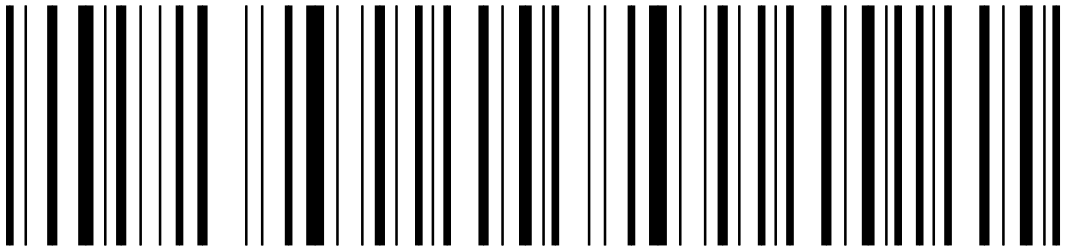
Beyond Point of Care:

Benefiting from Unit-of-Use Bar Code Traceability in the Life Sciences Supply Chain



APPLICATION WHITE PAPER

Zebra Technologies

Executive Summary

Enthusiasm for the tremendous patient safety benefits unit-of-use bar code pharmaceutical labeling can provide should extend throughout the life sciences supply chain. While unit-of-use labeling will position health services providers to ultimately make improvements to patient safety, pharmaceutical manufacturers and distributors are better positioned to enjoy more immediate benefits.

A thoughtful approach to meeting impending FDA unit-of-use labeling requirements, by pharmaceutical manufacturers, relabelers, repackagers and distributors can create new processes that will provide unprecedented control and efficiency for recalls, returns processing and inventory control. By reading unit-of-use codes, instead of just printing them for customers, companies can gain supply chain visibility and improve the quality of their information. A major benefit to data entry by scanning will be sharply reduced labor and effort required to comply with the myriad regulations covering the transport and storage of controlled substances, including the FDA's Good Manufacturing Practices (GMPs), 21 CRF Part 11 Electronic Signatures Rule and the Safe Medical Devices Act (SMDA).

Many benefits can be gained through process changes that take advantage of information available on unit-of-use labels with little incremental labeling or equipment costs. This white paper will:

- Present an overview of the proposed FDA rule for unit-of-use bar code labeling that is scheduled to become mandatory in 2006.
- Summarize recommendations and comments from leading pharmaceutical and medical associations.
- Describe how variable-information labeling can improve regulatory compliance, recall management, distribution and returns, production control, product authentication, customer service and other operations for manufacturers and distributors.
- Describe the printing and process changes pharmaceutical manufacturers need to take advantage of unit-of-use bar coding.

Introduction

On March 13, 2003 the FDA announced a proposed rule that would require unit-of-use pharmaceutical packaging to be labeled with the National Drug Code (NDC) number encoded in a bar code. The FDA plans to issue its final rule by the end of 2003 and proposed that it take effect three years after it is finalized.

The FDA also proposed to allow, but not require, drug makers to encode other information in the label, including lot number and expiration date. In the proposed rule (FDA docket 02N-0204) published in the Federal Register, the FDA acknowledged that encoding lot numbers and expiration date could improve recall management and provide other benefits, but stopped short of requiring variable data because of the scope of its effort. The document reads in part: "We agree that bar code may be useful outside the medication error context, but our rule focuses on the use of bar code to prevent medication errors."

Many pharmaceutical manufacturers will begin unit-of-use bar code labeling to comply with the FDA rule or because of customer requests. By focusing only on the compliance requirement, manufacturers may overlook

opportunities to improve their own production, record keeping and distribution operations. There is precedent for this adoption pattern in the retail industry, where mandatory compliance labeling programs first surfaced and has been followed in wholesale, automotive, aerospace and other industrial markets. Industries with mature compliance labeling programs in place now have some of the most sophisticated distribution and production systems in the world, in part because all segments of the supply chain have learned to take advantage of easily accessible information available from the bar code.

Early adopters in the pharmaceutical industry, including Abbott Laboratories, Baxter Healthcare and Pfizer, have envisioned these benefits and have implemented variable-information unit-of-use labeling programs that exceed FDA recommendations. These leaders envision tremendous benefits from variable-information printing and are investing to attain them.

The National Coordinating Council for Medication Error Reporting and Prevention (NCCMERP), whose members include the American Pharmaceutical Association, American Medical Association, Healthcare Distribution Management Association (HDMA), Generic Pharmaceutical Association, Institute for Safe Medical Practices, Pharmaceutical Research and Manufacturers of America (PhRMA) and United States Pharmacopeia, recommends that lot or batch control number and expiration date be encoded in the unit-of-use label in addition to the NDC.

Putting lot numbers and expiration dates in a bar code makes it easy to record the information accurately and automatically at any point in the supply chain. This capability improves data accuracy, while reducing the effort needed to record and transcribe the information. The healthcare industry spends $23 billion annually on order management, distribution, transportation and inventory management. Approximately $11 billion of these costs are unnecessary – caused by redundant, non-value-added activities according to a 1997 study on Efficient Healthcare Consumer Response (EHCR). Manufacturers and distributors can help drive these costs out of the supply chain, rather than shifting them to downstream partners, by using automated systems for data capture and communication. The following section describes how encoding lot numbers and expiration dates at the unit-of-use level can enable new processes that improve efficiency.

Applications

For many pharmaceutical manufacturers, the supply chain is the only place where their products are not tracked at the batch or lot level. Production management, enterprise resource planning, environmental health & safety monitoring and other systems frequently provide or require lot-level traceability. To maximize the quality management and safety benefits, it makes sense to extend batch-level traceability to the final product at the unit-of-use level.

In regulated environments where traceability is required, entering data by bar code scanning is highly advantageous because it creates 100 percent accurate electronic records. Studies have found skilled typists make an error once every 300 keystrokes, while the error rate for bar code scanning is estimated at one in one million characters. Data can be entered in much less time by scanning than by manual recording, and scanned data can be transferred to any database or software application without further manual data entry. For non-regulatory applications, encoding variable information at the unit-of-use label provides new levels of visibility and control.

The following examples describe potential benefits from using bar code scanning to automatically enter lot numbers or expiration date information into computer systems.

Recall Management

It would be nice if drug recalls were rare and isolated events, but in fact they are a common and costly occurrence in the pharmaceutical industry. The FDA's Office of Compliance, Center for Drug Evaluation reported 1,230 Type I and II drug recalls from 1997 to 2002, an average of 3.9 per week for the full six-year period. Recalls create extensive administrative and logistics burdens that have an immediate impact on operations. The long term cost, measured by reduced consumer and physician confidence, lost sales, and impact on share prices, depends in part on how quickly and efficiently the recall is handled.

The effectiveness of recall management is a direct result of the level of product visibility in the supply chain. The amount of information included on unit-of-use packaging can make the difference between a general, mass recall with notices going out in newspapers and TV news, and a highly targeted, limited recall where consumers may receive notification by a phone call from their own pharmacist or doctor. By marrying lot codes on unit-of-use labels with electronic records created by production control software systems, manufacturers could conduct a recall like this: "We are recalling 50mg tablets of Ourdrugicol, lot number 0123456789, made on March 19, 2003, between 8 a.m. and 1 p.m. on production line 2 at our Anytown, NJ facility. These products were shipped to Acme Drug Distributors warehouses in Memphis, TN and Columbus OH. No other products are affected."

Encoding lot numbers and expiration dates on the unit-of-use packaging enables manufacturers and distributors to trace specific products to specific customers. Production control systems and auditing procedures enable manufacturers to isolate quality or compliance problems at the batch level. By enabling batch-level traceability throughout the supply chain, specific quantities and shipments can be recalled. This degree of traceability limits the logistics handling costs and administrative burden, so recalls can be resolved more quickly. The audit trail would also limit liability exposure and prevent lawsuits from unaffected individuals. When returned products are received, lot codes can be efficiently checked with a bar code scan, so unaffected products can quickly be redistributed.

Returns Management

Variable information unit-of-use printing could have similar effects on returns management, although the benefits should be greater and more immediate because returns are part of everyday business. The pharmaceutical industry handles $2 billion worth of returns annually, according to a study by the Healthcare Distribution Management Association (HDMA). Poor record keeping and the inability to provide audit trails in reverse logistics creates inefficiencies and losses from otherwise acceptable products that can't be redistributed. The scope of the returns management task no doubt is one reason the HDMA's position paper on bar coding includes the following recommendation: "Use bar codes internally wherever possible. Use of bar codes to identify healthcare products has been shown to reduce labor costs in distribution and dispensing while, at the same time, reducing errors."

Pharmaceutical returns may be subject to regulations from the FDA, DEA, EPA, OSHA, and the U.S. Department of Transportation plus state and local transportation and biohazard laws. One of the best ways to collect the information and create the audit trail required to satisfy these regulations is to scan items with bar code readers, which can easily be programmed to attach a date-and-time record to every transaction. Lot-level scanning with the automatic time-and-date stamp creates traceability and produces tremendous time and labor savings for data recording.

By setting shipping or database systems to record shipments to customers by specific lot number, manufacturers and distributors can quickly verify that they are receiving authorized returns by scanning an item label. This practice could also help detect unauthorized or counterfeit products. Scanning expiration dates will enable companies to quickly determine if products are eligible for return and if returned products can be redistributed or require disposal or special handling.

Manufacturing Operations

Enterprise resource planning (ERP), manufacturing execution systems (MES), compliance and reporting systems all need accurate, timely data. Many production facilities already use bar codes to provide the data automatically, accurately and efficiently, track work in process, and provide electronic signatures, batch records and other documentation. However, if lot numbers aren't included on the final product, the link to the electronic record is broken and many of the traceability benefits are gone.

Encoding lot numbers in the unit-of-use packaging and marrying the information with electronic production records can satisfy 21 CRF Part 11 (Electronic Signatures Rule) reporting requirements and provide traceability by raw material batch, manufacturing equipment, time of production, equipment operator and other variables. This data is extremely helpful for recalls but can also be used for process analysis, quality control and other purposes. Manufacturers already track production by lot or batch. By expressing this information in a bar code, they are able to extend their audit trail, realize the full value of their enterprise applications, and enable new applications throughout the supply chain.

Inventory Management

Many pharmaceutical distribution operations are highly automated and make extensive use of bar coding. Meaningful improvements and cost savings are possible by leveraging the scanning infrastructure to process expiration dates in unit-of-use bar codes. Coupled with changes to database and inventory control software applications, automated entry and tracking of expiration dates would lead to improved stock rotation, better compliance with first-in/first-out (FIFO) handling practices, and reduced losses from expired products.

Including expiration dates with sales records could improve customer service and create new sales opportunities. For example, a software application could automatically send notification to customers when products near the expiration date. The message, or a follow-up contact by a salesperson, could also ask if customers need to reorder to cover potential shortfalls caused by expiration. The program would help customers manage their own inventories, increase sales and reduce the need for special handling rush orders.

The increasing use of break-pack shipments means that manufacturers and distributors can't rely on case or shipping container packaging to provide lot traceability. Scanning the unit-of-use label and entering a product quantity can replace outer-pack scanning to maintain traceability. The process also automates and simplifies billing for less-than-case quantities.

Product Authentication

Unit-level traceability can play an important role in fighting product counterfeiting and diversion. The International Federation of Pharmaceutical Manufacturers' Associations (IFPMA) estimates that 2 percent of worldwide pharmaceuticals are counterfeit, and the figure is on the rise. Encoding lot numbers at the unit-dose level can aid efforts by pharmaceutical manufacturers and law enforcement agencies to protect legitimate distribution channels and detect diverted or counterfeit products.

Manufacturers and distributors can prevent return fraud and detect diverted products by recording lot numbers that are sold to specific customers, as was described in the previous sections on recall management, inventory control and returns management. When items are presented for return, they would be scanned to record the lot number. A database lookup would verify whether or not the product was sold to the customer, so the return could be authorized or refused.

A similar application could help detect the source of diverted products. When diverted products are recovered, authorities could check database records and follow the audit trail to see who last had possession of them.

Sample Management

U.S. pharmaceutical companies spent more than $4 billion in 2000 managing sample distribution and related record keeping and administrative tasks, which does not include lost sales time from reps, who spent an average of 5.5 hours per week completing sample-related paperwork, according to a series of studies. Despite the time and money spent on sample management, more than 80 percent of survey respondents said their information was not accurate.

Companies could improve the quality of their data, limit their risk of being out of compliance with the Prescription Drug Marketing Act (PDMA) and reduce data entry administrative requirements by instituting bar code scanning as part of sample distribution procedures. Sales representatives with scanner-equipped PDAs or laptops could automatically record the receipt and disbursement of all samples. The scanning process would save considerable data entry time, and the captured information satisfies PDMA compliance requirements.

Implementing Variable Data Labeling

The applications described above require changes to business processes, databases and application software to take advantage of lot numbers and expiration dates encoded on unit-of-use packaging. The extent of these changes and the time, money and effort required to implement them is specific to each company based on the desired applications, functionality and existing information system infrastructure. Companies must set their foundation for future applications by selecting a bar code symbology and the most appropriate print technology to support variable data unit-of-use labeling.

Symbology Choices

The FDA's proposed rule did not specify which symbology should be used for unit-of-use labeling, creating the likelihood that multiple symbologies will be used when the rule takes effect. However, the FDA did specifically disallow the use of two-dimensional (2D) symbologies, including Data Matrix and PDF417, which severely limits options for space efficiently encoding lot codes and expiration dates. Fortunately, the reduced space symbology (RSS) family is an outstanding option for encoding variable data at the unit-of-use level, and is also an excellent choice for all unit-of-use labeling applications. Other commonly considered symbologies include Code 128 and Code 39, which are already widely used in the pharmaceutical industry.

Many packaging engineers already have experience using Code 128 and Code 39 symbologies for outer pack labels. Neither Code 128 nor Code 39 scales well, making them unsuitable for small-item identification. For example, encoding an NDC number would require a Code 39 or Code 128 symbol of well more than an inch long and by 0.25 inch tall. Adding the lot number or expiration date would add significantly to symbol size. Most unit-level packaging doesn't accommodate these minimum symbol sizes, making Code 128 and Code 39 poor choices for the application.

The RSS family of symbologies was created specifically to help identify the 10% of pharmaceutical products a UCC/EAN study found are unsuitable for marking with traditional symbologies. RSS Stacked enables an ID code, lot number and expiration date to be encoded in a symbol less than an inch wide. Other symbologies in the RSS family provide options for additional space savings and data capacity. Most legacy, low-cost scanners used throughout the supply chain can easily process RSS symbols, which gives RSS cost and adoption-time advantages over other symbologies.

Zebra recommends the use of the RSS family for all unit-of-use bar code labeling. RSS is the ideal medium for unit-of-use pharmaceutical bar coding because it is the most space efficient option, which gives packagers maximum flexibility for symbol design and placement. RSS is also supply chain friendly, because it can be read with many legacy bar code readers, making it convenient and cost effective to use. Most importantly, RSS has been proven effective in the real world by dozens of early adopters in all segments of the industry, from pharmaceutical packagers to healthcare facilities.

Print Technology Choices

The limited symbology guidance in the FDA proposal will likely result in multiple symbologies being requested or required by different customers to support their own preferences. Therefore it is extremely important for pharmaceutical manufacturers, packagers and relabelers to develop flexible printing systems that can easily handle all the possible symbology and data encoding options.

The most common technologies currently used for pharmaceutical printing may not be the most effective options for fulfilling emerging labeling challenges. Current print systems are optimized for high-speed, high-volume printing of non-customized packaging without bar codes or variable information. They may lack the adaptability required for shorter print runs that include specific variable data produced for specific customer orders. The high-speed printing capability will be rendered useless if the equipment requires excessive changeover time to accommodate different label formats.

Given these conditions, pharmaceutical labelers should investigate thermal printing technology for unit-of-use labeling. While thermal printers do not have the top-end speed to match web press and ink jet printers, their ability to create variable information bar codes on demand is unsurpassed. Expiration dates and other variable data can be calculated and printed automatically with no operator intervention, providing tight quality control and time savings, especially during changeovers.

Thermal is the dominant technology for producing bar code labels in all industries. Thermal printers excel at producing high-quality, variable-information labels, and are commonly used to create compact bar codes for specimen vials, electronic components, sample containers, and other small items. Even at top speeds, thermal printers maintain the precision needed to produce scannable symbols. High resolution (600dpi) models are especially well suited for producing compact unit-of-use bar codes.

Thermal printers are the smallest and most affordable devices capable of creating unit-dose codes, with models that fit easily on a desktop. Many distributors already use thermal printers for shipping and receiving applications and are familiar with the performance and convenience the technology provides. Manufacturers can use integrated, print-and-apply applicators with thermal printing engines for accurate, automatic label placement on production lines. Their space-efficient design, integrated bar code support, and affordability make thermal printers the only suitable choice for use at all levels in the supply chain.

Zebra Technologies is one of the world's leading providers of thermal bar code printers, print engines, and labels. Zebra supports all of the bar code symbologies used in life sciences, including RSS, and works closely with standards bodies to ensure future compliance.

Conclusion

Encoding variable data on unit-of-use packaging provides an efficient way to collect information required for compliance and traceability. It also extends information outwards, so companies can fully leverage their enterprise systems and enable powerful new supply chain applications. Variable information at the unit-of-use level closes the loop between enterprise and supply chain traceability systems.

Labeling requirements and business processes are changing, so printing methods may need to change to keep pace. The combination of RSS and thermal printing is the most convenient, reliable and efficient way to produce variable information unit-of-use labels. To learn more about implementing bar code solutions, contact Zebra at 1.800.423.0442 or visit our Web site at www.zebra.com. Zebra Technologies is a world leader in bar code printing with an installed base of more than 3 million units. Together with our partners we have the experience, industry knowledge and specialized products needed for successful implementation of bar coding systems throughout the life sciences industry.

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