

Document on

***“Compilation of MSDS for the 708+ Hazardous, Toxic
and/or Flammable Chemicals”***



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केन्द्रीय प्रदूषण नियंत्रण बोर्ड

(भारत सरकार का संगठन)

पर्यावरण एवं वन मंत्रालय

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FOREWORD

In India, it is estimated that more than 10 million chemicals are used commercially. Industrial chemicals comprise almost two third of these chemicals. These chemicals are categorized as hazardous, flammable & / or toxic based on their physico-chemical properties, toxicity and reactivity. Any mishandling of these chemicals can be harmful and even lethal, not only to those in direct contact but also to those who are in the vicinity of the work shed. Hence, handling of hazardous/toxic chemicals has emerged as one of the major concerns, considering the overall safety aspect of the chemicals. In order to handle all the chemicals safely and act in a reasonable safe manner during accident, it was considered essential to obtain comprehensive information on the hazards originating from these chemicals. Hence, the Central Board took up a project on "Compilation of MSDS for the 708* Hazardous, Toxic and/or Flammable Chemicals" with the assistance of National Chemical Laboratory (NCL), Pune.

The Manufacture, Storage and Import of Hazardous Chemicals Rules, 1989, amended in the year 2000, and Public Liability Insurance (PLI) Rules, 1991, both notified by the Ministry of Environment & Forests contain list of hazardous and toxic chemicals. These details have been compiled for a list of 735 chemicals that are common in these Rules and a Database of these chemicals has been prepared. Safety data sheets for all the chemicals have been compiled and made available in the form of a compact disk (CPCB MSDS 2007), which enables to search the safety data for any chemical, display its safety data, generate a report for display, to save in a computer and also to take printout. The information compiled is totally based on information in the public domain. The compact disc CPCB MSDS 2007, has been made available with all the State Pollution Control Boards. The present document provides overview of development of database with the example of safety data sheets for chemicals.

I am thankful to my colleagues, Shri U.N. Singh, SEE, Shri R.C.Saxena, SEE, and Ms Alka Srivastava, Jr. Scientific Assistant for providing the support and assistance for compilation of database under the guidance of Sh. J.S.Kamyotra, Member Secretary.

I hope this document will be useful for State Pollution Control Boards, the Manufactures, Dealers, Indenters, Laboratory, Universities and all the concerned dealing with the hazardous, toxic and flammable chemicals.

(J. M. Mauskar)

February 2, 2009

1.0 Objective of the project:

The objective of the project was to prepare a database and a compact disc of the Material Safety Data Sheets (MSDS) for the 708 hazardous, toxic and/or flammable chemicals (as per the list provided by CPCB) in the appropriate format.

2.0 Background

In India, it is estimated that more than 10 million chemicals are used commercially. Industrial chemicals comprise almost two thirds of these chemicals. There is a wide range of hazards posed by chemicals. These have been classified according to their physico-chemical properties, reactivity and toxicity and the type of hazards these exhibit (flammability, toxicity etc.) These have also been classified according to their use pattern or application (for example pharmaceuticals, pesticides etc.). In order to act in a reasonable safe manner and handle all the chemicals with due respect it is essential to first obtain a comprehensive information on the hazards originating from them. Although the minimum relevant information on common hazards may be available from the product catalogue and labels of the containers etc., more detailed but essential information is often found on the Material Safety Data Sheets, commonly abbreviated MSDS.

Material Safety Data Sheets come in many forms and present the information in different ways. Regardless of the format, The Occupational Safety Health Administration (OSHA) requires that all individuals using or otherwise coming into contact with chemical materials have access to the Material Safety Data Sheet (MSDS) for those materials. The MSDS provides pertinent information as to the chemical identity of the product, hazardous ingredients present, physical characteristics, fire and explosion data, reactivity data, handling recommendations and procedures, and personal protection recommendations.

The Ministry of Environment & Forests, under the Environment (Protection) Act of 1986, with an objective for proper management of Chemicals have notified Rules called the Manufacture, Storage and Import of Hazardous Chemicals Rules, 1989, amended in the year 2000, contains a list of 684 hazardous & toxic chemicals under Schedule 1 (Part II) and other lists of 30 chemicals under Schedule 2 and Schedule 3 (Part –I). The Public Liability & Insurance (PLI) Rules, 1991 has a list of 179 chemicals. The CPCB has compiled a list of 708 chemicals that are common to these schedules and rules.

Schedule 9 of the Manufacture, Storage and Import of Hazardous Chemicals Rules, 1989, amended in the year 2000, also has a specific format for providing the material safety data sheets (Annexure 2)

In order to compile a database for the listed 708 chemicals, it was first essential to conduct the survey of the literature on safety aspects of these chemicals. Accordingly, literature information on all the aspects of the chemicals was carried out with the aid of books, monographs, and online information on Internet, databases and E-books to collect the relevant information. The details are provided in the following section.

3.0 Literature review

A literature search has been carried out, to collect the information and data for various items listed in the MSDS format. The required information and data has been collected from the standard books, monographs, internet sites and other CDROM data base for sourcing material safety data sheets, information on and other data base available on the internet and other and data as required for the compilation of MSDS of the desired chemicals, listed under Schedule 1 (part ii) has been collected.

3.1 Books & Monographs:

The library at National Chemical Laboratory, Pune has a vast collection of over 250 books, dedicated to safety. Of these it also has a collection of at least 15 books and monographs, which have a compilation of safety and environmental data. IN addition, there is a database compiled by ICMA (Indian Chemical Manufacturers Association) now known as ICC (Indian Chemical Council), Material safety data sheets Phase-I, Phase-II & Phase-III. The books and monographs that have been referred to are listed in Annexure- 4.

3.2 On-line open literature & Internet:

The Internet also offers a vast open literature source for the collection of data. The data available at many of these sites is more relevant to the chemicals that are commonly used either in research or industry. There are also sources that cater to information related to safety, handling, transportation and environment.

Some of the sources of information for collecting safety information and data are as under

- 1 National Institute for Occupational Safety & Health (NIOSH) International Chemical Safety Cards. (<http://www.cdc.gov/niosh/ipcs/nicstart.html>)

- 2 TOXNET, a cluster of databases on toxicology, hazardous chemicals, environment, health and toxic releases. (<http://www.toxnet.nlm.nih.gov/>)
- 3 Agency for Toxic Substances and Disease registry (<http://www.atsdr.cdc.gov/toxfaq.html>)
- 4 Cornell Material safety Data sheets (<http://msds.pdc.cornell.edu/msdssrch.asp>)
5. US Environmental Protection Agency (Chemical Emergency Preparedness and Prevention) has listed the Chemical Profiles and First Aid treatments of 364 extremely hazardous Chemicals, and have been referred to at :

<http://yosemite.epa.gov/oswer/ceppoehs.nsf/Profiles/>

<http://yosemite.epa.gov/oswer/ceppoehs.nsf/firstaid/>
6. The International Occupational Safety and Health Information Centre (International al labor Organization) has a searchable database for more than 5000 chemicals as “Chemical safety cards” at

<http://www.ilo.org/public/english/protection/safework/cis/products/icsc/dtasht/>
7. Hazardous Substances Data Bank (HSDB®) : HSDB is a toxicology data file on the National Library of Medicine's (NLM) Toxicology Data Network (TOXNET®). It focuses on the toxicology of potentially hazardous chemicals. It is enhanced with information on human exposure, industrial hygiene, emergency handling procedures, environmental fate, regulatory requirements, and related areas. All data are referenced and derived from a core set of books, government documents, technical reports and selected primary journal literature. HSDB is peer-reviewed by the Scientific Review Panel (SRP), a committee of experts in the major subject areas within the data bank's scope. HSDB is organized into individual chemical records, and contains over 5000 such records
8. ChemIDplus (<http://sis.nlm.nih.gov/chemical.html>)
ChemIDplus is a free, web-based search system that provides access to structure and nomenclature authority files used for the identification of chemical substances cited in National Library of Medicine (NLM) databases, including the TOXNET® system. ChemIDplus also provides structure searching and direct links to many biomedical resources at NLM and on the Internet for chemicals of interest. The database contains over 380,000 chemical records, of which over 269,000 include chemical structures, and is searchable by Name, Synonym, CAS Registry Number,

Molecular Formula, Classification Code, Locator Code, Structure, and/or Biological/Chemical properties.

3.3. Electronic books: NCL also had access to Electronic versions of two books, namely

- 1 The Dictionary of Substances and Their Effects (DOSE, 2nd Electronic Edition) 2004. The Dictionary of Substances and Their Effects (DOSE, 2nd Electronic Edition) 2004 by The Royal Society of Chemistry/ Knovel Corp.
- 2 Sittig's Handbook of Toxic and Hazardous Chemicals and Carcinogens (4th Edition). Copyright[©] 2002 by Noyes Publications & William Andrew Publishing / Knovel Corp

3.4. Other database at NCL: Some of the other important sources of information have been a collection of database already available at NCL. These include:

1. The Hazardous Chemical Database (from the University of Akron and marketed by Seaman International Limited. The highlights of the database are:
 - Full data information on over 20,000 chemicals on one CD-ROM
 - Over 90 available data fields per chemical including:
 - name and synonyms
 - formula
 - chemical structure
 - 10 reference numbers (including CAS, EINECS, RTECS, TCSA, EPA, RCRA, Merck, Beilstein, UN number, DOT number)
 - description and uses
 - 18 chemical and physical properties
 - transport (IMO inc Packing Group, USCG)
 - hazards (storage, handling, protection, spill, stability, incompatibilities, decomposition, static electricity, emergency response guide ERG2000)
 - health (exposure limits, exposure effects, first aid)

An abridged version of the database is also available at
<http://ull.chemistry.uakron.edu/erd/>

2. NIOSH pocket guide to Chemical Hazards and other databases (October 2003)
3. The MERCK Chemical database (ChemDAT).(International Edn., 2002)

4.0. Development of database for MSDS

4.1 Digitization of data

It is observed that the information on various aspects of chemicals that has been collected from so many different sources is not in a uniform format. For example, the information available in the conventional form like books, monographs, texts etc is available as a hard copy. While that obtained from the Internet or other sources is in digital form (HTML, RTF, PDF, WORD etc)

Since the objective of the project is to compile the safety information for chemicals in a digital form, the first priority was to convert all the available data into digital form, Thus, all those data that were available as a hard copy and required to be input into the final version were digitized, (scanned using a HP scan jet 7400c model) and saved as a PDF file.

4.2 Organization of the database:

i. Arrangement of chemicals in the database:

The list of chemicals provided by CPCB for 708 chemicals purports to be a list that has chemicals taken from the schedule 1 part (ii), schedule 2, and PLI rules. However, it is observed that the list does not have entries at S. Nos. 210, 355, 376, 377 & 599. In addition many a chemicals that have been listed have generic names (xxx and salts, xxxx metal, oxides, carbonate, sulphides as powder; xxxx salts, esters, amides; xxxx and compounds.

It is also observed that the list of 708 chemicals is unique. It does not relate to any of the lists provided either under schedule1 (part ii) or the PLI rules.

In order to derive the maximum benefit out of the database and also and have relevance and link to the schedule lists etc, it was therefore decided that the arrangement of chemicals in the database would follow the following order:

1. Chemicals listed in Schedule 1 (part ii) of the Manufacture Storage and Import of Hazardous Chemicals Rules, 1989
2. Chemicals from the PLI rules that are not covered under the Schedule 1 (part ii)
3. Salts, oxides, carbonates, esters, amides, etc of the chemicals mentioned in the lists.

The final list of chemicals covered under the database is given in Annexure 1.

ii. Normalization of data:

It may be noted that for the purpose of uniformity and desirability, the raw data as obtained from several sources was also normalized and then fed into the current database; For example, most of the data sources describe temperature function in °F. However, for the purpose of maintaining standards, these data were changed to °C by using an online [link](http://www.unitconversion.org/index.html)
<http://www.unitconversion.org/index.html>

Similarly, the data for the classification of chemicals was converted to the CREFT system, as indicated by the Emergency Response Centre (ERC), Bhopal.

iii. Ghost Chemicals:

It was observed that a few chemicals from the schedule lists did not find mention in any of the safety database. Attempts were made to get as much information as possible from many other sources like:

OSHA, USA
EPA, USA
NIOSH, USA
Canadian Centre for Occupational Health and Safety
CHEMWATCH, (a professional and paid service in Australia)
Emergency response center, Bhopal
ICMA, Mumbai
DGFASLI (Ministry of Labour), Mumbai

It may be noted that this limitation was observed, and pointed out to CPCB during the initial period of the project. In a follow-up action, CPCB suggested some sources and also tried through its own network.. However, neither could succeed in getting the information. The chemicals are:

1. Aluminium azide
2. Cobalt nitrilmethylidyne compound
3. Dithiazanine iodide
4. Fluoro 2-hydroxy butyric acid amid salt ester
5. Fluoroacetic acid, esters
6. Fluorobutyric acid amide salt esters
7. Fluorocrotonic acid amides salts esters
8. O,O-Diethyl-S-isopropylthio methyl phosphorodithioate
9. O,O-Diethyl-S-propylthio methyl phosphorodithioate
10. OO diethyl s ethyl suph methyl phos

11. Phosphorothioic acid , methyl ester
12. Potassium nitride
13. Propen-1,-2-chloro-1,3-diol diacetate
14. Tert-Butyl peroxy carbonate
15. Tert-Butyl peroxy maleate

However, the final version of MSDS 2007 lists these chemicals such that it may be added in as and when information becomes available.

4.3 Software development

I. Software design and coding

The front-end development involves a number of features to connect to the database and also to retrieve the data in desired format and save it in a user-friendly manner. Considering the requirements of the project the program was prepared in Java platform. The features apply swings of java provided by the Java Foundation Class.

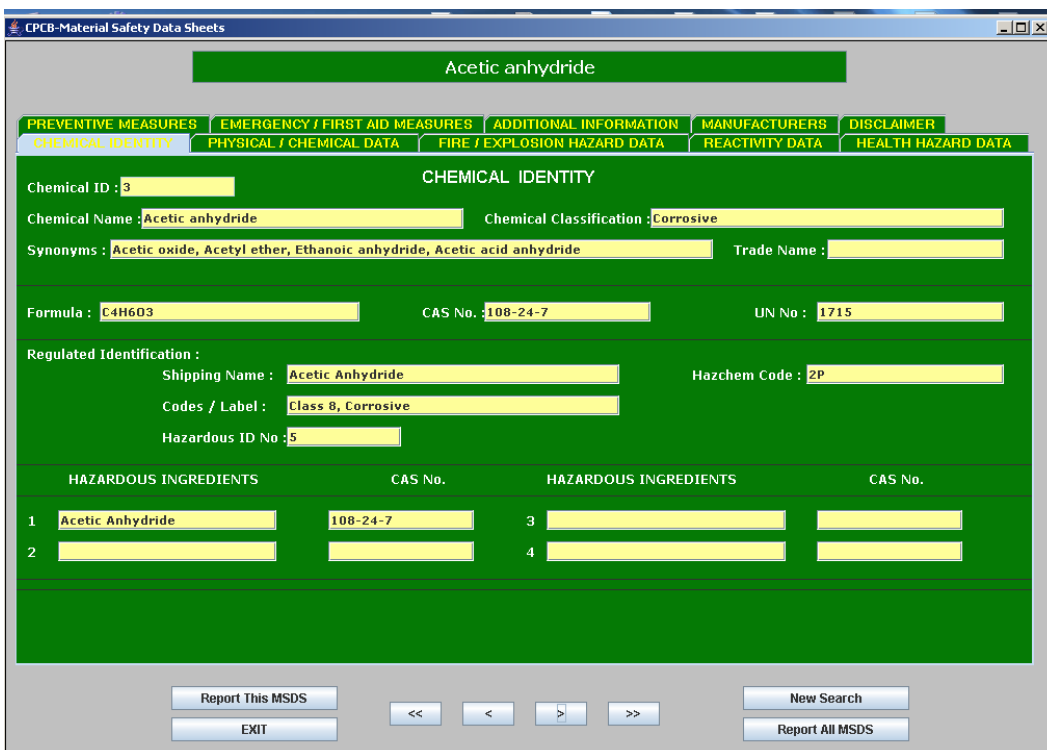
The present version of *MSDS 2007*[®] has been prepared for the Windows operating system. Java runs on all relevant operating systems, including Windows, the Mac, and Linux. Java becomes a better option because of its cross-platform support. The java program prepared can be transferred to another OS with the help of the class files. Java also gives many options to connect to many of the databases and this makes it simpler.

II. Develop front end screens for all fields (10)

Selecting the java application and then applying the MSDS format as per the ten fields given above is a tedious work. A simple user friendly application was to be developed. So the GUI (Graphic User Interface) application tools from java were used.

Java's GUI toolkit Swing was applied in the program considering its added features. Swing is a complex GUI framework. It has a complete set of GUI components ranging from buttons and text fields to tables, trees, and styled text editors. These components do not rely on the native widgets of the operating system; instead, Swing components are painted using graphic primitives such as lines, rectangles, and text. The painting is delegated to a look and feel (L&F) plug-in that can imitate the native L&F. Swing also has a platform-independent L&F called "Metal." A number of above-mentioned features helped in applying the ten point MSDS format. Many errors had to be fixed through while working with the program to make it more robust. The following snapshots give the GUI application prepared.

Msd.java is the java file, which includes all the ten screens for the program. Each desired field was prepared in the GUI and accordingly allocated required space for easy scrolling through the data.



The GUI can be browsed through by clicking on each of the ten screens giving the parameters for the relative screen. Buttons have been linked at the bottom to move to the next or previous entry in the program. Also there are links to the new search for search option. Each data filed from the database was allotted suitable space in the GUI tool developed. Proper alignment and colour selection was done for easy reading.



III. Database structure and preparation

As the application was to be prepared for a desktop application and a Windows based system presently, the database choice was MS-Access. Microsoft Access is a relational database management system from Microsoft, which combines the relational Microsoft Jet Database Engine with a graphical user interface and software development tools. Due to its easy accessibility and transfer methods MS-Access was used for the back-end.

The user should have pre-installed Microsoft Office MS-Access installed to view the database.

Creation of database in MS Access

In order to compile safety information for the desired chemicals, it was decided to use the Microsoft Office Access as the database. As per the suggested format for the MSDS, a database was created with 10 tables under different titles:

1. Chemical Identity
2. Physical & Chemical data
3. Fire & Explosion hazard data
4. Reactivity data
5. Health hazard data
6. Preventive measures
7. Emergency & First Aid measures
8. Additional Information / references
9. Manufacturers / Supplier data
10. Disclaimer

Under each title, additional fields were created as required. For example, in Table no. 1 for Chemical Identity, nine fields were created to accommodate data for:

Table no. 1 for Chemical Identity

- I. Chemical ID
- II. Chemical name
- III. Chemical classification
- IV. Synonyms
- V. Trade name
- VI. Formula
- VII. C.A.S.No.
- VIII.U.N.No.
- IX. Shipping name
- X. Codes / Labels
- XI. Hazardous Waste ID No.
- XII.Hazchem Code
- XIII.Hazardous ingredients

Similarly, additional fields were created for each Table as per the desired format. The tables were filled in with the information obtained from the literature sources for each of the chemicals listed in the hazardous chemicals database. The information that was available in the HTM or TXT format was directly filled in. However, the information that was available in the hard copy

was first digitized using a scanner and then converted to the text mode and used.

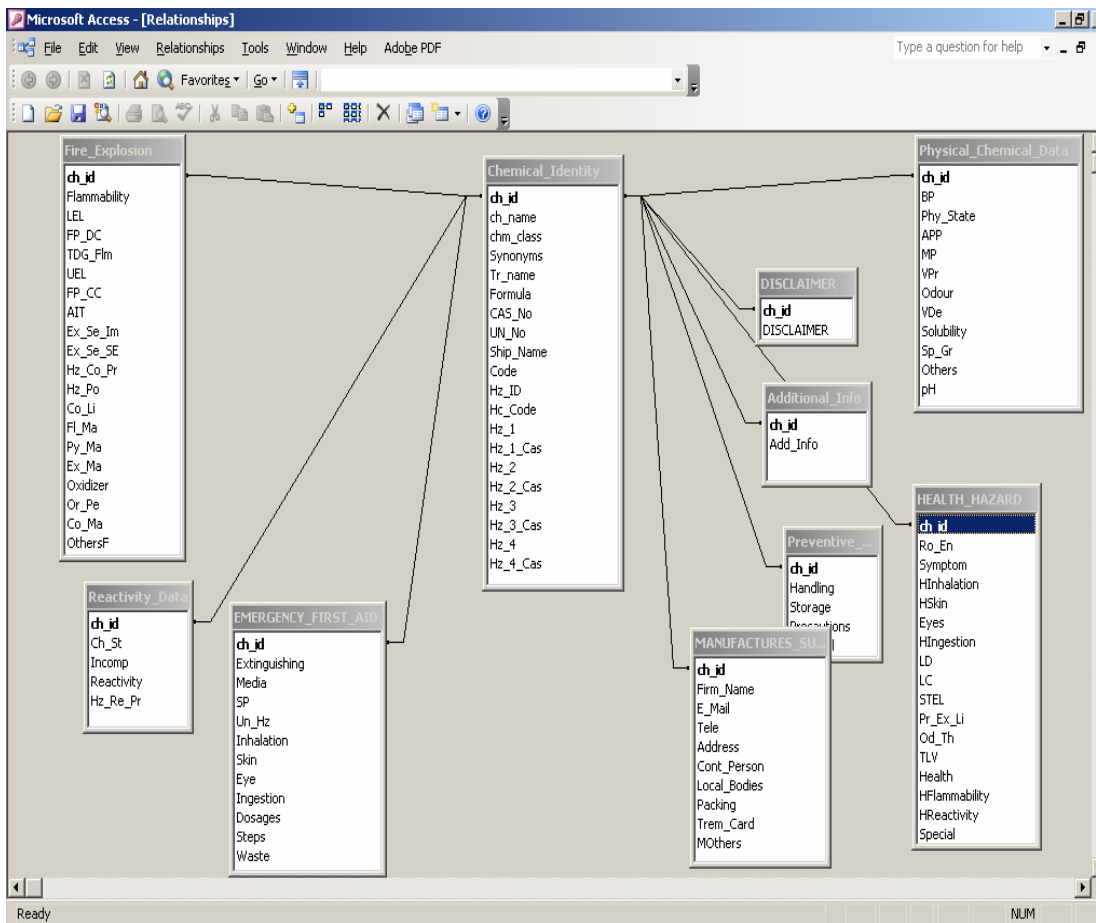
The Chemical ID no. is the primary key for the database in each table. Each table has the chemical id number, so they can be linked through the primary key.

IV. Database connectivity

The database and the java program need to be connected in order to view the data. The JDBC-ODBC bridge was used which is a standard part of JDK and links Java programs to Microsoft Access databases.

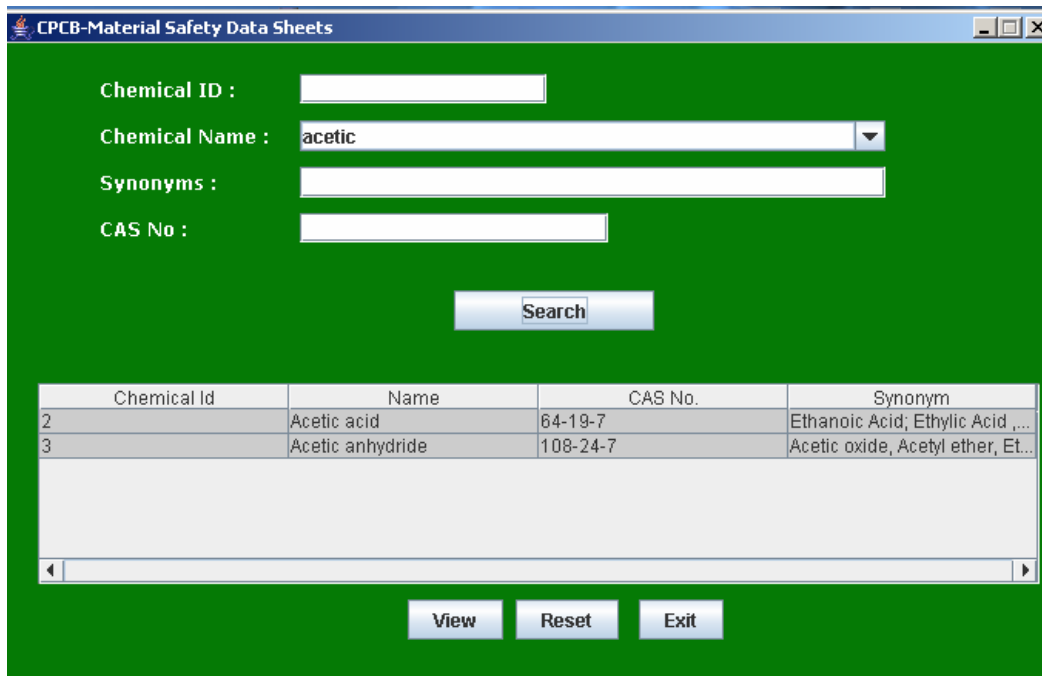
The proper queries were fired to link the database and there respective fields so that the data from the database was retrieved properly. The data type for each field was defined appropriately considering the type of data to be stored for each filed. The search query looks for the search field as per the search query entered and links the corresponding chemical id no. and this helps in linking the rest of the tables. Then the relative data for each parameter is selected with the queries to retrieve data for each filed with respective chemical id.

A view of the database tables and how they can be related is as follows;



V. Develop screens for keyword search options

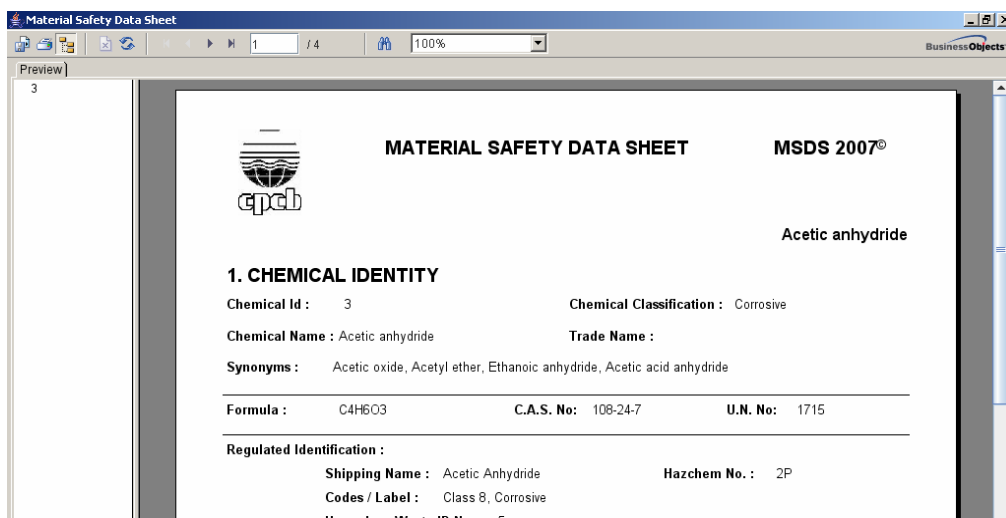
The database was connected as mentioned above but to browse through the database we need a proper search option to implement. A Java GUI was prepared for the search tool. Four search options were prepared. So search can be done with either Chemical Id. Number or Chemical name or Synonyms or CAS number. The search query would fire when a search option is entered and it searches the database linking to the chemical id number and then displays the results in a tabular format.



The search query searches the database and selects the correct chemical id with the respective data.

VI. Report generation through Java interface

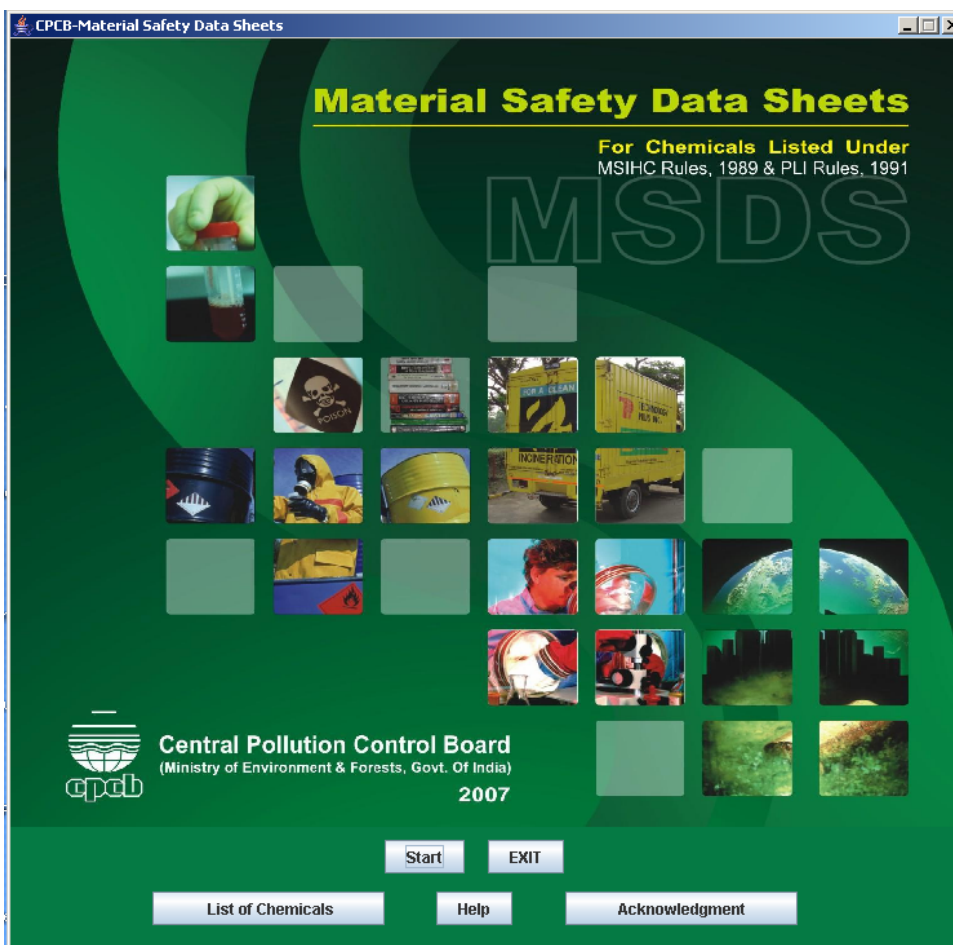
Saving a report or printing the MSDS was an important task. Crystal Reports was used to prepare the Report format for the Java interface. Crystal Reports allows creating flexible, feature-rich reports and then integrating them into Windows applications. The respective data fields were prepared in the report and connected to the database. The report generation allows to print the report and also to save in a PDF format. This makes it flexible to save the database and transport it as required.



Arranging the data fields in the proper format was a difficult work. All the margins have been taken care of to print the records properly. The pages of the report have been well edited to include all the data fields according to their data type.

VII. The start of the program

The starting screen for the program was also implemented in the Java GUI.



The welcome screen allows starting the program and also gives links to the 'List of Chemicals', 'Help' and 'Acknowledgement' files that explain the main features of the program in brief.

VIII. Data validation of the MSDS database

Data validation was done for the initially prepared database. There were number of sources available online and offline. The most important databases were compiled into MS-Access format to compare the check the data. This

included referring to the databases 'The Chemical Database' (Hazardous chemical database), 'DOSE', 'EPA profiles', 'NIOSH' and 'Sittig's Handbook'. The data from each database was aligned parallel with the initial MSDS database. The comparison was done and relative missing fields were added. Wherever necessary the units were converted into a common format as number of databases use there own format of data units.

A wide number of other online databases were also referred such as 'The Chemical Database', 'ChemId Plus' and the etc. This validation included both referring to the above mentioned databases and also offline references of the books.

A view of the database validation:

1. CHEMICAL IDENTITY	NCL MSDS	Hazardous Chemicals	DOSE	EPA Profiles	NIOSH
Chemical Id :	<input type="checkbox"/> Checked	5961	32		
Chemical Name :	Acetaldehyde	Acetaldehyde	acetaldehyde		Acetaldehyde
Chemical Classification :	Toxic, Flammable	No Classification	flammable liquid	No Classification	No Classification
Trade Name :		No Trade Name	No Trade Name	No Trade Name	No Trade Name
Synonyms :	Ethyl aldehyde, Acetic aldehyde, Ethanal, Acetylhydride, Aldehyde, AAD	Ethyl aldehyde Acetic aldehyde Ethanal	No Synonyms		Synonyms & Trade Names Acetic aldehyde
Formula :	C ₂ H ₄ O	Acetylhydride	C ₂ H ₄ O		CH ₃ CHO
C.A.S. No.:	75-07-0	Aldehyde	75-07-0		75-07-0
U.N. No.:	1089	AAD	UN No.: 1089		DOT ID & Guid
Regulated Identification :					
Shipping Name :	Acetaldehyde	C ₂ H ₄ O			
Codes / Label :	Class 3, Flammable Liquid	75-07-0 1089			
Hazardous Waste ID No.:	5				
Hazchem No.:	2YE	Notes:			
Hazardous Ingredients 1:	Acetaldehyde				
C.A.S. No. 1:	75-07-0				

The database was accordingly updated to the present *MSDS 2007*[©]. A number of minor details needed to be taken care of as each database has its own method of data representation.

The final validated database was included in the *MSDS 2007*[©].

IX. Compilation of the installation files for the user

A layman cannot run through all the code and compile the code each time. So, this program needed to be prepared in an easy to use installation single file or the setup file.

The installation setup file was prepared from the whole program, using a standard licensed copy of the latest version of 'InstallShield 2008 Express

Edition'. Installshield prepares installation setup file with the available code. All the files were compiled well including the Java code, help files and the database file. A licensed version of the 'InstallShield 2008 Express Edition' was bought by NCL, Pune for running the program.

All the files well arranged in there respective folders were used. The installation has been prepared for a Windows Operating system. The added benefit of the latest version of **Installshield** used is that the setup prepared can also perform well in a Windows Vista edition. The whole compilation prepares a single setup file which would be easy for the user to just run the installation and then wait for the setup to take place. After the respective links are generated in the program files in a Windows OS (Operating System) linking to the program.

5.0 **The final document: CPCB MSDS 2007 CD**

Safety data sheets for all the chemicals have been put together into a compact disc CPCB MSDS 2007, which enables the search of the safety data for any chemical, display its safety data, generate a report for display, save in the computer and also take a printout.

Detailed information and instructions are reproduced in Annexure 3 as a Help file.

Printout of the MSDS of a few chemicals is also attached in Annexure 5. It may be noted that the copy of the final report includes the MSDS of all the chemicals in the database as a pdf file.

Annexure 1

List of Chemicals in the database *MSDS 2007*[®]

ID No.	Chemical Name
1	Acetaldehyde
2	Acetic acid
3	Acetic anhydride
4	Acetone
5	Acetone cynohydrin
6	Acetone thiosemicarbazide
7	Acetonitrile
8	Acetylene
9	Acetylene tetrachloride
10	Acrolein
11	Acrylamide
12	Acrylonitrile
13	Adiponitrile
14	Aldicarb
15	Aldrin
16	Allyl alcohol
17	Allylamine
18	Allyl chloride
19	Aluminium (powder)
20	Aluminium azide
21	Aluminium borohydride
22	Aluminium chloride
23	Aluminium fluoride
24	Aluminium phosphide
25	4-Aminodiphenyl
26	Amino pyridine
27	2-Aminophenol
28	Aminopterin
29	Amiton
30	Amiton oxalate
31	Ammonia
32	Ammonium chloroplatinate
33	Ammonium nitrate
34	Ammonium nitrite
35	Ammonium picrate
36	Anabasine

ID No.	Chemical Name
37	Aniline
38	Aniline 2,4,6-trimethyl
39	Anthraquinone
40	Antimony pentafluoride
41	Antimycin A
42	ANTU (alpha-Naphthylthiourea)
43	Arsenic pentoxide
44	Arsenic trioxide
45	Arsenous trichloride
46	Arsine
47	Asphalt
48	Azinphos-ethyl
49	Azinphos methyl
50	Bacitracin
51	Barium azide
52	Barium nitrate
53	Barium nitride
54	Benzal chloride
55	Benzenamine, 3-trifluoromethyl
56	Benzene
57	Benzene sulfonyl chloride
58	Benzene, 1-(chloromethyl)-4 nitro
59	Benzene arsenic acid
60	Benzidine
61	Benzidine salts
62	Benzimidazole, 4,5-dichloro-2 (trifluoromethyl)
63	Benzoquinone-P
64	Benzotrichloride
65	Benzoyl chloride
66	Benzoyl peroxide
67	Benzyl chloride
68	Beryllium (powder, compound)
69	Bicyclo(2,2,1) heptane-2- carbonitrile
70	Biphenyl
71	Bis (2-chloroethyl) sulphide
72	Bis (chloromethyl) ketone
73	1,1-di-(tert-Butylperoxy)cyclohexane
74	2,2-Bis (tert-butylperoxy) butane
75	bis(2,4,6-Trinitrophenyl)amine
76	Bis(chloromethyl) ether
77	Bismuth and compounds

ID No.	Chemical Name
78	Bisphenol-A
79	Bitoscanate
80	Boron powder
81	Boron trichloride
82	Boron trifluoride
83	Boron trifluoride compound with methyl ether 1:1
84	Bromine
85	Bromine pentafluoride
86	Bromo chloro methane
87	Bromadiolone
88	Butadiene
89	Butane
90	Butanone-2
91	Butyl amine tert
92	Butyl glycidyl ether
93	Butyl isovalerate
94	Butyl peroxy maleate, tertiary
95	Butyl vinyl ether
96	Butyl-n-mercaptan
97	C.I. Basic Green
98	Cadmium oxide
99	Cadmium stearate
100	Calcium arsenate
101	Calcium carbide
102	Calcium cyanide
103	Campechlor (toxaphene)
104	Cantharidin
105	Captan
106	Carbachol chloride
107	Carbaryl
108	Carbofuran
109	Carbon tetrachloride
110	Carbon disulphide
111	Carbon monoxide
112	Carbophenothion
113	Carvone
114	Cellulose nitrate
115	Chloroacetic acid
116	Chlordane
117	Chlorfenvinphos
118	Chlorinated benzenes

ID No.	Chemical Name
119	Chlorine
120	Chlorine dioxide
121	Chlorine trifluoride
122	Chlormephos
123	Chlormequat chloride
124	Chloroacetyl chloride
125	Chloroacetaldehyde
126	Chloroaniline-2
127	4-Chloroaniline
128	Chlorobenzene
129	Chloroethyl chloroformate
130	Chloroform
131	Chloroformyl morpholine
132	Chloromethane
133	Chloromethyl methyl ether
134	Chloronitrobenzene
135	Chlorophacinone
136	Chlorosulphonic acid
137	Chlorothiophos
138	Chloroxuron
139	Chromic acid
140	Chromic chloride
141	Chromium powder
142	Cobalt carbonyl
143	Cobalt nitrilmethylidyne compound
144	Cobalt (powder)
145	Colchicine
146	Copper and compounds
147	Copper oxychloride
148	Coumafuryl
149	Coumaphos
150	Coumatetrayl
151	Crimidine
152	Crotenaldehyde
153	Crotonaldehyde
154	Cumene
155	Cyanogen bromide
156	Cyanogen iodide
157	Cyanophos
158	Cyanothoate
159	Cyanuric fluoride

ID No.	Chemical Name
160	Cyclo hexylamine
161	Cyclohexane
162	Cyclohexanone
163	Cycloheximide
164	Cyclopentadiene
165	Cyclopentane
166	Cyclotetramethylene tetranitramine
167	Cyclotrimethylenetrinitramine
168	Cypermethrin
169	DDT
170	Decaborane (1:4)
171	Demeton
172	Demeton-S-methyl
173	Di-n-propyl peroxydicarbonate (Conc. 80%)
174	Dialifos
175	Diazodinitrophenol
176	Dibenzyl peroxydicarbonate
177	Diborane
178	Dichloroacetylene
179	Dichlorobenzalkonium chloride
180	Dichloroethyl ether
181	Dichloromethyl phenylsilane
182	2,6-Dichlorophenol
183	2,4-Dichlorophenol
184	Dichlorophenoxy acetic acid
185	Dichloropropane-2,2
186	Dichlorosalicylic acid-3,5
187	Dichlorvos
188	Dicrotophos
189	Dieldrin
190	Diepoxybutane
191	Diethyl carbamazine citrate
192	Diethyl chlorophosphate
193	Diethyl ethanolamine
194	Diethyl peroxydicarbonate
195	Diethyl phenylene diamine
196	Diethylamine
197	Diethylene glycol
198	Diethylene glycol dinitrate
199	Diethylene triamine
200	Diethyleneglycol butyl ether

ID No.	Chemical Name
201	Diglycidyl ether
202	Digitoxin
203	2,2-Dihydroperoxypropane
204	Diisobutryl peroxide
205	Dimefox
206	Dimethoate
207	Dimethyl dichlorosilane
208	Dimethyl hydrazine
209	Dimethylnitrosamine
210	Dimethyl p phenylene diamine
211	Dimethyl phosphor amido cyanidic acid
212	Dimethyl phosphorochloridothioate
213	Dimethyl sulfolane
214	Dimethyl sulphide
215	Dimethylamine
216	Dimethylaniline
217	Dimethylcarbamoyl chloride
218	Dimetilan
219	Dinitro-o-cresol
220	Dinitrophenol
221	Dinitrotoluene
222	Dinoseb
223	Dinoterb
224	Dioxane
225	Dioxathion
226	Dioxine N
227	Diphacinone
228	Diphosphoramid octamethyl
229	Diphenyl methane di-isocyanate (MDI)
230	Dipropylene glycol butyl ether
231	Dipropylene glycol methyl ether
232	Di-(sec-butyl)peroxydicarbonate
233	Disulfoton
234	Dithiazanine iodide
235	Dithiobiurate
236	Endosulfan
237	Endothion
238	Endrin
239	Epichlorohydrin
240	EPN
241	Ergocalciferol

ID No.	Chemical Name
242	Ergotamine tartrate
243	Ethanesulfenyl chloride, 2 chloro
244	Ethanol 1-2 dichloroacetate
245	Ethion
246	Ethoprophos
247	Ethyl acetate
248	Ethyl alcohol
249	Ethyl benzene
250	Ethyl bis amine
251	Ethyl bromide
252	Ethyl carbamate
253	Ethyl ether
254	Ethyl hexanol-2
255	Ethyl mercaptan
256	Ethyl mercuric phosphate
257	Ethyl methacrylate
258	Ethyl nitrate
259	Ethyl thiocyanate
260	Ethylamine
261	Ethylene
262	Ethylene chlorohydrin
263	Ethylene dibromide
264	Ethylene diamine
265	Ethylenediamine dihydrochloride
266	Ethylene flourohydrine
267	Ethylene glycol
268	Ethylene glycol dinitrate
269	Ethylene oxide
270	Ethyleneimine (inhibited)
271	Ethylene dichloride
272	Fenamiphos
273	Femitrothion
274	Fensulphothion
275	Fluenetil
276	Fluorine
277	Fluoro 2-hydroxy butyric acid, salts
278	Fluoroacetamide
279	Fluoroacetic acid amides
280	Fluoroacetyl chloride
281	4-fluorobutyric acid, esters
282	4-Fluorocrotonic acid, esters

ID No.	Chemical Name
283	Fluorouracil
284	Fonofos
285	Formaldehyde
286	Formetanate hydrochloride
287	Formic acid
288	Formoparanate
289	Formothion
290	Fosthietan
291	Fuberidazole
292	Furan
293	Gallium trichloride
294	Glyconitrile
295	Guanyl-4-nitrosaminogwynyl-1-tetrazene
296	Heptachlor
297	3,3,6,6,9,9-Hexamethyl-1,2,4,5-tetroxonane (conc. 75% or more)
298	Hexachlorobenzene
299	Lindane
300	Hexachlorocyclopentadiene
301	Hexachlorodibenzo-p-dioxin
302	Hexachloronaphthalene
303	Hexafluoropropanone sesquihydrate
304	Hexamethyl phosphoramidate
305	Hexamethylene diamine N N dibutyl
306	Hexane
307	Hexanitrostilbene 2,2,4,4,6,6
308	Hexene
309	Hydrogen selenide
310	Hydrogen sulphide
311	Hydrazine
312	Hydrazine nitrate (55% solution)
313	Hydrochloric acid (gas)
314	Hydrogen
315	Hydrogen bromide
316	Hydrogen cyanide
317	Hydrogen fluoride
318	Hydrogen peroxide
319	Hydroquinone
320	Indene
321	Indium powder
322	Indomethacin

ID No.	Chemical Name
323	Iodine
324	Iridium tetrachloride
325	Iron pentacarbonyl
326	Isobenzan
327	Isoamyl alcohol
328	Isobutyl alcohol
329	Isobutyronitrile
330	Isocyanic acid 3 4-dichlorophenyl ester
331	Isodrin
332	Isofluorphate
333	Isophorone diisocyanate
334	Isopropyl alcohol
335	Isopropyl chlorocarbonate
336	Isopropyl formate
337	Isopropyl methyl pyrazolyl dimethyl carbamate
338	Juglone
339	Ketene
340	Lactonitrile
341	Lead arsenite
342	Lead at high temp (molten)
343	Lead azide
344	Lead styphnate
345	Leptophos
346	Lewisite
347	Liquefied petroleum gas
348	Lithium hydride
349	m-Dinitrobenzene
350	Magnesium powder or ribbon
351	Malathion
352	Maleic anhydride
353	Malononitrile
354	Managanese tricarbonyl cyclopentadiene
355	Mechlor ethamine
356	Mephospholan
357	Mercuric chloride
358	Mercuric oxide
359	Mercury acetate
360	Mercury fulminate
361	Mercury methyl chloride
362	Mesitylene
363	Methacrolein diacetate

ID No.	Chemical Name
364	Methacrylic anhydride
365	Methacrylonitrile
366	Methacryloyl oxyethyl isocyanate
367	Methamidophos
368	Methane
369	Methanesulphonyl fluoride
370	Methidathion
371	Methiocarb
372	Menthonyl
373	Methoxy ethanol
374	Methoxyethyl mercuric acetate
375	Methacryloyl chloride
376	Methyl 2-chloroacrylate
377	Methyl alcohol
378	Methyl amine
379	Methyl bromide
380	Methyl chloride
381	Methyl chloroform
382	Methyl chloroformate
383	4-Methyl-1-cyclohexene
384	Methyl disulphide
385	Methyl ethyl ketone peroxide (conc. 60 %)
386	Methyl formate
387	Methyl hydrazine
388	Methyl isobutyl ketone
389	Methyl isocyanate
390	Methyl isothiocyanate
391	Methyl mercuric dicyanamide
392	Methyl mercaptan
393	Methyl methacrylate
394	Methyl phencapton
395	Methyl phosphonic dichloride
396	Methyl thiocyanate
397	Methyl trichlorosilane
398	Methyl vinyl ketone
399	Methylene bis (2-chloroaniline)
400	Methylene chloride
401	Methylenebis-4,4 (2-chloroaniline)
402	Metolcarb
403	Mevinphos
404	Mezacarbate

ID No.	Chemical Name
405	Mitomycin C
406	Molybdenum powder
407	Monocrotophos
408	Morpholine
409	Muscimol
410	Mustard gas
411	n-Butyl acetate
412	n-Butyl alcohol
413	n-Hexane
414	N-Methyl-N,2,4,6-tetranitroaniline
415	Naphtha
416	Naphtha solvent
417	Naphthalene
418	2-Naphthylamine
419	Nickel tetracarbonyl
420	2-Nickel (metal, oxides, carbonates, sulphides as powder)
421	Nicotine
422	Nicotine sulphate
423	Nitric acid
424	Nitric oxide
425	Nitrobenzene
426	Nitrocellulose (dry)
427	Nitrochlorobenzene
428	Nitrocyclohexane
429	Nitrogen
430	Nitrogen dioxide
431	Nitrogen oxide
432	Nitrogen trifluoride
433	Nitroglycerine
434	1-Nitropropane
435	2-Nitropropane
436	Nitroso dimethyl amine
437	Nonane
438	Norbormide
439	o-Cresol
440	o-Nitrotoluene
441	o-Toluidine
442	o-Xylene
443	p-Nitroaniline
444	Oleum

ID No.	Chemical Name
445	OO diethyl s ethyl sulph methyl phos
446	O,O-Diethyl-S-isopropylthio methyl phosphorodithioate
447	O,O-Diethyl-S-ethylsulphinylmethyl phosphorothioate
448	O,O-Diethyl-S-ethylsulphonyl methyl phosphorothioate
449	O,O-Diethyl S-ethylthiomethyl phosphorothioate
450	Organo rhodium complex
451	Orotic acid
452	Osmium tetroxide
453	Ouabain
454	Oxamyl
455	Oxetane 3,3-bis(chloromethyl)
456	Oxidiphenoxarsine
457	Oxydisulfoton
458	Oxygen (liquid)
459	Oxygen difluoride
460	Ozone
461	p-Nitrophenol
462	Paraffin
463	Paraoxon
464	Paraquat
465	Paraquat methosulfate
466	Parathion
467	Parathion methyl
468	Paris green
469	Pentaborane
470	Pentachloroethane
471	Pentachlorophenol
472	Pentabromophenol
473	Pentachloro naphthalene
474	Pentadecylamine
475	Pentaerythritol tetranitrate
476	Pentane
477	Pentanone
478	Perchloric acid
479	Perchloroethylene
480	Peroxyacetic acid
481	Phenol
482	Phenol 2,2-thiobis (4, 6 - dichloro)

ID No.	Chemical Name
483	Phenol 2,2-thiobis (4-chloro 6-methyl phenol)
484	Phenol, 3-(1-methylethyl)-, methylcarbamate
485	Phenyl hydrazine hydrochloride
486	Phenyl mercury acetate
487	Phenyl silatrane
488	Phenyl thiourea
489	Phenylene-p-diamine
490	Phorate
491	Phosacetim
492	Phosfolan
493	Phosgene
494	Phosmet
495	Phosphamidon
496	Phosphine
497	Phosphoric acid
498	Phosphoric acid dimethyl (4-methyl thio) phenyl
499	Phosphonothioic acid, dimethyl-, s-(2-bis) ester
500	Phosphorothioic acid , methyl ester
501	Phosphorothioic acid, O,O-dimethyl S-(2methyl)
502	Phosphorothioic, methyl-ethyl ester
503	Phosphorous
504	Phosphorous oxychloride
505	Phosphorous pentoxide
506	Phosphorous trichloride
507	Phosphorous penta chloride
508	Phthalic anhydride
509	Phylloquinone
510	Physostigmine
511	Physostigmine salicylate (1:1)
512	Picric acid
513	Picrotoxin
514	Piperidine
515	Piprotal
516	Pirinifos-ethyl
517	Platinous chloride
518	Platinum tetrachloride
519	Potassium arsenite
520	Potassium chlorate
521	Potassium cyanide
522	Potassium hydroxide
523	Potassium nitride

ID No.	Chemical Name
524	Potassium nitrite
525	Potassium peroxide
526	Potassium silver cyanide
527	Powdered metals and mixtures (Self-heating metal powders)
528	Promecarb
529	Promurit
530	Propanesultone
531	Propargyl alcohol
532	Propargyl bromide
533	Propen-1,-2-chloro-1,3-diol diacetate
534	Propiolactone beta
535	Propionitrile
536	Propionitrile, 3-chloro
537	Propiophenone, 4-amino
538	Propyl chloroformate
539	Propylene dichloride
540	Propylene glycol allyl ether
541	Propylene imine
542	Propylene oxide
543	Prothoate
544	Pseudocumene
545	Pyrazoxon
546	Pyrene
547	Pyridine
548	Pyridine, 2-methyl-5-Vinyl
549	Pyridine, 4-nitro-1-oxide
550	Pyridine 4-nitro-1-oxide
551	Pyriminil
552	Quinalphos
553	Quinone
554	Rhodium trichloride
555	Salcomine
556	Sarin
557	Selenious acid
558	Selenium hexafluoride
559	Selenium oxychloride
560	Semicarbazide hydrochloride
561	Silane (4-amino butyl) diethoxymethyl-
562	Sodium
563	Sodium anthra-quinone-1-sulphonate

ID No.	Chemical Name
564	Sodium arsenate
565	Sodium arsenite
566	Sodium azide
567	Sodium cacodylate
568	Sodium chlorate
569	Sodium cyanide
570	Sodium fluoroacetate
571	Sodium hydroxide
572	Sodium pentachloro-phenate
573	Sodium picramate
574	Sodium selenate
575	Sodium selenite
576	Sodium sulphide
577	Sodium tellorite
578	Stannane acetoxy triphenyl
579	Stibine
580	Strychnine
581	Strychnine sulphate
582	Styphnic acid
583	Styrene
584	Sulfotep
585	Sulphoxide, 3-chloropropyl octyl
586	Sulphur dichloride
587	Sulphur dioxide
588	Sulphur monochloride
589	Sulphur tetrafluoride
590	Sulphur trioxide
591	Sulphuric acid
592	Tellurium
593	Tellurium hexafluoride
594	TEPP
595	Terbufos
596	tert-Butyl alcohol
597	Tert-butyl peroxy carbonate
598	tert-Butyl peroxyisopropyl carbonate
599	tert-Butyl peroxyacetate (conc > = 70 %)
600	tert-Butyl peroxyvalate (conc >= 77%)
601	tert-Butyl peroxyiso-butyrate (conc>=80%)
602	Tetra hydrofuran
603	Tetramethyl lead
604	Tetranitromethane

ID No.	Chemical Name
605	2,3,7,8 - Tetrachlorodibenzo-p-dioxin
606	Tetraethyl lead
607	Tetrafluoroethylene
608	Tetramethylene disulfotetramine
609	Thallic oxide
610	Thallium carbonate
611	Thallium sulphate
612	Thallos chloride
613	Thallos malonate
614	Thallos sulphate
615	Thiocarbazide
616	Thiocynamicacid, 2- (benzothioazolyethio) methyl
617	Thiofamox
618	Thiometon
619	Thionazin
620	Thionyl chloride
621	Thiophenol
622	Thiosemicarbazide
623	Thiourea (2-chloro-phenyl)
624	Thiourea (2-methyl phenyl)
625	Tirpate
626	Titanium powder
627	Titanium tetra-chloride
628	Toluene
629	Toluene 2,4-diisocyanate
630	Tolylene 2,6-diisocyanate
631	Trans 1,4-di chloro-butane
632	Tri nitro anisole
633	Tri (cyclohexyl) methylstannyl 1,2,4 triazole)
634	Tri(cyclohexyl) stannyl-1h-1,2,3- triazole
635	Triaminotrinitrobenzene
636	Triamiphos
637	Triazophos
638	2,4,6-Tribromophenol
639	Trichloronaphthalene
640	Trichloro (chloromethyl) silane
641	Trichloroacetyl chloride
642	Trichloro(dichlorophenyl)silane
643	Trichloroethyl silane
644	Trichloroethylene
645	Trichloromethane sulphenyl chloride

ID No.	Chemical Name
646	Trichloronate
647	Trichlorophenol 2,3,6
648	Trichlorophenol 2,4,5
649	Trichlorophenyl silane
650	Trichlorophon
651	Triethoxy silane
652	Triethylamine
653	Triethylenemelamine
654	Trimethyl chlorosilane
655	Trimethyl propane phosphite
656	Trimethyl tin chloride
657	Trinitroaniline
658	Trinitrobenzene
659	Trinitrobenzoic acid
660	2,4,6-Trinitrophenetole
661	Trinitro-m-cresol
662	2,4,6-Trinitrotoluene
663	Triorthocresyl phosphate
664	Triphenyltin chloride
665	Tris (2-chloroethyl) amine
666	Turpentine oil
667	Uranium and compounds
668	Valinomycin
669	Vanadium pentoxide
670	Vinyl acetate monomer
671	Vinyl bromide
672	Vinyl chloride
673	Vinyl cyclohexane dioxide
674	Vinyl fluoride
675	Vinyl norbornene
676	Vinyl toluene
677	Vinylidene chloride
678	Warfarin
679	Warfarin sodium
680	Xylene dichloride
681	Xylidine
682	Zinc dichloropentanitrile
683	Zinc phosphate
684	Zirconium and compounds
685	Ammonium nitrates in fertilizers
686	Chlorotrinitrobenzene

ID No.	Chemical Name
687	Fluoro 2-hydroxy butyric acid
688	Fluoro 2-hydroxy butyric acid , amides
689	Fluoro 2-hydroxy butyric acid , esters
690	Fluoroacetic acid
691	Fluoroacetic acid, esters
692	Fluoroacetic acid, salts
693	Methyl isobutyl ketone peroxide
694	O,O-Diethyl-S-isopropylthio methyl phosphorodithioate
695	O,O-Diethyl-S-propylthio methyl phosphorodithioate
696	Peracetic acid
697	tert-Butyl peroxy isopropyl carbonate(concentration \geq 80%)
698	Tert-butyl peroxy maleate (conc \geq 80 %)
699	2,4,6-Trinitroanisole
700	2,4-Dinitrophenol sodium salt hydrate
701	4 - fluorocrotonic acid , amides
702	4-Fluorobutyric acid
703	4-Fluorobutyric acid , amides
704	4-fluorobutyric acid , salts
705	4-Fluorocrotonic acid
706	4-Fluorocrotonic acid , salts
707	Benzidine dihydrochloride
708	Beryllium acetylacetonate
709	Beryllium nitrate
710	Beryllium silicate
711	Beryllium sulfate
712	Bismuth basic carbonate
713	Bismuth nitrate
714	Bismuth subsalicylate
715	Bismuth sulfide
716	Carbonylhydrotris(triphenylphosphine)rhodium
717	Chloro(1,5-cyclooctadiene)rhodium(I) dimer
718	Copper(I) bromide
719	Copper(I) iodide
720	Copper(II) fluoride
721	Dibenzyl
722	Dichlorobenzene
723	Ethylenebis(indenyl)zirconium dichloride
724	N,N,N',N'-Tetramethylbenzidine
725	Rhodium, carbonylchlorobis(triphenylphosphine)

ID No.	Chemical Name
726	Trichlorobenzene
727	Tris(triphenylphosphine)rhodium(I) chloride
728	Uranium hexafluoride
729	Uranium(IV) bromide
730	Uranium(IV) chloride
731	Zinc phosphide
732	Zirconium tert-butoxide
733	Zirconium(IV) bromide
734	3,3'-Dihydroxybenzidine
735	Powdered metals and mixtures (Metal powder, flammable)

Annexure 2

The Manufacture, Storage and Import of Hazardous Chemical Rules, 1989

SCHEDULE -9

(See Rule 17)

SAFETY DATA SHEET

1. CHEMICAL IDENTITY

Chemical Name		Chemical Classification	
Synonyms		Trade Name	
Formula	C.A.S.No	U.N. No.:	
Regulated Identification	Shipping Name Codes/Lable	Hazchem No.:	
		Hazardous Waste I.D. No.:	
Hazardous Ingredients	C.A.S. No.	Hazardous Ingredients	C.A.S No.:
1.		3.	
2.		4.	

2. PHYSICAL AND CHEMICAL DATA

Boiling Range/Point °C	Physical State	Appearance
Melting/Freezing Point °C	Vapour Pressure @ 35 °C mm/Hg	Odour
Vapour Density (Air=1)	Solubility in Water at 30°C Others	
Specific Gravity Water =1	pH	

3. FIRE AND EXPLOSION HAZARD DATA

Flammability	Yes/No	<i>LEL</i>	%	Flash Point °C	Auto ignition Temperature °C
TDG Flammability		<i>UEL</i>	%	Flash Point °C	
Explosion Sensitivity to Impact				Explosion Sensitivity to Static Electricity	Hazardous Combustion Products
Hazardous Polymerisation					
Combustible Liquid		Explosive Material		Corrosive Material	
Flammable Material		Oxidiser		Others	
Pyrophoric Material		Organic Peroxide			

4. REACTIVITY DATA

Chemical Stability

Incompatibility With other Material

Reactivity

Hazardous Reaction Products

5. HEALTH HAZARD DATA

Routes of Entry

Effects of Exposure/Symptoms

Emergency Treatment

TLV(ACGIH)	ppm	mg/m ³	STEL	ppm	mg/m ³
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Permissible

Exposure Limits LD ₅₀	ppm	mg/m ³	Odour threshold LD ₅₀	ppm	mg/m ³
NEPA Hazard	Health		Flammability		Stability Special
Signals					

6. PREVENTIVE MEASURES

Personnel
Protective
Equipment

Handling and
Storage
Precautions

7. EMERGENCY AND FIRST AID MEASURE

Fire Extinguishing
Media

FIRE

Special Procedures

Unusual Hazards

EXPOSURE

First Aid Measures

Antidotes/Dosages

SPILLS

Steps to be taken

Waste Disposal Method

8. ADDITIONAL INFORMATION / REFERENCES

9. MANUFACTURER / SUPPLIER DATA

Name of Firm	Contact Person in Emergency
Mailing Address	Local Bodies Involved
Telephone/Telex Nos.	Standard Packing
Telegraphic Address	Tremcard Details/Ref Other.

10. DISCLAIMER

Information contained in this material data sheet is believed to be reliable but no representation, guarantee or warranties of any kind are made as to its accuracy, suitability for a particular application or results to be obtained from them. It is upto the manufacturer/seller to ensure that the information contained in the material safety data sheet is relevant to the product manufactured/handled or sold by him as the case may be. The Government makes no warranties expressed or implied in respect of the adequacy of this document for any particular purpose.

Annexure 3

HELP

- 1) About MSDS 2007[©]
- 2) Installation
- 3) Data search
- 4) Glossary

1) About MSDS 2007[©]?

This database MSDS 2007[©] is a compilation of more than 700 Safety Data Sheets for all the chemicals listed under the,

- i) Manufacture, Storage and Import of Hazardous Chemicals Rules 1989, and further amended in 2000 [Schedule 1 (Part II)] and,
- ii) Chemicals notified as part of Public Liability & Insurance Rules, (PLI) 1991, and notified by the Ministry of Environment & Forests, New Delhi, India. There are many a chemicals that are common in both the lists. The software enables the search of the safety information for any of the listed chemical, which are displayed over ten different screens that can be viewed on the screen with a tab on the title. The complete safety data may also be displayed in the ten-point layout according to the CPCB format and printed as a hard copy.

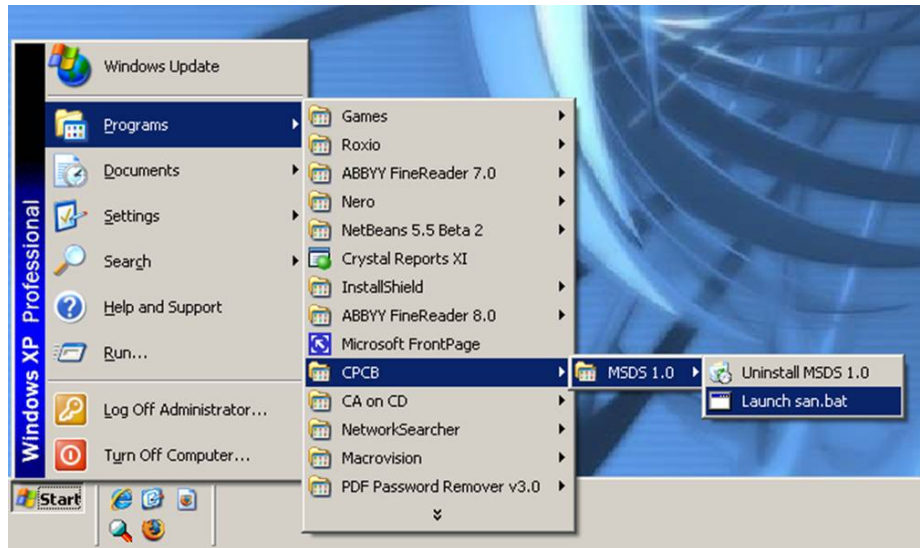
2) Installation

1. This CD will Autorun in Windows 98 & later. If it does not happen, please execute setup.exe in the CD-ROM. To do this, go to RUN from the START menu and type X:\setup.exe, where X is the drive letter of the CD-ROM drive. The CD-ROM is best viewed in Windows XP or later at a resolution of 1024 x 768 at 24/32 bit true colour.
2. Microsoft Office Access must be installed to use the program.
3. Adobe Acrobat Reader must be installed to save and print the report.
4. Recommended minimum system requirement
 - Pentium 800 MHz
 - 128 MB RAM
 - 1024 x 768 display resolution at high / true colour mode
 - 4X CD-ROM drive
 - Windows 98 or later

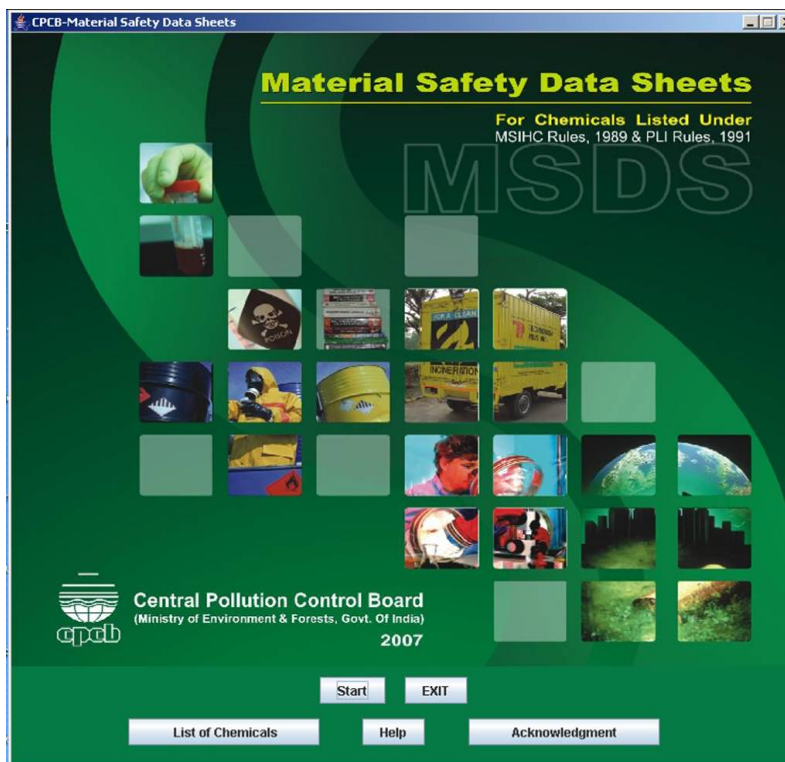
3) Data search

To access MSDS for a chemical through MSDS 2007[®], follow the directions below:

To start the program in windows, go to PROGRAMS from START menu followed by CPCB and MSDS and LAUNCH as shown below.



Click on START to search MSDS



The search window gives four options to search with viz., Chemical Identity No., Chemical Name, Synonyms and CAS No.

To search enter any one of the fields in the following format and press SEARCH

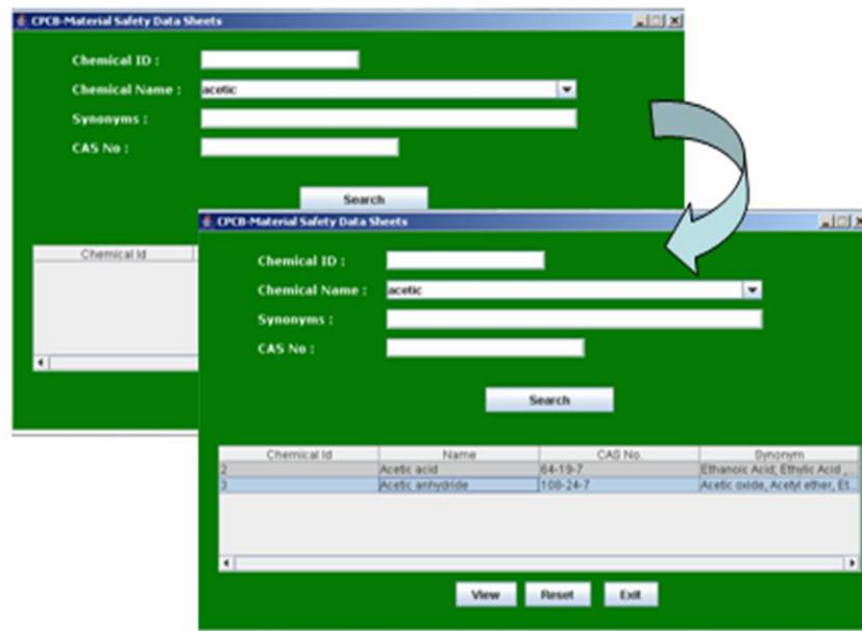
Chemical Identity No (1-735)

Chemical Name (Exact name / starting with)

Synonyms (Exact name / starting with)

CAS No.: (xx-xxxx-xx)

The search results are displayed in the box below:



Select the desired entry and click VIEW

The MSDS of the selected chemical is displayed in the ten page format and each page may be viewed one at a time.

Acetic anhydride

[PREVENTIVE MEASURES](#) |
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 [FIRE / EXPLOSION HAZARD DATA](#) |
 [REACTIVITY DATA](#) |
 [HEALTH HAZARD DATA](#)

CHEMICAL IDENTITY

Chemical ID : 3

Chemical Name : **Acetic anhydride** Chemical Classification : **Corrosive**

Synonyms : **Acetic oxide, Acetyl ether, Ethanoic anhydride, Acetic acid anhydride** Trade Name :

Formula : **C4H6O3** CAS No. : **108-24-7** UN No. : **1715**

Regulated Identification :

Shipping Name : **Acetic Anhydride** Hazchem Code : **2P**

Codes / Label : **Class 8, Corrosive**

Hazardous ID No : **5**

	HAZARDOUS INGREDIENTS	CAS No.	HAZARDOUS INGREDIENTS	CAS No.
1	Acetic Anhydride	108-24-7	3	
2			4	

 << < > >>

Acetic anhydride

[PREVENTIVE MEASURES](#) |
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PHYSICAL / CHEMICAL DATA

Boiling Pt / Range °C: **139.9**

Melting / Freezing Pt °C: **-73**

Vapour Density:
(Air=1) **3.52**

Specific Gravity:
(Water =1) **1.082 g/cu cm @ 20 deg C**

Physical State : **Liquid**

Vapour Pressure @ 35°C :
(mm Hg) **10mm Hg at 36 °C**

Solubility in water at 30°C :
(g/100 mL) **Slowly soluble**

pH :

Appearance: **Colourless**

Odour : **Strong acetic odour.**

Others : **Miscible with alcohol, ether. Decomposes in hot alcohol**

 << < > >>

Acetic anhydride

[PREVENTIVE MEASURES](#) |
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 [FIRE / EXPLOSION HAZARD DATA](#) |
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 [HEALTH HAZARD DATA](#)

HEALTH HAZARD DATA

Routes of entry :

Effects of Exposure / Symptoms :

Emergency Treatment :

Inhalation :

Remove the victim at once to fresh air area, if breathing becomes difficult give oxygen.	Eyes : Irrigate with plenty of water for 15 mins.
--	---

Skin : Remove the wetted clothes, flush the affected area with plenty of water.


Ingestion : Do not induce vomiting. If victim is conscious and alert, give 2-4 cupfuls of milk or water. Never give anything by mouth to an unconscious person. Get medical aid immediately.


LD50 (oral-rat) : STEL % :

LC50 (rat) : Odour Threshold :

Permissible Exposure Limit : TLV :

NEPA Hazard :	Health	Flammability	Reactivity	Special
Signals :	<input type="text" value="3"/>	<input type="text" value="2"/>	<input type="text" value="1"/>	<input type="text" value=""/>

 button navigates to safety information for the chemical with the next Chemical ID No.

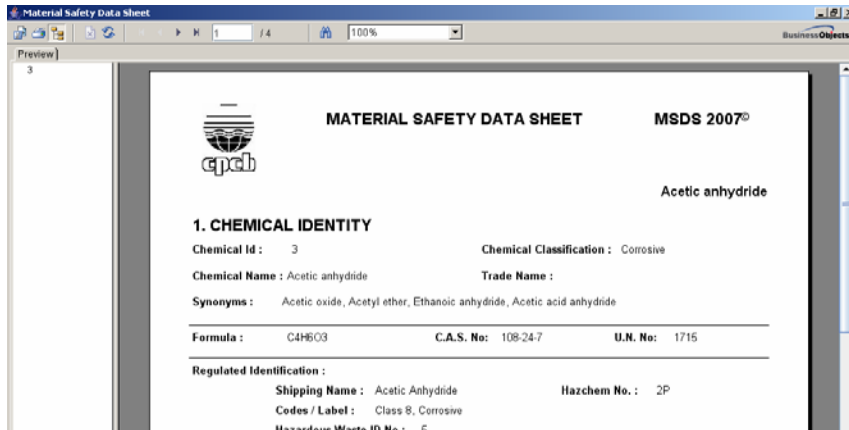
 button navigates to safety information for the chemical with the previous Chemical ID No.

 button navigates to safety information for the last chemical in the database

 button navigates to safety information for the first chemical in the database

Reports:

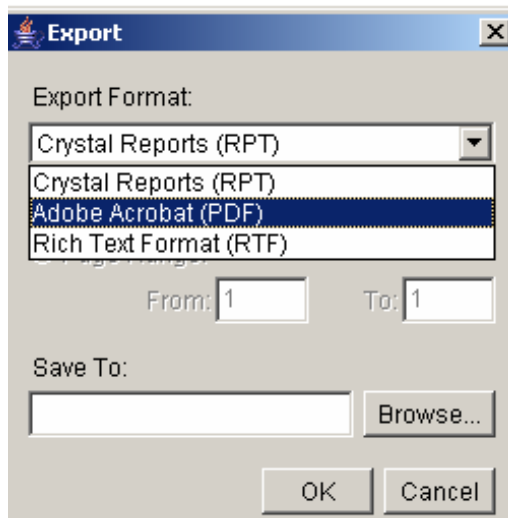
Press 'REPORT THIS MSDS' to generate a complete report for the listed entry only (normally 4-5 pages).



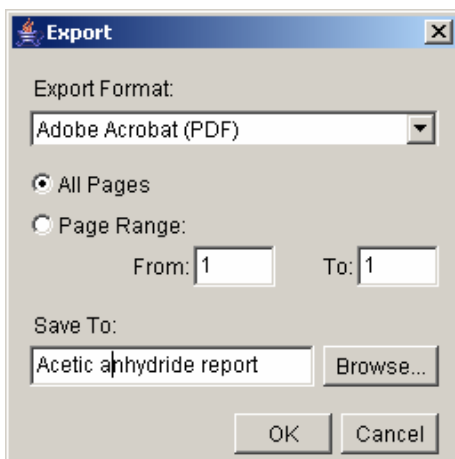
 button saves the report and  button prints the report



Select 'Adobe Acrobat (PDF)' to save the file in pdf format.



Select 'All Pages' to save all the pages of the report and then click 'OK'.



[A sample report of 'Acetic anhydride can be viewed here'](#)

Press 'REPORT ALL MSDS' to generate a report for all listed entries in the database (~2400 pages).

4) Glossary

1. Chemical name : Approved chemical name, or common name.
2. Synonyms : The other name by which the chemical is known.
3. CAS No. : The unique identification number assigned each compound registered with the Chemical Abstracts Service (CAS). The number allows one to uniquely identify a chemical regardless of the naming system.
4. U.N. No. : United Nations (UN) Numbers are four-digit numbers used world-wide in international commerce and transportation to identify hazardous chemicals or classes of hazardous materials. These numbers generally range between 0000 and 3500 and are ideally preceded by the letters "UN" (for example, "UN1008") to avoid confusion with other number codes.
5. Shipping Name : Name indicted against the specific U.N. No.
6. Codes/Label/Class : The classification of goods by the type of goods involved. The hazards transport of goods is sub-divided to show the primary hazard of the substance, which

determines the Class into which the substance is assigned, and, where appropriate, the subsidiary risks. The classifications identified are those adopted by the United Nations Committee of Experts on the Transport of Dangerous Goods and on the Globally Harmonised System of Classification and Labelling of Chemicals, and are as follows:

- a. Class 1: Explosives: Substances which may

explode under the effect of flame heat, heat or photochemical conditions, or which are more sensitive to shocks or friction than dinitrobenzene. A substance which is not itself an explosive but which can form an explosive atmosphere of gas, vapour or dust is not generally included in Class 1.
- b. Class 2: Gases – compressed, liquefied, dissolved under pressure or deeply refrigerated. Some gases are flammable; others non-flammable.
- c. Class 3: Inflammable(flammable) liquids: These are liquids or mixture of liquids, or liquids containing solids in solution or suspension having flash point of not more than 60.5 degree C (closed-cup), or not more than 65.6 degree C (open-cup).
- d. Class 4:
 - i. Inflammable solids
 - ii. Substances liable to spontaneous combustion
 - iii. Substances which, in contact with water, emit flammable gases.
- e. Class 5:
 - i. Oxidising substances
 - ii. Organic peroxides
- f. Class 6:

- i. Poisonous (toxic) substances
 - ii. Infectious substances
 - g. Class 7: Radioactive substances
 - h. Class 8: Corrosive substances
 - i. Class 9: Miscellaneous dangerous substances not covered by other classes.
- 7. Hazchem Code : Emergency Action codes (EACs), also known as Hazchem, are for the use of the emergency services in conjunction with Emergency Action Code Cards. EACs indicate to the emergency services actions that may be necessary, during the first few minutes of an incident involving dangerous goods, should the officer in charge of the incident deem it necessary to take immediate actions. The code uses one of the numerals 1, 2, 3 or 4 followed by one or two letters.
- 8. Hazardous Waste I.D. No. : Hazardous Waste Identification number as indicated under categories of Wastes in the Schedule of the Hazardous Wastes (Management and Handling) Rules 1989.
- 9. TDG Flammability : Transport of Dangerous Goods Flammability. This term is used in Canada and is based on Classifications of Dangerous Goods by the U.N. Committee of experts on Transport of Dangerous Goods. The Classes indicated are 2 (flammable), 3, 4 and 5.
- 10. LD₅₀ (Oral) : Lethal Dose Fifty (Oral) – a calculated orally ingested dose of a material which is expected to cause the death of 50% of an entire defined experimental animal population. Generally animals are rat, mouse or rabbit.
- 11. LC₅₀ : Lethal Concentration Fifty – a calculated concentration of a material in air, exposure to which for a specified length of time, hours (H), month (M), or week (W), is expected to cause the death of 50% of entire defined experimental animal population.
- 12. Permissible Exposure Limit : Permissible Levels of certain Chemical Substances in Work Environment as laid down in the Second Schedule of the Factories Act.
- 13. Threshold Limit Value - Short-Term Exposure Limits: The parts of vapor (gas per million parts of contaminated air by volume at 25°C (77°F) and one atmosphere pressure is given. The limits are given in milligrams per cubic

meter maximum permissible average exposures for the time periods specified.

14. ppm : Parts per million parts of air.
15. mg/m³ : Milligram per cubic metre.
16. NFPA Hazard Signals : National Fire Protection Associations USA
Hazard Signal – A simple, readily recognizable and easily understood markings (alerting signals) which give at a glance a general idea of the inherent hazards of the material and the order of severity of these hazards as they relate to fire prevention, exposure and control. The system identifies the hazards of a material in terms of three categories – Health, Flammability and Reactivity, and indicates the order of severity in each of these categories. Another category (special) is reserved for additional information when such may be of value to the fire fighter.
17. Chemical Classification (Hazardous) : The chemicals hazard classification as per the CREFT Classification.
18. ACGIH : The American Conference of Governmental Industrial Hygienists, Inc., ACGIH, is an organization open to all practitioners in industrial hygiene, occupational health, environmental health, or safety. Their web site is <http://www.acgih.org/>.
19. Asphyxiant : An asphyxiant is a substance that can cause [unconsciousness](#) or death by suffocation ([asphyxiation](#)). Asphyxiants which have no other health effects and are sometimes referred to as simple asphyxiants. Asphyxiants work by displacing so much oxygen from the ambient atmosphere that the hemoglobin in the blood can not pick up enough oxygen from the lungs to fully oxygenate the tissues. As a result, the victim slowly suffocates.
20. Flammable limits : Flammable limits apply generally to vapours and are defined as the concentration range in which a flammable substance can produce a fire or explosion when an ignition source (such as a spark or open flame) is present. The concentration is generally expressed as percent fuel by volume.
- a. Above the upper flammable limit (UFL) the mixture of substance and air is too rich in fuel (deficient in

oxygen) to burn. This is sometimes called the upper explosive limit (UEL).

- b. Below the lower flammable limit (LFL) the mixture of substance and air lacks sufficient fuel (substance) to burn. This is sometimes called the lower explosive limit (LEL).

Any concentration between these limits can ignite or explode -- use extreme caution! Being above the upper limit is not particularly safe, either. If a confined space is above the upper flammable limit and is then ventilated or opened to an air source, the vapor will be diluted and the concentration can drop into the flammable limit range.

21. Flash Point

: This is defined as the lowest temperature at which vapors above a volatile combustible substance will ignite in air when exposed to a flame. Depending on the test method used, the values given are either Tag closed cup (C.C.) (ASTM D56) or Cleveland open cup (O.C.) (ASTM D93). The values, along with those in 6.2 and 6.7 below, give an indication of the relative flammability of the chemical. In general, the open cup value is about 10° to 15°F higher than the closed cup value.

Annexure 4

List of books and monographs referred to:

1. Braker,W. And Mossman,A.L., "Effects Of Exposure To Toxic Gases: First Aid And Medical Treatment", New Jersey: Matheson Gas Products, 1970.
Keywords: Public Health And Safety; Effect; Treatment; Exposure; First Aid; Toxic Gas; Safety
2. Braker,W. And Morsman,A.L., "Matheson Gas Data Book", Ed. 5, New Jersey: Matheson Gas Products, 1971.
Keywords: Chemical Technology; Safety; Gas; Data; Compressed Gas
3. Bretherick,L, "Handbook Of Reactive Chemical Hazards,An Indexed Guide To Published Data", Kent: Butterworth And Co Publishers Ltd., 1975.
Keywords: Accidents: Prevention, Safety; Safety; Chemicals; Hazard; Handbook; Data; Pharmaceuticals; Organic; Compounds; Formulary;
4. Bretherick,L, "Handbook Of Reactive Chemical Hazards", Ed. 3rd, Kent: Butterworth And Co Publishers Ltd., 1985.
Keywords: Accidents: Prevention, Safety; Safety; Chemical; Reactivity; Hazardous Substances;
5. Bretherick,L. And Urben,P.G._Ed, "Handbook Of Reactive Chemical Hazards", V 2, Ed. 5, Oxford: Butterworth-Heinemann Ltd, 1995.
Keywords: Accidents: Prevention, Safety; Safety; Chemical Reaction; Kinetics; Hazards; Reactivity; Chemical Composition; Chemical Structure; Protective Measures
6. "Dictionary Of Organic Compounds", 5th Supple, Ed. 5th, London: Chapman And Hall Ltd, 1987.
Keywords: Organic Chemistry; Organic Compound; Safety; Dictionary; Hazardous Compound; Toxic Compound;
7. Keith,L.H.Ed. And Walters,D.B_Ed, "Compendium Of Safety Data Sheets For Research And Industrial Chemicals", Part I, New York: Vch Publishers Inc, 1985.
Keywords: Accidents: Prevention, Safety; Chemicals; Safety; Research; Data; Industrial; Compendium; Compound; Measures;
8. Keith,L.H.Ed. And Walters,D.B_Ed, "Compendium Of Safety Data Sheets For Research And Industrial Chemicals", Part Iii, New York: Vch Publishers Inc, 1985.
Keywords: Accidents: Prevention, Safety; Chemicals; Safety; Research; Data; Industrial; Compendium; Compound; Measures;

9. Keith,L.H.Ed. And Walters,D.B_Ed, "Compendium Of Safety Data Sheets For Research And Industrial Chemicals", Part Ii, New York: Vch Publishers Inc, 1985.
Keywords: Accidents: Prevention, Safety; Chemicals; Safety; Research; Data; Industrial; Compendium; Compound; Measures;
10. Sax,N.I, "Dangerous Properties Of Industrial Materials", Ed. 3rd, New York: Van Nostrand Reinhold Co, 1968.
Keywords: Accidents: Prevention, Safety; Safety; Hazard; Chemical; Toxicology; Property; Data; Storage; Industrial Handling; Material;
11. Sax,N.I., "Dangerous Properties Of Industrial Materials", Pt 1., Ed. 6, New York: Van Nostrand Reinhold Co, 1984.
Keywords: Accidents: Prevention, Safety; Safety; Chemicals; 33 Environment; hazard; toxicology; industry; materials; pollution; occupational disease; industrial; radiation; hazardous; substance; dangerous; nuclear medicine; biohazard;
12. Sax,N.I., "Handbook Of Dangerous Materials", 1951.
Keywords: Accidents: Prevention, Safety; Safety
13. Sax,N.I. And Lewis,R.J_Ed, "Rapid Guide To Hazardous Chemicals In The Workplace", New York: Van Nostrand Reinhold Co, 1986.
Keywords: Accidents: Prevention, Safety; Safety; Public Health And Safety; Chemicals; Directory; Handbook; Hazardous Materials; Hazardous Substances;
14. U.S.Environmental Protection Agency, Washington USA, "Extremely Hazardous Substances,Superfund Chemical Profiles", Vol 1, A-L.-- Park Ridge: Noyes Publications, 1988.
Keywords: Accidents: Prevention, Safety; Hazardous Substance; Safety;
15. U.S.Environmental Protection Agency,Washington,Usa, "Extremely Hazardous Substances,Superfund Chemical Profiles", Vol 2,M-Z.-- Park Ridge: Noyes Publications, 1988.
Keywords: accidents: prevention, safety; hazardous substance; safety;
16. Weiss,G_ED, "Hazardous chemicals data book", ED. 2nd-- park ridge: noyes publications, 1986.
Keywords: accidents: prevention, safety; chemicals; safety; data hazardous materials; handling;

Annexure 5

Sample MSDS reports of 5 chemicals

1. Acetic anhydride
2. Ethylene oxide
3. Isopropyl alcohol
4. Potassium chlorate
5. Sulphuric acid



MATERIAL SAFETY DATA SHEET

MSDS 2008[©]

Acetic anhydride

1. CHEMICAL IDENTITY

Chemical Id : 3 Chemical Classification : Corrosive

Chemical Name : Acetic anhydride Trade Name :

Synonyms : Acetic oxide, Acetyl ether, Ethanoic anhydride, Acetic acid anhydride

Formula : C₄H₆O₃ C.A.S. No: 108-24-7 U.N. No: 1715

Regulated Identification :

Shipping Name : Acetic anhydride Hazchem No. : 2P

Codes / Label : Class 8, Corrosive

Hazardous Waste ID No : 5

Hazardous Ingredients	C.A.S. No.	Hazardous Ingredients	C.A.S. No.
1. Acetic anhydride	108-24-7	3.	
2.		4.	

2. PHYSICAL / CHEMICAL DATA

Boiling Pt / Range °C : 139.9 Physical State : Liquid Appearance : Colourless

Melting / Freezing Pt °C : -73 Vapour Pressure @ 35°C mm Hg : 10mm Hg at 36 °C Odour : Strong acetic odour.

Vapour Density (Air =1) : 3.52 Solubility in water at 30°C : g/100ml Slowly soluble Others : Miscible with alcohol, ether. Decomposes in hot alcohol

Specific Gravity (Water =1) : 1.082 g/cu cm @ 20 deg C pH :

3. FIRE / EXPLOSION HAZARD DATA

Flammability : Yes LEL % : 2.9 Flash Point °C (OC) : 57.5

TDG Flammability : UEL % : 10.3 Flash Point °C (CC) : 48.8

Autoignition Temperature °C :	316
Explosion Sensitivity to Impact :	Stable
Explosion Sensitivity to Static Electricity :	
Hazardous Combustion Products :	Emits irritating vapour when heated. Toxic gases and vapors such as acetic acid and carbon monoxide may be released in fire involving acetic anhydride.
Hazardous Polymerization :	Does not occur.

Combustible Liquid : Yes	Explosive Material : No	Corrosive Material : Yes
Flammable Material : Yes	Oxidiser : No	Others :
Pyrophoric Material : No	Organic Peroxide : No	

4. REACTIVITY DATA

Chemical Stability :	Stable
Incompatibility With other Material :	With 2-amine ethanol, aniline, chlorosulfonic acid, (CrO ₃ +acetic acid), ethylenediamine, ethyleneimine, glycerol, oleum, HF, permanganates, NaOH
Reactivity :	Can react vigorously with oxidising materials, will react violently on contact with water or steam.
Hazardous Reaction Products :	

5. HEALTH HAZARD DATA

Routes of entry : Inhalation, ingestion, skin and eyes.

Effects of Exposure / Symptoms : Inhalation: Causes severe irritation of upper respiratory tract with coughing, burns, breathing difficulty, and possible coma. Vapors may cause dizziness or suffocation. Skin: Contact with skin causes irritation and possible burns, especially if the skin is wet or moist. Prolonged skin contact may be painless with reddening of the skin followed by a white appearance of the skin. May cause skin rash (in milder cases), and cold and clammy skin with cyanosis or pale color. Eyes: Contact with liquid is corrosive to the eyes and causes severe burns. May cause chemical conjunctivitis and corneal damage. Ingestion: May cause severe and permanent damage to the digestive tract. May cause perforation of the digestive tract. Ingestion of large amounts may cause CNS depression. May cause systemic effects.

Emergency Treatment :

Inhalation : Remove the victim at once to fresh air area, if breathing becomes difficult give oxygen.

Skin : Remove the wetted clothes, flush the affected area with plenty of water.

Eyes : Irrigate with plenty of water for 15 mins.

Ingestion : Do not induce vomiting. If victim is conscious and alert, give 2-4 cupsful of milk or water. Never give anything by mouth to an unconscious person. Get medical aid immediately.

LD50 (oral-rat) mg/kg :	1780 mg/kg	STEL :	5 ppm (21 mg/m3)	
Permissible Exposure Limit :	5 ppm (20 mg/m3)	Odour Threshold :	0.56 mg/m3	
TLV (ACGIH) :	5 ppm (20 mg/m3)	LC50 (rat) mg/kg :	1680 mg/m3 6 hr	
NFPA Hazard	Health	Flammability	Reactivity	Special
Signals :	3	2	1	

6. PREVENTIVE MEASURES

Personal Protective Equipment : Provide overclothing rubber shoes, face shield, respiratory protection is necessary for all exposure.

Handling : Store in a dry, cool, well ventilated area, away from heat, flame and oxidising agents.

Storage : Keep away from heat, sparks, and flame. Keep away from sources of ignition. Do not store in direct sunlight. Keep container closed when not in use. Keep from contact with oxidizing materials. Store in a cool, dry, well-ventilated area away from incompatible substances. Keep away from water.

Precautions : Avoid contact with liquid and vapours.

7. EMERGENCY / FIRST AID MEASURES

FIRE :

Fire Extinguishing Media : CO₂, dry chemical powder, alcohol foam. Do not use water.

Special Procedure: Use water in flooding quantities as fog. Solid streams of water may be ineffective. Cool all affected containers with flooding quantities of water. Apply water from as far a distance as possible.

Unusual Hazards: Vapour is invisible and heavier than air.

EXPOSURE :

First Aid Measure:

Inhalation : Remove the victim at once to fresh air area, if breathing becomes difficult give oxygen.

Skin : Remove the wetted clothes, flush the affected area with plenty of water.

Eyes : Irrigate with plenty of water for 15 mins.

Ingestion : Do not induce vomiting. If victim is conscious and alert, give 2-4 cupfuls of milk or water. Never give anything by mouth to an unconscious person. Get medical aid immediately.

**Antidotes /
Dosages :**

SPILLS :

Steps to be taken: Shut off leaks if without risk. Contain the spillage on sand or earth.

Waste Disposal Method: Neutralise with sodium bicarbonate solution. See "Additional Information"

8. ADDITIONAL INFORMATION / REFERENCES

Moderate fire and explosion hazard when exposed to heat and flame. Reaction with Ammonium nitrate+Hexamethylene tetraminium acetate+Nitric acid forms the products of explosive RDX and HMX. Potentially explosive reaction with Barium peroxide, Boric acid, Chromium trioxide.

Spillage treatment: Absorb spill with inert material, (e.g., dry sand or earth), then place into a chemical waste container. Avoid runoff into storm sewers and ditches which lead to waterways. Clean up spills immediately, using the appropriate protective equipment. Remove all sources of ignition. Use a spark-proof tool. Provide ventilation. Do not expose spill to water. Spill may be neutralized with lime. Cover with material such as dry soda ash or calcium carbonate and place into a closed container for disposal. A vapor suppressing foam may be used to reduce vapors.

9. MANUFACTURERS / SUPPLIERS DATA

Name of Firm :

Contact Person
in Emergency :

Mailing Address :

Local Bodies Involved :

Telephone / Telex Nos :

Standard Packing :

Telegraphic Address :

Trem Card Details / Ref :

Others:

10. DISCLAIMER

Information contained in this material data sheet is believed to be reliable but no representation, guarantee or warranties of any kind are made as to its accuracy, suitability for a particular application or results to be obtained from them. It is up to the manufacturer/ seller to ensure that the information contained in the material safety data sheet is relevant to the product manufactured/handled or sold by him as the case may be. The Government makes no warranties expressed or implied in the respect of the adequacy of this document for any particular purpose.

End of document.
Total No. of Pages: 4



MATERIAL SAFETY DATA SHEET

MSDS 2008 ©

Ethylene oxide

1. CHEMICAL IDENTITY

Chemical Id : 269 Chemical Classification : Toxic, Flammable, Reactive
 Chemical Name : Ethylene oxide Trade Name :
 Synonyms : Dimethylene oxide, oxirane, 1,2 Epoxyethane, Ethene oxide, EOX, Oxirane

Formula : C₂H₄O C.A.S. No: 75-21-8 U.N. No: 1040

Regulated Identification :

Shipping Name : Ethylene oxide Hazchem No. : 2PE
 Codes / Label : Class 2.3, Toxic, Flammable, Reactive
 Hazardous Waste ID No : 5

Hazardous Ingredients	C.A.S. No.	Hazardous Ingredients	C.A.S. No.
1. Ethylene oxide	75-21-8	3.	
2.		4.	

2. PHYSICAL / CHEMICAL DATA

Boiling Pt / Range °C : 10.7 Physical State : Gas Appearance : Colourless gas at room temperature and pressure; liquid below 12 deg C.

Melting / Freezing Pt °C : -111 Vapour Pressure @ 35°C mm Hg : 1314 mmHg at 25 deg C Odour : Sweet, ether like odour

Vapour Density (Air =1) : 1.49 Solubility in water at 30°C : g/100ml Soluble Others : Soluble in ether, benzene and alcohol.

Specific Gravity (Water =1) : 0.882 @ 10 deg C/10 deg C pH : Neutral

3. FIRE / EXPLOSION HAZARD DATA

Flammability : Yes LEL % : 3.0 Flash Point °C (OC) :

TDG Flammability : 3 UEL % : 100 Flash Point °C (CC) : -29 (Liquid)

Autoignition Temperature °C :	429
Explosion Sensitivity to Impact :	Stable
Explosion Sensitivity to Static Electricity :	May explode.
Hazardous Combustion Products :	Emits acrid smoke & irritating fumes.
Hazardous Polymerization :	Polymerization on contact with acids and alkali.

Combustible Liquid : Yes	Explosive Material : No	Corrosive Material : No
Flammable Material : Yes	Oxidiser : No	Others :
Pyrophoric Material : No	Organic Peroxide : No	

4. REACTIVITY DATA

Chemical Stability :	Stable under normal temperatures and pressures.
Incompatibility With other Material :	Strong acids, alkalis & oxidizers; chlorides of iron, aluminum & tin; oxides of iron & aluminum; water
Reactivity :	Violent polymerisation occurs on contact with ammonia, alkali hydroxides, amines, potassium acids, covalent halides. Explosive reaction with glycerol at 200 deg C.
Hazardous Reaction Products :	It reacts with chloride and water to produce two active germicides, 2-chloroethanol and ethylene glycol.

5. HEALTH HAZARD DATA

Routes of entry : Inhalation, Ingestion, Eyes & Skin

Effects of Exposure / Symptoms : Inhalation: Pulmonary irritation is a common symptom after inhalation. Pulmonary edema may be seen with acute exposures. Pneumonia may be a complication of ethylene oxide exposure. A rare report of asthma has also been reported. Skin: May be toxic/fatal if absorbed through skin. Contact may cause burns, severe injury and/or frostbite. Eyes: Contact may cause burns, severe injury and/or frostbite. Ingestion: Nausea, vomiting and diarrhea may occur.

Emergency Treatment :

Inhalation : Remove from exposure to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical aid immediately.

Skin : Flush skin with plenty of soap and water for at least 15 minutes while removing contaminated clothing and shoes. Remove contaminated clothing and shoes. Get medical aid.

Eyes : Irrigate exposed eyes with copious amounts of tepid water for at least 15 minutes. If irritation, pain, swelling, lacrimation, or photophobia persist, the patient should be seen in a health care facility.

Ingestion : If victim is conscious and alert, give 2-4 cupfuls of milk or water. Get medical aid immediately.

LD50 (oral-rat) mg/kg :	330 mg/kg	STEL :		
Permissible Exposure Limit :	1 ppm	Odour Threshold :	50 ppm	
TLV (ACGIH) :	1 ppm	LC50 (rat) mg/kg :	1462 ppm/4 hr	
NFPA Hazard	Health	Flammability	Reactivity	Special
Signals :	3	4	3	

6. PREVENTIVE MEASURES

Personal Protective Equipment :	Provide air-supplied mask, safety goggles, face shield, rubber shoes and hand gloves.
Handling :	Remove contaminated clothing and wash before reuse. Avoid contact with eyes, skin, and clothing. Avoid ingestion and inhalation.
Storage :	Keep in under positive nitrogen pressure and preferably refrigerated. Store away from heat , flame and sparks.
Precautions :	Avoid contact with liquid or vapours.

7. EMERGENCY / FIRST AID MEASURES

FIRE :

Fire Extinguishing Media : Extinguish with alcohol foam, carbon dioxide, dry chemical or water spray, fog, or foam.

Special Procedure: Move container from fire area if you can do so without risk. Stay away from ends of tanks. Fight fire from maximum distance. For massive fire in cargo area, use unmanned hose holder or monitor nozzles.

Unusual Hazards: Severe explosion hazard when exposed to flame.

EXPOSURE :

First Aid Measure:

Inhalation : Remove from exposure to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical aid immediately.

Skin : Flush skin with plenty of soap and water for at least 15 minutes while removing contaminated clothing and shoes. Remove contaminated clothing and shoes. Get medical aid.

Eyes : Irrigate exposed eyes with copious amounts of tepid water for at least 15 minutes. If irritation, pain, swelling, lacrimation, or photophobia persist, the patient should be seen in a health care facility.

Ingestion : If victim is conscious and alert, give 2-4 cupfuls of milk or water. Get medical aid immediately.

**Antidotes /
Dosages :**

SPILLS :

Steps to be taken: Shut off leaks if without risk. Contain the leaking liquid with sand or earth. Shut off all possible sources of ignition and increase ventilation.

Waste Disposal Method: Place in suitable containers for disposal. Allow to burn under control condition.

8. ADDITIONAL INFORMATION / REFERENCES

A very dangerous fire hazard when exposed to heat or flame. Severe explosion hazard when exposed to flame. A suspected human carcinogen

9. MANUFACTURERS / SUPPLIERS DATA

Name of Firm :

Contact Person
in Emergency :

Mailing Address :

Local Bodies Involved :

Telephone / Telex Nos :

Standard Packing :

Telegraphic Address :

Trem Card Details / Ref :

Others:

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MATERIAL SAFETY DATA SHEET

MSDS 2008 ©

Isopropyl alcohol

1. CHEMICAL IDENTITY

Chemical Id : 334 Chemical Classification : Flammable, Irritant

Chemical Name : Isopropyl alcohol Trade Name :

Synonyms : Isopropanol, 2-Propanol, Dimethyl carbinol, Sec-Propyl alcohol

Formula : C₃H₈O C.A.S. No: 67-63-0 U.N. No: 1219

Regulated Identification :

Shipping Name : Isopropyl alcohol Hazchem No. : 2YE

Codes / Label : Class 3, Flammable, Irritant

Hazardous Waste ID No : 5

Hazardous Ingredients	C.A.S. No.	Hazardous Ingredients	C.A.S. No.
1. Isopropyl alcohol	67-63-0	3.	
2.		4.	

2. PHYSICAL / CHEMICAL DATA

Boiling Pt / Range °C : 82.5 Physical State : Liquid Appearance : Colourless

Melting / Freezing Pt °C : -88.5 Vapour Pressure @ 35°C mm Hg : 45.4 mm Hg @ 25 deg C Odour : Alcohol odour

Vapour Density (Air =1) : 2.1 Solubility in water at 30°C : 1.00X10+6 @ 25 deg C Others : Miscible with chloroform, ether, alcohol.

Specific Gravity (Water =1) : 0.78505 @ 20 deg C/4 deg C pH : Neutral

3. FIRE / EXPLOSION HAZARD DATA

Flammability : Yes LEL % : 2 Flash Point °C (OC) : 18.5

TDG Flammability : 3 UEL % : 12.7 Flash Point °C (CC) : 11.6

Autoignition Temperature °C : 455.5
Explosion Sensitivity to Impact : Stable
Explosion Sensitivity to Static Electricity :
Hazardous Combustion Products : Emits acrid smoke and fumes.
Hazardous Polymerization : Will not occur.

Combustible Liquid : Yes Explosive Material : No Corrosive Material : No
Flammable Material : Yes Oxidiser : No Others :
Pyrophoric Material : No Organic Peroxide : No

4. REACTIVITY DATA

Chemical Stability : Stable
Incompatibility With other Material : Strong oxidisers
Reactivity : Reacts vigorously with oxidising materials. Reacts with barium perchlorate to form highly explosive propyl perchlorates. Violent explosive reaction when heated with isopropoxide + crotonaldehyde.
Hazardous Reaction Products : Reacts with air to form dangerous peroxides and with oxygen to form dangerously unstable peroxides. Reacts with barium perchlorate to form highly explosive propyl perchlorate.

5. HEALTH HAZARD DATA

Routes of entry : Inhalation, Ingestion, Skin and Eyes

Effects of Exposure / Symptoms : Vapours cause mild irritation of eyes and upper respiratory tracts. High concentrations may be anesthetic. Liquid irritates eyes and may cause injury. Harmless to skin. If ingested , causes drunkenness and vomiting.

Emergency Treatment :

Inhalation : Get medical aid immediately. Remove from exposure to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen.

Skin : Get medical aid if irritation develops or persists. Flush skin with plenty of soap and water.

Eyes : First check the victim for contact lenses and remove if present. Flush victim's eyes with water or normal saline solution for 20 to 30 minutes while simultaneously calling a hospital or poison control center.

Ingestion : If victim is conscious and alert, give 2-4 cupfuls of milk or water. Never give anything by mouth to an unconscious person. Get medical aid immediately. Induce vomiting by giving one teaspoon of syrup of Ipecac.

LD50 (oral-rat) mg/kg :	5045	STEL :	500 ppm (1225 mg/m3)	
Permissible Exposure Limit :	400 ppm (980 mg/m3)	Odour Threshold :	90 mg/m3	
TLV (ACGIH) :	400 ppm (980 mg/m3)	LC50 (rat) mg/kg :		
NFPA Hazard	Health	Flammability	Reactivity	Special
Signals :	1	3	0	

6. PREVENTIVE MEASURES

Personal Protective Equipment : Avoid contact with liquid and vapours. Do not eat or drink at work place. Provide organic vapour canister or air supplied mask, face shield, rubber hand gloves, apron and shoes.

Handling : Wash thoroughly after handling. Wash hands before eating. Use only in a well ventilated area. Use spark-proof tools and explosion proof equipment. Empty containers retain product residue, (liquid and/or vapor), and can be dangerous. Do not get on skin or in eyes. Avoid ingestion and inhalation. Do not pressurize, cut, weld, braze, solder, drill, grind, or expose empty containers to heat, sparks or open flames.

Storage : Store in a well ventilated area, free from heat, flame oxidisers. Keep in air tight containers.

Precautions :

7. EMERGENCY / FIRST AID MEASURES

FIRE :

Fire Extinguishing Media : Alcohol foam, CO2, dry chemical powder.

Special Procedure: Keep the containers cool by spraying water if exposed to heat or flame.

Unusual Hazards: Flashback along vapour trail may occur.

EXPOSURE :

First Aid Measure:

Inhalation : Get medical aid immediately. Remove from exposure to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen.

Skin : Get medical aid if irritation develops or persists. Flush skin with plenty of soap and water.

Eyes : First check the victim for contact lenses and remove if present. Flush victim's eyes with water or normal saline solution for 20 to 30 minutes while simultaneously calling a hospital or poison control center.

Ingestion : If victim is conscious and alert, give 2-4 cupfuls of milk or water. Never give anything by mouth to an unconscious person. Get medical aid immediately. Induce vomiting by giving one teaspoon of syrup of Ipecac.

**Antidotes /
Dosages :**

SPILLS :

Steps to be taken: Shut off leaks if without risk. Contain spillage on sand or earth. Wash the surfaces with water and soap.

Waste Disposal Method: Seal all waste in vapour tight plastic bags for eventual disposal.

8. ADDITIONAL INFORMATION / REFERENCES

9. MANUFACTURERS / SUPPLIERS DATA

Name of Firm :	Contact Person in Emergency :
Mailing Address :	Local Bodies Involved :
Telephone / Telex Nos :	Standard Packing :
Telegraphic Address :	Trem Card Details / Ref :
Others:	

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MATERIAL SAFETY DATA SHEET

MSDS 2008 ©

Potassium chlorate

1. CHEMICAL IDENTITY

Chemical Id : 520 Chemical Classification : Oxidizing
Chemical Name : Potassium chlorate Trade Name :
Synonyms : Chlorate of potassium, Chlorate of potash, Potassium oxy muriate, Potcrate, Berthollet's sal

Formula : KClO3 C.A.S. No: 3811-04-9 U.N. No: 1485

Regulated Identification :

Shipping Name : Potassium chlorate Hazchem No. : 1Y
Codes / Label : Class 5.1, Oxidizing
Hazardous Waste ID No : 8

Table with 4 columns: Hazardous Ingredients, C.A.S. No., Hazardous Ingredients, C.A.S. No. containing entries for Potassium chlorate.

2. PHYSICAL / CHEMICAL DATA

Boiling Pt / Range °C : 400 (Decomposes) Physical State : Solid Appearance : A white crystalline solid.

Melting / Freezing Pt °C : 368 Vapour Pressure @ 35°C mm Hg : Odour : Odourless

Vapour Density (Air =1) : 4.2 Solubility in water at 30°C : 70,000 mg/l @ 25 deg C Others : Soluble in glycerol. Insoluble in alcohol.

Specific Gravity (Water =1) : 2.320 at 20°C pH :

3. FIRE / EXPLOSION HAZARD DATA

Flammability : No LEL % : Flash Point °C (OC) :

TDG Flammability : 5.1 UEL % : Flash Point °C (CC) : 400

Autoignition Temperature °C :

Explosion Sensitivity to Impact : Stable

Explosion Sensitivity to Static Electricity : Stable

Hazardous Combustion Products : Toxic fumes are formed in fires.

Hazardous Polymerization : Will not occur.

Combustible Liquid : No Explosive Material : No Corrosive Material : No

Flammable Material : No Oxidiser : Yes Others :

Pyrophoric Material : No Organic Peroxide : No

4. REACTIVITY DATA

Chemical Stability : Stable

Incompatibility With other Material : Reducing agents

Reactivity : Decomposes on heating above 400°C, on contact with strong acids producing toxic fumes including chlorine dioxide, chlorine fumes and producing oxygen. Violent reaction or ignition with NH₃, NH₄CL, NH₄ + salts, (NH₄) Sb₂S₃, As, barium hypophosphite, calcium hypophosphite, CaS, charcoal, gallic acid, HI, lactos, organic matter.

Hazardous Reaction Products : Reacts with fluorine to form the explosive gas fluorine perchlorate.

5. HEALTH HAZARD DATA

Routes of entry : Inhalation, Ingestion, Skin & Eyes.

Effects of Exposure / Symptoms : Inhalation : Causes irritation of throat. Ingestion: Causes abdominal pain, nausea, vomiting, cyanosis collapse. Skin & eyes: Causes severe irritation.

Emergency Treatment :

Inhalation : Remove the victim to fresh air area and apply artificial respiration if needed. If the victim is conscious have him drink plenty of water and induce vomiting. In case of convulsions seek medical aid immediately.

Skin : Get medical aid immediately. Flush skin with plenty of soap and water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse.

Eyes : Flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical aid.

Ingestion : Do not induce vomiting. If victim is conscious and alert, give 2-4 cupfuls of milk or water. Never give anything by mouth to an unconscious person. Get medical aid immediately.

LD50 (oral-rat) mg/kg :		STEL :	
Permissible Exposure Limit :		Odour Threshold :	
TLV (ACGIH) :		LC50 (rat) mg/kg :	
NFPA Hazard	Health	Flammability	Reactivity
Signals :	2	0	1
			Special
			0

6. PREVENTIVE MEASURES

Personal Protective Equipment : Avoid contact with solid or dust. Provide dust mask, rubber hand gloves, side covered safety goggles I face shield, body overclothing, shoes.

Handling : Wash thoroughly after handling. Remove contaminated clothing and wash before reuse. Use with adequate ventilation. Minimize dust generation and accumulation. Keep container tightly closed. Avoid contact with heat, sparks and flame. Avoid contact with clothing and other combustible materials. Do not get on skin or in eyes. Avoid ingestion and inhalation.

Storage : Keep away from heat, sparks, and flame. Do not store near combustible materials. Store in a cool, dry place. Keep away from reducing agents.

Precautions :

7. EMERGENCY / FIRST AID MEASURES

FIRE :

Fire Extinguishing Media :

Special Procedure: Keep the containers cool by spraying water if exposed to heat or flame.

Unusual Hazards: Poisonous gases may be produced.

EXPOSURE :

First Aid Measure:

Inhalation : Remove the victim to fresh air area and apply artificial respiration if needed. If the victim is conscious have him drink plenty of water and induce vomiting. In case of convulsions seek medical aid immediately.

Skin : Get medical aid immediately. Flush skin with plenty of soap and water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse.

Eyes : Flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical aid.

Ingestion : Do not induce vomiting. If victim is conscious and alert, give 2-4 cupfuls of milk or water. Never give anything by mouth to an unconscious person. Get medical aid immediately.

Antidotes / Dosages :

SPILLS :

Steps to be taken: Sweep the spillage without making dust and wash the area with water and soap.

Waste Disposal Method: Seal all the waste in vapour tight plastic bags for eventual disposal

8. ADDITIONAL INFORMATION / REFERENCES

A powerful oxidiser and reactive material. It has been the cause of many industrial explosions. May explode on heating. Poisonous gases are produced in fire and also oxygen which increases the severity of fire.

9. MANUFACTURERS / SUPPLIERS DATA

Name of Firm :

Contact Person
in Emergency :

Mailing Address :

Local Bodies Involved :

Telephone / Telex Nos :

Standard Packing :

Telegraphic Address :

Trem Card Details / Ref :

Others:

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Sulphuric acid

1. CHEMICAL IDENTITY

Chemical Id : 591 Chemical Classification : Corrosive
Chemical Name : Sulphuric acid Trade Name :
Synonyms : Oil of vitriol, Battery acid, Chamber acid, Spent sulphuric acid

Formula : H₂SO₄ C.A.S. No: 7664-93-9 U.N. No: 1830

Regulated Identification :

Shipping Name : Sulphuric acid Hazchem No. : 2P
Codes / Label : Class 8, Corrosive
Hazardous Waste ID No : 16

Hazardous Ingredients	C.A.S. No.	Hazardous Ingredients	C.A.S. No.
-----------------------	------------	-----------------------	------------

1. Sulphuric acid	7664-93-9	3.	
2.		4.	

2. PHYSICAL / CHEMICAL DATA

Boiling Pt / Range °C : about 290 Physical State : Liquid Appearance : Colorless to dark brown, oily liquid

Melting / Freezing Pt °C : 10.31 Vapour Pressure @ 35°C mm Hg : 5.93X10⁻⁵ mm Hg at 25 deg C Odour : Odourless, choking odour when hot.

Vapour Density (Air =1) : 3.4 Solubility in water at 30°C : Miscible Others : Miscible with alcohol

Specific Gravity (Water =1) : 1.8 g/cm³ pH : 1 N sol= 0.3, 0.1 N sol= 1.2, 0.01 N sol= 2.1

3. FIRE / EXPLOSION HAZARD DATA

Flammability : No LEL % : Flash Point °C (OC) :

TDG Flammability : UEL % : Flash Point °C (CC) :

Autoignition Temperature °C :

Explosion Sensitivity to Impact : Stable

Explosion Sensitivity to Static Electricity : Stable

Hazardous Combustion Products : Emits toxic fumes of SO_x.

Hazardous Polymerization : Will not occur.

Combustible Liquid : No Explosive Material : No Corrosive Material : Yes

Flammable Material : No Oxidiser : Yes Others :

Pyrophoric Material : No Organic Peroxide : No

4. REACTIVITY DATA

Chemical Stability : Stable

Incompatibility With other Material : Organic chlorates, carbides, fulminates, picrates, metals

Reactivity : Powerful acidic oxidiser, ignites or explodes on contact with many materials like acetic acid, acetone cyanohydrin, (acetone + HNO₃), (acetone + K₂CR₂O₇), acetonitrile, acrolein, acrylonitrile.

Hazardous Reaction Products : Reacts with many metals to form flammable hydrogen gas which forms explosive mixtures with air. Reacts with water to produce heat and toxic and corrosive fumes.

5. HEALTH HAZARD DATA

Routes of entry : Inhalation, Ingestion, Eyes and Skin

Effects of Exposure / Symptoms : Inhalation of vapour from hot cone, acid may cause injury to lungs. Swallowing may cause injury or death. Contact with skin or eyes causes severe burns. Very dilute solution. causes dermatitis. Exposure causes bronchitis.

Emergency Treatment :

Inhalation : Observe victim for delayed pulmonary reaction. Move him to fresh air. Give artificial respiration.

Skin : Remove clothes and shoes. Do not use oil or ointment. Flush affected area with plenty of water.

Eyes : Wash with plenty of water for 15 mins.

Ingestion : Give plenty of water to drink, do not induce vomiting. Seek medical aid.

LD50 (oral-rat) mg/kg : 2140 mg/kg

STEL :

Permissible Exposure Limit : 1 mg/m³

Odour Threshold : 1.0 mg/m³

TLV (ACGIH) : 0.2 mg/m³

LC50 (rat) mg/kg : 347 ppm/1 hr.

NFPA Hazard	Health	Flammability	Reactivity	Special
Signals :	3	0	2	W

6. PREVENTIVE MEASURES

Personal Protective Equipment : Do not eat or drink at work place. Provide safety shower, eye wash basin, safety goggles /face shield, respirator (self-contained or air-line), rubber shoes, rubber gloves, rubber apron.

Handling : Wash thoroughly after handling. Remove contaminated clothing and wash before reuse. Do not get in eyes, on skin, or on clothing. Keep container tightly closed. Do not ingest or inhale. Do not allow contact with water. Use only in a chemical fume hood. Discard contaminated shoes. Keep from contact with moist air and steam.

Storage : Do not store near combustible materials. Keep container closed when not in use. Store in a cool, dry, well-ventilated area away from incompatible substances. Keep away from water. Corrosives area. Do not store near alkaline substances. Store protected from moisture.

Precautions : Avoid contact with the material

7. EMERGENCY / FIRST AID MEASURES

FIRE :

Fire Extinguishing Media : Dry chemical or carbon dioxide. Do not use water.

Special Procedure: Keep the containers cool by spraying water if exposed to heat or flame.

Unusual Hazards: Poisonous gas may be produced.

EXPOSURE :

First Aid Measure:

Inhaltion : Observe victim for delayed pulmonary reaction. Move him to fresh air. Give artificial respiration.

Skin : Remove clothes and shoes. Do not use oil or ointment. Flush affected area with plenty of water.

Eyes : Wash with plenty of water for 15 mins.

Ingestion : Give plenty of water to drink, do not induce vomiting. Seek medical aid.

Antidotes / Dosages :

SPILLS :

Steps to be taken: Shut off leaks if without risk. Contain leaking liquid on sand or earth. Do not absorb on sawdust or other combustibles.

Waste Disposal Method:

8. ADDITIONAL INFORMATION / REFERENCES

Sensitivities to sulphuric acid mists or vapours vary with individuals. Contact with water creates violent reaction generating much heat and splattering of hot acid. Attacks many metals, liberating hydrogen which is inflammable and forms explosive mixture with air.

9. MANUFACTURERS / SUPPLIERS DATA

Name of Firm :

Contact Person in Emergency :

Mailing Address :

Local Bodies Involved :

Telephone / Telex Nos :

Standard Packing :

Telegraphic Address :

Trem Card Details / Ref :

Others:

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