**Environmental Testing Inc. (ETI) Requirements Definitions**

**Entities**

**Entity: Employee**

Entity Description: Employees of ETI

**Attributes of Employee**

Employee\_ID: Unique number given to each employee

Role: Position within ETI

First\_Name: First name of employee

Last\_Name: Last name of employee

Years\_of\_Service: Length of time with ETI

**Entity: Instrument**

Entity Description: Instruments used to analyze laboratory samples

**Attributes of Instrument**

Instrument\_ID: Unique numerical identifier given to each instrument

Instrument\_Type: Type of analysis instrument can perform

Calibration\_Date: Date instrument was last calibrated, given in MM-DD-YYYY format

Calibration\_Renewal: Date instrument will need to be calibrated again

Status: Instrument availability. Can be “ready”, “in use”, “out of service” or “repair service requested”. Date given in MM-DD-YYYY format

**Entity: Project**

Entity Description: Projects performed by ETI

**Attributes:**

Project\_ID: Unique numerical ID given to each project

Customer\_Name: Liaison for project questions and deliverables

Analysis\_Requested: Analysis types requested by liaison upon project initiation

Due\_Date: Date the project must have deliverables completed and sent back to liaison by

Status: Current status of project. Can be “not started”, “sample preparation”, “sample analysis”, “data analysis”, “data review”, or “complete”. Given in MM-DD-YYYY format

**Entity: Sample**

Entity Description: Samples given to laboratory for analysis

**Attributes:**

Sample\_ID: Unique numerical identifier for each sample

Sample\_Type: Type of sample provided

Storage\_Location: Code corresponding to a physical location for sample storage. Outside of storage, sample could also be in preparation or analysis, which will have separate designation codes

Disposal\_Date: Date sample can be disposed of utilizing the proper SOP. Given in format MM-DD-YYYY

Customer\_Name\_FK: Foreign key from the Project table. Given here for easier access to analysts if questions arise, to contact project liaison.

Batch\_ID: Batch a sample belongs to. Denotes what samples were prepped or analyzed at the same time, but does not necessarily mean customer name matches throughout the batch.

**Entity: Supplies**

Entity Description: Materials for the preparation or analysis of samples

**Attributes:**

Supply\_ID: Unique identifier for supplies

Expiration\_Date: Date, if needed, in MM-DD-YYYY format that supply should be disposed of. Some supplies do not expire.

Supply\_Name: Name of each supply.

Quantity: Quantity of supply

Supply\_Location: Storage location of supply for easier retrieval

**Relationships**

Relationship: SUPPLIES “uses/ used by” SAMPLE

Cardinality: 1:M between SUPPLIES and SAMPLE

Business Rule: Supplies analyze one sample, but many supplies may be needed to analyze one sample. Samples must have supplies, but supplies do not need to be associated with samples, for example, if supplies are in storage.

Relationship: PROJECT “has many/are assigned to” SAMPLE

Cardinality: 1:M between SAMPLE and PROJECT

Business Rule: Samples are assigned to one project, but one project can have many samples. Project may have no samples assigned if the project has just begun or samples have not been received by the laboratory yet.

Relationship: SAMPLE “analyzed by/analyzes” INSTRUMENT

Cardinality: 1:M between SAMPLE and INSTRUMENT

Business Rule: Samples can only be loaded onto one instrument, but one instrument can carry many samples. Samples do not have to be loaded onto an instrument if in storage or sample preparation. Instruments do not have to be running samples.

Relationship: EMPLOYEE “handles/is handled by” SAMPLE

Cardinality: 1:M between EMPLOYEE and SAMPLE

Business Rule: One employee can handle many samples, but a sample must be handled by one employee at a time. Employees do not have to be handling samples. Samples do not have to be actively handled by an employee, if for instance, the samples are in storage.

Relationship: EMPLOYEE “oversees/ is overseen by” PROJECT

Cardinality: 1:M between PROJECT and EMPLOYEE

Business Rule: Projects are assigned to one employee, but an employee can work on multiple projects. Projects must be assigned to an employee, but an employee does not need to have a project.

Relationship: EMPLOYEE “loads/is loaded by” INSTRUMENT

Cardinality: 1:1 between EMPLOYEE and INSTRUMENT

Business Rule: One employee uses one instrument at a time. Employees do not have to be using instruments, and an instrument does not have to be in use.

**Other Assumptions/Special Rules**

This is a base model for the new Laboratory Information Management System (LIMS) to replace handwritten logs. As such, future versions might find other entities/relationships to include to cover other laboratory operations. To allow for client-requested maximum entity number, these operations, including analysis calculations, are not included here.

This project utilizes simulated data. In real-world laboratory operations, the Supply, Instrument, and Sample categories are likely to be changed or updated throughout the process. Simulated data will provide only the snapshot of the end result of these operations. For instance, one sample may in some circumstances, undergo multiple analyses. These could mean a different set of supplies used, different employees handling the sample, and the sample being loaded onto different instruments. In this case, the database acts as a log that stores only the most recent instance of these values.