Technical Details for the GASMAT Materials

The Detector

The detector and its setup are the same for all scenarios– this is to remove the extra work that was involved in previous exercises where participants had to calibrate detectors for each scenario and because calibration is not really a part of this activity.

The detector for GASMAT is a very standard generic coax HPGe. The detector holder is 0.51 mm thick aluminium with a 3 mm spacing between crystal face and detector end cap. A uniform dead layer of 1 mm is assumed all round the crystal. The crystal is 6 cm in diameter and 7 cm long. Relative efficiency is approximately 40% and the resolution is 1.8 keV at 1332 keV.

The detector is set up such that the energy calibration can be described with a zero of 1.353606 keV and a gain of 0.3320552 keV/channel with a full scale energy of 2721.5 kev (8192 channels).

A spectrum is provided of various isotopes in point source geometry presented normally to the front face of the detector along the central axis with no background present and counted to achieve reasonable statistics. Participants can use this to conduct their own energy/shape calibrations or determine some rudimentary efficiency calibration if they desire (please see the section on activity/quantitative analysis).

The isotopes included in this calibrations spectrum, all being 10 kBq and the spectrum being taken for a point source 30 cm from the end cap, were:

Americium-241, Cadmium-109, Cesium-137, Cobalt-60, Zinc-65, Manganese-54 and Cobalt-57.

Points to Remember –please read this!

1. The absolute aim of this activity is to figure out which of the scenarios are situations possibly involving special nuclear material – as described in the invitation email - and which probably involve something more innocent such as NORM, medical isotopes, etc etc. Qualitative analysis is the main concern of this exercise. No assurances are being provided as to the materials being presented containing information of sufficient quality to conduct detailed quantitative measurements. Please note that not all types of special nuclear material may be included. While no assurances are being made as to the material being sufficient to calculate activities in Bq's please note that information in the spectrum (such as peak ratios) should be of sufficient quality (allowing for possible shielding or whatever) to perhaps hazard a guess at what form a material is in, what type of material it may be, etc etc.

At any rate, participants should feel free to report whatever they want to – this exercise is not a proficiency test and participants should not be worried about getting "wrong" answers.

2. Neutrons or any effects arising from beta particles are not included in simulations. Nor are the effects of high count rates.

3. X-rays below about 40 keV are most likely unreliable in this instance – please do not try and use low energy x-rays in any determinations.

4. Unlike in previous activities such as REMSPEC etc, background in this activity is included in all scenarios. Background is to be taken as the gamma spectra recorded in the environs but not near the source. In some cases a background spectrum is provided. In some cases a background spectrum is not provided but one can assume that background is still actually present in the sample spectrum. One should bear in mind that the background measured may or may not be entirely representative of the background contrinution to the actual suspect source spectrum depending on where it was taken.

5. The 511 keV annihalation peak is not included in any spectra.

6. All spectra were "taken" at distances hopefully great enough to exclude any possible true summation effects nor is random summing included.

7. The background spectra provided do not include anything that are not natural – fallout nuclides, Chernobyl signals etc. are not included in background spectra.

8. The spectra are provided in a range of common formats. In most (if not all of the cases) the only reliable information in the files is channels, counts and live time. For files such as Canberras cnf you will probably have to open it, load the energy/shape calibration you made and save it again before it will let you do any analysis on the file in Genie. In addition, at least some versions of Genie seem reluctant to proceed to an actual identification phase of an analysis without some kind of efficiency calibration being present. In such circumstances or if this affects you….I suggest you use the calibration spectrum to derive a "dummy" efficiency calibration and use that, bearing in mind that quantitative results based upon such a claibration will be most likely wrong..

For formats such as .phd……. the only information that is reliable is the counts per channel and time. Everything else is just default information and should not be relied upon. See the section on phd format below.

9. Any date information such as date and time the spectrum was obtained is probably incorrect and spurious. Attempting to utilise that information in any way will probably cause problems, At any rate, decay should be entirely irrelevant for the purposes of the exercise. In a similar manner – live times and real times may be equal in some cases (for simplicity).

10. The source for all nuclear data was Lunds ToI at http://nucleardata.nuclear.lu.se/toi/index.asp Data was correct from this source as of the spring of this year.

11. Please use the same spectral format for the calibration spectrum and the scenario spectra. This is to ensure that there are no unforeseen differences between and two formats (such as the first channel being channel 0 or channel 1 or whatever).

12. The organisers can in no way assure that the materials distributed are in any way suitable for specialised suites such as MGA or MGAU or anything else. If a participant chooses to employ such suites and gets a crazy answer – consider yourself as having been warned!!!.

13. If the GASMAT materials are to be used in any other context than the GASMAT activity, the organisers would be grateful that full and appropriate acknowledgement is made to both the organiser and NKS and that attention is paid to the disclaimer down below.

14. The files are being submitted as .zip archives. In this archive, the Canberra file with the cnf extension causes some problems with some virus programs as the extension is or was also a windows system file of some type. The Canberra file is therefore named with the .cnx extension. Please rename to the cnf extension.

15. Please disable all your coincidence summation, density correction, decay correction and mother/daughter routines within your analysis software prior to attempting the GASMAT materials.

If there are problems with anything please contact me at mark.dowdall@nrpa.no

Regarding the phd format.

These files include a lot of information and not all of it, as for the other formats, is going to be correct. Any information as to energy, shape or efficiency calibrations in the files will most likely be erroneous. You _must_ calibrate for energy and shape yourselves. What you do with efficiency is up to yourselves.

Please note that all the time information in the file as to sample collection and things is wrong. The only thing that is correct is the live time. At any rate – time should have essentially no bearing on this exercise as qualitative measurements are what is the primary goal.

The matrix for the channel-counts in the phd format confuses me a little – some examples seem to denote the first channel as 1 and some denote it as 0. I have denoted as 1. I'm hoping that causes no problems. I did this because it was the way some of the other formats did it. If it does cause an issue it should be easy enough to write a batch file to fix it or something. Maybe its not a problem at all.

DISCLAIMER

The GASMAT materials are in no way assured as suitable for satisfying the requirements of any certifying body, accreditation organisation, method development process, quality assurance system or for demonstrating compliance with anybody or anything! Please do not misuse the materials as neither the organisers or NKS accept any responsibility what so ever for any damage or injury incurred by any party as a result of using these materials. The participants are participating at their own risk! Once GASMAT is finished the organisers make no binding commitment to providing any form of support in relation to the materials or their use.