Office of Radiological Security Transportation Security Efforts

William Stewart
Los Alamos National Laboratory on Detail to NNSA Office of Radiological Security
Michael Schultze
Oak Ridge National Laboratory
John Zarling
Idaho National Laboratory

Abstract

The NNSA's Office of Radiological Security (ORS) works with domestic and international partners to strengthen transportation security of radiological materials in the United States and abroad. The security of these shipments helps to ensure that material in transit cannot be misappropriated and used maliciously. Radiological material is most at risk during transportation therefore these security measures strengthen national security and ensure public health and safety. ORS institutes additional security measures to radiological shipments that are over and above the standards set by the NRC and IAEA because of the belief that transportation is the highest risk period during the lifecycle of that material.

ORS additional transportation security measures are multi-faceted and robust and are not simply limited to tracking of shipments from location to location. Although ORS tracked numerous shipments over long distances, advancements in adding security measures to containers and vehicles have increased overall transportation security for domestic and international radiological material movements. To increase transportation security, ORS has been involved in the design of vehicles that have security measures built in to the vehicle. Additionally, ORS has sponsored the design of two Type B(U) containers. These two containers, the 435-B (currently certified and under construction) and the 380-B (submitted for certification) have benefitted from a security by design approach which includes security enhancements designed alongside the function of the container. This paper will discuss ORS efforts to increase transportation security of radiological shipments as well as work with international partners to increase the security of radiological material transported in locations globally.

Introduction

The National Nuclear Security Administration's Office of Radiological Security (ORS) has a mission to enhance global security by preventing high activity radiological materials from use in acts of terrorism. ORS understands that radiological materials are most at risk while in transit and subsequently works with domestic and international partners to strengthen transportation security of

these materials in the United States and abroad. ORS estimates that there are over 1.6 million shipments of Category 1 and 2 annually worldwide and the incidence of cargo theft of radioactive material appears to be rising. According to the Center for Nonproliferation Studies (CNS) Global Incidents and Trafficking database, there were 177 incidents where nuclear and radiological materials were lost, stolen, or outside of regulatory control during transit between 2013 and June 2016. Further, CNS reported that almost half of all theft incidents in 2014 and 2015 involved material in transit and were nearly twice as likely to be stolen during transit as at fixed sites.

Challenges in assuring transportation security regulations are met, as well as assuring safe and secure conveyances, have lead ORS to develop a holistic and robust transportation security program. Preventing malicious acts from both external adversaries and the informed insider requires unique strategies and technologies. Working from a defense-in-depth mentality allows for layers of security which assure the highest degree of transportation security of radiological materials.

Current Transportation Security Regulations

United States

The Nuclear Regulatory Commission requirements for physical protection of radiological materials in transit is located in the US federal code of regulations, 49 CFR Part 173.22 and 10 CFR Part 37 subpart D. These regulations delineate physical protection regulations while transporting category 1 and category 2 radioactive materials within the US. These regulations include preplanning and coordination, advance notifications, physical protection requirements, and reporting requirements of events. While the regulations for both category 1 and category 2 share common principles, the regulations for category 1 are more stringent than for category 2 material.

International

International guidance on transportation security of nuclear and radiological materials are found in the International Atomic Energy Agency's (IAEA) Nuclear Security Series No.9, Security in Transit of Radioactive Material and UN Model Regulations UN Recommendations on the Transport of Dangerous Goods - Model Regulations. These documents cover important security related roles and responsibilities such as;

- The responsibility of the State;
- Legislative and regulatory frameworks;
- The need to establish or designate a competent authority;
- Responsibilities of those involved in transport (e.g. consignors, carriers and consignees);

• Security culture;
• Threat evaluation;
• Use of a graded approach;
• The concept of defense in depth;
• Management systems;
• Contingency/emergency plans;
• Confidentiality.

While the NSS-9 document provides excellent guidelines regarding security levels depending on the isotope and activity, absent are specific recommendations on the types of equipment to use for a given security level. While this enables each State to determine prescriptive measures based on its own regulations and unique situations, it also leaves much of the specific security measures open to interpretation.

Current ORS Efforts on Deployed Type B Containers

In general, ORS requires shippers, generator sites, and carriers to work together to ensure the security of radioactive material shipments en route from origin to destination. Before loading any material precautions must be taken to verify identity of the driver, destination, and motor carrier to ensure the pickup is legitimate. Drivers will be asked to produce photo identification. The Shipper will provide the generator site with this information prior to shipment as part of the transport security plan. Shippers must assess the security of transportation modes or combinations of modes available for transporting specific materials and select the most appropriate method to ensure it is both efficient and secure. ORS attempts to include security considerations in route selection and appropriate times for pick-up/delivery. Fueling and break locations (including approximate dates and times) should be scheduled when possible. Finally, routes should be planned to avoid highly populated areas, heavy traffic times, bridges, and tunnels when possible. Finally, ORS shipments will utilize some type of satellite monitoring, which will allow daily/routine checking and tracking of the shipment. This tracking system also establishes a method for emergency communication, which allows the drivers to report any unexpected occurrence with the equipment, load, or route. The shipper should also actively view/monitor the shipments on the road. Utilization of this system will allow the shipper to be alerted if shipment is not received when expected.

Proposed Future ORS Efforts on Deployed Type B Containers

The security of radioactive material during transport should not be limited to the security of the conveyance. It is proposed that security measures be implemented on both the conveyance (tractor and trailer) and the packages themselves to provide a holistic approach to security during transport.

Vehicle tracking has been around for almost as long as Global Satellite Positioning Systems have been in existence. While GPS vehicle tracking has become a popular way to monitor the progress of the conveyance, there will always be one major disadvantage in that you are tracking the conveyance and not the package itself. If the package is removed from the conveyance then recovery of the material becomes much more difficult.

Securing the Conveyance

Carriers transporting material for ORS are required to have a security plan in place that establishes their policy for the physical protection of the shipment. This plan also includes procedural steps in the event of theft or attempted theft or other off normal events. In the future, both the tractor and trailer used for ORS shipments will have a GPS tracking system for constant surveillance. In addition, this system will have the capability to be monitored by the ORS shipper's communication center in addition to the carrier. The tractor used for ORS shipments will have duress button, if the duress command is exercised, the alarm is transmitted (real time) to the monitoring facilities and notifications are made to state and local law enforcement agencies. If necessary, both the tractor and the trailer can be remotely disabled via the carriers monitoring facility. The conveyance remains immobilized until re-enabled by the carrier's security officer.

Securing the Package

Once an adversary has been detected, an effective security system is one that provides enough in design delay to slow an attacker long enough for local law enforcement to neutralize the threat. Although there are good estimations in regards to adversary timelines, there is no way to fully measure the effectiveness of a system without extensive knowledge of the threat and an understanding of the local law enforcement response time. While Type B containers have stringent safety requirements, there are currently no security requirements for packages that move high activity radiological material.

NNSA is currently involved in the development and construction of two Type B (U) containers. Theses containers will have additional security measures that exceed the current national and international security regulations. It is important that radiological materials are properly packaged in order to provide the appropriate level of safety, as well as provide some delay and protection against malicious acts. While actively tracking the material itself would be the most ideal solution, the technology necessary to survive the radioactive environment, or to do so through shielding, is problematic. Therefore tracking of the package and providing delay and detection measures are the most suitable option. While active tracking technology is suitable for this purpose, the device footprint may involve batteries, hardened enclosures, and other sensors in order to provide short reporting intervals and detection capabilities. However, one concern for operators is that affixing tracking

technology on the package itself may invalidate the Certificate of Compliance and therefore operators remain resistant to adopting active tracking technology.

435-B Package

The 435-B Type B(U) (USA 9355 B(U)) package was developed and licensed to transport radioactive sealed sources in the IAEA Long Term Storage Shield (LTSS) as well as shielded devices containing radioactive sources. The 435-B package does not supply significant radiation shielding; instead primary shielding is provided by the lead shielding in the LTSS or in the shielded devices. The 435-B package is leak tight and provides containment of the radioactive contents under normal condition of transport and hypothetical accident conditions.

The packaging consists of a base, a bell cover which is bolted to the base, and an internal lodgment which supports the LTSS. Devices are blocked and braced in an inner container for shipment. The 435-B package is approximately 210 cm tall, 178 cm in diameter and weighs a maximum of 4,590 Kg. The package is designed to be transported by ground, air, or by water in non-exclusive use.

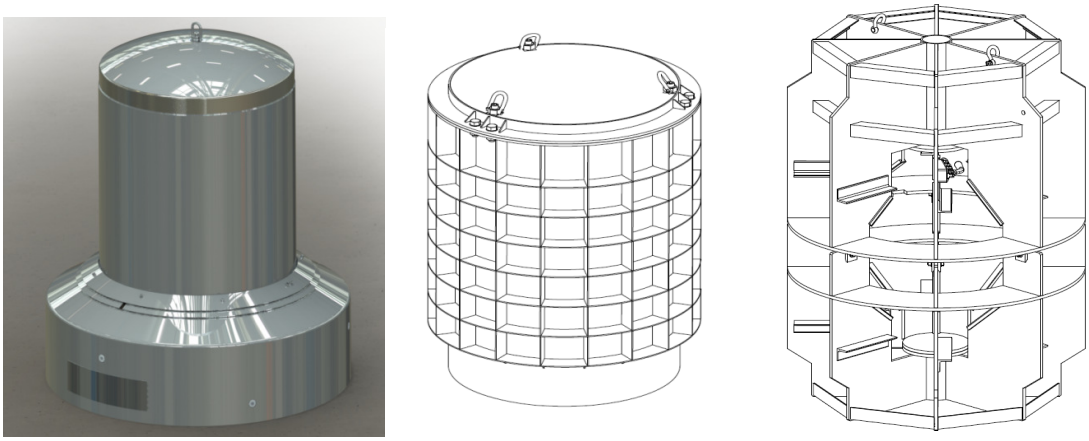

Figure 1: 435-B Type B(U) Package, Inner Container and LTSS Lodgment

The initial design of the 435-B did not incorporate any built in security features or inherent delay. ORS has been working with multiple National Laboratories to add security features that exceed the current national and international mandated requirements. Adding built in security features to the 435-B package after certification is both cost prohibitive and time prohibitive as these changes would require an amendment to the Certificate of Compliance. However, part of the overall transportation scheme for the 435-B package is a tie-down system designed to secure the 435-B package to conveyance. Because this system is not a certified component of the 435-B package it allows for modifications to add additional security measures to the 435-B package after certification. Among the

security features that will be instituted is the installation of a tracking and tamper detection system based on the Transport-Security Tracking and Reporting (T-STAR) system designed by Oak Ridge National Laboratory. This system will allow encrypted tracking, monitoring, and reporting of multiple items of both the conveyance and package. These items include, but not limited to, monitoring and tracking (shortest interval will be 5 minutes – user configurable for longer reporting), attachment to conveyance, presence of vehicle power (if transport is on vehicle providing power); temperature, light level; intrusion detection using a PIR sensor; and intrusion detection using a non-light based motion/range sensor.

380-B

The 380-B Type B(U) package is being developed (design currently under review) to transport radioactive sources contained in a device. The primary shielding is provided by lead shielding of the package and no credit is taken for shielding inherent to the devices. The 380-B package will be leak tight and provides containment of the radioactive contents under normal condition of transport and hypothetical accident conditions. The packaging will consist of a lead-shielded cask body, lead-shielded closure lid, and upper and lower impact limiters. Devices are placed in the cask body for shipment. When loaded and prepared for transport, the 380-B package is approximately 300 cm tall; 254 cm diameter and weighs a maximum of 30,450 kg. The package is designed to be transported by ground, air, or by water in exclusive use.

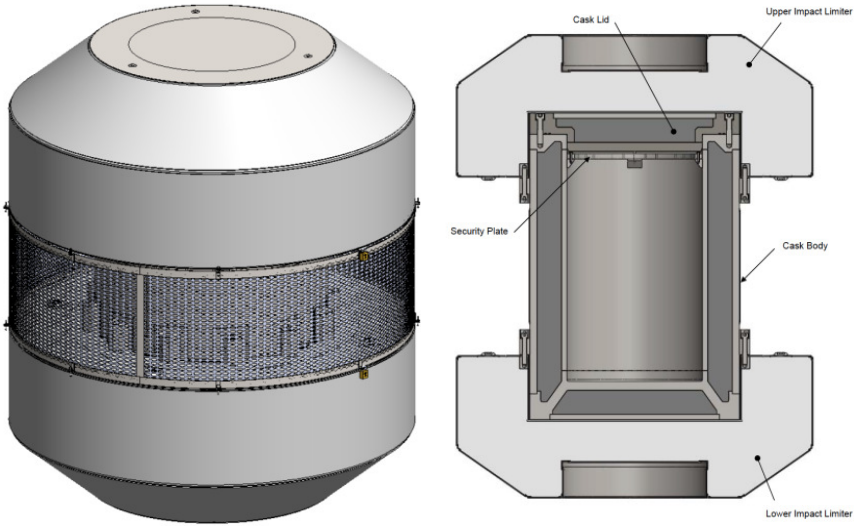

Figure 2: 380-B Type B(U) Package

Unlike the 435-B, ORS was able to design the 380-B with certain security features included in the design. Decisions were made early in the design stages of the 380-B package that the package should be designed to maximize the number of closure bolts beyond what is necessary and the closure bolts should be made of hardened steel. Design specifications also allowed for some means to wire security sensors through closure bolts providing tamper indication in the event a bolt is tampered with or removed.

Based on these requirements, the designers of the cask incorporated the tamper indication devices into the upper impact limiter brackets. The tamper indicator cable crosses the upper impact limiter attachment bolt heads. The bolt heads cannot be accessed without damaging the cable. The tamper indication cable is electronically monitored remotely to detect any changes in status. The designers also maximized the number of closure bolts to 36 closure bolts for the cask lid in addition to the 12 attachment bracket for upper impact limiter. It is also possible to install security locks on each side of the personnel barrier that must be removed to access the impact limiter attachment brackets. Other built in security features that are not obvious when examining the packages were also included in the design. ORS is currently in the process of instituting similar security measures that will be used in securing the 435-B package during transport.

Conclusions

Radiological material is most at risk during transportation and ORS has implemented additional security measures on shipments to both the conveyance and packages that go beyond tracking from location to location. While Type B packages are required to meet stringent safety standards, security has not been a focus of the package design process. This paper has shown that designing security systems that provide delay and detection into packaging is possible and can be accomplished without negatively impacting safety or functionality. ORS has successfully designed two Type B packages (435-B and 380-B) to address both safety and security, which can be used as a model for security by design of packages in the future. By adding these security measures to packages, containers, and vehicles, ORS has increased overall transportation security for domestic and international radiological material movements, as well as retaining public health and safety standards.

Acknowledgments

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