The National Data Centre Preparedness Exercise NPE 2019
Scenario design and expert technical analyses

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The National Data Centre Preparedness Exercise NPE 2019
Scenario design and expert technical analyses

NPE scenarios are partially simulated potentially CTBT relevant cases (often real waveform events combined with simulated RN Evidence)

NPE shall improve

- Analysis procedures
- Data products
- Communication routines between experts
- Merging of different kind of information
  - ... and scientists from various disciplines

Scenario Design NPE 2019 – An Italian-German collaboration

- Storyline and radionuclide scenario invented by colleagues from ENEA, Bologna
- Several meetings (at margins of SnT, WGB, INGE) to develop details
- Forward ATM for RN concentrations by German NDC
- Organizational issues and website managed by German NDC
- First request of Expert Technical Analysis during NPE 2019
The details of the scenario storyline of NPE 2019 are still confidential!

The original plan was to disclose the NPE scenario and to discuss results at the NDC Workshop to be held 14-17 April in Toledo Spain...

...because of the Covid-19 situation the Workshop was cancelled.

Together with our Italian colleagues and the CBT section at the PTS we will consider a suitable occasion for exchange on the NPE 2019 results.
ANNOUNCEMENT 30 July 2019:

The national nuclear safety authority of the state of RAETIA released the following public announcement.

"An accident at TRIGA reactor facility located in Pavia, RAETIA, has occurred this morning 30th July 2019.

We are expecting some small release of radioactive isotopes, but well below the hazardous limit for human health. A dedicated monitoring system has been activated around the facility and in the neighbouring in order to monitor the radioactivity in the air.
There is no need to activate any emergency procedures for the population neither any closure of schools and public areas is required”
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
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There were noble gas measurements at DEX33 Schauinsland of

Xe-133
Xe-135
Xe-131m

With kind of ambiguous isotopic ratios

And a tiny fraction of Xe-133 at RN 48
Only few events in central Europe in the SEL For 29-31 July 2019

Additional regional seismic exercise data for further event search and discrimination was provided in February 2020 as last stage of the exercise.
Expert Technical Analysis (ETA) Request

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

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. Characterisation of the isotopic composition and assessment of possible connection to other scenario samples

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### 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/m². The national experimental noble gas system has MDC values about 1 mBq/m².

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

<table>
<thead>
<tr>
<th>Isotope</th>
<th>Cs-137 (mBq/m³)</th>
<th>Cs-134 (mBq/m³)</th>
<th>I-131 (mBq/m³)</th>
<th>La-140 (mBq/m³)</th>
<th>Ba-140 (mBq/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.5</td>
<td>2.1</td>
<td>0.06</td>
<td>1.2</td>
<td>1</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Collection Stop</th>
<th>Xe-133</th>
<th>Xe-135</th>
<th>Xe-133m</th>
<th>Xe-131m</th>
</tr>
</thead>
<tbody>
<tr>
<td>2019/08/02 6 UTC</td>
<td>52</td>
<td>15</td>
<td>3.5</td>
<td>1.5</td>
</tr>
<tr>
<td>2019/08/03 6 UTC</td>
<td>121</td>
<td>7</td>
<td>6.6</td>
<td></td>
</tr>
<tr>
<td>2019/08/04 6 UTC</td>
<td>24</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2019/08/05 6 UTC</td>
<td>6.4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2019/08/06 6 UTC</td>
<td>6.7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2019/08/07 6 UTC</td>
<td>93</td>
<td>2.5</td>
<td>1.6</td>
<td></td>
</tr>
<tr>
<td>2019/08/08 6 UTC</td>
<td>22</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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IDC results on ETA request

- Quick response (within 14 days) with an „Exercise States Requested Methods Report“

- Sticked closely to the specific questions given in the request

- Performed suitable ATM for the additional radionuclide data from Vienna

- Radionuclide analysis difficult (partially due to some flaws in the RN scenario data)

- Considered waveform events listed in IDC products
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NPE 2019 Overview

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NPE 2017 - Task A – candidate SHI Events


Task to search for an SHI Event with H-phase arrivals at at least three hydroacoustic stations in the source region.

As the connection of SHI-Event and FRX29 xenon detection is hypothetical, there is no correct solution which event to chose...
NPE 2017 - Task B – Xenon background characterization

Episode of xenon detections at AUX04 / (NZX46) in November 2017 source characterization possible?
- Isotopic ratios
- Source localization by ATM methods
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NPE 2017 – Task C – Particulate RN / seismo-acoustic

Level 5 Detection at SEP63 early Oct 2017

SHI Event with Infrasound phases (and some seismic phases) in the source region

ATM for other ruthenium detections at other IMS stations and in (national) networks in South-East Europe excluded the explosions as real source.

Signals from strongest explosion at 26 Sep 19:59 were registered at 6 IMS Infrasound stations.
Abstract

Initial Situation

Waveform

Radionuclide

Particulate

Historic

NPE 2019 Overview

Framework

Disclosure

Event Search

Scenario

NPE 2012 Analysis

• event selection
• forward ATM
• concentrations

• isotopic ratio timing
• backward ATM
• event identification
• Mining explosion

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NPE 2013 - Challenging false positive scenario:
Induced earthquake in gas field in FRISIA, reactor incident in neighbour state.

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NPE 2010 – Focus „Multitechnology“

Abstract

Initial Situation
Waveform
NPE 2019 Overview
Internal Design
Radionuclide
- Particulate
- Noble Gas

 ETA
- Request
- Result

Historic NPE Map

Event Search

Infrasound

Open pitch mining explosion Wyoming, Noble gas release simulated

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Geostatistics for Geosciences and Geohazards
Abstract
For detection of non-compliance with the Comprehensive Nuclear-Test-Ban Treaty (CTBT) the global International Monitoring System (IMS) is being built up and nearly complete. The IMS is designed to detect and identify nuclear explosions through their seismic, hydroacoustic, infrasound, and radionuclide signature. The IMS data are collected, processed to analysis products, and distributed to the signatory states by the International Data Centre (IDC) in Vienna. The member states themselves may operate National Data Centers (NDC) giving technical advice concerning CTBT verification to their government. NDC Preparedness Exercises (NPE) are regularly performed to practice the verification procedures for the detection of nuclear explosions in the framework of CTBT monitoring. The NPE 2019 scenario was developed in close cooperation between the Italian NDC-RN (ENEA) and the German NDC (BGR). The fictitious state RAETIA announced a reactor incident with release of unspecified radionuclides into the atmosphere. Simulated concentrations of particulate and noble gas isotopes at IMS stations were given to the participants. The task was to check the consistency with the announcement and to search for waveform events in the potential source region of the radioisotopes. In a next step, the fictitious neighbour state EASTRIA provided further national (synthetic) measurements and requested assistance from IDC with so called Expert Technical Analysis (ETA) about the origin of those traces. The presentation shows aspects of scenario design, event selection, and forward atmospheric transport modelling as well as radionuclide and seismological analyses.