

INFORMATIONAL BRIEF ON:

ANSI ANS8.28 Work Group DOE TSG SNAPSHOT NDA (and DA) Training

Jeff A. Chapman
Oak Ridge National Laboratory

July 20, 2014 (10:00 a.m. - 12:00 p.m.)
NDA User's Group Meeting
INMM
Atlanta, Georgia, USA

ANSI ANS8.28 Work Group

Administrative Practices for the Use of Non-Destructive Assay Measurements for Nuclear Criticality Safety

- What
- Who
- Where and When
 - ANS Meetings
 - Bi-Monthly Telecons
 - KAVU Management System

ANSI ANS 8.x

ANS-8.1 (R), *Nuclear Criticality Safety in Operations with Fissionable Materials Outside Reactors*, D. Bowen/N. Brown

ANS-8.3 (R), *Criticality Accident Alarm System*, S. Monahan

ANS-8.5 (M), *Use of Borosilicate-Glass Raschig Rings as a Neutron Absorber in Solutions of Fissile Material*, J. Hicks

ANS-8.6 (M), *Safety in Conducting Subcritical Neutron-Multiplication Measurements in Situ*, B. Myers

ANS-8.7 (M), *Nuclear Criticality Safety in the Storage of Fissile Materials*, K. D. Kimball

ANS-8.10 (R), *Criteria for Nuclear Criticality Safety Controls in Operations With Shielding and Confinement*, A. Prichard

ANS-8.12 (R), *Nuclear Criticality Control and Safety of Plutonium-Uranium Fuel Mixtures Outside Reactors*, D. Biswas

ANS-8.14 (M), *Use of Soluble Neutron Absorbers in Nuclear Facilities Outside Reactors*, L. J. Berg

ANS-8.15 (R), *Nuclear Criticality Control of Special Actinide Elements*, C. Rombough

ANS-8.17 (M), *Criticality Safety Criteria for the Handling, Storage, and Transportation of LWR Fuel Outside Reactors*, B. O. Kidd

ANS-8.19 (R), *Administrative Practices for Nuclear Criticality Safety*, R. W. Carson

ANS-8.20 (R), *Nuclear Criticality Safety Training*, R. A. Knief

ANS-8.21 (R), *Use of Fixed Neutron Absorbers in Nuclear Facilities Outside Reactors*, D. Erickson

ANS-8.22 (M), *Nuclear Criticality Safety Based on Limiting and Controlling Moderators*, M. J. Crouse

ANS-8.23 (M), *Nuclear Criticality Accident Emergency Planning and Response*, J. S. Baker

ANS-8.24, (M) *Validation of Neutron Transport Methods for Nuclear Criticality Safety Calculations*, L. L. Wetzel

ANS-8.26, (M) *Criticality Safety Engineer Training and Qualification Program*, J. A. Morman

ANS-8.27, (M) *Burn-up Credit for LWR Fuel*, D. Lancaster

Proposed ANS-8.28, *Administrative Practices for the Use of Non-Destructive Assay Measurements for Nuclear Criticality Safety*, J. Chapman

Proposed ANS-8.29, *Nuclear Criticality Safety in Reprocessing*, A. Garcia

Who

| | |
|---------------------|---------------------------|
| Ernie Elliott | LANL |
| Jerry McKamy | NNSA |
| Larry Berg | DOE-EM |
| Nicole Ellis | Consultant |
| Bob Wilson | DOE-EM |
| Frank Lamb | Consultant |
| Chris Haught | Y12 |
| Tom Nirider | Hanford |
| Dave Dolin | SRS |
| John Winkel | Hanford |
| Dominic Winstanley | Sellafield |
| Dave Kirkwood | Sellafield |
| Ashby Bridges | NE FNM |
| Robert Hayes | WIPP |
| James Clark | B&W |
| David Kupferer | DNFSB |
| Wade Scates | INL |
| Cynthia Gunn | Y12 |
| Sandi Larson | Y12-Consultant |
| Michaele Brady Raap | PNNL |
| Doug Bowen | ORNL |
| Jeff Chapman | ORNL |
| Mike Dunn | ORNL |
| Megan Pritchard | Nuclear Safety Associates |

KAVU Workspace

The screenshot displays the KAVU Workspace web application. The browser address bar shows the URL http://workspace.ans.org/apps/org/workgroup/portal/my_documents.php. The page header includes the American Nuclear Society logo and name, along with navigation links for Public Workspace, Workspace, and user information (Jeff Chapman, Oak Ridge National Laboratory, Administration, Reports, Help). The main content area is titled "My Documents" and features a filter sidebar on the left. The filter sidebar indicates that documents are displayed in all states, related to all projects, from all submitters that have been submitted from 2014-06-13. Below the filter, there are links for "All Documents (11)", "Top Downloads (6)", "Open for Comment (3)", and "Approval Balloted (3)". The main document list, titled "All Documents", shows 11 documents. The table below lists the first seven documents:

| Name | State | Submitter | Group | Date | Actions |
|--|-------|----------------|------------|------------|---------|
| ANS-8.27 Draft (w-ANS-8 Comments Incorporated) | Final | Schroeder, Pat | SC - ANS-8 | 2014-06-13 | |
| ANS-8.27 PINS (for Rev. of 2008) | Final | Schroeder, Pat | SC - ANS-8 | 2014-06-13 | |
| ANS-8.27 1st Ballot Comment Responses | Final | Schroeder, Pat | SC - ANS-8 | 2014-06-13 | |
| ANS_SC8_agenda_june2014.docx | Final | Paulson, Lon | SC - ANS-8 | 2014-06-13 | |
| ANS-8_agenda_jun2013.docx | Final | Paulson, Lon | SC - ANS-8 | 2014-06-13 | |
| ANS-8_agenda_nov2013.docx | Final | Paulson, Lon | SC - ANS-8 | 2014-06-13 | |
| ANS-8_minutes_nov2013_final.docx | Final | Paulson, Lon | SC - ANS-8 | 2014-06-13 | |

The bottom of the screenshot shows the Windows taskbar with the system clock indicating 11:59 AM on 6/16/2014.

Where are we and What is our Schedule?

- June 2014
 - Re-baselining
 - References
- August 2014
 - Telecon
- October 2014
 - Telecon
- November 2014
 - Working Outline @ ANS Winter Meeting, Anaheim
- 2020 – Balloting (qed)

Meeting Minutes

- Open Forum-Re-baselining the Standard
 - SCOPE and OBJECTIVES Discussion
 - What problem(s) does this standard need to provide a solution for?
 - ACTION: Members to think through their remarks and consolidate their thinking with reply back to WG.
 - References Needed
 - Reviewed ASTM Standard List
 - ACTION: Members to supply references and then begin to construct and write papers to ANS for reference (within the standard).
- Summary
 - Current Scope and Objectives need significant work
 - Recommendation to use the concept of 8.19 and 8.25 to define the end users (stakeholders of the standard). Doug Bowen agreed to help us with this “transition” of the standard.

Open Forum- Prioritize the Likes/Dislikes/Scope

- a. What is Administrative? Does it need to be expanded?
- b. DQOs? P&B? TMU? Methods? Training? Qualification? Assessments?

References

- ASTM C1592 / C1592M - 09 Standard Guide for Making Quality Nondestructive Assay Measurements
- Other C26.10 ASTM Standards (Att. 4)
- 1970-1980 NRC Reg. Guides
- NDA Ops Site Program Plans and Technical Basis Documents
- Assessments---Lines of Inquiry
 - Portsmouth QSNDA DOEIPPO/03-0235&DO
 - K-25, Y-12
 - LANL
 - SRNL
 - DNFSB2007-1 <-> TSG Correspondence
 - » <http://www.dnfsb.gov/board-activities/recommendations/safety-related-situ-nondestructive-assay-radioactive-materials>
 - International
- Technical Papers
- 8.24 Appendix----look at this for validation of methods/models.
- Identify Needs (for submission of technical papers/summaries)

Existing Scope

- Project need (from PINS form): Non-Destructive Assay (NDA) measurements of fissionable material are made for many purposes for varying data quality objectives. This has often caused confusion on the part of both the NDA community and the criticality safety community in communicating measurement needs for criticality safety uses.
- Scope summary (from PINS form): This standard provides administrative practices covering the interface between the criticality safety community and the NDA community including in-situ measurements and measurements of containerized materials.
- Goal statement - This standard will provide guidance for ensuring that NDA measurements made for criticality safety purposes are planned, executed, and results used in a consistent and defensible manner, and that the infrastructure necessary to accomplish this is identified and provided.

DOE TSG

(for DNFSB 2007-1)

- Who .. is the Technical Support Group?
 - Frank Lamb, Cynthia Gunn, Glenn Pfennigwerth, Tom Sampson, Dave Dolin, Jeff Chapman, Doug Bowen
- What .. Are we doing?
 - Closed out the Defense Board Recommendation
 - Implementation Plan
 - <http://www.dnfsb.gov/board-activities/recommendations/safety-related-situ-nondestructive-assay-radioactive-materials>

Peter S. Winokur, Chairman
Jessie H. Roberson, Vice Chairman
John E. Mansfield
Joseph F. Bader
Sean Sullivan

**DEFENSE NUCLEAR FACILITIES
SAFETY BOARD**

Washington, DC 20004-2901



March 19, 2013

The Honorable Steven Chu
Secretary of Energy
U.S. Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585-1000

Dear Secretary Chu:

The Defense Nuclear Facilities Safety Board (Board) issued Recommendation 2007-1, *Safety-Related In Situ Nondestructive Assay of Radioactive Materials*, on April 25, 2007, which sought to improve assay programs for radioactive material holdup at defense nuclear facilities. The letter from the Administrator of the National Nuclear Security Administration to the Board, dated October 22, 2012, describes actions the Department of Energy (DOE) has taken to address the remaining open commitments of the Implementation Plan. The Board agrees that these actions are sufficient to close the Recommendation.

- Determining what we do next.....

6/28/2015

SNAPSHOT

- Design and build a portable, turn-key system for the measurement of fissile material accumulated in process equipment (pipes, filters, glove boxes, etc.)
- Provide critical replacement of existing HMS-4 system
- The new system shall meet the following specifications:
 - Utilize portable scintillation detectors for photon detection
 - Utilize portable neutron slab/SNAP detectors
 - Utilize commercially-available off-the-shelf, portable, hardware:
 - detectors/collimators
 - multi-channel analyzers (MCAs)
 - HVPS, pre-amp, amplifier, discriminators
 - Field Controller
 - System integration that is flexible and adaptable to allow for future R&D and benchmarking within the context of the DNFSB 2007-1 Implementation Plan (IP)

INSEP:

SYSTEMATIC APPROACH to TRAINING

SAT

Now let's look for some specific guidance...on Training Requirements

- ASTM C1490-14. The Selection, Training and Qualification of Nondestructive Assay (NDA) Personnel
 - Defines Four Job Titles:
 - Senior NDA Professional NDA Professional
 - NDA Technical Specialist NDA Qualified Instrument Operator
 - With Education / Expertise / Duties (for each Job Title)
- ANSI N42.37. Training Requirements for Homeland Security Purposes Using Radiation Detection Instrumentation for Interdiction and Prevention
 - Purpose: This standard establishes minimum requirements and provides recommendations and guidelines for training users in basic radiation detection and the proper use of radiation detection instrumentation

C1490-14. List of Training Categories

TABLE 1 List of major training categories and academic components for each category. Due to the variability from site to site these listings are not intended to be comprehensive for all situations.

| Training Category | Itemized Contents | Recommended Level of Training by NDA Personnel Category |
|--|---|--|
| Nuclear Theory | Radioactivity; Radiation Interactions | Basic: Specialist, Operator, Auditor Advanced: Senior Professional, Professional |
| NDA Measurement | Radiation Detectors & Counters; Spectroscopy; Energy Resolution; Collimation, Shielding, & Background; Spectrum Processing; Counting Statistics; Limits of Detectability; Measurement Control; Quality Assurance; Selection of Method | Basic: Specialist, Operator, Auditor Advanced: Senior Professional, Professional |
| Nondestructive Assay Methods | Gamma-Ray Spectrometry; Active & Passive Neutron Counting; X-Ray Fluorescence; Isotopic Composition; Solution Concentration; Generalized Geometry Holdup | Basic: Operator, Specialist, Auditor Advanced: Senior Professional, Professional |
| Instrument Calibration & Maintenance | Instrument Configuration & Setup; Calibration Schemes; Calibration Standards; Curve Fitting; Diagnostics | Basic: Specialist, Auditor Advanced: Senior Professional, Professional |
| Calculations & Correction Factors | Fundamental Equations & Relationships; Modeling & Sampling; Correction Factors; Measurement Uncertainty; MDA | Basic: Specialist, Auditor Advanced: Senior Professional, Professional |
| NDA Software ^A | Maestro; Gamma Vision; ISOTOPIC; ISOCS; HMS4; NaI GEM; WINU235, INCC, MultiCal, FRAM, MGAU; Genie 2000 as examples | Basic: Specialist, Auditor Advanced: Senior Professional, Professional |
| Process Facility Knowledge ^A | Facility Process Flow; Process Chemistry; Packaging and Containers | Basic: Senior Professional, Professional, Auditor |
| Understanding of Customer Needs, Requirements, and Applications ^A | Nuclear Criticality Safety, Nuclear Material Accountability, Waste Management | Basic: Senior Professional, Professional Advanced: Auditor (at minimum site discipline being audited) |

^A Normally facility dependent.

N42.37 Three Levels of Training

- Level 1 -> Level 2 -> Level 3 (each progressively more difficult)
 - Competencies – what you need to be able to do
 - Instrumentation
 - Method for Demonstrating Competency (Tests, Proficiency Tests)
- Example competencies are:

| Level 1 | Level 2 | Level 3 |
|--|--|---|
| Basic operation of the radiation detection instrument(s) to be employed to include: performing functional checks, monitoring the instrument for alarms, and recognizing an alarm | Differentiation between false alarms and real alarms caused by either innocent (nuisance) or illicit radioactive materials | Identification AND quantification of radionuclides Identify limitations of appropriate radiation detectors |

**NDA and DA for pre-34C and 34C APPLICABILITY
TRAINING MATRIX**

| FUNCTION | TYPE of FACILITY/OPERATION | | | FOR WHOM | | | METHODS | KNOWLEDGE | SKILLS | ATTITUDE |
|----------------------|-------------------------------------|------|------|----------|-----|----|---------|---|--------|----------|
| | Description | Item | Bulk | Oper. | SRA | DA | | | | |
| Determine NM Mass | Reactor Power-Fuel Receipt Facility | X | | X | | | | HM-5: Active Length | | |
| Verify NM Enrichment | Reactor Power-Fuel Receipt Facility | X | | X | | | | HM-5: 235U Enrichment | | |
| PRE-34C | | | | | | | | | | |
| Determine U Mass | U Mill | | X | X | | X | | Collect Sample(s) Lab Anal. - Alpha Spectrometry | | |
| | | | | | | | X | Bulk Gamma-Spectrometry | | |

The Mechanism of Nuclear Fission

NIELS BOHR

University of Copenhagen, Copenhagen, Denmark, and The Institute for Advanced Study, Princeton, New Jersey

AND

JOHN ARCHIBALD WHEELER

Princeton University, Princeton, New Jersey

(Received June 28, 1939)

On the basis of the liquid drop model of atomic nuclei, an account is given of the mechanism of nuclear fission. In particular, conclusions are drawn regarding the variation from nucleus to nucleus of the critical energy required for fission, and regarding the dependence of fission cross section for a given nucleus on energy of the exciting agency. A detailed discussion of the observations is presented on the basis of the theoretical considerations. Theory and experiment fit together in a reasonable way to give a satisfactory picture of nuclear fission.

INTRODUCTION

THE discovery by Fermi and his collaborators that neutrons can be captured by heavy nuclei to form new radioactive isotopes led especially in the case of uranium to the interesting finding of nuclei of higher mass and charge number than hitherto known. The pursuit of these investigations, particularly through the work of Meitner, Hahn, and Strassmann as well

Just the enormous energy release in the fission process has, as is well known, made it possible to observe these processes directly, partly by the great ionizing power of the nuclear fragments, first observed by Frisch³ and shortly afterwards independently by a number of others, partly by the penetrating power of these fragments which allows in the most efficient way the separation from the uranium of the new nuclei formed by the fission.⁴ These products are above all character-

INMM NDA User Group Meeting
Sunday 20th July, 2014
Chair: Stephen Croft, Oak Ridge National Laboratory
Room M108

| Time | Discussion Topic | Speaker |
|---------------|--|-----------------------------------|
| 10:00am | Welcome and Introduction | Stephen Croft |
| 10:05-10:10am | ASTM C26.10 NDA Consensus Standard Update | Ram Venkataraman |
| 10:10-10:15am | ESARDA NDA Working Group Report | Stephen Croft (for Patrick Chard) |
| 10:15-10:25am | ANSI ANS 8.28 Working Group/TSG/Standards/SNAPSHOT | Jeff Chapman |
| 10:25-10:35am | Hybrid K-Edge Densitometer Calibration and QC Standards | Tyler Guzzardo |
| 10:35-10:45am | NBL Reference Materials | Peter Mason |
| 10:45-10:55am | The University Contribution | Franklin DuBose |
| 10:55-11:05am | Opportunities to Improve Measurement Practice | Graham Walford |
| 11:05-11:10am | Uranium-233 Preservation and R&D Potential | Louise Worrall |
| 11:10-11:20am | Mini-Tomographic Gamma Scanner | Ram Venkataraman |
| 11:20-11:30am | Practical Uranium-Enrichment Measurements | Fabio Diaz |
| 11:30-11:40am | Current Status of Isotopic Codes Support and Development | Andrey Bosko |
| 11:40-12:00 | Discussion/Any Other Business | All |

NEXT

