Providing the Professional option for your Business Needs

TECHNETIUM
ASSET TRACKING AND MANAGEMENT

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White Paper – RFID vs BARCODE

Case for the use of RFID with Medical Waste Containers

There is no doubt that barcodes will remain a prominent auto-ID solution for the foreseeable future. However, in an increasingly competitive corporate environment, organizations are looking to yield new levels of efficiency and attempt to gain, not only cost reductions but also a competitive edge and improve their market share – and many organizations are starting to do so with RFID.

Barcode	RFID
Require line of sight to be read	Can be read without line of sight
Can only be read individually	Multiple tags can be read simultaneously
Could be impaired if damaged or dirty	Can cope with harsh or dirty environments
Cannot be updated	New information can be over-written
Require manual tracking and therefore are susceptible to human error	Can be automatically tracked removing human error

"If RFID is truly more efficient, why hasn't it replaced barcoding entirely? Like all technologies, RFID has its limitations – and so does barcoding."

RFID has clear advantages over barcodes when it comes to durability and longevity, security and efficiency. But RFID has disadvantages, too, and there are situations where barcoding is far more practical.

- **RFID Tag Type: Active vs Passive tags – Costs**

Cost is a significant factor in determining the viability for the use of RFID in the management of medical waste containers. Cost is one of the main obstacles to RFID technology for many businesses. A typical barcode label costs a few US cents each, while an RFID tag can run from one dollar upwards of 30 dollars or more, depending on the type of tag you need. RFID readers systems can be ten times more expensive than barcode scanners.

In addition to the cost of the RFID tags and readers, RFID implementations are significantly more expensive and complex than a barcoding system.

Given the two types of RFID tags – active tags differ from passive tags in that they incorporate a battery and offer greater reading distance. The base cost of an active tag with battery is in the order of 5 dollars to 15 dollars each dependent on volume, the amount of memory on the tag and the packaging of the tag. At these cost levels it would be considered to be too costly to even be considered a viable option for containers that cost under 10 dollars. The base cost of a passive tag is generally in the range of around 30¢ to 1 dollar per tag depending on the volumes involved. At this rate it could be viable for reusable containers but may still prove to be too expensive for disposable containers.

An RFID solution has to work for both reusable and disposable containers, otherwise the client would need to run two separate systems for container tracking (RFID and barcode). Not only would this defeat the prime purpose of implementing RFID, but this would add significant operational complexity in terms of training, system deployment, maintenance and additional operational cost.

- **Container selection (RFID vs Barcode) – handheld scanners and auto-readers**

While RFID is well known for its ability to scan multiple items at once, this isn't always an advantage. In large warehouses, an RFID reader can scan all tags within its range, which doesn't work well if you're only trying to scan items from a specific shipment or in a certain location on the floor.

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The major benefit promised by RFID is the automatic scanning of containers without the need for manual intervention. The basic premise is the placement the containers all together on a single pallet or in a truck and to read them simultaneously. This would require RFID reader systems installed at all scanning points including operation sites, on each truck and possibly at the client's locations. Typical installations include the RFID reader hardware, cabling for power and data, instillation of antennas.

- At operational sites: This would require a dedicated area for container handling which is isolated from other containers so as not to inadvertently read non-selected containers.
- On the trucks: The possible problems here are twofold. Firstly, this creates separation problems when dealing with mixed loads (empty and full containers) as they could inadvertently be read together. Secondly, if a 3rd party hire truck is used as a temporary replacement for an out-of-service truck, the truck reader would have to be transferred, or additional hardware would need to be kept on hand which can be installed or removed as required.
- At the client's locations: Each site would require a dedicated area for container handling. If the user services a significant number of locations this option could be problematic, both from a cost and a physical logistics perspective.

What is easily achievable with a handheld scanner can prove to be somewhat of a challenge using an automatic RFID reading system. While barcoding can't scan multiple items at the same time, it offers more accuracy and reliability compared with RFID. Since a barcode scanner captures each barcode individually, you don't have to worry about accidentally scanning the wrong container or more items than intended. Further challenges include capturing the status of individual containers such as non-compliance (broken, overfilled, not sealed properly), the inability to determine and capture the direction of a load in or out of a location, the ability to capture digital signature from clients. In order to efficiently manage medical waste containers in the field there would still require the addition of RFID hand-held scanners, which would then negate the primary value of RFID and limit the benefit over barcode scanning. It should be noted that RFID enabled handheld scanners are significantly more expensive than barcode scanners.

➢ **Accuracy of RFID – Signal interference and environmental issues**

The physics of RFID plays a critical part in what makes a project a success or failure. Because RFID tag performance varies as a function of tag type, orientation, range, substrate and the material to which the tag is affixed, many interdependencies exist between the physics of RFID and business process objectives. Passive UHF technology is not perfect. Radio waves are affected by the presence of liquids (anatomic waste) or metal (sharps, needles and blades), interference from other RF devices and so forth.

> *"Providers of passive radio frequency identification systems often boast in a perfect environment read rates of 99 percent, or a similar statistic just below 100 percent. However, this number can drop below 85% in the real world."*
>
> ** The Truth about RFID Read Rates – RFID Journal May 2013*

Tags do not always work as expected. This may be due to a number of issues: the wrong tag design being selected for the job, the tag placed in the wrong location, or masked by some interference, e.g. metal, cabling etc.

RFID tags are tuned electronic circuits requiring a special match between the tag's antenna and its internal circuitry, called complex conjugate. Outside interference can impact on the effectiveness of the tag signal. Typically, waste management involves a large number of sites that the user drops off at and picks up from. It would be difficult to quantify what environmental problems might be encountered at each site.

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With barcoding, you still need to consider the application and surface on which your label or tag will be used, but a barcode won't simply become unreadable based on the material or contents of the item. RFID requires different types of tags depending on the characteristics of the item itself, whereas one type of barcode label can be used on different assets.

The nature of the medical waste disposal industry requires near 100% accountability. Environmental legislation and client liabilities determines that even accuracy figures as high as 85 - 90% may not be acceptable, both from a compliance point of view as well as for billing.

- **Final Thought**

RFID lends itself well to in-facility tracking ("under roof management") as well as conveyor belt style tracking with its standard alignment and positioning of items. The nature of the tracking solutions with regards medical waste is such that human intervention is required in the business process, e.g. document signing, visual inspection and handling of containers. Unlike auto RFID scanning environments, a handheld scanning solution allows for this level of required interaction and the corresponding complexity.

Given that there would still need to be handheld scanners deployed and possibly barcodes even with a full RFID scanning system, the added benefits are offset by the additional costs and efforts it requires.

While RFID is a powerful technology, the implementation and use require careful planning. An in-depth analysis and conversation need to be had with customers that think they need an RFID system, to determine whether the complexity and expense makes it infeasible for their business. Whether you choose barcoding or RFID depends largely on the security and durability requirements of your application and the time and money that your business is prepared to spend.

BARCODES VS RFID AT A GLANCE

		BARCODES	RFID TAGS
COST	Barcode scanners and labels are usually the cheaper option.	✓	X
GETTING STARTED	The complexity of hardware selection and encoding can make RFID harder to implement.	✓	X
ACCURACY	Both technologies have strengths and weaknesses here depending on the environment and application.	✓	✓
RANGE	RFID often has a superior scanning range and does not require a direct line of sight.	X	✓
DATA STORAGE	RFID tags can hold a lot of data although this often isn't necessary when the data is stored centrally via your software.	X	✓
SPEED	RFID allows a higher read rate than barcodes.	X	✓
UNIVERSALITY	Barcodes are largely universal, but RFID frequencies and types vary across applications and regions.	✓	X