REMOTE MONITORING OF
Alpha Gamma Hot Cell Facility by ARG-US RFID System

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OVERVIEW

- Argonne has developed an active Radio Frequency Identification (RFID) system for monitoring and tracking sensitive nuclear packages. The system is called ARG-US ("Watchful Guardian") RFID.
- ARG-US RFID has been in fielding-testing and applications at selected U.S. Department of Energy (DOE) sites since 2010.
- To demonstrate that the system can monitor nuclear and radiological facilities as well, a compact ARG-US RFID system was installed in the Alpha Gamma Hot Cell Facility (AGHCF) at Argonne in 2013.
- AGHCF is a Hazard Category 2 non-reactor nuclear facility that is being decommissioned.
- The deployed ARG-US RFID system includes an in-cell rover/robot and monitors worker areas, material transfer area, and cell exhaust HEPA filters. The system is performing as designed and providing information that assists in the facility operation.

ARG-US RFID SYSTEM

- The ARG-US RFID system consists of:
  - Battery-powered RFID tags
  - A reader network
  - An application software suite
  - Secured database servers
  - Storage and transport web applications
  - Tag-initiated communication and alarms
- The tags can house a full suite of sensors:
  - Temperature
  - Humidity
  - Shock
  - Seal integrity (tactile sensor)
  - Loop seal
  - Radiation (gamma and neutron)

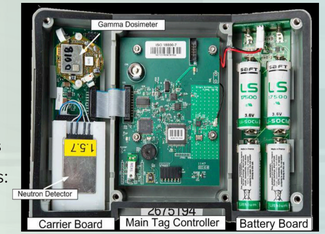


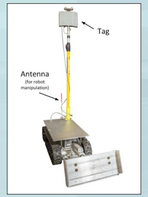
FIGURE 1. The ARG-US RFID tag, shown with the metal back-plate removed. (The tactile seal sensor and loop seal are not shown.)

REMOTE SPATIAL RADIATION SURVEY OF THE AGHCF

- The decommissioning process involves cleaning up the hot cell; obtaining information on the amount and distribution of radioactive material inside is necessary.
- Robotic surveying is remote and mobile, which improves safety and efficiency and decreases cost, among other benefits.

FIGURE 2. Alpha Gamma Hot Cell work stations.

- The ARG-US RFID system obtained the radiation levels at locations in the cell that is not possible otherwise (see below).
- A small treaded remote-controlled robot enables movement.
- The base of the compact robot is about the same size as a piece of hand-carried luggage for air travel.
- The ARG-US RFID tag is mounted at the top of a pole, the height of which is adjustable, as shown in Figure 3.



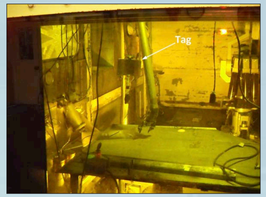
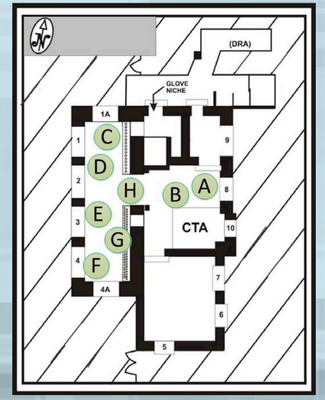


Figure 3. (a) Robot used for remote in-cell survey. An ARG-US RFID tag is attached at the top of a mounting pole. (b) The robot is seen through a cell window.

RESULTS OF IN-CELL ROBOT SURVEILLANCE

- At location D, the radiation level measured by the robot/tag was ~11 R/h.
- The ARG-US RFID system allows radiation levels in the cell to be measured for the first time.
- Workers can use the data to plan and verify progress on the removal of highly radioactive waste from the hot cell.
- Most importantly, prudent planning and verification processes can now be performed without subjecting personnel to high radiation.



Robot path (in time sequence):

A	0.26 R/hr
B	0.5 R/hr
C	4 R/hr
D	10.8 R/hr
E	6 R/hr
F	6 R/hr
G	6 R/hr
H	5.4 R/hr

Figure 4. The radiation levels measured at different locations of the AGHCF. Location D is where most fuel sectioning was performed in the past.

DATA FROM CONTINUOUS FACILITY MONITORING

- The neutron count rate and counts exhibited occasional spikes that were due to source materials being processed in the CTA on the corresponding dates.

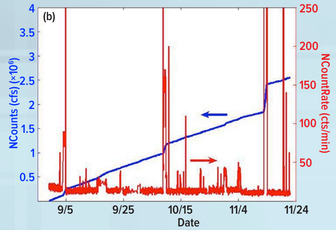


FIGURE 5. Neutron count rate and counts at the Clean Transfer Area (CTA).

BENEFITS AND FUTURE

- Remote monitoring of the AGHCF by the ARG-US RFID system began in August 2013 and is continuing. Radiation levels for the entire facility are mapped in real time 24/7.
- Remote monitoring with a fixed reader network for the facility and a mobile robot for the hot cell greatly enhances safety and efficiency and decreases cost, among other benefits.
- Deployment of a robot with an ARG-US RFID tag inside the hot cell captured crucial radiation data previously unobtainable. Additional testing is under way to extend the data transmission capability with an external antenna.
- The ARG-US RFID system demonstrated performance and reliability in remote monitoring of the AGHCF, lending credence to its use at other radiological facilities.