

# ARG-US: RFID System for Management of Nuclear Materials



Model 9975 Drums in Storage

## FEATURES

**Secure** – The system can monitor thousands of drums 24/7 via secured RF/Ethernet links. The system can also track and monitor drums during transport. Any abnormal situation will trigger an alarm for immediate action. Alarm situations include seal tampering, unauthorized move, high temperature, humidity, or shock.

Drum information is stored in tags and archived in local and central servers.

**Reliable** – Tags resistant to radiation ( $\geq 30$  kR); long battery life ( $\approx 10$  yr)

**Sensors** – (Seal Integrity, Temperature, Humidity, Shock, Radiation, Battery Strength) provide alarms, environmental data, and event logs.

**Versatile** – Custom software modules (storage and transportation) are user-friendly and can be easily integrated into existing on-site databases.

Drum information can be retrieved remotely and shared with authorized off-site users via secured Internet.

**Modest Cost** – The system employs mature technology and a commercially available ISO-18000 platform from Savi Technology and other leading manufacturers of active RFID tags for the U.S. Department of Defense. (Cost: approximately 200 USD per RFID tag).

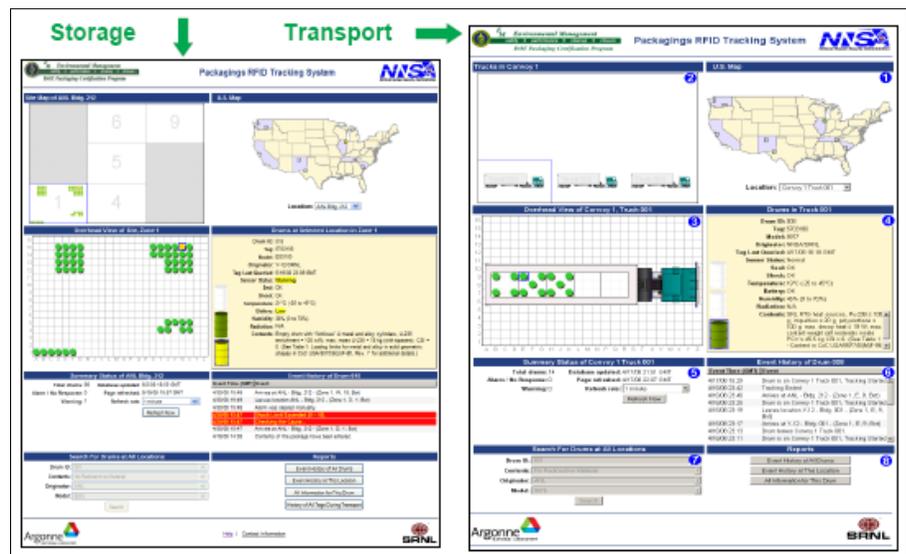
The ARG-US system, developed by Argonne National Laboratory for the U.S. DOE Packaging Certification Program, is the result of extensive hardware and software development. The form factor of the radio frequency identification (RFID) tag has been designed to be broadly compatible with common material packagings and has undergone radiation endurance testing. The sensor suite includes sensors for seal integrity, radiation, temperature, humidity, and shock, and it can be expanded to accommodate additional sensors. Sophisticated battery life management and monitoring extends battery life to 10 years or more.

Two specialized software applications — ARG-US TransPort and ARG-US OnSite — have been developed, providing a powerful, customizable platform for full life-cycle materials management during transport, storage and disposition. The system incorporates secure communications, databases, and web services. Together, these features can significantly improve performance and reduce costs associated with nuclear material operations and the management of aging packagings, while enhancing safety, safeguards, and security.



RFID tags mounted on Models 9975, 9977, 9978, ES-3100, and DOT 7A drums

Argonne tested key features of the RFID tracking system for nuclear materials packagings during storage and transportation in a weeklong, 1700-mi demonstration in 2008, followed by a 300-mi mini-demonstration in 2009, and a road test in 2010 after completing system integration of the ARG-US RFID equipment and Qualcomm satellite communication equipment (OmniTRACS) in a government-owned truck. In October 2010, Argonne completed the integration of the ARG-US RFID technology with DOE's TRANSCOM, the established satellite tracking and communication system for radioactive material shipments across the country.



Sample web pages for tracking packages in storage and transportation

Five DOE sites and national laboratories have acquired ARG-US RFID systems for ongoing field testing and applications in storage and transportation. In 2010, a pilot RFID Command Center was established at Argonne to support continuing device and system development and growing applications in civilian nuclear fuel cycles and other high-risk materials.

In April 2011, ARG-US was chosen by an industry panel to receive *RFID Journal's* prestigious "Most Innovative Use of RFID" Award. ARG-US was also selected as a finalist to present at the 2011 World's Best Technology Innovation Marketplace, a preeminent technology forum.

<b>Physical</b>	Width:	200 mm (7.9 in.)
	Length:	150 mm (5.9 in.)
	Thickness:	30 mm (1.2 in.)
	Weight:	≈860 g (1.9 lb)
<b>Environmental</b>	Temperature:	-32°C to 70°C (-26°F to 158°F)
	Humidity:	100% non-condensing
	Vibration and Shock:	MIL-STD-810E Method 514.4, Category 10
	EM Emissions:	HERO-certified
<b>UHF RF transceiver</b>	Frequency:	433.92 MHz
	Range:	91 m (300 ft) line-of-sight
	Data rate:	27.8 Kbps
	Protocol:	Savi EchoPoint Air Protocol 2.1, Draft standard for ISO 18185
<b>LF RF receiver</b>	Frequency:	123 KHz
	Range:	3.7 m (12 ft)
	Protocol:	Savi EchoPoint Air Protocol 1.1
<b>Network</b>	Wireless:	RF read/write capable
	Wired:	Sensor expansion port and serial read/write capable
<b>Memory</b>	User memory:	128 KB non-volatile
	Sensor memory:	128 KB non-volatile
<b>Power</b>	Battery type:	3.6-V primary lithium (Li-SOCl <sub>2</sub> ), A-size
	Battery number:	4
	Battery life:	>10 yr, depending on usage
	Battery status:	Report normal or low
<b>Sensor</b>	Seal:	Detect tampering via change in seal bolt tension
	Shock:	Detect and record vibration above threshold
	Temperature:	Detect and record abnormal thermal condition
	Humidity:	Detect and record abnormal humidity condition
	Radiation:	Detect and record dose and dose rate of gamma radiation field

**Web:** <http://rampac.energy.gov/RFID/RFID.htm>

## About the DOE Packaging Certification Program

Dr. James M. Shuler  
*Manager, DOE Packaging Certification Program*  
 U.S. Department of Energy  
 Office of Packaging and Transportation  
 EM-45, CLV-2047  
 1000 Independence Ave., SW  
 Washington, D.C. 20585  
 301-903-5513  
 301-903-9770 fax  
[James.Shuler@em.doe.gov](mailto:James.Shuler@em.doe.gov)

## Contact

Dr. Yung Y. Liu  
*Manager, Packaging Certification and Life-Cycle Management Group*  
 Decision and Information Sciences Division  
 Argonne National Laboratory  
 9700 S. Cass Ave., Bldg. 221  
 Argonne, IL 60439  
 630-252-5127  
 630-252-5715 fax  
[yyliu@anl.gov](mailto:yyliu@anl.gov)