CHEMICAL INVENTORY DATABASE INTERFACE SYSTEM

GRADUATE PROJECT REPORT

By

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ABSTRACT

This project consists of the analysis, design and implementation of an on-line database system of hazardous materials for the Texas A&M Univ-Corpus Christi Physical Plant. The database is used to maintain a record of the hazardous materials used by different departments of the university. It also keeps track of the hazardous waste collected from various departments along with ways to dispose of this material. Inventory levels, a list of departments, a list of orders placed and a list of vendors also are contained in the associated database. The system provides user-friendly programs to access the database to produce various hazardous-material inventory reports.
BACKGROUND AND RATIONALE

The extensive use of the chemicals by different departments of the Texas A&M Univ-Corpus Christi necessitates the maintaining of data about the chemicals needed by the departments, the vendors supplying them and data about the hazardous chemical waste collected after the use of these chemicals. When a department needs a chemical, it will place an order to the appropriate vendor. The vendor delivers the order either to the physical plant or the department directly. In the former case, the physical plant records the required data and redelivers the chemical to the respective department. In the latter case, the department sends the inventory form of a particular chemical to the physical plant for recording. Manual entries of inventory data cause concern about the accuracy of the data.

This very basic, manual, recording system consists of following documents requiring actions:
1) The chemical inventory form containing details of the chemical and the department that placed the order.
2) The spreadsheet, recording orders placed to different vendors.
3) The spreadsheet containing information about the hazardous waste collected from different departments.

The proper recording of this data can be very time consuming. As the amount of data increases, it is often difficult to track inventories with a manual recording system, and large inventories are especially difficult to track. Thus, a manual recording system can be a slow and error-prone process.

A computer-based recording system would be an efficient and cost-effective alternative to this manual recording system. The record entries will be quick, dependable and very convenient to modify and query. The data will be dynamic, easy to store and will be viewed by more than the person maintaining the database.
The purpose of this project is to develop an interface between the hazardous-material database and the World Wide Web using Oracle 7.3.2 as a back end. The end product enables the authorized database users to input (update) hazardous-material data using the web browser. This database design will thus, be a birds-eye view of a methodology in which the Physical Plant can have access to the inventory on-line, have an update of the hazardous-materials stock, and monitor the flow of hazardous materials.
NARRATIVE

The Chemical Inventory Database is a relational database with ten tables as provided in Appendix A. It contains the information about chemicals used by departments, vendors supplying these chemicals, orders placed by departments, hazardous chemical waste collected from different departments and methods of treating hazardous chemical waste.

This project is the design and implementation of an interface system between the Chemical Inventory Database and the World Wide Web. The advantage of this software is the ability to provide instant, up-to-date information about chemical data to the Texas A&M Univ-Corpus Christi Physical Plant and the general public. This system has been developed and implemented with user friendly features. These include providing a special user interface to retrieve and update the Chemical Inventory Database and provide necessary security.
Major Components

The final product generates eleven interrelated forms and reports. The user can navigate through the database using the hypertext links in these forms and reports. These are:

1. A form prompting the user for authentication.
2. A form generating the user-chosen section of the database.
3. A form generating the search for the chemical.
4. A report is generating all the properties of the specific chemical.
5. A form generating an option list for a specific department.
6. A report generating the department chemical-inventory form.
7. Forms to perform an insert, an update, or deletion of the departmental chemical-inventory data.
8. A form generating the orders placed for a department.
9. A report generating data about the collected hazardous-waste material in the department.
10. A report generating vendor information.
11. A report generating orders list for any date-range of interest.

To run this system, the user has to access the Chemical Inventory Database web site on the World Wide Web using any browser. The URL for the site is http://robin.tamu.cc.edu:8890/apps/owa/dvapa.grardproj.main.
The general description of each report and form is given in the following sections.

1. **A form prompting the user authentication:**

   The user is prompted to enter a password to view or modify the protected section of the database. The program administrator assigns the user ID and password to the certified monitors.

2. **A form generating the user-chosen section of the database.**

   On the main interface page, there are five functional submit buttons that enable the user to navigate through the database via the links of the *Chemical Inventory, Departments, Vendors, Hazardous-Waste and Orders.*

   To view the complete chemical-inventory database, the user selects the "Chemical Inventory" button on the main page. The user is given the option to view the Chemical Inventory or to query the database as per his/her specifications.

   To view the department chemical-inventory, update the vendor data, place on order for a chemical or to update the chemical-hazardous data, the user selects the "Department" button.

   Depending upon the type of vendor, the user opens the Vendors form by clicking on the "Vendors" button to view the details of a particular vendor, chemicals they supply and chemicals they dispose.

   To view the orders placed by departments in the database, the user selects the "Orders" button for any period of interest.
To view the hazardous waste material collected in different departments, the user selects the “Hazardous-Waste” button for a range of period.

3. A form generating search for the chemical:

By using this form, the user performs a search for a chemical either by chemical ID or by chemical name. If the user cannot remember the exact name of the chemical he can always search the database by using nearest matching words. When the user submits the query, the program generates a report containing the basic identification information about all the chemicals in the database that match word submitted by the user. The parameter list includes the chemical ID, chemical name and available amount.

4. A report generating all the properties of the specific chemical:

This report contains a detailed description of the selected chemical. The user must select the chemical that he obtained from the search option to get a summarized report of chemical he wants to view. The information provided includes the chemical ID, chemical name, amount available, container type, date it was manufactured, date of expiration, formula of the chemical, department making order, vendor supplied, vendor disposed, hazardous waste, and method of disposal.

This report will also provide the user with links to the main page.
5. A form generating an option list for a specific department.

The user will be given the choice to select from the following:

a) View the chemical inventory form.

b) Insert, Update or Delete the chemical inventory data.

c) Update the vendor’s list.

b) Order the chemicals from the different vendors.

c) Update the hazardous-waste inventory.

In this form, authenticated users can select any of the above choices to access the corresponding reports and forms. Also, the user can go back to the main page.

6. A report generating the department chemical-inventory form:

This report contains the description of chemicals that are used by a specific department along with the department details. The information provided includes:

Name of the chemical, amount available, formula, physical property, quantity available, name of the department, container type, department ID, department name, person in-charge, telephone number and building name. This form is known as 'Work Area Chemical Inventory' form.

The user can return either to the main page or to the department page by selecting a hyperlink.
7. Forms to perform an insert, an update, delete the departmental chemical-inventory data.

Using this form, the authenticated person in-charge in a department performs the update of different chemicals. Upon receiving a supply of the new chemical, the person in-charge makes an entry of the items and performs the update. The person in-charge is also given the choice to delete the chemicals that are void. The different parameters that are to be entered are the chemical ID, chemical name, amount available, formula, physical property, container type, date manufactured, date expired and material safety data sheet (MSDS).

The user can return either to the main page or to the department page by selecting a hyperlink.

8. A form generating orders placed for a department.

By using this form, the authenticated person in-charge for a department can place an order for the chemicals. A parameter list to place an order includes: order number, the chemical ID, the chemical description, department ID, vendor ID, date needed, unit, unit price, total amount and type of shipment.

The user can return either to the main page or to the department page by selecting a hyperlink.
9. A report generating the data about the collected hazardous-waste material in the department:

This report contains the information of hazardous waste that was collected at different labs, and departments. The parameters included in this report are: the chemical ID, chemical name, amount of hazardous waste, reason for disposal, method of treatment, and the details of the vendor (if the vendor is called for the treatment).

The user can return either to the main page or to the department page by selecting a hyperlink.

10. A report generating a list of all vendors:

This report contains a detailed description of the vendor, chemicals they supply and dispose depending upon type of vendor. The parameter list includes the vendor ID, company, person to contact, address, zip code, phone number, chemical ID, and name of the chemical.

This report also provides the user with links to the main page.

11. A report generating orders list for any date-range of interest:

In this report, the user can view the orders placed by departments for any date-range of interest. The parameters included in this report are: order number, the chemical ID, chemical name, department ID, vendor ID, unit, unit prize and total prize.

This report also provides the user with links to the main page.
PROJECT ENVIRONMENT

This interface system displays to any web browser such as Netscape. The Oracle 7.3.2 relational database system running under Digital Unix on a DEC Alpha 3000 was used as the back end. The Hypertext Markup Language (HTML) was used to generate the reports. Common Gateway Interface (CGI) programs were used to access the Oracle database and to generate the above mentioned HTML reports dynamically. PL/SQL procedures created by users were used to generate an HTML page as output under the Unix operating environment. SQL * Plus was used to query the database.
PROCEDURE

The following steps were taken during the design process of the Chemical Inventory Database with the World Wide Web.

1. Interviewed Mr. James Kenefik, the client on behalf of Texas A&M Univ-Corpus Christi Physical Plant, to determine what type of interface system is desired, and documented his specific needs and requirements.
2. Conducted research on several Oracle-Web interface software products to evaluate which program should be used.
3. Evaluated the cost effectiveness of alternative software and hardware.
4. Designed the interface system (Figure 1) that will meet all user requirements.

The following steps were taken to complete the development of the proposed Chemical Inventory Database Interface with the World Wide Web.

1. Implemented the system using HTML, Oracle 7.3.2, and digital Unix.
2. Installed and tested the system with active data.
3. Developed the user documentation.
Chemical Inventory Database System Overview

Figure 1
The Chemical Inventory Database Interface System uses a set of PL/SQL Procedures and Common Gateway Interface (CGI) scripts and HTML files to display the data stored in the Chemical Inventory Database.

**Figure 2** illustrates the key components of the CGI scripts designed to access the database. A brief overview of the process is as follows:

The Oracle WebServer is an HTTP server with a tightly integrated Oracle 7 Server that enables the creation of HTML documents from the data stored in an Oracle database. When the data changes, the HTML documents are updated automatically, with no further effort on the part of the site administrator.

The four components that make up the Oracle WebServer to deliver both the static and dynamic pages are as follow:

- **Oracle Web Listener**

  The Oracle Web Listener receives a request from a user using any Web browser. Upon receiving the request from the client, Oracle Web Listener first determines whether that request is for a static document or a dynamic document. If the request is for a static document, the Web Listener sends the file and its associated type information directly to the client. If the request is for a dynamic document, it is created "on the fly" by a program invoked by the Web Listener, in compliance with the Common Gateway Interface (CGI). CGI is an interface that enables HTTP servers to run a program and use the output of that
program in the document that is sent to the user. The Web Listener uses it to invoke the Oracle Web Agent when a database procedure is requested.

- **Oracle Web Agent**

  The Oracle Web Agent handles requests from users for dynamic pages. It handles the connection to Oracle 7.3.2 Server, the invocation of the requested procedure, and the transmission of the resulting HTML document back to the Web browser.

- **Oracle WebServer Developers Toolkit**

  The Oracle WebServer Developer's toolkit is set of PL/SQL routines and procedures to help the customer create programs to generate dynamic documents presentable in HTML format.

- **Oracle 7 Server**

  The Oracle 7.3.2 Server is a high-performance, relational Database Management System managing a large amount of data in a multi-user environment. It is also secure from unauthorized access and performs well even in situations of concurrency.

*Table 1* presents a listing of Oracle database tables used in the Chemical Inventory Database and briefly describes contents of the each table. The data dictionary for each table is provided in *Appendix A.*
Web Access to Chemical Inventory Database on Oracle Server

(Figure 2)
TABLE 1

<table>
<thead>
<tr>
<th>TABLE NAME</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemical</td>
<td>Describes the chemical properties.</td>
</tr>
<tr>
<td>Department</td>
<td>Describes the department properties.</td>
</tr>
<tr>
<td>Vendors</td>
<td>Describes vendor properties (supply or dispose).</td>
</tr>
<tr>
<td>Orders</td>
<td>Orders placed by department.</td>
</tr>
<tr>
<td>Supply</td>
<td>Relates the chemicals and vendor table.</td>
</tr>
<tr>
<td>Inventory (Belongs)</td>
<td>Relates the Chemical and Department tables.</td>
</tr>
<tr>
<td>WebUserPasswords</td>
<td>Holds the user passwords.</td>
</tr>
<tr>
<td>WebUserGroups</td>
<td>Describes the all groups that user belongs to</td>
</tr>
<tr>
<td>WebPageGroups</td>
<td>Records which groups have access to that page.</td>
</tr>
<tr>
<td>WebUsers</td>
<td>A log of all users onto the system.</td>
</tr>
</tbody>
</table>

The following section presents functional descriptions of the modules used to implement the Chemical Inventory Database Interface System. Sample outputs of the modules are given in Appendix B. Program listings for the modules are provided in Appendix C.
A form prompting user authentication


Function: In this module the user is prompted to enter a unique ID and a password to view or modify the secured section of database. The function ‘ShowPageTo’ uses the user ID and password as input and queries the department table and checks for his authentication. Exclusively Oracle Web Server and the Oracle Database handle the security.

Functions & procedures: Function ShowPageTo (value in varchar2 Default Null) returns Boolean.
Procedure Checkdatabase (did in varchar2, pword in varchar2, destination in varchar2 Default Null).
Procedure CheckInPage (destination in varchar2 Default Null).

Example: Procedure Main (key in varchar2)
Begin
    If not Dyapa.security.ShowPageTo (key) then
        Dyapa.security.CheckInPage (dyapa.gradproj.main)
    Else
        Tamu.prolog (‘WELCOME TO CHEMICAL DATABASE’);
        Htp.formopen(‘http://robin.tamu.cc.edu:8890/apps/owa’);
        ...
    end if;
end Main;

Output: Security system allows the Oracle Web Server to make decisions as to what information should be displayed to a user at a given time. After the verification, the user navigates the “Main navigation-page” or else generates the “Error-page”.
Form generating the user-chosen section of the database

Input: Chemical, Vendor, Department, Orders and Supply tables.

Function: This is the opening section for the Chemical Inventory Database Interface System. There are five functional submit buttons that enable the user to navigate through the database via links of Chemical Inventory, Departments, Vendors, Orders and Supply tables.

Functions & procedures: procedure Main (key varchar2 Default Null).

Output: This module presents the opening banner page for accessing the other pages in Chemical Inventory Database Interface System. This page contains five submit buttons that allow the user to navigate different parts of the database.

Report generating all the properties of specific chemical

Input: Chemical, Department, Vendor, Orders and Supply tables.

Function: In this module, the chemical-inventory “submit” button invokes chemical_search procedure, which allows the user to search for a chemical either by the chemical ID or by the chemical name. When the user submits the query, the program generates a report that contains the basic identification information about the chemicals. This query is based on the string of characters submitted by the user in the database. Based on the query results, the user can select a chemical obtained from the search option to view the properties. Another procedure “chemical_show” uses the chemical ID of the selected chemical as input for querying the
database, generates an HTML page with retrieved information of all the properties, and prints the data in a tabular format.

Functions & procedures:

Procedure `Options` (key in varchar2, submit in varchar2).

Procedure `Chemical_search` (key in varchar2, aName in varchar2,
                       Searchby in varchar2).

Procedure `Chemical_show` (key in varchar2, ravi1 in varchar2,
                       Submit in varchar2).

Output: This report contains a detailed description of the selected chemical. It includes the Chemical ID, Chemical name, Amount available, Container Type, Formula, MSDS, Date of Manufacture, Date of Expiration, Date Ordered, Department making order, Vendor supplied, Method of disposal, Reason for disposal, and Vendor disposed.

**Department chemical inventory report**

Input: Department and chemical Tables.

Function: The procedure “Department” generates a report, contains the description of the chemicals used by a specific department along with department details. The procedure accesses the Department and Chemical tables to retrieve all the pertinent information about the selected department and generates a list of chemicals used by that department. The procedure uses the department ID and code values for querying the tables. The procedure
“PrintTab” generates an HTML page with all retrieved information from tables and prints the data in a tabular format.

**Functions & procedures:**

Procedure `Department` (key in varchar2, submit in varchar2).

Procedure `PrintTab` (key in varchar2, selectCol in owu.ident_arr,
                       WClause in varchar2, orderCol in varchar2,
                       Submit in varchar2).

**Output:** Generates a report with department description and information of chemicals used by the department. The information provided includes the Chemical name, the Chemical ID, Amount available, Department ID, Department name, Building, Room number, and Person in-charge.

**Forms to perform an insert, an update, delete**

departmental chemical inventory data.

**Input:** Chemical, Department, Supply tables.

**Function:** This module contains three functional buttons:

1. **Insert**- by selecting this button, the user can add new chemical to the chemical table. The procedure “RI_Insert” generates a form with text boxes to allow the user to enter data. Procedure “Chemical_Insert” adds new data to chemical table.

2. **Update**- by selecting this button, the user can select (by choosing the checkbox) the columns to update. Procedure “RI_Update” generates
the form where user can update, and procedure “Checkin” updates the corresponding columns.

3. **Delete**—by selecting this button, the user can select (by choosing the checkbox) the columns to delete. The procedure “RI_Delete” generates a form to delete a chemical. Procedure “CheckDel” deletes the corresponding row from table.

**Functions & procedures:**
- Procedure *RI_Insert*
- Procedure *RI_Update*
- Procedure *RI_Delete*
- Procedure *CheckIn*
- Procedure *CheckDel*
- Procedure *Update_process*

**Output:** Generates the HTML form with information of the success or failure of insert, update or delete. If successful, the corresponding actions of insert, update, or deletion of columns in the Chemical, Department and Supply tables is facilitated.
A form generating orders placed for a department

Input: Orders table

Function: This module generates the form in which the authenticated Person incharge in the department can place an order for chemicals. The procedure “Order-Update” generates a form where user places an order.

Functions & procedures:
Procedure Department.
Procedure Order_update.

Output: Generates a confirmation form or an Error Message.

A Report on Hazardous-waste Material

Input: Department, Chemical, Vendor and Haz-Waste.

Function: This module generates a report on hazardous waste collected in different departments. Procedure “Haz_Waste” generates the report of hazardous waste material collected during a period of time in a tabular format.

Functions & procedures: Procedure Haz_waste.

Output: Generates an HTML form with all the information about hazardous waste collected over different departments for a specific span of time.
A Report on List of All Vendors

Input: Vendor type from Vendor and uses Chemical and Supply tables.

Function: This module generates a list of all the vendors of a chemical. The procedure “Vendor_search” uses the Vendor ID to query the Chemical, Vendor and Supply tables. It retrieves the information of the vendor, chemicals they supply (or dispose) depending on type of vendor. It generates an HTML page with information from the tables in a tabular format.

Functions & procedures:

Procedure Options

Procedure Vendor_search

Output: Generates a report of all the vendors of a chemical based on Vendor classification (supply/dispose). The parameter list includes the Vendor ID, Vendor name, Person to contact, Address, Zip code, Phone number, Chemical ID and Chemical name.

A Report Generating an Orders list for any date-range of interest

Input: Date-range of interest from Orders table and uses the Chemical, Department and Vendors tables.

Function: In this module, the user can view the orders placed by specific departments for any date-range of interest. Procedure “Orders” uses two
input Date parameters and queries the Orders table to retrieve the Order details and generate an HTML page in a tabular format.

**Functions & procedures:**

Procedure *Options*

Procedure *Orders*

**Output:** Generates a report of orders placed during the user choice date-range. The parameters included in this report are Order number, Chemical ID, Chemical description, Department ID, Vendor ID, Unit, Unit prize, Total and Type of shipment.
RESULTS AND FUTURE WORK

A graphical-user-interface system to access Chemical Inventory Database through the World Wide Web was implemented. This is a user-friendly system with graphical-user-interface features. The user can navigate through the database simply by choosing hypertext links in the reports, saving the user from writing complicated SQL statements to manipulate the data. This system also enables the Chemical Inventory Database users to update, insert and delete the database through the World Wide Web, thus enhancing the effective maintenance of the chemical database. It also assists the Texas A&M Univ-Corpus Christi Physical Plant people to track the chemical data, thus avoiding a manual entry system.
REFERENCES


Ram Prasad Bhattachar (1996). Graduate Project Proposal
“Nueces River Authority’s Water Quality DataBase Interface System”. Texas A&M Univ-Corpus Christi.


Oracle/Web Development tools.


Oracle WebServer.

World Wide Web - [http://hoohoo.ncsa.uiuc.edu/cgi](http://hoohoo.ncsa.uiuc.edu/cgi).
The Common Gateway Interface.
List of Chemical Inventory Database Tables (in Oracle 7.3)

Independence and Dependence Table Description

1) **Chemical Table:**

*Table is created to describe the properties of the individual chemical.*

1. Chemical_id: Chemical identification number---*Primary key*.

2. Chemical_name: Name of the chemical---*unique*.

3. Amount_available: Amount of the chemical currently stored in inventory.

4. Formula: Chemical formula if available
   E.g. Sulfuric Acid = H2so4.

5. Physical_property: Physical property of the chemical (Liquid, Solid or Gas).

6. Container_type: Chemical storage unit.

7. Date_manufactured: Date of the chemical manufactured.

8. Date_expired: Date of chemical expired.

9. MSDS: Safety precautions that should take for chemical storage and utilization.

2) **Department Table:**

*Table is created to describe the departments*

1. Dept_id: Department Identification number---*Primary key*

2. Dept_name: Name of the department --- *Unique*

3. Person-in-charge: Person who is maintaining the labs of a particular department.

4. Office: Office in the department.

5. Telephone_number

6. Building_name: Name of the building where department located.
3) **Inventory (belongs) Table:**

*Table relates chemical and department*

1. Chemical_id: Chemical Identification number—*Foreign Key references Chemical Table.*
2. Dept_id: Department Identification Number—*Foreign Key references Department Table.*

4) **Vendor Table:**

*Table is created to describe the vendors*

1. Vendor_id: Vendor identification number—*Primary Key.*
2. Vendor_name: Name of the company supply (or dispose) the chemical—*Unique*
3. Address: Address of the company (street number)
4. State: State in which the company is located.
5. Zip: Zip code for that state.
6. Phone_number: Phone number of the company.

5) **Orders Table:**

*Table relates departments and vendors*

1. Order_num: Order number for the chemical ordered—*Primary Key*
2. Chemical_id: Chemical Identification number—*Foreign key references Chemical Table.*
3. Dept_id: Department Identification number—*Foreign Key references Department Table.*
4. Vendor_id: Vendor identification number—*Foreign key references Vendor Table.*
5. Chemical_desc: Description of the chemical ordered.
6. Unit: Units in which chemical is measured.
7. Unit_price: Cost per unit price.
8. Total: Total amount in dollars.
9. Date_ordered: Date ordered by the department.
10. Date_needed: Date needed by the department.

6) Supply Table:

Table relates chemicals and vendors

1. Chemical_id: Chemical Identification number---Foreign Key references Chemical Table.
2. Vendor_id: Vendor identification number---Foreign Key references Vendor Table.
3. Vendor_type: Type of vendor (Supply or Disposal).
4. Method: Method of disposal if chemical is disposed.
5. Reason: Reason for the disposal.

7) WebUserPasswords:

Table to hold Web user passwords.

1. Department_id: Department Identification number---Foreign key references Department Table.
2. Password: Password given by web administrator to the department people ---Primary Key.

8) WebUserGroups:

Describes all the groups that the user belongs

1. Groups: Groups names that can access secured database---Primary key.
2. Department_id: Department identification number---Foreign Key references Department Table.
9) WebPagegroups:

Records the groups have access to that page.

1. Page_name: Web pages which user can access.---**Primary Key.**

2. Groups: Groups that can access the database.

10) WebUsers:

*Table to store Log of all users onto the system.*

1. User_id: User identification number

2. Hidden_id: Which indicates the number of user logged on to the system.

3. BrowseDate: Indicates the date, when user logged on to the system.
Security system

Chemical ID
Chemical Name
Submit

Choose the chemical

Chemical Information
Submit

Order order vendor hazardous
Order up
Vendor up
Hazardous up

Chem Inv
Chemical
Update
Delete
Insert

Chemical inventory

Insert update Delete confirmation

Department Update

Insert data

Search for vendor

Vendor search Date

Results of search

Chemical

Insert update Delete conformation

Results of the search

Chemical

Update

Delete

Insert

Hazardous waste material
Submit

Error message

Operational flow diagram
<table>
<thead>
<tr>
<th>Table name</th>
<th>Chemical</th>
<th>Vendor</th>
<th>Orders</th>
<th>Supply</th>
<th>Inventory</th>
<th>WUP</th>
<th>WUG</th>
<th>WPG</th>
<th>WU</th>
</tr>
</thead>
<tbody>
<tr>
<td>SECURITY USER CHOSEN SECTION</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>I,U,D</td>
<td>I,U,D</td>
<td>I,U,D</td>
<td>I,U,</td>
</tr>
<tr>
<td>REPORT OF SPECIFIC CHEMICAL</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td></td>
</tr>
<tr>
<td>CHEMICAL INVENTORY</td>
<td>I,U,D</td>
<td>S</td>
<td></td>
<td></td>
<td></td>
<td>S</td>
<td>S</td>
<td>S</td>
<td></td>
</tr>
<tr>
<td>ORDERS PLACED</td>
<td>I,U</td>
<td>U</td>
<td>U,I</td>
<td>U,I,D</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HAZARDOUS WASTE</td>
<td>I,U,D</td>
<td>S</td>
<td>I,U</td>
<td></td>
<td>I,U</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VENDORS LIST</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>I,U</td>
<td>I,U</td>
<td>I,U</td>
<td>I,U</td>
<td></td>
</tr>
<tr>
<td>ORDERS LIST FOR DATE RANGE</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td></td>
</tr>
</tbody>
</table>

**FORMS & REPORTS Vs TABLES**

I = Insert rows into table.

U = Update the rows Of table.

D = Delete the rows From table.

S = Select the rows From table.