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APPLICATION OF BAR CODES TO THE AUTOMATION OF ANALYTICAL SAMPLE DATA COLLECTION

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ABSTRACT

The Health Protection Department at the Savannah River Plant collects 500 urine samples per day for tritium analyses. Prior to automation, all sample information was compiled manually. Bar code technology was chosen for automating this program because it provides a more accurate, efficient, and inexpensive method for data entry.

The system has three major functions:

- o Sample Labeling - is accomplished at remote bar code label stations composed of an Intermec 8220 (Intermec Corp.) interfaced to an IBM-PC.
- o Data Collection - is done on a central VAX 11/730 (Digital Equipment Corp.). Bar code readers are used to log-in samples to be analyzed on liquid scintillation counters. The VAX 11/730 processes the data and generates reports.
- o Data Storage - is on the VAX 11/730 and backed up on the plant's central computer.

A brief description of several other bar code applications at the Savannah River Plant is also presented.

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INTRODUCTION

The Savannah River Plant (SRP) produces special nuclear materials. SRP is located on more than 200,000 acres of federal land in South Carolina along the Savannah River. The Savannah River Plant is owned by the Department of Energy and operated by E. I. du Pont de Nemours and Company, Inc.

Production facilities at SRP include four heavy-water-moderated production reactors, two separations canyons, and one fuel-fabrication area. A defense waste processing facility is currently under construction.

The Savannah River Plant has compiled an outstanding safety record in its 30 years of operation as a nuclear research and production facility. No employee has ever been injured by a nuclear process or radiation exposure at the plant site. The Tritium Bioassay System (TBS) is part of this safety program. It facilitates the testing, recording, and reporting of test results for tritium bioassay samples collected from stations located throughout SRP. TBS utilizes modern bar code technology to enhance laboratory automation. Bar codes are also being used at the Savannah River Plant for inventory and other laboratory systems. This system is described below in detail.

TRITIUM BIOASSAY SYSTEM

Background

The Health Protection Department at SRP analyzes approximately 500 urine sample per day for tritium as part of its safety program. (Tritium is a radioactive form of hydrogen.) Because of this heavy sample load, it was necessary to automate the analytical processing of tritium bioassay samples.

Prior to automation, personnel donating samples were required to write the date and time of their sample, their payroll number, and their department on a label and then place the label on their sample container. These labels were available at the bioassay label stations located sitewide. The samples were collected on a regular basis and brought to the Bioassay Laboratory. When the samples were received, lab technicians manually transcribed the sample log-in information on receiving reports. The sample preparation was also done manually by the lab technicians. A liquid scintillation counter processed the samples and printed out the test results. Analytical results were also manually recorded on the receiving report. The reports were keypunched and sent to a central facility for processing, generation of reports, and archiving. A more efficient, accurate, and inexpensive method was needed.

Goals

The Tritium Bioassay System was designed to eliminate any possible manual transcription errors, enhance productivity by freeing personnel to do more challenging work, provide timely reports, and to provide the Health Protection Department with an easily accessible data base.

Automated Procedure

The Tritium Bioassay System utilizes bar code labeling stations in the field that allow operations personnel to generate labels for their tritium bioassay samples. The labels identify donor, donation date, time, and area in Code 39 bar code. This allows the lab technicians to identify the bioassay samples to the lab computer via a bar code reader. The robotic sample preparation system prepares the samples for counting in the liquid

scintillation counter. The lab computer automatically collects the test results from the liquid scintillation counter. The lab computer also prepares the receiving reports and transfers the receiving data to other computer systems on the site network.

Bioassay Label Stations

The Bioassay Label Stations are composed of IBM-PCs interfaced to Intermec 8220 impact-font bar code printers. Code 39 was chosen as the bar code symbology because it is the Department of Energy standard and it allows all 128 ASCII characters to be represented. Code 39 has strong self-checking properties that provide for a high level of data security. Software was developed to minimize the user input necessary to print the sample label.

Laboratory Setup

Intermec 9520 portable bar code readers were selected for logging in the samples. These readers have a liquid crystal display that technicians can use for verifying the bar code readings. Two Zymark robots automatically prepare the samples. Sample analysis is done on a mechanically modified Beckman 9800 liquid scintillation counter. The laboratory computer is a VAX 11/730.

INVENTORY SYSTEMS

The Savannah River Laboratory utilizes a bar-code-based system to inventory all portable capital equipment. This system uses bar code labels at all doorways to identify the equipment location, and bar code labels with encoded tag numbers to identify the equipment. Both labels are produced with an Intermec 8200 impact-font bar code printer. A Telxon Tell Transactional Computer, Model 790, with custom software is used for data collection. A similar system is being installed in the Savannah River Plant. This system will use the newer Intermec 8404 bar code printer.

LABORATORY APPLICATIONS

Defense Waste Processing Facility

A fully automated laboratory information management system is being designed for the Defense Waste Processing Facility (DWPF), currently under construction. This system will use bar codes to identify samples, identify instruments, and track samples. Each sample will be labeled with a unique sample number printed in Code 39 bar code. The sample labels will be printed with an Intermec 8404 bar code printer on polester stock. An Intermec 8220 will be used to print location labels for all lab benchs, and instrument identification labels for all instrumentation. Intermec Model 1600 scanners with 9420 readers will be mounted in all glove boxes and placed strategically in the laboratory for easy access. The sample and instrument labels will be used to properly associate the sample and with its analytical result. The sample and location labels will be used to track the sample's progress through the laboratory.

Separations Canyon

A bar code labeling system was installed in a separations canyon at SRP in April 1985. This system was necessary to provide accurate sample and sampling-point identification, and sample log-in information for the canyon laboratory computer system. An IBM-PC, installed in the canyon control room, is interfaced remotely to an Intermec S35 bar code printer installed in the sample aisle. The system provides two labels for sample identification. One label, containing the tank number, time, date, area, run number, and analysis code, is printed when the sample is requested. Preprinted tank labels available at the sampling point verify the tank number. Samples are logged into the laboratory with an Intermec Model 1600 scanner and Model 9420 bar code reader.

CONCLUSIONS

Bar code technology has provided an efficient, fast, and accurate means of capturing data at the Savannah River Plant. Several applications of bar codes have been presented. Du Pont is actively investigating other applications of bar codes at SRP.