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Labs Use EPC Gen 2 Tags to Manage Biological Samples

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The FreezerPro system enables researchers to pinpoint the locations of frozen human tissue, viruses and other materials stored within vials or plates packed in boxes.

By Claire Swedberg

Jan. 4, 2010—Two biomedical research laboratories that store human biological matter are using an RFID-based system to enable the tracking of frozen tissue and cells, as well as hazardous matter, while minimizing the need for lab personnel to handle the substances. The system, known as FreezerPro, is provided by Frederick, Md. company RURO, and is designed for the frozen sample storage market, in order to allow a user to know which items are stored in its freezers, what has been removed and when, and to easily locate them. Samples are typically inserted into clear, tube-shaped plastic vials placed in storage boxes. In high-volume labs, however, samples are also put in plates—flat plastic trays that have wells in which samples are placed. The plates, measuring approximately 2.5 inches in width and 4 inches in length, are stacked one on top of another in storage boxes, in quantities of up to nearly 400. Regardless of whether vials or plates are used, a freezer may contain thousands of samples.

The labs that have adopted RURO's system are storing samples in vials. By utilizing the system, the facilities have better security over their samples, which can include highly hazardous substances, such as frozen bacteria or viruses, as well as valuable items, such as material for stem-cell research. They can also use the system to complete storage audits quickly. Both laboratories asked not to be named for this article.

Doug Milliken, RURO's sales director

Historically, cold-storage labs face challenges tracking substances stored in vials within boxes that are, in turn, placed in freezers. Samples are stored at between -90 degrees and -190 degrees Celsius (-130 and -310 degrees Fahrenheit). Most vials and plates are either identified with a serial number or description handwritten on their exterior with a pen, or a bar-code label wrapped around them. The sample containers are stored in boxes that can contain between 64 and 100 samples. To ensure that a specific sample is where it should be, and to be sure the wrong sample is never removed, lab technicians must maintain a close inventory of which container is in which location. Whenever a vial is removed, its serial number must be recorded, or a bar-code label must be scanned to ensure that the proper sample has been taken out. In both cases, the build-up of frost on a container makes that task difficult. Frost often needs to be removed by hand to identify a vial, explains Doug Milliken, RURO's sales director. The over-handling of many such samples is undesirable, however, due to the hazardous nature of what is stored inside.

With the FreezerPro system, the labs use desktop readers and adhesive RFID labels attached to the exterior of each sample container. On every container's FreezerPro label, the labs print a bar-coded serial number provided for redundancy, as well as human-readable text regarding the sample, and also

encode a unique ID number onto the label's embedded EPC Gen 2 passive ultrahigh-frequency (UHF) RFID tag (manufactured by Partnered Print Solutions). The samples are stored in boxes fitted with RFID tags encoded with unique ID numbers. FreezerPro software links the ID number of each box's tag with that of the tag attached to the particular sample container inside that box. As new vials or plates are created, the labs encode and print the labels on a Zebra Technologies printer, and then attach them. Once the labels are attached and the samples are placed in a box, the box simply needs to be placed on a reader, and the software can then capture all of the sample ID numbers, sparing the staff from having to remove specific samples to check their identity.

One of the two laboratories began utilizing the system about one year ago, and is now tracking approximately 30,000 samples of human biological material. The facility chose the RFID system to reduce the amount of handling necessary for verifying the proper usage of the correct sample for research work, and for decreasing the time spent taking inventory of the freezers. The lab must track the items when performing audits, which are conducted at least once annually.

There are as many as 50 researchers working in the facility, and tracking each vial to ensure it was safely stored had been the lab's greatest challenge. With the new system, researchers can simply sign into the FreezerPro software, which resides on the laboratory's back-end system, and key in the particular item they seek to work with. According to Milliken, the software will then indicate in which freezer the item is located (this data must be input by the individual who put the sample away), as well as in which box.

The lab has three Impinj Speedway desktop RFID readers—two installed in the freezer storage area, and one in the lab itself. When a sample is removed from the freezer, a technician takes the entire box to the interrogator and places it on top of the device. The reader captures the tag ID number of the box, as well as those of all the samples within, then sends that information to the FreezerPro software, which interprets those ID numbers and displays the results on a computer monitor, including an alert if any samples are missing, or if they have been placed in the wrong box.

The software displays a map of the box, with each storage space within that box showing a colored icon indicating the type of sample within the container stored in that space. It also identifies whether the sample the researchers seeks is in that box. In that way, each box need not be opened when vials are being searched for. When the box is returned to the freezer, it is once again placed on the desktop interrogator, which reads the ID numbers of the box and vial RFID labels, then sends that data to the FreezerPro software, thereby indicating the items have been returned to the freezer.

The second laboratory, which is storing samples for the U.S. military, is employing the system similarly to the first lab. The facility began using the system about five months ago. In this case, security is the highest priority, and the system is in place, first and foremost, to ensure samples are where they should be located. The researchers know, at each scan of every box, whether all vials are accounted for. In that way, by performing frequent inventory counts, staff members can know that a sample is missing, and can reduce the amount of time spent searching for vials that are not in the container in which they

were expected to be found. The lab uses two FreezerPro readers to track approximately 2,000 samples.

The RFID labels cost around $1 apiece, Milliken says, while the software is priced at about $5,000, the Zebra encoder carries a price tag of $6,000 and Impinj readers range between $4,000 and $6,000 each. Creating a system that works at the temperatures of the laboratories was a challenge for RURO, Milliken says. Impinj, Partnered Print Solutions and RURO thus worked together to develop tags that could be read at extremely low temperatures, through a layer of frost. The tags are also capable of being read in the presence of liquid nitrogen.