASTRIA wishes to receive help in identifying the origin of those detections listed at the bottom. In particular, EASTRIA kindly requests:

1. Backward Atmospheric transport modelling for the given samples;
2. Search for (real) waveform events in the region of potential origin including events not yet included in IDC SEL/REB products; and
3. Analysis of the isotopic ratios and assessment of consistency to other scenario samples given on the NPE2019 website:
https://www.seismologie.bgr.de/NPE/NPE19/

To the
Provisional Technical Secretariat of the
Preparatory Commission for the Comprehensive
Nuclear-Test-Ban Treaty Organization
Vienna International Centre
1140 Vienna

NPE control team notifyed IDC Director informally by e-mail in Nov 2019 about idea and plan to request ETA within NPE 2019 and received a positive response.

Expert Technical Analysis (ETA) request

ETA request by EASTRIA

Eastria has provided national NPE2019 radionuclide measurements to the IDC and requests assistance with an Expert Technical Analysis to identify potential sources. Within the request it was asked for

1. Backward Atmospheric transport modelling for the given samples
2. Search for (real) waveform events in the region of potential origin including events not yet included in IDC SEL/REB products.
3. Characterization of the isotopic composition and assessment of possible connection to other scenario samples

+++EXERCISE SCENARIO, SIMULATED CONCENTRATIONS BASED ON FICTITIOUS FORWARD ATM +++

The virtual sampling was performed in the city of Vienna, EASTRIA, at 48.24 degree northern latitude and 16.42 degree eastern longitude. Sampling time is 24 hours for all samples.

The national particulate sampling system has a MDC of about 50 microBq/m³ The national experimental noble gas system has MDC values about 1 mBq/m³.

In the particulate sample with collection stop August 2nd 2019 - 9:00 UTC among others (natural background) the following isotopic activity concentrations were detected:

Cs-137	Cs-134	I-131	La-140	Ba-140
0.5 mBq/m³	2.1 mBq/m³	0.06 mBq/m³	1.2 mBq/m³	1 mBq³

The noble gas system obtained the following measurements, all activity concentration values are given in mBq/m³:

Collection stop	Xe-133	Xe-135	Xe-133m	Xe-131m
2019/08/02 6 UTC	52	15	3.5	1.5
2019/08/03 6 UTC	121	7	6.6	
2019/08/04 6 UTC	24			
2019/08/05 6 UTC	6.4			
2019/08/06 6 UTC	6.7			
2019/08/07 6 UTC	93		2.5	1.6
2019/08/08 6 UTC	22			

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EXERCISE EXERCISE EXERCISE

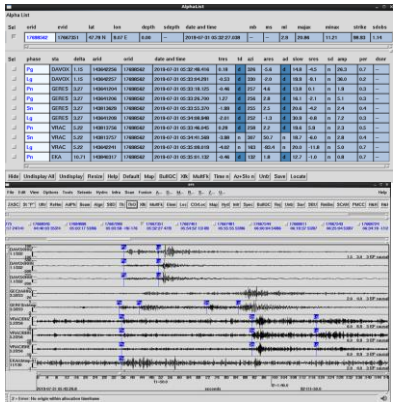
Exercise-SRMR (State Requested Methods Report) for the NPE2019-Exercise

Requesting State Party:	Eastria
Date of request issuance:	5 December 2019
Date of request receipt:	6 December 2019
Event referred to by Eastria:	TRIGA reactor event according to the NPE2019 scenario
Event location:	Pavia, RAETIA
Event time:	30 July 2019
Event related data:	24 IMS radionuclide samples as summarized in Appendix 1 Eastria refers to these data as "other scenario samples of NPE2019"
National data provided:	8 national radionuclide samples as summarized in Appendix 2
Quote of the request:	Eastria has provided national NPE2019 radionuclide measurements to the IDC and requests assistance with an Expert Technical Analysis to identify potential sources. Specifically EASTRIA asks for: 1. Backward Atmospheric transport modelling for the given samples. 2. Search for (real) waveform events in the region of potential origin including events not yet included in IDC SEL/REB products. 3. Analysis of the isotopic ratios and assessment of consistency to other scenario samples of NPE2019.

Contents

IDC results on ETA request

- Quick response (within 14 days) with an „Exercise State Requested Methods Report"
- Sticked closely to the specific questions given in the request
- Performed suitable ATM for the additonal radionuclide data from Vienna
- Radionuclide analysis difficult, potential connection of Xe at DEX33 and Vienna recognized
- Considered waveform events listed in IDC products
- Identified small earthquake at Lake Constance 30 July, 5:32 UTC



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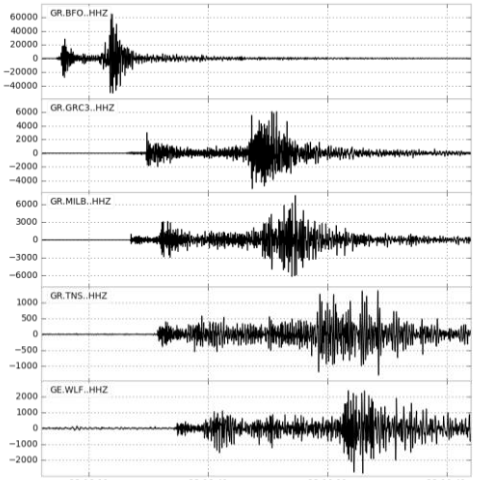
NPE 2019 Seismic event

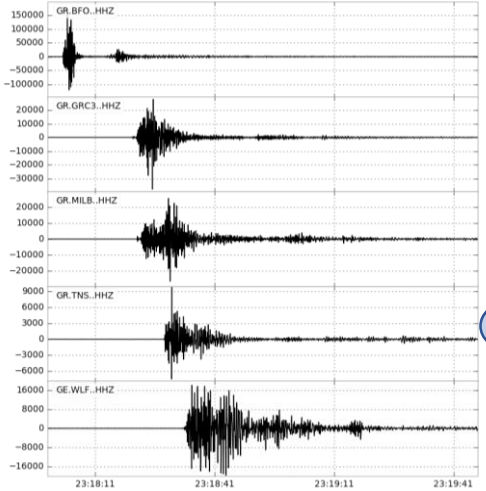
Parameter of scenario event

Origin time	29 June 2019 23:17:47.9 UTC
Epicentre	47.739N 9.108E
Source depth	3 km
Magnitude	3.7 ML
Region	Lake Constance

Original Waveform Data



Modified NPE-data



Seismic data of regional station for two days (29/30 July 2019) were provided. Within the data the signature of the NPE 2019 event was manipulated to show somehow explosive characteristics.

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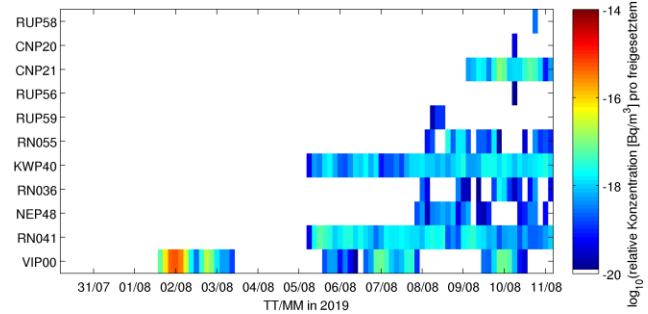
Scenario with two radionuclide sources, non-compliance!

1

Intentional fire in spent fuel storage at TRIGA reactor, Pavia, with release of particulates:

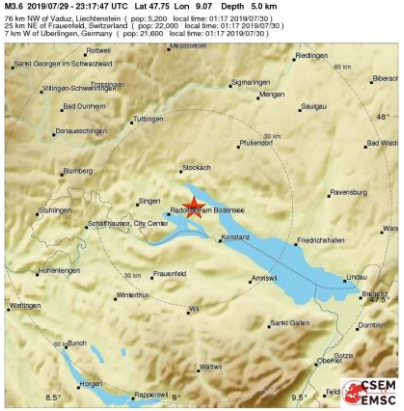
Ba-140, La-140, Cs-134, Cs-137, I-131

Conistent with official announcement of Raetia



Unfortunately some RN scenario flaws:

- inconclusive $^{140}Ba/^{140}La$ (*ment to be „somehow equilibrium“*)
- switched $^{137}Cs/^{134}Cs$
- difficult ATM situation at the alps

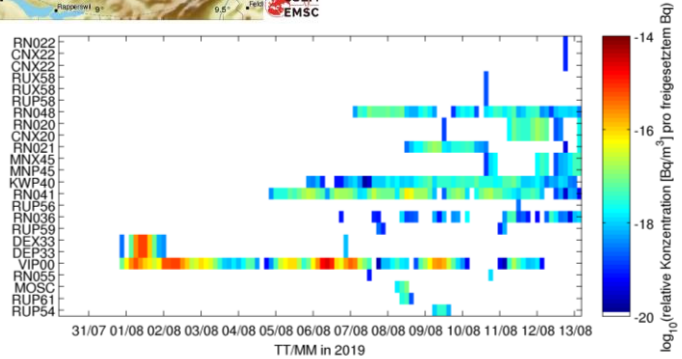


2

Delayed xenon release from nuclear explosion in the ground of Lake Constance (Bodensee)

Xe-133, Xe-135,
Xe-133m, Xe-131m

Special at DEX33:
admixture of real xenon background



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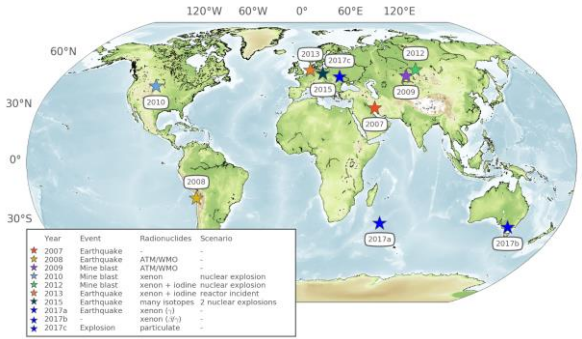
Summary NPE 2019

- Tricky non-compliance scenario with distraction release from intentional burning of spent reactor fuel (some shortcomings in istopic composition)
- Some shortcomings in RN concentrations
- Fictitious nuclear explosion based on shallow ML 3.7 earthquake undetected in IDC pipeline
- First ETA request to IDC ever
- First time synthetically altered waveforms
- Delayed discussion and disclosure

Venue for sharing of NPE2019 results among NDC yet to come…

Short Discussion about NPE process and needs during S&T NDC session Friday 16-18

Outlook to NPE future



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