NKS EPHSOGAM – INSTRUCTIONS AND DETAILS

Dear Participant

Many thanks for your participation in this NKS activity. The text below is intended to provide useful information, details and instructions and should be read prior to responding to the activity.

Background.

The EPHSOGAM activity simulates 4 scenarios whereby radioactivity is detected on air filter samples at a number of locations. The operators of the stations request assistance and send gamma spectral data for the stations. The goal of the activity is, for each of the 4 scenarios, to provide an estimate of the location of the release, the time of the release, the nature of the release with respect to qualitative and quantitative information and any other information the participants would like to provide. In particular and in addition to the above, the organizers are interested in how participants approach the problem of identifying release locations and details.

Data Provided.

Each scenario will involve 3 monitoring stations. Information as to the locations of these stations will be provided (please note – we have not tried to ensure that the stations are in logical or real positions so if you find one in a lake or something, that's not a mistake, it's just the way it is). The stations were "sampling" for different periods of time and will have "sampled" different volumes of air. This information will be provided in the relevant information file for each scenario. The time periods during which each station was sampling will also be provided. Total Gamma Dose Rate data will be provided for three of the scenarios. Gamma spectra will be provided for each of the stations in each of the scenarios. Technical detail as to these spectra is provided in this text.

For Scenario 3, we are providing you with the location (just the location) of the release – the Grafenrheinfeld nuclear power plant in Germany. We are doing this to allow participants to fine tune their systems, test themselves. We would be grateful however if you would also report how you performed in this scenario for a situation where we had not provided this information. This will provide valuable input.

The Sources.

In developing the release "sources" we have tried to ensure that the release locations correspond with actual facilities or whatever from which a release may occur. We have not paid any attention to whether or not those facilities were actually operating during the EPHSOGAM time period. Please do not assume a release could not have occurred from any particular site or facility because the facility was offline during the period for which EPHSOGAM is being conducted.

We have attempted to utilize realistic source terms with respect to amounts released and what was released. For practicality, the entire suite of possible isotopes from a source term has not been utilized. The most significant nuclides from a gamma spectrometry/dose point of view have been chosen (so for example, an isotope with insignificant gamma emissions relative to other isotopes will not have been included). Isotopes with half-lives less than an hour or so have, generally, not been included.

No attempt was made to ensure correctness with respect to various mother/daughter relationships.

Air sampling.

It can be assumed that the monitoring stations were using a super type of filter paper with 100% retention of particulate isotopes. For isotopes with gaseous and particulate forms, please just assume that all the isotope was present in particulate form. There was no reduction of sampling rate with time. The sampling times and rates of air sampling were not intended to be realistic. The times during which the samplers were active were "simplified" to some extent and tend to be a bit "ideal" with respect to plume passage etc.

Decay between emission and sampling has been included.

Gamma Data.

The gamma data was simulated as having been drawn from a very standard HPGe detector. The "detector" and its electronics are the same for all scenarios and all monitoring stations in order to keep things simple. The same calibration applies for all scenarios and stations.

Some details as to the spectra:

There was no decay of gamma isotopes over the period of gamma counting. Please switch off any type of decay corrections in your analysis routines.

No accounting was made of mother-daughter ingrowth relationships. Please switch off any related routines in your analysis software.

Gamma counting took place immediately after the sample was removed from the air sampler.

The samples were counted at a distance of 10 cm from the detector so true coincidence summation does not have to be accounted for. It can be assumed that no natural nuclides ended up on the air filters.

The detectors (all of them, for all scenarios) were calibrated with a mixed standard isotope solution presented to the detector in exactly the same geometry and sample matrix as for the samples). There is no need for any density corrections or whatever.

Nuclear data – the nuclear data used in EPHSOGAM was taken from the Table of Isotopes hosted at Lund University Sweden and which can be accessed at http://nucleardata.nuclear.lu.se/toi/ and was correct as of June 2017. Please ensure that your libraries and routines are at least up to date to 2017 or so!

The relevant reference time for each spectrum can be the time the count was started.

Detector.

The detector was a very standard coaxial HPGe detector, crystal size was 5.4 cm diameter and 5.1 cm in length. Endcap was aluminium, 3 mm from the crystal face. Nominal rel. efficiency was 22% and the resolution was 2.1 keV at 1332 keV. The MCA system was 4096 channels, zero was 0 keV, the gain was 0.75 keV/channel and the full scale energy was 3072 keV.

Calibration.

Calibration of the detector was conducted using a mixed isotope source present in the exact same configuration (matrix and geometry) as the samples. The source consisted of (at the time of counting) 10000 Bq of each of the following:

^{241}Am, ^{109}Cd, ^{57}Co, ^{139}Ce, ^{113}Sn, ^{85}Sr, ^{88}Y, ^{60}Co and ^{137}Cs.

Dead Time.

For some reason the dead time is excessive for some of the more active spectra. Please just ignore as it should have no influence on anything.

File formats.

We have tried to include the common gamma spectrum file formats. For various reasons, only the crucial information is included – channels, counts, live time, dead time, start time. Any other information is probably wrong!

Please note: Canberras proprietary .cnf file format shares the same extension as a system file on some versions of MS Windows. This can mean that the file will not be downloaded or virus checkers stop it or whatever. **We have renamed the .cnf files to .cnx. Please just rename them back!!**

The file naming format for the spectra is as follows: Scenario_X_Station_X.ext where X is the scenario and station number and .ext is the relevant extension. The calibration files are just called calibration. Please use the same file format for both calibration and the sample spectra – there have been problems before with how different formats treat the first channel (is it 0 or 1) and we do not know if that is still an issue. Using the same format for calibration and analysis will remove any potential problems for safety.

The formats included are:
Ortec .chn and .spe, Canberra .cnf (**renamed to .cnx**), an Excel type .csv, the CTBTO .phd format and the XML .n42 format. At least one of these should work with most systems. If not please contact me.

Dose Rates.

Time development of total dose rate for each scenario and station will be provided for the relevant time periods. This will be in .csv format and can be opened in Excel or Notepad or whatever. This data will not be relevant for Scenario 4.

Reporting.

We are not going to be super fussy as to how reporting is done. If participants can send us the following information in whatever format you like, we will be happy.

For each Scenario.

1. Where you think the release occurred – a GPS coordinate, a circle drawn in Google Earth, a facility name, etc.

2. When you think the release occurred.

3. What isotopes do you think were released and how much of each.

4. Any other observation or conclusion you would like to draw – how the release developed over time, etc etc.

5. We would be grateful if you could provide information as to how you approached the problem – software used, how you estimated the release point etc.

For each Scenario and Station

1. What isotopes were in the sample

2. the concentrations of those isotopes in the sample in Bq/m^3