Sharing Expertise and Experience through Focused Packaging- and Transportation-related Training Courses*[*]

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ABSTRACT

Under the mandate of the amended U.S. Atomic Energy Act of 1954, the U.S. Department of Energy (DOE) has the authority to regulate all aspects of activities involving radioactive materials that are undertaken by DOE or on its behalf. Within the DOE's Office of Packaging and Transportation, the DOE Packaging Certification Program (PCP) is responsible for the certification of fissile material and Type B packages that conform to U.S. Department of Transportation and U.S. Nuclear Regulatory Commission requirements. To facilitate the implementation of the pertinent DOE Orders, rules and regulations in a safe and secure manner, PCP regularly sponsors training courses on a broad range of packaging- and transportation-related topics. The courses are offered to packaging designers and users, regulators and system administrators, and fissile handlers and shippers from the United States and abroad. The courses are typically organized and prepared by the contractor U.S. national laboratories.

Several of these training courses are conducted by Argonne National Laboratory, i.e., (1) Quality Assurance (QA) for Radioactive Material Transportation Packaging, (2) Application of the American Society of Mechanical Engineers (ASME) Boiler & Pressure Vessel Code to Radioactive Material Transportation Packaging, and (3) Training and Certification of the ARG-US Radio Frequency Identification (RFID) System for Enhancing Safety and Security during Transport and Storage of Radioactive Materials. In addition, Argonne is developing a training course on transport security for nuclear and other radioactive materials. All training courses include individual/group problem exercises and certificate examinations. Argonne started offering the training courses on QA in the early 1990s and the ASME Code in 2000, and the courses for the ARG-US RFID system in 2008. The first training course on transport security is anticipated to be convened in November 2013.

To date, over 1500 professionals in the U.S. packaging community and abroad have completed the Argonne training courses. A detailed description of these courses and their benefits to the DOE and the packaging community is the subject of this paper.

INTRODUCTION

In the early 1990s, the U.S. Department of Energy (DOE) Packaging Certification Program (PCP), Office of Packaging and Transportation, Office of Environmental Management began sponsoring a suite of training courses conducted by its contractor laboratories in support of safety and security of nuclear and other radioactive material packages in both transportation and storage. These courses are offered annually.

Argonne National Laboratory has conducted three of these training courses:

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(a) Quality Assurance (QA) for Radioactive Material Transportation Packaging [1], beginning in the early 1990s;
(b) Application of the American Society of Mechanical Engineers (ASME) Boiler & Pressure Vessel Code (the ASME Code) to Radioactive Material Transportation Packaging [2], beginning in 2000; and
(c) Training and Certification of the ARG-US Radio Frequency Identification (RFID) System for Enhancing Safety and Security during Transport and Storage of Radioactive Materials, beginning in 2008.

Argonne is also developing and preparing to offer a training course on transport security for nuclear and other radioactive materials. The course will address the specific security requirements for shipments in the United States, as well as examine the international requirements, recommendations and guidance. The first training course on security during the transport of nuclear and other radioactive material in the United States is anticipated to be convened in November 2013.

All of these training courses include individual/group problem exercises and certificate examinations. Over 1500 professionals in the U.S. packaging community and abroad have taken the Argonne training courses to date. To increase the outreach of the training courses, consideration is being given to arranging with universities in the United States for participants to obtain college credit. Use of advanced learning technology is also being considered to enhance the effectiveness of training and communication.

TRAINING COURSE ON QUALITY ASSURANCE FOR RADIOACTIVE MATERIAL TRANSPORTATION PACKAGING

Personnel working in the design, evaluation, certification, use and maintenance of packagings utilized for the transport of fissile material and Type B quantities of radioactive material need to have a working knowledge of, and familiarity with, the specific QA requirements in Subpart H of Title 10 of the Code of Federal Regulations Part 71 [3]. DOE/PCP has issued documents that establish requirements and guidance on QA [4, 5] with a view to assisting personnel involved in these packaging activities in satisfying the Subpart H QA requirements. In addition, DOE/PCP sponsors a course on QA for radioactive material transportation packaging.

Issues that are addressed in the course include methods for not only satisfying, in general, the QA requirements of Subpart H, but also applying the graded approach to QA for packaging elements, and satisfying a recently promulgated requirement [6] that each DOE entity subject to DOE Order 4601.C [4] "*that participates in the design, fabrication, procurement, use or maintenance of a hazardous materials packaging must have a QA Program approved and audited by the Headquarters Certifying Official (HCO) that satisfies the requirements of 10 CFR 71, Subpart H, QA, for certified Type B and fissile radioactive material packagings.*"

The course highlights the applicable QA requirements from relevant DOE orders, federal regulations, and NRC regulatory guides; discusses the application of ASME NQA-1 for Type B and fissile material packaging; and elaborates on current issues resulting from the differences in emphasis between a compliance-based QA program (in Subpart H, 10 CFR 71) for packaging and a performance-based QA program for DOE nuclear facilities (based on 10 CFR 830, "Nuclear Safety Management"), and from the final rule changes in 10 CFR 71 that became effective on October 1, 2004.

Historical Background

Historically, during the early years of the twentieth century, the responsibility for quality rested with the craftsman. If the product quality was high, the craftsman was rewarded with additional orders for the product at higher prices. Quality remained the responsibility of the craftsman until the spread of mass production, at which point the responsibility was transferred to the foreman on the production floor. However, in many cases, production was stressed over quality. As a result, quality problems often arose. This situation ultimately led to production facilities assigning independent inspectors to evaluate the quality of products. This approach was followed by the emergence of a quality control department. During the middle part of the twentieth century, QA requirements and procedures became formalized at national and then international levels.

As a result, during the 1960s, the Atomic Safety and Licensing Board of the U.S. Atomic Energy Commission determined that the nuclear industry should adopt a compliance-based system for QA programs. This determination led to the development and publication of 10 CFR Part 50, Appendix B, Quality Assurance for Production and Utilization Facilities, including civilian nuclear power reactors, in 1970. During the 1970s, the American National Standards Institute (ANSI) and the ASME became actively involved in QA; in 1979, they published the ANSI/ASME Standard NQA-1. During the 1980s, ANSI and ASME continued their QA standards activities, and they issued NQA-2 in 1983 for specific applications in nuclear power plants (e.g., the cleaning of fluid systems and associated components, and software quality assurance) and NQA-3 in 1989 for site characterization; however, both NQA-2 and NQA-3 were eventually withdrawn and merged into ASME NQA-1, which was published in 1997 and has since been updated once and amended twice, in 2000, 2004, and 2008, respectively (ASME 2008).

For packages used for the transport of Type B quantities of radioactive material and fissile material, 10 CFR Part 71, Subpart H, Quality Assurance for Packaging and Transportation of Radioactive Material, was first issued in 1977. It has been revised and now consists of the requirements issued in 2004 [3].

Quality Assurance for Fissile Material and Type B Packagings Used by DOE Entities

Department of Transportation (DOT) Regulation 49 CFR 173.7(d) [7] states that Type B and fissile material packagings can be certified by the DOE if they are evaluated against packaging standards equivalent to those in 10 CFR 71. DOE Order 460.1C [4] requires that an application for a fissile or Type B package certification must include a safety analysis report for packaging (SARP), which is the basis for demonstrating that the package design and the packagings procured or fabricated to that design conform with the standards of 10 CFR Part 71, Subparts E, F, G, and H, and any other applicable standards that the Assistant Secretary for Environmental Management or a Secretarial Officer/Deputy Administrator in the National Nuclear Security Administration may determine applicable for granting a certificate.

Subpart H of 10 CFR 71 describes a compliance-based QA program for packagings that must be satisfied by these requirements. The key characteristics of the QA program are that it is process-oriented and requires independent verification and documentation of the planned actions. The QA program must be based on 18 QA criteria set forth in Subpart H, and provides requirements for design, purchase, fabrication, handling, shipping, storing, cleaning, assembly, testing, operation, maintenance, repair, and modification of components of packaging that are important to safety. For package designs reviewed and certified by DOE, the SARP must contain a Chapter 9, which addresses QA.

The Quality Assurance Training Course

Figure 1 is a flowchart depicting the topics covered in the QA training course. The course begins with a discussion of basic QA principles and concepts, regulatory aspects, DOE orders and compliance versus performance, the role of QA in the safety and performance of transportation packaging, and the relationship between QA and the development of the ASME Code. The course also provides a specific discussion of the 10 CFR 71, Subpart H, QA program requirements and inspections, followed by information on (a) DOE’s QA approval program and QA audits, (b) packaging QA related to commercial grade dedication, and (c) a general description of ASME NQA-1. Applications of QA for design control; software development; maintenance and use; and welding are also discussed, as is the use of the graded approach in QA.

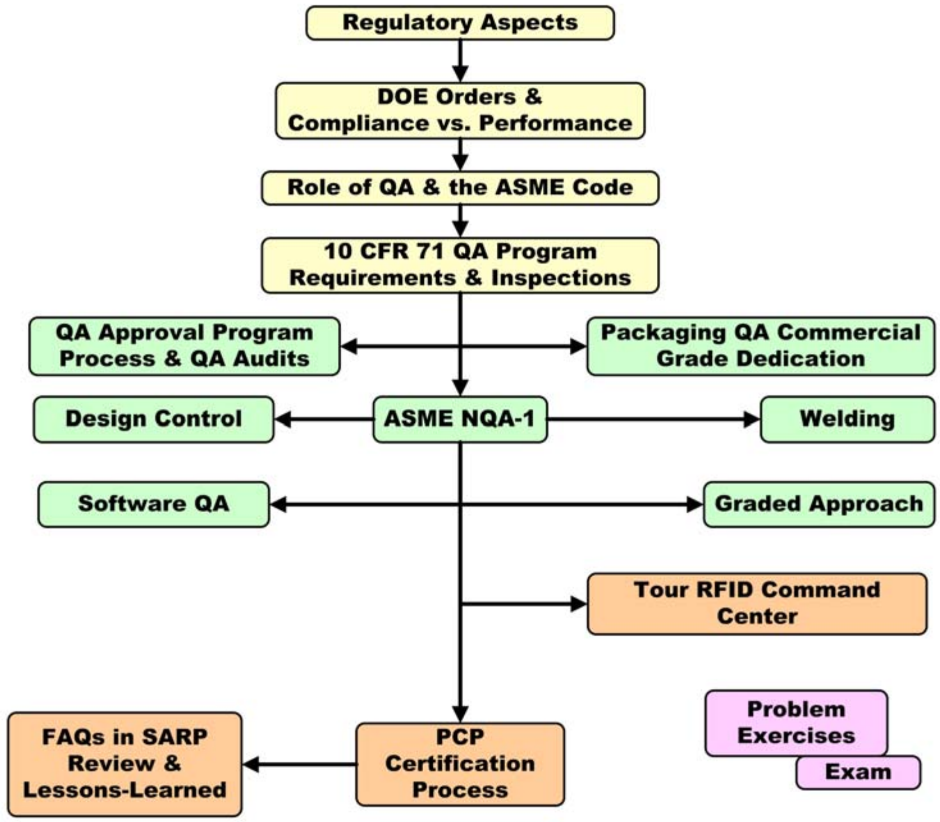

Figure 1. Flowchart of the Course for Quality Assurance for Radioactive Materials Transport Packaging.

The course emphasizes the importance of integration of QA into all aspects of the life cycle of radioactive material transportation packaging, which includes design, procurement, fabrication, testing, use, maintenance, and decommissioning.

The course also includes problem exercise sessions that aim to provide working examples on developing QA requirements that are necessary for inclusion in Chapter 9 of a SARP, along with the questions that are frequently asked in SARP reviews and the PCP certification process. The training course contains 12 to 14 lecture units to be delivered in 2.5 days. Three examples of key issues addressed in the course follow.

The Compliance-based Approach versus the Performance-based Approach

As discussed by Fabian et al. [1], a compliance-based QA system is a system that satisfies all requirements in a multitude of processes, e.g., design control, welding, and nondestructive examination; whereas a performance-based QA system is a system that achieves overall results and objectives, e.g., a leak-tight shipping container. DOE applies a performance-based system of QA programs to its facilities [8]. However, since DOT [7] requires that DOE transportation activities relating to Type B and fissile material packages must comply with 10 CFR 71 [3], QA for these transport packages must follow the compliance-based QA system specified in 10 CFR 71, Subpart H.

One key feature of a compliance-based QA system as imposed by DOE is that individuals who verify quality and perform audits must be independent from the individuals who achieve quality for a product, service, or process but are not responsible for cost and schedule. This, in part, is what has led to the DOE requirement that each DOE entity that participates in the design, fabrication, procurement, use or maintenance of these packagings must have a QA Program approved and audited by the DOE Headquarters Certifying Official, and that this approval is based on demonstration that this entity satisfies the requirements of Subpart H.

The development of Chapter 9 of a SARP, and how to comply with the requirements of Subpart H, are emphasized in the training course.

The ASME NQA-1 Requirements

The standard ASME NQA-1-2008 [9], Quality Assurance Requirements for Nuclear Facility Applications, satisfies 10 CFR 71, Subpart H, QA requirements. The standard represents a unified QA standard; it includes 18 requirements, and describes essential features of each requirement. The 18 requirements in ASME NQA-1 are fully consistent with the 18-point QA criteria of Subpart H of 10 CFR 71. Organizations that invoke this standard can specify the extent of the requirements to be used; for example, designer and user generally do not follow the same set of requirements.

The training course selects two major elements, design control and QA program, for in-depth discussion and illustration on how to effectively apply the requirements of NQA-1 in concert with the 18-point criteria of Subpart H.

The Graded Approach in QA

In applying 10 CFR 71.101(b), the licensee, certificate holder, and/or applicant for a Certificate of Compliance (CoC) is required to apply each of the applicable criteria for each component of a packaging, following a graded approach to the extent that the approach is consistent with each component's importance to safety. The training course provides a method for application of the graded approach for QA requirements, using guidance [10] as to whether a packaging component or related activity is to be classified in quality category A, B, or C, with decreasing importance to safety.

TRAINING COURSE ON THE APPLICATION OF THE ASME CODE TO RADIOACTIVE MATERIAL TRANSPORTATION PACKAGING

The DOE has established guidelines for the qualifications and training of technical staff preparing and reviewing SARPs for the transportation of Type B radioactive and fissile materials. One of the qualifications is that the staff needs to have a working knowledge of, and familiarity with, the ASME Code. DOE/PCP sponsors a training course on the application of the ASME Code to Type B transportation packagings. The course addresses both the ASME design requirements and the safety requirements in the federal regulations. The features of the ASME Code training course are outlined here.

Historical Background

The DOE has, for decades, conducted operations that involve fissile and radioactive materials including spent nuclear fuel, high-level waste, radioisotopes and byproducts. These fissile and radioactive materials must be processed, used, stored, and disposed of by DOE at various locations in the U.S. and elsewhere, and their safe transport is of paramount importance in sustaining the various activities. These materials are often of different shapes, sizes, and physical and chemical forms which, in turn, may require transportation packaging with different structural, thermal, shielding, and criticality characteristics. The contents of a package will generally drive the packaging design, which must satisfy three fundamental safety requirements under both normal conditions of transport and hypothetical accidents: (1) containment of radioactivity; (2) shielding of external radiation; (3) maintaining subcriticality if contents are fissile materials. As noted previously, Type B and fissile material packagings can be certified by the DOE if they are evaluated against packaging standards equivalent to those in 10 CFR 71 [7]. The Package Approval Standards in Subpart E of 10 CFR 71.41(a) state that a packaging must be evaluated by tests or another method of demonstration acceptable to the NRC. NRC Regulatory Guide 7.6 [11] states that an acceptable method evaluating Type B packaging is by analysis using the ASME Code.

The ASME Code Training Course

The purpose of the ASME Code training course is to provide guidance for the application of the ASME Code to packaging for the transportation of high-level radioactive materials or fissile materials, and to facilitate the design, fabrication, examination, and testing of a packaging. The course addresses both ASME Code design requirements and safety requirements in the federal regulations for Type B transportation and storage containments and other packaging components, including the background, structure, application, and current activities involving the Code, with emphasis on the ASME Section III, Division 3 *Containments for Transportation and Storage of Spent Nuclear Fuel and High Level Radioactive Material and Waste* [12], including discussion of Section III, Division 1, and Section VIII, Division 1. Among the specific topics addressed are the application of requirements to structural materials, containment, loading and design; the design of containment internal support structures and buckling analysis; fabrication, weld examination, and test requirements; quality assurance; physical testing and modeling considerations; containment, criticality, and shielding considerations; and special topics, such as hydrogen gas generation, long-term storage, and aging management.

Figure 2 is a flowchart depicting the topics covered in the ASME Code training course. The course begins with the regulatory aspects, code background and structure, and general requirements in Sections III and VIII, followed by materials, design, fabrication, examination, testing, and quality assurance. Special topics such as non-ductile fracture, thermal stresses, bolted closure and buckling are included in the course because they are judged important and treated as extensions to the main topics, as are the PCP certification process and the frequently asked questions in SARP reviews. In the remainder of this paper, only the main topics are discussed and their salient features highlighted. The entire course consists of approximately 20 to 24 lecture units that are delivered in 2.5 to 3 days.

The ASME Code Requirements

The latest issue of 10 CFR 71 [3] does not endorse any specific codes or standards; rather § 71.31(c) specifies that the applicant "*shall identify any established codes and standards proposed for use in package design, fabrication, assembly, testing, maintenance, and use. In the absence of any codes and standards, the applicant shall describe and justify the basis and rationale used to formulate the package quality assurance program.*" Despite this lack of a specific endorsement, the use of the ASME Code is strongly encouraged by both the NRC and the DOE.

As abbreviated in Figure 2, a wide range of topics are addressed in the ASME Code training course, including:

- The regulatory requirements that apply to Type B and fissile material packagings;
- General Code requirements;
- Selecting both Code and non-Code materials for the packaging components;
- The design of the packaging with specific focus on
    - the design of the containment system, including issues related to bolted closures and buckling failure,
    - the design of criticality safety group components, and
    - the design of other safety group components;
- The fabrication and examination of packagings, particularly welding;
- Packaging testing; and
- Quality assurance for packagings.

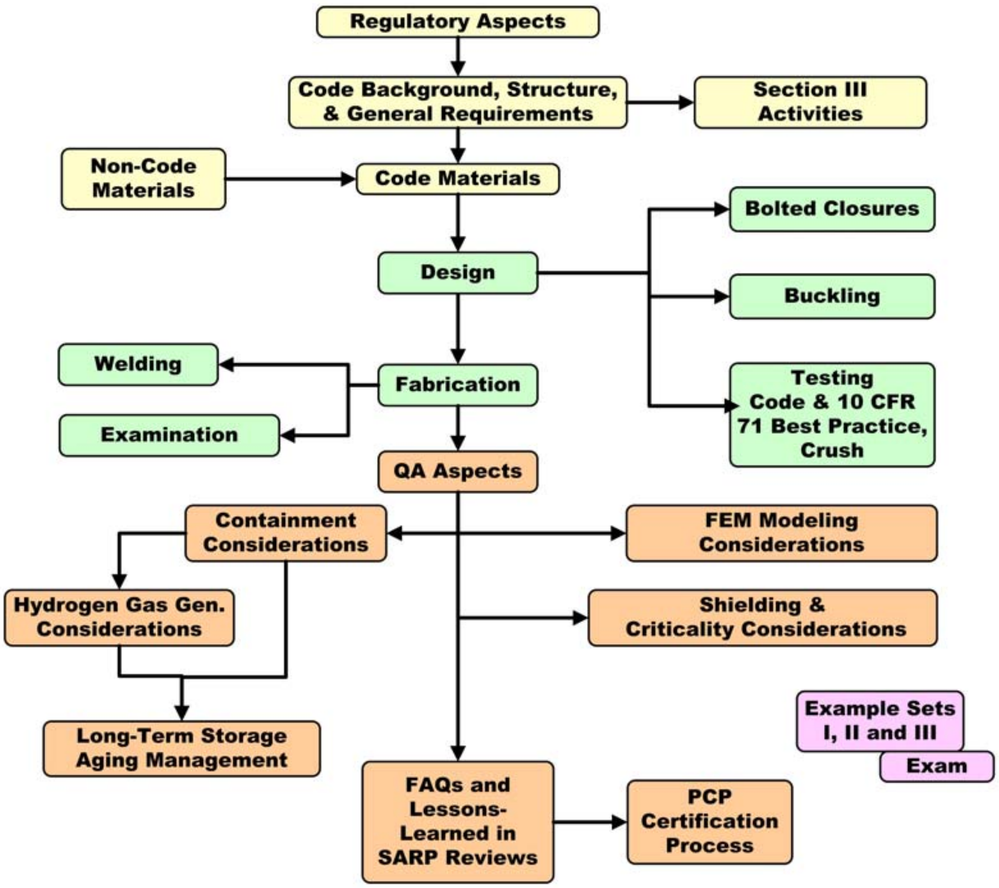

Figure 2. Flowchart of the Course for the ASME Code for Radioactive Materials Transport Packaging.

The training course emphasizes that the time and cost of obtaining a CoC for a Type B and fissile package depend directly on the quality of the SARP, which must demonstrate package compliance to all applicable safety standards. This training course provides a comprehensive review of the relevant ASME Code and Federal Regulation requirements for designing a Type B and fissile material packaging, and thus facilitates expedited and effective preparation and review of a SARP and ultimately the construction of packagings that meet all the safety and regulatory requirements. Aging management is a relatively recent topic added to address the need and issues associated with the interim storage of transportation packagings.

TRAINING COURSE ON THE ARG-US RADIO FREQUENCY IDENTIFICATION (RFID) SYSTEM

The purpose of the ARG-US RFID system training course is to provide training on the use of the system in tracking and monitoring the “state of health” of packages containing nuclear and radioactive materials in both transport and storage. The ARG-US RFID system was developed by Argonne for DOE/PCP. It is undergoing field-testing and application at selected DOE sites [13]. The system includes RFID tags, readers, and software for local and web-based applications, supported by an operations command center at Argonne that is also used for training prospective users.

In addition to supporting DOE/PCP, Argonne staff members have assisted the World Institute for Nuclear Security and the World Nuclear Transport Institute in the preparation of the first joint international best practice guide (BPG) on electronic tracking for the transport of nuclear and other radioactive materials, as well as a companion case study on the use of ARG-US RFID [14]. The BPG and the case study will be incorporated into the training course to provide guidance on how to determine if an electronic tracking system should be used and its potential benefits and costs.

Training on the ARG-US RFID system is conducted on an as-requested, as-needed basis. The training, which typically lasts for one day, results in qualification and a certification of participants in the use of the ARG-US RFID tracking and monitoring system for installation in facilities where packages of sensitive nuclear and radioactive materials are stored, and for transport packages and conveyances for monitoring shipments. The training includes hands-on exercises on specific tasks, with expectations of the level of achievement for each task, and a case study. The specific elements of the course include training sessions on hardware (tags, readers), software (ARG-US OnSite and ARG-US TransPort), and drum-type packages (9975, 9977, 9978, 9979, ES-3100 and DOT 7A) used in transportation and storage. This course is being held in the Argonne RFID Command Center (Figure 3), and the class size is typically limited to five participants, owing to the hands-on nature of the course.

A variant of the course may be offered, as a sub-tier element of the training course being developed at Argonne, covering all aspects of security during transport of nuclear and other radioactive materials, as described below.

Figure 3. The Argonne RFID Command Center: Two DOE-Certified Type B Packagings, the 9979 (Green Drum) and the ES-3100, Are Shown with ARG-US RFID Tags Mounted.

THE TRAINING COURSE ON SECURITY OF NUCLEAR AND OTHER RADIOACTIVE MATERIAL DURING TRANSPORT IN THE UNITED STATES

Since the events of September 11, 2001, a significant amount of emphasis has been placed, both in the United States and internationally, on providing enhanced security for transport of all dangerous goods, including nuclear and other radioactive materials.

U.S. Domestic Requirements and Guidance

The DOT has issued, in 49 CFR Part 171, regulations addressing requirements and the basis for (a) emergency response information and training requirements, both of which are relevant to security as well as safety; and (b) developing, maintaining and applying transport security plans. DOT also delineates, in 49 CFR Part 172, detailed requirements for development and implementation of plans to address security for the following Class 7 (radioactive) shipments:

(a) a quantity of UF_6 requiring placarding,
(b) the International Atomic Energy Agency (IAEA) Code of Conduct Category 1 and 2 materials,
(c) Highway Route Controlled Quantities,
(d) NRC-specified radionuclides listed as a radioactive materials quantity of concern, and
(e) specific additional requirements for transport by rail.

DOT also specifies, in 49 CFR Part 174, additional requirements for transport of certain radioactive material and other dangerous goods by rail, in 49 CFR Part 175 by air, in 49 CFR Part 176 by water, and in 49 CFR Part 177 by public highway [15].

The U.S. Coast Guard has promulgated specific requirements for the handling of dangerous cargoes and for security of vessels, harbors and waterfront facilities [16, 17].

The NRC has recently revised 10 CFR Part 73, which specifies security requirements during transport of (a) formula quantities of strategic nuclear material, (b) more than 100 grams of irradiated reactor fuel, (c) special nuclear material of moderate strategic significance, (d) special nuclear material of low strategic significance, and (e) byproduct material. The NRC has also recently revised 10 CFR Part 37, which establishes requirements for physical protection of Category 1 and Category 2 quantities of radioactive material. Related to these revisions are modified requirements for 10 CFR Parts 20, 30, 32, 33, 34, 35, 36, 39, 51, and 71 [18]. The NRC has issued two guidance documents [19, 20] to facilitate compliance with the requirement of 10 CFR Parts 37 and 73.

The DOE is developing Orders that are anticipated to contain requirements for security similar to those listed above from DOT, the Coast Guard and NRC.

International Requirements, Recommendations and Guidance

In parallel with the U.S. domestic efforts, a significant effort at the IAEA has resulted in a series of IAEA Nuclear Security Series documents [21] providing recommendations and guidance on security during the transport of nuclear and other radioactive materials. The IAEA, working with various experts, has prepared training materials for two courses: (a) Training for Security during the Transport of All Radioactive Material, and (b) Training for Security during the Transport of Nuclear and other Radioactive Material. The IAEA is also preparing a master’s degree-level educational programme that includes a transport security element, which will be supplemented by a textbook on that subject. The IAEA course material and textbook have been developed with significant input from and support of experts in the United States, including Argonne staff.

These efforts were preceded by the issuing of the Convention on the Physical Protection of Nuclear Material (CPPNM) [22], to which the U.S. is party. The CPPNM imposes certain requirements on the transport of various categories of nuclear material. The international community has also issued an amendment to the CPPNM [23], which is not yet in effect; it is awaiting ratification by a sufficient number of countries. Once the amendment goes into effect, additional security requirements for the transport of radioactive materials will be in force for those countries party to the amendment.

Shortly after the events of September 11, 2001, the international community, working through the IAEA, developed a Code of Conduct on the Safety and Security of Radioactive Sources [24]. The Code of Conduct is not legally binding, but the U.S. has agreed to voluntarily follow the recommendations of the Code. To a great extent, 10 CFR Part 37 is structured according to, and goes beyond the requirements of, the Code of Conduct.

Finally, every two years, the United Nations Committee of Experts issues an updated version of the "*Recommendations on the Transport of Dangerous Goods*" [25]. This document is a primary source of recommendations on security that are adopted into national regulations (e.g., in the U.S. by the DOT), and also become binding upon states party to the Chicago Convention through the International Civil Aviation Organization's (ICAO's) "*Technical Instructions for the Safe Transport of Dangerous Goods by Air*," and to the Safety of Life at Sea (SOLAS) convention through the International Maritime Organization's (IMO's) International Maritime Dangerous Goods (IMDG) Code.

The ICAO Technical Instructions and the IMO IMDG Code become binding on U.S. shippers of dangerous goods by air and sea, respectively, since the U.S. is party to both the Chicago and the SOLAS conventions. Chapter 1.4 of the Model Regulations [25] follows a graded approach with respect to the hazard posed by the specific dangerous goods being transported; it contains general security provisions that are essentially consistent with the recommendations of the IAEA and the requirements of the CPPNM. Section 7.2.4 of the Model Regulations provides specific additional security provisions for transport by road, rail and inland waterway.

The Transport Security Training Course

Figure 4 is a flowchart depicting the topics covered in the transport security training course.

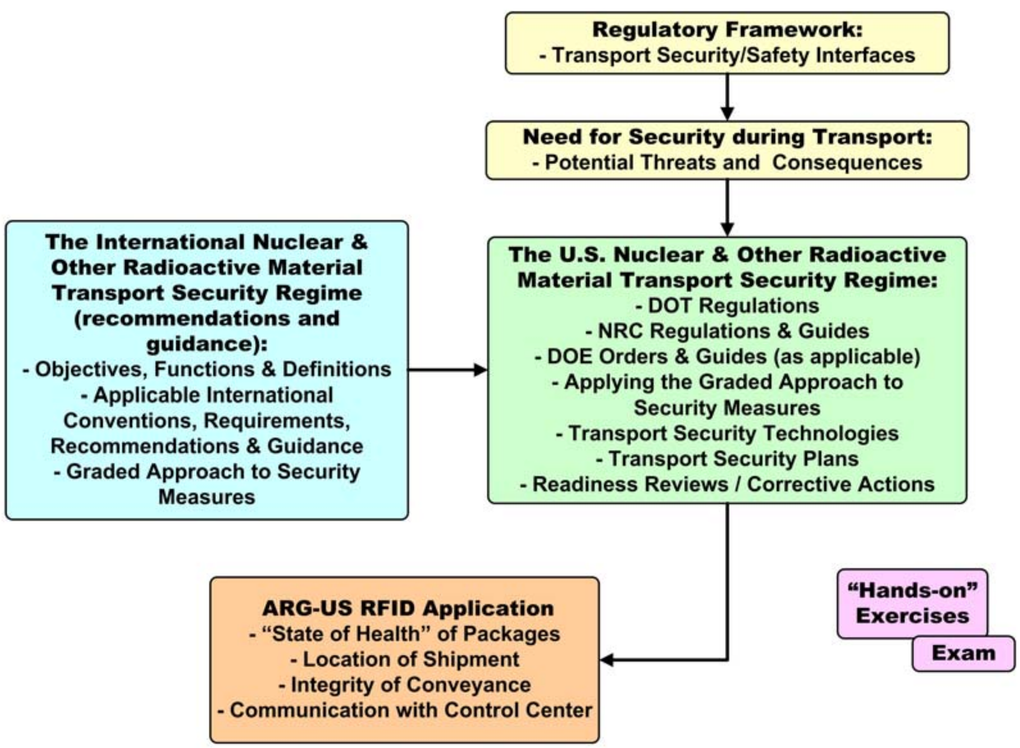

Figure 4. Flowchart of the Course for Security during the Transport of Nuclear and Other Radioactive Material.

Participants in the training course will gain insight into the security measures needed for transport and in-transit storage in the United States, guidance on how to apply these security measures on the basis of existing NRC and IAEA guidance documents, and practical experience in (a) preparing a transport security plan for specific shipments, (b) performing readiness reviews based on the transport security plan, (c) identifying corrective actions for deficiencies based on the readiness review, and (d) group exercises applying the ARG-US RFID system to shipments of material requiring a robust set of security measures.

The course will be tailored with information from the Department of Homeland Security, and will reflect DOT and NRC regulations as well as DOE Orders and guidance documents from these agencies that are applicable to domestic shippers of both nuclear and other radioactive materials.

SUMMARY AND CONCLUSIONS

The DOE Packaging Certification Program has sponsored training courses over a broad range of packaging- and transportation-related topics. These courses are typically organized and prepared by the contractor U.S. national laboratories. Argonne National Laboratory currently conducts three of these courses, covering QA; application of the ASME Code to radioactive material transportation packaging; and training and certification on the ARG-US RFID System. In addition, Argonne is developing a training course on transport security for nuclear and other radioactive materials. All training courses include individual/group problem exercises and certificate examinations. Argonne started offering the training course on QA in the early 1990s and the ASME Code in 2000, and the course on the ARG-US RFID system in 2008. The first training course on transport security is anticipated to be convened in November 2013. To date, over 1500 professionals in the U.S. packaging community and abroad have completed the Argonne training courses.

Knowledge transfer is important to sustain the goals of organizations such as the DOE. Sharing expertise and experience through focused packaging- and transportation-related training courses is, by design, organized knowledge transfer. To increase the outreach of the training courses, consideration is being given to arranging with universities in the United States for participants to obtain college credit. Use of advanced learning technology is also being considered to enhance the effectiveness of training and communication.

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