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1 Overview

The Client (SIP) maintains a large sample population of Sample Materials. These samples are kept for years, physically moved around laboratory containment units (freezers or refrigerators), and some scientists who deal with the materials are familiar enough with the contents that they refer to them by Sample Name.

Often scientists are using these samples and may not have a structured mechanism to record the movement of used samples. This missing structure to accommodate the scientists interaction with samples and locations makes locating sample material very difficult.

2 Objective

The web based application that is the subject of this document should act as a mechanism for scientists to record samples movement so that tracking samples of the same material can be more easily done. It should also be possible to visualize and query an audit log of the operations executed, although the objective of the system is only recording the said audit log, and not provide tools to visualize it.

3 Existing System, SIP.

Currently the system is a PowerBuilder application which acts as a thin wrapper around the RDBMS, Sybase 12.5 which stores the data as well as provides some application logic via triggers and stored procedures. We will base the existing functionality on this application. This application, SIP has a variety of features such as:

- Reporting on data using a tabular (Excel-like) view.
- Editing constraints on data entry forms such as what required fields, valid locations and location types, etc.
- Easily enable the moving of aliquots between locations.
- Entry of new sample materials into the application.

4 Proposed Solution

SIP is looking for a framework to build on top of as the application evolves. We have specified two frameworks we will stitch together using the Python programming language. Zope 3 is the application server which handles critical infrastructure such as: security, database connectivity, user authentication, protocol integration and component-based development hooks. SQLAlchemy will be the object-relational mapping subsystem that will handle the marshaling of objects to SQL and back again. Our goal is to bridge these frameworks together using components and then build the SIP application using said components.

5 Software Use

- The software manages the location and use of sample material in the SIP.
- Sample materials are entered by a Lab technician for a Project.
- Projects are centered around grant funds at SIP.
- Scientists working on a Project often use sample material frequently in experiments.
- Inventory (sample material) is used frequently since it has large amounts of data already associated with the material.
- Material is often split up into units called Aliquots.
- Aliquots are sample material and since it belongs to a original sample it should would need to be traced back to its point of Origin.

- There are certain circumstances where aliquots may have been tainted (ruined) at some point and it would be important to traceback existing aliquots and samples from the same point of Origin so that they too could be tested to see if they have spoiled (or be able to use good material in tests).
- Sample material is kept in a variety of locations ranging from deep-freezers, nitrogen-based freezers to ordinary refrigerators. The sample material is made up of one or more Aliquots, which can each be independently placed any of the available locations.
- Inventory must be tracked as it moves from one location to another. There must also be a audit log kept of any transaction dealing with Inventory. This is important for security and privacy reasons. So any transaction in the system such as creation of samples, aliquot creation, transferal of genetic material from/to a freezer must be kept in a audit log in the system.
- Sample material and aliquots have a minor quirk with regards to how they are used (in real life this is not a problem but needs to be addressed in the software/UI) people refer to the samples by Name and Location. When an aliquot is created it is still referred to by the originating Sample's name. This can be confusing because usually its the context in which they are referring to that gives you the appropriate sample. End users will not tolerate having to refer to unique id's or naming conventions (old habits die hard). So people can refer to sample material as, SAMPLE NAME X, IN CONTAINER Y since there can be many samples of the same type in CONTAINER Y we may need to specify where in CONTAINER Y.
- Containers contain containers. In our system a container is a freezer or some other sort of container. There can be shelves inside a freezer, boxes on the shelves, inside a box there can be more boxes and inside that box it could be free standing or it could be in located in a grid of samples (3 down, right 2). It must be very simple for people to be move a individual or a collection of samples (multiple samples or a container of samples) to/from a container.

5.1 Managing Projects

The new application will have several administration screens where managers can configure the application or project specifics. The application configuration section is responsible for creating projects and administering all the locations used by the organizations. The Project Manager has the ability to pick users from the central user list and assign them roles. Project Managers can assign what locations to include in a project. Lastly Project Managers can configure what sample type's are available in a project. The application aims to streamline the management of application and project tasks.

5.2 Security

We will need to define a series of Permissions that will be used by the application. These will guard against users from executing routines they do not have access to. The permissions will then be setup by Role or by Group. A Principal (User/Role/Group) will have sets of permissions assigned to them and will prevent them from accessing protected parts of the application. User Interface options will change depending on permissions available to the user (in the Project).

Stakeholders in the system usually fall into one or more of the following roles:

- Application Manager user of the system that is responsible for creating and maintaining Projects. They also have rights to all Projects. This is similar to a 'root' user.
- Project Manager user of the system that is responsible for creating and maintaining a Project. They are responsible for administrating users inside a Project and have access to all areas inside a particular Project
- Lab Technian user of the system that is responsible for creating new Sample inventory, adding and maintaining aliquots that make up a sample, as well as deriving Samples
- User (Scientist) user primarily interested in the storage and quantities of a Aliquot. Also interested in the history of a sample.

5.3 Auditing

Any changes to application data such as adding, editing, moving sample material inside the application will require audit logs. There are two reasons for doing this: keeping a track of historical usage and movement of sample materials. The application should prompt the user when a change is being made so that audit entries can be commented. Projects should be toggleable to control whether or not to prompt users for commit messages. We will need to audit coarse grain events such as:

- Modification of a User (Add, Edit, Remove)
- Modificataion of a Sample (Add, Edit, Remove)
- Transfer of a Sample (from/to Location)

5.4 Authentication

In the current SIP application the Sybase database server authenticates the credentials passed in. Users, Passwords and Groups are managed by the database. i.e. Sybase uses internal database system tables to store this information. The new application will make connections to the Sybase server as a single user (sip_application) and the Zope application server will authenticate credentials using its own mechanism (looking up in a application database table information). This means that traditional Sybase infrastructure for managing a Sybase instance will not be able to (easily) manage the Users, Groups and Roles for the WSIP application. LDAP is good alternative to storing user authentication information in the RDBMS. Then LDAP user management tools can be used to manage application users.

5.5 Permissions

Permissions will be configured per Project. So a person may have permissions to move a sample in one project but not another. Depending on the Role of the user the Permissions will be applied at different levels of the application. For instance a Applications Administrator will be able to move a Sample to/from any Container in all Projects.

6 Use Cases

6.1 Validate User

Actor: SIP Stakeholder

Summary: Users needing to gain access to the Inventory System must login. The credentials will be authenticated inside the application using data from the Sybase RDBMS.

Post-condition:

- Credentials submitted by Stakeholder are authenticated by the Application

Actions:

- Stakeholder fills out username and password and clicks 'login' button
- Password is then MD5-HASHed and is compared against the password in the database tables

Post-Actions:

Successful Authentication:

- User will have a cookie set to their web browser.
- Browser will be redirected to the Project Listing page, where the user can choose from the available projects to perform actions associated with a Project.

Failed Authentication:

- User will be redirected to the login screen with a notification message stating that Authentication has failed.

6.2 List Available Projects

Actor: SIP Stakeholders

Summary: When a stakeholder enters the application they should see a list of all the projects where they have the permission to view the Project.

Pre-condition:

- User has been logged in and a authorization cookie placed on browser.

Actions:

- Add Sample when clicked the current browser window will load a empty Create Sample form.
- Transfer Sample when clicked the user would be presented with the Transfer Sample form, where they can transfer the location of a Aliquot(s).
- Derive Sample when clicked the user would be brought to the Derive Sample form. They could then change the Sample Type of particular Sample/Aliquot.
- Administer Project Project Manager or a user with the Administer Project permission for a particular Project in the listing would see this option. This contains a link to the administrative setup screens for a particular project.

Post-condition:

- Stakeholder sees a listing of her available Projects.

6.3 Create Sample

Actor: Lab Technican

Summary: A new sample needs to be entered into the inventory system. The sample must be associated with a Project. The sample type must be categorized into Project specific category. Sample Types can provide supplementary fields that must be fulfilled on entering a new sample of said Sample Type. A sample can be created without filling out aliquot's or location information.

Pre-condition:

- User must have the 'Add Sample' permission.

Actions:

- Pick the project with which the sample will be associated
- Enter the Sample Id
- Pick the Sample Type of the Sample [REQUIRED]
- Will notify the user interface if there are further actions required by the user to select a Sample Type
- User will be presented with a button to click on that will launch window to gather more information required by Sample Type.
- Fill out fields as needed ensuring required fields are filled.
- Select either a EGO or an ANIMAL when filling out patient id.
- Click the 'Save' button at the bottom of the screen.

Post-condition:

- HTML FORM values must be validated.
- CreateSample method will be called which will insert the validated values.
- User will be redirected to a empty Sample Entry form.
- There will be a status message indicating to the user that data has been saved.

6.4 Edit Sample

Actor: Lab Technician, Data Manager

Summary: The sample edit screen is the main interface into editing attributes of a Sample or an associated Aliquot. All attributes can be changed on a Sample including the Animal/Ego ID, Dates associated with the sample, as well as the Sample Type and its associated fields. All available Aliquots of the Sample are listed in the middle of the screen. By clicking on the ID (hyperlink) the form will be reloaded with the Aliquot's information available to edit. Aliquot information such as unit measurements, locations and dates may be modified.

Pre-condition:

- User has been logged in and a authentication cookie placed on browser.
- Sample has been saved to database and retrieved.

- Sample Type Field values have been entered.

Actions:

- If the ADD Aliquot button is clicked
- Prompt the User for a Commit Message
- Validate the newly entered Aliquot data
- Application saves the data
- User is redirected back to the Sample Edit form with a confirmation that the data has been saved.
- If the SAVE Sample button is clicked
- Prompt the User for a Commit Message
- Validate the newly entered Sample Information
- Application saves the data
- User is redirected back to the Sample Edit form populated with the newly entered data
- A confirmation message will indicate the information has been saved..
- If CANCEL button is clicked
- User is redirected to the Project Listing page with a message, No changes have been saved.

Post-condition:

- Sample information has been validated.
- Sample Type Field values have been validated.
- Aliquot information (if entered) has been validated.

6.5 Create Aliquot

Actor: Lab Technican and Scientist

Summary: Samples are informational. Aliquots are sample materials that are physically exist in a measured quantity. More than one aliquot can be of the same sample. We could have a sample called SAMPLE1 that is of sample type, TYPE1. There could be one or more aliquots of SAMPLE1. This states that we have physical sample materials for SAMPLE1. When aliquots are used their measurements (concentration, weight or volumne) will change. When the measurements become 0 it will be marked depleted. Aliquots are the central unit of work that users in the system are concerned.

Pre-condition:

- User must have the 'Add Aliquot' permission on a Sample.

Actions:

- Locate a sample from within a Project

- In the Sample Entry screen there will be a empty aliquot form allowing users to easily add aliquots.
- Fill out the aliquot measurements and location information
- Click the 'Save Aliquot' button to commit the save.
- Prompt the user with a commit message.
- Save the information.

Post-condition:

- HTML FORM values must be validated
- CreateAliquot method would be called on a Sample object.
- Users will be redirected to the current Sample Entry form.
- There will be a status message notifying users that data has been saved.

6.6 Move Sample

Actor: Lab Technican, Scientist, Project Manager

Summary: Samples/Aliquots often need to be moved from their existing location to a new location. This happens very frequently and must have a easy-to-use interface to faciliatate this transfer with as little impedance as possible. Scientists move aliquots to containers nearest them, and often sample materials are transferred between on-site and off-site containers. It is understood that Users can transfer samples/aliquots from/to any containers. There will be two trees on both sides and the user will be able to drill down in the container of sample and another container in the destination to transfer the sample.

Pre-Condition:

- User has the 'Move Sample' permission on a Sample.

Actions:

- User is presented with a dual pane of containers. The same containers are listed on both sides. Each container contains a arbitrarily amount of containers.
- The user drills down into the 'source' container to find the sample they are looking for. They will select the sample they find in the container and click the 'transfer' button. It will prompt for the amount of units to transfer: DEFAULTS to the entire sample.
- The 'transferral clipboard' will show all the items that are selected to be transferred.
- The user then drills down into the destination container. They can then DRAG 'N DROP the items from the 'transferral clipboard' from the clipboard to the destination. You will not be able to select units to transfer from the clipboard.
- The clipboard is emptied when contents have all been transferred. There is a 'commit' action that will commit the transaction to the database.

Post-Condition:

- HTML form is validated with submitted values
- transferToContainer method is called on Sample providing the ID of the destination Container. Optionally there could be a units argument that allowed fine-grained transfer of sample, instead of transferring the entire Sample.
- UPDATES in the database will occur
- AUDIT LOGS ENTRIES are entered.
- The source sample will disappear if the entire unit is transferred and appear in the destination container.
- A status message will indicate to the user that the material has moved.

6.7 Application Setup

Actor: Application Manager

Summary: The application setup screens are used to configure central services made available to projects. Creating projects and setting up locations are the most important.

Pre-condition:

- User has been logged in and a authorization cookie placed on browser.
- User has the 'Application Setup' permission

Actions:

- A new project can be easily created by typing the new project's name in the 'Project Name' input box (see Create Project)
- A new location can be easily created by typing the new location name and choosing the container type (see Create Location)

6.8 Application Setup: Create Project

Actor: Application Manager

Summary: The Project at SIP is the main organizational unit where users interact with the application most. Projects are the workspace where aliquot measurements are changed, samples are derived and material is transferred between locations.

Pre-conditions:

- Security check against the Application that User has 'Create Project' permissions.

Actions:

- Enter Project Id
- Click the 'Add Project' underneath the 'Project Name' input area.

Post-conditions:

- Form validation on submitted HTML form values

- Ensure the project name is unique.
- The Project is created and added
- Users is redirected back to the application configuration page. If they would like to administer the project they can select the newly created project from the drop down list and click the 'Adminster Project' button to be brought to the project configuration page.

6.9 Application Setup: Create Location

Actor: Application Manager

Summary: Locations must have a type, which is the type of the 'root' container, the temperature range for the freezer, and the physical location of the freezer (building and room).

Pre-condition:

- Ensure user has 'Application Setup' permissions.

Actions:

- User clicks on the 'Location Setup' icon/title in the Application Setup menu.
- User is presented with a empty Location Form that contains the following fields:
 - Location ID
 - Acceptable Temperature Range (in C or F)
 - Container Type
 - Building
 - Room

Post-condition:

- HTML forms are validated
- The Location is created and added.

6.10 Application Setup: Create User

Actor: Application Manager

Summary: The Application Manager is the only person allowed to create new users on the system. He is responsible for filling in the user's personal information and choosing a good password.

Pre-condition:

- Ensure user has 'Application Setup' permissions.

Actions:

- User goes to the Application Setup form
- User is presented with a empty 'Create User' form with the following fields:

- Username
- Full Name
- Password
- Confirm Password

Post-condition:

- HTML forms are validated
- User is created and added to the project

6.11 Project Setup: Location Assignment

Actor: Application Manager, Project Manager

Summary: Locations are defined at the application level. Project Managers can pick from the central list of Locations that they would like to store materials in during the lifetime of a project. In the project setup screen there will be a multi select list of available Locations.

Pre-condition:

- Ensure user has 'Project Setup' permissions.

Actions:

- Select from a list of available Locations in a multi select box. Users can select multiple items by holding CONTROL and selecting Locations.
- Click the 'Assign Location(s)' button next to the Location list.

Post-condition:

- Ensure that Locations have been selected
- Assign Locations to the project
- Display a message indicating assignments have been saved. Assigned Locations will show selected in the list.

6.12 Project Setup: Technician Assignment

Actor: Application Manager, Project Manager

Summary: Technicians are defined at the application level. Project Managers can pick from the central list of Technicians that they would like to store materials in during the lifetime of a project. In the project setup screen there will be a multi select list of available Technicians.

Pre-condition:

- Ensure user has 'Project Setup' permissions.

Actions:

- Select from a list of available Technicians in a multi select box. Users can select multiple items by holding CONTROL and selecting Technicians.

- Click the 'Assign Technician(s)' button next to the Technician list.

Post-condition:

- Ensure that Technicians have been selected
- Assign Technicians to the project
- Display a message indicating assignments have been saved. Assigned Technicians will show selected in the list.

6.13 Project Setup: Create Sample Type

Actor: Project Manager

Summary: Sample types play two central roles in a sample. First they are a categorization mechanism for sample material, i.e. this sample is of type buffycoat. Secondly a sample type such as a buffycoat for a project may have fields for input associated with it. The sample type and its associated fields are administered in a projects' administration section. Fields associated with a Sample Type (see Modify Sample Type Fields) can be configured by Project Managers using the web interface. These fields will define name, title, description of a field and whether a field is required. Form validation rules will also be associated with the Field. Form validation rules will be any valid TALES expression. An example of ensuring value for a field is less than 4000 would look like, python: value < 4000. This would require values entered into the field to be less than 4000 or the submission of the form will display an error. Data that fails validation will indicate to the user why the expression is failing: The value must be, value < 4000. All values for the form must be valid for any values to be committed to the database.

Pre-condition:

- Security check against the Application that User has 'Project Setup' permissions for a Project. The 'Administrate Project' icon will appear.

Actions:

- User logs into the system
- User is presented with a listing of all Projects in which they have been associated.
- If the User has the 'Project Setup' permission for a Project an 'Administrate Project' icon will appear on the same line as the Project information.
- User clicks the 'Administrate Project' icon
- In the Administrate Project view they will see a number of options including 'Add Sample Type'.
- User clicks 'Add Sample Type'
- User is presented with a form where they must enter the Sample Type Name/Title to create.
- If the Sample Type Name is Unique to the Project they are brought to the 'Sample Type Setup' form.

Post-condition:

- Check to see if the Sample Type Name has already been used in the Project.

6.14 Project Setup: Create Container Type

Actor: Application Manager, Project Manager

Summary: Container Types are used to categorize Container's. Containers come in two varieties: root containers and child containers. Root Containers represent the physical entity at a Location. Root Container Types examples include Freezers and Nitrogen Tanks (Containers that can not be nested). Child containers can be nested in root Containers as well as other child containers, such as Frames or Racks.

Pre-condition:

- Ensure user has 'Project Setup' permission.

Actions:

- Container Type name is entered
- A checkbox indicating if the Container Type is a Root Container Type.
- User is prompted with a Commit Message
- User is redirected to Project Setup screen
- Display an error message if the Container Type name is already used.
- Display a confirmation message that the changes have been saved.

Post-condition:

- Check to see if Container Type name is already in use.

6.15 Project Setup: Create Container

Actor: Application Manager, Project Manager

Summary: Containers are created inside of a Location object. A location object must contain a single Root Container which can contain an arbitrary amount of child containers. The User drills down from a Location into the destination parent container to add a new Container. When creating a new Container the user must select a Container Type and will be able to define Rows and Columns (integers) to populate the parent container with N (Rows*Columns) subcontainers with the selected Container Type. The newly created child containers will be labeled Container Type \$ROW x \$COLUMN. An example of creating a number of Chiclets inside of a Frame. A Frame can contain some 324 Chiclets. These Chiclets are organized by physical position in the Frame. This positioning is defined using X, Y cartesian co-ordinates. In the application after a Frame is created the User would go into the newly created Frame and create a Chiclet. The User would create a new child Container and would select Chiclet from the Container Type and enter 18 Rows and 18 Columns. Upon saving this would create 324 Chiclet containers inside the parent Frame container. The chiclet representing the left top child container would be Chiclet 1 x 1 and the bottom right Chiclet would be represented with the label, Chiclet 18 x 18.

Pre-condition:

- Ensure user has 'Project Setup' permission.

Actions:

- Inside the destination folder the user would Create Container
- Container Type would be selected.
- Rows and Columns values are optionally excepted.
- User is prompted by a Commit Message.
- Application generates child containers in the target Container.
- User is redirected to the parent's contents listings with a message displaying Containers have been created.

Post-condition:

- Ensure a Container Type has been selected.

6.16 Project Setup: Assign Roles to Users

Actor: Application Manager, Project Administrator

Summary: Users are stored outside of the application, in this case a RDBMS table. Each project setup will allow administrators to assign roles users from the central list. The administrator can assign what roles they will have in the project.

Constraint:

- Application Managers can give/remove roles both globally (at the application level) or locally (at the project level). Project Managers can only act on roles on the projects they are managers.

Actions:

- Administrator selects a user or users from a list.
- Administrator changes the role setting to one of ('Allow', 'Deny', 'Unset').
- By clicking the 'Save' button the selected users in the list are submitted to the application to be assigned roles

Post-condition:

- User names are selected.
- HTML form validates
- User is redirected back to 'Assign Role to User' form

6.17 Sample Type Setup: Add Fields to Sample Type

Actor: Project Manager

Summary: One approach to capturing extra data when a Sample is being entered in the existing SIP application is on the selection of 'Sample Type'. There are extra fields that are displayed for data entry when a Sample Type is selected. These fields vary depending on what has been configured for the Sample Type. For a particular Project a Buffy Coat may require different attributes to be entered than from 'Serium'. In the Sample Type setup it is possible for an administrator to add/modify Fields that are associated with a Sample Type. Each Field that is associated with Sample Type will have the ability for the administrator to configure it and constrain the data that is entered into the Field.

Pre-condition:

- Administrator has permission to 'Administer Project' in the current Project
- Administrator has created and selected a 'Sample Type' to administer Fields

Actions:

- Once inside the Sample Type Setup the user will see a listing of Fields
- User will click the 'Add Field' button
- The 'Add Field' view will display the following information:
- Field Name [text] this is the internal name used by the application.
- Field Title [text] this is the field name/title that will be shown on the actual form.
- Field Description [text] if there is need for a Description of what the Field is used to be inlined in the form
- Field Required [boolean] a checkbox indicating whether or not the Field must be filled in by a user.
- Field Validation [text/TALES] will be a check box. If checked, the created field will have a TALES constraint to be used to validate the input. This would normally be a python: expression that would evaluate the 'field' object's value (what the user had entered into the form).
- User would click 'Save' and validation would occur and Save would take place.
- User could click 'Cancel' button and be brought back to the list of Fields.

Post-condition:

- Check to see if the Sample Type Name has already been used in the Project.
- Check to see if the Field Name has already been used by Sample Type.

6.18 Application Logout

Actor: SIP Stakeholders

Summary: At any point in the application a user will be able to click a 'Logout' hyperlink that will expire the cookie on their machine and log them out of the application.

Pre-condition: User is logged into the application

Post-condition: User is no longer logged in

Actions:

- User clicks the 'Logout' link
- Cookie is expired on the users browser
- User is brought to a 'You have now been logged out' page

7 Glossary

NIH (National Institutes of Health)

The federally-funded institution dedicated to biomedical research, from which most of SIP's research grants are paid.

P.I. (Principle Investigator)

The term for the scientist to whom NIH funds are awarded for a research project. This individual is the scientific leader and financial administrator of a project, and who has the final authority for permissions to access study data and biomaterials.

Project

Most biomedical research studies are targeted, that is, they are organized to investigate a particular aspect (cause, symptom, risk factor, etc.) of a disease, frequently in a well-defined set of subjects. This organization is reflected in the way NIH research funds are granted, and most importantly here, in the way data and biomaterials are organized, stored and inventoried. Thus, in the context of the BMIA, a project is a name defining the a data set and its management, which is associated with a study and its P.I. A project is frequently given the name (or a mnemonic version) of the official name of the research study. SIP examples: StrongHeart, GOCADAN, MAPP, BabPP.

Laboratory Technician

An individual with technical training and experience in physically preparing, handling, storing and analyzing biomaterials. With the increasing automation of laboratory instruments, lab techs are now spending much of their time working at the computer. Their duties typically include entry or preparation of inventory data at the most fundamental level, making their role in database operations a crucial one. We have made some progress in automating computer-related tasks of lab techs in a few projects, and we anticipate further workflow development at this level.

Data Manager

The individual in charge of hands-on management of data for a project. This requires a basic understanding of the scientific uses of samples and data derived from them, as well as familiarity with SIP computer organization and appropriate applications. This individual is a senior member of the SIP technical staff who typically is the only person granted inventory write permission by the project P.I. At the present time, the data manager is responsible for too much hand work and detail. While this imparts an intimate knowledge of database procedures, it is not an efficient use of highly skilled scientific personnel. Our current priority is to develop more systematic Biomedical Materials Inventory procedures so as to relieve the data manager of tasks that are more appropriately automated or assigned to lab tech operations.

Biomaterials

This is the general term for the cells, body fluids, tissues, organs, etc., as well as substances developed from these sources, collected from study subjects for use in a research project. Most fluids are taken by venipuncture or simple external collection (i.e., urine). Collection of tissues and organs may require surgical removal. A variety of techniques are used to isolate cells from blood and tissues. DNA and other molecular substances may be derived from these cells.

Sample

This refers to the specific material collected from a study subject. A sample may be analyzed and discarded, but whenever possible, a sufficient amount of sample is collected and put in long-term storage (mostly in low-temperature freezers) so that many analyses can be done in the indefinite future. We keep many types of samples, each of which requires its own method of collection, preparation and storage, the details of which must be recorded and available to lab techs, data managers and scientists.

Sample Name

a non-unique id for a sample that scientists sometimes refer to in their dealings with Sample Material.

Sample Type

The type of sample collected and stored depends on the requirements of the project. To date we can define the following types:

- Blood – This usually refers to whole or unprocessed blood taken directly from a vein by venipuncture or at necropsy. For the most part, a whole blood sample is not stored as is. Rather it is divided into its major components before storage. These components are separated by treating the blood with an anticoagulant and centrifuging the mixture.
- Plasma – Is the liquid portion of whole blood which stays at the top of the tube.
- RBC (red blood cells) – Comprise the component that settles to the bottom layer of the tube.

- Buffy coat – Is the thin yellowish layer of wbc (white blood cells) overlying the packed red cells in the tube.
- Serum – The clear liquid that separates from whole blood when it is allowed to clot completely. It is different from plasma since it contains does not contain substances that promote clotting.
- Solid tissue – Tissues such as liver, brain, muscle, etc. usually requiring surgical removal (referred to as biopsy if the subject is living, necropsy if the subject is dead).

Aliquot

Samples are frequently divided into separate roughly equal portions (called aliquots) and stored (often in different locations) for purposes of redundancy, backup or ease of handling. But note that we allow an aliquot count of one (that is, we use the term aliquot even when a sample has not been subdivided).

Inventory Number

This is a unique integer sequence number identifying an inventory entry. Used and assigned as a database internal.

Sample ID

This is a unique name (consisting of any combination of alphabetic and numeric text characters) identifying a sample. This is assigned externally to the database by the originator of the biomaterials sample and is used by lab techs, data managers and scientists to reference the sample.

Date Sample Generated

This is usually the date that the sample was collected from the study subject. Assigned externally to the database.

Aliquot Location

- Freezer – Most aliquots are stored in low temperature freezers, each of which is uniquely identified by location and name. SIP uses more than n hundred freezers for sample storage.
- Rack – The interior of each freezer is filled with a numbered grid of removable, multi-shelved wire racks.
- Box – Each rack shelf contains an ordered set of small (4 x 4 x 2 inch) fiber or plastic boxes in which are placed the actual sample containers. Depending on the sample type, a full box may contain mm to nn sample containers (aliquots?).
- Frame – the old chiclet storage scheme used canes and frames.