



**Presentation of the
ESARDA WORKING GROUP
FOR TECHNIQUES AND STANDARDS
FOR NON DESTRUCTIVE ANALYSIS**

Patrick Chard (chairman), CANBERRA UK Ltd

- **Introduction to the NDA-WG**
 - **Objectives**
 - **Tasks**
 - **Membership**
- **Review of WG's activities**
 - **Recent achievements**
 - **Ongoing projects**
 - **New projects & collaborations**

Terms of Reference

Objective

- **To provide the Safeguards Community with expert advice on NDA techniques, procedures on standards and reference materials and on the performance of NDA methods**

Terms of Reference

Tasks (1)

- **Maintain a list of NDA methods & instruments**
- **Determine the reliability of NDA methods (inter-comparison exercises)**
- **Advise inspection authorities on R&D needs**
- **Promote and coordinate R&D programs**
- **Assist in the development of new NDA methods**
- **Promote use of Reference Materials**

Terms of Reference

Tasks (2)

- **Assess Performance Values**
 - for uncertainty estimation
- **Review International Target Values**
- **Consider sampling problems & errors**
- **Develop internationally agreed terminology**
- **Promote cooperation with inspection authorities**
- **Collaborate with other working groups**

NDA-WG participants (List under review)

Members:

EC/JRC, EC/ENER,

IRSN/CEA/CETAMA (France),

AREVA/CANBERRA, Sellafield Ltd, Babcock/Cavendish

SCK-CEN, SKB, SKI (Belgium)

SSM, IKI, STUK,

Chalmers Univ,

ENEA

WAK-GMH (Germany)

Observers:

IAEA, AWE (UK), LANL/LLNL/ORNL (USA), AMETEK (USA),

ABACC, University Michigan

NDA-WG management

Chairman :

Patrick Chard (CANBERRA UK) since May 2013

Vice-Chairman and secretary :

Alessandro Borella (SCK.CEN) since May 2013

Activity 2013: meetings

- **DA/NDA/NA-NT WGs Reference materials workshop:
February, Luxembourg**
- **NDA-WG & International GS WG:
May, Bruges, with the 35th Annual ESARDA Meeting**
- **Invited presentation at INMM NDA User Group:
July, California, US**
- **NDA-WG:
December, Brussels, hosted by SCK.CEN**

February 2013: DA/NDA/NA-NT

Reference materials workshop

- **Captures current needs status:**
 - Reference materials,
 - Nuclear data,
 - Harmonisation of uncertainty methods, modelling for uncertainty est.
 - Benchmarking, evaluation of codes
 - Training, Sharing best Practice
- **Will shape new work program for NDA WG**
- **This is just the start, needs followup (May 2014)**
- **Report complete (website), summary for Bulletin 50**

3rd ESARDA Benchmark on Monte Carlo

AWCC in multiplicity mode:

Report published in ESARDA Bulletin #42

Follow-Up (2012-2013)

Further analysis of the full simulation data:

- 1. Identification of the sources of discrepancies among the participants => distribution of a questionnaire focused on influencing factors deriving from the physical model of the detector, the acquisition electronics, the sample and nuclear data**
- 2. New benchmark using the same MC input files, in order to improve the evaluation of the components of the modelling uncertainty, to be launched**



Replacement of He-3 for neutron detectors

- **Provide a forum of exchange among the labs working on alternative techniques to He-3 technology**

Presentations on ongoing research programmes

- **Fostering collaboration between European laboratories in general and ESARDA members in particular**

EC-FP7 SCINTILLA project launched in 2012

Partners : 9 members, including EC/JRC, CEA, IKI

Advisory group : 7 members, including DG Ener, STUK, IRSN

- **Benchmarking and evaluation**

Testing campaigns in Ispra (2013)

Medium Resolution Gamma Spectrometry

- **New project started 2012, measurements completed in 2013**
- **Aim to evaluate use of CZT detectors for Pu spectra**
- **Pu sample spectra measured at ITU**
- **Project underway – phase 1 starts May 2014**
 - Phase 1: Participants develop and test isotopics algorithms**
 - Phase 2: Unknown samples distribution**
 - Phase 3: Pu mass determination**

International WG on gamma isotopic measurements (IWG-GST) (1)

Background

Triggered by an IAEA request on sustainability and standardization of gamma evaluation codes, in 2008.

1st project: Test platform of gamma spectra for evaluation, qualification of gamma evaluation codes for U/Pu isotopics

- Definition of needs**
- Definition of the database content and architecture**
- Collection of ideal spectra – complete**

International WG on gamma isotopic measurements (IWG-GST) (2)

Progress in 2013

- *IWG-GST meeting May 2013 at ESARDA symposium*
- *Discussed assessment criteria for quality of spectra*
- *Agreed database structure developed by IRSN*
- *Ongoing collaboration US DoE (Brent McGuinness) + IRSN (Anne-Laure Weber) for appraisal of spectra. Assessment planned early 2014.*

Will continue to meet and update at NDA WG

International WG on gamma isotopic measurements (IWG-GST) (3)

Next Steps (2014)

- *Complete ideal spectra assessment*
- *Plan publication of database on ESARDA website*
- *Launch “Guidebook” project for isotopics codes*
- *Launch project extension to non-ideal (waste) spectra*

Feedback from EC Inspectorate, May 2013, demonstrates the high priority for this work

Publications 2013-14

- **Performance Values - NDA for waste:**
ESARDA Bulletin 48 (December 2012)
- **5 NDA sessions at ESARDA Symposium:**
NDA WG members chaired 4 sessions
2 sessions on Neutron systems,
1 session on NDA Measurements (Gamma, Nuclear Data),
2 sessions on spent fuel verification
Best papers selected and peer-reviewed for publication:
ESARDA Bulletin 49 (June 2013) and 50 (planned)
- **Summary report of reference materials workshop (Feb 2013):**
ESARDA Bulletin 50 (planned)

Workplan for 2014 (1)

New Projects

1. **New NDA technology data sheets:**
Address output of Feb'13 reference materials workshop,
Useful for new ESARDA work – Arms Control / Security
2. **Gamma Spectrum modelling for Pu isotopics codes**
3. **Survey for nuclear data needs**

Suggested New Projects

1. **Pulse shape analysis techniques - scintillator n detectors**

Workplan for 2014 (2)

Ongoing Projects

1. **Gamma isotopics codes work (see earlier)**
High priority
2. **Medium Resolution Gamma Spectrometry**
3. **Complete neutron benchmark:**
Sensitivity studies followup

Workplan for 2014 (3)

International collaborations

- **Continue International Gamma Spec WG**
Select reference gamma spectra for database,
to be used for code validation (March),
Then develop to “guidebook” for isotopics codes
- **Continue partnership with INMM NDA User Group**
Both attend ESARDA NDA and INMM meetings
Joint project on Pu spectrum modelling,
Explore nuclear data needs
Plan for NDA uncertainties special session INMM 2015

Example - NDA Technology datasheets

Questionnaire to understand the status for each NDA application field:

1. Please elaborate the objective of performing measurements for safeguards
2. Please define the current range of measurement sample types (e.g. fuel assembly types, waste container types)
3. Please list and summarise the relevant national and international standards (ISO, IAEA guidelines, site-specific safeguards procedures.....) that apply.
4. Please state the measurement performance objectives and describe how these are a) defined and b) tested once the system is in operation
5. Please define which radionuclides are required to be measured for safeguards purposes
6. Please list and summarise the current NDA system types that are currently used as standard and state whether they are commercial off-the-shelf systems or specially designed for specific applications.
7. For each assay system type summarise the performance characteristics and limitations.
8. Are the assay systems used as shared systems for other un-related measurement purposes (for example a waste system used for plant process control and to provide safeguards data on fissile mass) ?
9. What new challenges are faced in the industry – a) now and b) expected in the future ?
Please be specific and show how “performance gaps” relate to performance of existing technology (question 7).
For example i) reactor new fuel types that present difficulties for gamma / neutron assay ? ii) current assay systems do not offer sufficient accuracy for future safeguards objectives ?
10. Please provide details of technical and non-technical requirements with regard to the answers for question 9.
11. What R&D and supply chain organisations are relevant in the provision of the NDA systems ?
In which types of organisations is the expertise required for i) design, ii) operation and iii) data analysis of the systems, located ?
12. Do you see opportunities from using technology from outside industries, to satisfy future challenges ? Give examples ?

Planned meetings 2014

- **May**

**Luxembourg, during 36th ESARDA,
NDA-WG meeting,**

Joint meetings NDA/DA/NA-NT, NDA/CS

- **July**

Present ESARDA NDA WG at INMM NDA UG

- **November**

NDA WG, Ispra