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ABSTRACT

One of the major challenges facing people committed to Teaching Safety in High Schools, Colleges, and Universities is keeping up with both the wide range of relevant technical information about potential hazards (ranging from fire protection to chemical hazards to biological issues) and the ever-changing world of safety regulations and standards. It is unlikely that a single individual can keep abreast of this aspect of the science curriculum without access to a library of safety information and a well-developed network of peers with similar interests. Fortunately, the development of the Internet provides a cheap and convenient way of developing and maintaining these resources. This paper will discuss how the Internet can be used as a safety information resource, with a focus on laboratory safety resources. (Author)

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Support from Afar: Using Chemical Safety Information on the Internet

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One of the major challenges facing people committed to Teaching Safety in High Schools, Colleges, and Universities is keeping up with both the wide range of relevant technical information about **potential hazards** (ranging from fire protection to chemical hazards to biological issues) and the ever-changing world of **safety regulations and standards**. It is unlikely that a single individual can keep abreast of this aspect of the science curriculum without access to a **library** of safety information and a well-developed **network of peers** with similar interests.

Fortunately, the development of the Internet provides a cheap and convenient way of developing and maintaining these resources. This paper will discuss how the Internet can be used as a safety information resource, with a focus on laboratory safety resources.

Using Internet Information

The Internet contains a continuously growing and changing collection of information. This, plus the speed and low cost of searching the Internet, make it a useful tool for safety information, including safety research and networking with colleagues. This section describes Internet information in a general way in order to develop a plan for using it as effectively as possible. The key point to remember about all forms of electronic information is that it is truly "support from afar" - that is **the people who write the information are not familiar with your local situation and cannot be expected to deliver definitive opinions or advice.** They can help you identify the right questions and find answers to them, but your professional judgement will be the final determinant about the appropriate course of action.

Internet Information

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There are two basic types of information available on the Internet. Which type of information will be more valuable to you will depend on your particular needs.

The first type of information is the collection of **public file libraries** on the World Wide Web. These libraries have been put together for various purposes by academic institutions, commercial and non-commercial organizations and government agencies. You visit these libraries by using software tools called Web browsers (Netscape, Explorer, etc.).

The second type of Internet information is **informal discussions** between people of similar interests and of varying expertise. These **interactive discussions** are organized around particular subjects and discussion groups, which operate through as *e-mail lists* or *newsgroups*. The information in these discussions is less formal than file libraries on the web, and thus has different stengths and weaknesses when compared to the file libraries.

Tools for Exploring the Web

The file libraries of the World Wide Web are interconnected by links from one site to another. However, finding the right place to start your search for safety information is not always obvious. Fortunately, two tools have developed to assist with this problem.

Web Directories

Exploring the Internet has been made much easierby the development of web directories. These are web sites which list a large number of general interest Internet sites, organized into subject categories. The most popular of these directories is Yahoo (http://www.yahoo.com). Yahoo's home page lists a variety of subject areas. Clicking on one of these titles leads to subcategories and then to a list of web sites that provide information about these subject areas. By using Yahoo as a starting point, you can get a sense of the capabilities of the Web and the type of information available there.

Search Engines

Usually, however, you are looking for information on a specific subject. Using a subject based directory such as Yahoo is not the most efficient way of approaching this sort of search on the Internet. Rather, you want to be able to specify particular words that you want to find and have the computer find files that contain those words for you. This requires the use of a web search engine. One of the most powerful search engines currently available on the net is

Google, found at http://www.google.com.

Conducting Web Searches

The difference between search engines and web directories is best given by example. A search for the words "*hazardous materials*" with Yahoo produced 151 hits. Google produced about 1,100,000. Yahoo found sites that specifically listed "*hazardous materials*" as keywords associated with their site - primarily commercial producers of hazardous materials handling equipment and training courses. Google found many other files containing the words "*hazardous materials*", including job descriptions, safety plans and information about specific chemicals.

Remember, that although Google can generate a large number of hits for a particular search, it is important to remember that Google does not represent a "netwide" search. The rapidly changing nature of web sites makes it impossible for even the most powerful computers to track them with complete accuracy. Google is covers only a portion of all the web sites that are available, and many of its references are out of date. In addition, the "relevance rankings" that determine which web sites are listed at the top of a search are influenced by a variety of factors. **Careful selection of keywords and use of subject-specific indices will increase the usefulness of your searches.**

Refining Your Search

As the "*hazardous materials*" example demonstrates, simply putting in the first words that occur to you to search on can be rather inefficient. The first step in refining your searches involves phrasing your question in way that you are clear what answer you need. This is often rather easy (*does OSHA have any regulations that specifically cover the use of this chemical?*), but other times this can be more difficult (*is this workplace situation a confined space?*).

If you are having trouble coming up with a question that describes your need, it may be better to think up the name of a magazine article that would be just what you need. A **four or five word phrase** is a good place to start your search. It is important to think about possible other meanings for the words you select. For example, "*safety*" may refer to chemical concerns in your mind, while it refers to law enforcement issues in many other people's minds. An ambiguous word such as this is usually a poor choice to search for.

An Internet Search Strategy

With the considerations described above in mind, a strategy for effective use of the Internet as an information library can be developed. However, remember that **it is easy to get distracted from the question you are trying to answer** while using the Internet. In order to conduct research on the Internet efficiently, it is important to have a step by step search strategy in mind while you are looking. This strategy should follow these steps:

1. Define your question

Consider whether the Internet is the best place to look for the information you're interested in. Information that does not change often or is of wide application is probably available on paper, in a library. On the other hand, for very specific or very new information, the Internet can be an unmatched resource.

a) Decide what kind of information you're looking for.

Looking for a specific piece of **data** (e.g. *the flashpoint of acetone*) is different from looking for a **technical interpretation** of that data (*use of acetone requires adequate ventilation due to its flammability*), which is different from looking for a **rule of thumb** (*use acetone in a fume hood if you're using more than 500 milliliters*). These different types of information will be found with different strategies in different places on the Net.

Formal databases: For specific pieces of data, formal databases are the best places to look. There are a variety of such sources, such as material safety data sheet collections and databases containing government regulations. These databases are usually indexed to allow for keyword searches. Selecting the keywords carefully will make your search more efficient.

Professional interpretations: For technical interpretations of raw data, the best places to look are in collections of policies and procedures that are available on line. Such collections are usually associated with policy libraries that companies and institutions put on-line for the convenience of their employees or customers. A good way to find these documents is to use the Internet search engines. For this search, use keywords that apply as specifically as possible to your item of interest. Until you have refined your search terms, be prepared for many "false hits" - returns that are of no interest - for these searches. However, you are also likely to find several useful unexpected sources as you use the search engines.

Informal information: Because informal knowledge requires technical expertise to apply appropriately, it is unlikely to be found in more static information sources on the Net such databases or collections of interpretations. However, the Internet has many informal information collections available in

the archives of electronic mailing lists that operate on the Net. These are the first places to check fo rrules of thumb and how they are applied. The SAFETY archives (http://list.uvm.edu/archives/saf ety.html) are a good place to start such a search. Even if you do not find the information you are after there, you may find a reference to another Internet resource that has the information you are looking for.

Remember, deciding what kind of information you are looking for will be important in determining what you find. If you aren't sure what the question is or should be, discuss the situation with someone else (perhaps by e-mail) is an appropriate first step.

b) Select keywords to search for

The result of the steps involved in refining your question should be a **set of keywords** which you want to search for. For example, if you are simply after the flashpoint of acetone, "*flashpoint*" and "*acetone*" are appropriate keywords. Whereas if you are concerned about ventilation requirements for using acetone, "*flashpoint*" is not likely to be helpful and "*flammable liquid*" may be a reasonable substitute for "*acetone*". You will use these keywords in performing searches at various web sites that are likely to contain appropriate information.

Keywords need to be as specific as possible while allowing for variations in terminology that are likely to arise. Using keywords such as "*safety*" or "*health*" are likely to produce too many sites for most purposes. Most web site indexes allow you to use logical connectors such as "and", "or" and "not" when conducting your search. This can help you refine your keyword search until you have about **20-40 hits**. Lists of hits longer than that are probably too long to effectively search and an indication that your keyword strategy should be refined.

2. Select a web site to start your search with

Once you have a good idea of what kind of information you need to answer your question and what keywords are likely to be associated with that information, you are ready to start searching the file libraries on the Net. This is the time to start with a hotlist of web sites that you are familiar with. The beginning of such a hot list is given at the bottom of this paper.

It is best to test out your initial set of keywords by using it with one search engine with the idea of seeing how many useful responses it produces before using other search engines. In this phase of your research, it is better to start with a more subject-focused index. Fortunately, in the occupational and environmental health and safety area there are a few indexes established

specifically focused at this area. At http://list.uvm.edu/archives/saf ety.html, there is an index to the SAFETY e-mail list archives. This database consists of over 75,000 e-mail messages discussing a wide variety of safety issues. As well as providing access to the discussions by SAFETY participants, this database provides a good way to refine your search strategy in a limited universe of subjects. The advantage of using this database is that the keywords are likely to be used in the same context that you are thinking of them, so the results are likely to be germane to your question.

By searching in this database, you can see if the phrase you chose is commonly used by other safety professionals to describe the situation you are thinking of. If the results are not related to your specific concerns, you can change the words you are using until the results are more appropriate. Once the keywords are refined in this search, they are likely to be more effective when searching larger databases like Google.

In general, more than 20 hits in a search indicate that the search needs to be further refined. Various search engines provide different ways of manipulating the keywords you have decided to use. For example, large databases usually require that all of the keywords you enter to be included in the file for it to be considered a relevant hit. This is because of the wide variety of subjects they cover creates many hits on an individual word. The details of composing these searches are usually found at the search engine of the web site.

3. Ask a discussion group

If your search of the file libraries fail to produce the information you're after, or you're looking for more informal information than is available at web sites, it is time to **post a request for information** to an appropriate e-mail list or a newsgroup. To increase your chances of success when you ask a question of a list, be sure to follow netiquette guidelines appropriate to that group.

First, check the archives of the group's discussion to see if it is the right group to ask your question of and to be sure that it isn't a question that has been asked and answered repeatedly. When framing the question, be as specific as possible in asking the question, so those who read it can determine what type of answers are appropriate.

4. Check your information!

Always be sure to confirm information you've gotten from the Net before you act on it. Remember that the information available on the Internet was written based on someone else's assumptions, in ignorance of the details of your particular situation. There may be specific, critical differences between the situation that you face and that of the person writing the information. The

effort involved in confirming net information may range from **asking yourself** "*Does this make sense?*", to checking a **paper reference source**, to **consulting with a professional** with more expertise than yours.

Networking on the Network

In addition to the ability to access file libraries for research purposes, the Internet provides significant opportunities for professional networking. As is the case with any professional network, the Internet can help you: **learn more** about the basic technical issues of your field; **get tips** about approaching specific problems; **be aware of new issues** developing in the field; find prospective partners or consultants; and celebrate (or commiserate) with others in similar circumstances. The advantage of the Internet for networking activities is that it provides a convenient way to have ongoing discussions with geographically dispersed colleagues. These discussions can take place either in a group or individually. This section describes some of the considerations involved in using the Internet for this purpose.

General Considerations

As the Internet has grown in popularity, the time required to remain current with it has increased as well. While the technical details of using e-mail and web sites have simplified significantly in the 1990's, the task of wading through all the possibly relevant information sources has become more complex. It is important that you have a clear idea of what your goals for using the Internet are, otherwise you may find that you can devote a lot of time to using it without much pay back.

Using the Internet to network with other people with similar interests can minimize this learning curve. The benefits of networking on the Internet are that it is a low-budget, low-travel way to be involved in your professional community. Productive professional relationships can be developed with a wide range of people without face-to-face meetings. These relationships usually start in discussion areas such as e-mail lists or newsgroups. They often develop into private correspondence that is able to be more speculative than public discussions.

The primary costs of developing a network of professional contacts over the Internet are time, patience and a network connection. Fortunately, a powerful Internet connection is not required, as most networking happens via e-mail with low graphical content and small files. A good place to find more information about the process of networking and how it is affected by the Internet is *The Network Observer*, which is written by Phil Agre. He has written several interesting articles on this topic. More information can be found on the Web at http://dlis.gseis.ucla.e du/people/pagre/tno.html

Finding Discussion Groups

There are thousands of discussions groups operating on the Internet, either through e-mail or on newsgroups, and sometimes with a gateway between both forms. Some are formally organized with charters; others are simply collections of e-mail addresses being held together by someone's personal e-mail software. Finding discussions that are of most interest to you can be a bit of a challenge. However, there are several good places to check.

The first place to check is trade magazines and professional journals. "What's New on the Internet?" is a favorite topic for articles. These articles usually include both a list of web sites relevant to the profession and discussion groups. It is important to note what type of forum is being discussed when reading these lists; using a newsgroup is significantly different than using an e-mail list from the computer point of view.

Another place to look for relevant discussions are the various "lists of lists" that exist on the Internet. For the health and safety field, the first place to start is at the Canadian Centre for Occupational Health and Safety's Internet Resource list of e-mail groups.

Remember that formal descriptions of discussions groups can often be significantly different from the actual subjects talked about within the group. Therefore, it is a good idea to watch the list traffic for a while to get a sense of the tone and expertise of the list's participants before asking a question of the group.

For laboratory safety issues, there are three prominent lists:

The **SAFETY** list (safety@list.uvm.edu) is one of the oldest and most active lists on the Internet. Its audience consists of about 3000 safety professionals from a wide variety of fields and settings, 80% of which are U.S. based.

The **LABSAFETY-L** (labsafety-l@siu.edu) is a discussion list for members of Laboratory Safety Workshop and National Association of Chemical Hygiene Officers interested in in laboratory health, safety and regulatory issues.

The **BIOSAFTY** (biosafty@mitvma.mit.edu) is a list for biosafety discussions, of particular importance since the terrorism related events of 2001.

Conclusion

The Internet can be a valuable source of safety information for people responsible for managing the safety of the a classroom setting that uses hazardous materials. Practice and care must be used, however, to assure that the information collected from the Internet is **accurate and appropriately**

applied to the situation at hand. The limitations of the information "from afar" must be kept in mind at all times. Fortunately, determining those limitations is made signifincantly easier by e-mail groups that are provide an interested audience of peers to discuss your concerns with.

Leading Health and Safety Web Sites

(current as of September, 2002)

Biosafety Resource Page	information about biological hazards in the lab	http://www.absa.org
Canadian Centre for Occupational Health and Safety	includes databases and general guidance on a wide range of health and safety issues	http://www.ccohs.ca
ChemFinder	raw chemical information database	http://chemfinder.camsoft.com/
Documentation for Immediately Dangerous to Life or Health Concentrations	information about acute hazards of chemicals from NIOSH	http://www.cdc.gov/niosh/idlh/idlh-1.html
Environmental Protection Agency	regulatory and background information about hazardous chemical use and disposal	http://www.epa.gov
Health Canada,	general biosafety	

Laboratory Biosafety Guidelines	including MSDS's for biological agents	http://www.hc-sc.gc.ca/hpb /lcdc/biosafty/docs/
NIOSH Criteria Documents	Detailed research reports on the health effects of about 100 chemicals	http://www.cdc.gov/niosh/critdoc2. html
North American Emergency Response Guidebook (1996)	Regulatory information about the transport of hazardous chemicals	http://www.tc.gc.ca/ canutec/erg_gmu/erg2000_menu.htm
Oklahoma State University Online Training Modules	presentations on a variety of safety issues	http://www.pp.okstate.edu/ ehs/modules/home.htm
Occupational Safety and Health Administration	regulatory information about use of hazardous materials in workplaces	http://www.osha.gov/
Radiation and Health Physics Home Page	information about the use of radioactive materials	http://www.umich.edu/~radinfo/
SAFETY e-mail list archives	discussions of general safety issues - over 60,000 messages in a searchable database	http://list.uvm.edu/archives/saf ety.html
	a variety of reference	

Seton Identification Products	information, including regulatory and material safety data sheet collections	http://www.setonresourcecenter.com
Young Worker Awareness, Workplace Health and Safety Agency, Ontario, Canada	information aimed at young employees in the workplace	http://www.youngworker.ca/english/index.htm

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