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Summary Report

Second Research Coordination Meeting on Reference Database for Neutron Activation Analysis

IAEA Headquarters, Vienna, Austria
7 – 9 May 2007

Prepared by

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March 2008

IAEA Nuclear Data Section, Wagramer Strasse 5, A-1400 Vienna, Austria

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Abstract

The second meeting of the Co-ordinated Research Project on "Reference Database for Neutron Activation Analysis" was held at the IAEA, Vienna from 7 – 9 May 2007. A summary of the presentations made by participants is given, along with reports on specifically assigned tasks and subsequent discussions. In order to meet the overall objectives of this CRP, the outputs have been reiterated and new task assignments made.

March 2008

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1. Introduction

The aims of the Co-ordinated Research Project (CRP) on "Reference Database for Neutron Activation Analysis" are to improve the status of the database of nuclear constants for k_0-NAA, to contribute to the quantification of nuclear structure and decay data, and to remove or reduce some of the discrepancies that exist between the integral constants and values derived from differential data. This CRP originated following the support of the International Nuclear Data Committee (INDC) which advises the Nuclear Data Section (NDS) on nuclear data issues. The INDC recommended in the Summary Report of their meeting of May 2002, INDC/P(02)-23, that a CRP on "Reference Database for Neutron Activation Analysis" be initiated in 2005.

A complementary project is in progress at NAPC Industrial Applications and Chemistry Section on "k_0-IAEA Software Development for Neutron Activation Analysis". This software package has been chosen as the reference analysis tool for the current CRP.

The 1st Research Coordination Meeting (RCM) was held at the IAEA, Vienna, Austria, 3-5 October 2005, and is summarized in IAEA report INDC(NDS)-0477, and the 2nd RCM was held at the IAEA, Vienna, Austria, 7-9 May 2007 and is summarized here.

A. L. Nichols, Head of the IAEA-NDS, opened the meeting and M. A. Kellett (IAEA-NDS), the Project Officer, presented some initial comments reiterating the aims and scope of the CRP. M. Blaauw (TUD, NL) was elected Chair of the meeting and R. B. Firestone (LBNL, USA) Rapporteur. Following the adoption of the Agenda (Appendix A) the Chair invited each participant (Appendix B) to present a summary of the work being carried out under the auspices of the CRP.

2. General Presentations

2.1 F. De Corte, Ghent University, Belgium

Presented a summary of work that has been carried out in order to address the various tasks assigned at the 1st RCM, including:

a) determination of the gamma peak area from a supplied spectrum using two different pieces of software, i.e. *hyperlab* and *hypermet*, - results supplied to M. Blaauw, task co-ordinator,

b) contributed to the detector efficiency calibration exercise - results supplied to Z. Revay, task co-ordinator,

c) recommendation of a number of other candidate materials, which could be used for neutron spectrum characterisation, based on their suitable capture and/or threshold reactions and availability, i.e. ^{115}In, ^{64,68}Zn, ^{58}Ni, ^{54,58}Fe and ^{98,100}Mo,

d) assessment of the validity of using and future availability of the SMELS (synthetic multi-element standard) material. Following discussion with the supplier of SMELS (Peter Vermaercke of SCK, Mol, Belgium), the material was judged to be appropriate for use in internal comparisons and so no alternative needs be sought. Those CRP participants who do not yet have a sample can obtain one upon written request. No further production of the SMELS material was envisaged, and

e) an electronic file containing half-life data extracted from the k_0 database was given to M. A. Kellett for his use in comparing these data with other available sources, particularly the newly compiled JEFF-3.1 radioactive decay data sub-library. Following the comparison exercise a number of differences were identified owing to the different origins of these data. Generally the k_0 database takes half-life values from Isotope Explorer at Lawrence Berkeley National Laboratory (http://ie.lbl.gov/isoexpl/isoexpl.htm).

Finally, it was noted that materials analysis by neutron activation analysis is no longer possible at Ghent University as the research reactor has been shutdown.

2.2 S. A. Jonah, Ahmadu Bello University, Nigeria

Presented a summary of work that has been carried out in order to characterise the reactor at Ahmadu Bello University, which is a miniature tank-in-pool low-power research reactor, including:

a) neutron flux measurements which showed the stability of the reactor over a several hour period of operation, and also allowed the characteristics of two new irradiation channels to be determined,
b) development of an MCNP-5 model of the reactor that is being run on a cluster of machines running LINUX. This model has been used to calculate the neutron energy spectrum in a standard 640 group structure in both inner and outer channels, and these results compare well with measurement, as do the neutron spectrum parameters, e.g. f-factors,
c) the fission spectrum averaged cross-section measurements showed reasonable agreement with evaluated sources, with further measurements planned. The measurements were made relative to both the $^{27}Al(n,p)$ and $^{197}Au(n,\gamma)$ cross-sections,
d) the k_0-IAEA software has been installed and testing has started - further work is required,
e) a measurement of the SMELS material is underway prior to analysis, and
f) the capability for measurements of σ_0 and I_0 using the Cd-ratio technique are being developed.

2.3 P. Schillebeeckx, IRMM, Geel, Belgium

Presented a summary of the GELINA facility at the IRMM in Geel and measurement capabilities, including that of total and partial cross sections via the time-of-flight technique. In particular:

a) new evaluations for the following relevant materials have been produced: ^{nat}Cd, ^{197}Au, ^{55}Mn, W and Zr (natural and enriched isotopes for the latter two), and
b) details of the neutron resonance analysis technique were given, along with an example of its use to determine the elemental composition of an archaeological artefact. The technique can also be used to characterise reference materials provided that the basic thermal neutron capture cross-section is well-known, typically to better than 2% uncertainty.

2.4 M. A. Menezes, CDTN/CNEN, Brazil

Presented a summary of work carried out using their TRIGA Mk I reactor, which was reconfigured to 250 kW in 2001 following installation in 1960. Various upgrades to the data analysis suite were made culminating in the use of the k_0-IAEA software as of 2006, through collaboration with R. Jaćimović from IJS, Slovenia. In particular:

a) neutron flux characterisation has been carried out using the Cd-ratio for the multi-monitor method, and results compared with MCNP-4B calculations using the neutron flux in each specific irradiation channel (previously an average flux across the whole carousel was used). The prediction of the thermal flux with the MCNP model is generally good when compared with measurements (most channels are better than a few percent), but the epithermal flux results show a systematic over-prediction by MCNP of between ~20% and ~40% for different channels. Comparing the measured and calculated f-factors leads to an under-prediction by MCNP of the same order as the over-prediction in the epithermal flux, and
b) analyses of three different types of the synthetic multi-element standard material (SMELS) have been carried out using their original analysis tools, and compared with k_0-IAEA results. Generally the results compare well, although the type II material gives systematically low concentrations when analysed with k_0-IAEA. Noted that the uncertainty limits determined by the k_0-IAEA software were much larger and this phenomenon needs to be investigated.

2.5 R. Jaćimović, Jožef Stefan Institute, Slovenia

Presented a summary of work carried out on the neutron spectrum characterisation of their 250-kW TRIGA Mk II reactor with graphite reflector. In particular:

a) a total of 33 channels/samples were measured at maximum power, both in the core (6) and in the carousel (27), using specially prepared high-purity Al-Au discs,
b) the determination of thermal and fast neutron spectra was achieved by measuring the induced activities via the $^{27}Al(n,\alpha)^{24}Na$ and $^{197}Au(n,\gamma)^{198}Au$ reactions,
c) the results show that the thermal neutron flux on the core periphery (carousel) drops by a

factor of three compared to the flux in the central channel, while the fast neutron flux falls by a factor of ten,

d) the measurements were carried out by means of two independent HPGe systems and agree to within ~2% after normalization, and

e) the variations of the thermal neutron flux around the core in the carousel facility relative to one particular irradiation position (IC40) is ~20%, and ~30% for the fast neutron flux.

2.6 R. B. Firestone, Lawrence Berkeley National Laboratory, USA

Presented a summary of work on the comparison of recommended k_0 factors and those inferred from other nuclear data. In particular:

a) recommended k_0 factors from the De Corte k_0 database were compared with those calculated from the evaluated total thermal neutron radiative capture cross sections (σ_0) along with the partial γ-ray thermal radiative cross sections (σ_γ (= $\sigma_0 P_\gamma$)) measured at the Budapest reactor,

b) the agreement between the k_0 factors from these independent data sources is very good, although the variations between them indicate that both the k_0 and σ_γ databases can be improved by consideration of all data sources,

c) the number of k_0 values has been extended to include 4659 known γ rays from 181 activation parents with half-lives greater than 1 ms, and

d) plans are being made to investigate the observed discrepancies in the k_0 and σ_0 values and adopt a recommended set of k_0 values, evaluated using standard statistical combination methods, to be included in a future release of the Evaluated Gamma-ray Activation File (EGAF).

2.7 M. Arribére, Comisión Nacional de Energía Atómica, Argentina

Presented a summary of work, including the final results of the measurement of resonance integrals for the cases where both ground and metastable states are formed. In particular:

a) studied the $^{79}Br(n,\gamma)^{80g+m}Br$ and $^{81}Br(n,\gamma)^{82g+m}Br$ reactions, which are particularly interesting as ^{80}Br has a shorter half-life than ^{80m}Br, whereas ^{82}Br has a longer half-life than ^{82m}Br,

b) the work required an extension of the efficiency calibration to different distances for two HPGe detectors (carried out using standard sources),

c) estimation of the self-shielding effects for both γ rays and neutrons, as well as use of the STAY'SL least-squares fitting unfolding program for dosimetry, and

d) production of an analytical solution for the irradiating neutron flux.

2.8 Z. Révay, Institute of Isotopes, Budapest, Hungary

Presented a summary of work on prompt gamma activation analysis (PGAA) being carried out at the cold neutron beam facility. In particular:

a) the neutron beam is a pure cold beam with an f-factor of 60,000, which can be used with or without a beam chopper,

b) in-beam measurements, which are particularly useful for relatively short-lived nuclei, were reported for 12 nuclei, and the results shown were generally consistent with theoretical and/or other measured values,

c) two interesting examples illustrating the usefulness of the in-beam technique were shown for ^{24m}Na and ^{60m}Co formation,

d) chopped-beam measurements were also reported for 20 nuclei (many having multiple peaks) - generally good agreement was seen in comparison with other measured values, with only a very small number requiring further investigation,

e) plans for further in-beam and chopped-beam measurements at Budapest were shown, along with two sets of suspicious k_0 and/or Q_0 values (one set from G. Kennedy (Ecole Polytechnique, Montreal, Canada) and the other from A. Simonits (Atomic Energy Research Institute, Budapest, Hungary)) many of which warrant re-measurement (see Section 8).

3. Task Specific Presentations

At the 1st RCM three main tasks had been identified and allocated to task co-ordinators, who presented their findings.

3.1 Peak Area Determination, M. Blaauw

Presented a summary of the peak area determination task by collating the results obtained from the various participants. Each participant had been supplied with the same combined ^{152}Eu and ^{22}Na γ-ray test spectrum obtained at Delft University of Technology using a 10% efficiency well-type detector. The participants had locally analysed this spectrum in order to obtain the areas of the numerous peaks, and their analyses were returned to the co-ordinator for comparison. The various observations include:

a) no participant had corrected for the ~4% dead time determined at the time the spectrum was measured (determined by using a constant 25 Hz pulse),
b) some participants had used the anomalous peak at 121.8 keV (off the energy calibration curve) for their actual energy calibration (along with the 1408 keV peak), and this approach had created problems in identifying the energies for all other peaks. The co-ordinator therefore made an adjusted peak area file using the calibration approach followed by these participants, so that their analyses could then be correctly examined,
c) almost all participants quoted underestimated peak area uncertainties, except one, whose energy uncertainties were very large (~10 keV) probably because they were the peak widths, rather than the actual uncertainty on the energy determined for the peak,
d) identification of small peaks was affected by the initial problematic energy calibration,
e) the lack of dead-time correction, or indeed, the lack of certainty as to whether one had been applied or not, reflects badly on the spectrum analysis software in not making it clear to users which corrections have been applied,
f) more attention should be paid to determining the energy calibration, i.e. more than two energy points should be used, and finally,
g) the co-ordinator felt that all participants were able to determine peak areas sufficiently well, albeit care should be taken with:
    i) the initial energy calibration,
    ii) correct determination of the dead-time correction, and
    iii) accurate reporting of uncertainties.

3.2 Comparison of Detector Efficiency Calibration Methods, Z. Révay

Presented a summary of the detector efficiency calibration task, but first showed the overall form of a semi-empirical efficiency curve which can be created by applying various corrections to the total efficiency which is approximately the geometric efficiency - e.g. absorption (in both the dead layer and the aluminium window), and the strongly energy-dependent components from the photo-electric effect, Compton scattering (single and multiple) and pair production (at higher energies).

The task involved using a supplied set of peak areas, energy and emission probabilities and source activities (all quoted with their associated uncertainties) to determine a detector efficiency curve. A number of analysis methods were compared, particularly the use of a variety of different order polynomials. Concluded that:

a) published efficiency curves are too generic to be used for specific detectors, if the required uncertainty level is to be achieved,
b) fitted functions do not normally follow any physically reasonable shape, i.e. as expected from a semi-empirical approach,
c) the more parameters that are used, the better the fit,
d) the mid-energy range cannot be fitted with a straight line, although this is often used,
e) the curves received were comparable to a few percent, and
f) the exercise showed that the supplied data are not perfect, but this may, in fact, be due to coincidence summing in these data owing to the source being too close to the detector. Hence the repetition of this exercise is suggested.

It was emphasised that in locally measuring the efficiency curve for one's own detector, many systematic uncertainties cancel out when this detector is actually used, and that one common problem is when an efficiency curve is adopted from another laboratory - even though the respective detectors are "identical".

3.3 Materials Analysis Test (SMELS), M. Arribére

Presented the results of the inter-comparison exercise that had been obtained for the materials analysis of three different types of SMELS material at Centro Atomico Bariloche, Argentina (CAB) and Jožef Stefan Institute, Slovenia (JSI).

The details of the two irradiation facilities were given, and Arribére noted that owing to a refuelling shutdown of the Argentinean reactor, all of the planned irradiations at this facility could not be undertaken and that this had also affected the optimization of the γ-ray counting. Hence higher uncertainties, arising from the poorer counting statistics, were reported.

The following two important parameters were assessed to check the accuracy with which the proficiency test was carried out:

a) precision: shows the ability of a facility to provide reproducible results and is determined by the ratio of the standard deviation from a series of measurements (three in this case) to the average uncertainty. A ratio of < 1 shows that reproducible results are being achieved and both facilities showed a ratio significantly < 1 for all elements identified in the three SMELS samples (see Table 1), and

Table 1: Precision of the SMELS results

Material	JSI	CAB
SMELS I	0.15-1.05	0.02-0.99
SMELS II	0.16-0.45	0.01-0.80
SMELS III	0.15-0.89	0.06-0.63

b) accuracy: shows the ability of a facility to determine the elemental compositions of a sample, when compared to the recommended values. Both facilities produced consistent values, within the measured uncertainties, for all three SMELS samples. Typically the content of individual elements was measured to within 1-2% of the recommended values, with 5% being the worst for the Cs concentration in SMELS type I and Co/Zr in type III, and exceptionally the Se concentration measured at JSI for type III was ~15% low. The JSI results for SMELS II were seen to be systematically low by ~2-5%. All of the CAB results had generally higher uncertainties owing to the problems with the refuelling shutdown of the reactor, meaning that in some cases a poor choice of decay time was forced upon them.

The results of the analysis of all three materials from both groups are in good agreement with the certified concentration values of the three types of SMELS materials, and the elemental contents obtained at JSI had lower uncertainties for the reasons explained.

4. Neutron Spectrum Characterisation

A. Trkov (Jožef Stefan Institute, Slovenia (JSI)) detailed the work undertaken on neutron spectrum characterisation. The basic goal of this work is to allow a neutron spectrum to be described analytically so that the constants used in neutron activation analysis (NAA) can be defined and derived directly from differential cross-section data. In this way, measured values for k_0 can be used to validate the cross-section data. However, in order for this feedback to be useful, the neutron spectrum must have an accurate analytical description.

A procedure was described to allow an analytical function to be obtained. Firstly, the spectrum shape is calculated through a full-core Monte Carlo simulation, which has been validated through flux

distribution measurements, and then the resulting spectrum is parameterised to give the analytical function. The parameters are then adjusted to give the final spectrum function through activation measurements, generally with several monitors and including cadmium-ratio measurements.

Application of this method has been carried out at the TRIGA Mk II reactor at JSI and results were shown. By using cross-section data from the IRDF-2002 library and the obtained spectral function, a good comparison was seen between calculated and measured reaction rates in the four main irradiation positions of the reactor. It was stressed that epithermal self-shielding must also be included in the calculations. The calculated thermal spectrum was lower than that measured via the activation of gold foils, particularly in the core-centre channel. One of the main weaknesses of this method is that reliable cross-section data are required and this is not always the case for reactions containing resonances, whereas threshold reactions tend to have better quality data.

The main goal of this work is to allow the validation and/or adjustment of cross-section data for many nuclides, once an appropriate analytical function is obtained via the method described. Hence this approach can provide another opportunity for the validation of differential cross sections, and thus feedback to the nuclear data community.

5. The k_0-IAEA Software Package – Recent Developments

M. Blaauw (Delft University of Technology, the Netherlands) presented details of recent developments of the k_0-IAEA software. The main improvement has been the ability to import spectra from various Multi-Channel Analyser (MCA) devices so that analysis and peak area determination can be carried out. A tutorial dedicated to the usage of the software is nearing completion that will also include audio instruction. Chemical composition data for a variety of reference materials will be included in a future version of the software. Blaauw also stressed the use of multiple sources/spectra in determining the efficiency curve - reliance on only one source/spectrum can lead to incorrect peak identification if such sources/spectra are not used.

Révay commented that perhaps a better description of certain terminology could be provided in the accompanying documentation. However, Blaauw felt that adequate information was already provided in the manual and/or help files, and also that the forthcoming tutorial would help to alleviate any confusion.

Following Firestone's suggestion that the k_0 data library provided with the software package should have an associated date, as this library is periodically updated, Blaauw agreed that this would be the case in future versions.

6. Nuclear Constants in Relation to Differential Data

A. Trkov once again reiterated the role that neutron activation measurements and k_0-value determination can play in providing feedback to the differential cross-section data community, via the calculational route that was described earlier. However, the important aspect of self-shielding, and its energy dependence, was discussed at length - it was concluded that a measurement for ^{124}Sn could be useful, owing to the separate feeding of ground and metastable states.

7. Goals and Scope

A general discussion took place in which each participant identified the areas in which they could further contribute, or where they felt that new emphasis was required. Following this discussion three main topics were outlined:

i) k_0-software: recent improvements were acknowledged and gratefully appreciated, but the inclusion of correct uncertainty propagation in the calculation of peak areas and energies would be very useful, as will be the tutorial,
ii) k_0-database: a complete, unified database containing consistent k_0, Q_0 and γ-ray emission

probability values is required, which will probably require further k_0 and Q_0 measurements,

iii) k_0-calculation methodology: the definition of a methodology for calculating k_0 values from differential data is necessary, as well as an understanding of the effect that differential data have on final k_0 values. Thus, in conjunction with an appropriate database of consistent differential data, new facilities could apply the k_0 method (with the k_0-IAEA software) more easily.

8. Measurements and Facilities

Z. Révay had already presented (see Section 2.8) two lists of "suspicious" k_0 and/or Q_0 values which require re-measurement. Following extensive discussion on the contents of these two lists, a set of values requiring re-measurement, or further investigation, was formulated and those participants with the capability to perform such measurements were identified. Table 2 gives the main details of the measurement facilities, and Table 3 summarizes the outcome of the discussion on the problematic nuclei.

Table 2: Available k_0-NAA facilities and their relevant characteristics

Facility	Country	f-value	Transit time
CNEA	Argentina	20-100	20-30s
CNEN	Brazil	24	120s
JSI	Slovenia	15-30	1s
CERT	Nigeria	20-50	180s
KFKI	Hungary	∞	1μs
TUD	Netherlands	30 (60)	>20s (>600s)

Table 3: Problematic nuclei requiring further investigation/measurement

Nuclide	Value	Method	Capability exists/comments
^{115}Cd	k_0,Q_0	Two channel	Arribére, Jonah, Jaćimović
^{192}Ir	k_0		k_0 value missing[†] from ADNDT 85 (2003)[*]
^{197}Hg	k_0,Q_0		Arribére, Jonah
^{75}Se	k_0,Q_0		Kennedy, Jaćimović
^{153}Gd/^{153}Sm[‡]	k_0		Kennedy, Jonah
^{159}Gd	k_0		Kennedy, Jonah
^{131}Ba	k_0,Q_0	Two channel/Cd covers	Arribére, Jonah
^{109}Pd	k_0	Beam chopper	Révay, Kennedy
^{116m,n}In	k_0,Q_0	Two channel	Révay, Jaćimović
^{134m}Cs	k_0,Q_0	Two channel	Révay, Jonah
^{36}S[#]	k_0	Beam chopper/enriched sample	Révay, Jonah
^{49}Ca[#]	k_0	Beam chopper	Révay, Jonah
^{95}Zr	k_0,Q_0		all participants could undertake measurements
^{90m}Y	k_0,Q_0		Blaauw
^{58}Fe	k_0,Q_0	}	problem when compared with the resonance integral value from differential data
^{186}W	k_0,Q_0		

† k_0 value was not included in the original publication, but was thought to have been measured.

* Frans De Corte and András Simonits, *Recommended nuclear data for use in the k_0 standardization of neutron activation analysis*, Atomic Data and Nuclear Data Tables 85 (2003) 47–67, doi:10.1016/S0092-640X(03)00036-6

‡ listed together as often only available as a mixed source.

\# requires extension of the energy efficiency curve beyond the usual upper energy limit, which could be achieved using a locally produced ^{24}Na source (has a γ-ray at 3.75 MeV).

9. Deliverables, Outputs and Tasks

The overall objectives and outputs of the CRP were well defined at the start of the project. Following the discussions during the meeting, they were restated for clarity.

1. The CRP will result in a selected set of newly measured k_0 and Q_0 values. These new values will be tested in the analysis of reference materials, and recommended to the wider k_0 community.
   (When conflicts arise between k_0 and Q_0 values measured at different facilities, an attempt will be made to reconcile them by means of the methodology described by A. Trkov.)
2. The CRP will produce a comparison database where the k_0, Q_0 and half-life values are compared with values in other databases. These results will be added to the Evaluated Gamma-ray Activation File (EGAF).
3. A k_0 consistent differential cross-section database of recommended data will be produced.

In order that the above can be achieved, a more detailed breakdown of the required tasks was defined.

a. A proficiency test of efficiency calibration in a summing free environment will be led by Z. Révay.
b. A list of monitor nuclides and a template for experimental results will be supplied to the participants by A. Trkov.
c. All participants will report their experimental results (three independent measurements) to A. Trkov.
d. The neutron spectrum shape for each facility will be derived by A. Trkov.
e. Selected participants will report experimental results for the suspicious reactions (based on three separate measurements) as listed in Table 3, to A. Trkov.
f. k_0 and Q_0 values will be derived from the experimental results, and discrepancies reconciled as necessary by A. Trkov.
g. Newly determined k_0 and Q_0 values will be tested by M. Blaauw.
h. A letter to IUPAC will be written by M.A. Kellett informing them of this k_0 activity.

10. Date of the Next Meeting

The 3rd and final RCM for this CRP will take place from Monday 17th to Wednesday 19th November 2008, at the IAEA Headquarters, Vienna, Austria.

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Atoms for Peace: The First Half Century
1957–2007

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Meeting Room A2313

AGENDA

Monday 7 May

08:30 - 09:30	**Registration** (IAEA Registration desk, Gate 1)
09:30 - 10:00	**Opening Session**
	Opening by N. Ramamoorthy, Director-NAPC
	Introductory Remarks – M.A. Kellett
	Election of Chairman and Rapporteur
	Discussion and Adoption of Agenda (Chairman)
	Election of task co-ordinators
10:00 - 11:00	**Administrative Matters**
	Coffee break
11:00 - 12:30	**Session 1: Presentations by participants**
	(15 minutes for each presentation and 5 minutes for discussion)
12:30 – 14:00	*Lunch*
14:00 - 15:30	**Session 1 (cont'd): Presentations by participants**
	(15 minutes for each presentation and 5 minutes for discussion)
	General Discussion
15:30 - 16:00	*Coffee break*
16:00 - 17:30	**Session 2: Definition of a proficiency test case**
	Detector calibration
	Neutron spectrum determination / monitor reactions
	Gamma spectrum analysis
	Processing of results
	General Discussion

Tuesday 8 May

08:30 - 09:30	**Session 3: Neutron spectrum determination**
	Conventional methods of NAA
	Spectrum unfolding
	Direct measurements
	Computational methods
	General Discussion
09:30 – 10:15	**Session 4: k0-IAEA software package**
	Detector calibration utilities
	Spectrum processing utilities
	Scope of software intercomparison with other products
	Software extensions
	General Discussion
10:15 – 10:45	*Coffee break*
10:45 – 12:15	**Session 5: Specific features**
	Items drafted by chairman
12:15 – 14:00	*Lunch*
14:00 – 15:30	**Session 6: Nuclear constants in relation to differential data**
	Relation between integral and differential data
	Neutron self-shielding
	Effective resonance energy
	Gamma emission probabilities
15:30 – 16:00	*Coffee break*
16:00 – 17:30	**Session 7: Criteria for determining the scope of new measurements**
	Needs and priorities
	Available facilities
	Available manpower
19:00	*Dinner at Restaurant on the banks of the "Old Danube"*

Wednesday 9 May

09:00 - 10:30	**Session 8: Task assignment and drafting of 2nd RCM Summary Report**
10:30 – 11:00	*Coffee break*
11:00 – 12:30	**Session 8 (cont'd): Task assignment and drafting of 2nd RCM Summary Report**
12:30 - 14:00	*Lunch*
14:00 – 15:30	**Session 9: Review of the 2nd RCM Summary Report**
15:30	Closing of the Meeting

2nd Research Coordination Meeting on

"Reference Database for Neutron Activation Analysis"

IAEA Headquarters, Vienna, Austria

7 to 9 May 2007

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