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A DATABASE DESIGN FOR CVS PHARMACY'S PATTERSON, CALIFORNIA DISTRIBUTION CENTER

BY

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Executive Summary

CVS Pharmacy's Patterson, California Distribution Center did not have an efficient and cost effective method for auditing shipped out products. The purpose of this project was to create a new system and procedure for the Patterson Distribution Center to audit shipped out container totes. The distribution center's original method was slow, inefficient, and involved paper waste, considerable travel time, and several manual procedures. This project was meant to develop a new process and database system to provide a solution to their problem.

The end goal of this project was to implement the designed method and system of auditing for daily use in the distribution center.

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Introduction

The objective of this project was to design and implement an efficient and time effective method of auditing shipped out products from CVS Pharmacy's Patterson, California Distribution Center. The main aspect of the final method includes a Microsoft Access database. The database was designed to help the auditing process of split-case picks. Currently the distribution center prints out pick lists with products and their quantities and manually audits several totes per day. Each supervisor is required to audit between twenty-five and fifty totes per shift. The process of manually auditing these totes is very inefficient and time consuming.

In addition to improving the entire auditing process, this project implemented a human factors analysis of computer interface designs. Several layouts were designed and tested to determine the most accessible and easy to use final product.

Cost analysis and estimation were implemented to determine if the investment was beneficial for CVS. Payback period was calculated to find the time frame of the initial investment. Time studies of the original process versus the new process were conducted to determine how much time and money would be saved in the future.

Background

CVS Caremark is the forty-fourth largest company is the world and the largest pharmaceutical company. They currently have twenty-one distribution centers throughout the United States. These distribution centers are responsible for delivering and stocking products for anywhere between 300 to 1,000 stores in their respective region.

The northern California distribution center, located in Patterson, is responsible for supplying approximately 750 CVS stores, including those operating in Hawaii. The warehouse is around 850,000 square feet in size and stocks approximately 20,000 different products.

Each distribution center is fully responsible for the auditing of shipments to guarantee accuracy in those shipments. CVS' split-case picking system makes this process difficult.

The split-case picking system is a method of replenishing each store with the exact products and quantities that were sold the previous day. This system was adopted by Wal-Mart, the worlds largest company. This allows each store to maintain a constant inventory for all products carried. To ensure shipments are correct, several totes sent out daily must be audited to make sure products and quantities are correct. As one can see, this can be a very tedious and time-consuming process.

CVS Pharmacy's Patterson, California Distribution Center is currently looking for the most effective and time sensitive method to complete this process. Different ideas such as databases, Microsoft Excel Workbooks, and others have been

discussed but have yet to be implemented. Microsoft Excel workbooks and Access databases allow users to fully store data. Once audits are complete, the distribution center desires a computer-based program that can generate accuracy percentages and produce feedback. With the correct implementation of one or both of these programs, CVS can develop a program to provide this.

Literature Review

This chapter of the report will show research that was conducted with the use of scholarly journal articles, Internet sources, and text references. This was done prior to the project to help familiarize myself with background information on the incorporated methods used in the project.

Database design, human factors engineering, and engineering economics were among the topics researched in this chapter. This section was developed with the intent to familiarize readers with the methods used throughout this project.

Database Design

Before computers, a popular way to store data was on index cards. Each card contained relevant data such as a product's name or location, unique identifier, category, price, description, and the supplier's name and phone number. To find particular product information or locations, you either needed to keep track of the products on a separate sheet of paper or go through the index cards to pull every one representing a product made by that supplier (Frye, 2010).

With today's computer capabilities, storing the same data on a computer will make locating products much easier. For example, if a company has a Microsoft Word or Excel table with a column for each type of data they want to store, they can change the order of the table rows to group all the products of a specific category or supplier to be grouped together.

However, using Microsoft Word or Excel to store data is not the most efficient solution. There are many limitations when forming tables within these programs. Designing a table can become very repetitive and time consuming as the

user would have to enter numerous pieces of data every time an addition or change is desired (Frye, 2010).

A much more efficient way to store data would be with the use of a database. By definition, a database management system is a collection of programs that enables users to store, modify, and extract information from a database. There are several types of database management systems (DBMS), ranging from small systems that run on personal computers to large systems that are ran on mainframes or large servers (Database Management Systems, 2011).

Databases are designed to combine data from several sources into a single table. Once the data is entered into a table, it can be merged with other tables within the database to provide very useful information for the user (Frye, 2010). Databases have become a huge part of efficiently maintaining information for an entire company's inventory. This allows several users across an entire server to access data about products and inventory status.

Access is Microsoft's database management program. It is part of the Microsoft Office suite. Access has become a reliable database software application used to maintain excessive amounts of information. The program enables users to maintain collections of data arranged according to a fixed structure. Its structure makes the information easy to select, sort, display, and print (Barrows, Simpson, Young, 2007).

Access is a general-purpose program that works with almost any type of information. A database can be as simple as a list of products to replace your index card file, as previously mentioned above. It can be as complex as an entire library's

book collection and check out process. Microsoft Access can also handle complex databases that contain lots of types of information and lots of customized programming (Barrows, Simpson, Young, 2007).

Access databases contain six types of objects, which consist of the data and tools needed to use Access. The six types of objects are:

- Tables
- Queries
- Forms
- Reports
- Macros
- Modules

(Groh, 2010)

In this project, I will use the functions of tables, queries, forms, reports, and macros.

Tables

Tables are where data is stored. A table is an Access object that is made up of a series of records. Tables are essentially the electronic version of index cards. Tables contain several records that contain information in the same format. For example, in a product list, each record might contain product description, SKU, UPC, and more relevant information obtaining to the product. Each individual piece of information — such as product name or SKU Number is called a field (Barrows, Simpson, Young, 2007).

A single database can contain many tables. A hardware stores database might contain tables for products, vendors, and customers. Much more complex

databases might contain tens or hundreds of tables that are all interlinked (Barrows, Simpson, Young, 2007).

Queries

Queries are the objects that extract information from the database. A query selects and defines a particular group of records that fulfill a certain requirement or condition. Queries have the ability to combine data from tables then filter, sort, or display desired information. Queries are also often used when changing, adding, and deleting records is desired (Groh, 2010).

"Queries are the primary mechanism for retrieving information from a database and consist of questions presented to the database in a predefined format. Many database management systems use the Structured Query Language (SQL) standard query format." (Chapple, 2011)

Forms

A form is a standard database object that displays information from one or more tables on the computer screen. Forms provide Access users an easy way to enter data. They are especially useful when the users want to enter data into multiple tables all at once. Form provide users with many capabilities; for example, users can

- Edit records
- Enter new records
- Format table's information layout
- Specify order in which information appears
- Group items together

- Use pull-down lists to sort or edit information

Forms can be a great way to interact with the database without having to work on the inside with coding and designing of the database (Barrows, Simpson, Young, 2007).

Reports

Reports give users the capability to present data in a printed format. Access supports several different types of reports and has many built-in layouts for design reports. A report may list all records in a given table or they may combine with queries to filter data and display only defined records.

Reports often combine several tables to present complex relationships among different sets of data. Access also has the capability to present information in reports in graphs or tables to better display the desired data (Groh, 2010).

Macros

When designing Microsoft Access databases, users can use a combination or two separate programming languages, macros and visual basic. Macros are built in programs that automate commands given to them. Macros can be created within Access to automate several commands within the database. Macros are often linked with forms to create commands upon request. Users don't have to be a programmer to create and use macros. Access helps you write them by providing drop-down menus of commands (Barrows, Simpson, Young, 2007).

Human Factors Engineering

Ergonomics is the study of the interaction between people and machines and the factors that affect the interaction. The purpose of ergonomics is to improve the

performance of systems by improving human machine interaction. One main way systems can be improved is by designing the user interface to make it more compatible with the task and the user. This makes it easier to use and more resistant to errors (Bridger, 2009).

The user interface consists of input devices, output devices, the information input by users, and the information output by the computer. Programmers, system analysts, user interface specialists, or even the users can design user interfaces, but most are designed and developed by computer programmers and system designers. A study suggests that programmers, with limited or no training and experience in user interface design, make as many as 90 percent of the user interface decisions (Bailey, 1996).

Often, computer-based system designers are experts in the hardware and software aspects, but know little about the capabilities, limitations, skills, tasks, and needs of the end users. This results in systems that fail to adequately support the users' tasks, and require more effort and training to learn than users or their employees are willing to invest in. These types of systems and programs may place new demands on users, making tasks more difficult and time consuming than easier and more efficient (Pulat, Alexander, 1991).

Designing a useful and useable computer system involves people with skill and experience in user interface design. User interface experts are usually human factors engineers or industrial engineers who specialize in this field. To design a useful and useable interface requires knowledge of the end users. This includes

what they do and how the new computer system will help them do their jobs more easily and quickly (Pulat, Alexander, 1991).

There are several tools used to gain understanding of the users and their jobs. These tools include personal interviews, surveys, questionnaires, and market analyses. Involving the user directly in the design process as early as possible will lead to a more successful system design.

Along with the right tools used to design user interfaces, there are Human-Computer Interaction Standards (HCI Standards). Many of these standards have been in existence for many years and are organized according to traditional views of technology and trade. When it comes to user interfaces, there are more standards than one might think. The reason is that computer technology forms the basis of many different industries, and standards can have an important impact on market success.

Engineering Economics

Engineering economic analysis is most suitable for intermediate problems, as well as the economic aspects of more complicated problems. It focuses on costs, revenues, and benefits that occur at different times. Engineering economics is the division of economics that deals with solving complex problems, which are a mixture of economic, political, and humanistic elements. Engineering economic analysis is used to answer many different questions (Newman, Lavelle, Eschenbach, 2009).

- Which engineering projects are worthwhile?
- Which engineering projects should have a higher priority?

- How should a specific engineering project be designed?
- How to achieve long-term financial goals?
- How to compare different ways to finance projects?
- How to make short and long-term investment decisions?

Before beginning analyzing costs of a project, one must differentiate between fixed expenses and variable expenses (or costs). Fixed expenses are those costs that are independent of change in volume. Variable expenses are those expenses that increase or decrease proportionally with increases or decreases in volume (Riggs, 2004). This project aims to reduce the average cost by ultimately seeking out the lowest possible variable cost while still meeting the customer's demand.

In this project there are three aspects of engineering economic analysis that will be analyzed. These include payback period, rate of return, and net present value.

Payback period is simply the period of time required for profit or other benefits from an investment to equal the cost of the investment. Some definitions consider depreciation of the investment, interest, and income taxes (Newman, Lavelle, Eschenbach, 2009).

Rate of return analysis is the most commonly used analysis technique in industry. There are sometimes problems that occur when computing the rate of return, but its major advantage is that it is a single figure of merit that is readily understood. There is another big advantage to rate of return analysis. Selecting an interest rate for present worth and annual cash flow calculations may be difficult. In rate of return analysis, no interest rate is needed to compute the calculations.

Instead, an internal rate of return is calculated from the cash flow (Newman, Lavelle, Eschenbach, 2009).

To calculate a rate of return on investment, one must convert the various consequences of the investment into a cash flow. From there, the cash flow is solved for the unknown value of the internal rate of return.

Net present value is the difference between the present value of cash inflows and the present value of cash outflows. It analyzes the profitability of an investment or project. NPV analysis is sometimes sensitive to the reliability of future cash inflows that an investment or project will yield.

Net present value compares the value of a dollar today to the value of that same dollar in the future, taking inflation and returns into account. Using net present value when deciding to do a project or not, if the NPV is positive, the project should most likely be accepted. However, if the NPV is negative, the project should be denied because this means the cash flows will also be negative (Net Present Value (NPV) Definition, 2011)

Summary

The three subjects discussed in the literature review were incorporated throughout the project's design and implementation. In order to give readers the proper background knowledge of the subjects, many hours of research was conducted.

Design

The design chapter of the report will cover the project's requirements, purpose, current process, and deciding factors that arose during the design stages of the project. It will touch on method's and computer programs considered and the reasons for final decisions.

Requirements

CVS Pharmacy's Patterson, California Distribution Center is looking for a more efficient way to audit product totes that are shipped out daily. The distribution center must be able to audit a certain percentage of totes shipped out daily and calculate an error percentage. Additionally, management would like to be able to track error percentages for all products as well as employees that are picking and packing the totes. This will allow them to determine any quality issues within the picking isles or any problems with employees.

Figure 1: Totes Used for Picking

Auditing Purpose

The distribution center is required to audit between 4 and 5% of the totes that are shipped out daily. CVS has adopted a replenishment process called split-case picking. This means that as products are purchased from stores, the exact product and quantity is replenished the very next day. Ideally, totes are sent to stores daily with 100% accuracy. With anywhere from 2,500 to 4,000 totes being shipped out daily, 100 to 200 of these totes must be audited for incorrect items or inaccurate quantities. An error percentage is

calculated for upper management and corporate to analyze and take action if necessary.

This percentage is calculated for many purposes. The main reason is to give each store some leniency. The distribution center's monthly error percentage becomes each stores monthly error percentage. All stores are given the same error percentage when it comes to product shortage. This method was implemented after management realized having each store manager audit the totes as they came in was too time consuming. Each store is allowed the same monthly error percentage. Anything greater leads to the belief that the store may have theft or other issues.

Current Process

The current process being used is very repetitive and not very time efficient. It requires a lot of manual work and travel and could be vastly improved. The workday is broken down into two shifts, daytime and graveyard. Each shift has two isle managers and anywhere from 50 to 100 pickers. Each isle managers is required to audit twenty-five to fifty totes per shift. The current process takes between three and five minutes per tote. Therefore, each isle manager is spending between one and two hours of their shift auditing. Time studies of the original process can be found in Appendix A.

The steps of the current auditing process is as follows:

1. Select 3-5 totes off the line to audit
2. Write down tote identification numbers
3. Travel to the managers office (50-500 feet depending on location)
4. Enter container id numbers into CVS website

5. Print pick lists
6. Walk back to the location where the totes were selected from
7. Manually audit each tote
8. Walk back to the office
9. Manually enter data into a Microsoft Excel spreadsheet
10. Calculate desired accuracy statistics and percentages

The Excel workbook used in steps 9 and 10 is where upper management can view error percentages. Although the workbook is thorough and gives management necessary data, the process of obtaining this data is extremely slow and inefficient. To determine desired percentages, sorting and calculations must be done.

The isle managers repeat this tedious process several times per day. There are other important tasks that the managers must take care of throughout the day. Analyzing of the entire process, including data entry and calculations, was done to help finalize a more efficient method for each step. If the process time of auditing totes was reduced, the isle managers will have time to work on other important tasks.

Microsoft Access vs. Microsoft Excel

When brainstorming a way to improve this process, Microsoft Access or Microsoft Excel seemed like good options. There were many reasons these two programs were considered but the most important was that CVS already had the software for each. Therefore, no extra computer software expenses would be necessary to design the new process.

When deciding between the two programs, features that each software package was capable of providing were considered. The main benefit of using Microsoft Excel was that the isle managers and upper management were already very familiar with the program and the current workbook could be built on with the addition of some VBA code. They had been using the program with the previous auditing method and it is an easier program to use and understand. The major drawback of using Excel is that it lacks the ability to store and link data tables like Access. Therefore printing reports and pick-lists, auditing, and entering the data would still be a manual process.

Microsoft Access is a much more sophisticated software and has the ability to form relationships between data tables. This would prove to be a key factor in deciding between the two programs. Microsoft Access also has the capability of importing and linking tables from the Internet, other Access databases, and Microsoft Excel files. This made transferring data from the current workbook and the CVS website very easy. The main drawback of using Access is its ease of use. Many people are not familiar with Access and have never used it. Also, any future problems would require the right person to fix or debug the database.

Upon analysis of the pros and cons of Access and Excel, my manager, Marilou Felstead, and I decided that with my knowledge of Microsoft Access and its great capabilities, we should use it. Therefore, Microsoft Access was decided upon and I could begin designing the new tote auditing database and process.

UPC Scanner

In order to make the tote auditing process more time efficient, a new method was necessary. This new method needed to be some form of auditing that would allow the isle managers to verify and count the products faster, reduce travel time and paper wasted on printing, and develop a method to more efficiently enter and track the data.

The first step was to brainstorm ideas that would be easy enough to implement and teach the isle managers to use very quickly. It would have to mimic the current process pretty precisely. Several different options were considered but the usage of a UPC scanner proved to be the best.

Figure 2: Symbol 2208 UPC Scanner

UPC scanners are fairly easy to use and are commonly used in warehouse environments. Tennis Warehouse uses UPC scanners to ship, pick, and audit products. Their company wide database allows employees to scan products to find locations, ship them out, or enter them into the system.

This seemed like a great idea for the CVS auditing process. If the isle managers were able to scan the items in the totes and the database could produce an error rate and let them know which items were extra or missing, the process could be done much faster than their current process. The next step involved

writing and designing a Microsoft Access Database that implemented this feature to allow faster auditing times.

Database Design

Designing a database with a short learning curve was the main focus. Throughout the process, many different designs were tested and revised. The main method of finalizing the database came from feedback from the end users. Each isle manager was given a new design and asked to test it and provide feedback about what they liked and disliked. From here, changes were made to accommodate their feedback.

Constraints

Since Microsoft Access is the program of choice, and CVS already has Access on their computers, purchase of new computer software was not necessary. Another constraint was implementing CVS' company-wide website information into the database. The information from the website that needed to be put into the database included; product descriptions, SKU's and UPC number's, and employee information. Also, every time a new tote was audited, the pick-list containing the products and their quantities, the store information, and the picker's information needed to be transferred into the database to accurately calculate error rates and other relevant data.

Economic Analysis

In order to determine how much money a new auditing process would save the distribution center, an estimated current cost was necessary. Determining how much money was wasted on time and paper alone was outrageous. Each isle

manager's hourly wage is $22. With the results from time studies of the original process, it was determined that it took on average 3.47 minutes to audit one tote. With each isle manager auditing 25-50 totes per day and working 250 days per year, each would audit between 6,250 and 12,500 totes per year. With this average time, each isle manager would spend roughly 360 to 720 hours per year auditing. At their hourly wage, this would cost CVS roughly $32,000-$64,000 per year.

Each tote audit requires the printing of one page. With today's cost of paper, this could cost $350-$700 per year. The current process is costing CVS approximately $32,350-$64,700 per year. A table of payback calculations can be found in Appendix C.

Additionally, a net present value analysis was conducted to determine if investing in the new process and database was a good decision. Finally, a return on investment was calculated to finalize the amount of money gained or lost by the investment.

Summary

The greatest challenge when designing the new tote auditing process was determining what was relevant to the project. Microsoft Access allows users a wide variety of options when designing a database. Constant communication with the end users, isle managers and upper front office management was key in determining exactly what the database needed to feature.

Methods

In order to know exactly how the current method worked, auditing a few totes seemed necessary. This experience provided information about the longest steps of the current process. The most tedious part of the process was manually defining products and counting them. For example, one or two large bottles of wine are easy to define and count but fifty to one hundred slightly different toothbrushes can become confusing. When a tote contains many similar products, manually counting and defining them can lead to errors. Eliminating this part would not only decrease time, it would decrease the amount of human error.

Database Design

In order to test the database, many versions were given to the isle managers. No explanation was given except for the user manual that was written for each design. The features of each version were the same but the interface layout and how certain functions worked varied. The isle managers were told to test the different versions and provide feedback with what one was easiest to use. Also, input from them on what features of each design they liked and disliked would prove the help in the design of the final database.

Many meetings with the isle managers and upper management were conducted to determine which features would best suit the company. Once the final design was complete, the isle managers were given a copy of the database to test. Any input they had was taken into consideration and subtle changes were made to finalize the program.

The ultimate goal when creating the final design was to have it as simple as possible. This would ensure the time to audit would be minimized as much as possible and it would be very easy to use for anyone. One of the main goals was to design a database with a very small learning curve. This way if new isle managers are hired or upper management decides to have other positions conduct the audits, these employees will be able to learn how to use to database very quickly.

Human Factors Engineering

Ease of use was the main concern for upper management. Since none of the isle managers had ever used Microsoft Access, the learning curve needed to be very simple. Many versions of the database were released for testing by each of the isle managers. When they were comfortable with using the current version, feedback was a key asset. Each manager was able to provide information on what he or she liked and disliked most about the version. From there, additions, removal, or adjustments to that particular feature were made.

This process was used about ten times until the exact features, colors, and button layouts were easiest to use for them were known. Although no statistical analysis was conducted, the end product is suitable for all end users.

Economic Analysis

The economic analysis was fairly simple for the process and database. First, to determine the payback period, hourly rates of the isle managers were defined. Then time spent by each isle manager auditing was calculated. Upon completion of the new database, time studies were conducted. The time differences were calculated. The amount of time per year that would be saved was then calculated.

With the isle managers' hourly rate, the total time saved per year, and the cost of designing and implementing the database, payback period and approximately how much time and money would be saved yearly was calculated. Simple calculations in Microsoft Excel were used to determine the return on investment and net present value.

Results

This chapter discusses and shows the final database design, the final auditing process, and the final economic analysis.

Database

The final database design incorporates all user defined requests and requirements. The main auditing menu allows users to import the desired pick list into the database from CVS' website. From there, users can select a particular tote to audit. A screen shot of the main form can be seen below.

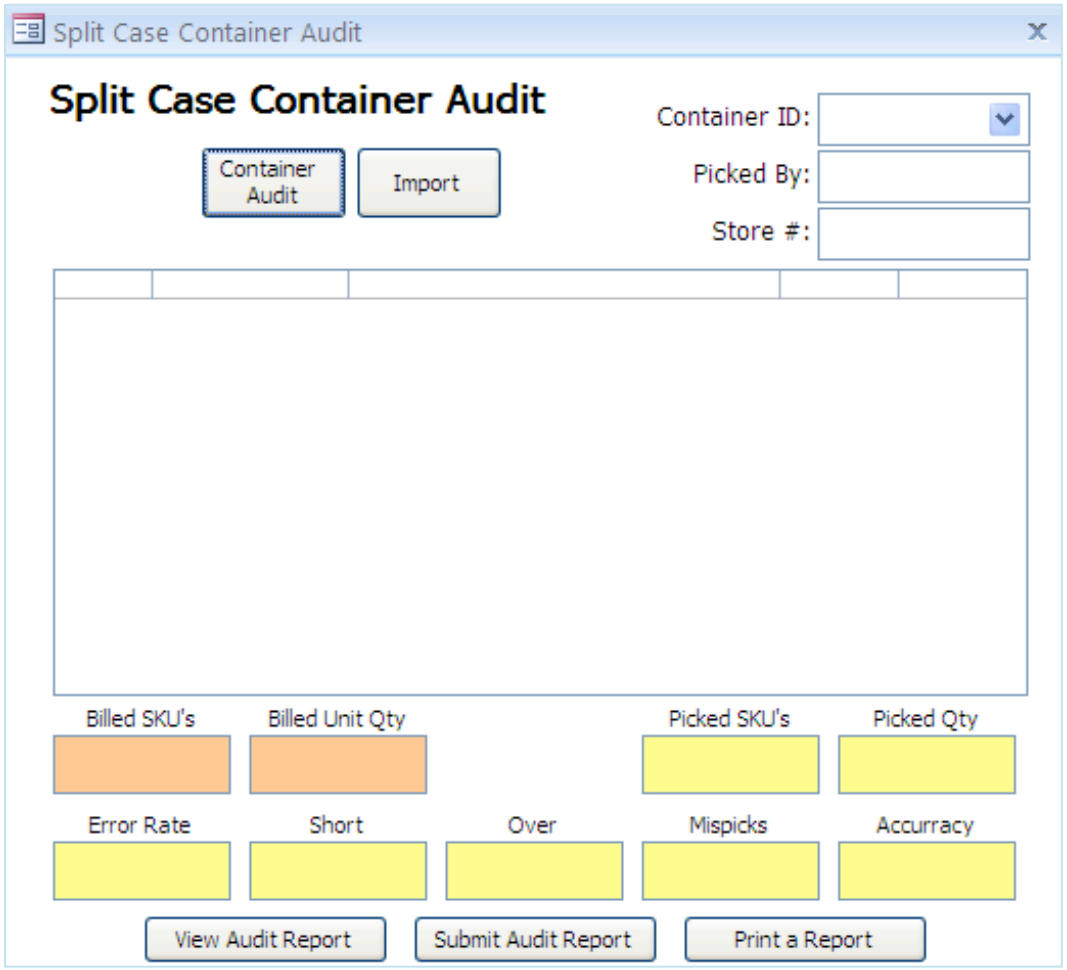

Figure 3: Main Auditing Form

The purpose of the main form is to eliminate the steps of manually printing out pick lists. With the elimination of this step, time, travel distance, and paper are saved. The UPC scanner also eliminates having to identify each product via its description or UPC number. The scanner also reduces human error as it eliminates the step of counting each product. In Figure 4, below, one can see that the database has the ability to automatically count and update the audit percentage and accuracy rate as products are scanned in.

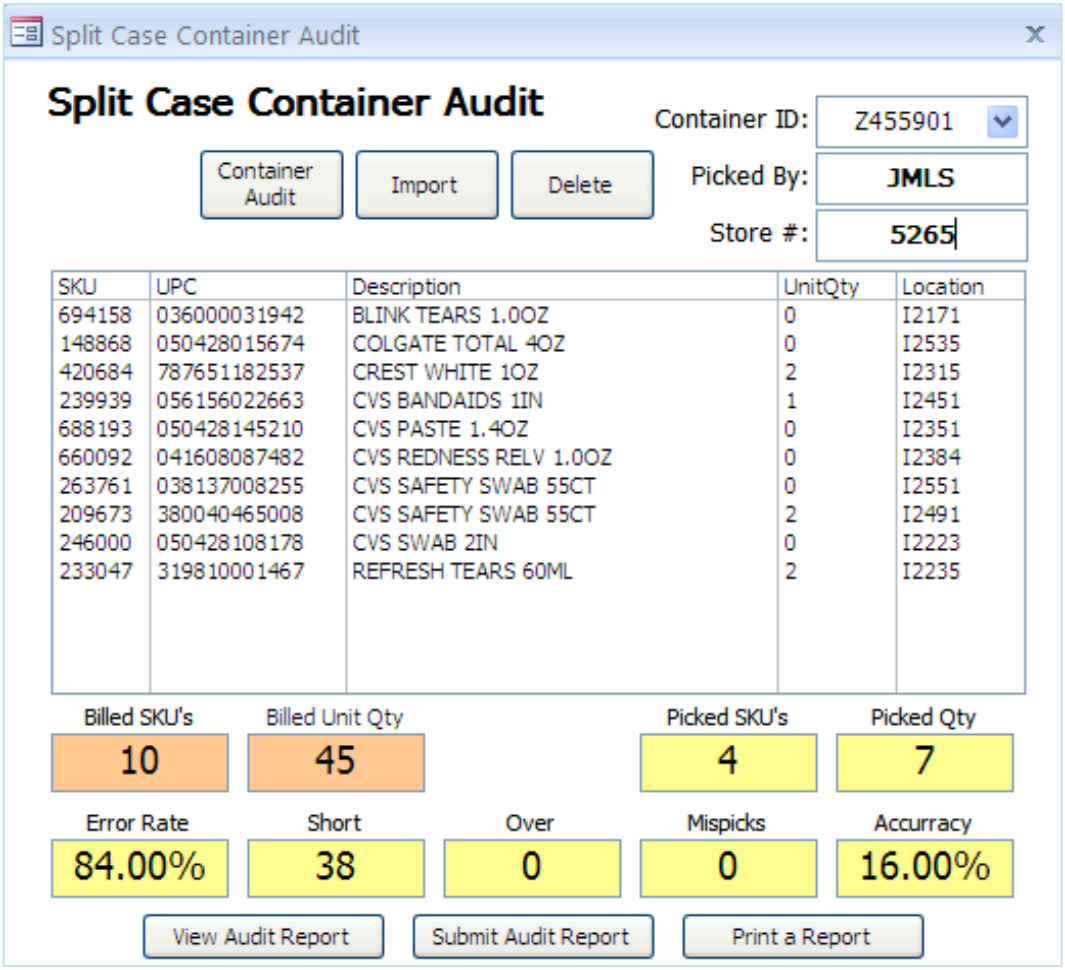

Figure 4: Main Form with Imported Pick List

This form allows the user to see all products that were requested. As the user scans in product UPC's, the "Qty" of the particular product is updated. All boxes at the bottom of the form are also updated with each scan.

"Billed SKU's" is the number of different products that were billed to this particular tote. "Billed Unit Qty" is the number of items billed to the tote. "Picked SKU's" is the number of different products that have been scanned into the system. "Picked Qty" is the total number of scans thus far. "Error Rate" is a simple calculation of (Items Short + Items Over + Mispicks)/Billed SKU's. Likewise the "Accuracy" Rate is 100% minus the Error Rate. "Short," "Over," and "Mispicks" are all directly related to too many or few products or products that are not billed to the particular tote.

Another main function of the database is its ability to report out information. This section was requested and helped designed by industrial engineer, Marilou Felstead. The main purpose of this section is to view accuracy statistics. Users may select any date range and the database will produce reports with information on picking accuracy, products most frequently incorrectly picked, employees most frequently making errors, and much more. Figure 5 shows the main screen to perform printing options.

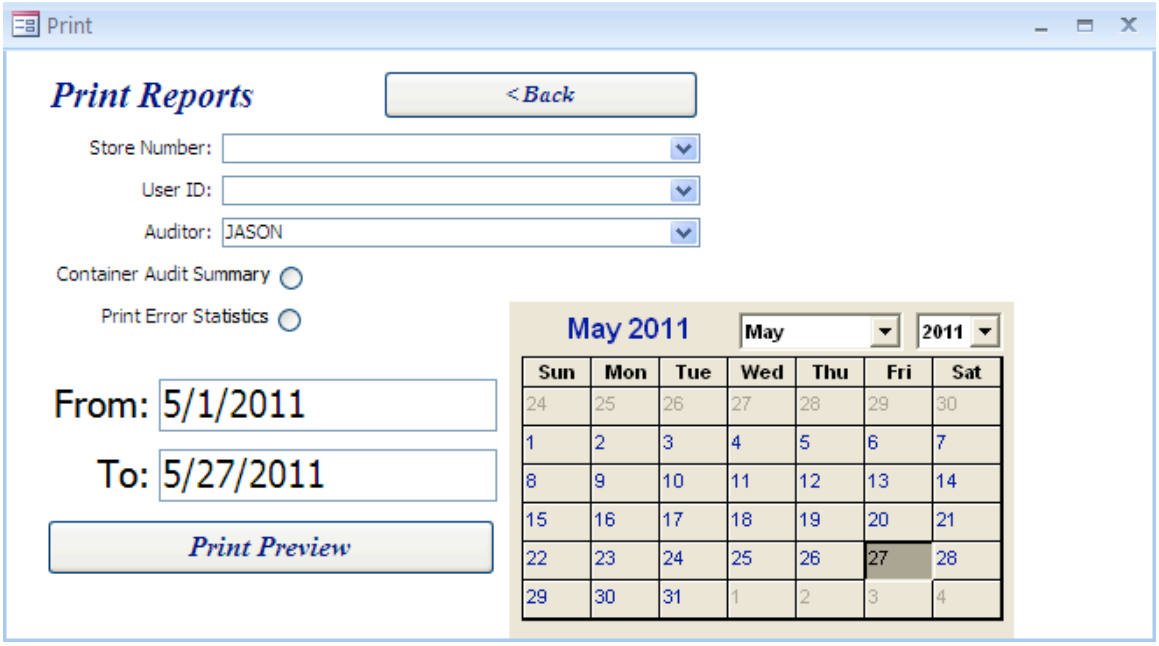

Figure 5: Print Reports Screen

Along with the ability to print reports about products, upper management has the ability to view picking statistics about each employee. To determine a particular employee's performance, their picking statistics can be reported and printed out. This allows upper management the ability to audit a particular employee's current performance, viewing how accurate their picks have been over a certain time frame. Examples of reports can be seen in Appendix E.

Overall, the new Microsoft Access database provides the distribution center with the ability to audit totes and track the accuracy of products and employees. The final program includes all requests and requirements made by upper management and isle managers.

Final Auditing Process

The original auditing process was a long and tedious operation. As previously mentioned in the design chapter, the steps included:

1. Select 3-5 totes off the line to audit
2. Write down tote identification numbers
3. Travel to the managers office (50-500 feet depending on location)
4. Enter container id numbers into CVS website
5. Print pick lists
6. Walk back to the location where the totes were selected from
7. Manually audit each tote
8. Walk back to the office
9. Manually enter data into a Microsoft Excel spreadsheet

With the implementation of the new database and process, steps 2, 3, 5, 6, and 8, are eliminated. The UPC scanner reads each product's information, reducing the time of step 9 significantly. The new process is much faster and efficient, cutting down average auditing time from 3.47 to 1.70 minutes, for a total of 1.77 minutes/tote saved. To see time studies of the original and old process refer to Appendices A and B.

The new process steps include:

1. Select a tote to audit
2. Open the Microsoft Access Database
3. Enter the container ID into the database
4. Import pick list corresponding to that container ID
5. Scan all products included in the tote
6. Remove excess items and/or pick missing items

The new process is much faster and easier to use. The two tables below show a comparison of the time improvements per tote for each step.

Table 1: Average time per step (Original Method)

Step	**Ave. Time/Tote (Min)**
Select Totes	0.23
Write Numbers	0.05
Walk	0.09
Print	0.07
Walk	0.10
Audit	1.66
Walk	0.10
Enter Data	1.13

Table 2: Average time per step (New Method)

Step	**Ave. Time/Tote (Min)**
Select Tote	0.21
Enter Info into Database	0.40
Scan Items	0.91
Print Report	0.17

When talking with the isle managers who audit on a daily basis, they mentioned that the new process saved them an hour or so each day. Along with the database, an instruction manual was created for future users. The instruction manual includes where to locate the database on the CVS server, how to import information, how to use the database, and the different features in reporting that the database offers. A copy of this user manual can be seen in Appendix D.

Economic Analysis

Payback period was the first economic calculation. The database took roughly 150 total hours to design, write, test, and implement. At an hourly rate of $18, the entire process cost CVS $2,700. With a calculated savings of $16,575 to $33,150 per year ($66 - $132 / day), depending on number of totes audited in a particular year, the payback period was calculated to be between 20 and 42 days. For such savings, this investment was very small and yielded a very quick payback period. All payback period calculations can be seen in Appendix C.

Net present value is calculated to determine if going through with a particular project is a good idea. When calculating net present value, one must use a constant interest rate. When forecasting the net present value for this project, three different interest rates were considered. Over a five-year period, calculations with interest rates of 5%, 7%, and 10% were calculated. With a 5% interest rate, the net present value was calculated to be between $70,000 and $140,000. At a 7% interest rate, $65,000 – $133,000 was the calculated NPV. Finally, using the highest interest rate of 10%, the NPV was $60,000 - $123,000. As one can see, when calculating the NPV with any of the three interest rates, the project has a very high NPV. This means that the project is good and should be implemented.

Return on investment provides a payback percentage over a particular time period. For this project, a return on investment was calculated over the next five years. Depending on the amount of totes that are audited each year, the return on investment was calculated to be between 600% and 1200%. This is a great ROI,

showing that with the small investment of $2,700, CVS will profit greatly over the next five years.

Conclusion

The main purpose of this project was to design a more efficient auditing process that implemented a computer based program to replace the existing process of auditing totes at CVS Pharmacy's Patterson, California Distribution Center. The issue with the existing process was its length and inefficiency. There was an extensive amount of travel time wasted during the process. Traveling from the auditing location to the office occurred four times. This process was taking up about a quarter of an isle manager's shift, 2 hours/day. The new process takes between 45 minutes and an hour and a half to audit the desired amount of totes.

The objectives of this project, to design and implement a new tote auditing process for CVS, were met and exceeded. The feedback from upper management and the isle managers was what made this possible. This was a good experience as it directly reflected what a customer relationship would be like.

A great deal of experience was gained through this project. My knowledge of Microsoft Access was increased substantially. The database has been fully incorporated into daily operations at CVS's Patterson location. They have been using the process and program problem free for about 9 months now. Talking with upper management occasionally, they are very happy with its functions, results, and time it has saved them.

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Appendix A – Original Method Time Studies

Totes	Items	QTY/ Tote		Select Totes	Write Numbers	Walk	Print	Walk	Audit	Walk	Enter Data		Total	Time (Min)	Time (Min)/Tote
7	105	15.0		67	14	16	29	19	662	21	342		1170	19.50	2.79
8	94	11.8		103	19	13	24	15	598	17	327		1116	18.60	2.33
6	56	9.3		49	22	15	12	10	419	17	293		837	13.95	2.33
6	76	12.7		78	11	43	21	49	514	40	402		1158	19.30	3.22
6	89	14.8		98	16	57	24	65	501	61	375		1197	19.95	3.33
5	34	6.8		56	12	34	21	39	398	37	257		854	14.23	2.85
6	59	9.8		84	31	26	24	21	419	25	364		994	16.57	2.76
6	114	19.0		76	27	48	27	56	672	55	538		1499	24.98	4.16
6	165	27.5		117	33	78	24	89	894	76	576		1887	31.45	5.24
7	204	29.1		204	22	56	33	64	1056	69	497		2001	33.35	4.76
7	46	6.6		167	26	32	29	30	436	37	451		1208	20.13	2.88
8	78	9.8		99	33	19	25	22	563	28	562		1351	22.52	2.81
6	32	5.3		78	21	65	18	73	398	70	397		1120	18.67	3.11
8	47	5.9		60	45	30	42	28	421	37	421		1084	18.07	2.26
5	62	12.4		72	11	23	27	19	562	26	307		1047	17.45	3.49
5	54	10.8		56	9	65	25	75	519	61	269		1079	17.98	3.60
6	86	14.3		44	14	45	41	38	647	33	541		1403	23.38	3.90
6	45	7.5		78	18	48	38	40	497	56	471		1246	20.77	3.46
8	90	11.3		65	22	89	36	59	893	77	375		1616	26.93	3.37
7	104	14.9		68	14	31	25	33	781	38	401		1391	23.18	3.31
7	67	9.6		54	7	28	34	24	639	27	521		1334	22.23	3.18
6	54	9.0		79	13	63	37	55	602	66	354		1269	21.15	3.53
6	78	13.0		101	24	12	31	18	761	20	604		1571	26.18	4.36
7	40	5.7		62	11	19	25	24	569	20	398		1128	18.80	2.69
6	76	12.7		54	14	27	21	22	784	33	429		1384	23.07	3.84
6	35	5.8		71	23	51	19	50	539	59	561		1373	22.88	3.81
8	65	8.1		87	44	29	22	34	704	30	538		1488	24.80	3.10
9	39	4.3		55	32	34	27	27	639	49	476		1339	22.32	2.48
7	107	15.3		106	36	17	31	15	1153	21	631		2010	33.50	4.79
6	89	14.8		144	18	11	30	21	972	19	561		1776	29.60	4.93
8	76	9.5		123	26	52	29	59	792	63	438		1582	26.37	3.30
7	101	14.4		208	17	26	34	31	1063	31	506		1916	31.93	4.56
8	97	12.1		219	28	44	18	39	994	49	723		2114	35.23	4.40
8	71	8.9		85	25	32	29	37	684	44	510		1446	24.10	3.01
															3.47

Appendix B – Proposed Method Time Studies

T.S.	# of Items in Totes	Select Tote	Enter Info into Database	Scan Items	Print Report	Total Time	Total Time (Min)
1	21	9	24	57	9	99	1.65
2	12	11	27	28	7	73	1.22
3	16	14	22	36	11	83	1.38
4	9	11	30	16	13	70	1.17
5	7	10	19	20	14	63	1.05
6	17	8	18	54	6	86	1.43
7	24	9	24	69	8	110	1.83
8	29	13	26	79	7	125	2.08
9	33	7	29	81	10	127	2.12
10	14	11	22	51	10	94	1.57
11	17	17	20	55	9	101	1.68
12	8	21	21	26	8	76	1.27
13	11	20	29	34	6	89	1.48
14	19	14	21	60	6	101	1.68
15	10	8	19	28	7	62	1.03
16	32	6	17	87	11	121	2.02
17	15	10	12	48	13	83	1.38
18	6	12	27	29	12	80	1.33
19	5	15	23	20	10	68	1.13
20	17	19	27	57	9	112	1.87
21	24	12	19	66	12	109	1.82
22	12	11	21	43	14	89	1.48
23	28	15	20	79	16	130	2.17
24	31	18	33	94	8	153	2.55
25	19	21	31	62	9	123	2.05
26	8	22	30	41	10	103	1.72
27	17	14	29	60	11	114	1.90
28	11	13	25	41	15	94	1.57
29	26	18	27	57	13	115	1.92
30	29	10	19	79	9	117	1.95
31	12	11	21	36	12	80	1.33
32	7	7	24	29	7	67	1.12
33	16	9	29	58	8	104	1.73
34	23	14	30	71	11	126	2.10
35	15	10	26	52	10	98	1.63
36	33	19	31	96	8	154	2.57
37	27	16	36	87	9	148	2.47
38	40	13	19	109	14	155	2.58
39	26	11	31	91	16	149	2.48
40	13	10	26	31	11	78	1.30
41	17	9	21	49	10	89	1.48
42	22	15	16	64	8	103	1.72
43	6	17	19	26	9	71	1.18
44	9	19	21	31	10	81	1.35
45	16	11	24	53	11	99	1.65
46	27	10	27	71	14	122	2.03
47	14	7	30	48	13	98	1.63
48	27	9	29	89	10	137	2.28
49	7	10	19	26	11	66	1.10
50	17	11	24	53	16	104	1.73
							1.70

Appendix C – Economic Analysis Calculations

Original Method

Ship Out:	2500	-	4000	Totes/day
Audit: (4-5%)	100	-	200	Totes/day
	25000	-	50000	Totes audited/year
Managers (4)	25	-	50	Totes/manager/day
Original Method	3.47		Min/Tote	
	86.75	-	173.5	Minutes/day/manager spent auditing
	1.445833333	-	2.891666667	Hours/day/manager spent auditing
	361.4583333	-	722.9166667	Hours/year/manager spent auditing
	$7,952.08		$15,904.17	Cost of auditing per manager per year
	$31,808.33	-	$63,616.67	
Paper	25000	-	50000	Totes audited/year
Cost	$70.00		per case	5000 pages/case
	5	-	10	Cases / year
Cost	$350.00	-	$700.00	/year in paper
	$32,158.33	-	$64,316.67	Cost of original method/year

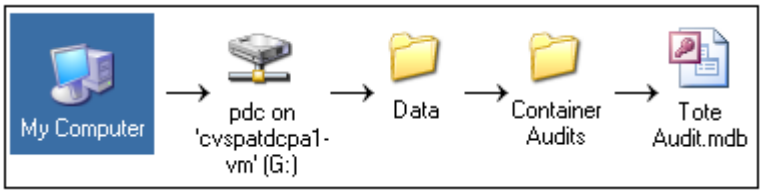
Proposed Method

Ship Out:	2500	-	4000	Totes/day
Audit: (4-5%)	100	-	200	Totes/day
	25000	-	50000	Totes audited/year
Managers (4)	25	-	50	Totes/manager/day
New Method	1.7		Min/Tote	
	42.5	-	85	Minutes/day/manager spent auditing
	0.708333333	-	1.416666667	Hours/day/manager spent auditing
	177.0833333	-	354.1666667	Hours/year/manager spent auditing
	$3,895.83		$7,791.67	Cost of auditing per manager per year
	$15,583.33	-	$31,166.67	
	$15,583.33	-	$31,166.67	Cost of original method/year
	$16,575.00	-	$33,150.00	Savings / Year
	$66.30	-	$132.60	Savings / day

Appendix D – Database User Manual

Container Audit Database User Manual

Opening the Database



Importing Container Data

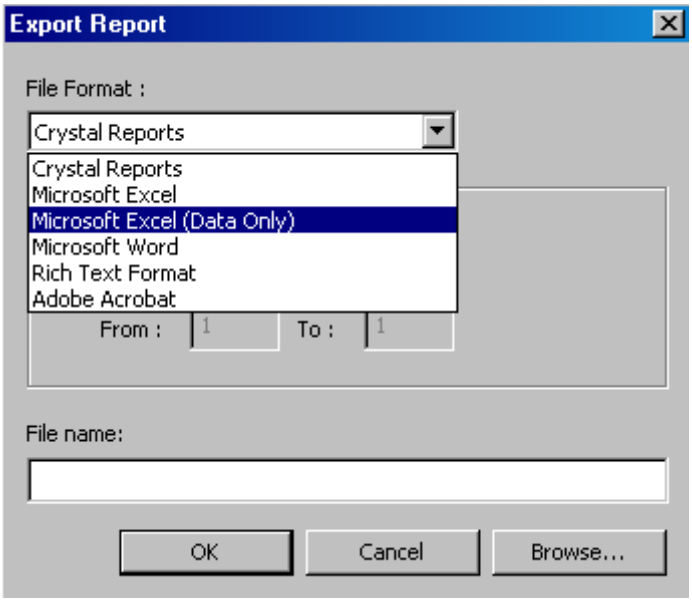
[1] Click the "Container Audit" Button

[2] RDM will appear in the Taskbar. Open and select "Refresh" 

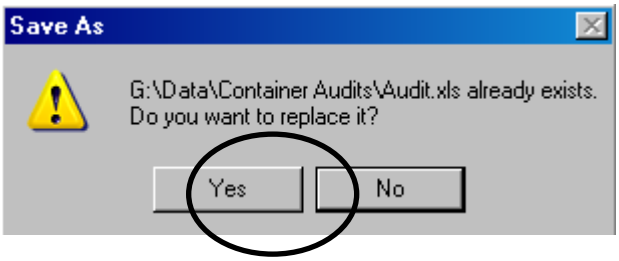
[3] Enter the Container ID and select "Finish"

[4] Select "Export Report" 

[5] Change the "File Format" to Microsoft Excel (Data Only) and select "Browse…"
If the "Container Audit" folder does not pop up, see Opening the Database directions.



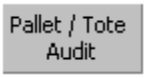
[6] VERY IMPORTANT: The file must be saved as "ContainerAuditReport.xls" in the "Container Audits" folder. It is ok to save over the previous excel file. Click "Save" and "Yes" SEE BELOW



[7] Select "OK" from the "Export Report" Window

[8] When prompt to open the exported report, click "No"
SEE BELOW

[9] Close Crystal Report Viewer and go back to the database. Click “Pallet / Tote Audit”

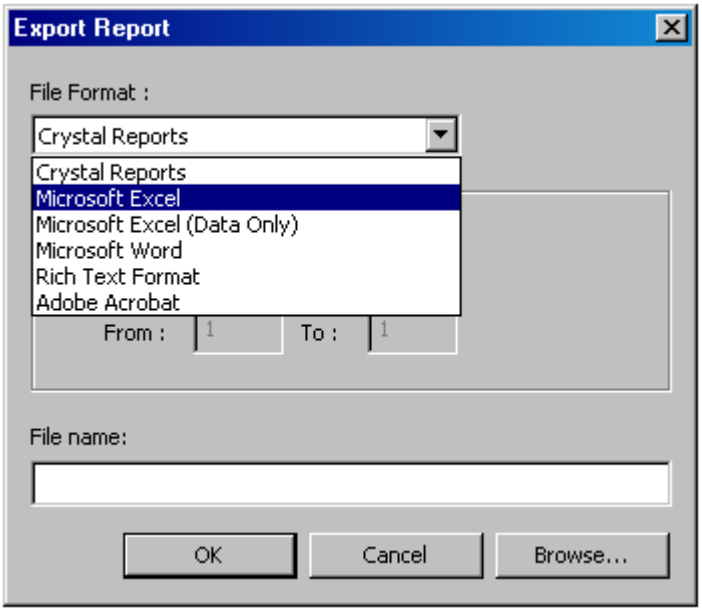


[10] RDM will appear in the Taskbar. Open and select “Refresh” 

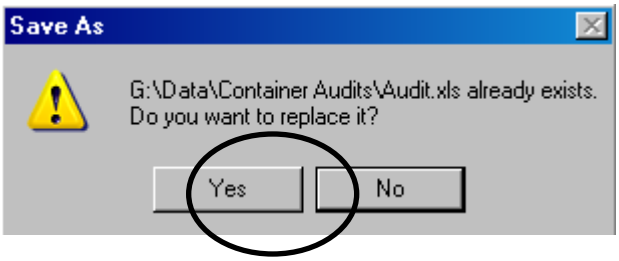
[11] Enter the Container ID and select “Finish”

[12] Select “Export Report” 

[13] **VERY IMPORTANT: Change the “File Format” to Microsoft Excel** and select “Browse…”
If the “Container Audit” folder does not pop up, see Opening the Database directions.

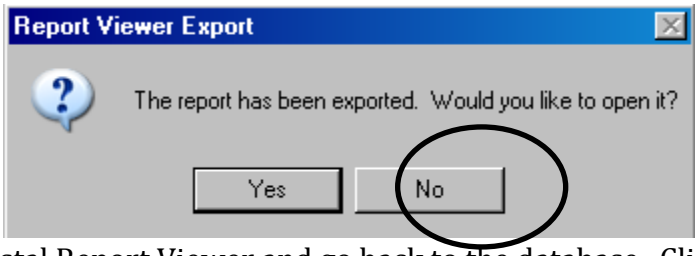


[14] VERY IMPORTANT: The file must be saved as “PalletToteAuditReport.xls” in the “Container Audits” folder. It is ok to save over the previous excel file. Click “Save” and “Yes” SEE BELOW



[15] Select "OK" from the "Export Report" Window

[16] When prompt to open the exported report, click "No"
SEE BELOW



[17] Close Crystal Report Viewer and go back to the database. Click the "Import Button"

[18] The Container ID should be viewable on the dropdown menu. Select the correct ID and proceed to auditing.

Auditing Process

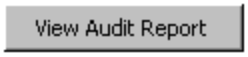
[1] Scan Product Bar Codes (PickedQty will automatically update as you go):

Click on product to enter audit qty.

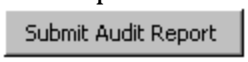
SKU	Description	Location	UPC	PickedQty
628529	CANADIAN CLB 1.75L 1.75	A1652	089540168418	0
612705	CPT MRGN PBAY 750M	A1723	090151718909	0
166620	DEKUYPER TRPLE SEC 750M	A1673	080686381402	0
281115	FC BLDY MRY 33.8Z 33.8	A1632	070491800953	0

[3] If there is a product incorrectly picked and its description is not on list, scan the bar code anyways. The SKU, Description, Location, UPC, and QTY will be added to the list.

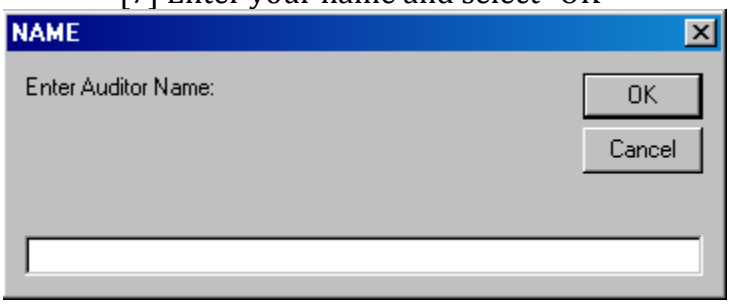
[5] When auditing is complete, select the "View Audit Report" button. Here, user can review data.



[6] Go back to main page, and make any changes, if necessary. Select the "Submit Audit Report" button.



[7] Enter your name and select "OK"



[8] The last step of the audit process is entering the in store date found on the container ID label. To do this simply click the date on the calendar (SEE BELOW)

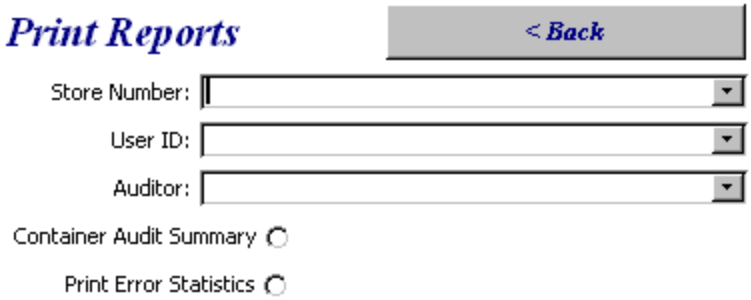
[9] Select "OK" Button. Audit report has been submitted.

[10] Print Report and close "Print Preview" page.

Audit is complete. Information should clear and you can begin another.

Printing Reports

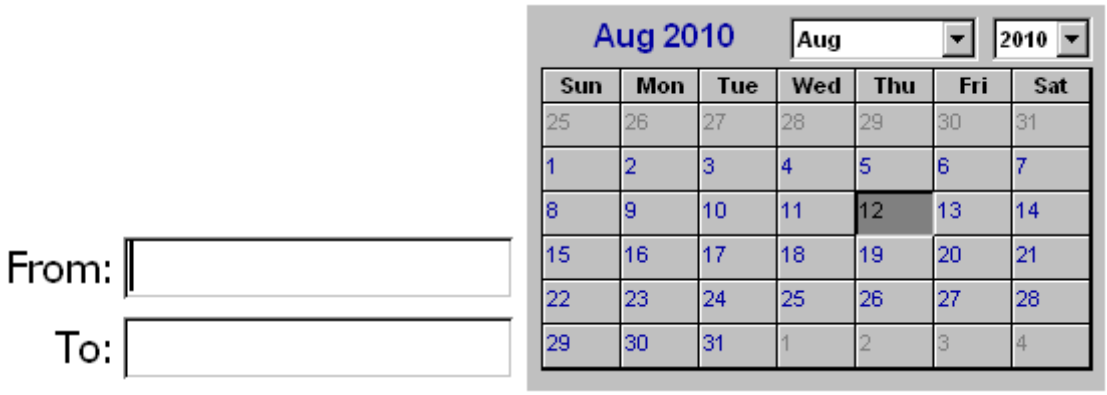
To access the print page, select the "Print a Report" button on the bottom right corner of the main form.



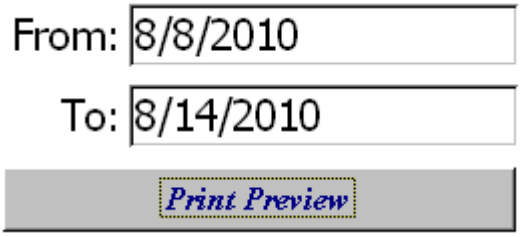
SEE ABOVE FORM

1. To print a report by store, select the "Store Number" drop-down list.
2. To print a report by USER (Picker), select the "User ID" drop-down list.
3. To print a report by Auditor, select the "Auditor" drop down-list.
4. To print an overall summary, select the "Container Audit Summary" option circle
5. To print an error report, select the "Print Error Statistics" option circle.

After selection has been made, a calendar will be visible (SEE BELOW)



Select the date duration you would like to print data from.



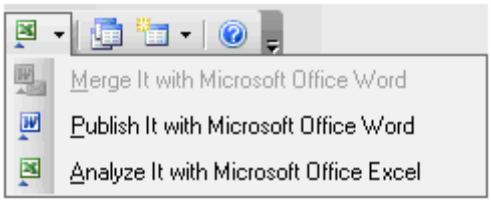
Click the "Print Preview" button or press "Enter" on the keyboard to view a Print Preview of you selected data and date range.

Once the Print Preview has appeared, select the "Print" button on the top left corner to print.

Other Options Include:
Selecting File → Print
Pressing Ctrl and P on the keyboard

Saving Data

To save the data, in print preview select the "Analyze it with Microsoft Excel" or "Publish it with Microsoft Word" buttons at the top of the screen (SEE BELOW). The report will be saved to your desktop and automatically open.



Appendix E – Report Examples

Audit Summary Report by Auditor

Auditor: LISA DIAZ **8/1/2010 - 8/31/2010**

	Audit Date	Picker	Container ID	Store	In Store Date	Total Units	Total Audit Units	Short	Over	Mispicks	Accurracy	Error Rate
1	8/11/2010	PADB	3W31667	7774		14	14	0	0	0	100.00%	0.00%
2	8/12/2010	CHEL	3W61766	9159		45	45	0	0	0	100.00%	0.00%
3	8/12/2010	LARM	3W40156	9802		12	7	5	0	0	58.33%	41.67%
4	8/12/2010	CHEL	3W58018	9893		10	10	0	0	0	100.00%	0.00%
5	8/12/2010	SANA	3W52697	9500		10	10	0	0	0	100.00%	0.00%
6	8/12/2010	ITSA	3W59131	9261		12	12	0	0	0	100.00%	0.00%
7	8/12/2010	MORC	3W65219	9149		8	8	0	0	0	100.00%	0.00%
8	8/12/2010	ROSO	3W64551	2124		80	80	0	0	0	100.00%	0.00%
9	8/12/2010	CAMH	3W64360	9949		53	53	0	0	0	100.00%	0.00%
10	8/12/2010	SALS	3W65458	9390		12	12	0	0	0	100.00%	0.00%
11	8/17/2010	CHSY	3U54969	9894		25	25	0	0	0	100.00%	0.00%
12	8/17/2010	WAIK	3W30586	9329		39	39	0	0	0	100.00%	0.00%
13	8/17/2010	MORB	3U55007	9296		25	25	0	0	0	100.00%	0.00%
14	8/17/2010	ARML	3W33193	9690		148	148	0	0	0	100.00%	0.00%
15	8/17/2010	GIRR	3V41203	9219		47	47	0	0	0	100.00%	0.00%
	Totals		**15**			540	535	5	0	0	99.07%	0.93%

Audit Summary Report by User

Picker: FAND **5/1/2011 - 5/24/2011**

	Audit Date	Container ID	Store	In Store Date	Total Units	Total Audit Units	Short	Over	Mispicks	Accurracy	Error Rate
1	8/13/2010	3X29592	9830		31	31	0	0	0	100.00%	0.00%
	Totals		**1**		31	31	0	0	0	100.00%	0.00%

Audit Summary Report by Store

Store #: 2928 **8/1/2010 - 8/31/2010**

	Audit Date	In Store Date	Container ID	User ID	Total Units	Total Audit Units	Short	Over	Mispicks	Accurracy	Error Rate
1	8/21/2010		3Y78173	MACA	58	58	0	0	0	100.00%	0.00%
2	8/21/2010		3Y78794	WAIK	78	78	0	0	0	100.00%	0.00%
	Totals		**2**		136	136	0	0	0	100.00%	0.00%