Optimization of the network coverage of the IMS noble gas component.

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INTERNATIONAL MONITORING SYSTEM

Noble gas network – 39+1 stations
Standard modelling conditions

- 1kt yield underground / underwater

- Underground
  1% release at maximum of Xe-133 activity (after about 100h)

- Underwater
  100% release of activity within 3h

Source: Kalinowski, 2011
Standard modelling conditions

- 1kt yield underground / underwater
- Xe-133 with half-life of 5.25 days
- Background emissions from 200 NPP and 5 MIPF
- 14 days transport time
- 40 noble gas stations

► Atmospheric transport modelling
  with Flexpart 8.23 and 0.5deg NCEP data
IMS NOBLE GAS NETWORK
Purpose and provisions

1. **Detection** of unusual radioxenon emissions
   
   ► **PROVISION:**
   
   Any release of radioxenon should reach a monitoring station.

2. **Localization** of event through inverse modelling
   
   ► **PROVISION:**
   
   More samples lead to better localization capability.
Standard conditions

Average detection probability

- 100%
- 75%
- 50%
- 25%
- 0%

Average number of samples

- 10 +
- 100%
- 75%
- 50%
- 25%
- 0%

Regional gaps in the network coverage. Detection probability and localization capability do not always correlate.
Reducing the background would greatly increase regional capabilities.
Increased yields – 20 kt TNT

Higher yields (/higher leakage) greatly increases the detection and localization capability.
Transport time – 7 days

In many locations more detections are to be expected more than 7 days after release.
Other radioxenon isotopes

Other isotopes are less likely to be detected, but...
Other radioxenon isotopes at 20 kt TNT yield

For higher yields (/leakage) other isotopes can be a realistic option.
INTERNATIONAL MONITORING SYSTEM
Noble gas & radionuclide network
Extended network – 60 stations

The 20 equatorial RN stations would fill the biggest NG detection gaps.
Extended network – 80 stations

Average detection probability

Most mid-latitude RN stations are in regions of already good NG coverage.
Summary and Recommendations

- Differentiation between detection probability and localisation capability
- Good coverage for most parts of the globe
  - Gaps due to background and equatorial winds
- Other radioxenon isotopes are secondary means (needed for activity ratios)
- Last detection of event can take time (transport time)
- Extension of 20 stations would yield most benefit

- Scenarios
  - With and without background
  - 1kt and 20kt yields

- 7 days and 14 days transport time
- Four radioxenon isotopes
- 40, 60 and 80 stations
Appendix

60 stations with background

80 stations with background
Appendix

100kt without background

100kt with background