SRS
savannah river site

Implementing Barcoding in SQL*LIMS

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- **Savannah River Site is a Department of Energy Facility**
- **Located in Aiken, SC**
- **Primary work is environmental restoration**
- **Multiple laboratories across the Site**
  - **Ranging from large to small labs doing a variety of work**
- **Combined Barcoding experience in department is 50 man-years plus**
  - **Have recognized experts in barcoding at Site**

- **How to engineer implementation of barcoding in the SQL*LIMS lab**
  - **A step by step engineering approach**
  - **Provides insight into hidden issues (or avoiding "*Opps! I did not think of that!"*)**
- **How to measure success**
  - **Set the conditions for success**
  - **Ensuring goals are reasonable (*"Sure… We can do that!"*)**
- **How different strategies can be used implement barcoding in SQL*LIMS**

- **Avoids operator transcription errors**
- **Allows for quicker inventory of samples spread out across multiple labs**
- **Reduces process times and increases work efficiency**
- **Eases operator tedium**

- **An Engineering Workflow is needed to map the process**
  - **Primary and critical step**
  - **Basis for all decisions**
  - **Allows verification of improvements**
- **Record real work vs. process time for each step before barcode implementation**
- **Identify sample environment**
- **Identify sample life in the workflow**

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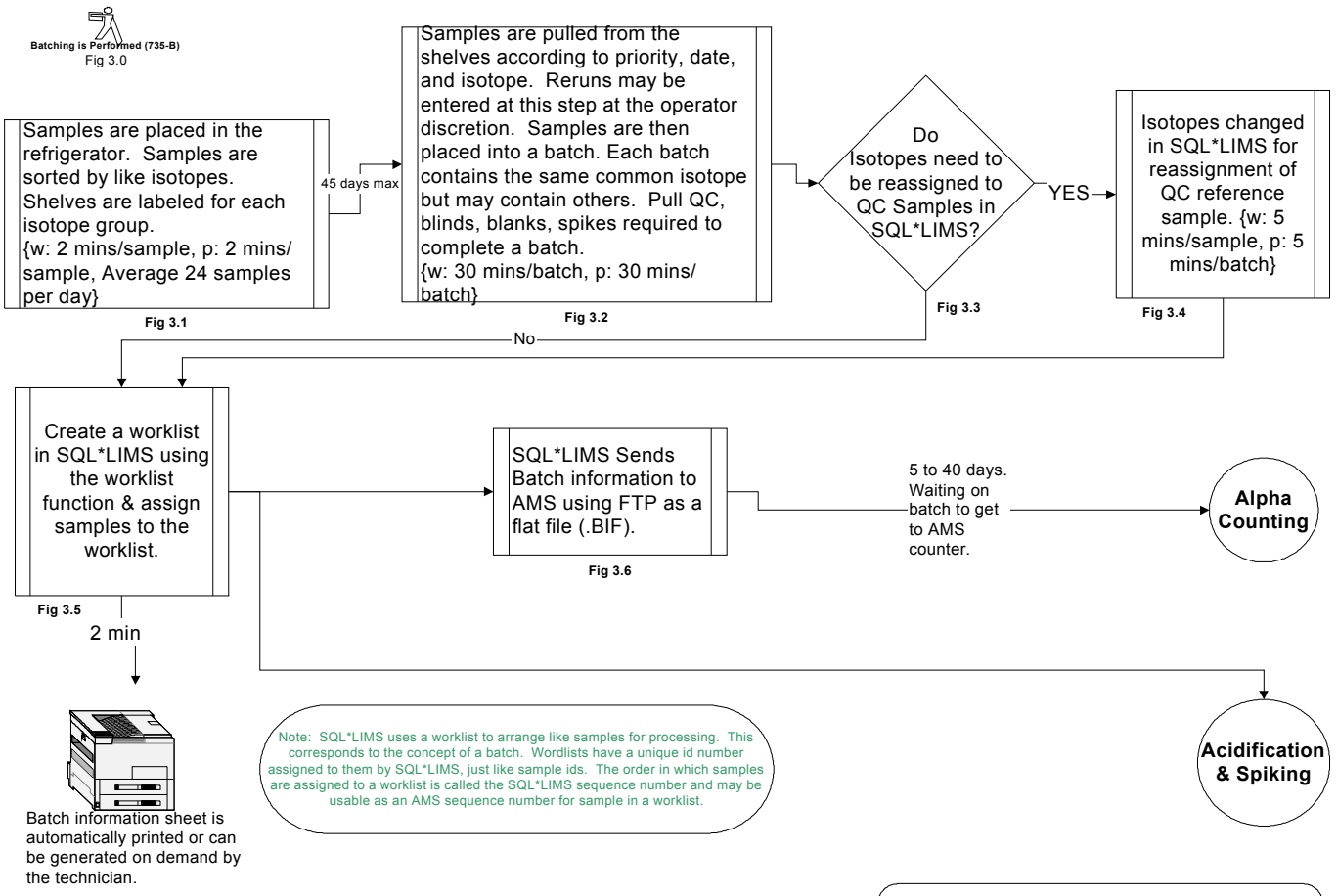
Step 1: Develop an Engineering Workflow (cont)



- **Identify the environment the sample will be in**
  - **Is the sample in an office environment?**
  - **Is the sample to be placed in cold storage (liquid nitrogen), cold & wet, hot & wet, or hot water?**
  - **Is the sample to be placed in a hood or glove box?**
    - **This may indicate a harsh chemical environment**
  - **Does the sample transition from one environment to another?**
- **Update the workflow diagram to capture the type of environment**

- **What type of containers are the samples in?**
  - **Shape and curvature**
  - **Is the sample going into an instrument carrier?**
  - **Is the material of the container metal, glass, or plastic?**
  - **Do the sample containers change during processing?**
  - **Is the container re-used or a throw away?**

- **Update the Engineering Workflow diagram with the type of sample containers and if they change**

- **Does the barcode need to be a single unique number?**
  - **SQL*LIMS Sample Id Number?**
  - **Customer Id Number?**
  - **Does the unique id number change during processing?**
- **Is the sample to be aliquoted or sub-divided?**
  - **If so, do you want the sample id and the method?**
- **Update the Engineering Workflow to contain the data to be barcoded**
  - **Note where the barcode may be added to or changed**

- **Data to be tracked is one factor in determining barcode symbology. Most common codes in use at WSRC are:**
  - **Code 39**
    - **Variable length code with 44 symbols (upper case alphabetic, numeric, and $/+%**
    - **Medium density**
    - **Not very efficient use of space, produces long barcodes**
  - **Code 128**
    - **Variable length code with alphanumeric symbology with 106 distinct symbols**
    - **High Density**
    - **Very efficient use of space, can produce short barcodes**
  - **PDF417**
    - **encodes entire ASCII set (255 characters)**
    - **high density 2D code**

- **The barcode label is one of the most critical part of the bar coding process**
- **Review the Engineering Workflow diagram**
  - **Is the label exposed to a harsh environment(s)?**
    - **Environment determines the label material type and the adhesive**
      - **polyester (hot water, freezer, liquid nitrogen)**
      - **vinyl (solvent/chemical resistant, freezer, liquid nitrogen)**
      - **Matte White Nylon Cloth (freezer, liquid nitrogen)**
      - **Paper shipping label (water resistant only)**
    - **Get samples of each label type to test in the environment(s) from a supplier as recorded on engineering workflow**
    - **Test for the longest expected lifetime of the sample in the process flow as recorded on engineering workflow**

- **What type of container is the sample to be held in?**
  - **The type of container determines the adhesive used for the labeling**
  - **If the container is to be re-used, a peel-able label is needed**
- **What area on the container is available for printing?**
  - **Short, high curvature containers require labels be attached vertically and be of high density**
  - **If the sample container goes into an instrument container or rack, does the sample have to be exposed for instrument scanning?**

- **Does the sample require more than one label?**
  - **If a record of the samples tested or received in an area is required, multiple barcodes may be need**
  - **If a sample is aliquoted, additional barcodes will be needed if a SQL*LIMS sub-sample is not created**
  - **These items may require a piggy-back label stock**
- **Note that not all label stock is suitable for use with all barcode symbology**
- **A barcode applied to a report does not necessarily require any special label**

- **An example of a poor choice in barcode label material**
  - **Barcodes applied to samples in hostile environment peeled and turn black**
  - **Obscured the SQL*LIMS id and other identifying numbers**

- **Example of samples placed in instrument carrier or transport rack**

Non-Low Profile Label

With Label, Sample
Will Not Fit Into Container

Low Profile Label

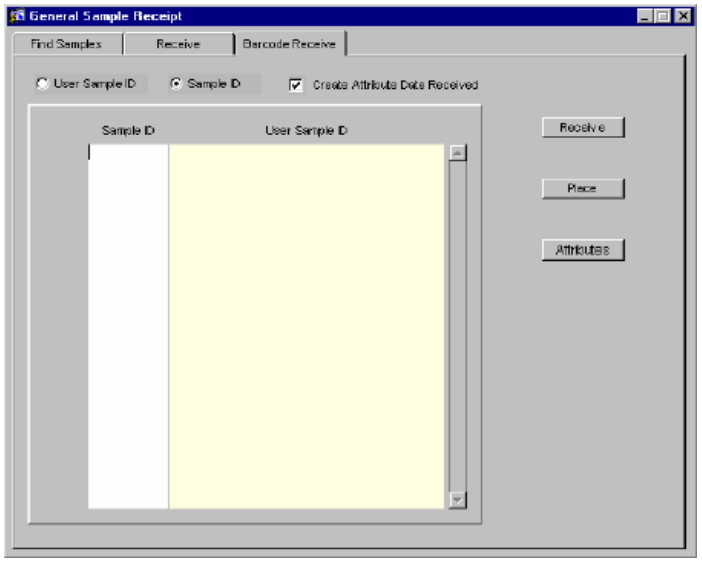
With Low Profile Label, Sample
Will Fits Into Container

- **Review the Engineering Workflow**
- **Choose locations where barcode printers will be used and update the Engineering Workflow**
  - **Dependent on number of labels printed and at what time in the process**
  - **Dependent on the type of barcode label printed**
    - **Bar code on report or analysis**
    - **Bar code label for application on a sample**
- **Type of barcode printer dependent on label stock and symbology**
- **Network barcode printers give the best utilization**
  - **Even non-network enabled barcode printers can be converted to network use**

- **Determine the software to generate the barcode labels**
  - **You can generate barcode labels from SQL*LIMS using Oracle Reports**
  - **Software used may be dependent on the type of printer used**
  - **Most common label printers used at WSRC is Zebra for barcode labels and laser printers for barcoded reports**
- **Special labels will require a dedicated barcode printer**
  - **Thermal transfer ribbon vs. laser printer**

- **Scanner type is dependent on**
  - **Location where scanning to be performed**
  - **Type of symbology used**
  - **Type of label being scanned**
- **Scanners may be**
  - **Connected to a PC via a "wedge" between keyboard and SQL*LIMS station (most common)**
  - **Mobile and require a receiving station**
  - **Be stationary (similar to food checkout)**
- **Scanners may be programmable**
  - **Will allow decoding of complex barcodes that are then parsed and sent out with imbedded tabs and carriage returns**
- **Update the Engineering Workflow to take into account the type of scanners needed in each area**

- **Sample Receiving**
  - **Area where biggest bang for buck can be achieved**
  - **Two flavors:**
    - **Receive from outside lab samples to be analyzed**
    - **Generate internal barcode label for samples**
  - **SQL*LIMS can receive samples by barcode from** *Log, Sample Receipt, Barcode Receipt*



- **Sample Tracking**
  - **Verifies sample is in a particular location for inventory purpose**
- **Documentation or report tracking**
  - **SQL*LIMS report has encoded the method id**
- **Task Processing**
  - **List of possible selections for standard results barcoded and on a laminated sheet**
  - **At SQL*LIMS client PC, operator scans solution into SQL*LIMS**

- **Custom Portal**
  - **Build a custom form that allows printing of labels on demand.**
  - **More flexible than SQL*LIMS Event printing**
- **Use ROWCALC to print labels at operation level**
  - **Allows printing of labels based on sample type via a custom PL/SQL package**
  - **Avoids problems with status actions at sample level**

- **After implementation of bar coding wait a month**
  - **Review Engineering Workflow times and processes**
  - **Note changes in work vs. process times**
  - **Update Engineering Workflow to new times and additional processes**
- **Repeat review in 6 months and add additional changes as needed**
- **Generally, a 15-20% improvement is not unusual and can go as high as 30%**