Development of an Environmental and Industrial Hygiene Relational Database Application

S. Martens, M. Plese, M. Puskar

Abbott Laboratories
1401 Sheridan Road
North Chicago, IL 60064
Corporate Environmental, Health and Safety Laboratory (CEHS Lab)
CEHS Lab Worldwide Client Base
Needs

IH data entry tool

Env. data entry tool

Sampling Guide

LIMS
Needs

Data repository

Reporting and querying tool

Integrated field and lab system
Relational Database Application

- Developed in-house
- Client-server based application
- Runtime Microsoft® Access front end
- Open database connectivity (ODBC)
- Oracle® database back end
- 40+ Networked users
- Stand alone version
Field Data Repository
LIMS
Reporting
Future Plans
Field Data Repository

- Method driven application
- Allows for input of all IH and environmental data
- Server data storage
  - Internal and external security
  - Data backup
  - Easily administered
Sample Collection Logic

Field

Consult IHDA Sampling Guide

Collect Sample

Input Sample Data into IHDA
Field Data Entry Screens: Main Menu
Field Data Entry: Method Selection

- Identify method used
- Method determines future screens
Field Data Entry:
General Sampling Information

Automatic employee name entry
PPE Entry
Field Data Entry: PPE Information

Option for more than one selection
Field Data Entry: General Sampling Information

Sample Information

- Sample Type: PERSONAL
- Sample Date: 05/17/2001
- Field Number: 0059
- Collector Name: JOHN DOE

Div: CED
Site: NC
Floor: 1
Shift: 1
Bldg: A1
Dept: 1234
Room: 123
Multiple Depts: N

Other Departments:
Location Comments: AT HEAR DOORWAY OF ROOM

Timing
- Start Time [24 clock]: 700
- Stop Time: 1500
- Sample Restarted: N
- Total Time [minutes]: 480

Copy Current Sample... Add Blanks... Main Menu Previous Sample Next Sample

Record: of 1 (Filtered)

Autocalculated Multiple start / stop times
Field Data Entry:
General Sampling Information

Ventilation Information
## Field Data Entry: Sampling Device Information

**Employee**: SMITH, JOHN  
**Sample Type**: PERSONAL  
**Sample Date**: 05/17/2001  
**Field Number**: 0059  
**Collector Name**: JOHN DOE

<table>
<thead>
<tr>
<th>Field</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pump Manufacturer</strong></td>
<td>GILIAN</td>
</tr>
<tr>
<td><strong>Pump Model Number</strong></td>
<td>513A</td>
</tr>
<tr>
<td><strong>Pump Calibration Device</strong></td>
<td>BIOS DRY-CAL</td>
</tr>
<tr>
<td><strong>Cal. Device Serial Number</strong></td>
<td>LR157</td>
</tr>
<tr>
<td><strong>Location Cal. Records</strong></td>
<td>SAFETY OFFICE</td>
</tr>
<tr>
<td><strong>Pre-samp. Cal. Date</strong></td>
<td>05/17/2001</td>
</tr>
<tr>
<td><strong>Pre-samp. Flow Rate</strong></td>
<td>20.5 ml/min</td>
</tr>
<tr>
<td><strong>Post-samp. Cal. Date</strong></td>
<td>05/17/2001</td>
</tr>
<tr>
<td><strong>Post-samp. Flow Rate</strong></td>
<td>21.2 ml/min</td>
</tr>
<tr>
<td><strong>Average Pump Flow</strong></td>
<td>Autocalculated</td>
</tr>
<tr>
<td><strong>Date Samples to Lab</strong></td>
<td>Autocalculated</td>
</tr>
<tr>
<td><strong>Total Volume Air Sampled</strong></td>
<td>10.0000 liters</td>
</tr>
</tbody>
</table>

**Sampling Device**
Field Data Entry: Environmental Sampling Data

Same form: environmental data fields overlaid
Field Data Entry:
Environmental Sampling Data

[Image of a software interface for environmental sampling data entry]
Field Data Entry: “Copy” and “Blank” Features
Field Data Entry: ‘Linking’ Samples

Zero exposure assumed for remainder of shift?

To select - Hold down the ctrl key and click on samples to link - 
or for consecutive samples - select first sample then hold shift key and select last sample or drag mouse to last sample.
# Field Data Entry: ‘Linking’ Samples

## IHDA Link Sampling

<table>
<thead>
<tr>
<th>Analyte</th>
<th>Field Project</th>
<th>Class</th>
<th>Field Number</th>
<th>Last Name</th>
<th>Social Sec</th>
<th>Zero Assume</th>
<th>Link</th>
</tr>
</thead>
<tbody>
<tr>
<td>METHYL ETHYL KETONE</td>
<td>MEK SAMPLING</td>
<td>TWA</td>
<td>MRP1010-001</td>
<td>PLESE</td>
<td>323468321</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>METHYL ETHYL KETONE</td>
<td>MEK SAMPLING</td>
<td>TASK</td>
<td>MRP1010-002</td>
<td>MARTENS</td>
<td>390624318</td>
<td>Yes</td>
<td>10/10/2000 3:52:58 PM</td>
</tr>
<tr>
<td>METHYL ETHYL KETONE</td>
<td>MEK SAMPLING</td>
<td>TASK</td>
<td>MRP1010-003</td>
<td>MARTENS</td>
<td>390624318</td>
<td>Yes</td>
<td>10/10/2000 3:52:58 PM</td>
</tr>
<tr>
<td>METHYL ETHYL KETONE</td>
<td>MEK SAMPLING</td>
<td>TASK</td>
<td>MRP1010-004</td>
<td>MARTENS</td>
<td>390624318</td>
<td>Yes</td>
<td>10/10/2000 3:52:58 PM</td>
</tr>
</tbody>
</table>

### Zero Exposure Assumption

To select: Hold down the ctrl key and click on samples to link.

For consecutive samples: select first sample then hold shift key and select last sample or drag mouse to last sample.

## Link ID

[Image of Link ID]
Field Data Repository

LIMS
Sample Collection Logic

Field

- Consult IHDA Sampling Guide
- Collect Sample
- Input Sample Data into IHDA

CEHS Lab

- Log in Samples Using IHDA
- IHDA Interfaces with Instruments
- Issue Results via IHDA
Laboratory Information Management System (LIMS)

- IHDA generates instrument sequence
- IHDA generates sample labels
- Sample result data from instrument uploaded into IHDA
- Secure
Laboratory Information Management System (LIMS)

Lab Administrator

Lab User

Field User

Main Menu

Vers: 2000
Last Ref. Update: ONLINE REF

Enter New Samples
Edit Field Information
Directly Entry Results
Import from Lab
Export to Lab
Process Definitions
Reports
Administration
Employee List
Enter Holidays
Exit
Search
Laboratory Information Management System (LIMS)

Lab Administrator

- Import Samples from Field
- Assign Project Numbers
- Enter/Edit Results
- Sign Off Projects
- Export Results to Field
- Recalculate Project
- Main Menu

Lab User

- Import Samples from Field
- Assign Project Numbers
- Enter/Edit Results
- Sign Off Projects
- Export Results to Field
- Recalculate Project
- Main Menu
Field Data Repository
LIMS
Reporting
IHDA
Sample Collection Logic

Consult IHDA Sampling Guide

Collect Sample

Input Sample Data into IHDA

CEHS Lab

Log in Samples Using IHDA

IHDA Interfaces with Instruments

Issue Results via IHDA

Field

Generate Reports via IHDA

Field
Report Tools

- Lab-specific reports
  - Issue sample results to client
- Field-specific reports
  - Notification
  - Summary
- E-mail capability
- ‘Save As’ capability
Report Tools

Main Menu

Vers: 2000

Last Ref. Update: ONLINE REF

- Enter New Samples
- Edit Field Information
- Laboratory Menu
- Import from Field
- Export to Field
- Process Definitions
- Reports
- Administration
- Employee List
- Enter Holidays
- Exit
- Search
# Lab-Specific: Reporting Results to Client

## Sample Status Report

### Corporate Environmental, Health and Safety Lab
Abbott Laboratories, 1401 Sheridan Road D-051H, M2B
North Chicago, IL 60064
DEA Registration No.: PA0133594
AIHA Laboratory No.: 101145

<table>
<thead>
<tr>
<th>Field No.</th>
<th>Sample Date</th>
<th>Dept. Samp.</th>
<th>Site Samp.</th>
<th>Time (min)</th>
<th>Component Name</th>
<th>LOD</th>
<th>Result</th>
<th>Units</th>
<th>Break thru</th>
<th>FF/DE</th>
<th>LOQ</th>
<th>Badge Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>MRP1010-001</td>
<td>10/16/03</td>
<td>NC</td>
<td>480</td>
<td>METHYL ETHYL KETONE</td>
<td></td>
<td>3.04</td>
<td>PPM</td>
<td>N</td>
<td></td>
<td></td>
<td>6.05</td>
<td>MC-G</td>
</tr>
<tr>
<td><strong>Method of Analysis</strong></td>
<td>GC</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MRP1010-002</td>
<td>10/16/03</td>
<td>NC</td>
<td>120</td>
<td>METHYL ETHYL KETONE</td>
<td></td>
<td>6.98</td>
<td>PPM</td>
<td>N</td>
<td></td>
<td></td>
<td>6.05</td>
<td>MC-G</td>
</tr>
<tr>
<td><strong>Method of Analysis</strong></td>
<td>GC</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MRP1010-003</td>
<td>10/16/03</td>
<td>NC</td>
<td>120</td>
<td>METHYL ETHYL KETONE</td>
<td></td>
<td>3.80</td>
<td>PPM</td>
<td>N</td>
<td></td>
<td></td>
<td>8.05</td>
<td>MC-G</td>
</tr>
<tr>
<td><strong>Method of Analysis</strong></td>
<td>GC</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MRP1010-004</td>
<td>10/16/03</td>
<td>NC</td>
<td>120</td>
<td>METHYL ETHYL KETONE</td>
<td></td>
<td>2.73</td>
<td>PPM</td>
<td>N</td>
<td></td>
<td></td>
<td>8.05</td>
<td>MC-G</td>
</tr>
<tr>
<td><strong>Method of Analysis</strong></td>
<td>GC</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Reviewed By: MARCIA PLESE
Sign-off Date: 10/16/03
Turnaround Days: 0
### Sample Status Report

**Collector:** LAB LABADMIN  
**Div. Samp:** CHMS

<table>
<thead>
<tr>
<th>Field No.</th>
<th>Sample Date</th>
<th>Dept. Samp.</th>
<th>Site Samp.</th>
<th>Time (min)</th>
<th>Component Name</th>
<th>LOB</th>
<th>Result</th>
<th>Units</th>
<th>Break thru</th>
<th>EEDE</th>
<th>L</th>
</tr>
</thead>
<tbody>
<tr>
<td>001C01B01</td>
<td>4/7/00</td>
<td>AP</td>
<td></td>
<td></td>
<td>METHYLENE CHLORIDE</td>
<td>&lt;</td>
<td>6.98</td>
<td>MCO</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>001C01B01</td>
<td>4/7/00</td>
<td>AP</td>
<td></td>
<td></td>
<td>ACETONE</td>
<td>&lt;</td>
<td>4.35</td>
<td>MCG</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>001C01B01</td>
<td>4/7/00</td>
<td>AP</td>
<td></td>
<td></td>
<td>2-PROPAHOL</td>
<td>&lt;</td>
<td>4.52</td>
<td>MCG</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Additional Info:** RUSH SAMPLE. DUE: 01/05/2100. DEMO

<table>
<thead>
<tr>
<th>Field No.</th>
<th>Sample Date</th>
<th>Dept. Samp.</th>
<th>Site Samp.</th>
<th>Time (min)</th>
<th>Component Name</th>
<th>Result</th>
<th>Units</th>
<th>Break thru</th>
<th>EEDE</th>
<th>L</th>
</tr>
</thead>
<tbody>
<tr>
<td>003CH201</td>
<td>4/7/00</td>
<td>NC</td>
<td>300</td>
<td></td>
<td>METHYLENE CHLORIDE</td>
<td>164</td>
<td>PPM</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>003CH201</td>
<td>4/7/00</td>
<td>NC</td>
<td>300</td>
<td></td>
<td>ACETONE</td>
<td>24.4</td>
<td>PPM</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Additional Info:** RUSH SAMPLE. DUE: 01/05/2100. DEMO

Reviewed By: MARCIA F  
Sign-off Date: 07/28/2000
Lab-Specific:
Reporting Results to Client

Distribution to multiple recipients
Report Tools
Field-Specific Reports

- Available Reports
  - Equipment and Study Procedure
  - Production Parameters
  - Departmental Notification
  - Employee Notification
  - Summary of Results

- All reports can be saved as a Word or Excel file or sent via e-mail
EQUIPMENT AND STUDY PROCEDURES

May 18, 2001
ABBOTT LABORATORIES
ABBOTT PARK

Breathing zone samples were collected by attaching the sampler in the "breathing zone" of the operator(s) being monitored.

All samples for laboratory analysis collected during this study were submitted for analysis to the Abbott Corporate Environ (CEHS Lab), which is accredited by the American Industrial Hygiene Association.

<table>
<thead>
<tr>
<th>Field #</th>
<th>Collection Media</th>
<th>Catalog #</th>
<th>Pump Type</th>
<th>Flow Rate</th>
<th>Total Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>101200VD01</td>
<td>ADSORBENT TUBE</td>
<td>226-09</td>
<td>GILIAN 1</td>
<td>205</td>
<td>510</td>
</tr>
<tr>
<td>101200VD02</td>
<td>ADSORBENT TUBE</td>
<td>226-09</td>
<td>GILIAN 2</td>
<td>205.5</td>
<td>482</td>
</tr>
<tr>
<td>101200VD03</td>
<td>ADSORBENT TUBE</td>
<td>226-09</td>
<td>GILIAN 3</td>
<td>207</td>
<td>500</td>
</tr>
<tr>
<td>101200VD04</td>
<td>ADSORBENT TUBE</td>
<td>226-09</td>
<td>GILIAN 4</td>
<td>202</td>
<td>510</td>
</tr>
</tbody>
</table>
Report Generation: Data From Other Databases

IHDA

Abbott Toxicology Database

Report

Sampling data
TWA, %PEL
Exposure limits
On 04/25/2001, monitoring was conducted for METHYLENE CHLORIDE in Department 05IH, Building M2B, NORTH CHICAGO, at the operation(s) identified below. The contaminant levels found are listed in the following table. Note that three results are listed for each sample or group of samples collected.

<table>
<thead>
<tr>
<th>Date</th>
<th>Process</th>
<th>Inside Resp.?</th>
<th>Time (min)</th>
<th>Contaminant</th>
<th>Sample Result PPM</th>
<th>TWA Result*</th>
</tr>
</thead>
<tbody>
<tr>
<td>04/25/2001</td>
<td>INDUSTRIAL HYGIENE MONITORING OF PREVENTIVE MAINTENANCE GROUP. OFFICE WORK.</td>
<td>N</td>
<td>440</td>
<td>METHYLENE CHLORIDE</td>
<td>10.3</td>
<td>9.4</td>
</tr>
<tr>
<td>04/25/2001</td>
<td>MAINTENANCE, PREVENTIVE</td>
<td>N</td>
<td>480</td>
<td>METHYLENE CHLORIDE</td>
<td>10.8</td>
<td>10.8</td>
</tr>
<tr>
<td>04/25/2001</td>
<td>FERMENTATION/METHYLENE CHLORIDE RECOVERY</td>
<td>N</td>
<td>84</td>
<td>METHYLENE CHLORIDE</td>
<td>11.2</td>
<td>10.6</td>
</tr>
<tr>
<td>04/25/2001</td>
<td>FERMENTATION/METHYLENE CHLORIDE RECOVERY</td>
<td>N</td>
<td>15</td>
<td>METHYLENE CHLORIDE</td>
<td>90.2</td>
<td>10.6</td>
</tr>
<tr>
<td>04/25/2001</td>
<td>MAINTENANCE, PREVENTIVE</td>
<td>N</td>
<td>316</td>
<td>METHYLENE CHLORIDE</td>
<td>8.77</td>
<td>10.6</td>
</tr>
</tbody>
</table>

*Autocalculated*
### Report Generation: Departmental Notification

From Toxicology Database

<table>
<thead>
<tr>
<th>Organization</th>
<th>(8-hr) TWA</th>
<th>(15-min) STEL</th>
<th>Ceiling</th>
<th>Skin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Occupational Safety and Health Administration (OSHA)</td>
<td>25</td>
<td>125</td>
<td></td>
<td></td>
</tr>
<tr>
<td>American Conference of Governmental Industrial Hygienists (ACGIH)</td>
<td>50</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>American Industrial Hygiene Association (AIHA)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Abbott Drug Handling Committee (ADHC, mcg/ml3)</td>
<td>174000</td>
<td></td>
<td>N/A</td>
<td></td>
</tr>
</tbody>
</table>

* TWA - Time-Weighted Average or Estimated Time-Weighted Average
**%EEL is calculated using either the ADHC Employee Exposure Limit or the OSHA Permissible Exposure Limit

---

Supervisor/Section Manager  
Date

---

* TWA - Time-Weighted Average or Estimated Time-Weighted Average
**%EEL is calculated using either the ADHC Employee Exposure Limit or the OSHA Permissible Exposure Limit
Report Generation: Employee Notification

### Report Details

- **Employee Name:** John Doe
- **Social Security Number:** 56565656
- **Department:** 05

On 04/25/2001, monitoring was conducted for METHYLENE CHLORIDE in Department OSH, Building M2B, NORTH CHICAGO, at the operation(s) identified below. The contaminant levels found are listed in the following table. Note that three results are listed for each sample or group of samples collected.

### Monitoring Results

<table>
<thead>
<tr>
<th>Date</th>
<th>Process Description</th>
<th>Inside Time</th>
<th>Sample Result</th>
<th>TWA Result</th>
<th>STEL Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>04/25/2001</td>
<td>Industrial Hygiene</td>
<td>440</td>
<td>METHYLENE CHLORIDE 10.3</td>
<td>0.4</td>
<td>38</td>
</tr>
</tbody>
</table>

### Reference Organizations

- Occupational Safety and Health Administration (OSHA)
- American Conference of Governmental Industrial Hygienists (ACGIH)
- American Industrial Hygiene Association (AIHA)
- Abbott Drug Handling Committee (ADHC, mcg/m³)

#### Exposure Limits

<table>
<thead>
<tr>
<th>Environment</th>
<th>TWA (mcg/m³)</th>
<th>STEL (mcg/m³)</th>
<th>Ceiling (mcg/m³)</th>
<th>Skin</th>
</tr>
</thead>
<tbody>
<tr>
<td>(8-h)</td>
<td>25</td>
<td>125</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(15-min)</td>
<td>50</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>174000</td>
<td></td>
<td></td>
<td>0.4</td>
</tr>
</tbody>
</table>

*TWA - Time-Weighted Average or Estimated Time-Weighted Average

**STEL is calculated using either the ADHC Employee Exposure Limit or the OSHA Permissible Exposure Limit.*

---

*Signature*

**Employee Signature**

**Supervisor/Section Manager**

---

*Date*
Query Tool
Query Tool:
Select Criteria -- Run Query
### Query Tool: Print or Save Query Results

#### IHDA 2000

#### Criteria Selection Form

<table>
<thead>
<tr>
<th>No.</th>
<th>Field No</th>
<th>Sample Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>2213</td>
<td>AV-323-5BLAN</td>
<td>BLANK</td>
</tr>
<tr>
<td>2213</td>
<td>AV-323-3</td>
<td>PERSONAL</td>
</tr>
<tr>
<td>2213</td>
<td>AV-323-2</td>
<td>PERSONAL</td>
</tr>
</tbody>
</table>

#### Records: 1 of 3

<table>
<thead>
<tr>
<th>1:</th>
<th>2:</th>
<th>3:</th>
<th>4:</th>
<th>5:</th>
<th>6:</th>
<th>7:</th>
<th>8:</th>
<th>9:</th>
<th>10:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Options:
- Close
- Print Setup
- Print Preview
- Print... Ctrl+P
- Save As
- Exit

#### Buttons:
- Select
- Clear Criteria
- Fields...
- Close
Benefits of the IHDA

<table>
<thead>
<tr>
<th>Main Menu</th>
<th>Last Ref. Update:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vers: 2000</td>
<td>ONLINE REF</td>
</tr>
</tbody>
</table>

- **Enter New Samples**
- **Edit Field Information**
- **Direct Entry Results**
- **Import from Lab**
- **Export to Lab**
- **Process Definitions**
- **Reports**
- **Administration**
- **Employee List**
- **Enter Holidays**
- **Exit**
- **Search**

IHDA
Benefits of the IHDA

- Fewer sample collection errors
- User-friendly, consistent field data input
- Improved and more efficient reporting
  - Standardization
- Centralized search capability
Benefits of the IHDA

- Improved sample throughput in lab
  - Reduced potential for error
- Improved efficiency
- Secure repository for all data
- Corporate needs
- Quality needs
Future Plans

- Move IHDA from a client-server system to a server-based only application
  - Accessible via intranet or ‘thin client’
- Spanish version of reports
- Noise monitoring data
- Web sample status tool
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Development of an Environmental and Industrial Hygiene Relational Database Application

S. Martens, M. Plese, M. Puskar

Abbott Laboratories
1401 Sheridan Road
North Chicago, IL 60064