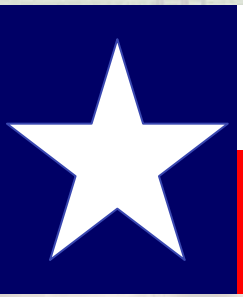
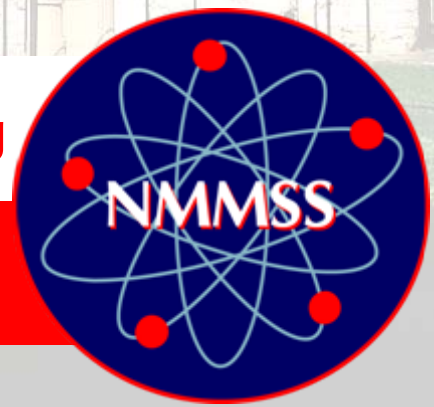
Revision of ANSI N15.8, "Nuclear Material Control Systems for Nuclear Power Plants"

Thomas Morello, Constellation Energy
Martha Williams, U.S. Nuclear Regulatory Commission



NMMSS Users Annual Training Meeting

San Antonio, Texas—May 20-22, 2008



Topics

- Background: Problems identified with control and accounting (MC&A) of irradiated fuel at nuclear power plants
- Activities undertaken to resolve the issues that were identified
- ANSI N15.8 working group established to revise guidelines for MC&A at power reactors, given the information gained from identifying and resolving problems

Background

2000 Millstone Unit 1 (decommissioning) identifies that 2 rods are missing.

- Problem identified during review of records and physical inventory conducted in preparation for dry storage.
- Conclusion of investigation: The two rods were most likely shipped in a burial cask to a burial site licensed to receive low-level waste.

2003 NRC issues a Temporary Instruction (TI) to inspect MC&A programs at power reactors.

- Phases I and II of TI 2515/154 require resident inspectors to answer questions regarding the licensees' programs.
- Phase III requires a thorough review of MC&A programs at a minimum of 12 sites.

Background, continued

2004 Vermont Yankee identifies that a container with 2 rod segments in it is missing

- Problem identified during conduct of Phase II inspections.
- Following a lengthy search, missing rod pieces are found in another location in spent fuel pool.

2004 Humboldt Bay (decommissioning) identifies that 3 rod segments are missing.

- Problem identified during records review and physical inventory conducted in preparation for dry storage.
- Licensee found numerous fragments of failed fuel rods in the spent fuel pool.
- Conclusion of investigation: The rod segments were most likely shipped to a burial site licensed to receive low-level waste.

Background, continued

2005 NRC issues Bulletin.

- Notifies licensees about MC&A concerns.
- Requests licensees to
  - confirm accuracy of MC&A records;- visually confirm that all items containing special nuclear material (SNM) are in the spent fuel pool locations specified in the records.

2005 Oconee identifies that a rod is missing.

- Container storing 383 spent fuel rods actually contains 382.
- After extensive records review and search, missing rod is found in another container.
- Licensee identifies additional records discrepancies.

Background, continued

2005 Hatch finds a bucket of fragments, for which no records are available, in the spent fuel pool.

- One end plug with an identification number is traced back to an assembly that records indicated was intact. Thorough records review indicates that not all spent fuel can be accounted for and that parts of some rods appear to be missing.

2006 NRC accelerates schedule and expands scope of TI 2515/154 inspections.

- Inspections at 100% of power reactors
- Inspections at all sites with wet storage of irradiated fuel, including laboratories

Background, continued

2007 Dresden identifies that a container of irradiated pellets is missing.

- Conclusion of investigation: The container was most likely shipped to a burial site licensed to receive low-level waste.

2007 NRC completes TI 2515/154 inspections.

- 100% of power reactors and other facilities with wet storage of irradiated fuel inspected
- 77% of sites cited for violation of Part 74.19, Title 10 of the Code of Federal Regulations (10 CFR)

Regulations in 10 CFR 74.19

- Keep records showing receipt, inventory (including location and unique identity), acquisition, transfer, and disposal of all SNM possessed.
- Establish, maintain, and follow written procedures sufficient to account for all SNM possessed under license.
- Perform physical inventories of all SNM possessed at intervals not to exceed 12 months.

Summary of Inspection Results

Operating Power Reactors	15	No findings
	31	One SL IV Violation
	14	Two SL IV Violations
	1	Three SL IV Violations
	2	SL III Violation without Civil Penalty
	1	SL III Violation with Civil Penalty
	1	SL II Violation with Civil Penalty
Decommissioning Power Reactors	2	SL IV Violation
	2	SL II Violation with Civil Penalty
Other Wet Storage	2	No findings
	2	SL IV Violation

Implications and Issues

- MC&A problems were more wide-spread than originally thought.
- Fuel failure and reconstitution did not imply that control over rods and pieces would be lost.
  - Some licensees had adequately accounted for and controlled all fuel, even small pieces.
- Failure to adequately account for or control SNM can increase the potential for occupational and public radiation exposure.
- Failure to adequately account for or control SNM can make a facility more vulnerable to theft or diversion and present possible challenges to the common defense and security of the United States.

ANSI N15.8 Working Group

- Working group established in 2005.
  - ANSI N15.8 revision undertaken in response to problems identified with accounting and control of irradiated fuel.
- Members solicited from industry and government.
  - Experience desired in developing, inspecting, and implementing MC&A programs.
- Agreed-upon task: Revise existing ANSI N15.8-1974.
  - Establish acceptable guidelines for MC&A systems at power reactors that address recently identified problems.
  - Acceptable practices must meet the regulations.

Revising ANSI N15.8

- ANSI N15.8-1974, “Nuclear Material Control Systems for Nuclear Power Plants”
  - Did not address damaged fuel and the possibility of broken rods.
  - Did not address reconstitution
- Revised standard informed by licensee experience and NRC inspection experience.
  - Over 90% of power plants have experienced fuel damage and/or have reconstituted assemblies.
  - Specific problems identified involved control of and accounting for small items containing SNM, such as rods, rod fragments, and instruments.

Revising ANSI N15.8

- Issue: Responsibility for SNM was not always clearly defined in procedures.
  - Some licensees exercised little or no oversight of contractors working in the spent fuel pool.
- Response: The revised Standard establishes overall responsibility for implementing the MC&A program.
  - Oversight of vendors/contractors by site personnel is an earmark of an effective MC&A program.
  - SNM control and accounting is the responsibility of plant management and staff.
  - Verification of SNM activities by a second person specified.

Revising ANSI N15.8

- Issue: Some licensees did not keep complete records of activities involving rods and pieces.
  - Some licensees left the record-keeping up to contractors performing work in the spent fuel pool.
  - Complete and accurate records of activities involving separated rods and pieces could have prevented the problems at Hatch, Oconee, and Humboldt Bay.
- Response: The revised Standard emphasizes the importance of complete records.
  - The accounting records are the foundation of the MC&A program.
  - Creation of an item, e.g. a rod fragment, should be recorded.
  - Precise location within an area should be part of the record.

Revising ANSI N15.8

- Issue: Not all licensees had adequate written procedures covering MC&A activities.
  - Vermont Yankee and Millstone Unit I had no procedures to prevent mistaking SNM items for non-SNM.
- Response: The revised Standard describes in detail the minimum requirements for adequate procedures.
  - Written procedures covering the SNM accounting and control system shall be prepared and maintained.
  - Procedures govern receipt, internal transfer, shipment, and physical inventory of SNM.
  - Procedures for characterizing and identifying items as SNM or non-SNM to preclude loss of control

Revising ANSI N15.8

- Issue: References to MC&A in the reconstitution procedures and other fuel handling procedures were sometimes inadequate.
  - Fuel movement forms were sometimes missing
- Response: The revised Standard clarifies that internal control of SNM should be adequately covered by procedures.
  - Expanded section on internal control
  - Records of internal movement of SNM items required
  - Clear identification of non-SNM items stored with SNM items
  - Use of sealed and/or tamper-safed containers
  - Procedures for control and accounting of SNM when damaged cladding results in fragments

Revising ANSI N15.8

- Issue: Most physical inventories did not include verification of items other than assemblies.
  - Annual visual verification could have prevented Vermont Yankee's problem and saved the licensee money.
- Response: The revised Standard describes in detail what constitutes an acceptable physical inventory.
  - Clarification of what constitutes a "physical" inventory
  - Any ambiguity removed as to when to inventory the contents of a storage device rather than just inventory the storage device as a single entity
  - Clarification that physical inventory covers all SNM

Revising ANSI N15.8

- Issue: Some licensees failed to recognize that physical inventory and record-keeping are separate requirements
  - Comparing the book records with the physical inventory results as part of the inventory process could have prevented the problems at Millstone Unit 1 and Vermont Yankee.
- Response: The revised Standard clearly states that the physical inventory should be compared with and reconciled against the book inventory (the inventory of record).
  - Investigation and resolution of discrepancies between the book and physical inventories

Revising ANSI N15.8

- Issue: Containers used to store rods and pieces varied from site to site.
- Response: The revised Standard defines a "fuel component container" as an item similar to a fuel assembly in form/fit/function.
  - Different types of acceptable storage devices that can be accounted for as a single item specified
  - If a closed container is opened, the contents must be physically inventoried before the container is closed if the container is to be treated as a single item for inventory purposes.
  - Items in open buckets subject to individual physical inventory

Revising ANSI N15.8

- Issue: MC&A training for personnel who perform work in the spent fuel pool, but who are not directly responsible for MC&A, was often inadequate.
  - SNM items lacking clear identification as SNM can be mistaken for non-SNM and shipped to a low level waste facility as likely happened at Millstone Unit 1.
- Response: The revised Standard states that personnel responsible for MC&A of SNM should have training appropriate to their functions.
  - Oversight of spent fuel pool activities

Other Changes to ANSI N15.8

- Renamed ANSI N15.8 “Special Nuclear Material Control and Accounting Systems for Nuclear Power Plants”
  - Added “and Accounting Systems” to emphasize importance of accurate records

- Clarified MC&A terminology
  - Book inventory / Physical inventory
  - Dry storage canister / ISFSI
  - Fuel component / Fuel component container
  - Item count
  - Material control records
  - Non-fuel SNM / Non-fuel SNM container
  - Sealed container / Tamper-safing

Other Changes to ANSI N15.8

- Enhanced guidance
  - Characterization and identification of items as SNM or non-SNM to prevent loss of control over SNM items
  - Procedures for internal transfers
  - Configuration control over procedures
  - Corrective action program
  - Receipt of SNM, internal control, and shipment
  - Use of tamper-indicating devices
  - Non-fuel SNM (instruments)
  - Periodic assessment of the MC&A program

Status of ANSI N15.8

- Steps completed
  - Draft standard approved by working group members
  - Draft standard reviewed by ANSI editor
- Current status
  - Revised standard submitted to the N15 ballot roster for approval
- Presented at the 8th International Conference on Facility Operations – Safeguards Interface in Portland Oregon on April 2, 2008
- Publication expected in late 2008

Working Group Members

Martha Williams, Chair	U.S. Nuclear Regulatory Commission
Paul D. Adam	Wolf Creek Nuclear Operating Corporation
James Crabtree	U.S. Department of Energy
Giancarlo Delfini	Entergy Nuclear Operations
Frank J. Fresella	Public Service Enterprise Group
Edward B. Gibson	Southern Nuclear Operating Company
William Herwig	South Carolina Electric and Gas
Melanie May	INMM ASC N15 Advisor
Thomas Morello	Constellation Energy
Everett Redmond	Nuclear Energy Institute
Glenn Tuttle	U.S. Nuclear Regulatory Commission
Dori Votolato	U.S. Nuclear Regulatory Commission