Graduate Theses, Dissertations, and Problem Reports

2000

Hazardous materials database

Veena Vadiala
West Virginia University

Follow this and additional works at: <https://researchrepository.wvu.edu/etd>

Recommended Citation

Vadiala, Veena, "Hazardous materials database" (2000). *Graduate Theses, Dissertations, and Problem Reports*. 1091.
<https://researchrepository.wvu.edu/etd/1091>

This Thesis is protected by copyright and/or related rights. It has been brought to you by the The Research Repository @ WVU with permission from the rights-holder(s). You are free to use this Thesis in any way that is permitted by the copyright and related rights legislation that applies to your use. For other uses you must obtain permission from the rights-holder(s) directly, unless additional rights are indicated by a Creative Commons license in the record and/ or on the work itself. This Thesis has been accepted for inclusion in WVU Graduate Theses, Dissertations, and Problem Reports collection by an authorized administrator of The Research Repository @ WVU. For more information, please contact researchrepository@mail.wvu.edu.

HAZARDOUS MATERIALS DATABASE

Veena Vadiala

Thesis submitted to the College of Engineering and Mineral Resources at

West Virginia University

in partial fulfillment of the requirements for the degree of

Masters of Science

in

Industrial Engineering

Rashpal S. Ahluwalia, Ph. D., Co-chair

David Whaley, Ph. D., Co-chair

Robert C. Creese, Ph. D.

Department of Industrial and Management Systems Engineering

Morgantown, West Virginia

2000

Keywords: hazardous materials, database, Visual Basic, dismantling

ABSTRACT
HAZARDOUS MATERIALS DATABASE

Veena Vadiala

Handling and disposal of a retired object can be a major component of its Life Cycle Cost. Often, during dismantling of a retired object many hazardous materials are released. Disposal of hazardous materials also need to comply with various federal regulations. Agencies like Occupational Safety and Health Administration (OSHA) and the Environmental Protection Agency (EPA) set these safety regulations. It is possible to apply generic exposure and release controls to protect workers from hazardous materials. For the most cost effective hazard controls it is necessary first to identify the materials and their properties of primary concern. There is a need to have an integrated database for properties of Hazardous Materials.

This project developed a database for properties of hazardous materials. The database was implemented in Microsoft Access. Thirty-four chemicals and their categories were identified. These chemicals are encountered during dismantling of a retired object. The database currently contains 60 main fields, which also contain subfields. Information such as its physical properties, chemical properties, health hazards, releases from demolition or various other industrial processes and references to safety, health and environmental regulations can be obtained from this database. A decision support system was developed as a front end to Access. The decision support system was implemented in Visual Basic.

In the future, this database can be expanded to include non-hazardous materials. The database capabilities were demonstrated on the hazardous materials occurring in the ship dismantling industry. It is expected that the database will save significant time and cost in data retrieval. Information retrieval from the database is through an intuitive graphical interface, and suitable for use by a non-computer person.

Table of Contents

ABSTRACT	ii
ACKNOWLEDGEMENT	viii
List of Figures	v
List of Tables.....	vi
 CHAPTER 1: INTRODUCTION.....	 1
1.1 Databases and Decision Support Systems.....	1
1.2 Need for an Integrated Database for Hazardous Materials	2
1.3 Problem Statement	2
1.4 Solution approach.....	3
1.5 Research Objectives	3
 CHAPTER2: LITERATURE REVIEW.....	 5
2.1 Existing Chemical Databases	5
2.2 Major Drawbacks	8
2.3 Sources used to populate the Hazardous Materials Database	9
 CHAPTER 3: DATABASE DESIGN.....	 11
3.1 Physical Properties	11
3.2 Chemical Properties	15
3.3 Health and Ecological Hazards	17
3.4 Environmental Concern.....	20
3.5 Safety and Environmental Regulations	21
3.6 Exposure Criteria.....	22
 CHAPTER 4: IMPLEMENTATION.....	 25
4.1 Query Engine.....	25
 CHAPTER 5: APLPLICATION.....	 35
5.1 Ship Disposal Application.....	35
 CHAPTER 6: CONCLUSIONS.....	 59
6.1 Conclusions	59
6.2 Future Work	59
 REFERENCES	 62

APPENDIX

Appendix 1: Acute Symptoms	64
Appendix-2: Allergen.....	65
Appendix 3: Aquatic Fate	66
Appendix 4: Atmospheric Fate	67
Appendix 5: BOD.....	68
Appendix 6: Cancer.....	69
Appendix 7: RCRA	70
Appendix 8: Chronic Symptoms	71
Appendix 9: Clean Air Act.....	72
Appendix 10: Corrosivity.....	73
Appendix 11: DOT.....	74
Appendix 12: Extinguishing Agents	75
Appendix 13: Flammability/Combustibility	76
Appendix 14: Irritant.....	77
Appendix 15: Materials Table.....	78
Appendix 16: Oral Acute Aquatic Toxicity	79
Appendix 17: Percent Dissociated	80
Appendix 18: Reactivity/Instability	81
Appendix 19: Target Organ Applicable	82
Appendix 20: Terrestrial Fate	83
Appendix 21: Water Solubility	84
Appendix 22: Worker Exposure Criteria (Chronic-TWA)	85
Appendix 23: Worker Exposure Criteria (acute-CEIL)	86
Appendix 24: Worker Exposure Criteria (acute-STEEL)	87
Appendix 25: Program Codes	88
Appendix 25.1: Acute Symptoms	88
Appendix 25.2: Allergen.....	89
Appendix 25.3: Aquatic Fate	91
Appendix 25.4: Atmospheric Fate	92
Appendix 25.5: BOD.....	94
Appendix 25.6: Clean Air Act.....	95
Appendix 25.7: Cancer.....	97
Appendix 25.8: Chronic Symptoms.....	99
Appendix 25.9: Corrosivity.....	100
Appendix 25.10: RCRA	102
Appendix 25.11: DOT.....	103
Appendix 25.12: Extinguishing Agents	105
Appendix 25.13: Record Maintenance.....	106
Appendix 25.14: Flammability/Combustibility	108
Appendix 25.15: Main Form.....	109
Appendix 25.16: Materials.....	112
Appendix 25.17: Oral Acute Aquatic Toxicity	113
Appendix 25.18: Invalid password.....	115
Appendix 25.19: Percent Dissociated	115

Appendix 25.20: Query on boiling point	117
Appendix 25.21: Query on classification.....	117
Appendix 25.22: Query on melting point.....	118
Appendix 25.23: Query on molecular weight	119
Appendix 25.24: Query on Vapor Pressure	119
Appendix 25.25: Reactivity/Instability	120
Appendix 25.26: Search by Chemical Name	121
Appendix 25.27: Search by CAS	122
Appendix 25.28: Search by Molecular Formula	123
Appendix 25.29: Startup	123
Appendix 25.30: Terrestrial Fate	124
Appendix 25.31: Water Solubility	125
Appendix 25.32: Worker Exposure Criteria (acute-CEIL.....	127
Appendix 25.33: Worker Exposure Criteria (acute-STEEL.....	128
Appendix 25.34: Worker Exposure Criteria (chronic-TWA.....	130
Appendix 26: Relationships Diagram of the Tables	132

LIST OF FIGURES

Figure 4.1: HMD Query Engine.....	27
Figure 4.2: Password Form	27
Figure 4.3: Screen showing Invalid Password	28
Figure 4.4: Showing Pull Down Menu of File.....	28
Figure 4.5: Showing Pull Down Menu of Record Maintenance	29
Figure 4.6: Listing the items in pull down menu for Physical Properties	29
Figure 4.7: Showing Pull Down Menu for chemical Properties	30
Figure 4.8: Showing Pull Down Menu for Health Hazards	31
Figure 4.9: Showing the Pull Down Menu for Safety and Environmental Regulations	31
Figure 4.10: Showing the Pull Down Menu for Exposure Criteria.....	32
Figure 4.11: Showing the Pull down Menu for Environmental Concern.....	33
Figure 4.12: Showing the Pull Down Menu for Search	33
Figure 4.13: Showing the Pull Down Menu for Query	34
Figure 5.1: Physical Properties.....	35
Figure 5.2: Water Solubility.....	36
Figure 5.3: Percent Dissociated Table of Physical Properties	36
Figure 5.4: Showing Flammability/Comustibility Table	37
Figure 5.5: Extinguishing Agents Table of Chemical Properties.....	37
Figure 5.6: Reactivity/Instability Table of Chemical Properties.....	38
Figure 5.7: Corrosivity Table of Chemical Properties	38
Figure 5.8: Cancer Table of Health and Ecological Hazards	39
Figure 5.9: Showing Aquatic Fate Table	39
Figure 5.10: Acute Symptoms Table of Health and Ecological Hazards.....	40
Figure 5.11: Chronic Symptoms Table of Health and Ecological Hazards	40
Figure 5.12: Allergen Table of Health and Ecological Hazards	41
Figure 5.13: Oral Acute aquatic Toxicity Table	41
Figure 5.14: Showing the Clean Air Act Table.....	42
Figure 5.15: Showing RCRA Table	42

Figure 5.16: DOT Table of Safety and Environmental Regulations.....	43
Figure 5.17: Terrestrial Fate.....	43
Figure 5.18: Atmospheric Fate Table.....	44
Figure 5.19: BOD Table.....	44
Figure 5.20: Worker Exposure Criteria (acute-STEEL) Table.....	45
Figure 5.21: Worker Exposure Criteria (acute-CEIL) Table	45
Figure 5.22: Worker Exposure Criteria (chronic-TWA) Table.....	46
Figure 5.23: Pull down Menu for Search	46
Figure 5.24: Form to enter CAS #.....	47
Figure 5.25: Chemical Name Properties	48
Figure 5.26: Search by Chemical Name.....	48
Figure 5.27: Form to Search by Molecular Formula.....	49
Figure 5.28: Search by Molecular Formula	49
Figure 5.29: Search Results Form	50
Figure 5.30: Pull Down Menu.....	51
Figure 5.31: Molecular Weight Query	51
Figure 5.32: Search Criteria Form.....	52
Figure 5.33: Search Results form.....	52
Figure 5.34: Boiling Point Query.....	53
Figure 5.35: Boiling Point Criteria.....	53
Figure 5.36: Query Results.....	54
Figure 5.37: Melting Point Query	54
Figure 5.38: Results of Query	55
Figure 5.39: Select any Class Form	55
Figure 5.40: Dropdown List of Classes of Compounds	56
Figure 5.41: Results of Query	56
Figure 5.42: Vapor Pressure Query.....	57
Figure 5.43: Results of Query	57
Figure 5.44: Help.....	58

LIST OF TABLES

Table 3.1.1: Materials.....	14
Table 3.1.2: Percent Dissociated	15
Table 3.1.3 Water Solubility	15
Table 3.2.1: Reactivity/Instability	16
Table 3.2.2: Flammability/Combustibility	16
Table 3.2.3: Extinguishing Agents.....	17
Table 3.2.4: Corrosivity	17
Table 3.3.1: Aquatic Fate	18
Table 3.3.2: Acute Symptoms	18
Table 3.3.3: Chronic Symptoms.....	18
Table 3.3.4: Allergen.....	18
Table 3.3.5: Oral Acute Aquatic Toxicity.....	19
Table 3.3.6: Cancer	19
Table 3.4.1: Atmospheric Fate	20
Table 3.4.2: BOD	20

Table 3.4.3: Terrestrial Fate	21
Table 3.5.1: Clean Air Act	22
Table 3.5.2: DOT	22
Table 3.5.3: RCRA.....	22
Table 3.6.1: Worker Exposure Criteria (acute-STEL.....	24
Table 3.6.2: Worker Exposure Criteria (acute-CEIL	24
Table 3.6.3: Worker Exposure Criteria (chronic-TWA)	24
Table 4.1: Main form with the menus	26
Table 4.2: Record Maintenance	26
Table 4.3: Tools.....	26

ACKNOWLEDGEMENTS

I am thankful to my parents for their unyielding support, sacrifices and encouragement throughout my studies. I am greatly indebted to my research advisors, Dr. Rashpal Singh Ahluwalia and Dr. David Whaley for their invaluable guidance throughout this research. The advice and insight provided by Dr. Ahluwalia in all matters pertaining to research have been extremely invaluable. I was fortunate to have him as a teacher in classroom. Dr. Whaley was extremely kind in explaining important aspects of research. His guidance and encouragement have made a difference. I would like to express special thanks to both of them for their generous time and kind co-operation.

I am grateful to Dr. Robert Creese for his valuable comments and suggestions that improved the quality of the report. His suggestions during the initial stages of the research were also valuable. His kindness is very much appreciated.

My heartfelt thanks to Mr. Wiselin Das Mathuram and Mr. Ravi Gottumukkala for helping me solve problems in visual basic during this research. Finally, I thank IMSE department of WVU for their continued financial support, which was of great help in my pursuit for completion of M.S studies.

CHAPTER 1: INTRODUCTION

Development of the database structure described in this work was originally motivated by the need for an easily used compendium of the properties of materials encountered in dismantling and recycling or disposal of components of retired marine vessels, here called ‘ships’. However, the broader need was recognized to create a database structure which could be useful for many activities, including those where materials encountered could harm people or the environment.

This database structure was developed for use in the United States (US), so it contains referrals to applicable US regulations. However, in principle, similar references to the requirement of other jurisdictions could easily be incorporated in the future.

1.1 DATABASES AND DECISION SUPPORT SYSTEMS

It is only in recent years that the profound impact of the ongoing explosion of useful information on organizations and individuals has been widely appreciated. Previously, people considered tangible assets whose value could be appraised with reasonable precision [1]. The value of information is harder to define, but nonetheless it can be enormously important. Computers process data to derive and arrange information, and data is often stored in large databases. Complex software called database systems or database management systems have been developed to allow convenient storage and retrieval of data to provide useful information. Until a few years ago, database systems were used almost exclusively in large organizations on mainframes. Today, many people interact with database systems on microcomputers for personal and business applications.

Decision Support Systems (DSS) are computer-based systems that help decision-makers confront ill-structured problems through direct interaction with data and analysis models [3]. In late 1960s and early 1970s, the first DSS began to appear. They were the result of a number of factors such as:

- Emerging computer hardware and software technology
- Research efforts at leading universities

- A growing awareness of how to support decision making
- A desire for better information
- An increasingly turbulent economic environment and
- Stronger competition pressures.

The principal tenets of a Decision Support System are [2]:

- These systems can be designed specifically to facilitate the decision making processes
- These systems support rather than automate decision making, and
- These systems are able to respond quickly to the changing needs of decision-makers.

Decision Support Systems have to balance three system capabilities, ease of use by non-technical users, access to a wide variety of data, and analysis and modeling in a variety of ways. DSS constitute a significant current frontier in the application of computers. DSS help by expediting access to information that would otherwise not be readily available.

1.2 NEED FOR AN INTEGRATED DATABASE FOR HAZARDOUS MATERIAL:

Retirement from use is inevitable for any manufactured or constructed object. Dismantling and disposal are vital parts of Life Cycle Cost (LCC) of a retired object. During dismantling and disposal many things need to be taken into consideration, such as environmental issues and safety regulations. Effects of chemicals released to the environment during dismantling and disposal are a major concern [4], including issues like aquatic fate, terrestrial fate, and atmospheric fate. Within the US, safety regulations set by the Occupational Safety and Health Administration (OSHA), and the Environmental Protection Agency (EPA) have to be strictly followed. A need was recognized for an integrated Hazardous Materials Database (HMD), which has all the above-mentioned characteristics.

1.3 PROBLEM STATEMENT:

There is no database which provides broad coverage for the properties of hazardous chemicals, including the applicable safety and environmental regulations, which can assist the user in handling and disposal of a retired object. The HMD is being developed primarily for assisting

the persons or organizations responsible for handling and disposal of hazardous materials in objects to be dismantled at the end of their useful life. With all of the potential availability among dismantling scenarios, we have recognized the value of assembling a substantial database of recognized properties of materials, hazardous or otherwise, likely to be found on objects to be dismantled and their components recycled or disposed, now and in the future.

During dismantling, and replacing or disposal of components of a retired object the possible effects of chemicals encountered during the process on the people and environment need to be considered. When there is need to determine safe and legal handling and disposal of a particular chemical substance, gathering all its properties (physical, chemical and hazardous), applicable health regulations, and safety and environmental issues is a tedious and a time consuming activity. This led to the idea of developing a database of hazardous chemical substances with all their relevant properties, including health hazards to workers and potential to harm the environment from the chemicals released, and the applicable safety, health and environmental regulations, which would be flexible, easy and rapid for an organization to use, when it is interested in the dismantling and recycling or disposal of a retired object.

The HMD for chemicals developed here includes metals and nonmetals, as well as organic and inorganic compounds, with access to properties pooled at one place.

1.4 SOLUTION APPROACH:

Keeping in mind the above issues the HMD was developed which can hold extensive information about a chemical. The Database was designed by creating tables and linking them with primary keys. There is one main table called the **Materials Table**, with links to the other tables. The HMD contains a total of 22 tables. Visual Basic (VB) was used as the front-end tool for designing a query engine for the database. VB is flexible, compatible with any database and can be installed on any kind of a computer.

1.5 OBJECTIVES OF THIS RESEARCH:

The objectives of this research are to:

- Design a database for hazardous materials

- Populate this structure with properties of a sample of chemicals encountered in ship dismantling
- Develop a user interface which facilitates accessing data related to any kind of chemical substance, and
- Apply this database finally to ship dismantling.

CHAPTER 2: LITERATURE REVIEW

2.1 EXISTING CHEMICAL DATA SOURCES

CHEMICAL INVENTORY DATABASE is a user-friendly tool to help maintain an inventory of chemicals and produce summary documentation [6]. It is designed so that a user can find where a particular chemical is stored. It helps in saving money by not allowing him to purchase a chemical, which is already in use by the company and also in saving time when keeping the inventory up to date and. It makes printing and editing of the listing easy. This database is suitable for small organizations with a moderate level of inventory of several hundred chemicals. It's designed for use, so that everyone authorized in the organization can easily access the inventory information. This database cannot be used by dismantling industry since it is designed only for maintaining inventory of chemicals.

BRETHERRICK'S REACTIVE CHEMICAL HAZARDS DATABASE VERSION 2.0 is a CD ROM, which offers access to information on safe handling and use of reactive chemicals [8]. It includes every chemical for which documented information on reactive hazards has been found. This CD ROM is published by Butterworth-Heinemann, Newton MA.02158 USA. It costs \$554.96.

SAMPLE CHEMICAL DATABASE is a chemical database consisting of experimental data and correlations of temperature-dependent properties for 1635 pure chemicals [7]. Collected data have been evaluated, correlated, and checked for thermodynamic consistency. From this database we can view data sets, Design Institute for Physical property Data (DIPPR) approved property constants and regressed correlation coefficients for temperature-dependent properties, as well as calculate temperature-dependent properties in any set of units.

CHEMICAL DATABASE DEVELOPED BY UNITED NUCLEAR SCIENTIFIC EQUIPMENT & SUPPLIES deals with chemicals that are used in Fireworks, Explosives, Rocket Fuels or explosives in themselves [11]. All of the uses are not given and only the related

purposes of each are stated. Whenever possible the following information on chemical formula, melting temperature, decomposition temperature, form (liquid, powder, crystal, etc), whether it will explode, whether it is poisonous, and its usage is provided. These chemicals are offered as a guide for information purposes only and cannot be purchased.

LIGAND CHEMICAL DATABASE FOR ENZYMATIC REACTIONS: A LINK BETWEEN ENZYME STRUCTURES AND CHEMICAL REACTIONS: This database is developed by LIGAND chemical Database for Enzymatic Reactions, which is designed to link enzyme structures with enzyme-catalyzed chemical reactions [10].

GUIDE FOR HANDLING HAZARDOUS MATERIALS: This is designed as a simple guide to Hazardous Materials. United Parcel Service has recognized the need for a manual, which will provide all necessary information, while being simple enough for inexperienced shippers to use [18]. The manual incorporates a large number of products, which do not appear in the official DOT listing. The serial number permits UPS to maintain a record of persons holding copies, with the intent that revision pages will be provided as required.

INDUSTRIAL FIRE HAZARDS HANDBOOK: The purpose of this is to provide a broad yet thorough introduction to major industries and industrial processes, with emphasis on the fire hazards that accompany them. This Handbook, therefore, is intended to complement the NFPA codes and standards, and help the user apply them intelligently. It is meant as a basic reference book, which will serve a broad audience, including fire science students as well as those directly involved in industrial fire protection.

HAZARDOUS MATERIALS HANDBOOK: The design of this handbook enables a firefighter to carry information useful to him primarily during inspections, but also at fires. There are seven headings in the main section of the handbook [19]. These are Name of the material (Description of Flash Point), NFPA 704M ID (The National Fire Prevention Association Classification of the fire hazards of material based on their flash points and boiling points), DOT Classification (The Department of Transportation classification for each hazardous

substance is noted), Firefighting Procedures (FFP), Explosive Hazards, Water and Air Reactivity, Hazardous Mixtures and Toxicity Hazards

EMERGENCY ACTION GUIDE FOR SELECTED HAZARDOUS MATERIALS: This guide was prepared to help emergency service personnel during the first 30 minutes of an accident involving a spill of a volatile, toxic, gaseous and /or flammable material that is shipped in bulk [20]. General and specific safety procedures to follow are provided in spill guides arranged alphabetically by hazardous material. Each left-hand page identifies a specific hazardous material, outlines its potential hazards and provides immediate action information for fires, spills and first aid. Each right hand page specifies recommended evacuation areas and distances for protecting the public from dangerous concentrations of toxic vapors and explosions. Where applicable, necessary water pollution controls are provided.

HAZARDOUS MATERIALS: This book approaches the study of Hazardous Materials from a frame of reference, which explains why the various materials act and react as they do [21]. This explanation is based on the atomic and molecular structure and the chemical reactivity of the materials. This book communicates through the use of common nomenclature, chemical symbols, and structural formulas. The reader is introduced to the laws and principles governing the behavior of hazardous materials as a background for learning to control the behavior. Frequently encountered materials, which have hazardous properties, are identified, both chemically and practically, rationale for fire fighting is based on both their chemical reactivity and their physical properties. Nationally accepted procedures for identifying hazardous chemicals and methods for crisis –handling of them are summarized.

TOXIC METALS POLLUTION CONTROL AND WORKER PROTECTION: This book contains those metals and compounds that are most likely to cause poisoning in industry while being processed, and in general environment while the disposal of their process-effluents is being implemented [22]. What is more important and effective in the prevention of toxic metals poisoning is through removal of toxic agents in a manner that positively precludes ingestion or contact by all potential victims, and therein lies the emphasis and main endeavor of the book. In this book are condensed vital data that are scattered and difficult to pull together. Important

techniques are interpreted and explained by actual case histories. This condensed information will enable the users to establish a sound background for action.

A GUIDE TO WORKING WITH HAZARDOUS MATERIALS – The high degree of concern in the industrial community as well as the public at large, is often needlessly aggravated by unfamiliarity with many of these substances as well as the extent of their presence and potential effects [23]. This book is provided as a resource to help the industrial manager, safety and pollution control engineer establish his/her comprehensive program for information and procedures about hazardous substances in workplace.

2.2 MAJOR DRAWBACKS OF SOME OF EXISTING DATA SOURCES:

CHEMICAL STRUCTURES DATABASE: The chemical structures database contains more than 2250 automatically collected chemical structures from the Internet, complete with the information about HTML page addresses. This database is searchable with usual chemical search operations, full structure and sub structure search, formula search name search and so on [5]. This database makes chemical information much more accessible and boosts publication of quality chemical information with attached chemical structures. But it is temporarily disabled.

HAZARDOUS CHEMICAL DATABASE is a resource of approximately 2000 dangerous chemicals [9]. The database contains information about organic chemicals, inorganic chemicals, data, information, laws and regulations, EPA number, name of chemical substances, molecular formula, molecular weight, physical properties, use of chemical, melting point, boiling point, flash point, vapor pressure, water solubility, acute human health effects, safety protection for workers, first aid, spills and emergencies, handling and storage, fire hazards, work place exposure etc. This data can be obtained in the form of a CD ROM.

2.3 SOURCES USED TO POPULATE THE HAZARDOUS MATERIALS DATABASE (HMD):

HAZARDOUS PROPERTIES OF CHEMICAL SUBSTANCES: A wide range of information about hazardous characteristics, toxic properties of chemical substances, target organs and toxicology, cancer causing chemicals, teratogenic substances, flammable and combustible properties of chemical substances, explosive characteristics of chemical substances are obtained [13].

FATE AND EXPOSURE DATA FOR ORGANIC CHEMICALS: For each chemical, the physical properties as well as the environmental fate and monitoring data were identified by conducting searches of the environmental Fate Data Bases of Syracuse Research Corporation (SRC) [14].

CHEMICAL NAMES AND SYNONYMS: This gives a list of CAS Registry Numbers, Simplified Molecular Input Line Entry System (SMILES) notation, chemical names, chemical synonyms and molecular weights of all the chemicals [15].

HAZARDOUS MATERIALS HANDBOOK: Hazardous Materials Handbook covers nearly 1350 hazardous chemicals found in industrial workplace and frequently transported in bulk. It has a record of all the chemical names, their synonyms, physical description, chemical designation, health hazards, fire hazards, chemical reactivity, environmental, shipping information, hazard classification and physical and chemical properties [16].

ENVIRONMENTAL CONTAMINANT REFERENCE DATA BOOK: It is a reference compendium of physical, chemical and biological effects of environmental contaminants-primarily individual chemicals but also some selected simple and complex mixtures. Each substance is summarized and summaries include information on CAS number, DOT and NIOSH numbers, synonyms various detection limits, environmental transport, fate, and effects (selected narrative information on soil adsorption, volatilization, biodegradation, bioaccumulation, probable exposures and effect types), water chemistry, metabolic pathways, molecular formulas,

regulatory jurisdictions and authorities, standards, reactions, monitoring methods and international standards [17].

CHAPTER 3: DATABASE DESIGN

There are currently a total of 22 tables in the Hazardous Materials Database (HMD), among which the Materials Table is the main table and all the other tables are sub-tables to it. The user can get a wide range of information regarding the materials, which have been entered such as physical properties, chemical properties, environmental transport and fate properties, toxicity etc. We have initially identified 30 chemicals and categories of chemicals, mostly hazardous, occurring in ship dismantling.

HMD is divided into six major groups:

- **PHYSICAL PROPERTIES**
- **CHEMICAL PROPERTIES**
- **HEALTH AND ECOLOGICAL HAZARDS**
- **ENVIRONMENTAL CONCERN**
- **SAFETY AND ENVIRONMENTAL REGULATIONS**
- **EXPOSURE CRITERIA**

3.1 PHYSICAL PROPERTIES

At present physical properties are divided into three tables:

1. Materials Table
2. Percent Dissociated Table
3. Water Solubility

3.1.1 MATERIALS TABLE

Table 3.1.1 gives the Materials Table and its fields. The various fields are explained below:

CAS #: It is a unique identifier assigned to each chemical registered with Chemical Abstracts Services (CAS) of the American Chemical Society. This number is used to identify chemicals on the basis of their molecular structure. CAS numbers, in the format xxx-xx-x, can be used in

conjunction with chemical names for positive identification and searching on computerized databases.

Molecular Formula: The formula is in Hill notation, which is given as the number of carbons followed by the number of hydrocarbons followed by any other elements in alphabetical order.

Wiswesser Line Notation: This is a chemical structure representation that can be used for substructure searching, in order to predict a property from that structure.

Smiles Notation: A different chemical structure representation that can be used for substructure searching, in order to predict a property from that structure.

Boiling Point: Boiling Point at 1 atmosphere is the temperature of a liquid when its vapor pressure is 1 atmosphere. It indicates whether a liquid will boil and become gas at any particular temperature and sea-level atmospheric pressure.

Melting Point: The melting/freezing point is the temperature at which a solid changes to a liquid or a liquid changes to a solid.

Molecular Weight: It is the weight of a molecule of the chemical relative to a value of 12 for one atom of carbon.

Henry's constant: The Henry's Law constant (H), is the air/water partition coefficient, which is published in two forms. A non-dimensional H relates the chemical concentration in the gas phase to its concentration in the water phase. The dimensional H can be determined by dividing the vapor pressure in atmospheres by the water solubility in mole/m³ to give H in atm-m³/mole. H provides an indication of the partition between air and water at equilibrium and also is used to calculate the rate of evaporation from water.

Vapor Pressure: It is defined as the equilibrium pressure of the saturated vapor above the liquid, measured in millimeters of mercury (760mmHg = 14.7 psia) at 20deg C unless another

temperature is specified. The vapor pressure of a chemical provides considerable insight into the transport of a chemical in the environment. The volatility of the pure chemical is dependent upon the vapor pressure, while volatilization from water is dependent upon the vapor pressure and solubility in water.

Log Octanol/Water Partition Coefficient: The octanol water partition coefficient is the ratio of the chemical concentration in Octanol divided by the concentration in water at equilibrium. Occasionally chemical Octanol/water partition coefficients are not calculated because a necessary fragment constant for the chemicals are not available.

Bioconcentration Factor: Certain chemicals due to their hydrophobic nature have a tendency to partition from the water column and bioconcentrate in aquatic organisms. This concentration of chemicals in aquatic organisms is of concern because it can lead to toxic concentrations being reached when the organism is consumed by higher organisms such as wild life and humans. Such bioconcentrations are usually reported as the Bioconcentration factor (BCF), or its log which is the concentration of chemical in the organism at equilibrium divided by the concentration of the chemical in water.

Oral LD50 rat: LD stands for lethal dose. LD50 is the amount of material given all at once, which causes death of 50% (one half) of a group of test animals. LD50 is one way to measure short term poisoning potential (acute toxicity) of a material. Here rat is used as the test animal. For example LD50 (oral rat) 5mg/kg means that 5 milligrams of that chemical for every one-kilogram body weight of the rat, when administered in one dose by mouth causes the death of 50% of the test group.

Table 3.1.1- MATERIALS

Chemical Name	Description
CAS #	Identifier assigned by Chemical Abstract Society
Smiles	Chemical structure representation
Classification	Which group the chemical belongs to
Wiswesser_Notation	One of chemical structure representation
Molecular_Wt	Weight of molecule of chemical
Molecular_Formula	Number of carbons and hydrocarbons present
Boiling_Point	Temperature at which chemical boils
Boiling_Point_Range	Range of temp at which the chemical boils
Melting_Point	Temperature at which it melts
Melting_Point_Range	Range of temperature at which the chemical melts
Log Octanol Water partition coefficient	Conc in octanol/conc in water at equilibrium
Density	Density of chemical at 25 deg C
VP	Equilibrium pressure of saturated vapor above liquid
Henry's constant	It is the air/water partition coefficient
Bioconcentration factor	Conc of chemical in organism/conc in water
Oral LD50 rat	Dose given causes the death of 50% of test animals
Sources	Sources used to get the information
Notes	Notes for the chemical

3.1.2 PERCENT DISSOCIATED

Table 3.1.2 gives the various fields of Percent Dissociated which are explained below

Dissociation constants: The acid dissociation constant as the negative log (pKa) is given for chemicals that are likely to dissociate at environmental pHs (between 5 and 9). Chemical classes where dissociation is important include phenols, carboxylic acids, and aliphatic aromatic amines. The degree of dissociation affects such processes as photolysis (absorption spectra of chemicals that dissociate can be considerably affected by pH), evaporation from water (ions do not evaporate), soil or sediment adsorption, and bioconcentration.

Table 3.1.2- PERCENT DISSOCIATED

Chemical Name	% Dissociation in aqueous solution
pH2	
pH4	
pH7	
pH9	
pH11	

3.1.3 WATER SOLUBILITY

Table 3.1.3 is Water Solubility, which is explained below

Water Solubility: The water solubility of chemicals provides considerable insight into the fate and transport of a chemical in the environment. High water soluble chemicals, which have a tendency to remain dissolved in the water column and not partition to soil or sediment or bioconcentrate in aquatic organisms, are less likely to volatilize from water and are generally more likely to biodegrade. Low water soluble chemicals are just the opposite; they partition to soil or sediments and bioconcentrate in aquatic organisms, many volatilize more readily from water, and are less likely to be biodegradable. Other fate processes that are or can be affected by water solubility include photolysis, hydrolysis, oxidation, and wash out from the atmosphere by rain or fog. The water solubility Table is shown below.

Table 3.1.3 -WATER SOLUBILITY

Chemical Name	Description
Soluble	If the chemical is soluble (Yes/No)
Low	If the solubility of the chemical is low
Medium	If the solubility of chemical is medium
High	If the solubility of chemical is high

3.2 CHEMICAL PROPERTIES

Chemical Properties are divided into four tables:

1. Reactivity/Instability
2. Flammability/Combustibility
3. Extinguishing Agents

4. Corrosivity

3.2.1. REACTIVITY/INSTABILITY

This Table gives the reactivity of the chemical with oxidizers, titanium, and selenium

Table 3.2.1- REACTIVITY/INSTABILITY

Chemical Name	Description
Oxy	If the chemical reacts with oxidizers
Ti	If the chemical reacts with titanium
Se	If the chemical reacts with selenium

3.2.2 FLAMMABILITY/COMBUSTIBILITY

This table gives information about the flash point, auto ignition temperature and the upper and lower exposure limits of the chemical.

Flash Point: It is defined as the lowest temperature at which vapors above a volatile combustible substance will ignite in air when exposed to a flame.

Flammable limits in air: The percent concentration in air (% by volume) is given for the LEL (lower explosive-flammable limit in air, % by volume) and UEL (upper explosive-flammable limit in air, % by volume) at room temperature unless otherwise specified. The values, along with those in Flash Point and Auto ignition temperature give an indication of relative Flammability of the chemical.

Table 3.2.2 -FLAMMABILITY/ COMBUSTIBILITY

Chemical Name	Description
Non Flammable	If chemical is not flammable
Flash Point	Lowest temp at which chemical vapor ignites when exposed to flame
Auto ignition temp	Lowest temperature at which chemical catches fire
LEL percent	Lower exposure limit
UEL percent	Upper exposure limit

3.2.3 EXTINGUISHING AGENTS

Table 3.2.3 gives whether the chemical is used or not used as an extinguishing agent

Table 3.2.3 - EXTINGUISHING AGENTS

Chemical Name	Description
Use	Any extinguishing agent that can be used in the presence of the chemical
Not Use	Any extinguishing agent that cannot be used in the presence of the chemical

3.2.4 CORROSIVITY

This table gives the information about the reactivity of the chemical towards flesh, towards steel and the material, which corrodes that particular chemical.

Table 3.2.4 - CORROSIVITY

Chemical Name	Description
Toward Metal	Corrosivity of the chemical towards metal
Toward Flesh	Corrosivity of the chemical towards flesh
Towards Glass	Corrosivity of the chemical towards glass

3.3 HEALTH AND ECOLOGICAL HAZARDS

This group is divided into six tables:

1. Aquatic Fate
2. Acute Symptoms
3. Chronic Symptoms
4. Allergen
5. Oral Acute Aquatic Toxicity
6. Cancer

3.3.1 AQUATIC FATE

This section reviews how a chemical will behave if released to fresh, marine, or estuarine surface waters. Field studies or aquatic model ecosystems are used when they provide insight into the overall behavior in water. When field or aquatic ecosystems studies are not available or do not give enough data to make conclusions on the aquatic fate of the chemical, data from appropriate degradation, transport, or monitoring sections will be used to synthesize how a chemical is likely to behave if released to water.

Table 3.3.1– AQUATIC FATE

Chemical Name	Description
Biodegrade	Breakdown by the action of living things
Adsorb to Sediment	Adsorption of chemical to sediment
Photolysis	Destruction of materials initiated by reactions by absorption of light
Photo -Oxidation	Uses light to initiate reactions that destroy contaminants

3.3.2 ACUTE SYMPTOMS AND TOXICITY

Acute Symptoms observed when the chemical is taken inside the body either through inhalation or ingestion or adsorption through skin or eye.

Table 3.3.2 - ACUTE SYMPTOMS AND TOXICITY

Chemical Name	Description
Inhalation	Intake into the body through breathing
Ingestion	Intake into the body through mouth

3.3.3 CHRONIC SYMPTOMS AND TOXICITY

These are the chronic symptoms observed when the chemical is inhaled or taken in by ingestion or by adsorption through the skin.

Table 3.3.3 - CHRONIC SYMPTOMS AND TOXICITY

Chemical Name	Description
Inhalation	Intake into the body through breathing
Ingestion	Intake into the body through mouth

3.3.4 ALLERGENICITY

Table 3.3.4 gives the information about whether the chemical is an allergen to skin, respiratory tract or other organs of the body.

Table 3.3.4 - ALLERGENICITY

Chemical Name	Description
Skin	Allergen to skin
Respiratory	Allergen to lungs
Other	Allergen to other organs

3.3.5 ORAL ACUTE AQUATIC TOXICITY

Toxicity by ingestion: The LD₅₀ values are those defined by the National Academy of Sciences, committee on Hazardous Materials. LD₅₀ signifies that about 50% of the animals given the specified dose by mouth will die [14]. The values of Water Fowl LD₅₀ and Fish LC₅₀ for the chemical in table 3.3.5

Table 3.3.5 - ORAL ACUTE AQUATIC TOXICITY

Chemical Name	Name of the chemical
Fish LC ₅₀	Amount when taken will kill the fish
Water Fowl LD ₅₀	When consumed 50% of the animals will die

3.3.6 CANCER

A carcinogen is a substance capable of causing cancer. Most cancers are induced by many synthetic or naturally occurring chemicals, which include inorganic substances, organics, hormones, and many solid-state materials.

Mutagens: These cause cell mutations, which may or may not later develop into cancer, birth defects or other health effects.

Genotoxic Carcinogens: Carcinogenic chemicals may alter Deoxyribonucleic acid (DNA) to cause uncontrolled cell replication. DNA is a long macromolecule that carries a genetic code through which genotypic characteristics are inherited. A chemical may interact with DNA through the genetic mechanism, altering the structure or number of the chromosomes, causing gene mutation or duplication. Such substances are known as Genotoxic carcinogens.

Teratogens: These are chemical and physical agents that can cause birth defects and mortality among new born, malformations, growth retardation and functional disorders.

Table 3.3.6 - CANCER

Chemical Name	Description
Mutagen	Causes mutations
Genotoxic carcinogen only	Alters genes, can lead to cancer
Promoter carcinogen only	Enhances cell proloferation, can lead to cancer

3.4 ENVIRONMENTAL CONCERN:

This group has three tables under it, which are as follows:

1. Atmospheric Fate
2. BOD
3. Terrestrial Fate

3.4.1 ATMOSPHERIC FATE

This section reviews how a chemical will behave if released to atmosphere. The vapor pressure will be used to determine if the chemical is likely to be in the vapor phase or adsorbed to particulate matter. The water solubility will be used to assess the likelihood of washout with rain.

Table 3.4.1 –Atmospheric Fate

Chemical Name	Description
Reactions	Various other chemicals with which it reacts
T _{1/2} for 24 hrs	Half life for 24 days
T _{1/2} day time	Half life during day
T _{1/2} night time	Half life during night
T _{1/2} Dry sedimentation	Dry remove half life
T _{1/2} Wet deposition	Precipitation washout half life

3.4.2 BOD

Biological Oxygen Demand (BOD): Also called “biochemical oxygen demand”, this is a standard way of describing how much oxygen dissolved in water is consumed by biological oxidation of the chemical during the stated period of time. When given in percent, the values indicate the pounds of chemical during the time stated.

Table 3.4.2 - BOD

Chemical Name	Description
BOD 5 day mg/l	Biological oxygen demand for 5day, mg/l
BOD T _{1/2}	Biological oxygen demand other formats

3.4.3 TERRESTRIAL FATE

This section shows how a chemical will behave if released to soil or ground water. Field studies or terrestrial model ecosystem studies are used when they provide insight into overall behavior in soil. Quite often, field or terrestrial ecosystem studies either are not available or do not give enough data to make conclusions on the terrestrial fate of a chemical. In these cases, data from sections on biodegradation, abiotic degradation, soil adsorption/mobility, volatilization from water/soil, and any appropriate monitoring data will be used to synthesize how a chemical is likely to behave if released to soil.

Soil Adsorption/Mobility: For many chemicals experimental soil or sediment partition coefficients are available. These values are measured by determining the concentration in both the solution (water) and solid (soil or sediment) phases after shaking for about 24 to 48 hours and using different initial concentrations.

Table 3.4.3 – TERRESTRIAL FATE

Chemical Name	Description
Aerobic Biodegradation	Biodegradation in the presence of air
Anaerobic Biodegradation	Biodegradation in the absence of air
Soil adsorption/Mobility	Conc in both solution / solid after shaking for 24 to 48hrs

3.5 SAFETY AND ENVIRONMENTAL REGULATIONS

This group is divided into three tables:

1. Clean Air Act
2. DOT (U.S Department of Transportation)
3. Resource Conservation and Recovery Act (RCRA, Waste Management)

3.5.1 CLEAN AIR ACT

Table 3.5.1 has three fields

HAP stands for Hazardous Air Pollutant

EHS stands for Extremely Hazardous Substance

HRP stands for High Risk Pollutants

Table 3.5.1- CLEAN AIR ACT

Chemical Name	Description
Criteria Pollutants	Co, SO, NO _x etc
HAP	Hazardous air pollutants
EHS	Extremely hazardous substances
HRP	High risk pollutant

3.5.2 DOT

This is a Hazard identification number that is assigned to the substance by the US Department of Transportation (DOT). This identification number identifies substances regulated by DOT and must appear on shipping documents, the exterior of packages and on specified containers.

FIFRA stands for Federal Insecticide Fungicide Rodenticide Act. Table 3.5.2 has following fields

Table 3.5.2 – DOT

Chemical Name	Description
Water pollutant	If it pollutes water
Hazard class	Rating given to every chemical
Registration pesticide FIFRA	If it can be used as pesticide or insecticide

Table 3.5.3 – Resource Conservation and Recovery Act (RCRA, Waste Management)

Chemical Name	Description
Flammability	Flammability of the chemical
Reactivity	Reactivity of the chemical
Primary valence	Valency of chemical
Ion coordination	Ion coordination of chemical
Corrosivity	Corrosivity of the chemical
Toxicity	Toxicity of the chemical

3.6 EXPOSURE CRITERIA:

This group is divided into three tables:

1. Worker Exposure Criteria (acute- STEL), Short-Term Exposure Limit
2. Worker Exposure Criteria (acute-CEIL), Ceiling Exposure Limit
3. Worker Exposure Criteria (chronic-TWA), Time-Weighted Average Exposure Limit

Exposure Limits:

These are legally enforceable airborne permissible exposure limits (PELs) from OSHA, and recommended airborne exposure limit guidelines called recommended exposure limits (RELs) from National Institute of Occupational Safety and Health (NIOSH) or called threshold limit values (TLVs) from the American Conference of Government Industrial Hygienists (ACGIH) or called Work Place Environmental Exposure Levels (WEEL) from the American Industrial Hygienists Association.

There are 3 kinds of **TLVs**. A time weighted average TLV (TLV-TWA) is a concentration in breathing air for a normal 8-hour workday and a 40-hour workweek, to which it is believed that nearly all workers may be exposed, day after day without adverse effects. A ceiling TLV value (TLV-C) is the concentration that should not be exceeded during any part of the working exposure. If instantaneous monitoring is not feasible, then the (TLV-C) can be assessed by sampling over 15-minute periods except for those substances that may cause immediate irritation when exposures are short. A short-term exposure limit (TLV-STEL) is a 15-minute TWA exposure concentration in air, which should not be exceeded at any time in a workday, even if the 8-hour TWA is within the TLV-TWA. Exposures above the 8 hour TLV-TWA up to the TLV-STEL should not last more than 15 minutes and should not occur more than 4 times in a work day. This should be atleast 60 minutes between successive exposures in the range.

There are 3 kinds of **PELs**. A time weighted average PEL (PEL-TWA) is a concentration that must not be exceeded during any 8-hour shift or 40-hour workweek. An OSHA ceiling concentration must not be exceeded during any part of the workday; if instantaneous monitoring is not feasible, the ceiling must be assessed as a 15 minute TWA exposure. A short-term exposure limit PEL (PEL-STEL) is defined similarly to a TLV STEL.

All **WEELS** are expressed as either time weighted average (TWA) concentrations or ceiling values, however, different time periods are specified depending on the properties of the agent. An 8-hour TWA indicates a time weighted average concentration for a normal 8-hour workday and a 40-hour workweek. A ceiling limit should not be exceeded at any time during the

workday. A short-term TWA is a time weighted average concentration of shorter duration (such as 15 minutes) established to limit excursion levels.

All the above-discussed values for a chemical are tabulated which can be seen from tables 3.6.1, 3.6.2 and 3.6.3.

Table 3.6.1 - WORKER EXPOSURE CRITERIA (ACUTE-STEL) mg/m³

Chemical Name	Description
TLV	Threshold limit value
WEEL	Workplace environmental exposure level

Table 3.6.2 - WORKER EXPOSURE CRITERIA (ACUTE-CEIL) mg/m³

Chemical Name	Description
PEL	Permissible exposure limit
TLV	Threshold limit value
WEEL	Workplace environmental exposure level

Table 3.6.3 - WORKER EXPOSURE CRITERIA (CHRONIC-TWA) mg/m³

Chemical Name	Description
TLV	Threshold limit value
WEEL	Workplace environmental exposure level
PEL (respirable)	Permissible exposure limit

CHAPTER 4: IMPLEMENTATION

Microsoft Access is a powerful, yet intuitively easy-to-use, database management system, designed to run in the Windows environment. Its primary purpose is to provide an efficient system for storing large amounts of data - a system in which any one piece of information can be quickly located. Additionally, relationships between data can be established allowing one to additionally retrieve the related information of any one piece of information requested. Access includes many features for manipulating the information that is stored. Using the program, one can

- Sort and rearrange information in various ways
- Extract and work with subsets of the information.

The Database contains a main table and several sub tables under it. These are linked with the help of Primary keys and foreign keys. In HMD the chemical name was made the primary key since most chemicals have a unique name. The relationships diagram can be seen from appendix 26 at the end.

4.1 THE QUERY ENGINE:

A Query engine was developed to assist the user in creating and retrieving data for HMD. Visual Basic was selected to be the front end for accessing data from HMD. It is flexible and compatible with any kind of database. The Graphical User Interface (GUI) an inherent feature of Visual Basic, uses illustrations for text, which enable users to interact with the application.

TABLES SHOWING THE MAIN MENUS THEIR CORRESPONDING FIELDS AND SUB FIELDS:

Table 4.1: MAIN FORM WITH MENUS

File	Tools	Help
Record Maintenance	Search	Help file
Exit	Query	

Table 4.2: RECORD MAINTENANCE

Physical Properties	Chemical Properties	Health Hazards	Safety Regulations	Environmental Concern	Exposure Criteria
Materials	Reactivity /Instability	Aquatic Fate	Clean Air Act	Atmospheric Fate	Worker exposure criteria (STEL)
Percent Dissociated	Flammability /combustibility	Acute symptoms	DOT	Biological Oxygen demand (BOD)	Worker exposure criteria (CEIL)
Water Solubility	Extinguishing Agents	Chronic symptoms	Characteristic RCRA	Terrestrial Fate	Worker exposure criteria (TWA)
	Corrosivity	Allergen			
		Oral Acute Aquatic Tox			
		Cancer			

Table 4.3: TOOLS

Search	Query
By CAS #	On Molecular weight
By Chemical Name	On Boiling Point
By Molecular Formula	On Melting Point
	On Vapor Pressure (VP)
	On classification
	Print

Help: helps the user in using the database

Exit: exits the program

The first screen of HMD Query Engine is shown in Figure 4.1. There are two buttons 1.“ENTER” button, which is to enter into the database, and the “EXIT” Button, which is used to end the program.

On clicking the “ENTER” button a new form is opened as shown in Figure 4.2

It asks the user to enter a password. This feature is included for security reasons; only authorized users can access the database

Figure 4.1: HMD Query Engine

Figure 4.2: Password Form

There is a “LOGIN” button, which should be clicked after typing in the password. If an Invalid Password is entered then a message saying “Invalid Password” appears on the screen as shown in

Figure 4.3. If correct password is typed, then the form named home is displayed. The menu items of the home form are

- File
- Tools
- Help

Figure 4.3: Screen showing Invalid Password

When the mouse is placed on top of File, it displays the following pull down menu Figure 4.4

1. Record Maintenance
2. Exit

Figure 4.4: Home form with the pull down menu for the file displayed

On the home form when user clicks on the Record Maintenance of the file pull down menu option, another pull down menu, showing the following properties appears Figure 4.5.

- a) Physical properties
- b) Chemical Properties
- c) Health and Ecological Hazards
- d) Exposure Criteria
- e) Safety and Environmental Regulations and
- f) Environmental concern

Figure 4.5: Showing the pull down menu of Record Maintenance

Clicking on the physical properties leads to another pull down menu, which has the following:

- 1) Materials
- 2) Water solubility and
- 3) Percent Dissociated tables as shown in the Figure 4.6 below

Figure 4.6: Listing the items in pull down menu for Physical Properties

Clicking on the chemical properties leads to another pull down menu of the following items:

- 1) Flammability/Combustibility
- 2) Extinguishing Agents
- 3) Reactivity/ Instability and
- 4) Corrosivity

as shown in the Figure 4.7 below

Figure 4.7: Showing the list of items in the pull down menu for Chemical Properties

Clicking on the Health Hazards leads to another pull down menu of the following items:

- 1) Cancer
- 2) Aquatic Fate
- 3) Acute Symptoms and Toxicity
- 4) Chronic Symptoms and Toxicity
- 5) Allergenicity and
- 6) Oral acute aquatic Toxicity

as shown in the Figure 4.8 below

Figure 4.8: showing the pull down menu for Health Hazards

Clicking on the Safety Regulations and guidelines on the Record Maintenance leads to another pull down menu of the following items:

- 1) DOT
- 2) Clean Air Act and
- 3) RCRA

which are shown in the Figure 4.9 below

Figure 4.9: Showing the pull down menu for Safety and Environmental Regulations

Clicking on the Exposure Criteria leads to another pull down menu of the following items:

- 1) Worker Exposure Criteria (acute-STEL)
- 2) Worker Exposure Criteria (acute-CEIL) and
- 3) Worker Exposure Criteria (chronic- TWA)

as shown in the Figure 4.10 below

Figure 4.10: Showing the pull down menu for Exposure Criteria

Clicking on the Environmental Concern on the Record Maintenance menu selection leads to another pull down menu of the following:

- 1) Toxicity
- 2) Atmospheric Fate
- 3) Terrestrial Fate and
- 4) BOD

which is shown in the Figure 4.11 below

Figure 4.11: Showing the pull down menu for Environmental Concern

When the user clicks on the menu item Search, of the Tools, a form is displayed with the following three options

- By CAS#
- By Chemical Name
- By Molecular Formula as shown in Figure 4.12 below

Figure 4.12: Showing the pull down menu for Search

When the user clicks on the menu item Query of the Tools, the form as shown in Figure 4.13 below is displayed with the following seven options

- d) On Molecular Weight
- e) On Boiling point
- f) On Melting point
- g) Molecular formula
- h) Save query as and
- i) Print

Figure 4.13: Showing the pull down menu for query

HELP: The Help option in the main menu helps the user in using the frontend for the Hazardous Materials Database effectively. It guides the user by providing information about all the forms and how to use them.

When the user clicks on the menu item Water Solubility of the Physical Properties, the form shown in Figure 5.2 is displayed

The screenshot shows a software window titled "Water Solubility". On the left side, there is a vertical list of labels: "Chemical Name:", "Inchi:", "Iupac:", "Molecular Weight:", and "Solubility:". To the right of these labels is a table with five rows. The first row contains the text "2,4-dinitrophenol". The other four rows are empty. At the bottom of the window, there is a toolbar with buttons labeled "Add", "Update", "Delete", "Refresh", and "Close". The status bar at the very bottom indicates "Record 1 of 1".

Figure 5.2: Water Solubility

When the user clicks on the menu item Percent Dissociated of the Physical Properties, the form as shown in Figure 5.3 below is displayed

The screenshot shows a software window titled "Percent Dissociated". On the left side, there is a vertical list of labels: "Chemical Name:", "P1%", "P2%", "P3%", "P4%", and "P5%:". To the right of these labels is a table with five rows. The first row contains the text "2,4-dinitrophenol". The other four rows are empty. At the bottom of the window, there is a toolbar with buttons labeled "Add", "Update", "Delete", "Refresh", and "Close". The status bar at the very bottom indicates "Record 1 of 1".

Figure 5.3: Percent Dissociated Table of Physical Properties

When the user clicks on the menu item Flammability/Combustibility of the Physical Properties, the form shown in Figure 5.4 is displayed

[illegible]

37

When the user clicks on the menu item Reactivity/Instability of the Chemical Properties, form as shown in Figure 5.6 below is displayed

Reactivity/Instability

Chemical Name: Aluminum

Other Reactions: reacts with all forming aluminum oxide

Add Update Delete Refresh Close

Figure 5.6: Reactivity/Instability Table of Chemical properties

When the user clicks on the menu item Corrosivity of the Chemical Properties, the form as shown in Figure 5.7 below is displayed

Corrosivity

Chemical Name: Aluminum

Material which corrode: Acid, other metals

Second Phase: _____
Second Sheet: _____

Add Update Delete Refresh Close

Record 1

Figure 5.7: Corrosivity Table of chemical Properties

Health and Ecological Hazards: These can be obtained from Cancer, Aquatic Fate, Acute Symptoms, Chronic Symptoms, Allergen and Oral Acute Aquatic Toxicity tables. Cadmium is genotoxic, has acute symptoms from both inhalation and ingestion, has chronic symptoms both from inhalation and ingestion, and damages the liver badly.

When the user clicks on the menu item Cancer of the Health and Ecological Hazards, the form as shown in Figure 5.8 below is displayed

Inhalation	Ingestion
Genotoxic	Yes
Acute	Yes
Chronic	Yes
Allergen	Yes
Oral Acute	Yes

Figure 5.8: Cancer Table of the Health and Ecological Hazards

When the user clicks on the menu item Aquatic Fate of the Health and Ecological Hazards, the form below in Figure 5.9 is displayed

Inhalation	Ingestion
Genotoxic	Yes
Acute	Yes
Chronic	Yes
Allergen	Yes
Oral Acute	Yes

Figure 5.9: Showing the Aquatic Fate Table

When the user clicks on the menu item acute symptoms of the Health and Ecological Hazards, the form as shown in Figure 5.10 is displayed

The screenshot shows a software window titled "Acute Symptoms". On the left, there is a sidebar with the text "Chemical Hazards" and three input fields labeled "Ingestion:", "Inhalation:", and "Injection:". To the right of these fields are three corresponding input boxes containing the text "Aluminum", "H2O", and "Air". The main area of the window is a large blue rectangle. At the bottom, there is a toolbar with buttons labeled "Add", "Update", "Delete", "Refresh", and "Close". Below the toolbar, a status bar indicates "Record 1".

Figure 5.10: Acute Symptoms Table of Health and Ecological Hazards

When the user clicks on the menu item chronic symptoms of the Health and Ecological Hazards, form as shown in Figure 5.11 below is displayed

The screenshot shows a software window titled "Chronic Symptoms". On the left, there is a sidebar with the text "Chemical Hazards" and three input fields labeled "Ingestion:", "Inhalation:", and "Injection:". To the right of these fields are three corresponding input boxes containing the text "Aluminum", "H2O", and "Air". The main area of the window is a large blue rectangle. At the bottom, there is a toolbar with buttons labeled "Add", "Update", "Delete", "Refresh", and "Close". Below the toolbar, a status bar indicates "Record 1".

Figure 5.11: Chronic Symptoms Table of Health and Ecological Hazards

When the user clicks on the menu item Allergen of the Health and Ecological Hazards, the form as shown in Figure 5.12 below is displayed

Figure 5.12: Allergen Table of Health and Ecological Hazards

When the user clicks on the menu item Oral Acute Aquatic Toxicity of the Health and Ecological Hazards, the form below in Figure 5.13 is displayed

Figure 5.13 - Oral Acute Aquatic Toxicity Table

Safety and Environmental Regulations:

These can be obtained from Clean Air Act, Clean Water Act, RCRA, and DOT tables.

When the user clicks on the menu item Clean Air Act of the Safety and Environmental Regulations, the form below in Figure 5.14 is displayed

The screenshot shows a software window titled "SA - Safety and Environmental Regulations". On the left, a menu lists "Clean Air Act", "RCRA", "Hazardous Waste", "Hazardous Materials", "Hazardous Substances", "Hazardous Waste", "Hazardous Materials", "Hazardous Substances", "Hazardous Waste", "Hazardous Materials", "Hazardous Substances". The "Clean Air Act" item is selected. The main area is a large blue rectangle. At the bottom, there is a toolbar with buttons: "Add", "Update", "Delete", "Refresh", "Close".

Figure 5.14: Showing the Clean Air Act Table

When the user clicks on the menu item RCRA table of the Safety and Environmental Regulations, the form below in Figure 5.15 is displayed

The screenshot shows a software window titled "SA - Safety and Environmental Regulations". On the left, a menu lists "Clean Air Act", "RCRA", "Hazardous Waste", "Hazardous Materials", "Hazardous Substances", "Hazardous Waste", "Hazardous Materials", "Hazardous Substances", "Hazardous Waste", "Hazardous Materials", "Hazardous Substances". The "RCRA" item is selected. The main area is a large blue rectangle. At the bottom, there is a toolbar with buttons: "Add", "Update", "Delete", "Refresh", "Close".

Figure 5.15: Showing the RCRA Table

When the user clicks on the menu item DOT of the Safety and Environmental Regulations, the form as shown in Figure 5.16 below is displayed

Figure 5.16: DOT Table of Safety and Environmental Regulations

Environmental Concern: These can be obtained from Atmospheric Fate, Terrestrial Fate and BOD tables.

When the user clicks on the menu item Terrestrial Fate of the Environmental Concern, the form as shown in Figure 5.17 below is displayed

Figure 5.17: Terrestrial Fate Table

When the user clicks on the menu item Atmospheric Fate of the Environmental Concern menu selection the form as shown in Figure 5.18 below is displayed

Chemical Name	By release: T1/2	release:	T1/2: day/week	T1/2: for 24 hrs	T1/2: nighttime:
	0.0 day/week	0.0	0.0 day/week	0.0 day/week	0.0 day/week

Figure 5.18: Atmospheric Fate Table

When the user clicks on the menu item BOD of the Environmental Concern pull, the form below in Figure 5.19 is displayed

Chemical Name	BOD: day/week	BOD: 1/2
	0.0 day/week	1.0 1/2

Figure 5.19: BOD Table

Exposure Criteria: These can be obtained from Worker Exposure Criteria (acute- STEL), Worker Exposure Criteria (acute-CEIL) and Worker Exposure Criteria (chronic-TWA) tables. Cadmium has a TWA TLV of 0.05 mg/m³ and TWA PEL of 0.3mg/m³.

When the user clicks on the menu item Worker Exposure Criteria (acute-STEL) of the Exposure Criteria, the form as shown in Figure 5.20 below is displayed

The screenshot shows a software window titled "Worker Exposure Criteria (acute-STEL) [mg/m³]". It features a table with three rows and two columns. The first row is labeled "Exposure Criteria", the second "PEL", and the third "STEL". The table is currently empty. The window has a standard Windows-style title bar and a menu bar at the bottom with options like "File", "Edit", "Format", "Tools", and "Help".

Figure 5.20: Worker Exposure Criteria (acute-STEL) Table

When the user clicks on the menu item Worker Exposure Criteria (acute-CEIL) of the Exposure Criteria, the form below in Figure 5.21 is displayed

The screenshot shows a software window titled "Worker Exposure Criteria (acute-CEIL) [mg/m³]". It features a table with three rows and two columns. The first row is labeled "Exposure Criteria", the second "PEL", and the third "CEIL". The table is currently empty. The window has a standard Windows-style title bar and a menu bar at the bottom with options like "File", "Edit", "Format", "Tools", and "Help".

Figure 5.21: Worker Exposure Criteria (acute-CEIL) Table

When the user clicks on the menu item Worker Exposure Criteria (chronic-TWA) of the Exposure Criteria, the form below in Figure 5.22 is displayed.

The screenshot shows a software window titled "Worker Exposure Criteria (chronic-TWA) Table". On the left side, there is a vertical list of labels: "Chemical Name", "PEL (permissible)", "PEL (maximum)", "TLV", and "WEL". To the right of these labels is a table with five horizontal rows, each corresponding to one of the labels. The rest of the window is a large, empty blue area. At the bottom, there is a standard Windows taskbar with buttons for "File", "Options", "Database", "Reports", and "Help".

Figure 5.22: Worker Exposure Criteria (chronic-TWA) Table

When the user clicks on the menu item Search, of the Tools a form is displayed with the following three options

- j) By CAS#
- k) By Chemical Name
- l) By Molecular Formula as shown in Figure 5.23 below

The screenshot shows a software window titled "Tools". A pull-down menu is open, displaying three options: "By CAS #", "By Chemical Name", and "By Molecular Formula". The menu is positioned over a large blue area. The taskbar at the bottom shows several open applications, including "MSN Messenger", "Internet Explorer", "Chemicals", and "Query Engine".

Figure 5.23: Pull down menu for Search

The user can get specific information desired such as, he can search for a specific Chemical and its properties from the database by inputting the CAS # or Molecular Formula and vice versa.

When the user clicks on “ By CAS#” in the Search the form shown below opens. A drop down list of all CAS numbers in the database is provided at “Enter the CAS#” in the form at the top. User can chose any CAS# from the drop down list and get the corresponding properties of that particular chemical. The form is as shown in Figure 5.24 below

The image shows a web browser window with a dark blue background. At the top, there is a title bar that says "Search by CAS#". Below the title bar, there is a text input field labeled "Enter the CAS#" with a dropdown arrow on the right. Below this field, there is a horizontal line. Under the line, the text "These are the properties of the element: Label9" is displayed. Below this text, there are four rows of labels and input fields: "Boiling point" with a text input field, "Melting point" with a text input field, "Molecular weight" with a text input field, and "Molecular Formula" with a text input field. At the bottom of the window, there is a taskbar with several icons and a clock showing "3:31 PM".

Figure 5.24: Form to enter CAS#

Let's say the user chose '7429-30-5' from the drop down list of CAS numbers, the search program will search the database and gets the corresponding chemical name and its properties as shown in Figure 5.25 below

Search by CAS#

Enter the CAS#

These are the properties of the element: Aluminum

Boiling point	<input type="text" value="2527"/>
Melting point	<input type="text" value="660"/>
Molecular weight	<input type="text" value="27"/>
Molecular Formula	<input type="text" value="Al"/>

Figure 5.25: Chemical Name and its Properties

When the user clicks on “ By Chemical Name” in the Search, a form shown below opens Figure 5.26. A drop down list of all chemical Names in the database is provided at “Enter the Chemical name” in the form at the top. User can chose any Chemical from the drop down list and get the corresponding properties of that particular chemical along with its CAS#.

Search by Chemical Name

Enter the Chemical Name

These are the properties of the above compound with CAS #

Boiling point	<input type="text"/>
Melting point	<input type="text"/>
Molecular weight	<input type="text"/>
Molecular Formula	<input type="text"/>

Figure 5.26: Search by Chemical Name

Let's say the user chose 'Ethylene Glycol', the search program will search the database and gives the corresponding CAS# and its properties as shown in Figure 5.27 below

Search by Chemical Name

Enter the Chemical Name

These are the properties of the above compound with CAS # 107-21-1

Boiling point	<input type="text" value="198"/>
Melting point	<input type="text" value="-13"/>
Molecular weight	<input type="text" value="62"/>
Molecular Formula	<input type="text" value="C2H6O2"/>

Figure 5.27: Form to choose a Chemical

When the user clicks on “ By Molecular Formula” in the Search, the form shown below Figure 5.28 opens. A drop down list of all Molecular Formulas in the database is provided at “Enter the Molecular Formula” in the form at the top. User can chose Molecular Formula of any Chemical from the drop down list and get the corresponding properties of that particular chemical.

Search by Molecular Formula

Enter the Molecular formula

These are the properties of the compound with above molecular formula

Boiling point	<input type="text"/>
Melting point	<input type="text"/>
Molecular weight	<input type="text"/>

Figure 5.28: Form to Search by Molecular Formula

Let's say the user chose 'C₂H₆O₂' which is the molecular formula of Ethylene Glycol. The search program will search the database and gives the corresponding chemical name and its properties as shown in Figure 5.29 below

The screenshot shows a software window titled "Search by Molecular Formula". It features a text input field containing "C₂H₆O₂". Below this, a message states: "These are the properties of the compound with above molecular formula". To the right of this message, the name "Ethylene Glycol" is displayed. Below the message, three properties are listed, each with a corresponding value in a text box: "Boiling point" with "198", "Melting point" with "-13", and "Molecular weight" with "62". The window has a standard Windows taskbar at the bottom with icons for Start, Internet Explorer, Netscape, and a taskbar showing "Chemicals - Microsoft Word" and "C:\Temp Engine". The system clock in the bottom right corner shows "2:17 PM".

These are the properties of the compound with above molecular formula		Ethylene Glycol
Boiling point	198	
Melting point	-13	
Molecular weight	62	

Figure 5.29: Search Results Form

When the user clicks on the menu item Query of the Tools pull down menu the form as in Figure 5.30 shown below is displayed with the following seven options

- On Molecular Weight
- On Boiling point
- On Melting point
- Molecular formula
- Save query as and
- Print

Figure 5.30: Pull Down Menu

Querying with molecular Weight form looks like the Figure 5.31 shown below. This is useful when he wants chemicals and its properties with molecular weight greater or less than certain value.

Figure 5.31: Molecular Weight Query

Let's say the user enters a value of 100 and he selects greater than, he can do this as shown below Figure 5.32

Searching with molecular weight

What are the compounds whose molecular weights are

☒ Greater than
☐ Lesser than

100

Chemical Name	MW (g/mol)	Index	Classification	Chemical Formula	Molecular Weight	Molecular Formula	Index Name	Index Point Range	Index Point
Aluminum	26.981538		Aluminum metal	Al	26.98	Al			
Carbon	12.0107		Carbon metal	C	12.01	C			
Hydrogen	1.00794		Hydrogen gas	H ₂	2.02	H ₂			
Oxygen	15.9994		Oxygen gas	O ₂	32.00	O ₂			
Aluminum Oxide	78.0031		Aluminum oxide	Al ₂ O ₃	78.00	Al ₂ O ₃			
Aluminum Hydroxide	78.0031		Aluminum hydroxide	Al(OH) ₃	78.00	Al(OH) ₃			
Aluminum Chloride	133.444		Aluminum chloride	AlCl ₃	133.44	AlCl ₃			
Aluminum Sulfate	342.151		Aluminum sulfate	Al ₂ (SO ₄) ₃	342.15	Al ₂ (SO ₄) ₃			
Aluminum Nitrate	212.096		Aluminum nitrate	Al(NO ₃) ₃	212.09	Al(NO ₃) ₃			
Aluminum Hydroxide	78.0031		Aluminum hydroxide	Al(OH) ₃	78.00	Al(OH) ₃			
Aluminum Chloride	133.444		Aluminum chloride	AlCl ₃	133.44	AlCl ₃			
Aluminum Sulfate	342.151		Aluminum sulfate	Al ₂ (SO ₄) ₃	342.15	Al ₂ (SO ₄) ₃			
Aluminum Nitrate	212.096		Aluminum nitrate	Al(NO ₃) ₃	212.09	Al(NO ₃) ₃			

Figure 5.32: Search Criteria Form.

After the selection on clicking Enter all the chemicals with molecular weight greater than 100 and their corresponding properties are displayed. This can be seen from the form below Figure 5.33

Searching with molecular weight

What are the compounds whose molecular weights are

☒ Greater than
☐ Lesser than

100

Chemical Name	MW (g/mol)	Index	Classification	Chemical Formula	Molecular Weight	Molecular Formula	Index Name	Index Point Range	Index Point
Aluminum	26.981538		Aluminum metal	Al	26.98	Al			
Carbon	12.0107		Carbon metal	C	12.01	C			
Hydrogen	1.00794		Hydrogen gas	H ₂	2.02	H ₂			
Oxygen	15.9994		Oxygen gas	O ₂	32.00	O ₂			
Aluminum Oxide	78.0031		Aluminum oxide	Al ₂ O ₃	78.00	Al ₂ O ₃			
Aluminum Hydroxide	78.0031		Aluminum hydroxide	Al(OH) ₃	78.00	Al(OH) ₃			
Aluminum Chloride	133.444		Aluminum chloride	AlCl ₃	133.44	AlCl ₃			
Aluminum Sulfate	342.151		Aluminum sulfate	Al ₂ (SO ₄) ₃	342.15	Al ₂ (SO ₄) ₃			
Aluminum Nitrate	212.096		Aluminum nitrate	Al(NO ₃) ₃	212.09	Al(NO ₃) ₃			
Aluminum Hydroxide	78.0031		Aluminum hydroxide	Al(OH) ₃	78.00	Al(OH) ₃			
Aluminum Chloride	133.444		Aluminum chloride	AlCl ₃	133.44	AlCl ₃			
Aluminum Sulfate	342.151		Aluminum sulfate	Al ₂ (SO ₄) ₃	342.15	Al ₂ (SO ₄) ₃			
Aluminum Nitrate	212.096		Aluminum nitrate	Al(NO ₃) ₃	212.09	Al(NO ₃) ₃			

Figure 5.33: Search Results Form

Querying with Boiling Point form looks like the Figure 5.34 shown below. This is useful when user wants chemicals and its properties with boiling point greater or less than certain value.

[illegible]

Figure 5.35: Boiling Point Criteria

The results are as shown below Figure 5.36

What are the compounds whose Boiling point is

- Greater than
- Lower than

Compound Name	SMILES	Index	Chemical Name	Chemical Formula	Molecular Weight	Boiling Point (°C)	Boiling Point (°F)	Melting Point (°C)
Hexamethylenediamine	NCN		Hexamethylenediamine	C ₆ H ₁₆ N ₂	116.21	164.13	327.43	-93.3
Diethylamine	CCN(CC)		Diethylamine	C ₄ H ₁₁ N	73.14	89.3	192.7	-85.0
Dimethylamine	CN(C)		Dimethylamine	C ₂ H ₇ N	45.09	68.7	153.7	-115.3
Trimethylamine	CN(C)C		Trimethylamine	C ₃ H ₉ N	59.12	6.7	44.1	-162.3
Ammonia	N		Ammonia	NH ₃	17.03	-33.3	-28.6	-77.7

Figure 5.36: Query Results

Querying with Melting Point looks like the Figure 5.37 shown below. This is useful when user wants chemicals and their properties with melting point greater or less than certain value.

[illegible]

Figure 5.37: Melting Point Query

Let's say the user enters a value of 500 and he selects greater than, the following results are displayed as shown in Figure 5.38 below

What are the compounds whose melting point is

- Greater than 500
- lower than 500

Compound Name	Melting Point (°C)	Boiling Point (°C)	Density (g/cm³)	Refractive Index	Viscosity (cP)	Surface Tension (mN/m)	Heat of Vaporization (kJ/mol)	Heat of Fusion (kJ/mol)	Heat of Combustion (kJ/mol)
Acetone	-94.5	56.2	0.79	1.36	0.32	23.7	29.1	17.0	-1791
Aluminum	933	2542	2.70	1.35	0.012	1196	10.7	10.7	-10850
Carbon	3550	4000	2.27	1.30	0.001	3640	1.9	1.9	-39351
Chlorine	-34.6	34.6	1.56	1.44	0.009	11.7	6.4	6.4	-91.8
Chromium	1907	2671	7.19	1.56	0.025	271	20.9	20.9	-1247

Figure 5.38: Results of Query

The user has an option of finding out what all compounds belonging to a certain family by the following query Figure 5.39

[illegible]

Figure 5.39: Select Any Class Form

Figure 5.40 below shows the drop down list of various classes of chemicals present

Figure 5.40: Drop down list of various classes of compounds

Lets say the user selected “organic compound”, then the following results are displayed Figure 5.41

The screenshot shows the same software window after selecting "organic compound" from the dropdown menu. The table now displays results for organic compounds. The table has columns for chemical name, molecular weight, and other properties. The results are as follows:

Chemical Name	Molecular Weight	Other Properties
Alcohol	1279.10.2	organic compound
Alloy	1279.10.2	organic compound
Aluminum compound	1279.10.2	organic compound
Compound	1279.10.2	organic compound
Ferrous compound	1279.10.2	organic compound
Inert gas	1279.10.2	organic compound
Metal	1279.10.2	organic compound
Organic compound	1279.10.2	organic compound

Figure 5.41: Results of Query

Querying with Vapor pressure form looks like the Figure 5.42 shown below. This is useful when he wants chemicals and their properties with Vapor pressure greater or less than certain value.

[illegible]

Figure 5.42: Vapor Pressure Query

For example if 0 is entered and greater than is chosen as the option then the following results are displayed Figure 5.43

What are the compounds whose Vapor Pressure is

- Greater than
- less than

Compound Name	Chemical Formula	Boiling Point (°C)	Vapor Pressure (mmHg)	Boiling Point (°C)	Vapor Pressure (mmHg)	Boiling Point (°C)	Vapor Pressure (mmHg)
Water	H ₂ O	100.0	760.0	100.0	760.0	100.0	760.0
Ethanol	C ₂ H ₅ OH	78.3	100.0	78.3	100.0	78.3	100.0
Acetone	C ₃ H ₆ O	56.0	100.0	56.0	100.0	56.0	100.0
Diethyl Ether	C ₄ H ₁₀ O	34.6	100.0	34.6	100.0	34.6	100.0

Figure 5.43: Results of Query

When user clicks on the “help” of the main menu the following screen pops up which helps the user to understand the front end well. Helps him in accessing data using front end

This can be seen from the form below Figure 5.44

Figure 5.44: Help

CHAPTER 6: CONCLUSIONS AND FUTURE WORK

6.1 Conclusions

A Hazardous Materials Database (HMD) was developed. HMD stores physical and chemical properties of the chemicals along with their CAS numbers. It also stores data on health hazards, safety regulations and guidelines set by agencies like ACGIH, EPA, and OSHA on exposure criteria and environmental concern. Since this database has all the properties pooled at a single place, it saves look up time. The HMD is made available to a user through a front end developed in Visual Basic. The Graphical User Interface of Visual Basic is easy to use.

The HMD presently has a total of 34 hazardous chemicals with all the above listed properties. The names of the chemicals include aluminum, aluminum alloy, aluminum bromide, aluminum chloride, arsenic, asbestos, boron carbide, cadmium, chromium, copper, copper oxide, corundum, ethylene glycol, ferrosferic oxide, ferrous oxide, ferrous sulfide, freon, hematite, iron, lead, manganese alloy, oxy acetylene, plastic, platinum-niobium alloy, pyrite, rubber, silver chloride, styrofoam, titanium, titanium alloy, tri butyl tin hydride, tri butyl tin oxide, tri butyl tin, zinc chloride. The Hazardous Materials Database is presently being applied to ship dismantling. By knowing various properties of the chemical the necessary safety measures can be implemented which help in safe handling and disposal of the product, without any detrimental impact on the environment.

6.2 Future work

The database can be expanded to Non Hazardous Materials. Apart from the disposal application the HMD database can also be used for recycling of a retired object. This database could be web based so that, it will be easy to access for anyplace and anytime.

The front end of the database is designed only for physical properties. In future the front-end design can be expanded to chemical properties, health hazards, safety regulations and guidelines exposure criteria and environmental concern.

The database can be used for the entire Life Cycle Design of a Product, from the beginning stages, that is, collection of raw materials to disposal of the product, including recycling.

This is illustrated below.

Expansion of Database to be used over the Life Cycle of a Product:

Database is designed in such a way that it can be useful over the entire life cycle of a product. To demonstrate this we have added four more tables to the database as shown below, for the example of a ship scrapping.

The different tables added are as follows:

- Main Table
- Ships Table
- Dismantling sites table and
- Cutting technology table

Main Table which has the following fields

- Chemical Name
- Cutting technology
- Ship Type
- Country

Ships table has the following fields:

- Name
- Ship type
- Flag state
- Dead Weight (DWT)
- Build Date
- Retrofit
- Estimated Volume of Hazardous Materials

Dismantling sites Table has the following fields

- Country

- City
- Capacity
- Safety Record
- Hazardous Material Handling Capability
- Health Hazards
- Labor Cost

Cutting Technology Table has the following fields

- Cutting Technology
- Cutting tool
- Energy Requirement
- Energy Cost

This Database can be used to get many kinds of information regarding a ship, like its location, name of the ship, type of the ship, the different cutting technologies used etc. The whole history of the ship, how it is constructed, what are the hazardous materials that are released during disposal, safety regulations to be followed, health hazards from chemicals released and much more.

References

1. J. Grant, 1987-Logical Introduction to Databases Towson State University -Harcourt Brace Jovanovich Publishers
2. S. L. Alter, 1980-*DECISION SUPPORT SYSTEMS-Current practices and continuing Challenges*.
3. R. H. Sprague, Jr and H. J. Watson, 1986-*DECISION SUPPORT SYSTEMS-Putting theory into Practice*.
4. US Bureau of Mines - Automobile Disposal- A National Problem-Case studies of factors that influence the accumulation of Automobile Scrap.
5. <http://www2.ccc.uni-erlangen.de/services/webmol.html>- The WWW Chemical Structures Database.
6. <http://www.tus.com.au/default.htm> - The Chemical Inventory Database
7. <http://dippr.byu.edu/samplesite/chemsearch.asp> - Sample chemical Database
8. <http://math.cd-rom-di.../482.Brethericks.Reactive.Chemical.Hazards.Databas.shtm>- Bretherick's Reactive Chemical Hazards Database Version 2.0
9. <http://www.wiz.uni-kassel.de/dain/ddb/x284.html>- Hazardous Chemical Database
10. <http://www.genome.ad.jp/manuscripts/GIW95/Poster/GIW95P27.html>- LIGAND Chemical Database for Enzymatic Reactions: a link between enzyme structures and chemical reactions.
11. <http://www.unitednuclear.com/chemical.html>- United Nuclear Chemical Database
12. <http://ull.chemistry.uakron.edu/erd> - Hazardous chemical Database
13. P. Patnaik, 1999 - *A Comprehensive guide to the Hazardous Properties of Chemical substances*- second edition, John Wiley & Sons, Inc., Publication.
14. P. H. Howard, 1990 -*Handbook of Environmental Fate and Exposure Data For Organic Chemicals*- Lewis Publishers, volume II.
15. P. H. Howard and M. Neal, - *Dictionary of Chemical Names and Synonyms*
16. R. P. Pohanish and S. A. Greene, 1996- *Hazardous Materials Handbook*.
17. J. C. Prager, Volume I, 1995-*Environmental Contaminant Reference Data book*.
18. "Guide For Handling Hazardous Materials"- UPS March 1973

19. J. H. MEIDL, 1972- "*Hazardous Materials Handbook*"-Glencoe press.
20. U.S Department of Transportation, 1978- "*Emergency Action Guide for Selected Hazardous Materials*"
21. Schieler and Pauze, 1976 - "*Hazardous Materials*"- Van Nostrand Reinhold Company
22. M. Sittig, 1976 - "*Toxic Metals Pollution Control and Worker Protection*"- Noyes Data Corporation
23. P. N. Cheremisinoff, 1987, Pudvan Publishing Co - "*A Guide to Working with Hazardous Materials*"

APPENDIX 1 - ACUTE SYMPTOMS TABLE

Microsoft Access - [acute symptoms : Table]

File Edit View Insert Format Records Tools Window Help

	Chemical Name	inhalation	ingestion
+	Aluminum	yes	No
+	Aluminum alloy		
+	Aluminum Bromide		
+	Aluminum chloride	yes	yes
+	Arsenic	yes	
+	Asbestos	yes	
+	Boron Carbide		
+	Cadmium	yes	yes
+	Chromium	yes	
+	Copper	yes	
+	Copper Oxide		
+	Corundum		
+	Ethylene Glycol	no	yes
+	Ferrosoferric Oxide		
+	Ferrous Oxide		
+	Ferrous Sulfide		
+	Freon		
+	Hematite		
+	Iron	yes	
+	Lead		
+	Manganese alloy		
+	Oxy-acetylene		
+	Plastics		
+	Platinum-Niobium		
+	Pyrite		
+	Rubber		
+	Silver Chloride		
+	Styrofoam(Polystyrene)		
+	Titanium	yes	
+	Titanium alloy		
+	tributyl		
+	tributyl tin hydride		
+	tributyl tin oxide		
+	Zinc Chloride	yes	yes

Record: 1 of 34

Datasheet View

Start | Thesis.doc - Microsof... | APPENDIX.doc - Mic... | VDemo | Copy of Materialsdb ... | acute symptoms ... | 1:39 PM

APPENDIX 2 – ALLERGEN TABLE

Microsoft Access - [allergen : Table]				
File Edit View Insert Format Records Tools Window Help				
Chemical Name	skin	respiratory	other	
+ Aluminum		yes	Brain	
+ Aluminum alloy				
+ Aluminum Bromide				
+ Aluminum Chloride				
+ Arsenic	yes	yes	Liver	
+ Asbestos		yes		
+ Bron Carbide				
+ Cadmium		yes	Liver	
+ Chromium	yes	yes	Kidneys	
+ Copper	yes	yes		
+ Copper Oxide				
+ Corundum				
+ Ethylene Glycol	yes	no	Eyes	
+ Ferrosferic Oxide				
+ Ferrous Oxide, Iron Oxide				
+ Ferrous sulfide, Iron Monosulfide				
+ Freon				
+ Hematite				
+ Iron		yes		
+ Lead				
+ Manganese alloy				
+ Oxy-acetylene				
+ Plastics		yes	eyes, nose	
+ Platinum-Niobium				
+ Pyrite				
+ Rubber				
+ Silver Chloride				
+ Styrofoam(Polystyrene)				
+ Titanium		yes		
+ Titanium alloy				
+ tributyl tin				
+ tributyl tin hydride				
+ tributyl tin oxide				
+ Zinc Chloride				

Record: 1 of 34

Datasheet View

Start | Thesis.doc - Microsof... | VDemo | Copy of Materialsdb : ... | APPENDIX.doc - Mic... | allergen : Table | 1:42 PM

APPENDIX 3 – AQUATIC FATE TABLE

Microsoft Access - [Aquatic fate : Table]					
File Edit View Insert Format Records Tools Window Help					
	Chemical Name	biodegrade	adsorp to sediment	photolysis	photo-oxidation
+	Aluminum				
+	Aluminum alloy				
+	Aluminum Bromide				
+	Aluminum Chloride				
+	Arsenic				
+	Asbestos				
+	Boron Carbide				
+	Cadmium				
+	Chromium				
+	Copper				
+	Copper Oxide				
+	Corundum				
+	Ethylene Glycol	yes	No		insignificant
+	Ferrosoferic Oxide				
+	Ferrous Oxide, Iron Oxide				
+	Ferrous sulfide, Iron Monosulfide				
+	Freon				
+	Hematite				
+	Iron				
+	Lead				
+	Manganese alloy				
+	Oxy-acetylene				
+	Plastics				
+	Platinum-Niobium				
+	Pyrite				
+	Rubber				
+	Silver Chloride				
+	Styrofoam(Polystyrene)				
+	Titanium				
+	Titanium alloy				
+	tributyl tin				
+	tributyl tin hydride				
+	tributyl tin oxide				
+	Zinc Chloride				

Record: 1 of 34

Datasheet View

Start | Thesis.doc - Microsof... | VDemo | Copy of Materialsdb :... | APPENDIX.doc - Mic... | Aquatic fate : Ta... | 1:44 PM

APPENDIX 4 – ATMOSPHERIC FATE TABLE

Microsoft Access - [Atmospheric fate : Table]						
File Edit View Insert Format Records Tools Window Help						
Chemical Name	reactions	T1/2 for 24 hrs	T1/2 daytime	T1/2 nighttime	dry remov T1/2	
+ Aluminum						
+ Aluminum alloy						
+ Aluminum Bromide						
+ Aluminum Chloride						
+ Arsenic						
+ Asbestos						
+ Boron Carbide						
+ Cadmium						
+ Chromium						
+ Copper						
+ Copper Oxide						
+ Corundum						
+ Ethylene Glycol	yes	24 hrs				
+ Ferrosoferric Oxide						
+ Ferrous Oxide, Iron Oxide						
+ Ferrous sulfide, Iron Monosulfide						
+ Freon						
+ Hematite						
+ Iron						
+ Lead						
+ Manganese alloy						
+ Oxy-acetylene						
+ Plastics						
+ Platinum-Niobium						
+ Pyrite						
+ Rubber						
+ Silver Chloride						
+ Styrofoam(Polystyrene)						
+ Titanium						
+ Titanium alloy						
+ tributyl tin						
+ tributyl tin hydride						
+ tributyl tin oxide						
+ Zinc Chloride						

Record: 2 of 34

Datasheet View

Start | Copy of Materialsdb : Data... | APPENDIX.doc : Microsoft... | Atmospheric fate : Ta... | 1:53 PM

APPENDIX 5 – BOD TABLE

Microsoft Access - [BOD : Table]			
File Edit View Insert Format Records Tools Window Help			
	Chemical Name	BOD 5day mg/L-O2	BOD 1/2
+	Aluminum		
+	Aluminum alloy		
+	Aluminum Bromide		
+	Aluminum Chloride		
+	Arsenic	none	none
+	Asbestos		
+	Boron Carbide		
+	Cadmium		
+	Chromium		
+	Copper		
+	Copper Oxide		
+	Corundum		
+	Ethylene Glycol	12.5%	
+	Ferrosoferric Oxide		
+	Ferrous Oxide, Iron Oxide		
+	Ferrous sulfide, Iron Monosulfide		
+	Freon		
+	Hematite		
+	Iron		
+	Lead		
+	Manganese alloy		
+	Oxy-acetylene		
+	Plastics		
+	Platinum-Niobium		
+	Pyrite		
+	Rubber		
+	Silver Chloride		
+	Styrofoam(Polystyrene)		
+	Titanium		
+	Titanium alloy		
+	tributyl tin		
+	tributyl tin hydride		
+	tributyl tin oxide		
+	Zinc Chloride	none	none
Record: 1 of 34			
Datasheet View			

APPENDIX 6 – CANCER TABLE

Microsoft Access - [cancer : Table]							
File Edit View Insert Format Records Tools Window Help							
	Chemical Name	mutagenic	genotoxic	promoter	Lung	others	Gastrointestinal
+	Aluminum	No	No	No			
+	Aluminum alloy						
+	Aluminum Bromide						
+	Aluminum Chloride						
▶	Arsenic	yes			yes	kidneys, liver	yes
+	Asbestos						yes
+	Boron Carbide						
+	Cadmium		yes				
+	Chromium				yes		
+	Copper						
+	Copper Oxide						
+	Corundum						
+	Ethylene Glycol						
+	Ferrosoferic Oxide						
+	Ferrous Oxide, Iron Oxide						
+	Ferrous sulfide, Iron Monosulfide						
+	Freon						
+	Hematite						
+	Iron						
+	Lead						
+	Manganese alloy						
+	Oxy-acetylene						
+	Plastics						
+	Platinum-Niobium						
+	Pyrite						
+	Rubber						
+	Silver Chloride						
+	Styrofoam(Polystyrene)						
+	Titanium						
+	Titanium alloy						
+	tributyl tin						
+	tributyl tin hydride						
+	tributyl tin oxide						
+	Zinc Chloride						

Record: 5 of 34

Datasheet View

Start | Copy of Materialsdb : Data... | APPENDIX.doc - Microsoft... | cancer : Table | 1:55 PM

APPENDIX 7 – RCRA TABLE

Microsoft Access - [characteristic RCRA : Table]							
File Edit View Insert Format Records Tools Window Help							
	Chemical Name	flammability	reactivity	primary valence	lon coordina	corrosivity	toxicity
+	Aluminum	fine powder flammable	fine powder component o	3	6		
+	Aluminum alloy						
+	Aluminum Bromide						
+	Aluminum Chloride						
+	Arsenic						
+	Asbestos						
+	Boron Carbide						
+	Cadmium						
+	Chromium						
+	Copper						
+	Copper Oxide						
+	Corundum						
+	Ethylene Glycol						
+	Ferrosoferric Oxide						
+	Ferrous Oxide, Iron Oxide						
+	Ferrous sulfide,Iron Monosulfide						
+	Freon						
+	Hematite						
+	Iron						
+	Lead						
+	Manganese alloy						
+	Oxy-acetylene						
+	Plastics						
+	Platinum-Niobium						
+	Pyrite						
+	Rubber						
+	Silver Chloride						
+	Styrofoam(Polystyrene)						
+	Titanium						
+	Titanium alloy						
+	tributyl tin						
+	tributyl tin hydride						
+	tributyl tin oxide						
+	Zinc Chloride						

Record: 1 of 34

Datasheet View

Start | Copy of Materialsdb : Data... | APPENDIX.doc - Microsoft... | characteristic RCRA : ... | 1:56 PM

APPENDIX 8 – CHRONIC SYMPTOMS TABLE

Microsoft Access - [chronic symptoms : Table]			
File Edit View Insert Format Records Tools Window Help			
	Chemical Name	inhalation	ingestion
+	Aluminum	yes	No
+	Aluminum alloy		
+	Aluminum Bromide		
+	Aluminum Chloride	yes	yes
+	Arsenic	yes	
+	Asbestos	yes	
+	Boron Carbide		
+	Cadmium	yes	yes
+	Chromium	yes	
+	Copper	yes	
+	Copper Oxide		
+	Corundum		
+	Ethylene Glycol	no	yes
+	Ferrosoferric Oxide		
+	Ferrous Oxide, Iron Oxide		
+	Ferrous sulfide, Iron Monosulfide		
+	Freon		
+	Hematite		
+	Iron	yes	
+	Lead		
+	Manganese alloy		
+	Oxy-acetylene		
+	Plastics		
+	Platinum-Niobium		
+	Pyrite		
+	Rubber		
+	Silver Chloride		
+	Styrofoam(Polystyrene)		
+	Titanium	yes	
+	Titanium alloy		
+	tributyl tin		
+	tributyl tin hydride		
+	tributyl tin oxide		
+	Zinc Chloride	yes	yes
Record: 1 of 34			
Datasheet View			
Start Copy of Materialsdb : Data... APPENDIX.doc - Microsoft... chronic symptoms : T... 1:58 PM			

APPENDIX 9 – CLEAN AIR ACT TABLE

Microsoft Access - [clean air act : Table]

File Edit View Insert Format Records Tools Window Help

	Chemical Name	criteria pollutants	HAP	EHS	HRS
+	Aluminum	NA			
+	Aluminum alloy				
+	Aluminum Bromide				
+	Aluminum Chloride				
+	Arsenic				
+	Asbestos				
+	Boron Carbide				
+	Cadmium	NA			
+	Chromium				
+	Copper				
+	Copper Oxide				
+	Corundum				
+	Ethylene Glycol	NA			
+	Ferrosoferic Oxide				
+	Ferrous Oxide, Iron Oxide				
+	Ferrous sulfide, Iron Monosulfide				
+	Freon				
+	Hematite				
+	Iron	NA			
+	Lead				
+	Manganese alloy				
+	Oxy-acetylene				
+	Plastics				
+	Platinum-Niobium				
+	Pyrite				
+	Rubber				
+	Silver Chloride				
+	Styrofoam(Polystyrene)				
+	Titanium				
+	Titanium alloy				
+	tributyl tin				
+	tributyl tin hydride				
+	tributyl tin oxide				
+	Zinc Chloride				

Record: 1 of 34

Datasheet View

Start | Copy of Materialsdb : Data... | APPENDIX.doc - Microsoft... | clean air act : Table | 1:59 PM

APPENDIX 10 – CORROSIVITY TABLE

Microsoft Access - [corrosivity : Table]				
File Edit View Insert Format Records Tools Window Help				
Chemical Name	toward Steel	toward Flesh	Materials which corrode material	
Aluminum			Acids, other metals	
Aluminum alloy				
Aluminum Bromide				
Aluminum Chloride	no	no		
Arsenic				
Asbestos				
Boron Carbide				
Cadmium				
Chromium				
Copper				
Copper Oxide				
Corundum				
Ethylene Glycol				
Ferrosferic Oxide				
Ferrous Oxide, Iron Oxide				
Ferrous sulfide, Iron Monosulfide				
Freon				
Hematite				
Iron				
Lead				
Manganese alloy				
Oxy-acetylene				
Plastics				
Platinum-Niobium				
Pyrite				
Rubber				
Silver Chloride				
Styrofoam(Polystyrene)				
Titanium				
Titanium alloy				
tributyl tin				
tributyl tin hydride				
tributyl tin oxide				
Zinc Chloride				

Record: 1 of 34

Datasheet View

Copy of Materialsdb : Data... APPENDIX.doc - Microsoft... corrosivity : Table

2:01 PM

APPENDIX 11 – DOT TABLE

Microsoft Access - [DOT : Table]				
File Edit View Insert Format Records Tools Window Help				
	Chemical Name	water pollution	hazard class	registration pesticide FIFRA
+	Aluminum			
+	Aluminum alloy			
+	Aluminum Bromide			
+	Aluminum Chloride	harmful to aquatic life	8	
+	Arsenic	dangerous if it enters water	6.1	
+	Asbestos			
+	Boron Carbide			
+	Cadmium			
+	Chromium			
+	Copper			
+	Copper Oxide			
+	Corundum			
+	Ethylene Glycol	dangerous if enters water; aquatic life - 9		
+	Ferrosoferric Oxide			
+	Ferrous Oxide, Iron Oxide			
+	Ferrous sulfide, Iron Monosulfide			
+	Freon			
+	Hematite			
+	Iron			
+	Lead			
+	Manganese alloy			
+	Oxy-acetylene			
+	Plastics			
+	Platinum-Niobium			
+	Pyrite			
+	Rubber			
+	Silver Chloride			
+	Styrofoam(Polystyrene)			
+	Titanium			
+	Titanium alloy			
+	tributyl tin			
+	tributyl tin hydride			
+	tributyl tin oxide			
+	Zinc Chloride	harmful to aquatic life, dangerous when 8		
Record: 1 of 34				
Datasheet View				
Start Copy of Materialsdb : Data... APPENDIX.doc - Microsoft... DOT : Table 2:02 PM				

APPENDIX 12 – EXTINGUISHING AGENTS TABLE

Microsoft Access - [extinguishing agents : Table]		
File Edit View Insert Format Records Tools Window Help		
Chemical Name	Use	Not USE
+ Aluminum		
+ Aluminum alloy		
+ Aluminum Bromide		
+ Aluminum Chloride	dry chemical, foam, CO2	water
+ Arsenic		
+ Asbestos		
+ Boron Carbide		
+ Cadmium		
+ Chromium		
+ Copper		
+ Copper Oxide		
+ Corundum		
+ Ethylene Glycol		
+ Ferrosferic Oxide		
+ Ferrous Oxide, Iron Oxide		
+ Ferrous sulfide, Iron Monosulfide		
+ Freon		
+ Hematite		
+ Iron		
+ Lead		
+ Manganese alloy		
+ Oxy-acetylene		
+ Plastics		
+ Platinum-Niobium		
+ Pyrite		
+ Rubber		
+ Silver Chloride		
+ Styrofoam (Polystyrene)		
+ Titanium		
+ Titanium alloy		
+ tri butyl tin hydride		
+ tri butyl tin oxide		
+ tributyl tin		
+ Zinc Chloride		

Record: 1 of 34

Datasheet View

Start | Copy of Materialsdb : Data... | APPENDIX.doc - Microsoft... | extinguishing agents ... | 2:04 PM

APPENDIX 13 – FLAMMABILITY/COMBUSTIBILITY TABLE

Microsoft Access - [Flammability/combustability : Table]

File Edit View Insert Format Records Tools Window Help

Chemical Name Non Flammable Flash point Auto ignition temp LEL percent UEL percent

Aluminum		NA	NA	NA	NA
Aluminum alloy					
Aluminum Bromide					
Aluminum Chloride	not flammable	not flammable	not flammable		
Arsenic		NA	NA	NA	NA
Asbestos					
Boron Carbide					
Cadmium		NA	NA	NA	NA
Chromium					
Copper					
Copper Oxide					
Corundum					
Ethylene Glycol	flammable	116deg C	400 deg C	3.2%	15.3%
Ferrosoferric Oxide					
Ferrous Oxide, Iron Oxide					
Ferrous sulfide, Iron Monosulfide					
Freon					
Hematite					
Iron		NA	NA	NA	NA
Lead					
Manganese alloy					
Oxy-acetylene					
Plastics					
Platinum-Niobium					
Pyrite					
Rubber					
Silver Chloride					
Styrofoam(Polystyrene)					
Titanium					
Titanium alloy					
tributyl tin					
tributyl tin hydride					
tributyl tin oxide					
Zinc Chloride	not flammable	NA	NA	NA	NA

Record: 1 of 34

Datasheet View

Start Copy of Materialsdb : Data... APPENDIX.doc - Microsoft... Flammability/combust... 2:05 PM

APPENDIX 14 – IRRITANT TABLE

Microsoft Access - [Irritant : Table]				
File Edit View Insert Format Records Tools Window Help				
	Chemical Name	skin	eye	respiratory
+	Aluminium alloy			
+	Aluminum		No	yes
+	Aluminum Bromide			
+	Aluminum Chloride	yes	yes	
+	Arsenic	yes		yes
+	Asbestos			yes
+	Boron Carbide			
+	Cadmium			yes
+	Chromium	yes		yes
+	Copper	yes	yes	yes
+	Copper Oxide			
+	Corundum			
+	Ethylene Glycol	No	No	
+	Ferrosulfuric Oxide			
+	Ferrous Oxide, Iron Oxide			
+	Ferrous sulfide, Iron Monosulfide			
+	Freon			
+	Hematite			
+	Iron			yes
+	Lead			
+	Manganese alloy			
+	Oxy-acetylene			
+	Plastics	yes	yes	yes
+	Platinum-Niobium			
+	Pyrite			
+	Rubber			
+	Silver Chloride			
+	Styrofoam(Polystyrene)			
+	Titanium			yes
+	Titanium alloy			
+	tributyl tin			
+	tributyl tin hydride			
+	tributyl tin oxide			
+	Zinc Chloride	yes	yes	

Record: 1 of 34

Datasheet View

Start | Copy of Materialsdb : Data... | APPENDIX.doc - Microsoft... | irritant : Table | 2:07 PM

APPENDIX 15 – MATERIALS TABLE

Microsoft Access - [Materials : Table]																
File Edit View Insert Format Records Tools Window Help																
	Chemical_Nam	CASno	Smiles	Classification	Wis	Molecu	Molecu	Boiling	Melting_Point	Log	Densi	VP	Henry's	lea	Oral	Sources
+	Aluminum	7429-90-5		metal		27 Al		2327	660		2.698					P. H. Howard an Volat
+	Aluminum alloy	12770-50-2		alloy												P. H. Howard an Volat
+	Aluminum Brom	7727-15-3		Aluminum comp		267 AlBr3										P. H. Howard an
+	Aluminum Chlor	7446-70-0		Aluminum comp		133 AlCl3		185	194		2.44					R. P. Pohanish a Volat
+	Arsenic	7440-38-2		metal		75 As		1380	650							R. P. Pohanish a Volat
+	Asbestos	1332-21-4		compound												P. H. Howard an Volat
+	Boron Carbide	12069-32-8		compound		55 CB4										P. H. Howard an Volat
+	Cadmium	7440-43-9		metal		112 Cd		767	321					250m		P. H. Howard an Volat
+	Chromium	7440-47-3		metal		52 Cr		2642	1900		7.14					P. H. Howard an Volat
+	Copper	7440-50-8		metal		64 Cu		2595	1083		8.94					P. H. Howard an Volat
+	Copper Oxide	1317-38-0		compound		80 CuO										P. H. Howard an Volat
+	Corundum	1302-74-5		Aluminum comp		102 Al2O3										P. H. Howard an
+	Ethylene Glycol	107-21-1	OCCO	alcohol	Q2C	62 C2H6O2		198	-13	-1.36			6x10E-8	yes	5 to 1	P. H. Howard an Volat
+	Ferrosferic Ox	1317-61-9		Ferrous compou		232 Fe3O4										P. H. Howard an
+	Ferrous Oxide,	1345-25-1		Ferrous compou		72 FeO										P. H. Howard an
+	Ferrous sulfide,	1317-37-9	S=[Fe]	Ferrous compou		88 FeS										P. H. Howard an
+	Freon	75-45-6	FC(F)Cl	inert gas		86 CHClF2										P. H. Howard an Volat
+	Hematite	1317-60-8		Ferrous compou		160 Fe2O3										P. H. Howard an
+	Iron	7439-89-6		metal		56 Fe										P. H. Howard an Volat
+	Lead	7439-92-1		metal		207 Pb		1740	328		11.35					P. H. Howard an Volat
+	Manganese allo	12604-53-4		alloy												P. H. Howard an Volat
+	Oxy-acetylene	0		organic compou												P. H. Howard an Volat
+	Plastics	61788-97-4		organic compou												P. H. Howard an Volat
+	Platinum-Niobiu			alloy												P. H. Howard an Volat
+	Pyrite	1309-36-0		Ferrous compou		120 FeS2										P. H. Howard an
+	Rubber	9006-03-5		organic compou												P. H. Howard an Volat
+	Silver Chloride	7783-90-6		compound		143 AgCl										P. H. Howard an Volat
+	Styrofoam(Poly	9003-53-6		organic compou		(C8H8)x										P. H. Howard an Volat
+	Titanium	7440-32-6		metal		48 Ti		3277	1677							P. H. Howard an Volat
+	Titanium alloy	7440-32-6		alloy		48 Ti										P. H. Howard an Volat
+	tributyl tin	688-73-3		organic compou		291 C12H28										P. H. Howard an Volat
+	tributyl tin hydri	688-73-3		organic compou		291 C12H28										P. H. Howard an Volat
+	tributyl tin oxide	56-35-9		organic compou		596 C24H54		254			1.17	1		194m		P. H. Howard an Volat
+	Zinc Chloride	7646-85-7		compound		136 C12Zn		730	283		2.91	1				R. P. Pohanish a Volat

Record: 1 of 34

Datasheet View

Start | Copy of Materialsdb : Data... | APPENDIX.doc - Microsoft... | Materials : Table | 2:09 PM

APPENDIX 16 – ORAL ACUTE AQUATIC TOXICITY TABLE

Microsoft Access - [oral acute aquatic tox : Table]		
File Edit View Insert Format Records Tools Window Help		
Chemical Name	Fish LC50	Water fowl LD50
+ Aluminum		
+ Aluminum alloy		
+ Aluminum Bromide		
+ Aluminum Chloride		
+ Arsenic		
+ Asbestos		
+ Boron Carbide		
+ Cadmium		
+ Chromium		
+ Copper		
+ Copper Oxide		
+ Corundum		
+ Ethylene Glycol		
+ Ferrosoferric Oxide		
+ Ferrous Oxide, Iron Oxide		
+ Ferrous sulfide, Iron Monosulfide		
+ Freon		
+ Hematite		
+ Iron		
+ Lead		
+ Manganese alloy		
+ Oxy-acetylene		
+ Plastics		
+ Platinum-Niobium		
+ Pyrite		
+ Rubber		
+ Silver Chloride		
+ Styrofoam(Polystyrene)		
+ Titanium		
+ Titanium alloy		
+ tri butyl tin hydride		
+ tributyl tin		
+ tributyl tin oxide		
+ Zinc Chloride		

Record: 1 of 34

Datasheet View

Start | Copy of Materialsdb : Data... | APPENDIX.doc - Microsoft... | oral acute aquatic t... 2:11 PM

APPENDIX 17 – PERCENT DISSOCIATED TABLE

Microsoft Access - [Percent Dissociated : Table]						
File Edit View Insert Format Records Tools Window Help						
	Chemical Name	PH2	PH4	PH7	PH9	PH11
+	Aluminum					
+	Aluminum alloy					
+	Aluminum Bromide					
+	Aluminum Chloride					
+	Arsenic					
+	Asbestos					
+	Boron Carbide					
+	Cadmium					
+	Chromium					
+	Copper					
+	Copper Oxide					
+	Corundum					
+	Ethylene Glycol					
+	Ferrosoferric Oxide					
+	Ferrous Oxide, Iron Oxide					
+	Ferrous sulfide, Iron Monosulfide					
+	Freon					
+	Hematite					
+	Iron					
+	Lead					
+	Manganese alloy					
+	Oxy-acetylene					
+	Plastics					
+	Platinum-Niobium					
+	Pyrite					
+	Rubber					
+	Silver Chloride					
+	Styrofoam(Polystyrene)					
+	Titanium					
+	Titanium alloy					
+	tributyl tin					
+	tributyl tin hydride					
+	tributyl tin oxide					
+	Zinc Chloride					

Record: 1 of 34

Datasheet View

Start | Copy of Materialsdb : Data... | APPENDIX.doc - Microsoft... | Percent Dissociated :... | 2:14 PM

APPENDIX 18 – REACTIVITY/INSTABILITY TABLE

Microsoft Access - [Reactivity/Instability : Table]				
File Edit View Insert Format Records Tools Window Help				
Chemical Name	Oxy	Ti	Se	Other Reactions
Aluminum				
Aluminum alloy				
Aluminum Bromide				
Aluminum Chloride				Reacts with water liberating hydrogen chloride
Arsenic				
Asbestos				
Boron carbide				
Cadmium				
Chromium				
Copper				
Copper Oxide				
Corundum				
Ethylene Glycol				
Ferrosoferric Oxide				
Ferrous Oxide, Iron Oxide				
Ferrous sulfide, Iron Monosulfide				
Freon				
Hematite				
Iron				
Lead				
Manganese alloy				
Oxy-acetylene				
Plastics				
Platinum-Niobium				
Pyrite				
Rubber				
Silver Chloride				
Styrofoam(Polystyrene)				
Titanium				
Titanium alloy				
tributyl tin				
tributyl tin hydride				
tributyl tin oxide				
Zinc Chloride				reacts with water and aqueous soln is acetic.
Record: 1 of 34				
Datasheet View				

APPENDIX 19 – TARGET ORGAN APPLICABLE TABLE

Microsoft Access - [target organ applicable : Table]										
Chemical Name	Kidneys	immu	respiratory	irritant	allergen	gastrointestina	cardiovascular	fertility	developmenta	teratogen
▶ Aluminum	yes		yes	yes	yes					
Aluminum alloy										
Aluminum Brom										
Aluminum Chlor										
Arsenic	yes		yes			yes				
Asbestos			yes	yes	yes	yes	yes			
Boron Carbide										
Cadmium	yes		yes	yes	yes					
Chromium	yes		yes	yes	yes					
Copper			yes	yes	yes					
Copper Oxide										
Corundum										
Ethylene Glycol	yes			yes			yes			
Ferrosoferri Ox										
Ferrous Oxide,										
Ferrous sulfide,										
Freon										
Hematite										
Iron			yes							
Lead										
Manganese allo										
Oxy-acetylene										
Plastics			yes	yes	yes					
Platinum-Niobi										
Pyrite										
Rubber										
Silver Chloride										
Styrofoam(Poly										
Titanium			yes	yes	yes					
Titanium alloy										
tributyl tin										
tributyl tin hydri										
tributyl tin oxide										
Zinc Chloride										

Record: 1 of 34

Datasheet View

Start | Copy of Materialsdb : Data... | APPENDIX.doc - Microsoft... | target organ applicab... | 2:16 PM

APPENDIX 20 – TERRESTRIAL FATE TABLE

Microsoft Access - [Terrestrial fate : Table]				
File Edit View Insert Format Records Tools Window Help				
	Chemical Name	aerobic biodegradation	anaerobic biodegradation	soil adsorption/mobility
+	Aluminum			
+	Aluminum alloy			
+	Aluminum Bromide			
+	Aluminum Chloride			
+	Arsenic			
+	Asbestos			
+	Boron Carbide			
+	Cadmium			
▶	Chromium			
+	Copper			
+	Copper Oxide			
+	Corundum			
+	Ethylene Glycol	1-4 days		low
+	Ferrosoferric Oxide			
+	Ferrous Oxide, Iron Oxide			
+	Ferrous sulfide, Iron Monosulfide			
+	Freon			
+	Hematite			
+	Iron			
+	Lead			
+	Manganese alloy			
+	Oxy-acetylene			
+	Plastics			
+	Platinum-Niobium			
+	Pyrite			
+	Rubber			
+	Silver Chloride			
+	Styrofoam(Polystyrene)			
+	Titanium			
+	Titanium alloy			
+	tributyl tin			
+	tributyl tin hydride			
+	tributyl tin oxide			
+	Zinc Chloride			

Record: 9 of 34

Datasheet View

Start | Copy of Materialsdb : Data... | APPENDIX.doc - Microsoft... | Terrestrial fate : Table | 2:18 PM

APPENDIX 21 – WATER SOLUBILITY TABLE

Microsoft Access - [Water Solubility : Table]					
File Edit View Insert Format Records Tools Window Help					
	Chemical Name	soluble	low	medium	high
+	Aluminum	No			
+	Aluminum alloy				
+	Aluminum Bromide				
+	Aluminum Chloride				
+	Arsenic				
+	Asbestos				
+	Boron Carbide				
+	Cadmium				
+	Chromium	yes			
+	Copper				
+	Copper Oxide				
+	Corundum				
+	Ethylene Glycol	yes			
+	Ferrosoferric Oxide				
+	Ferrous Oxide, Iron Oxide				
+	Ferrous sulfide, Iron Monosulfide				
+	Freon				
+	Hematite				
+	Iron				
+	Lead				
+	Manganese alloy				
+	Oxy-Acetylene				
+	Plastics				
+	Platinum-Niobium				
+	Pyrite				
+	Rubber				
+	Silver Chloride				
+	Styrofoam(Polystyrene)				
+	Titanium				
+	Titanium alloy				
+	tributyl tin				
+	tributyl tin hydride				
+	tributyl tin oxide				
+	Zinc Chloride				

Record: 1 of 34

Datasheet View

Start | Copy of Materialsdb : Data... | APPENDIX.doc - Microsoft... | Water Solubility : Table | 2:19 PM

APPENDIX 22 – WORKER EXPOSURE CRITERIA (CHRONIC-TWA) TABLE

Microsoft Access - [Wkr expo criteria(chronic-TWA)mg/m3 : Table]					
File Edit View Insert Format Records Tools Window Help					
	Chemical Name	TLV	WEEL	PEL(respirable)	PEL(total)
+	Aluminum	10		5	15
+	Aluminum alloy				
+	Aluminum Bromide				
+	Aluminum Chloride	2mg/m3			
+	Arsenic	0.1mg/m3		0.010 mg/m3	
+	Asbestos				
+	Boron Carbide				
+	Cadmium	0.05mg/m3			
+	Chromium	0.5mg/m3			
+	Copper	1mg/m3			
+	Copper Oxide				
+	Corundum				
+	Ethylene Glycol				
+	Ferrosoferic Oxide				
+	Ferrous Oxide, Iron Oxide				
+	Ferrous sulfide, Iron Monosulfide				
+	Freon				
+	Hematite				
+	Iron				
+	Lead				
+	Manganese alloy				
+	Oxy-acetylene				
+	Plastics				
+	Platinum-Niobium				
+	Pyrite				
+	Rubber				
+	Silver Chloride				
+	Styrofoam(Polystyrene)				
+	Titanium				
+	Titanium alloy				
+	tributyl tin				
+	tributyl tin hydride	0.1ppm			
+	tributyl tin oxide				
+	Zinc Chloride	1mg/m3		1mg/m3	

Record: 1 of 34

Datasheet View

NUM

Start | Copy of Materialsdb : Data... | APPENDIX.doc - Microsoft... | Wkr expo criteria(chr... | 2:21 PM

APPENDIX 23 – WORKER EXPOSURE CRITERIA (ACUTE-CEIL) TABLE

Microsoft Access - [Wkr exposure criteria(acute-CEIL).mg/m3 : Table]				
File Edit View Insert Format Records Tools Window Help				
Chemical Name	PEL	TLV	WEEL	
Aluminum				
Aluminum alloy				
Aluminum Bromide				
Aluminum Chloride		5ppm		
Arsenic	0.002mg/m3			
Asbestos				
Boron Carbide				
Cadmium	0.3mg/m3			
Chromium				
Copper				
Copper Oxide				
Corundum				
Ethylene Glycol				
Ferrosoferric Oxide				
Ferrous Oxide, Iron Oxide				
Ferrous sulfide, Iron Monosulfide				
Freon				
Hematite				
Iron				
Lead				
Manganese alloy				
Oxy-acetylene				
Plastics				
Platinum-Niobium				
Pyrite				
Rubber				
Silver Chloride				
Styrofoam(Polystyrene)				
Titanium				
Titanium alloy				
tributyl tin				
tributyl tin hydride				
tributyl tin oxide				
Zinc Chloride				

Record: 1 of 34

Datasheet View

Start | Copy of Materialsdb : Data... | APPENDIX.doc - Microsoft... | Wkr exposure criteri... | 2:23 PM

APPENDIX 24 – WORKER EXPOSURE CRITERIA(ACUTE- STEL) TABLE

Microsoft Access - [Wkr exposure criteria(acute-STEL)mg/m3 : Table]		
File Edit View Insert Format Records Tools Window Help		
Chemical Name	TLV	WEEL
▶ + Aluminum		
+ Aluminum alloy		
+ Aluminum Bromide		
+ Aluminum Chloride		
+ Arsenic	0.01mg/m3	
+ Asbestos		
+ Boron Carbide		
+ Cadmium	0.1mg/m3	
+ Chromium		
+ Copper		
+ Copper Oxide		
+ Corundum		
+ Ethylene Glycol		
+ Ferrosoferric Oxide		
+ Ferrous Oxide, Iron Oxide		
+ Ferrous sulfide, Iron Monosulfide		
+ Freon		
+ Hematite		
+ Iron		
+ Lead		
+ Manganese alloy		
+ Oxy-acetylene		
+ Plastics		
+ Platinum-Niobium		
+ Pyrite		
+ Rubber		
+ Silver Chloride		
+ Styrofoam(Polystyrene)		
+ Titanium		
+ Titanium alloy		
+ tributyl tin		
+ tributyl tin hydride	0.2	
+ tributyl tin oxide		
+ Zinc Chloride	2mg/m3	
Record: 1 of 34		
Datasheet View		
NUM		
Start Copy of Materialsdb : Data... APPENDIX.doc - Microsoft... Wkr exposure criteri... 2:25 PM		

APPENDIX - 25

25.1 Acute Symptoms Code

```
Private Sub Form_Unload(Cancel As Integer)
    Screen.MousePointer = vbDefault
End Sub
```

```
Private Sub datPrimaryRS_Error(ByVal ErrorNumber As Long, Description As String, ByVal Scode As Long,
ByVal Source As String, ByVal HelpFile As String, ByVal HelpContext As Long, fCancelDisplay As Boolean)
    'This is where you would put error handling code
    'If you want to ignore errors, comment out the next line
    'If you want to trap them, add code here to handle them
    MsgBox "Data error event hit err:" & Description
End Sub
```

```
Private Sub datPrimaryRS_MoveComplete(ByVal adReason As ADODB.EventReasonEnum, ByVal pError As
ADODB.Error, adStatus As ADODB.EventStatusEnum, ByVal pRecordset As ADODB.Recordset)
    'This will display the current record position for this recordset
    datPrimaryRS.Caption = "Record: " & CStr(datPrimaryRS.Recordset.AbsolutePosition)
End Sub
```

```
Private Sub datPrimaryRS_WillChangeRecord(ByVal adReason As ADODB.EventReasonEnum, ByVal cRecords
As Long, adStatus As ADODB.EventStatusEnum, ByVal pRecordset As ADODB.Recordset)
    'This is where you put validation code
    'This event gets called when the following actions occur
    Dim bCancel As Boolean
```

```
    Select Case adReason
    Case adRsnAddNew
    Case adRsnClose
    Case adRsnDelete
    Case adRsnFirstChange
    Case adRsnMove
    Case adRsnRequery
    Case adRsnResynch
    Case adRsnUndoAddNew
    Case adRsnUndoDelete
    Case adRsnUndoUpdate
    Case adRsnUpdate
    End Select
```

```
    If bCancel Then adStatus = adStatusCancel
End Sub
```

```
Private Sub cmdAdd_Click()
    On Error GoTo AddErr
    datPrimaryRS.Recordset.AddNew
```

```
Exit Sub
AddErr:
    MsgBox Err.Description
End Sub
```

```

Private Sub cmdDelete_Click()
    On Error GoTo DeleteErr
    With datPrimaryRS.Recordset
        .Delete
        .MoveNext
        If .EOF Then .MoveLast
    End With
    Exit Sub
DeleteErr:
    MsgBox Err.Description
End Sub

Private Sub cmdRefresh_Click()
    'This is only needed for multi user apps
    On Error GoTo RefreshErr
    datPrimaryRS.Refresh
    Exit Sub
RefreshErr:
    MsgBox Err.Description
End Sub

Private Sub cmdUpdate_Click()
    On Error GoTo UpdateErr

    datPrimaryRS.Recordset.UpdateBatch adAffectAll
    Exit Sub
UpdateErr:
    MsgBox Err.Description
End Sub

Private Sub cmdClose_Click()
    Unload Me
End Sub

```

25.2 Allergen form Code

```

Private Sub Form_Unload(Cancel As Integer)
    Screen.MousePointer = vbDefault
End Sub

Private Sub datPrimaryRS_Error(ByVal ErrorNumber As Long, Description As String, ByVal Scode As Long,
ByVal Source As String, ByVal HelpFile As String, ByVal HelpContext As Long, fCancelDisplay As Boolean)
    'This is where you would put error handling code
    'If you want to ignore errors, comment out the next line
    'If you want to trap them, add code here to handle them
    MsgBox "Data error event hit err:" & Description
End Sub

Private Sub datPrimaryRS_MoveComplete(ByVal adReason As ADODB.EventReasonEnum, ByVal pError As
ADODB.Error, adStatus As ADODB.EventStatusEnum, ByVal pRecordset As ADODB.Recordset)
    'This will display the current record position for this recordset
    datPrimaryRS.Caption = "Record: " & CStr(datPrimaryRS.Recordset.AbsolutePosition)
End Sub

```

```
Private Sub datPrimaryRS_WillChangeRecord(ByVal adReason As ADODB.EventReasonEnum, ByVal cRecords
As Long, adStatus As ADODB.EventStatusEnum, ByVal pRecordset As ADODB.Recordset)
```

```
    'This is where you put validation code
```

```
    'This event gets called when the following actions occur
```

```
    Dim bCancel As Boolean
```

```
    Select Case adReason
```

```
    Case adRsnAddNew
```

```
    Case adRsnClose
```

```
    Case adRsnDelete
```

```
    Case adRsnFirstChange
```

```
    Case adRsnMove
```

```
    Case adRsnRequery
```

```
    Case adRsnResynch
```

```
    Case adRsnUndoAddNew
```

```
    Case adRsnUndoDelete
```

```
    Case adRsnUndoUpdate
```

```
    Case adRsnUpdate
```

```
    End Select
```

```
    If bCancel Then adStatus = adStatusCancel
```

```
End Sub
```

```
Private Sub cmdAdd_Click()
```

```
    On Error GoTo AddErr
```

```
    datPrimaryRS.Recordset.AddNew
```

```
    Exit Sub
```

```
AddErr:
```

```
    MsgBox Err.Description
```

```
End Sub
```

```
Private Sub cmdDelete_Click()
```

```
    On Error GoTo DeleteErr
```

```
    With datPrimaryRS.Recordset
```

```
        .Delete
```

```
        .MoveNext
```

```
        If .EOF Then .MoveLast
```

```
    End With
```

```
    Exit Sub
```

```
DeleteErr:
```

```
    MsgBox Err.Description
```

```
End Sub
```

```
Private Sub cmdRefresh_Click()
```

```
    'This is only needed for multi user apps
```

```
    On Error GoTo RefreshErr
```

```
    datPrimaryRS.Refresh
```

```
    Exit Sub
```

```
RefreshErr:
```

```
    MsgBox Err.Description
```

```
End Sub
```

```
Private Sub cmdUpdate_Click()
```

```
    On Error GoTo UpdateErr
```

```

    datPrimaryRS.Recordset.UpdateBatch adAffectAll
    Exit Sub
UpdateErr:
    MsgBox Err.Description
End Sub

```

```

Private Sub cmdClose_Click()
    Unload Me
End Sub

```

25.3 Aquatic Fate form Code

```

Private Sub Form_Unload(Cancel As Integer)
    Screen.MousePointer = vbDefault
End Sub

```

```

Private Sub datPrimaryRS_Error(ByVal ErrorNumber As Long, Description As String, ByVal Scode As Long,
ByVal Source As String, ByVal HelpFile As String, ByVal HelpContext As Long, fCancelDisplay As Boolean)
    'This is where you would put error handling code
    'If you want to ignore errors, comment out the next line
    'If you want to trap them, add code here to handle them
    MsgBox "Data error event hit err:" & Description
End Sub

```

```

Private Sub datPrimaryRS_MoveComplete(ByVal adReason As ADODB.EventReasonEnum, ByVal pError As
ADODB.Error, adStatus As ADODB.EventStatusEnum, ByVal pRecordset As ADODB.Recordset)
    'This will display the current record position for this recordset
    datPrimaryRS.Caption = "Record: " & CStr(datPrimaryRS.Recordset.AbsolutePosition)
End Sub

```

```

Private Sub datPrimaryRS_WillChangeRecord(ByVal adReason As ADODB.EventReasonEnum, ByVal cRecords
As Long, adStatus As ADODB.EventStatusEnum, ByVal pRecordset As ADODB.Recordset)
    'This is where you put validation code
    'This event gets called when the following actions occur
    Dim bCancel As Boolean

```

```

    Select Case adReason
    Case adRsnAddNew
    Case adRsnClose
    Case adRsnDelete
    Case adRsnFirstChange
    Case adRsnMove
    Case adRsnRequery
    Case adRsnResynch
    Case adRsnUndoAddNew
    Case adRsnUndoDelete
    Case adRsnUndoUpdate
    Case adRsnUpdate
    End Select

```

```

    If bCancel Then adStatus = adStatusCancel
End Sub

```

25.4 Atmospheric Fate form Code

```
Private Sub cmdAdd_Click()  
    On Error GoTo AddErr  
    datPrimaryRS.Recordset.AddNew
```

```
    Exit Sub  
AddErr:  
    MsgBox Err.Description  
End Sub
```

```
Private Sub cmdDelete_Click()  
    On Error GoTo DeleteErr  
    With datPrimaryRS.Recordset  
        .Delete  
        .MoveNext  
        If .EOF Then .MoveLast  
    End With  
    Exit Sub  
DeleteErr:  
    MsgBox Err.Description  
End Sub
```

```
Private Sub cmdRefresh_Click()  
    'This is only needed for multi user apps  
    On Error GoTo RefreshErr  
    datPrimaryRS.Refresh  
    Exit Sub  
RefreshErr:  
    MsgBox Err.Description  
End Sub
```

```
Private Sub cmdUpdate_Click()  
    On Error GoTo UpdateErr  
  
    datPrimaryRS.Recordset.UpdateBatch adAffectAll  
    Exit Sub  
UpdateErr:  
    MsgBox Err.Description  
End Sub
```

```
Private Sub cmdClose_Click()  
    Unload Me  
End Sub
```

```
Private Sub Form_Unload(Cancel As Integer)  
    Screen.MousePointer = vbDefault  
End Sub
```

```
Private Sub datPrimaryRS_Error(ByVal ErrorNumber As Long, Description As String, ByVal Scode As Long,  
ByVal Source As String, ByVal HelpFile As String, ByVal HelpContext As Long, fCancelDisplay As Boolean)  
    'This is where you would put error handling code  
    'If you want to ignore errors, comment out the next line
```

```

    'If you want to trap them, add code here to handle them
    MsgBox "Data error event hit err:" & Description
End Sub

```

```

Private Sub datPrimaryRS_MoveComplete(ByVal adReason As ADODB.EventReasonEnum, ByVal pError As ADODB.Error, adStatus As ADODB.EventStatusEnum, ByVal pRecordset As ADODB.Recordset)
    'This will display the current record position for this recordset
    datPrimaryRS.Caption = "Record: " & CStr(datPrimaryRS.Recordset.AbsolutePosition)
End Sub

```

```

Private Sub datPrimaryRS_WillChangeRecord(ByVal adReason As ADODB.EventReasonEnum, ByVal cRecords As Long, adStatus As ADODB.EventStatusEnum, ByVal pRecordset As ADODB.Recordset)
    'This is where you put validation code
    'This event gets called when the following actions occur
    Dim bCancel As Boolean

```

```

    Select Case adReason
    Case adRsnAddNew
    Case adRsnClose
    Case adRsnDelete
    Case adRsnFirstChange
    Case adRsnMove
    Case adRsnRequery
    Case adRsnResynch
    Case adRsnUndoAddNew
    Case adRsnUndoDelete
    Case adRsnUndoUpdate
    Case adRsnUpdate
    End Select

```

```

    If bCancel Then adStatus = adStatusCancel
End Sub

```

```

Private Sub cmdAdd_Click()
    On Error GoTo AddErr
    datPrimaryRS.Recordset.AddNew

```

```

    Exit Sub
AddErr:
    MsgBox Err.Description
End Sub

```

```

Private Sub cmdDelete_Click()
    On Error GoTo DeleteErr
    With datPrimaryRS.Recordset
        .Delete
        .MoveNext
        If .EOF Then .MoveLast
    End With
    Exit Sub
DeleteErr:
    MsgBox Err.Description
End Sub

```

```

Private Sub cmdRefresh_Click()
    'This is only needed for multi user apps

```

```

    On Error GoTo RefreshErr
    datPrimaryRS.Refresh
    Exit Sub
RefreshErr:
    MsgBox Err.Description
End Sub

Private Sub cmdUpdate_Click()
    On Error GoTo UpdateErr

    datPrimaryRS.Recordset.UpdateBatch adAffectAll
    Exit Sub
UpdateErr:
    MsgBox Err.Description
End Sub

Private Sub cmdClose_Click()
    Unload Me
End Sub

```

25.5 BOD form Code :

```

Private Sub Form_Unload(Cancel As Integer)
    Screen.MousePointer = vbDefault
End Sub

Private Sub datPrimaryRS_Error(ByVal ErrorNumber As Long, Description As String, ByVal Scode As Long,
ByVal Source As String, ByVal HelpFile As String, ByVal HelpContext As Long, fCancelDisplay As Boolean)
    'This is where you would put error handling code
    'If you want to ignore errors, comment out the next line
    'If you want to trap them, add code here to handle them
    MsgBox "Data error event hit err:" & Description
End Sub

Private Sub datPrimaryRS_MoveComplete(ByVal adReason As ADODB.EventReasonEnum, ByVal pError As
ADODB.Error, adStatus As ADODB.EventStatusEnum, ByVal pRecordset As ADODB.Recordset)
    'This will display the current record position for this recordset
    datPrimaryRS.Caption = "Record: " & CStr(datPrimaryRS.Recordset.AbsolutePosition)
End Sub

Private Sub datPrimaryRS_WillChangeRecord(ByVal adReason As ADODB.EventReasonEnum, ByVal cRecords
As Long, adStatus As ADODB.EventStatusEnum, ByVal pRecordset As ADODB.Recordset)
    'This is where you put validation code
    'This event gets called when the following actions occur
    Dim bCancel As Boolean

    Select Case adReason
    Case adRsnAddNew
    Case adRsnClose
    Case adRsnDelete
    Case adRsnFirstChange
    Case adRsnMove
    Case adRsnRequery
    Case adRsnResynch
    Case adRsnUndoAddNew

```

```

Case adRsnUndoDelete
Case adRsnUndoUpdate
Case adRsnUpdate
End Select

If bCancel Then adStatus = adStatusCancel
End Sub

Private Sub cmdAdd_Click()
On Error GoTo AddErr
datPrimaryRS.Recordset.AddNew

Exit Sub
AddErr:
MsgBox Err.Description
End Sub

Private Sub cmdDelete_Click()
On Error GoTo DeleteErr
With datPrimaryRS.Recordset
.Delete
.MoveNext
If .EOF Then .MoveLast
End With
Exit Sub
DeleteErr:
MsgBox Err.Description
End Sub

Private Sub cmdRefresh_Click()
'This is only needed for multi user apps
On Error GoTo RefreshErr
datPrimaryRS.Refresh
Exit Sub
RefreshErr:
MsgBox Err.Description
End Sub

Private Sub cmdUpdate_Click()
On Error GoTo UpdateErr

datPrimaryRS.Recordset.UpdateBatch adAffectAll
Exit Sub
UpdateErr:
MsgBox Err.Description
End Sub

Private Sub cmdClose_Click()
Unload Me
End Sub

```

25.6 Clean Air Act Code:

```

Private Sub Form_Unload(Cancel As Integer)
Screen.MousePointer = vbDefault

```


End Sub

```
Private Sub datPrimaryRS_Error(ByVal ErrorNumber As Long, Description As String, ByVal Scode As Long,
ByVal Source As String, ByVal HelpFile As String, ByVal HelpContext As Long, fCancelDisplay As Boolean)
    'This is where you would put error handling code
    'If you want to ignore errors, comment out the next line
    'If you want to trap them, add code here to handle them
    MsgBox "Data error event hit err:" & Description
End Sub
```

```
Private Sub datPrimaryRS_MoveComplete(ByVal adReason As ADODB.EventReasonEnum, ByVal pError As
ADODB.Error, adStatus As ADODB.EventStatusEnum, ByVal pRecordset As ADODB.Recordset)
    'This will display the current record position for this recordset
    datPrimaryRS.Caption = "Record: " & CStr(datPrimaryRS.Recordset.AbsolutePosition)
End Sub
```

```
Private Sub datPrimaryRS_WillChangeRecord(ByVal adReason As ADODB.EventReasonEnum, ByVal cRecords
As Long, adStatus As ADODB.EventStatusEnum, ByVal pRecordset As ADODB.Recordset)
```

```
    'This is where you put validation code
    'This event gets called when the following actions occur
    Dim bCancel As Boolean
```

```
    Select Case adReason
    Case adRsnAddNew
    Case adRsnClose
    Case adRsnDelete
    Case adRsnFirstChange
    Case adRsnMove
    Case adRsnRequery
    Case adRsnResynch
    Case adRsnUndoAddNew
    Case adRsnUndoDelete
    Case adRsnUndoUpdate
    Case adRsnUpdate
    End Select
```

```
    If bCancel Then adStatus = adStatusCancel
End Sub
```

```
Private Sub cmdAdd_Click()
    On Error GoTo AddErr
    datPrimaryRS.Recordset.AddNew
```

```
Exit Sub
AddErr:
    MsgBox Err.Description
End Sub
```

```
Private Sub cmdDelete_Click()
    On Error GoTo DeleteErr
    With datPrimaryRS.Recordset
        .Delete
        .MoveNext
        If .EOF Then .MoveLast
    End With
Exit Sub
```

```

DeleteErr:
    MsgBox Err.Description
End Sub

Private Sub cmdRefresh_Click()
    'This is only needed for multi user apps
    On Error GoTo RefreshErr
    datPrimaryRS.Refresh
    Exit Sub
RefreshErr:
    MsgBox Err.Description
End Sub

Private Sub cmdUpdate_Click()
    On Error GoTo UpdateErr

    datPrimaryRS.Recordset.UpdateBatch adAffectAll
    Exit Sub
UpdateErr:
    MsgBox Err.Description
End Sub

Private Sub cmdClose_Click()
    Unload Me
End Sub

```

25.7 Cancer form Code :

```

Private Sub Form_Unload(Cancel As Integer)
    Screen.MousePointer = vbDefault
End Sub

Private Sub datPrimaryRS_Error(ByVal ErrorNumber As Long, Description As String, ByVal Scode As Long,
ByVal Source As String, ByVal HelpFile As String, ByVal HelpContext As Long, fCancelDisplay As Boolean)
    'This is where you would put error handling code
    'If you want to ignore errors, comment out the next line
    'If you want to trap them, add code here to handle them
    MsgBox "Data error event hit err:" & Description
End Sub

Private Sub datPrimaryRS_MoveComplete(ByVal adReason As ADODB.EventReasonEnum, ByVal pError As
ADODB.Error, adStatus As ADODB.EventStatusEnum, ByVal pRecordset As ADODB.Recordset)
    'This will display the current record position for this recordset
    datPrimaryRS.Caption = "Record: " & CStr(datPrimaryRS.Recordset.AbsolutePosition)
End Sub

Private Sub datPrimaryRS_WillChangeRecord(ByVal adReason As ADODB.EventReasonEnum, ByVal cRecords
As Long, adStatus As ADODB.EventStatusEnum, ByVal pRecordset As ADODB.Recordset)
    'This is where you put validation code
    'This event gets called when the following actions occur
    Dim bCancel As Boolean

    Select Case adReason
        Case adRsnAddNew
        Case adRsnClose

```

```

Case adRsnDelete
Case adRsnFirstChange
Case adRsnMove
Case adRsnRequery
Case adRsnResynch
Case adRsnUndoAddNew
Case adRsnUndoDelete
Case adRsnUndoUpdate
Case adRsnUpdate
End Select

If bCancel Then adStatus = adStatusCancel
End Sub

Private Sub cmdAdd_Click()
    On Error GoTo AddErr
    datPrimaryRS.Recordset.AddNew

    Exit Sub
AddErr:
    MsgBox Err.Description
End Sub

Private Sub cmdDelete_Click()
    On Error GoTo DeleteErr
    With datPrimaryRS.Recordset
        .Delete
        .MoveNext
        If .EOF Then .MoveLast
    End With
    Exit Sub
DeleteErr:
    MsgBox Err.Description
End Sub

Private Sub cmdRefresh_Click()
    'This is only needed for multi user apps
    On Error GoTo RefreshErr
    datPrimaryRS.Refresh
    Exit Sub
RefreshErr:
    MsgBox Err.Description
End Sub

Private Sub cmdUpdate_Click()
    On Error GoTo UpdateErr

    datPrimaryRS.Recordset.UpdateBatch adAffectAll
    Exit Sub
UpdateErr:
    MsgBox Err.Description
End Sub

Private Sub cmdClose_Click()
    Unload Me
End Sub

```

25.8 Chronic symptoms form Code:

```
Private Sub Form_Unload(Cancel As Integer)
    Screen.MousePointer = vbDefault
End Sub
```

```
Private Sub datPrimaryRS_Error(ByVal ErrorNumber As Long, Description As String, ByVal Scode As Long,
ByVal Source As String, ByVal HelpFile As String, ByVal HelpContext As Long, fCancelDisplay As Boolean)
    'This is where you would put error handling code
    'If you want to ignore errors, comment out the next line
    'If you want to trap them, add code here to handle them
    MsgBox "Data error event hit err:" & Description
End Sub
```

```
Private Sub datPrimaryRS_MoveComplete(ByVal adReason As ADODB.EventReasonEnum, ByVal pError As
ADODB.Error, adStatus As ADODB.EventStatusEnum, ByVal pRecordset As ADODB.Recordset)
    'This will display the current record position for this recordset
    datPrimaryRS.Caption = "Record: " & CStr(datPrimaryRS.Recordset.AbsolutePosition)
End Sub
```

```
Private Sub datPrimaryRS_WillChangeRecord(ByVal adReason As ADODB.EventReasonEnum, ByVal cRecords
As Long, adStatus As ADODB.EventStatusEnum, ByVal pRecordset As ADODB.Recordset)
    'This is where you put validation code
    'This event gets called when the following actions occur
    Dim bCancel As Boolean
```

```
    Select Case adReason
    Case adRsnAddNew
    Case adRsnClose
    Case adRsnDelete
    Case adRsnFirstChange
    Case adRsnMove
    Case adRsnRequery
    Case adRsnResynch
    Case adRsnUndoAddNew
    Case adRsnUndoDelete
    Case adRsnUndoUpdate
    Case adRsnUpdate
    End Select
```

```
    If bCancel Then adStatus = adStatusCancel
End Sub
```

```
Private Sub cmdAdd_Click()
    On Error GoTo AddErr
    datPrimaryRS.Recordset.AddNew
```

```
Exit Sub
AddErr:
    MsgBox Err.Description
End Sub
```

```
Private Sub cmdDelete_Click()
    On Error GoTo DeleteErr
    With datPrimaryRS.Recordset
        .Delete
```

```

        .MoveNext
    If .EOF Then .MoveLast
End With
Exit Sub
DeleteErr:
    MsgBox Err.Description
End Sub

Private Sub cmdRefresh_Click()
    'This is only needed for multi user apps
    On Error GoTo RefreshErr
    datPrimaryRS.Refresh
    Exit Sub
RefreshErr:
    MsgBox Err.Description
End Sub

Private Sub cmdUpdate_Click()
    On Error GoTo UpdateErr

    datPrimaryRS.Recordset.UpdateBatch adAffectAll
    Exit Sub
UpdateErr:
    MsgBox Err.Description
End Sub

Private Sub cmdClose_Click()
    Unload Me
End Sub

```

25.9 Corrosivity form Code

```

Private Sub Form_Unload(Cancel As Integer)
    Screen.MousePointer = vbDefault
End Sub

Private Sub datPrimaryRS_Error(ByVal ErrorNumber As Long, Description As String, ByVal Scode As Long,
ByVal Source As String, ByVal HelpFile As String, ByVal HelpContext As Long, fCancelDisplay As Boolean)
    'This is where you would put error handling code
    'If you want to ignore errors, comment out the next line
    'If you want to trap them, add code here to handle them
    MsgBox "Data error event hit err:" & Description
End Sub

Private Sub datPrimaryRS_MoveComplete(ByVal adReason As ADODB.EventReasonEnum, ByVal pError As
ADODB.Error, adStatus As ADODB.EventStatusEnum, ByVal pRecordset As ADODB.Recordset)
    'This will display the current record position for this recordset
    datPrimaryRS.Caption = "Record: " & CStr(datPrimaryRS.Recordset.AbsolutePosition)
End Sub

Private Sub datPrimaryRS_WillChangeRecord(ByVal adReason As ADODB.EventReasonEnum, ByVal cRecords
As Long, adStatus As ADODB.EventStatusEnum, ByVal pRecordset As ADODB.Recordset)
    'This is where you put validation code
    'This event gets called when the following actions occur
    Dim bCancel As Boolean

```

```

Select Case adReason
Case adRsnAddNew
Case adRsnClose
Case adRsnDelete
Case adRsnFirstChange
Case adRsnMove
Case adRsnRequery
Case adRsnResynch
Case adRsnUndoAddNew
Case adRsnUndoDelete
Case adRsnUndoUpdate
Case adRsnUpdate
End Select

If bCancel Then adStatus = adStatusCancel
End Sub

Private Sub cmdAdd_Click()
On Error GoTo AddErr
datPrimaryRS.Recordset.AddNew

Exit Sub
AddErr:
MsgBox Err.Description
End Sub

Private Sub cmdDelete_Click()
On Error GoTo DeleteErr
With datPrimaryRS.Recordset
.Delete
.MoveNext
If .EOF Then .MoveLast
End With
Exit Sub
DeleteErr:
MsgBox Err.Description
End Sub

Private Sub cmdRefresh_Click()
'This is only needed for multi user apps
On Error GoTo RefreshErr
datPrimaryRS.Refresh
Exit Sub
RefreshErr:
MsgBox Err.Description
End Sub

Private Sub cmdUpdate_Click()
On Error GoTo UpdateErr

datPrimaryRS.Recordset.UpdateBatch adAffectAll
Exit Sub
UpdateErr:
MsgBox Err.Description
End Sub

```

```
Private Sub cmdClose_Click()
    Unload Me
End Sub
```

25.10 Characteristic RCRA form Code :

```
Private Sub Form_Unload(Cancel As Integer)
    Screen.MousePointer = vbDefault
End Sub
```

```
Private Sub datPrimaryRS_Error(ByVal ErrorNumber As Long, Description As String, ByVal Scode As Long,
ByVal Source As String, ByVal HelpFile As String, ByVal HelpContext As Long, fCancelDisplay As Boolean)
    'This is where you would put error handling code
    'If you want to ignore errors, comment out the next line
    'If you want to trap them, add code here to handle them
    MsgBox "Data error event hit err:" & Description
End Sub
```

```
Private Sub datPrimaryRS_MoveComplete(ByVal adReason As ADODB.EventReasonEnum, ByVal pError As
ADODB.Error, adStatus As ADODB.EventStatusEnum, ByVal pRecordset As ADODB.Recordset)
    'This will display the current record position for this recordset
    datPrimaryRS.Caption = "Record: " & CStr(datPrimaryRS.Recordset.AbsolutePosition)
End Sub
```

```
Private Sub datPrimaryRS_WillChangeRecord(ByVal adReason As ADODB.EventReasonEnum, ByVal cRecords
As Long, adStatus As ADODB.EventStatusEnum, ByVal pRecordset As ADODB.Recordset)
    'This is where you put validation code
    'This event gets called when the following actions occur
    Dim bCancel As Boolean
```

```
    Select Case adReason
    Case adRsnAddNew
    Case adRsnClose
    Case adRsnDelete
    Case adRsnFirstChange
    Case adRsnMove
    Case adRsnRequery
    Case adRsnResynch
    Case adRsnUndoAddNew
    Case adRsnUndoDelete
    Case adRsnUndoUpdate
    Case adRsnUpdate
    End Select
```

```
    If bCancel Then adStatus = adStatusCancel
End Sub
```

```
Private Sub cmdAdd_Click()
    On Error GoTo AddErr
    datPrimaryRS.Recordset.AddNew
```

```
    Exit Sub
AddErr:
    MsgBox Err.Description
```

```

End Sub

Private Sub cmdDelete_Click()
    On Error GoTo DeleteErr
    With datPrimaryRS.Recordset
        .Delete
        .MoveNext
        If .EOF Then .MoveLast
    End With
    Exit Sub
DeleteErr:
    MsgBox Err.Description
End Sub

Private Sub cmdRefresh_Click()
    'This is only needed for multi user apps
    On Error GoTo RefreshErr
    datPrimaryRS.Refresh
    Exit Sub
RefreshErr:
    MsgBox Err.Description
End Sub

Private Sub cmdUpdate_Click()
    On Error GoTo UpdateErr

    datPrimaryRS.Recordset.UpdateBatch adAffectAll
    Exit Sub
UpdateErr:
    MsgBox Err.Description
End Sub

Private Sub cmdClose_Click()
    Unload Me
End Sub

```

25.11 DOT Code

```

Private Sub Form_Unload(Cancel As Integer)
    Screen.MousePointer = vbDefault
End Sub

Private Sub datPrimaryRS_Error(ByVal ErrorNumber As Long, Description As String, ByVal Scode As Long,
ByVal Source As String, ByVal HelpFile As String, ByVal HelpContext As Long, fCancelDisplay As Boolean)
    'This is where you would put error handling code
    'If you want to ignore errors, comment out the next line
    'If you want to trap them, add code here to handle them
    MsgBox "Data error event hit err:" & Description
End Sub

Private Sub datPrimaryRS_MoveComplete(ByVal adReason As ADODB.EventReasonEnum, ByVal pError As
ADODB.Error, adStatus As ADODB.EventStatusEnum, ByVal pRecordset As ADODB.Recordset)
    'This will display the current record position for this recordset
    datPrimaryRS.Caption = "Record: " & CStr(datPrimaryRS.Recordset.AbsolutePosition)
End Sub

```



```
Private Sub datPrimaryRS_WillChangeRecord(ByVal adReason As ADODB.EventReasonEnum, ByVal cRecords
As Long, adStatus As ADODB.EventStatusEnum, ByVal pRecordset As ADODB.Recordset)
```

```
    'This is where you put validation code
```

```
    'This event gets called when the following actions occur
```

```
    Dim bCancel As Boolean
```

```
    Select Case adReason
```

```
    Case adRsnAddNew
```

```
    Case adRsnClose
```

```
    Case adRsnDelete
```

```
    Case adRsnFirstChange
```

```
    Case adRsnMove
```

```
    Case adRsnRequery
```

```
    Case adRsnResynch
```

```
    Case adRsnUndoAddNew
```

```
    Case adRsnUndoDelete
```

```
    Case adRsnUndoUpdate
```

```
    Case adRsnUpdate
```

```
    End Select
```

```
    If bCancel Then adStatus = adStatusCancel
```

```
End Sub
```

```
Private Sub cmdAdd_Click()
```

```
    On Error GoTo AddErr
```

```
    datPrimaryRS.Recordset.AddNew
```

```
    Exit Sub
```

```
AddErr:
```

```
    MsgBox Err.Description
```

```
End Sub
```

```
Private Sub cmdDelete_Click()
```

```
    On Error GoTo DeleteErr
```

```
    With datPrimaryRS.Recordset
```

```
        .Delete
```

```
        .MoveNext
```

```
        If .EOF Then .MoveLast
```

```
    End With
```

```
    Exit Sub
```

```
DeleteErr:
```

```
    MsgBox Err.Description
```

```
End Sub
```

```
Private Sub cmdRefresh_Click()
```

```
    'This is only needed for multi user apps
```

```
    On Error GoTo RefreshErr
```

```
    datPrimaryRS.Refresh
```

```
    Exit Sub
```

```
RefreshErr:
```

```
    MsgBox Err.Description
```

```
End Sub
```

```
Private Sub cmdUpdate_Click()
```

```
    On Error GoTo UpdateErr
```

```

    datPrimaryRS.Recordset.UpdateBatch adAffectAll
    Exit Sub
UpdateErr:
    MsgBox Err.Description
End Sub

Private Sub cmdClose_Click()
    Unload Me
End Sub

```

25.12 Extinguishing Agents form Code

```

Private Sub Form_Unload(Cancel As Integer)
    Screen.MousePointer = vbDefault
End Sub

Private Sub datPrimaryRS_Error(ByVal ErrorNumber As Long, Description As String, ByVal Scode As Long,
ByVal Source As String, ByVal HelpFile As String, ByVal HelpContext As Long, fCancelDisplay As Boolean)
    'This is where you would put error handling code
    'If you want to ignore errors, comment out the next line
    'If you want to trap them, add code here to handle them
    MsgBox "Data error event hit err:" & Description
End Sub

Private Sub datPrimaryRS_MoveComplete(ByVal adReason As ADODB.EventReasonEnum, ByVal pError As
ADODB.Error, adStatus As ADODB.EventStatusEnum, ByVal pRecordset As ADODB.Recordset)
    'This will display the current record position for this recordset
    datPrimaryRS.Caption = "Record: " & CStr(datPrimaryRS.Recordset.AbsolutePosition)
End Sub

Private Sub datPrimaryRS_WillChangeRecord(ByVal adReason As ADODB.EventReasonEnum, ByVal cRecords
As Long, adStatus As ADODB.EventStatusEnum, ByVal pRecordset As ADODB.Recordset)
    'This is where you put validation code
    'This event gets called when the following actions occur
    Dim bCancel As Boolean

    Select Case adReason
    Case adRsnAddNew
    Case adRsnClose
    Case adRsnDelete
    Case adRsnFirstChange
    Case adRsnMove
    Case adRsnRequery
    Case adRsnResynch
    Case adRsnUndoAddNew
    Case adRsnUndoDelete
    Case adRsnUndoUpdate
    Case adRsnUpdate
    End Select

    If bCancel Then adStatus = adStatusCancel
End Sub

Private Sub cmdAdd_Click()

```

```
On Error GoTo AddErr
datPrimaryRS.Recordset.AddNew
```

```
Exit Sub
AddErr:
MsgBox Err.Description
End Sub
```

```
Private Sub cmdDelete_Click()
On Error GoTo DeleteErr
With datPrimaryRS.Recordset
.Delete
.MoveNext
If .EOF Then .MoveLast
End With
Exit Sub
DeleteErr:
MsgBox Err.Description
End Sub
```

```
Private Sub cmdRefresh_Click()
'This is only needed for multi user apps
On Error GoTo RefreshErr
datPrimaryRS.Refresh
Exit Sub
RefreshErr:
MsgBox Err.Description
End Sub
```

```
Private Sub cmdUpdate_Click()
On Error GoTo UpdateErr

datPrimaryRS.Recordset.UpdateBatch adAffectAll
Exit Sub
UpdateErr:
MsgBox Err.Description
End Sub
```

```
Private Sub cmdClose_Click()
Unload Me
End Sub
```

25.13 File Maintenance form Code:

```
Private Sub Form_Unload(Cancel As Integer)
Screen.MousePointer = vbDefault
End Sub
```

```
Private Sub datPrimaryRS_Error(ByVal ErrorNumber As Long, Description As String, ByVal Scode As Long,
ByVal Source As String, ByVal HelpFile As String, ByVal HelpContext As Long, fCancelDisplay As Boolean)
'This is where you would put error handling code
'If you want to ignore errors, comment out the next line
'If you want to trap them, add code here to handle them
MsgBox "Data error event hit err:" & Description
End Sub
```

```

Private Sub datPrimaryRS_MoveComplete(ByVal adReason As ADODB.EventReasonEnum, ByVal pError As
ADODB.Error, adStatus As ADODB.EventStatusEnum, ByVal pRecordset As ADODB.Recordset)
    'This will display the current record position for this recordset
    datPrimaryRS.Caption = "Record: " & CStr(datPrimaryRS.Recordset.AbsolutePosition)
End Sub

```

```

Private Sub datPrimaryRS_WillChangeRecord(ByVal adReason As ADODB.EventReasonEnum, ByVal cRecords
As Long, adStatus As ADODB.EventStatusEnum, ByVal pRecordset As ADODB.Recordset)
    'This is where you put validation code
    'This event gets called when the following actions occur
    Dim bCancel As Boolean

```

```

    Select Case adReason
    Case adRsnAddNew
    Case adRsnClose
    Case adRsnDelete
    Case adRsnFirstChange
    Case adRsnMove
    Case adRsnRequery
    Case adRsnResynch
    Case adRsnUndoAddNew
    Case adRsnUndoDelete
    Case adRsnUndoUpdate
    Case adRsnUpdate
    End Select

```

```

    If bCancel Then adStatus = adStatusCancel
End Sub

```

```

Private Sub cmdAdd_Click()
    On Error GoTo AddErr
    datPrimaryRS.Recordset.AddNew

```

```

    Exit Sub
AddErr:
    MsgBox Err.Description
End Sub

```

```

Private Sub cmdDelete_Click()
    On Error GoTo DeleteErr
    With datPrimaryRS.Recordset
        .Delete
        .MoveNext
        If .EOF Then .MoveLast
    End With
    Exit Sub
DeleteErr:
    MsgBox Err.Description
End Sub

```

```

Private Sub cmdRefresh_Click()
    'This is only needed for multi user apps
    On Error GoTo RefreshErr
    datPrimaryRS.Refresh
    Exit Sub

```

```

RefreshErr:
    MsgBox Err.Description
End Sub

Private Sub cmdUpdate_Click()
    On Error GoTo UpdateErr

    datPrimaryRS.Recordset.UpdateBatch adAffectAll
Exit Sub
UpdateErr:
    MsgBox Err.Description
End Sub

Private Sub cmdClose_Click()
    Unload Me
End Sub

```

25.14 Flammability/Combustibility form Code

```

Private Sub Form_Unload(Cancel As Integer)
    Screen.MousePointer = vbDefault
End Sub

Private Sub datPrimaryRS_Error(ByVal ErrorNumber As Long, Description As String, ByVal Scode As Long,
ByVal Source As String, ByVal HelpFile As String, ByVal HelpContext As Long, fCancelDisplay As Boolean)
    'This is where you would put error handling code
    'If you want to ignore errors, comment out the next line
    'If you want to trap them, add code here to handle them
    MsgBox "Data error event hit err:" & Description
End Sub

Private Sub datPrimaryRS_MoveComplete(ByVal adReason As ADODB.EventReasonEnum, ByVal pError As
ADODB.Error, adStatus As ADODB.EventStatusEnum, ByVal pRecordset As ADODB.Recordset)
    'This will display the current record position for this recordset
    datPrimaryRS.Caption = "Record: " & CStr(datPrimaryRS.Recordset.AbsolutePosition)
End Sub

Private Sub datPrimaryRS_WillChangeRecord(ByVal adReason As ADODB.EventReasonEnum, ByVal cRecords
As Long, adStatus As ADODB.EventStatusEnum, ByVal pRecordset As ADODB.Recordset)
    'This is where you put validation code
    'This event gets called when the following actions occur
    Dim bCancel As Boolean

    Select Case adReason
        Case adRsnAddNew
        Case adRsnClose
        Case adRsnDelete
        Case adRsnFirstChange
        Case adRsnMove
        Case adRsnRequery
        Case adRsnResynch
        Case adRsnUndoAddNew
        Case adRsnUndoDelete
        Case adRsnUndoUpdate
        Case adRsnUpdate
    
```

```

End Select

If bCancel Then adStatus = adStatusCancel
End Sub

Private Sub cmdAdd_Click()
    On Error GoTo AddErr
    datPrimaryRS.Recordset.AddNew

Exit Sub
AddErr:
    MsgBox Err.Description
End Sub

Private Sub cmdDelete_Click()
    On Error GoTo DeleteErr
    With datPrimaryRS.Recordset
        .Delete
        .MoveNext
        If .EOF Then .MoveLast
    End With
    Exit Sub
DeleteErr:
    MsgBox Err.Description
End Sub

Private Sub cmdRefresh_Click()
    'This is only needed for multi user apps
    On Error GoTo RefreshErr
    datPrimaryRS.Refresh
    Exit Sub
RefreshErr:
    MsgBox Err.Description
End Sub

Private Sub cmdUpdate_Click()
    On Error GoTo UpdateErr

    datPrimaryRS.Recordset.UpdateBatch adAffectAll
    Exit Sub
UpdateErr:
    MsgBox Err.Description
End Sub

Private Sub cmdClose_Click()
    Unload Me
End Sub

```

25.15 Main Form Code:

```

Private Sub AC_Click()
    frmacutesymptoms.Show 1
End Sub

Private Sub AF_Click()

```

```
frmaquaticfate.Show 1  
End Sub
```

```
Private Sub allergen_Click()  
frmallergen.Show 1  
End Sub
```

```
Private Sub ATF_Click()  
frmatmfate.Show 1  
End Sub
```

```
Private Sub bod_Click()  
frmbod.Show 1  
End Sub
```

```
Private Sub Boilingpoint_Click()  
frmquerybp.Show 1  
End Sub
```

```
Private Sub CAA_Click()  
frmcaa.Show 1  
End Sub
```

```
Private Sub cancer_Click()  
frmccancer.Show 1  
End Sub
```

```
Private Sub casno_Click()  
frmsearchcsno.Show 1  
End Sub
```

```
Private Sub chemicalname_Click()  
frmsearchchname.Show 1  
End Sub
```

```
Private Sub Co_Click()  
frmcorrosivity.Show 1  
End Sub
```

```
Private Sub CRCRA_Click()  
fmrcra.Show 1  
End Sub
```

```
Private Sub CS_Click()  
frmchronicsymptoms.Show 1  
End Sub
```

```
Private Sub DOt_Click()  
frmdot.Show 1  
End Sub
```

```
Private Sub Ea_Click()  
frmextinguishingagents.Show 1  
End Sub
```

```
Private Sub exit_Click()
```

```

Unload frmmain
End Sub

Private Sub FC_Click()
frmflammabilitycombustibility.Show 1
End Sub

Private Sub materials_Click()
frmmaterial.Show 1
End Sub

Private Sub melting_Click()
frmquerymeltingpoint.Show 1
End Sub

Private Sub MF_Click()
frmsearchmolfor.Show 1
End Sub

Private Sub mnuClassify_Click()
frmqueryclass.Show 1
End Sub

Private Sub molweight_Click()
frmquerymw.Show 1
End Sub

Private Sub OAAT_Click()
frmoralacuteaquatictox.Show 1
End Sub

Private Sub PD_Click()
frmpercentdissociated.Show 1
End Sub

Private Sub records_Click()
"frmpassword1.Show 1
'Unload frmpassword1
End Sub

Private Sub RI_Click()
frmReactivityInstability.Show 1
End Sub

Private Sub TF_Click()
frmtf.Show 1
End Sub

Private Sub vp_Click()
frmqueryvp.Show 1
End Sub

Private Sub WECCEIL_Click()
frmwecceil.Show 1
End Sub

```



```
Private Sub WECSTEL_Click()
frmwecstel.Show 1
End Sub
```

```
Private Sub WECTWA_Click()
frmwectwa.Show 1
End Sub
```

```
Private Sub WL_Click()

End Sub
```

```
Private Sub WS_Click()
frmwatersolubility.Show 1
End Sub
```

25.16 Materials form Code

```
Private Sub Form_Unload(Cancel As Integer)
Screen.MousePointer = vbDefault
End Sub
```

```
Private Sub datPrimaryRS_Error(ByVal ErrorNumber As Long, Description As String, ByVal Scode As Long,
ByVal Source As String, ByVal HelpFile As String, ByVal HelpContext As Long, fCancelDisplay As Boolean)
'This is where you would put error handling code
'If you want to ignore errors, comment out the next line
'If you want to trap them, add code here to handle them
MsgBox "Data error event hit err:" & Description
End Sub
```

```
Private Sub datPrimaryRS_MoveComplete(ByVal adReason As ADODB.EventReasonEnum, ByVal pError As
ADODB.Error, adStatus As ADODB.EventStatusEnum, ByVal pRecordset As ADODB.Recordset)
'This will display the current record position for this recordset
datPrimaryRS.Caption = "Record: " & CStr(datPrimaryRS.Recordset.AbsolutePosition)
End Sub
```

```
Private Sub datPrimaryRS_WillChangeRecord(ByVal adReason As ADODB.EventReasonEnum, ByVal cRecords
As Long, adStatus As ADODB.EventStatusEnum, ByVal pRecordset As ADODB.Recordset)
'This is where you put validation code
'This event gets called when the following actions occur
Dim bCancel As Boolean
```

```
Select Case adReason
Case adRsnAddNew
Case adRsnClose
Case adRsnDelete
Case adRsnFirstChange
Case adRsnMove
Case adRsnRequery
Case adRsnResynch
Case adRsnUndoAddNew
Case adRsnUndoDelete
Case adRsnUndoUpdate
Case adRsnUpdate
End Select
```

```
    If bCancel Then adStatus = adStatusCancel
End Sub
```

```
Private Sub cmdAdd_Click()
    On Error GoTo AddErr
    datPrimaryRS.Recordset.AddNew
```

```
    Exit Sub
AddErr:
    MsgBox Err.Description
End Sub
```

```
Private Sub cmdDelete_Click()
    On Error GoTo DeleteErr
    With datPrimaryRS.Recordset
        .Delete
        .MoveNext
        If .EOF Then .MoveLast
    End With
    Exit Sub
```

```
DeleteErr:
    MsgBox Err.Description
End Sub
```

```
Private Sub cmdRefresh_Click()
    'This is only needed for multi user apps
    On Error GoTo RefreshErr
    datPrimaryRS.Refresh
    Exit Sub
RefreshErr:
    MsgBox Err.Description
End Sub
```

```
Private Sub cmdUpdate_Click()
    'On Error GoTo UpdateErr

    datPrimaryRS.Recordset.UpdateBatch adAffectAll
    ' Exit Sub
UpdateErr:
    MsgBox Err.Description
End Sub
```

```
Private Sub cmdClose_Click()
    Unload Me
End Sub
```

25.17 Oral Acute aquatic Tox Form – code

```
Private Sub Form_Unload(Cancel As Integer)
    Screen.MousePointer = vbDefault
End Sub
```

```

Private Sub datPrimaryRS_Error(ByVal ErrorNumber As Long, Description As String, ByVal Scode As Long,
ByVal Source As String, ByVal HelpFile As String, ByVal HelpContext As Long, fCancelDisplay As Boolean)
    'This is where you would put error handling code
    'If you want to ignore errors, comment out the next line
    'If you want to trap them, add code here to handle them
    MsgBox "Data error event hit err:" & Description
End Sub

```

```

Private Sub datPrimaryRS_MoveComplete(ByVal adReason As ADODB.EventReasonEnum, ByVal pError As
ADODB.Error, adStatus As ADODB.EventStatusEnum, ByVal pRecordset As ADODB.Recordset)
    'This will display the current record position for this recordset
    datPrimaryRS.Caption = "Record: " & CStr(datPrimaryRS.Recordset.AbsolutePosition)
End Sub

```

```

Private Sub datPrimaryRS_WillChangeRecord(ByVal adReason As ADODB.EventReasonEnum, ByVal cRecords
As Long, adStatus As ADODB.EventStatusEnum, ByVal pRecordset As ADODB.Recordset)
    'This is where you put validation code
    'This event gets called when the following actions occur
    Dim bCancel As Boolean

```

```

    Select Case adReason
    Case adRsnAddNew
    Case adRsnClose
    Case adRsnDelete
    Case adRsnFirstChange
    Case adRsnMove
    Case adRsnRequery
    Case adRsnResynch
    Case adRsnUndoAddNew
    Case adRsnUndoDelete
    Case adRsnUndoUpdate
    Case adRsnUpdate
    End Select

```

```

    If bCancel Then adStatus = adStatusCancel
End Sub

```

```

Private Sub cmdAdd_Click()
    On Error GoTo AddErr
    datPrimaryRS.Recordset.AddNew

```

```

    Exit Sub
AddErr:
    MsgBox Err.Description
End Sub

```

```

Private Sub cmdDelete_Click()
    On Error GoTo DeleteErr
    With datPrimaryRS.Recordset
        .Delete
        .MoveNext
        If .EOF Then .MoveLast
    End With
    Exit Sub
DeleteErr:
    MsgBox Err.Description

```

End Sub

```
Private Sub cmdRefresh_Click()  
    'This is only needed for multi user apps  
    On Error GoTo RefreshErr  
    datPrimaryRS.Refresh  
    Exit Sub  
RefreshErr:  
    MsgBox Err.Description  
End Sub
```

```
Private Sub cmdUpdate_Click()  
    On Error GoTo UpdateErr  
  
    datPrimaryRS.Recordset.UpdateBatch adAffectAll  
    Exit Sub  
UpdateErr:  
    MsgBox Err.Description  
End Sub
```

```
Private Sub cmdClose_Click()  
    Unload Me  
End Sub
```

25.18 Invalid Password Code:

```
Private Sub Command1_Click()  
    If Text1.Text = "a" Then  
        Unload frmpassword  
        frmmain.Show 1  
    Else  
        Unload frmpassword  
        MsgBox ("Invalid password")  
        frmpassword.Show 1  
        Text1.Text = ""  
    End If  
End Sub
```

25.19 Percent Dissociated Code:

```
Private Sub Form_Unload(Cancel As Integer)  
    Screen.MousePointer = vbDefault  
End Sub
```

```
Private Sub datPrimaryRS_Error(ByVal ErrorNumber As Long, Description As String, ByVal Scode As Long,  
    ByVal Source As String, ByVal HelpFile As String, ByVal HelpContext As Long, fCancelDisplay As Boolean)  
    'This is where you would put error handling code  
    'If you want to ignore errors, comment out the next line  
    'If you want to trap them, add code here to handle them  
    MsgBox "Data error event hit err:" & Description  
End Sub
```

```

Private Sub datPrimaryRS_MoveComplete(ByVal adReason As ADODB.EventReasonEnum, ByVal pError As
ADODB.Error, adStatus As ADODB.EventStatusEnum, ByVal pRecordset As ADODB.Recordset)
    'This will display the current record position for this recordset
    datPrimaryRS.Caption = "Record: " & CStr(datPrimaryRS.Recordset.AbsolutePosition)
End Sub

Private Sub datPrimaryRS_WillChangeRecord(ByVal adReason As ADODB.EventReasonEnum, ByVal cRecords
As Long, adStatus As ADODB.EventStatusEnum, ByVal pRecordset As ADODB.Recordset)
    'This is where you put validation code
    'This event gets called when the following actions occur
    Dim bCancel As Boolean

    Select Case adReason
    Case adRsnAddNew
    Case adRsnClose
    Case adRsnDelete
    Case adRsnFirstChange
    Case adRsnMove
    Case adRsnRequery
    Case adRsnResynch
    Case adRsnUndoAddNew
    Case adRsnUndoDelete
    Case adRsnUndoUpdate
    Case adRsnUpdate
    End Select

    If bCancel Then adStatus = adStatusCancel
End Sub

Private Sub cmdAdd_Click()
    On Error GoTo AddErr
    datPrimaryRS.Recordset.AddNew

    Exit Sub
AddErr:
    MsgBox Err.Description
End Sub

Private Sub cmdDelete_Click()
    On Error GoTo DeleteErr
    With datPrimaryRS.Recordset
        .Delete
        .MoveNext
        If .EOF Then .MoveLast
    End With
    Exit Sub
DeleteErr:
    MsgBox Err.Description
End Sub

Private Sub cmdRefresh_Click()
    'This is only needed for multi user apps
    On Error GoTo RefreshErr
    datPrimaryRS.Refresh
    Exit Sub
RefreshErr:

```

```

    MsgBox Err.Description
End Sub

Private Sub cmdUpdate_Click()
    On Error GoTo UpdateErr

    datPrimaryRS.Recordset.UpdateBatch adAffectAll
Exit Sub
UpdateErr:
    MsgBox Err.Description
End Sub

Private Sub cmdClose_Click()
    Unload Me
End Sub

```

25.20 Form Query on boiling point:

```

Private optCheck As Boolean

Private Sub Option1_Click()
    optCheck = True
End Sub

Private Sub Option2_Click()
    optCheck = False
End Sub

Private Sub Text1_KeyPress(KeyAscii As Integer)

If KeyAscii = 13 Then
    If Text1.Text = "" Then
        MsgBox "Please enter a value for Boiling Point"
        Exit Sub
    Else
        If optCheck Then
            adoQmw.RecordSource = "select * from materials where boiling_point is not null and boiling_point > " &
Text1.Text & " order by boiling_point"
            adoQmw.Refresh
        Else
            adoQmw.RecordSource = "select * from materials where boiling_point is not null and boiling_point < " &
Text1.Text & " order by boiling_point"
            adoQmw.Refresh
        End If
    End If
End If
End Sub

```

25.21 Query on Classification form code:

```

Private optCheck As Boolean

```

```

Private Sub Option1_Click()
optCheck = True
End Sub

Private Sub Option2_Click()
optCheck = False
End Sub

Private Sub Combo1_click()
adoQmw.RecordSource = "select * from materials where classification =" & Combo1.Text & ""
adoQmw.Refresh
End Sub

Private Sub Form_Load()
Dim dbcs As Database
Dim rscs As Recordset
Dim i
Set dbcs = DBEngine.Workspaces(0).OpenDatabase("c:\vdemo\db2.mdb")
Set rscs = dbcs.OpenRecordset("select distinct classification from materials")
Do Until rscs.EOF
    If rscs.Fields("classification") <> "" Then
        Combo1.AddItem rscs!classification
    End If
    rscs.MoveNext
Loop
rscs.Close
dbcs.Close
End Sub

```

25.22 Query on Melting point code

```

Private optCheck As Boolean

Private Sub Option1_Click()
optCheck = True
End Sub

Private Sub Option2_Click()
optCheck = False
End Sub

Private Sub Text1_KeyPress(KeyAscii As Integer)

If KeyAscii = 13 Then
    If Text1.Text = "" Then
        MsgBox "Please enter a value for Melting Point"
        Exit Sub
    Else
        If optCheck Then
            adoQmw.RecordSource = "select * from materials where melting_point is not null and melting_point > " &
Text1.Text & " order by melting_point"
            adoQmw.Refresh
        Else
            adoQmw.RecordSource = "select * from materials where melting_point is not null and melting_point< " &
Text1.Text & " order by melting_point"

```

```

        adoQmw.Refresh
    End If
End If
End If
End Sub

```

25.23 Query on Molecular Weight code:

```
Private optCheck As Boolean
```

```
Private Sub Option1_Click()
    optCheck = True
End Sub
```

```
Private Sub Option2_Click()
    optCheck = False
End Sub
```

```
Private Sub Text1_KeyPress(KeyAscii As Integer)
```

```

    If KeyAscii = 13 Then
        If Text1.Text = "" Then
            MsgBox "Please enter a value for Molecular weight"
            Exit Sub
        Else
            If optCheck Then
                adoQmw.RecordSource = "select * from materials where molecular_wt is not null and molecular_wt > " &
                Text1.Text & " order by molecular_wt"
                adoQmw.Refresh
            Else
                adoQmw.RecordSource = "select * from materials where molecular_wt is not null and molecular_wt < " &
                Text1.Text & " order by molecular_wt"
                adoQmw.Refresh
            End If
        End If
    End If
End Sub

```

25.24 Query on VP Code

```
Private optCheck As Boolean
```

```
Private Sub Option1_Click()
    optCheck = True
End Sub
```

```
Private Sub Option2_Click()
    optCheck = False
End Sub
```

```
Private Sub Text1_KeyPress(KeyAscii As Integer)
```



```

If KeyAscii = 13 Then
    If Text1.Text = "" Then
        MsgBox "Please enter a value for Vapor Pressure"
        Exit Sub
    Else
        If optCheck Then
            adoQmw.RecordSource = "select * from materials where vp is not null and vp > " & Text1.Text & " order by
vp"
            adoQmw.Refresh
        Else
            adoQmw.RecordSource = "select * from materials where vp is not null and vp < " & Text1.Text & " order by
vp"
            adoQmw.Refresh
        End If
    End If
End If
End Sub

```

25.25 Reactivity/Instability form code:

```

Private Sub Form_Unload(Cancel As Integer)
    Screen.MousePointer = vbDefault
End Sub

```

```

Private Sub datPrimaryRS_Error(ByVal ErrorNumber As Long, Description As String, ByVal Scode As Long,
ByVal Source As String, ByVal HelpFile As String, ByVal HelpContext As Long, fCancelDisplay As Boolean)
    'This is where you would put error handling code
    'If you want to ignore errors, comment out the next line
    'If you want to trap them, add code here to handle them
    MsgBox "Data error event hit err:" & Description
End Sub

```

```

Private Sub datPrimaryRS_MoveComplete(ByVal adReason As ADODB.EventReasonEnum, ByVal pError As
ADODB.Error, adStatus As ADODB.EventStatusEnum, ByVal pRecordset As ADODB.Recordset)
    'This will display the current record position for this recordset
    datPrimaryRS.Caption = "Record: " & CStr(datPrimaryRS.Recordset.AbsolutePosition)
End Sub

```

```

Private Sub datPrimaryRS_WillChangeRecord(ByVal adReason As ADODB.EventReasonEnum, ByVal cRecords
As Long, adStatus As ADODB.EventStatusEnum, ByVal pRecordset As ADODB.Recordset)
    'This is where you put validation code
    'This event gets called when the following actions occur
    Dim bCancel As Boolean

```

```

Select Case adReason
Case adRsnAddNew
Case adRsnClose
Case adRsnDelete
Case adRsnFirstChange
Case adRsnMove
Case adRsnRequery
Case adRsnResynch
Case adRsnUndoAddNew
Case adRsnUndoDelete

```

```

Case adRsnUndoUpdate
Case adRsnUpdate
End Select

If bCancel Then adStatus = adStatusCancel
End Sub

Private Sub cmdAdd_Click()
On Error GoTo AddErr
datPrimaryRS.Recordset.AddNew

Exit Sub
AddErr:
MsgBox Err.Description
End Sub

Private Sub cmdDelete_Click()
On Error GoTo DeleteErr
With datPrimaryRS.Recordset
.Delete
.MoveNext
If .EOF Then .MoveLast
End With
Exit Sub
DeleteErr:
MsgBox Err.Description
End Sub

Private Sub cmdRefresh_Click()
'This is only needed for multi user apps
On Error GoTo RefreshErr
datPrimaryRS.Refresh
Exit Sub
RefreshErr:
MsgBox Err.Description
End Sub

Private Sub cmdUpdate_Click()
On Error GoTo UpdateErr

datPrimaryRS.Recordset.UpdateBatch adAffectAll
Exit Sub
UpdateErr:
MsgBox Err.Description
End Sub

Private Sub cmdClose_Click()
Unload Me
End Sub

```

25.26 Search By chemical Name Form code:

```

Option Explicit
Private dbcs As Database
Private rscs As Recordset

```

```

Private Sub dbcmbcs_Click()
Dim strsql As String
Dim i As Field
Set rscs = dbcs.OpenRecordset("select * from materials where chemical_name = '" & dbcmbcs.Text & "'",
dbOpenSnapshot)
    txtmw.Text = IIf(IsNull(rscs!molecular_wt), "Not Available", rscs!molecular_wt)
    txtbp.Text = IIf(IsNull(rscs!boiling_point), "Not Available", rscs!boiling_point)
    txtmp.Text = IIf(IsNull(rscs!melting_point), "Not Available", rscs!melting_point)
    txtmf.Text = IIf(IsNull(rscs!molecular_formula), "Not Available", rscs!molecular_formula)
    lblcn.Caption = IIf(IsNull(rscs!casno), "Not available", rscs!casno)
End Sub
Private Sub Form_Load()
Dim i
Set dbcs = DBEngine.Workspaces(0).OpenDatabase("c:\vdemo\db2.mdb")
Set rscs = dbcs.OpenRecordset("materials")
Do Until rscs.EOF
    If rscs.Fields("casno") <> "" Then
        dbcmbcs.AddItem rscs.Fields("chemical_name").Value
    End If
    rscs.MoveNext
Loop
rscs.Close
End Sub

Private Sub Form_Unload(Cancel As Integer)
dbcs.Close
End Sub

```

25.27 Search By CAS number code:

```

Option Explicit
Private dbcs As Database
Private rscs As Recordse
Private Sub dbcmbcs_Click()
Dim strsql As String
Dim i As Field
Set rscs = dbcs.OpenRecordset("select * from materials where casno = '" & dbcmbcs.Text & "'", dbOpenSnapshot)
    txtmw.Text = IIf(IsNull(rscs!molecular_wt), "Not Available", rscs!molecular_wt)
    txtbp.Text = IIf(IsNull(rscs!boiling_point), "Not Available", rscs!boiling_point)
    txtmp.Text = IIf(IsNull(rscs!melting_point), "Not Available", rscs!melting_point)
    txtmf.Text = IIf(IsNull(rscs!molecular_formula), "Not Available", rscs!molecular_formula)
    lblcn.Caption = IIf(rscs!chemical_name = Null, "Not available", rscs!chemical_name)
End Sub
Private Sub Form_Load()
Dim i
Set dbcs = DBEngine.Workspaces(0).OpenDatabase("c:\vdemo\db2.mdb")
Set rscs = dbcs.OpenRecordset("materials")
Do Until rscs.EOF
    If rscs.Fields("casno") <> "" Then
        dbcmbcs.AddItem rscs.Fields("casno").Value
    End If
    rscs.MoveNext
Loop
rscs.Close

```

End Sub

```
Private Sub Form_Unload(Cancel As Integer)
dbcs.Close
End Sub
```

25.28 Search by Molecular Formula Code

```
Option Explicit
Private dbcs As Database
Private rscs As Recordset
Private Sub dbcmbs_Click()
Dim strsql As String
Dim i As Field
Set rscs = dbcs.OpenRecordset("select * from materials where molecular_formula = " & dbcmbs.Text & "",
dbOpenSnapshot)
    txtmw.Text = IIf(IsNull(rscs!molecular_wt), "Not Available", rscs!molecular_wt)
    txtbp.Text = IIf(IsNull(rscs!boiling_point), "Not Available", rscs!boiling_point)
    txtmp.Text = IIf(IsNull(rscs!melting_point), "Not Available", rscs!melting_point)
    lblcn.Caption = IIf(rscs!chemical_name = Null, "Not available", rscs!chemical_name)
End Sub
Private Sub Form_Load()
Dim i
Set dbcs = DBEngine.Workspaces(0).OpenDatabase("c:\vdemo\db2.mdb")
Set rscs = dbcs.OpenRecordset("materials")
Do Until rscs.EOF
    If rscs.Fields("molecular_formula") <> "" Then
        dbcmbs.AddItem rscs.Fields("molecular_formula").Value
    End If
    rscs.MoveNext
Loop
rscs.Close
End Sub

Private Sub Form_Unload(Cancel As Integer)
dbcs.Close
End Sub
```

25.29 Start up form code:

```
Private Sub Command1_Click()
    frmpassword.Show 1
End Sub

Private Sub Command2_Click()
    End
End Sub
```

25.30 Terrestrial Fate form code:

```
Private Sub Form_Unload(Cancel As Integer)
    Screen.MousePointer = vbDefault
End Sub
```

```
Private Sub datPrimaryRS_Error(ByVal ErrorNumber As Long, Description As String, ByVal Scode As Long,
ByVal Source As String, ByVal HelpFile As String, ByVal HelpContext As Long, fCancelDisplay As Boolean)
    'This is where you would put error handling code
    'If you want to ignore errors, comment out the next line
    'If you want to trap them, add code here to handle them
    MsgBox "Data error event hit err:" & Description
End Sub
```

```
Private Sub datPrimaryRS_MoveComplete(ByVal adReason As ADODB.EventReasonEnum, ByVal pError As
ADODB.Error, adStatus As ADODB.EventStatusEnum, ByVal pRecordset As ADODB.Recordset)
    'This will display the current record position for this recordset
    datPrimaryRS.Caption = "Record: " & CStr(datPrimaryRS.Recordset.AbsolutePosition)
End Sub
```

```
Private Sub datPrimaryRS_WillChangeRecord(ByVal adReason As ADODB.EventReasonEnum, ByVal cRecords
As Long, adStatus As ADODB.EventStatusEnum, ByVal pRecordset As ADODB.Recordset)
    'This is where you put validation code
    'This event gets called when the following actions occur
    Dim bCancel As Boolean
```

```
    Select Case adReason
    Case adRsnAddNew
    Case adRsnClose
    Case adRsnDelete
    Case adRsnFirstChange
    Case adRsnMove
    Case adRsnRequery
    Case adRsnResynch
    Case adRsnUndoAddNew
    Case adRsnUndoDelete
    Case adRsnUndoUpdate
    Case adRsnUpdate
    End Select
```

```
    If bCancel Then adStatus = adStatusCancel
End Sub
```

```
Private Sub cmdAdd_Click()
    On Error GoTo AddErr
    datPrimaryRS.Recordset.AddNew
```

```
    Exit Sub
AddErr:
    MsgBox Err.Description
End Sub
```

```
Private Sub cmdDelete_Click()
    On Error GoTo DeleteErr
    With datPrimaryRS.Recordset
        .Delete
```

```

        .MoveNext
    If .EOF Then .MoveLast
End With
Exit Sub
DeleteErr:
    MsgBox Err.Description
End Sub

Private Sub cmdRefresh_Click()
    'This is only needed for multi user apps
    On Error GoTo RefreshErr
    datPrimaryRS.Refresh
    Exit Sub
RefreshErr:
    MsgBox Err.Description
End Sub

Private Sub cmdUpdate_Click()
    On Error GoTo UpdateErr

    datPrimaryRS.Recordset.UpdateBatch adAffectAll
    Exit Sub
UpdateErr:
    MsgBox Err.Description
End Sub

Private Sub cmdClose_Click()
    Unload Me
End Sub

```

25.31 Water Solubility Form code:

```

Private Sub Form_Unload(Cancel As Integer)
    Screen.MousePointer = vbDefault
End Sub

Private Sub datPrimaryRS_Error(ByVal ErrorNumber As Long, Description As String, ByVal Scode As Long,
ByVal Source As String, ByVal HelpFile As String, ByVal HelpContext As Long, fCancelDisplay As Boolean)
    'This is where you would put error handling code
    'If you want to ignore errors, comment out the next line
    'If you want to trap them, add code here to handle them
    MsgBox "Data error event hit err:" & Description
End Sub

Private Sub datPrimaryRS_MoveComplete(ByVal adReason As ADODB.EventReasonEnum, ByVal pError As
ADODB.Error, adStatus As ADODB.EventStatusEnum, ByVal pRecordset As ADODB.Recordset)
    'This will display the current record position for this recordset
    datPrimaryRS.Caption = "Record: " & CStr(datPrimaryRS.Recordset.AbsolutePosition)
End Sub

Private Sub datPrimaryRS_WillChangeRecord(ByVal adReason As ADODB.EventReasonEnum, ByVal cRecords
As Long, adStatus As ADODB.EventStatusEnum, ByVal pRecordset As ADODB.Recordset)
    'This is where you put validation code
    'This event gets called when the following actions occur
    Dim bCancel As Boolean

```

```

Select Case adReason
Case adRsnAddNew
Case adRsnClose
Case adRsnDelete
Case adRsnFirstChange
Case adRsnMove
Case adRsnRequery
Case adRsnResynch
Case adRsnUndoAddNew
Case adRsnUndoDelete
Case adRsnUndoUpdate
Case adRsnUpdate
End Select

If bCancel Then adStatus = adStatusCancel
End Sub

Private Sub cmdAdd_Click()
On Error GoTo AddErr
datPrimaryRS.Recordset.AddNew

Exit Sub
AddErr:
MsgBox Err.Description
End Sub

Private Sub cmdDelete_Click()
On Error GoTo DeleteErr
With datPrimaryRS.Recordset
.Delete
.MoveNext
If .EOF Then .MoveLast
End With
Exit Sub
DeleteErr:
MsgBox Err.Description
End Sub

Private Sub cmdRefresh_Click()
'This is only needed for multi user apps
On Error GoTo RefreshErr
datPrimaryRS.Refresh
Exit Sub
RefreshErr:
MsgBox Err.Description
End Sub

Private Sub cmdUpdate_Click()
On Error GoTo UpdateErr

datPrimaryRS.Recordset.UpdateBatch adAffectAll
Exit Sub
UpdateErr:
MsgBox Err.Description
End Sub

```

```
Private Sub cmdClose_Click()
    Unload Me
End Sub
```

25.32 Worker Exposure Criteria (acute-CEIL) CODE;

```
Private Sub Form_Unload(Cancel As Integer)
    Screen.MousePointer = vbDefault
End Sub
```

```
Private Sub datPrimaryRS_Error(ByVal ErrorNumber As Long, Description As String, ByVal Scode As Long,
ByVal Source As String, ByVal HelpFile As String, ByVal HelpContext As Long, fCancelDisplay As Boolean)
    'This is where you would put error handling code
    'If you want to ignore errors, comment out the next line
    'If you want to trap them, add code here to handle them
    MsgBox "Data error event hit err:" & Description
End Sub
```

```
Private Sub datPrimaryRS_MoveComplete(ByVal adReason As ADODB.EventReasonEnum, ByVal pError As
ADODB.Error, adStatus As ADODB.EventStatusEnum, ByVal pRecordset As ADODB.Recordset)
    'This will display the current record position for this recordset
    datPrimaryRS.Caption = "Record: " & CStr(datPrimaryRS.Recordset.AbsolutePosition)
End Sub
```

```
Private Sub datPrimaryRS_WillChangeRecord(ByVal adReason As ADODB.EventReasonEnum, ByVal cRecords
As Long, adStatus As ADODB.EventStatusEnum, ByVal pRecordset As ADODB.Recordset)
    'This is where you put validation code
    'This event gets called when the following actions occur
    Dim bCancel As Boolean
```

```
    Select Case adReason
    Case adRsnAddNew
    Case adRsnClose
    Case adRsnDelete
    Case adRsnFirstChange
    Case adRsnMove
    Case adRsnRequery
    Case adRsnResynch
    Case adRsnUndoAddNew
    Case adRsnUndoDelete
    Case adRsnUndoUpdate
    Case adRsnUpdate
    End Select
```

```
    If bCancel Then adStatus = adStatusCancel
End Sub
```

```
Private Sub cmdAdd_Click()
    On Error GoTo AddErr
    datPrimaryRS.Recordset.AddNew
```

```
Exit Sub
AddErr:
    MsgBox Err.Description
```



```

End Sub

Private Sub cmdDelete_Click()
    On Error GoTo DeleteErr
    With datPrimaryRS.Recordset
        .Delete
        .MoveNext
        If .EOF Then .MoveLast
    End With
    Exit Sub
DeleteErr:
    MsgBox Err.Description
End Sub

Private Sub cmdRefresh_Click()
    'This is only needed for multi user apps
    On Error GoTo RefreshErr
    datPrimaryRS.Refresh
    Exit Sub
RefreshErr:
    MsgBox Err.Description
End Sub

Private Sub cmdUpdate_Click()
    On Error GoTo UpdateErr

    datPrimaryRS.Recordset.UpdateBatch adAffectAll
    Exit Sub
UpdateErr:
    MsgBox Err.Description
End Sub

Private Sub cmdClose_Click()
    Unload Me
End Sub

```

25.33 Worker Exposure Criteria (acute-STEEL) code

```

Private Sub Form_Unload(Cancel As Integer)
    Screen.MousePointer = vbDefault
End Sub

Private Sub datPrimaryRS_Error(ByVal ErrorNumber As Long, Description As String, ByVal Scode As Long,
ByVal Source As String, ByVal HelpFile As String, ByVal HelpContext As Long, fCancelDisplay As Boolean)
    'This is where you would put error handling code
    'If you want to ignore errors, comment out the next line
    'If you want to trap them, add code here to handle them
    MsgBox "Data error event hit err:" & Description
End Sub

Private Sub datPrimaryRS_MoveComplete(ByVal adReason As ADODB.EventReasonEnum, ByVal pError As
ADODB.Error, adStatus As ADODB.EventStatusEnum, ByVal pRecordset As ADODB.Recordset)
    'This will display the current record position for this recordset
    datPrimaryRS.Caption = "Record: " & CStr(datPrimaryRS.Recordset.AbsolutePosition)

```

End Sub

Private Sub datPrimaryRS_WillChangeRecord(ByVal adReason As ADODB.EventReasonEnum, ByVal cRecords As Long, adStatus As ADODB.EventStatusEnum, ByVal pRecordset As ADODB.Recordset)

 'This is where you put validation code

 'This event gets called when the following actions occur

 Dim bCancel As Boolean

 Select Case adReason

 Case adRsnAddNew

 Case adRsnClose

 Case adRsnDelete

 Case adRsnFirstChange

 Case adRsnMove

 Case adRsnRequery

 Case adRsnResynch

 Case adRsnUndoAddNew

 Case adRsnUndoDelete

 Case adRsnUndoUpdate

 Case adRsnUpdate

 End Select

 If bCancel Then adStatus = adStatusCancel

End Sub

Private Sub cmdAdd_Click()

 On Error GoTo AddErr

 datPrimaryRS.Recordset.AddNew

Exit Sub

AddErr:

 MsgBox Err.Description

End Sub

Private Sub cmdDelete_Click()

 On Error GoTo DeleteErr

 With datPrimaryRS.Recordset

 .Delete

 .MoveNext

 If .EOF Then .MoveLast

End With

Exit Sub

DeleteErr:

 MsgBox Err.Description

End Sub

Private Sub cmdRefresh_Click()

 'This is only needed for multi user apps

 On Error GoTo RefreshErr

 datPrimaryRS.Refresh

Exit Sub

RefreshErr:

 MsgBox Err.Description

End Sub

Private Sub cmdUpdate_Click()

```

On Error GoTo UpdateErr

datPrimaryRS.Recordset.UpdateBatch adAffectAll
Exit Sub
UpdateErr:
MsgBox Err.Description
End Sub

Private Sub cmdClose_Click()
Unload Me
End Sub

```

25.34 Worker Exposure Criteria (chronicTWA) code:

```

Private Sub Form_Unload(Cancel As Integer)
Screen.MousePointer = vbDefault
End Sub

Private Sub datPrimaryRS_Error(ByVal ErrorNumber As Long, Description As String, ByVal Scode As Long,
ByVal Source As String, ByVal HelpFile As String, ByVal HelpContext As Long, fCancelDisplay As Boolean)
'This is where you would put error handling code
'If you want to ignore errors, comment out the next line
'If you want to trap them, add code here to handle them
MsgBox "Data error event hit err:" & Description
End Sub

Private Sub datPrimaryRS_MoveComplete(ByVal adReason As ADODB.EventReasonEnum, ByVal pError As
ADODB.Error, adStatus As ADODB.EventStatusEnum, ByVal pRecordset As ADODB.Recordset)
'This will display the current record position for this recordset
datPrimaryRS.Caption = "Record: " & CStr(datPrimaryRS.Recordset.AbsolutePosition)
End Sub

Private Sub datPrimaryRS_WillChangeRecord(ByVal adReason As ADODB.EventReasonEnum, ByVal cRecords
As Long, adStatus As ADODB.EventStatusEnum, ByVal pRecordset As ADODB.Recordset)
'This is where you put validation code
'This event gets called when the following actions occur
Dim bCancel As Boolean

Select Case adReason
Case adRsnAddNew
Case adRsnClose
Case adRsnDelete
Case adRsnFirstChange
Case adRsnMove
Case adRsnRequery
Case adRsnResynch
Case adRsnUndoAddNew
Case adRsnUndoDelete
Case adRsnUndoUpdate
Case adRsnUpdate
End Select

If bCancel Then adStatus = adStatusCancel
End Sub

```

```

Private Sub cmdAdd_Click()
    On Error GoTo AddErr
    datPrimaryRS.Recordset.AddNew

    Exit Sub
AddErr:
    MsgBox Err.Description
End Sub

Private Sub cmdDelete_Click()
    On Error GoTo DeleteErr
    With datPrimaryRS.Recordset
        .Delete
        .MoveNext
        If .EOF Then .MoveLast
    End With
    Exit Sub
DeleteErr:
    MsgBox Err.Description
End Sub

Private Sub cmdRefresh_Click()
    'This is only needed for multi user apps
    On Error GoTo RefreshErr
    datPrimaryRS.Refresh
    Exit Sub
RefreshErr:
    MsgBox Err.Description
End Sub

Private Sub cmdUpdate_Click()
    On Error GoTo UpdateErr

    datPrimaryRS.Recordset.UpdateBatch adAffectAll
    Exit Sub
UpdateErr:
    MsgBox Err.Description
End Sub

Private Sub cmdClose_Click()
    Unload Me
End Sub

```

[illegible]