



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); battery life ( $\approx 10$  yr)

Sensors (seal, temperature, humidity, shock) provide environmental history 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 a secured network.

**Modest Cost** – The system employs mature technology and a commercially available platform from Savi Technology. ( $\approx 200$  USD per RFID tag)

The Packaging Certification Program (PCP) of the U.S. Department of Energy's (DOE's) Environmental Management (EM), Office of Packaging and Transportation (EM-63), has developed a **Radiofrequency Identification (RFID)** tracking system for the management of nuclear material packages during storage and transportation. The system, developed by Argonne National Laboratory, involves hardware modification (e.g., form factor, seal sensor, and batteries), application software development, secured database and web server development, and irradiation experiments. Argonne tested key features of the RFID tracking system of nuclear materials packagings in a recent week-long, 1700-mi demonstration. Both the hardware and software platforms were verified to be stable and meeting the performance requirements. The PCP and national laboratories are working on several RFID system implementation projects at DOE sites, along with continuing device and system development and widening applications.



RFID tags mounted on Models 9975, 9977 and ES-3100 drums

Sample web page for tracking packages in transportation



<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 lbs)
<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
<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:	32 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 electrical resistivity
	Shock:	Record and detect acceleration above threshold
	Temperature:	Record and detect abnormal thermal condition
	Humidity:	Record and detect humidity above threshold
	Radiation	Under development

**Web:** [http://www.dis.anl.gov/projects/rfid\\_tech.html](http://www.dis.anl.gov/projects/rfid_tech.html)

**About the Packaging Certification Program**

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