

Very WIP still....

This document deals with Phase 1 only: The Bika Fire Assay LIMS

Phase 1 only · The Bika Fire Assay LIMS

Bika LIMS as part of an enterprise solution for mining organisation. 100 samples per day

Assumption: Many distinct fire assay work flow actions are not captured in current systems, mainly due to harsh conditions and computer illiteracy. The stages are signed off on paper and the system does allow for it to be logged from the paper trail or on-line in real time (where better conditions prevail)

Phase 2 later · Bika mining enterprise solution

Other parts of the solution are developed and integrated. These include elements for exploration, grade control, geo-chemical and production plant departments. Sample records will be already created by these and must be picked up by Bika off a MSSQL database and deliver analysis results there

Most mines also have their own [tribology](#) labs, analysing lubricants and engine oils of their heavy equipment for maintenance purposes, and Bika Tribo could be added to the mix in Phase 2

Questions

1. May we visit your lab...
2. Skills levels of users in early 'sample preparation' work-flow, the guys at the ovens. The system must make it easy to toggle these inputs, mainly of status changes, on or off
3. File formats for AA spectrometer i) work sheet upload ii) results returned
4. How widely is timeslots used

MSSQL

The LIMS is to reside on an MS SQL database, also to 'interface' with other apps in the enterprise running on MS Access

Ideal opportunity to make this move but also attempt to retain ZODB functionality for subsequent roll-outs

Many prospects have expressed requirements to be able to get their hands on data in tabular format. Bika Fire assay will allow for .csv exports from views such as work sheets and query results

New Roles?

Sampler
Hut manager
Supervisor (semi literate)

New modules

Samples. Finally!-)

- Some sample records will be created in the SQL db by other departments
- Samples are collected in batches - the sample record carries a batch number
- results can be viewed in batches as well - **Batches look-up and view pages**
- Some prospects use a Timeslot to indicate calendar times for easy sequencing - the year is divided and numbered in sequential 2 hour slots...
- This might be separated into 2 stages indicated by different statuses - often sample container is created and bar coded first with instructions to the 'sampler' as to where the sample must be collected. The sample itself is collected often days later. 'Sample_due' and 'Sampled'?
- Samples themselves are barcoded by the 'sampler'
- Sample ID prefix includes a code indicating where it originated from
- Some samples will be analysed again. ARs are maintained in a 1 - many relationship. **In the texts here further-on, 'Samples' actually means ARs**, the first is preferred during WIP here as this is the language used by the prospect, they'll be educated on this topic later
- Sample COC (chain of custody)

They get divided and stored in separate shelf positions made up of an address made up of: hut, shelf, box, rack, position etc.

The set-up of these, samples storage facilities, is controlled by other departments - they should have access to them in the system

- Fields

batch number

barcode

Sample reception

- Bar-code scanning triggers 'receive' action
- the bar-code is validated for i) correct format and ii) record exists
- rejections are logged and there is a standard report available to list them with
- functionality is provided to create sample records here - some times records are not created earlier
- *Short term retention shelf position captured*
- *Weighing workflow starts - bag weight*
- Sample receipt reports are available at this point - insufficient sample material,

- sample received/not received, etc.
- Samples get

Work flow

Exclusively by printed works sheet (Bika job cards) with sign-offs after every stage

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Drying

This process entails the removal of any water residue/moisture from the sample. The samples go into an oven at around 105 C, and barcode strips are added to the drying containers for tracking

This work is done by computer illiterate staff, but the facility should be created to mark this status

- *'analysis' weight captured*
- sample/AR gets given status 'drying'
- signed off *by supervisor*

ARs

Though most work flow proceed per work sheet - standard AR work flow is maintained

Work sheet templates. Finally!-)

A work sheet is created by a supervisor, by putting the samples on the work sheet in chronological order

The work sheet layout - and NB, iys ID number is determined by the size of the trays used in the ovens used in the work flow. Typically 4 columns by 6 rows, and this 24 sample tray is used for explanatory purposes

- tray sizes can be configured in the system set-up

- tray position is captured for each sample
- the 24 samples will always include:
 1. at least 1 'blank' - containing none of the mineral assay ed for, typically quaretz for gold ore
 2. some QC/Grade Control samples
 3. some duplicates - duplicate sample IDs on the same work sheet are catered for

The worksheet ID is determined by the position of coppering samples blue

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Worksheet is printed out for sign-off purposes for every stage of the sample process

- the system has the capability to capture this as a status change
- Worksheet is exported in CSV format for upload by Analytical Instrument, typically an [AA \(atomic absorption spectrometer\)](#)
- a works sheet generally gets restricted to samples from one client/department only - this can be toggled off in the set-up

AA Analysis

See [AA · atomic absorption spectrometry](#) in the glossary

Via bi-directional interface - worksheets get loaded from the LIMS onto the AA and the results returned from there, all .csv formats

- values returned via the interface to works sheets may be manually overwritten

There could be more than one AA and worksheets get assigned to a specific machine. The instrument ID is kept on the WS for QC purposes

All file movements are logged

- the positions of control samples are indicated - when the results are returned these are returned against the control samples' expected values *and calibrations/drift corrections recommended*

Catch Weight

Weighing out exactly 50 g of a sample for analysis is a time consuming process and as a productivity measure the 'catch weight' principle is applied. As soon as the sample weight is within acceptable limits, the weight is catpured and any difference with the desired weight factored into calculations further down stream as a '*concentration factor*'

Weighing takes place on interfaced balances that fires a value down its port as soon as it has stabilised on a valid weight

- valid catch weight limits are set in the set-up
- out of range values are reported to immediately
- balances are interfaced

Add QC functionality (Joris)

Catch weight to be used in statistical calculations when reporting on sample QC setup, local reference matrix and internal reference matrix.

each department has their own QC criteria, so different rules to create worksheet & QC depending on the department that the sample is requested by.

Fluxing

see [fluxing in the glossary](#)

- status change noted in system

Fusion

Again heated up in an oven *to remove non-gold particles such as lead*

- status change noted in system
- at the end of the fusion process the gold-glass remainder is weighed and captured

Hammering

Physical removal of glass around gold residue. for phase 1 non LIMS interaction

Cupulation

Furnace phase, no interaction with LIMS. In this process the metals are being separated, ie. difference between oxidised and non-oxidised (gold) metals.

Coppering blue markers

prills ...

see [Prills](#) in the Glossary

Digestion

Extraction of the gold particles through dissolution - acid is added to the non-oxidised metals part

For phase 1 no LIMS interaction

- status change

Validation/Publication

In normal Bika terminology this would be 'verification'

In this phase the worksheets are verified. QC and Grade Control Samples' results are compared with the known values that were expected. Anomalies here prevents the works sheet from being validated

Results of Duplicate Samples are compared. Anomalies here prevents the works sheet from being validated

If no anomalies, all values are on spec, the work sheet is automatically validated *and released/published*

On average 5% of work sheets fail at this stage, fire assaying is a messy business prone to contamination

In the event of anomalies -

- the statuses of the samples & worksheet go all the way back to catch-weight
- the worksheet maybe edited, ie the duplicate was in the wrong tray position - by a labmanager and manually validated

- Dynamic work sheet sorting allows for sorting on Sample type so Duplicates and QC samples can be displayed next to one another
- Out of range values are clearly indicated -

Yellow: below spec

Red: above spec

Green: in spec

Control Samples. Finally!-)

- set-up area
- data in tables (per instrument/analyst) and graphs available
- **ditto for duplicate samples**

Reporting

Several reports were mentioned in other paragraphs up to here, they'll be searched for and listed here again

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QC reports and graphs

Turn-around times

Consumables (Inventory - *with alarms for low stock levels*)

Statistical Report (to be specced)

Machine maintenace

(optional)

Other

notes and comments that are not part of a specific part of the workflow:

Ability to delete records of expected samples, that will never be received.

Ability to handle worksheet exceptions;

if samples are less than 19, i.e. uncomplete sample tray.Repeat worksheet

Repetitive samples

Allow spreadsheet import from Gold Production department, i.e. when Gold Prodcutions department requests analysis these will be submitted by xls spreadsheet.

Ability to import samples without barcodes

Edit sample name if it is not right.