Final Report

Small Business Safety Officer

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LIST OF ABBREVIATIONS

SBSO	Small Business Safety Officer
NIOSH	National Institute of Occupational Safety and Health
OSHA	Occupational Safety and Health Administration
SBA	Small Business Administration
MSD	Musculoskeletal Disorder
MSDS	Material Safety Data Sheets
PWP	Personalized Web Portals
CGI	Common Gateway Interface
HTML	Hypertext Markup Language
TUR	Toxics Use Reduction
TURI	Toxics Use Reduction Institute
P2OASys	Pollution Prevention Options Analysis System
HAZCOM	Hazard Communications
EPA	Environmental Protection Agency
NBEN	Northeast Business Environmental Network
CHO	Chemical Hygiene Officer
CFR	Code of the Federal Register

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1.0 ABSTRACT

Phase I Goals

The vision of "Small Business Safety Officer" is to provide a cost-savings portal for small businesses to integrate pollution prevention, cheaper and safer process alternatives and worker health and safety compliance into their business process. The specific goal of the Phase I program was to develop and evaluate a prototype containing a web-based expert-assisted system to generate an Intranet site to perform the following functions: determine applicable OSHA regulations; generate chemical hygiene and other safety plans; formulate policies such as chemical purchase, storage and disposal; perform medical recordkeeping; develop an accident and event reporting archive; create and operate a safety committee and emergency response team; provide ergonomics advice; generate forms; and host several advisor capabilities to provide safer and cheaper process alternatives. The prototype was to also create a general access safety web page to provide all employees with important safety information.

Accomplishments

A complete prototype of Small Business Safety Officer has been developed. The fundamental architecture is modeled after commercially-available tax preparation software that employs an interview process to determine the applicable IRS regulations and specific wizards to help prepare the forms. The design here is also an extensive interview to determine the applicable OSHA regulations with wizards to help prepare compliance documentation such as a Chemical Hygiene Plan. However, Small Business Safety Officer goes well beyond document preparation. The principal products generated by Small Business Safety Officer are safety and health websites populated with documents, links and tools to allow companies to fully implement and integrate worker safety and health into their overall business processes.

The Phase I Small Business Safety Officer prototype contains a complete end-to-end, fully populated architecture featuring the Initial Interview, a sample generated Public (Employee) Website, and a sample generated Administrative Website. The capabilities and tools incorporated in the Phase I prototype of Small Business Safety Officer greatly exceed what was promised in the proposal. This occurred in response to our on-site tests and evaluations with two New Hampshire businesses, presentation of the prototype to more than 30 New England businesses and on-line review of the prototype by thirteen companies. These interactions, which we expanded in response to the Summary Reviews, provided us with ideas and essential capabilities we believe will help make Small Business Safety Officer a successful commercial product. Some of these capabilities include additional advisor tools such as P2OASys, an alternative chemical process selection tool based on safety and health issues, Greenlist, an information resource tool developed by the Toxics Use Reduction Institute, and P2Finance, an economics/process alternative package developed by the EPA. Some features have been directly suggested by our on-site collaborators such as a means to interface to their own proprietary databases and extract/forward key data fields, on0line forms for toxicity data and tools to help find toxicity data across the Web.

Our interactions with the on-site collaborations and broad-based review of the product have been highly successful and we will continue these efforts in Phase II to include complete end-to-end installation and site testing at multiple firms. Our Phase I product, however, has

already proven highly successful as one of our site testers, Kluber Lubrication in Londonderry NH, has asked for us to add their logo and Corporate color scheme to the Employee and Administrative sites as they currently exist and make them available to their employees through a direct Internet connection to our server.

Through our Phase I R&D effort, we have developed several innovations for Small Business Safety Officer to ensure that companies will not only use it initially but they will be highly motivated to use it regularly and fully integrate it into their overall business process. First, we have developed an easy-to-use interview process for initial implementation. Second, we have incorporated several process alternative and cost savings advisors that will facilitate integration of worker safety and health practices into a company's overall business processes. Third, we are incorporating ergonomics into the product to provide a means of information dissemination on this critical topic. Fourth, the system is being designed to allow companies to custom design the final tools to address their specialized needs. Fifth, we are developing the tools to be consistent with a new communication model called Personalized Web Portals that allows users to format and customize information to facilitate understanding. And, finally, frequent use of the tools is being ensured by providing connection to extensive databases with automated extraction and presentation of information of relevance to all users defined by their own preferences.

Phase II Goals and Commercialization

From our on-site visits and collaboration with numerous New England businesses, we have learned a great deal about what businesses need to address Worker Safety and Health. There is a significant frustration that critical information is hard to find, that it is not centrally located and has to be extracted from disparate sources, and that it often requires subject matter experts to locate and interpret. Businesses, both large and small, are seeking worker safety and health solutions tailored to their business processes. Businesses are anxious to have process evaluation tools that can help them find cheaper, better, safer alternatives. Incorporating economics into a worker safety and health tool will enable companies to be proactive in improving their practices.

The design of Small Business Safety Officer must incorporate the diversity of businesses. The system must be dynamic. It must also have the ability to refine and revise Plans, Policies and Forms because business operations change continually. Users want information to find them rather than the other way around. Companies believe that a tool that addresses more than regulatory issues alone is needed to promulgate worker safety and health. In terms of implementing Small Business Safety Officer, we will need to consider a subscription arrangement. This will allow more frequent updates and revisions to be "pushed" to the users. We will also need to consider hosting company websites remotely for those firms that do not have an Intranet. To effectively communicate worker safety and health, the product must also follow an effective communication model. The model we have developed, called Personalized Web Portals, allows individuals to customize and personalize information to facilitate understanding. To provide users with the extensive database needed to address their diverse needs, Small Business Safety Officer will need to access additional databases. We are currently discussing such an arrangement with the Bureau of National Affairs.

2.0 SIGNIFICANT FINDINGS

What Businesses Need

From our on-site visits and collaboration with two businesses and from discussions with more than a dozen others at the Northeast Business Environmental Network meetings, we have learned a great deal about what businesses need to address Worker Safety and Health. There is a significant frustration that critical information is hard to find, that it is not centrally located and has to be extracted from disparate sources, and that it often requires subject matter experts to locate and interpret. Businesses, both large and small, are seeking worker safety and health solutions tailored to their business processes.

Businesses are anxious to have process evaluation tools that can help them find cheaper, better, safer alternatives. Incorporating economics into a worker safety and health tool will enable companies to be proactive in improving their practices.

Design and Content Implications for Small Business Safety Officer

The design of Small Business Safety Officer must incorporate the diversity of businesses. The system must be dynamic. It must also have the ability to refine and revise Plans, Policies and Forms because business operations change continually. Users want information to find them rather than the other way around. A tool that addresses more than regulatory issues alone is needed to promulgate worker safety and health.

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3.0 USEFULNESS OF FINDINGS

We have determined that "Small Business Safety Officer" has the potential to improve safety and health for millions of US workers. In our presentations to approximately a dozen companies and through direct demonstrations to two New Hampshire businesses, we have found that there is a significant need for this kind of product. Both small and large businesses have an ongoing need for safety and health information on issues relevant to their operations. In general, there is a significant frustration that critical information is hard to find, that it is not centrally located and has to be extracted from disparate sources, and that it often requires subject matter experts to locate and interpret.

We have learned that the distinction between large and small businesses has little to do with sales and more to do with resources. Many large companies have a staff dedicated to safety and health but most small companies and even branch offices of large companies do not. Each facility, however, has unique requirements and is seeking solutions specific to their business operations.

Helping companies develop tailored solutions to their safety issues and procedures is one of the keys to success. The other is to provide cost-savings and other process evaluation tools that will integrate safety and health into their overall business process. This will have a dual payoff. First, it properly integrates safety and health into the business process and, second, it allows fundamental economic analyses that will allow proactive process alternatives to be identified.

This approach will still retain worker safety and health emphasis from a regulatory perspective. However, it will introduce a new set of incentives for businesses to incorporate, update and upgrade worker safety and health practices.

We have developed several innovations for Small Business Safety Officer to ensure that companies will not only purchase it but also use it regularly. First, we have developed an easy-to-use interview process for initial implementation. Second, we have incorporated several process alternative and cost savings advisors that will facilitate integration of worker safety and health practices into a company's overall business processes. Third, the system is being designed to allow companies to custom design the final tools to address their specialized needs. Fourth, we are developing the tools to be consistent with a new communication model called Personalized Web Portals that allows users to format and customize information to facilitate understanding. And, finally, frequent use of the tools is being ensured by providing connection to extensive databases with automated extraction and presentation of information of relevance to all users defined by their own preferences.

4.0 SCIENTIFIC REPORT

4.1 Introduction

The proposed research program will design, develop and commercialize a software tool called "Small Business Safety Officer". This web-based tool will comprehensively target OSHA compliance at small companies (<500 employees), with particular emphasis on the 89% of small businesses having 20 employees or less. Small businesses, which account for 99% of all U.S. business firms with nearly half the total U.S. workforce, lag OSHA compliance due to high turnover, cost issues, and ignorance of the law.

We propose a web-based interactive program that will act with a responsible corporate official as the safety officer for small companies by creating the necessary regulatory safety and compliance framework. Phase I will develop a prototype focusing on small businesses subject to the laboratory standard (estimated to be 72,000 small companies accounting for 1.4M U.S. workers (Small Business Administration data for 1996)). Phase II will complete, pilot test and refine the prototype and will expand the program to other small business sectors. The capabilities of the interactive program will include:

- Informing the business about the applicable OSHA regulations
- An interview process to generate chemical hygiene and facility safety plans
- A section to formulate policy such as chemical purchase, disposal and allowed facility operations
- An accident and event reporting archive and an area to perform medical recordkeeping
- Chemical inventory and waste disposal cost tracking
- Formation and operation of a safety committee and emergency response team
- A forms generation area
- An advisor on pollution prevention and risk minimization for many functions common to small business manufacturing and laboratory operations.
- An area specific to ergonomics and office worker health and safety to reflect the proposed new OSHA standards
- Economics of safety and health focusing on the initial capital investment and ongoing maintenance costs with contrasting savings from reduced lost worker time

The "Small Business Safety Officer" will be an expert system program implementation tool. As such, it complements the existing program evaluation tools developed by OSHA called "Hazard Awareness Advisor" and "Safety and Health Program Advisor".

The proposed "Small Business Safety Officer" product incorporating the laboratory standard will be a valuable tool for research and development testing laboratories, electroplating firms, electronics components manufacturers (including printed circuit boards), medical and dental laboratories, and colleges and universities. Colleges and universities have recently drawn significant criticism from both EPA and OSHA for their lack of regulatory compliance. The

electronics components manufacturing small business sector has grown rapidly in the 90's and would benefit from a simple Intranet-based tool geared towards their unique safety and health challenges.

The program will be written in a web-based format that can be hosted on a company Intranet. This will provide access to all employees to the important safety information areas. For sensitive areas, password protection will be implemented to allow access only to the safety officer or other responsible corporate official(s).

The development and commercialization of this product incorporating a section devoted to the proposed ergonomics rule is timely. Data in the proposed rule (Federal Register, Vol 64, No 225) show that firms meeting SBA criteria will be disproportionately affected as the projected annualized costs for those with MSD's (musculoskeletal disorders) may greatly exceed 20% of profits (some exceed 100% of profits). To make this proposed rule a success, a concerted effort to educate small firms that "good ergonomics is good economics" needs to begin immediately.

Effective distribution of the program will be achieved by a marketing strategy emphasizing cost reduction (from reduced employee lost time), protection from prosecution and reduction of short and long-term liability to small company CEO's and Presidents. Manufacture and distribution will be performed through a joint venture between Mission Research Corporation (MRC) and the University of Massachusetts – Lowell. A two phase program between these two entities is proposed to research, test and produce the software product.

4.1.1 Background and Significance

The passage of the OSHAct in 1970 provided the first comprehensive legislation regarding worker safety and health. This act, and the substantial supporting regulations developed subsequently, places the responsibility for workplace safety on the employer and provides for full disclosure of information, training and legal recourse to the workers.

These regulations, however, are only effective if the affected companies, industries and business sectors are compliant with the law. Negative public relations, large fines, and high visibility have aided OSHA in obliging large firms, such as Fortune 500 companies, to be faithfully compliant by establishing ongoing, aggressive internal safety and health programs. Full compliance has been much less successful with small companies (those with 500 or fewer employees). The reasons include high turnover, cost issues, and simple ignorance of the law. Thus, this business sector is probably the least compliant although it represents the majority of U.S. businesses and approximately half of the work force.

To oblige compliance, OSHA has become much more aggressive of late in prosecuting cases. In addition to large fines and other penalties, OSHA is now including criminal charges against corporate officials in their strategy. Examples in the New England area include a large fine against Dartmouth for the death of a faculty member from exposure to organic mercury which penetrated latex gloves and the filing of criminal assault charges against a small lead

processing firm from a complaint filed by an administrative employee complaining of classic lead poisoning symptoms (looseness of teeth, nervous disorders).

Getting small business owners, Presidents and CEO's to implement fully compliant health and safety programs is a challenge. From the small business perspective becoming compliant could require more manpower, more time and more cost than they believe they can afford. Although regulatory compliance is a legitimate cost of doing business, there is inertia to initiating the compliance process because the long term savings have not been weighed against the short term costs. This factor, combined with the difficulty in determining what is needed for compliance can lead to only a token effort.

To address the educational factor and to aid businesses in identifying compliance needs, OSHA has developed program evaluation tools called "Hazard Awareness Advisor" and "Safety and Health Program Advisor". The latter is the most current and more ambitious project. These expert advisor tools can help small businesses identify compliance deficiencies and needs with a great deal of useful information with respect to what kinds of programs are required. Using another software expert analogy, the program evaluator tools act like a tax advisor. And precisely like that market, the next necessary product is a tax form preparation tool that is an implementation mechanism.

The "Small Business Safety Officer" product will fill this niche. It will be a program implementation tool, providing the small business with the required compliance infrastructure and documentation. The software program will be "one stop shopping" for select small business sectors, providing useful guidance and documentation specific to that industry. The proposed Phase I program will develop a prototype for those small businesses that must meet the laboratory standard. From the Small Business Administration 1996 data the estimated market is up to 72,000 small companies accounting for 1.4M U.S. workers. The Phase II program will complete the development and will extend the software to other important small business sectors.

4.2 Small Business Safety Officer, Phase I Design

4.2.1 Designing Web Tools

The Internet is still a relatively new and immature technology. However, it's limitations are already becoming apparent as evidenced by the recent downturn in the e-commerce sector. There are significant limitations to web-based communication tools if they are not properly designed. In fact, the majority of the current safety information websites and web tools contain some of these drawbacks. They are fairly easy to find. If a web page or website contains any of the following characteristics then it is unlikely to succeed as a communication tool:

- Static
- Flat and passive
- Dated or unchanging content
- Contains too much of little interest
- Difficult to maneuver and hard to find key information
- Inflexible and impersonal

To succeed as an effective communication tool, the characteristics noted above cannot be present. Users must be convinced that the web-based tools will address their personal needs. That cannot be accomplished if the same body of information is presented with every visit. The communication analogy is a daily newspaper. A lot of information is presented and users can find the sections they want easily and articles can spur additional communication such as letters to government officials, to the editor, etc. However, newspapers unlike static websites do not publish the same information every day. Yet, this is the design and approach of most web systems

We believe that to succeed in this new medium, users will want information to find them. Additionally, they will want the communication tools to have the following properties:

- Dynamic
- Active
- Multi-dimensional
- Fresh
- Personalized

We can accomplish these design goals as well as make a useful web-based communication tool that reaches the broadest possible number of workers and administrators by employing web page layout and content drivers based on user profiles incorporating keywords or metadata. An example might be a program manager needing specialized information about specific chemicals. By developing a profile that addresses these needs, the manager can access on his home page information of direct relevance to him such as regulations, rulings and toxicity data.

4.2.1.1 Evaluation of the Safety Information Exchange Business Process

The MRC Development Team (MRC, the University of Massachusetts Lowell and COES, LLC) has determined the scope of the project and identified many of the details of the business process for collecting, storing, access, retrieval, analysis, and operating an IT System needed for application to Worker Safety and Health. One of the keys to this activity is the development of formal Use Cases. Use Cases are the documentation of the step-by-step process that potential users would follow to access, search, retrieve, and apply Worker Safety and Health tools and needs. These documents are invaluable in the requirements definition/requirements survey that must be produced as a key part of the design. The Use Cases examined as part of the Phase I program are contained in this report.

4.2.1.2 Communication via the Internet

We have performed an extensive review and analysis of communication models (see the literature cited section). What we've concluded is that information exchange across the Web is predominantly based on a "push-pull" architecture, as shown in Figure 1. In this model, an information source will "push" information to a web server. The information is searched and browsed, or "pulled" by someone "surfing" the web. This technology can provide vast amounts of information from one or more sources, but it is missing any design to facilitate understanding by the receiver. The Internet "push-pull" architecture turns a desktop computer into a library, resource center, and yellow pages. However, without common understanding of the information content by the parties involved, we cannot achieve effective collaboration or communication.

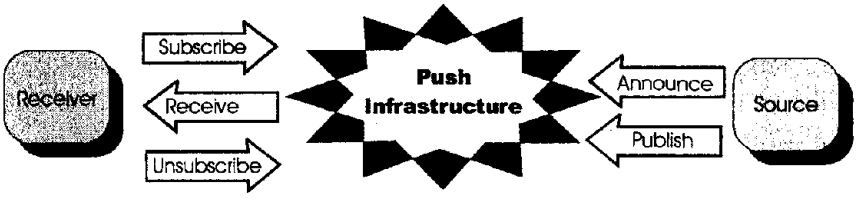


Figure 1. "Push-Pull" Communication Model

To address the communication shortfall inherent in the Web, we have created a new communication paradigm to serve as a basis for developing web-based tools and innovations. This paradigm is based on user-configured (i.e. personalized) web portals that will allow the receiver to organize, format, interpret and understand information on their own terms. These "personalized web portals" will seamlessly connect to the information push infrastructure (i.e. the Web) and will preserve information and data integrity but will allow all users to create their own communication environment, one that they can better understand.

Figure 2 presents our model for improving Worker Safety and Health communication, or any form of communication, using the web. The "push" architecture is still present but we have added "personalized web portals", or PWP, to provide the communication enabler. The PWP acts as an interface or interpreter with the database. It allows each person to interact with the common database of push information in a personalized architecture that supports his/her own world view, understandability, organization and perspective. Thus, individuals are free to impose their structure and organization on the common data, in a process that will more readily allow all parties to reach a mutual understanding.

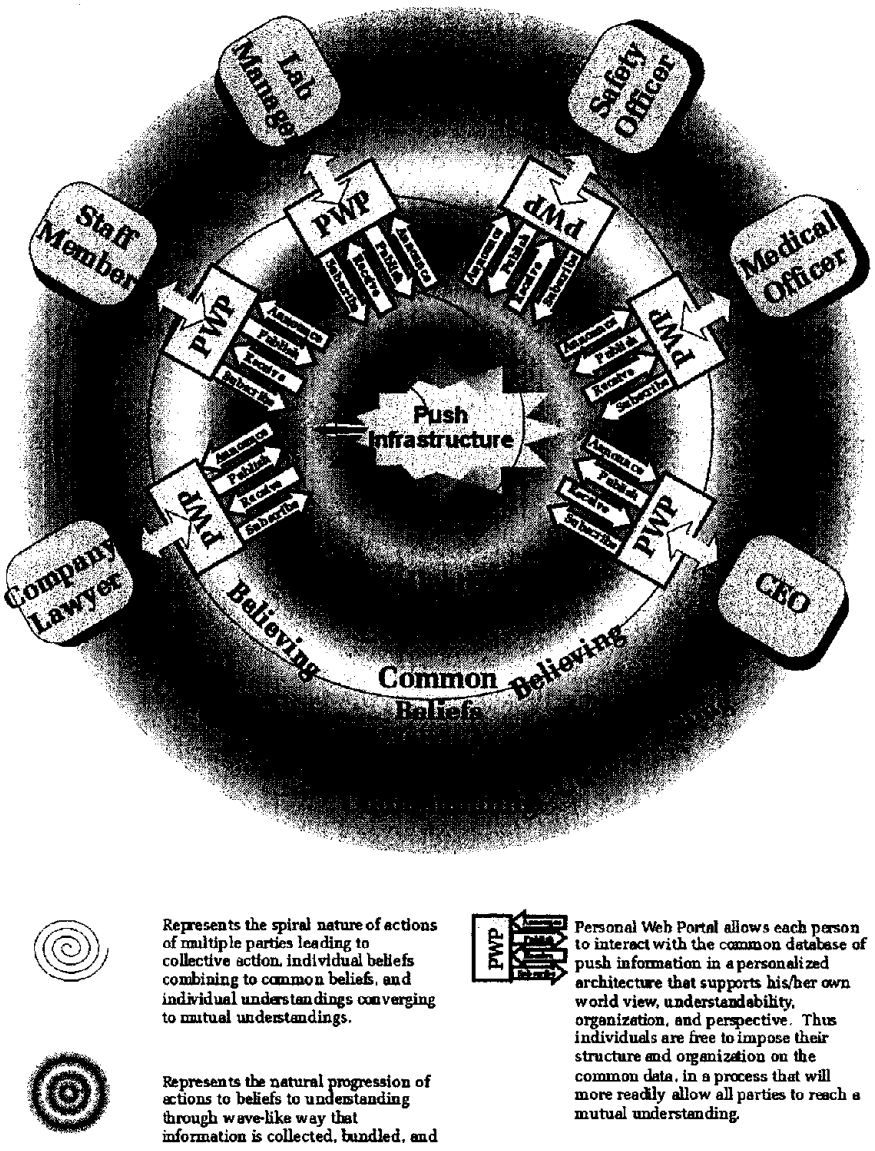


Figure 2. Personalized Web Portal Communication Model To Facilitate Worker Safety and Health Interaction and Collaboration

Several individuals and groups are represented in Figure 2 but this is not meant to be an exhaustive list. The spirals represent the spiral nature of actions of multiple parties leading to collective action, individual beliefs and individual understandings converging to mutual understanding. The concentric circles represent the natural progression of actions to beliefs to understanding facilitated through the PWP architecture.

We envision that "personalized web portals" will allow all members of a community to better communicate through the Web. This includes employees, Chemical Hygiene Officers, Corporate Administrators, program managers and others. For the proposed program, we envision portals designed to meet the needs of employees and administrators involved in Worker Safety and Health.

4.2.2 Coding

For the proposed work, we plan to use a combination of Microsoft Tools including Visual Studio, Visual Basic, Word, and MS Frontpage in anticipation of a small business's likelihood of using primarily Windows NT for their Intranet. This combined toolkit will allow us to select the most suitable code for each component application. The Web Pages can be generated in HTML using a combination of JAVAScript, VBScript, and PERL to support form submissions and file creations. A variety of other Microsoft tools will allow us to create, relate and access database information.

HTML alone could provide the standard tool needed for the vast majority of the work proposed. The other tools have already been developed in creation of second generation Web pages. The MIME (Multipurpose Internet Mail Extensions) specified first in 1992 provides the ability to transfer and display non-textual message content including images, audio, video, message, multipart, and text. Web development continued at a rapid pace at the National Center for Supercomputing Applications (NCSA). In 1993, NSCA unveiled the world's first prototype Internet browser "Mosaic." Finally, CERN and NCSA joined forces to create the CGI (Common Gateway Interface). The CGI allowed Web developers to interface with databases and other applications, respond to user input, and generate hypertext pages dynamically. CGI programs or "scripts" are collections of instructions that follow the CGI standard, execute user-defined tasks in real-time while providing dynamic output.

Working from the CGI scripting paradigm the third generation Web has been produced using a number scripting languages: OOP, Perl, JAVA, VBScript, etc. Companies like Sun Microsystems and Microsoft have developed many tools so that programmers can create scripts, web pages, and other Web resources easily. Microsoft coined the term Active Platform to describe a multi-tier distributed application across different operating system platforms for Internet or Intranet applications. With this came the ActiveX components (language-independent controls written in C++, Visual Basic, Java, or Visual J++), the Active Desktop (a platform for ActiveX, JavaApplets, and other scripts), and Active Server (processes Active Server Pages).

One of the more advanced Web Development tool to date is Microsoft's Visual InterDev. Once overcoming the installation foibles for a individual's machine, the Visual InterDev's development environment provides a superior coding tool which allows many developers to simultaneously and safely work on the same web site. As opposed to working page-by-page, Visual InterDev is designed for generating and publishing complete web sites. The pages can include ActiveX controls, DHTML, and VBScript, JAVAScript, etc., and more design controls that make use of FrontPage extensions. Developers can import components such as ActiveX controls, HTML files, DHTML files, Scripts, Images and more that were created using other Microsoft products such as Visual Basic or Word or third party products such as the Coffe HTML editor. Components can be exported and refined outside the Visual InterDev and then included again. Microsoft's SourceSafe is seamlessly integrated into the development environment.

4.2.3 Use Cases

Use Case Scenario #1 - Initial Compliance by New or Established Businesses

In this scenario a small business that is new or well-established chooses our software to become OSHA-compliant. The business is assumed to have little or no safety infrastructure and management is unclear what is required to become and remain compliant. "Small Business Safety Officer" was chosen by the company because it offered a "one-stop shopping" approach to becoming compliant. The business is looking for a simple and clear methodology to establish the required safety infrastructure and for advice and guidance regarding ongoing compliance procedures. We assume that the employee or corporate official appointed to implement the software has only passing familiarity with OSHA regulations.

Use Case Description

The appointed employee loads the software and should immediately encounter a menu asking the nature of the application (note: This menu is not included in the Phase I prototype). Choices should include: initial OSHA compliance program implementation, update of an established program, or specialized use. The employee selects the first choice. The next layer of questions seeks to determine the knowledge base of the user by asking whether they are well-versed, somewhat familiar or entirely new to worker safety and health. The response here will help configure the extent of the help functions, user aids and background information that is presented during use. In this scenario the user selects a response that they are entirely new to OSHA compliance.

Based on this user profile, the program asks whether a basic tutorial on OSHA compliance is desired. When the user selects yes, a series of screens containing both text and graphics can be scrolled at the user's pace. These screens describe the birth of OSHA in 1970 and its evolution and growth through the years. Also the responsibilities of employers and the rights of employees are clearly described. Each major point is backed up by multi-layered help functions that provide additional information.

After this initial overview tutorial, the user is asked whether they would like to perform the initial interview. The goal of this interview will be to provide a comprehensive map of OSHA regulations and recommendations based on detailed questions and answers describing the business operations. As this interview process progresses, the program is compiling a detailed matrix of key responses that are employed to search a database. Many of the screens used to perform this initial interview are already shown in the proposal. After the interview is finished, the complete compliance profile is saved, stored and can be printed and edited. The profile summarizes the business operations, the applicable OSHA regulations and the initial and ongoing compliance needs.

The program next asks if the user wishes to continue with plan implementation. If yes, the interview continues to develop safety policies, chemical purchase policies, forms, an intranet, a chemical hygiene plan, an evacuation plan, an emergency response plan, formation of a safety committee and formation of an emergency response team. Each of these functions should be laid

out an implemented as modules. Incremental progress should be saved and stored to permit completion over multiple sessions. Development of the modules will also allow specialized use.

Use Case Scenario #2 - Compliance Update or Specialized Use

In this scenario a business with some worker safety and health infrastructure already in place chooses our software to update their own procedures or to implement new program elements. The kinds of programs they may be seeking to implement are the creation of a safety web site for information dissemination to employees, establishment of an emergency response team, or creation of a safety committee.

Use Case Description

A knowledgeable employee, safety officer or appointed corporate official purchases and installs the software with one or more clearly defined goals in mind. For this use case we assume that two goals are sought: the first is the creation of a safety intranet and the second is the creation of an emergency response team.

For this scenario, the software should recognize that the user is at least moderately informed. Completion of the initial interview should still be encouraged to gather information on the company, its operations, to evaluate compliance needs and to pass the information onto the other program modules. Once the information is obtained, the user should be free to move to other program modules.

The model for use of this program is commercial tax preparation software. This software also requires an initial interview to collect detailed legal and financial information. It also has to use this information to search a resident database to determine the applicable tax codes. There is extensive help available from every screen. Users can take a tutorial but can also start the interview right away. Also, if they so choose, they can also navigate directly to key areas of interest and work on those exclusively through completion of the specific module. Progress is always saved to permit work to be performed over several sessions.

In this scenario, the company has decided it needs an emergency response team (ERT) and a safety intranet, either augmenting their own intranet or as a stand-alone. The motivations for these actions are likely the result of an incident or a change in business activities that have increased workplace hazards.

The user navigates directly to the ERT module. When the module is accessed it should make available a mini-tutorial describing the law and ERT's and request enough information (if it hasn't already been acquired through the initial interview) to determine whether an ERT is required for compliance. The mini-tutorial should describe the typical ERT composition, equipment, training, start-up costs and annual maintenance costs. All the screens and worksheets should be printable to provide a record. Links for sources of training and safety equipment should also be provided.

One of the principal reasons for creating a safety intranet site is to satisfy HAZCOM requirements. This centralized site can serve both as an information and policy repository for the company as well as a safety outreach to employees and as an information gathering tool for employees. The full capabilities of the web site are described in the proposal.

The web page would be very nearly automated through an expert system implemented through an interview and user upload process. The interview would ask for guidance from the user to design the layout, content and employee access. The upload process would likely include any pre-existing documents, policies, procedures, company graphics or logo, etc. Regular updates should be facilitated through this mechanism as well. The challenge will be to develop an easy to use tool that is uncomplicated but both powerful and customizable.

Use Case Scenario #3 - Use for Combined Economics and Safety

One of the unique features relevant to companies that have a laboratory or chemical processing facility is the inclusion of cost-savings advisors that examine chemical alternatives that are both safer and more economical. The principal reason for doing this is the recognition that safety alone will not be capable of selling the software. Saving money, however, will provide a motivation for companies to purchase and integrate the software into their business process.

In this scenario, a business is employing the software with the specific goal of trying to improve the bottom line. Our product needs to be specifically designed to help start-up companies and those that are well-established to simultaneously improve economics and worker safety and health.

Use Case Description

This capability is so important that it will have its own portal. Users could entitle it something like "The Economics of Safety". Users would use this portal to access the Toxic Use Reduction Institute (TURI) software, the chemical inventory and waste disposal tracking system and other resources specifically tailored to economics.

One of the possible ways users would benefit from this capability would be to review and improve their current processes by replacing currently used chemicals with TURI-identified cheaper, safer alternatives. An example of this might be a company researching solvents for general optics cleaning. They used to use TCE but several years ago switched to methanol. Our software should be able to point out that there are cheaper, safer alternatives such as isopropanol. This analysis should evaluate the initial purchase cost, the safety risk and the disposal costs.

Another way users could benefit is to modify their existing chemical inventory maintenance and inspection policies. The chemical inventory and waste disposal tracking system should be designed with cost and safety specifically in mind. For example by tracking existing inventory, the software can remind the user of existing supplies when an order is contemplated. By keeping unnecessary inventory to a minimum, both initial purchase costs and waste disposal costs are minimized. The software can also alert the user to expired inventory,

exceedingly high disposal costs for intended purchases, reminders for regular inventory roundups and disposal and other tips.

We also need to include other economic advantages to improved safety with perhaps some statistical data showing a well-informed workforce is both safer and more productive from reduced injuries and downtime.

Use Case Scenario #4 - Ergonomics Use

In this scenario a business is using the software with cost-savings, reduced absenteeism or other goals of ergonomics. The user could be researching ergonomic issues in general to become familiar with the topic. He/she could also be looking for ergonomic issues specific to their business and/or possible remedies. Finally, economic impact of the new rule needs to be addressed because this is the biggest complaint businesses already have with becoming compliant.

Use Case Description

In the first scenario, the user is likely browsing around to gather general information on ergonomics. To address this use case, we should have a tutorial on the subject that reviews the physiology of ergonomics both in general terms and with additional layers of detail.

As with the chemical alternatives, our system could identify ergonomically safer alternatives, including advisors that 1) assist with the selection of future office equipment and furniture acquisition, 2) identify common causes of MSD's, the risks associated with the companies current practices, 3) recommended changes (such as routine lifting and loading of heavy boxes in a shipping room), and 4) cost effective remedies for existing MSD's. Tools the user may benefit from include the ability to e-mail employees weekly ergonomics reminders, provide suggestions for lifestyle changes that would reduce their MSD's for that particular companies operations, and provide success stories illustrating how other businesses implemented effective ergonomics programs.

The next scenario involves the search on a specific issue with specific guidance on proposed solutions. For example, the user may wish to learn about carpal tunnel syndrome. They'll want to know the specific physiology, the causes, the solutions, the cost, and their reporting requirements under the new rule.

The final scenario has to focus on the economics of the issue. To implement all currently recommended ergonomics factors, it is clear that small businesses will bear a significant cost burden. A critical niche we can fill is to help them do this cost effectively. As with the mainstream safety issues, a critical selling feature of our product will be economics. To accomplish this goal we should have cost savings FAQ's, resources and web links for products and info, case studies, and a searchable database of issues, solutions and costs savings. Tips for changes or investments that can be made now to save money in the future should also be provided.

4.2.4 Preliminary Design

The preliminary conceptual design for this software is an interview-oriented interface for the initial use. This will establish the specific regulatory requirements and the program will then set up templates for necessary documentation, policy generation, forms preparation and other safety requirements. A pre-formatted home page suitable for access by the entire workforce will be generated. The following is an outline of the software capabilities:

Home Page – General Access

- General Safety Information
- Policies
- Emergency Information
- Safety Links
- Downloadable Forms
- Employee information on ergonomics

Compliance Section – Password Required

- Regulatory Requirements (Interactive)
  - Links to OSHA documents

- Compliance Document Generation (Interactive)
  - Laboratory Safety Plan (Chemical Hygiene Plan)
  - Emergency Response Plan
  - Facility Safety Plan

- Policy Formulation (Interactive)
  - Chemical Purchase
  - Chemical Disposal
  - Permitted Laboratory Operations

- Economics
  - Initial Costs and Long-term Savings

- Medical Surveillance (Entered and Updated by Safety Officer)
  - Employee Tracking Procedures
  - Accident, Event Reporting and Log

- Chemical Purchase, Inventory and Waste Disposal
  - Chemical Order Forms
  - MSDS Links
  - Hazard Information from NIOSH booklets
  - Chemical Inventory Tracking
  - Waste Disposal Cost and Tracking
  - Waste Disposal Advisor

- Safety Committee and ERT
  - Team Formation and Organization
  - HAZWOPR Training Log
  - Links to Safety Catalogs for Equipment Purchase
  - Hardware, Equipment Inventory and Maintenance Log
  - Emergency and Spill Response

- Ergonomics and Office Safety
  - Up-to-date information on the proposed new OSHA standard
  - Physical and electrical hazards
  - Handling "sick building syndrome"

- Pollution Prevention Advisor
  - Interactive Process Evaluation
  - Alternative Strategies, Procedures
  - Cleaner, Safer Processes
  - Total Clean Production

The full software capabilities and design issues are best described in several categories: Intrinsic Databases, Software Generated Databases, Available Compliance Documentation, Available Forms, Advisor Capabilities, and Help functions and Software.

Intrinsic Databases – These are sources of data that are transparent to the user but which are necessary for program capabilities. A partial list is as follows:

- Relational database cross-referencing OSHA compliance regulations with company operations and functions. This will be prepared by researching the OSHA regulatory literature and safety reference texts. Comprehensive lists of commercial business operations (from the Small Business Administration) and all small business OSHA regulations will be prepared and mapped.

- Chemical hazard information (exposure, handling and cleanup) from NIOSH handbooks (Chemical Hazards Handbook, 1996 North American Emergency Response Guidebook). These data will be needed by an emergency response team, if one is created. This database will also be accessed in the chemical purchase request and will be cross-referenced to the chemical purchase policy and chemical hygiene plan. This is necessary to permit only those chemicals which can be handled safely into the facility. These data will be downloaded from the NIOSH Web site or a subset will be entered manually.

- Access to MSDS information and a database of waste disposal costs. Access to MSDS sheets is essential to informing employees about chemical hazards and visible posting within the area of use aids emergency personnel. Program links to MSDS sheet web sites will be provided. A cost tracking system for waste disposal costs will be provided in this program. This database will contain regional data obtained from commercial waste disposal firms for specific chemicals and chemical classes that will allow the waste disposal liability to be critically evaluated. By cross-referencing these data to the simple chemical inventory and to

the P2GEMS site, chemical use can be decreased and less expensive substitutions can be made.

- Economics describing the initial and continuing capital costs of establishing a health and safety program contrasted against long term savings from fewer worker injuries and accidents and improved worker productivity.

Software Generated Databases – These data are generated by the program with some user input. Most are directly accessible to the user for updating, evaluation, printing and exporting:

- Medical recordkeeping. Depending upon the specific facility activities, specific medical surveillance such as blood testing, eye checkups may be either required or recommended. This section will provide for the permanent records of these procedures as required by law.

- Accident (injury), event reports and log. A database to track accidents (and workplace injuries) and their resolution will be made available in order to track long term liability.

- Training log and database. A log of worker training requirements will be produced by the software. This will include reminders of upcoming renewal events such as for the HAZWOPR training. We will work with the University of Massachusetts – Lowell, which provides employee safety training courses, to create a regional database of training providers that can be included in the software.

- Safety equipment inventory database and maintenance log. All purchased safety equipment will be trackable through this database as will regular maintenance and replacement items.

- Chemical purchase and inventory database. There are already several commercially available software packages that perform this function. Our software may be designed to interface to these packages. We plan only a simple database to perform inventory and hazard tracking.

- Chemical disposal cost tracking database. This database may be entirely separate or may be incorporated into the chemical purchase and inventory package. Its purpose will be to correlate the existing inventory with the disposal cost database to allow the full (or partial) disposal cost liability to be determined.

Forms – There will be a large number of OSHA required and other forms that can be prepared by the program for downloading, printing and hosting on the company intranet through the program-generated safety web site. The forms will be provided in Word and WordPerfect compatible formats. A partial list of these are:

- Chemical purchase and disposal. This form will include the name of the requestor, the identity of the chemical, the amount, the source, the intended use and the disposal method. There will be placeholders for the requestor's signature and the signature of the responsible corporate official (i.e. Chemical Hygiene Officer).

- Chemical hazard evaluation forms. These forms are intended to inform the company and the employee requesting the chemical about the nature of the hazard, the procedures for handling and exposure reduction, and small spill cleanup procedures. Data from MSDS sheets and from the NIOSH handbook compendium will be cross-referenced here.

- Accident (and injury), event reports. These are planned to be 1-2 page general purpose accident reports asking for descriptions of the event, the cause, the location, the identities of the workers involved, specification of any injuries and damaged property, and the nature of any remedial actions.

- Specific facility operations safety evaluations. These forms will be general purpose documents which will be filled out by workers and/or supervisors to enable the safety committee or safety officer to evaluate existing or planned facility operations. A compilation of these documents is essential to the reduction of long-term liability for the company.

- Emergency plan summaries for general posting. Brief, easy to read emergency procedures for posting in common areas will be generated here.

Available Compliance Documentation – We will carefully review the OSHA regulations to determine whether additional documentation is required for small business operations. The program PI has authored these plan in a previous assignment as the Safety Officer and Chemical Hygiene Officer of a small business. The list now includes:

- Chemical hygiene plan. This document needs to be complete, comprehensive and fully consistent with the small business operations.

- Facility safety plan. It is our experience that these documents are often requested by contracting government agencies.

- Emergency response plan. Companies using hazardous chemicals need to have one of two things, a simple evacuation plan combined with large spill cleanup to be handled by an outside firm or a complete emergency response plan. The software will aid the user to prepare either alternative and will recommend evacuation drill procedures and frequency.

Advisor Capabilities – The principal, and perhaps the most useful, advisor for the user will be the help and advice screens provided during the initial interview and during the course of the preparation of the compliance documents. A brief, but non-exclusive, list of the advisor capabilities is as follows:

- Pollution prevention, exposure reduction and risk minimization advisor through P2GEMS.

- Policy formulation (chemical purchase, disposal, permitted facility operations). These items are inherent to a Chemical Hygiene Plan (CHP). During the course of the CHP preparation stage, the user will be queried about what is permitted and what is not. These answers will be incorporated into these policy statements which will posted on the Safety home page.

- Employee safety and training advisor. This area cannot be comprehensively addressed with this package. However, the software will provide advice on worker training programs, available training information, and sources of training programs.

- Cost reduction advisor through inventory disposal cost tracking.

- Advice and suggestions specific to ergonomics and office worker health and safety to reflect the proposed new OSHA standards.

- Advice and direction on the establishment, training and equipping a Safety Committee and Emergency Response Team. The PI for this program has already performed this function previously. For this product, we will review the available OSHA literature and safety texts to recommend how this procedure can best be implemented in other small companies.

Software - The web-based "Small Business Safety Officer" will be delivered to users on CDROM with a user's guide.

- Safety home page. The safety home page will be generated by the "Small Business Safety Officer" after the interview process and will include downloadable forms, policy statements, emergency information, and extensive safety and health information links.

Help Functions - Extensive help functions will be developed for all user interactions. This will include advice on practices and strategies during compliance form preparation. Since this product is aimed at first time and layman users, detailed help screens that provide explanations, cross-references and implications will be provided.

4.3 Small Business Safety Officer Phase I Prototype

The Phase I architectural design for Small Business Safety Officer is composed of three different sites. The first is the interview site that is modeled after tax preparation software. The interview site is laid out in a sequential "tabbed" format to allow users to move linearly through a series of areas that launch wizards to design specific tools and components. The prototype is presently composed of six different areas. The first is entitled "Profile". This area collects sufficient information about the company and their business to determine the applicable OSHA regulations. The output of the "Profile" area is a list of the applicable regulations as well as the required Plans and OSHA-required compliance documentation. The "Compliance" displays these results and queries the user which of the Plans they would like help preparing. Depending upon the responses a number of sub-areas and associated wizards are launched. An example is the series of interview questions and wizard necessary to create a Chemical Hygiene Plan. Once this area is exited, the "Policies" area is next. This area allows users to create policies, forms and other documentation consistent with their Plans. The next area is called "Hazcom". This area will guide the user through the layout and content of both the Employee Intranet and the Administrative Intranet sites. The "Cost Savings" area offers the user the choices of several advisors to incorporate into the Intranet sites to perform process alternative and worker safety and health evaluations. The last area is the "Build" site where a comprehensive error checking process is performed, some final tips and advice is provided and from which the two Intranet sites are launched. A complete site diagram for the Phase I prototype Interview site is shown below.

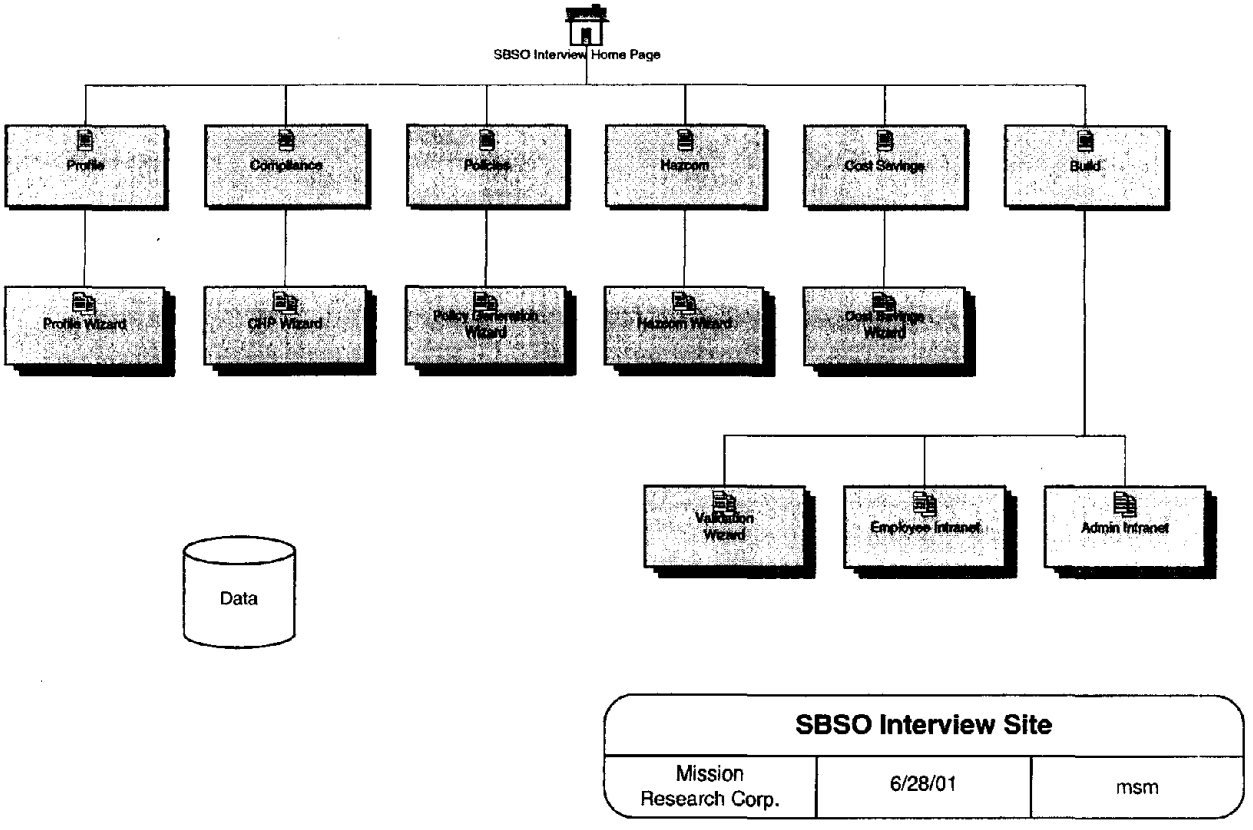


Figure 3. Site Diagram for the Initial Interview

The site diagram for the Employee Intranet site is shown in Figure 4. The content, layout and format will be determined through the Interview process. The intent in Phase I has been to show representative content. The general information areas we determined to be important for inclusion in the prototype are based on the preliminary design and from discussions with other companies. The areas included here are: Office Safety, Ergonomics, Laboratory Safety, Chemical Hygiene Plan, Chemical Handling, Web search tools called "Ask The Chemist", Experimental Safety Forms, Emergency Response General Information, Emergency Response Plan, Evacuation Plan, Guidelines, Incident Reports, Medical Recordkeeping, On-line Forms, an Event Calendar, and a Site Search capability.

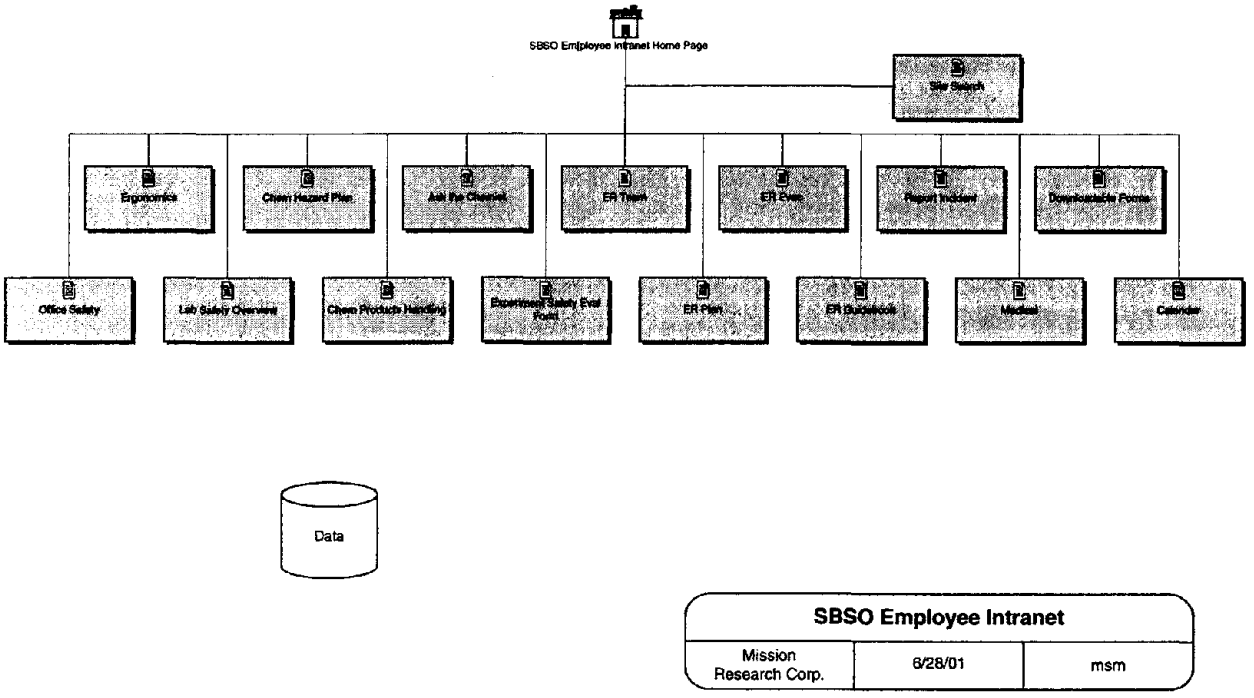


Figure 4. Site Diagram for the Public (Employee) Intranet

The site diagram for the Administrative Intranet site is shown in Figure 5. The intent of the Administrative Intranet is that access would be limited through usernames and passwords. The tools and capabilities provided here are intended for select Corporate officials to perform safety and help functions at a higher level, such as those requiring review and approval. These functions may include Plan revision, scheduling, evaluation of process alternatives and cost savings, moving proprietary information, and others. The Administrative Intranet will also have access to the Employee site but not the reverse. The general information areas we determined to be important for inclusion in the prototype are based on the preliminary design and from discussions with other companies. The areas included here are: Applicable OSHA Regulations, Download Links, Plans, Policies, Forms, Log of Incident Reports, Medical Recordkeeping, Calendar, Incident Report Form, P2Advisors, "Ask-the-Chemist" Advisor, and Information Transfer.

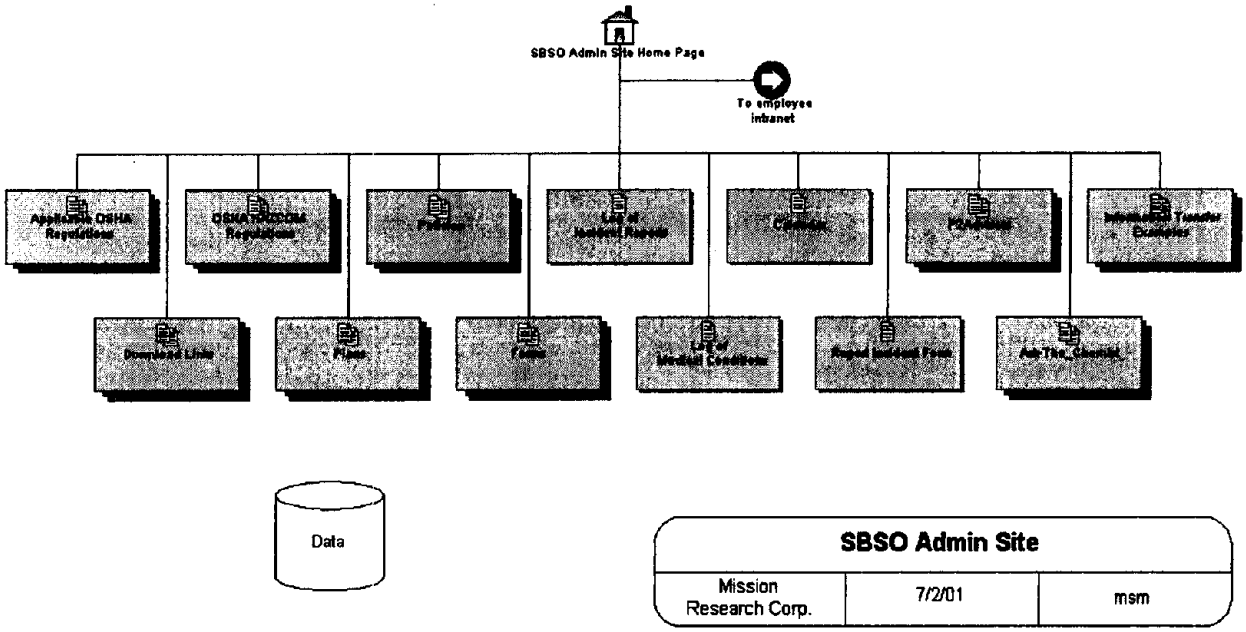


Figure 5. Site Diagram for the Administrative Intranet

4.3.1 Initial Interview

4.3.1.1 Overview

Using the "Initial Interview" software, a company's safety officer creates the following:

1. Compliance Documentation (e.g., Chemical Hygiene Plan, Facility Safety Plan, Emergency Response Plan)
2. SBSO Generated Databases (e.g., Medical Record keeping, Accident Log, Training Log and Database, Safety Equipment Inventory Database and Maintenance/Inspection Log, Chemical Purchase and Inventory Database)
3. Forms (e.g., Chemical Purchase, Experiment Evaluation, Chemical Disposal, Medical)
4. Employee (Public) Intranet
5. Administration (Private) Intranet

The information required for generating these outputs is acquired through our graphical user interface. The Initial Interview software is implemented as a web site using a variety of software languages (e.g., HTML, ASP, Java, JavaScript, etc.) The web site architecture allows us to create a system that both:

1. Has a logical, sequential flow for data entry, and
2. Allows the user to edit input values by jumping directly to the input controls and then rebuild or update outputs.

To accomplish the dual-natured flow, we use a tab-folder to categorically organize controls. Each tab has many pages. "Back" and "Next" buttons at the bottom of each tab page control the within-tab navigation. In Phase II, we will add bookmarks implemented as buttons above tabs, to provide entry into commonly used inputs (for example, to a list of procured chemicals).

The Phase I categories (tabs) are "Profile", "Compliance", "Policies", "Hazcom", "Cost Savings", and "BUILD", as shown in Figure 5. Following Microsoft's paradigm, we provide wizards and templates to generate compliance documentation, databases, forms, and such. A wizard, as defined by Microsoft Corporation, is a "feature that asks questions and then uses your answers to automatically lay out and format a document, such as a newsletter or a résumé." A template is "a special kind of document that provides basic tools for shaping a final document." Templates can contain the following elements: Text or formatting that's the same in every document of the same type, such as a memo or a report; Styles; AutoText entries; Macros; Menu and key assignments; and Toolbars.

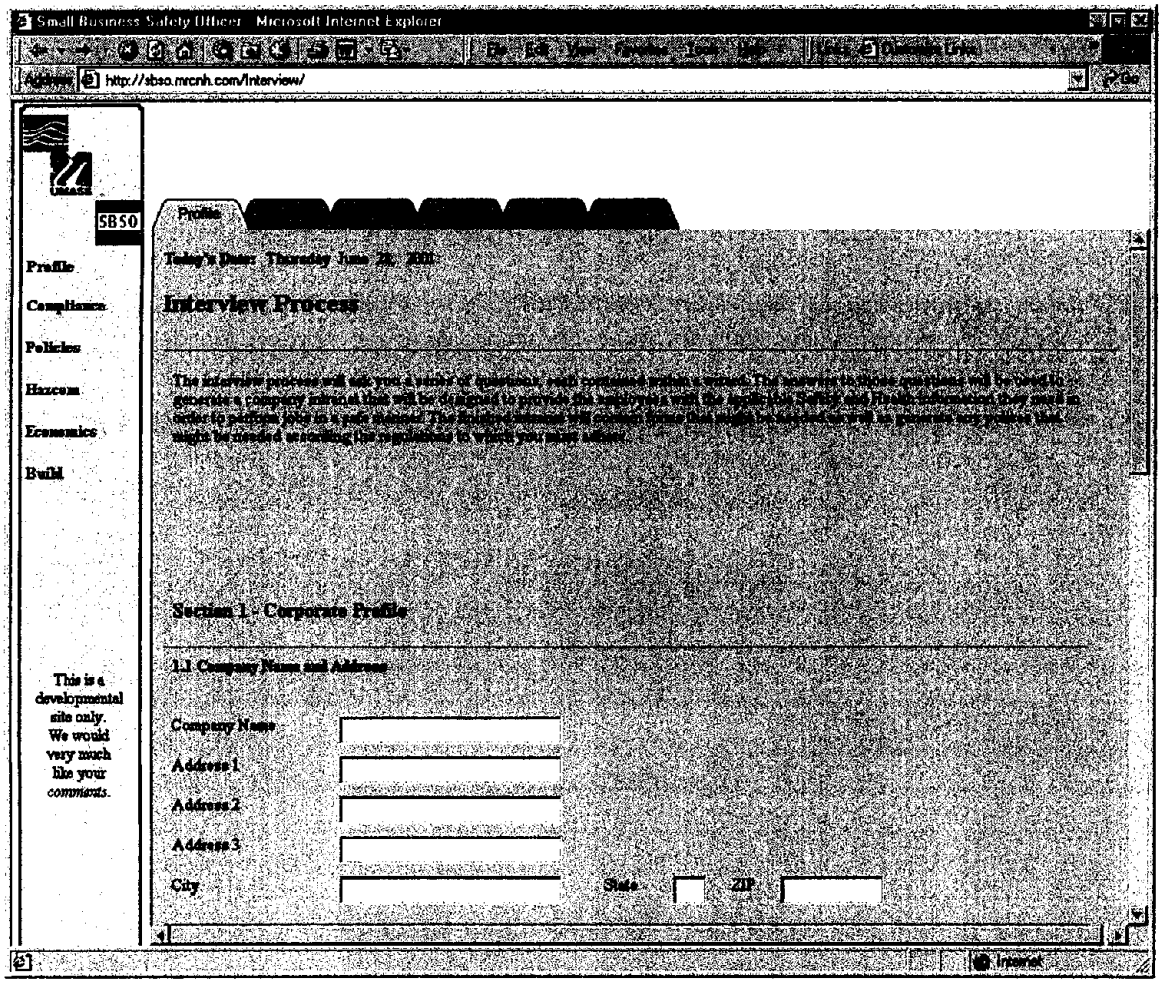


Figure 6. Initial Interview Software Interface

Various wizards are launched from data entry screens (pages) to generate compliance documentation, create the SBSO generated databases and corresponding forms/tools for populating those databases, etc. A data entry validation wizard, available on the "BUILD" tab, analyses all input data values and settings and reports back entries that are missing, out of acceptable range or acceptable list of values, inconsistent with other values, or nonsensical. On the "BUILD" tab, buttons invoke wizards that create the SBSO Employee (public) and SBSO Administrative (private) intranet site files.

4.3.1.2 Using "Initial Interview" For The First Time

Profile

First time users sequentially step through the system beginning with "Profile". The user enters the names, addresses, phone numbers, NAICS code, and other company-specific information common to all database documentation. These inputs are stored in the SBSO Inputs database along with date/time/person stamps.

Next, the first wizard, the OSHA Requirements Identification Wizard, is launched. This wizard presents the user with a questionnaire about company operations at that facility to determine:

1. Relevant OSHA Regulations
2. Required OSHA Compliance Documentation
3. Required OSHA Compliance Practices, Procedures, Equipment.

For example, one of the questions in the Phase I OSHA Requirements Identification Wizard is:

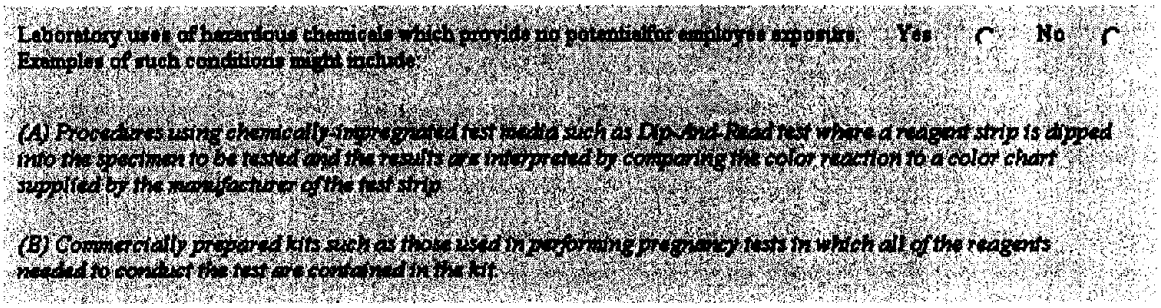


Figure 7. Example Input Question from the OSHA Requirements Identification Wizard

The initial value is "missing" or "no answer". The user selects "yes" or "no" by clicking the corresponding radio button. The series of answers provided to the OSHA Requirements Identification Wizard are stored in the SBSO Inputs database along with date/time/person stamps. The output of the OSHA Requirements Identification Wizard is a list of references to the OSHA regulations that are applicable to this facility and a list of the associated OSHA compliance documentation required.

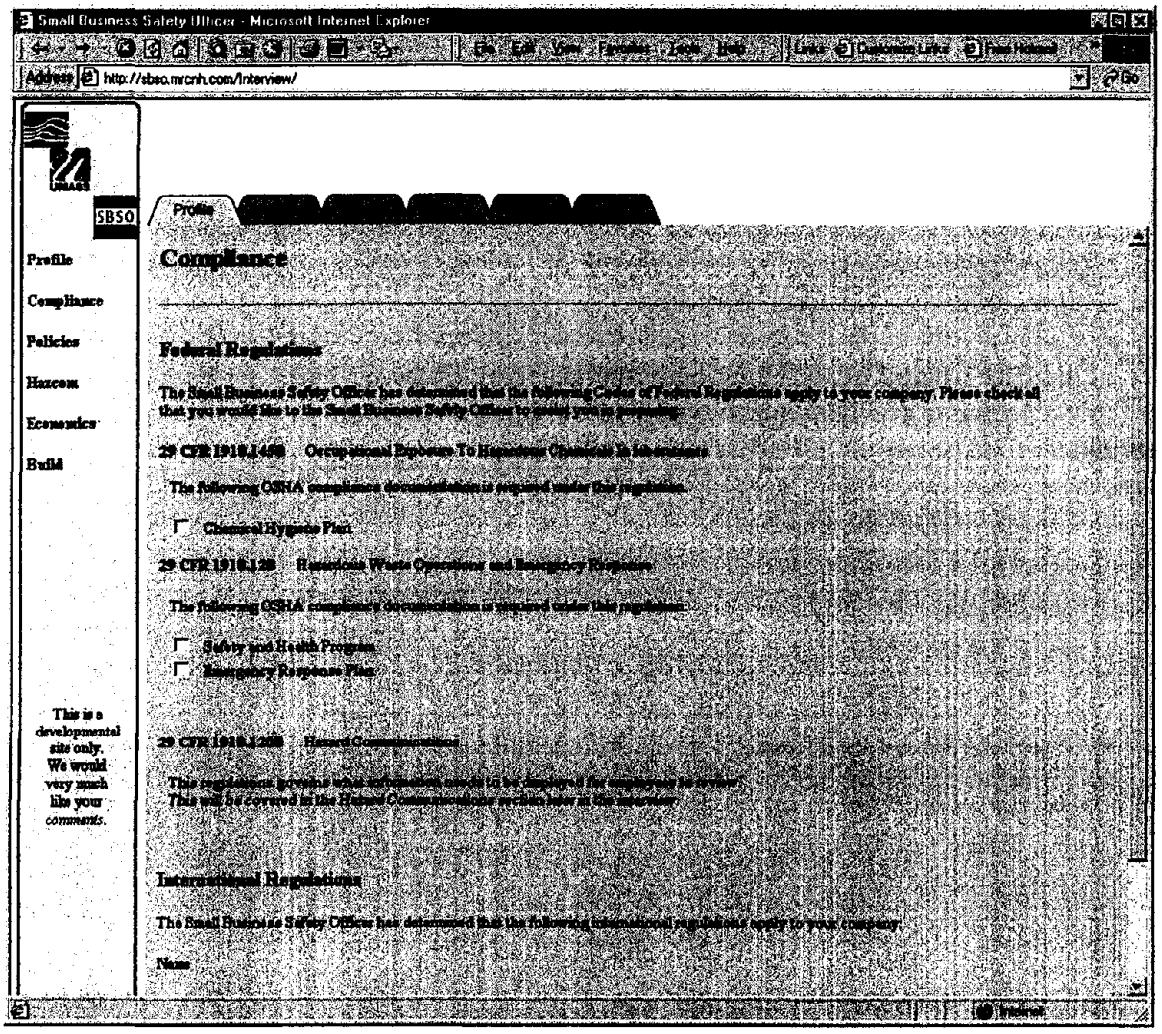


Figure 8. Example Output from the OSHA Requirements Identification Wizard

Compliance

From the output of the OSHA Requirements Identification Wizard (alternatively, the user can select these codes for himself) the user proceeds to the "Compliance" tab. In the compliance tab, the regulations and documentation determined applicable are presented to the user. Here the user can either enter filename for the relevant compliance documentation (that the company might already have) or launch a wizard to create a document.

For example, if the SBSO system determines that a Chemical Hygiene Plan is required, the Chemical Hygiene Plan Wizard, may be launched by the user. This wizard presents the user with a questionnaire about company operations at that facility to create a Chemical Hygiene Plan. Figure 8 illustrates this questionnaire. The series of answers provided to the Chemical Hygiene Plan Wizard are stored in the SBSO Inputs database along with date/time/person stamps. The output of the Chemical Hygiene Plan Wizard is the Chemical Hygiene Plan. It is a file maintained in a separate SBSO repository, and its name, date, etc., are stored in the SBSO Inputs database.

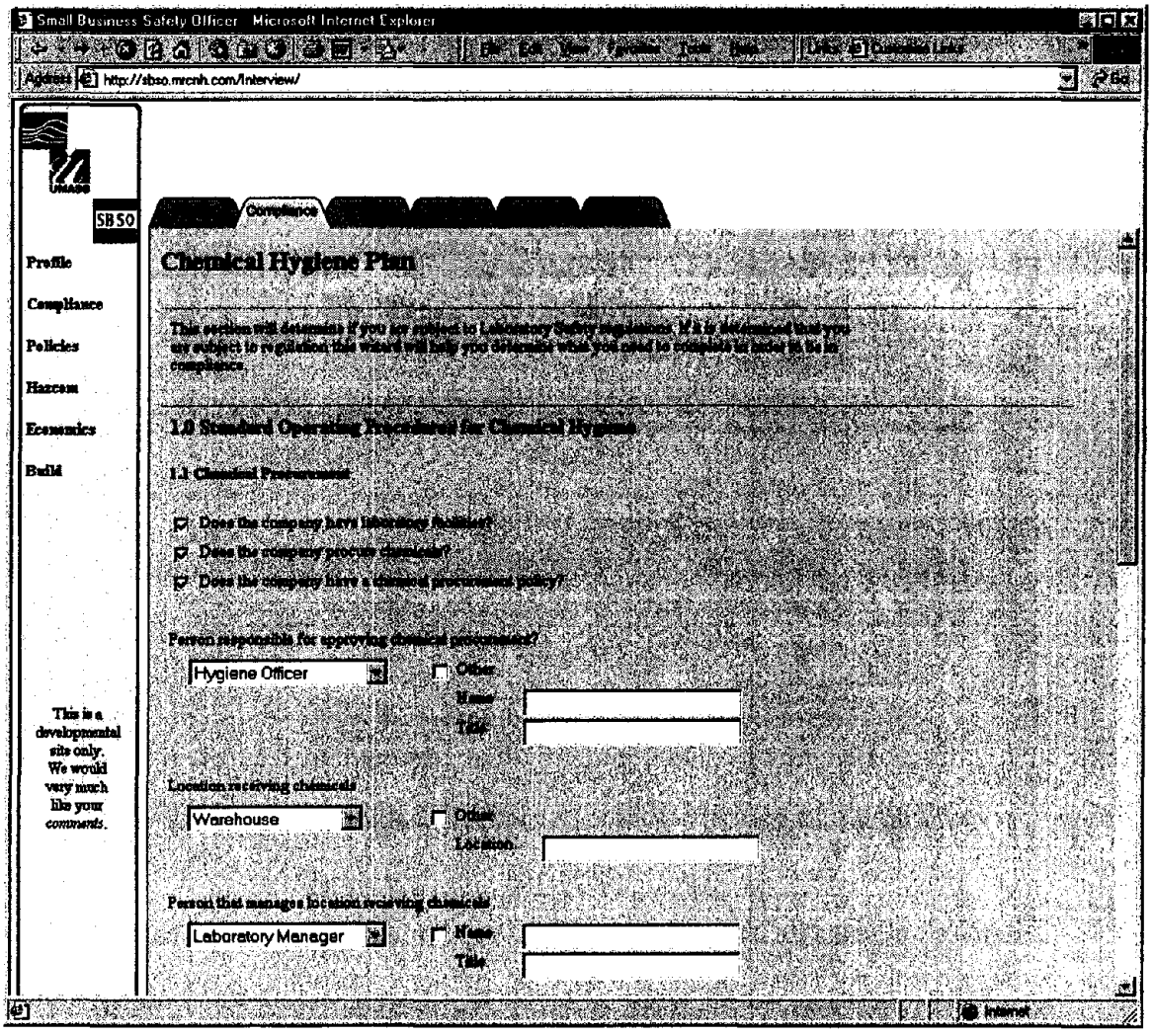


Figure 9. Example Input from the Chemical Hygiene Plan Wizard

It is our intention to make the output plan viewable at any time, even in the event that not all inputs are completed. In a sense, this wizard completes a document template for a generic chemical hygiene plan. This output plan can then be published in Word Document format, PDF files, HTML files, etc., and accessed from the SBSO Employee (public) and Administrative (private) Intranets. Determination of where, when and how the document is published via SBSO is made in the "Hazcom" section.

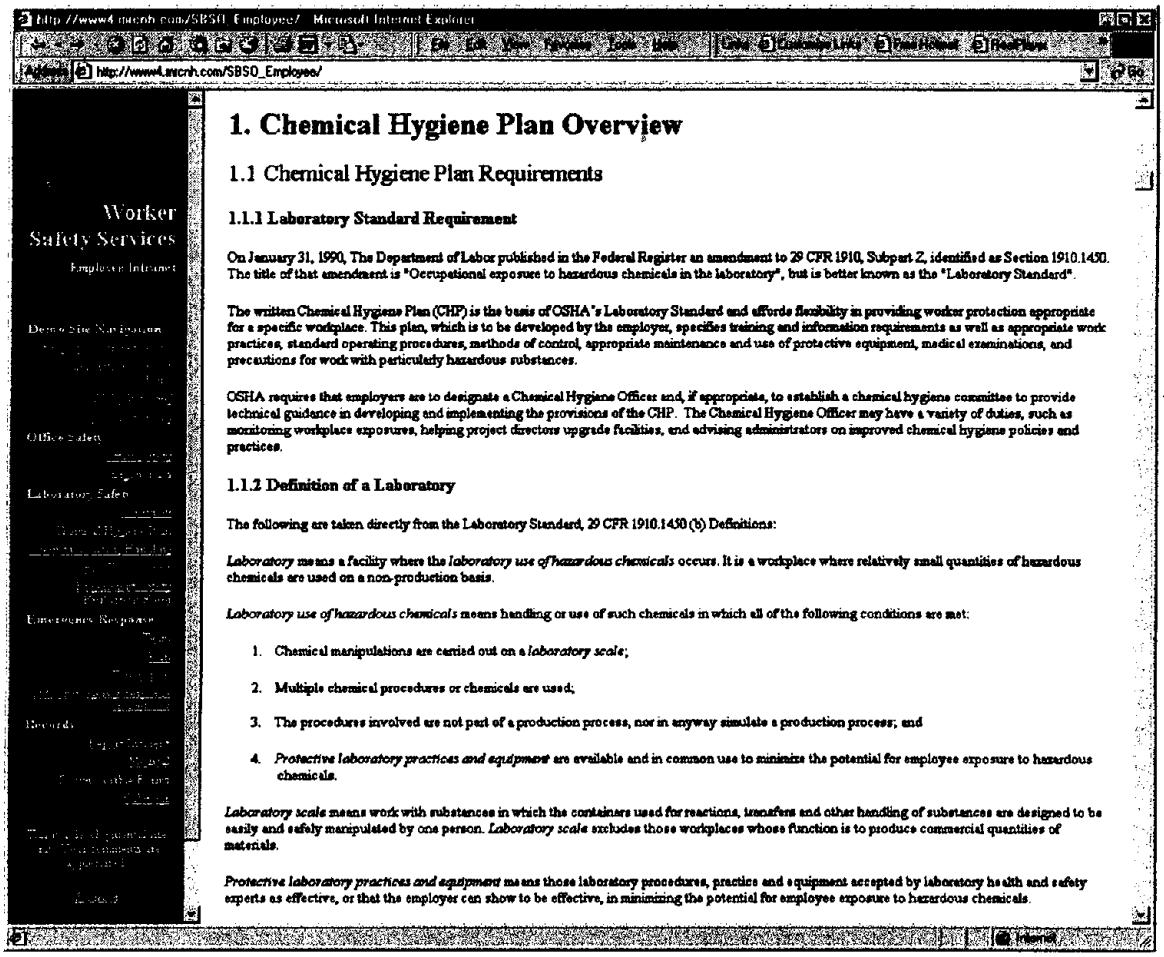


Figure 10. Example Output from the Chemical Hygiene Plan Wizard: The Chemical Hygiene Plan in HTML form

The Chemical Hygiene Plan Wizard is one of several available wizards for creating compliance documentation. Other plans included in the demo version are the Chemical Spill Plan, the Emergency Response Plan, the Evacuation Plan. Future plans could also include plans such as a Routine Laboratory and Glassware Inspection Plan or a Safety Equipment Inspection Plan. In the future, the "Compliance" section will also include tools for:

- Creating Forms for Implementation of the Compliance Plans
- Creating Medical Recordkeeping Databases.
- Creating Accident (injury), Event Reports and Log Databases.
- Creating Safety Equipment Inventory and Maintenance Databases.

From the "Compliance" tab, the user will be able to select or deselect the inclusion of these features.

Policies

From the "Compliance" tab, the user proceeds to the "Policies" tab. From the output of the OSHA Requirements Identification Wizard, the policies and policy documentation required by OSHA are presented to the user (Figure 10). Here the user can either enter filename for the relevant compliance documentation (that the company might already have) or launch a wizard to create a document.

For example, if the SBSO system determines that a Chemical Procurement Policy is required, the Chemical Procurement Policy Wizard, may be launched by the user. This wizard presents the user with a questionnaire about company operations at that facility to create a Chemical Procurement Policy. Figure 11 illustrates this questionnaire. The series of answers provided to the Chemical Hygiene Plan Wizard are stored in the SBSO Inputs database along with date/time/person stamps. The output of the Chemical Hygiene Plan Wizard is the Chemical Hygiene Plan. It is a file maintained in a separate SBSO repository, and its name, date, etc., are stored in the SBSO Inputs database.

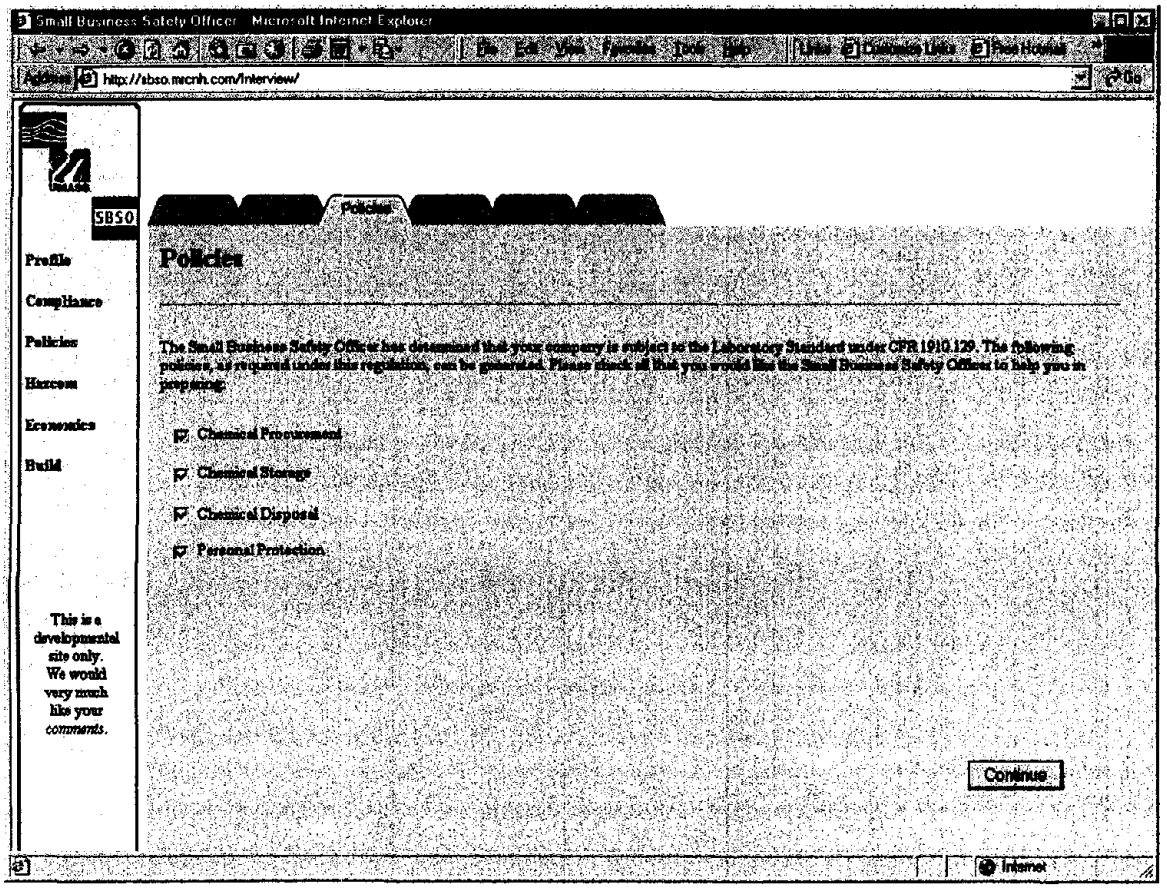


Figure 11. Selection of Applicable Policies Determined by the OSHA Requirements Identification Wizard

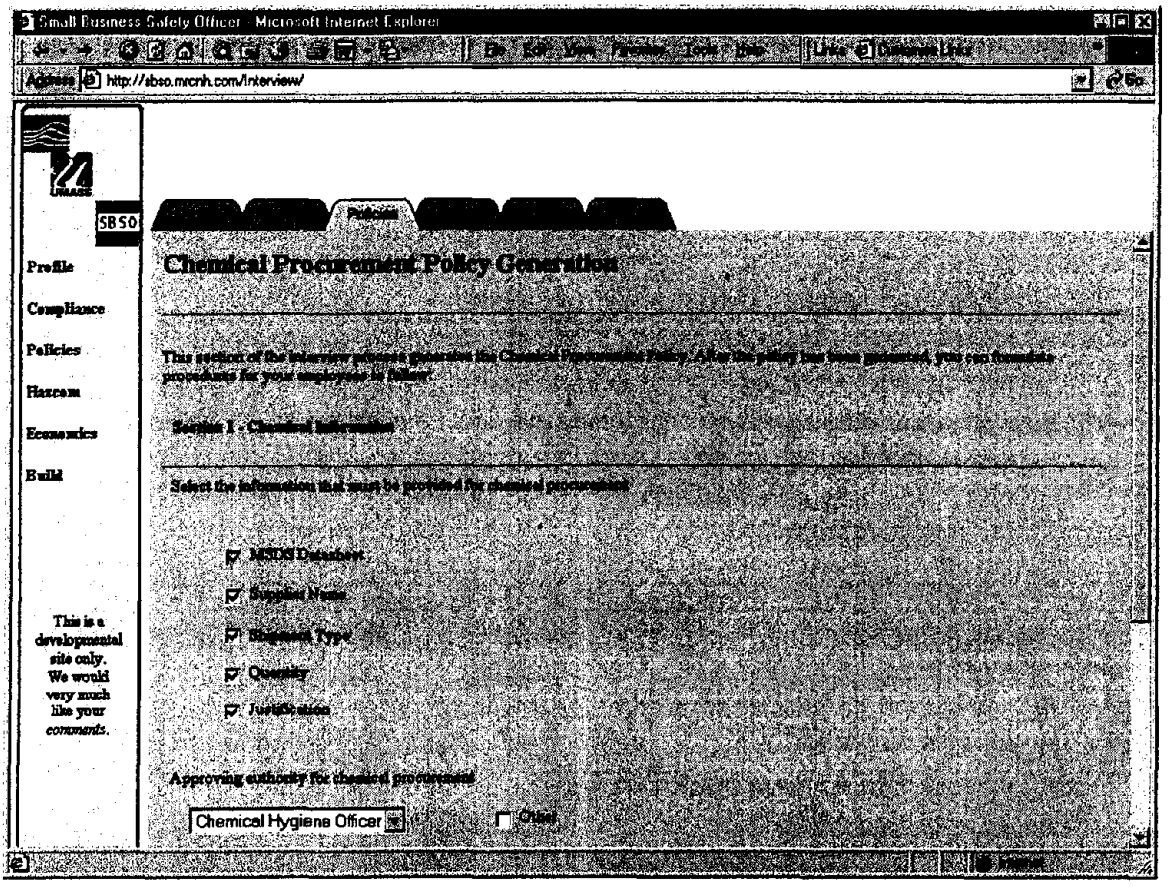


Figure 12. Example Input to the Chemical Procurement Policy Wizard

As with the compliance documentation, it is our intention to make the output policies viewable at any time, even in the event that not all inputs are completed. In a sense, this wizard completes a document template for a generic policy, in this example, a template for a Chemical Procurement Policy. This output policy can then be published in Word Document format, PDF files, HTML files, etc., and accessed from the SBSO Employee (public) and Administrative (private) Intranets. Determination of where, when and how the document is published via SBSO is made in the "Hazcom" section.

The Chemical Procurement Policy Wizard is one of several available wizards for creating compliance documentation. Our Phase I demo includes a Chemical Procurement Policy and a Use and Disposal Policy. Future policies could include policies for medical record keeping, employee safety training, chemical inventory tracking, etc. In the future, the "Policy" section will also include tools for:

- Creating Forms for Implementation of the Compliance Policies
- Creating Compliant Chemical Purchase and Inventory Databases.
- Creating Compliant Chemical Disposal (and Cost Tracking) Databases.
- Creating Compliant Training Logs and Databases.

From the "Policy" tab, the user will be able to select or deselect the inclusion of these features.

Hazcom

Together the "Compliance" and "Policies" sections establish the company-specific information and populate the system with a repository of plans, policies, forms, and SBSO generated databases (medical record keeping, etc.). In the "Hazcom" section, the user determines the form and format of the information to present in the SBSO Employee (public) and the SBSO Administration (private) Intranets. Since the principal mechanism is through the employee intranet, this section is currently focused on laying out that tool.

In the future, we intend to add the capability to lay out the content of the menu bars, personalize the site presentation and upload company logos. The methodology for employee access also needs to be addressed here. This can range from unrestricted access from a centralized server to password access to a remote host.

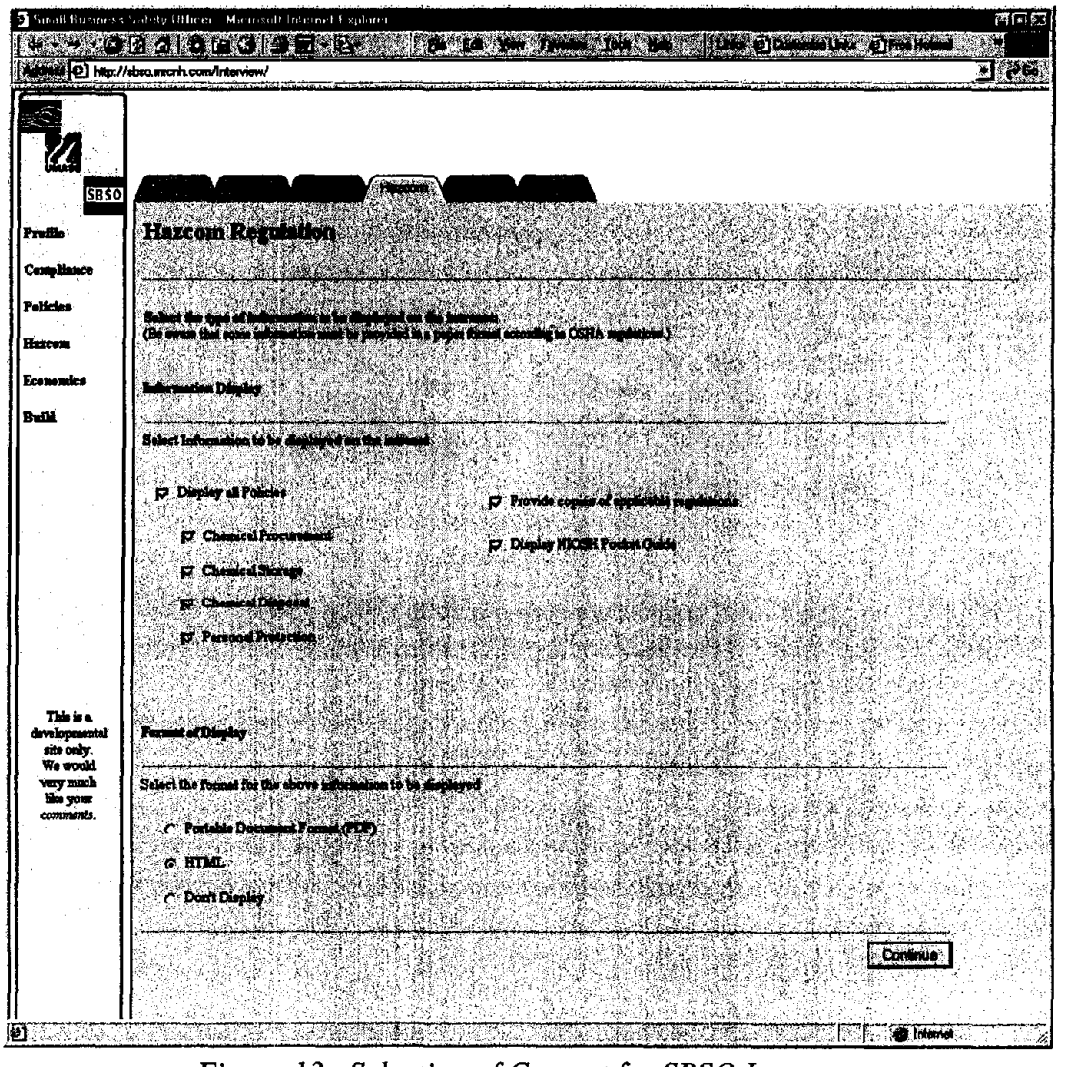


Figure 13. Selection of Content for SBSO Intranets

We envision a tool that would allow the user to select the Table of Contents Sections such as "Office Safety," "Laboratory Safety," etc., and then the subsections (names and links) of web pages for each of those main sections. This tool would allow the user to select from predefined topic headings, or create their own. The output would be a single web page to be the left-hand-side table of contents in the output SBSO Employee (Public) Intranet. A similar tool would generate the Table of Contents for the Administration (Private) Intranet.

Table 1. Table of Contents for Demo Version of SBSO Administration Intranet

Standards

Applicable OSHA Regulations
Download Links
OSHA HAZCOM Regulations

Library

Plans
Policies
Forms

Record Keeping

Log of Incident Reports
Log of Medical Conditions
Calendar
Report Incident

Cost Saving

P2 Advisors
Ask-The-Chemist

Information Transfer

Example

In the future, the "Hazcom" section will also have tools, templates, and wizards for creating the Intranet Web Pages. The generic layout, or template, of our Intranet web pages, include defined by our envisioned Create Web Page Wizard:

- A title,
- A welcome message,
- A horizontal bar,
- A list of applicable links to intranet and internet resources (in bullet list, paragraph or table format), and
- A right-hand-side graphic.

Alternatively, HTML text input or Web Page input can be provided by the user to associate with the links established in the Table of Contents. We envision a system that allows the user to include any of the following types of links from the Table of Contents:

- Second Tier Web Pages Created with the Create Web Page Wizard
- Document(s) in the SBSO Generated Database of Company Plans and Policies
- Forms(s) in the SBSO Generated Database of Forms (Electronic Submission)
- User-Supplied Web Pages
- Special Web Page Tools and Advisors (such as the P2Advisors, Calculators, Calendar, etc.)

In the future, the content and selection of these layout features is set here in the "Hazcom" tab via a Web Page Creation Wizard. The "Ask-The-Chemist" Web Page below illustrates potential output. We envision that the during the interview process, the user would 1) select from sample welcome statements or input their own, 2) select from our list of applicable source information that we identify on the basis of company needs, and 3) add their own "Ask-the-Chemist" links to that list to customize their intranet. The user links could be to resources they provide internally or to resources they've found on the world wide web. The statement and relevant resource links would be added to a list in the database populated by the interview process. When the "Ask-the-Chemist" page is clicked in the employee intranet, reading the database information dynamically creates the page. Where the "Ask-the-Chemist" pages is accessed is determined from the Table of Contents shown above.

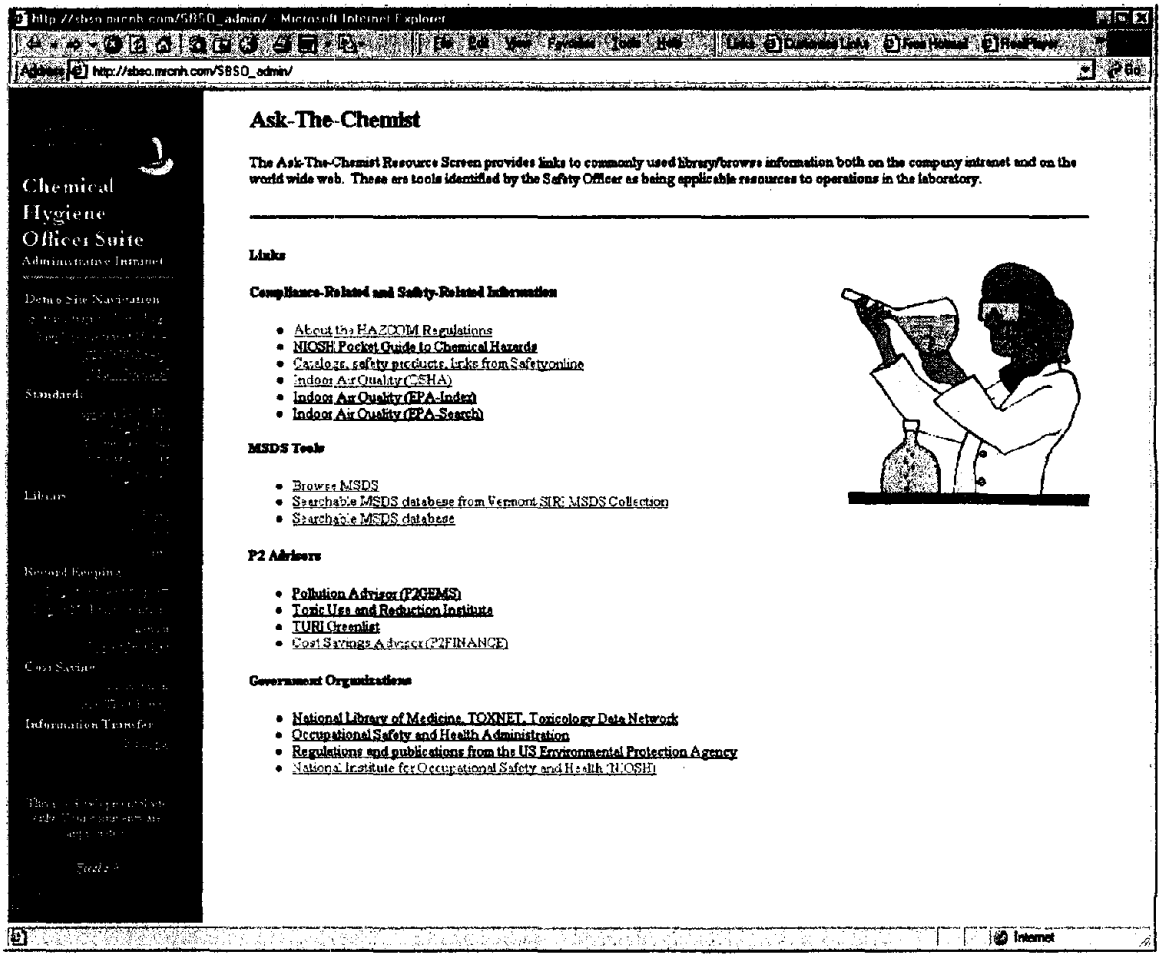


Figure 14. Representative Web Page from Demo Version of SBSO Administration Intranet

From the Table of Contents Wizard and the Web Page Creation Wizard, information for creating the Employee and Administration Intranets is input. These inputs are stored in the SBSO Inputs database along with date/time/person stamps. It is our intention to allow the generated Table of Contents page, and any of the content Web Pages to be viewed from the Hazcom Wizards; however, the entire site is not built, until the "BUILD" tab buttons are selected.

Cost Savings

The cost-savings section is a centerpiece of Small Business Safety Officer. We noted in the introduction page that Small Business Safety Officer is a cost-savings portal integrating pollution prevention, cheaper and safer process alternatives and worker safety and health. To accomplish these goals, we need to provide users with cost-savings expert advisors. We currently have three: P2Gems, P2Oasys and P2Finance. For the purposes of our demo, these are selected, and links to outside resources are provided in the P2Advisors Web Page available from the Table of Contents on the

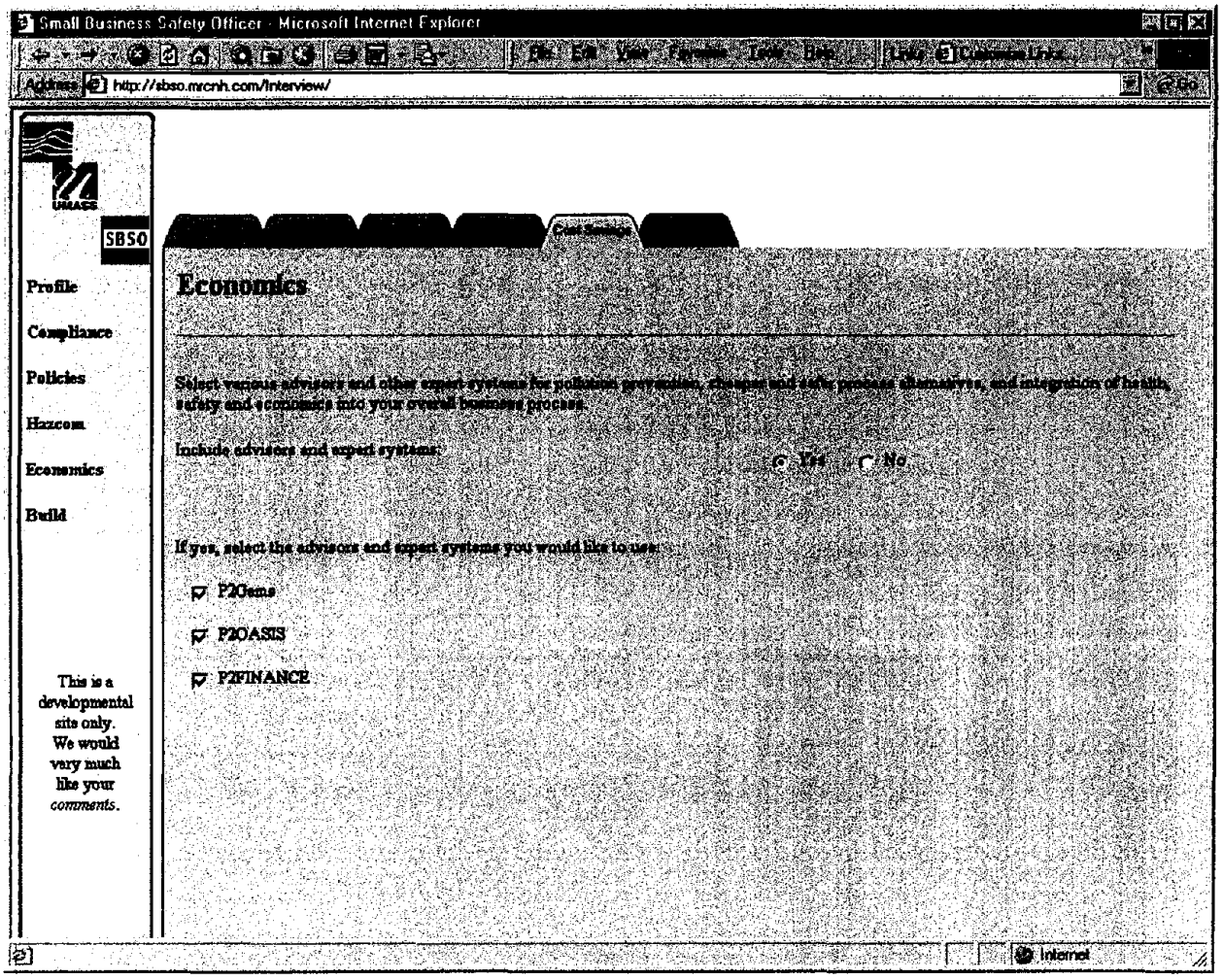


Figure 15. Select and Deselect Advisors in the "Cost Savings" Section

The "Hazcom" section allows the user to define a Table of Contents and Web Pages for inclusion. The "Cost Savings" section allows the user to add Cost Savings Advisors to those Web Pages. The advisors that are selected will be included in the administrative tools intranet site. Some advisors are simple hypertext links to outside resources. Other advisors are integrated into the functionality of the web sites. In future versions we envision the following functionality:

- Ability to dynamically search for information about a chemical (or hazard) from multiple external sources, and present that information to the user in the laboratory (we intend to provide a hands-free voice interface).
- Automatic search and display of P2 information during forms completion (in other words a user completing a chemical procurement form, for example, would be alerted of P2 advisor comments).
- Automated data entry during the Initial Interview process via advisors.
- Automatic search and entry for the P2 advisors themselves. For example, the P2Oasys program requires a cumbersome load of manual data entry. This resource would provide more automated data entry.

Our goal is to provide users with the ability to determine procurement-to-disposal cost estimates associated with hazardous chemicals – before they procure! – and to provide interfaces to tools that would recommend safer and/or cheaper chemicals. We want our SBSO tool to not only assist companies to become compliant with OSHA regulations but also to enable companies to develop sound business plans with long-term cost and safety optimization goals.

Other future advisors could include:

- Employee Safety and Training Advisor
- Cost Reduction Advisor through Inventory Disposal Cost Tracking
- Ergonomics Advisor (related to cost savings of decreased absenteeism)
- Advice and direction on the establishment, training, and equipping a Safety Committee and Emergency Response Team.
- Advice on establishing a timeframe for updating company profile information, plans, and policies. All this input data should be regarded as dynamic, and having some sort of expiration date. On a routine basis, these records should be reviewed.

Build

The "Build" tab completes the interview process. An Input Validation Wizard performs an overall interview validation or error checking and to launch the construction of the public intranet site and the administrative tool site. The current capabilities include the error checking and site creation buttons. Once the "Create" buttons are clicked, the intranet sites are launched. Future capabilities needed for the fully functional site may include specification and address of the server (local or remote), access restrictions, authorized user lists and other practical issues. Note that users can use the SBSO Initial Interview to simply identify relevant OSHA regulations and create the plans and policies without creating the Intranets. However, we feel that small businesses will have cost savings in their operations by having the ability to create Intranets for publication of these plans, policies and forms, for the dissemination of safety training and other safety information, and for the organization of the many databases such as the medical record keeping database and the inspection log.

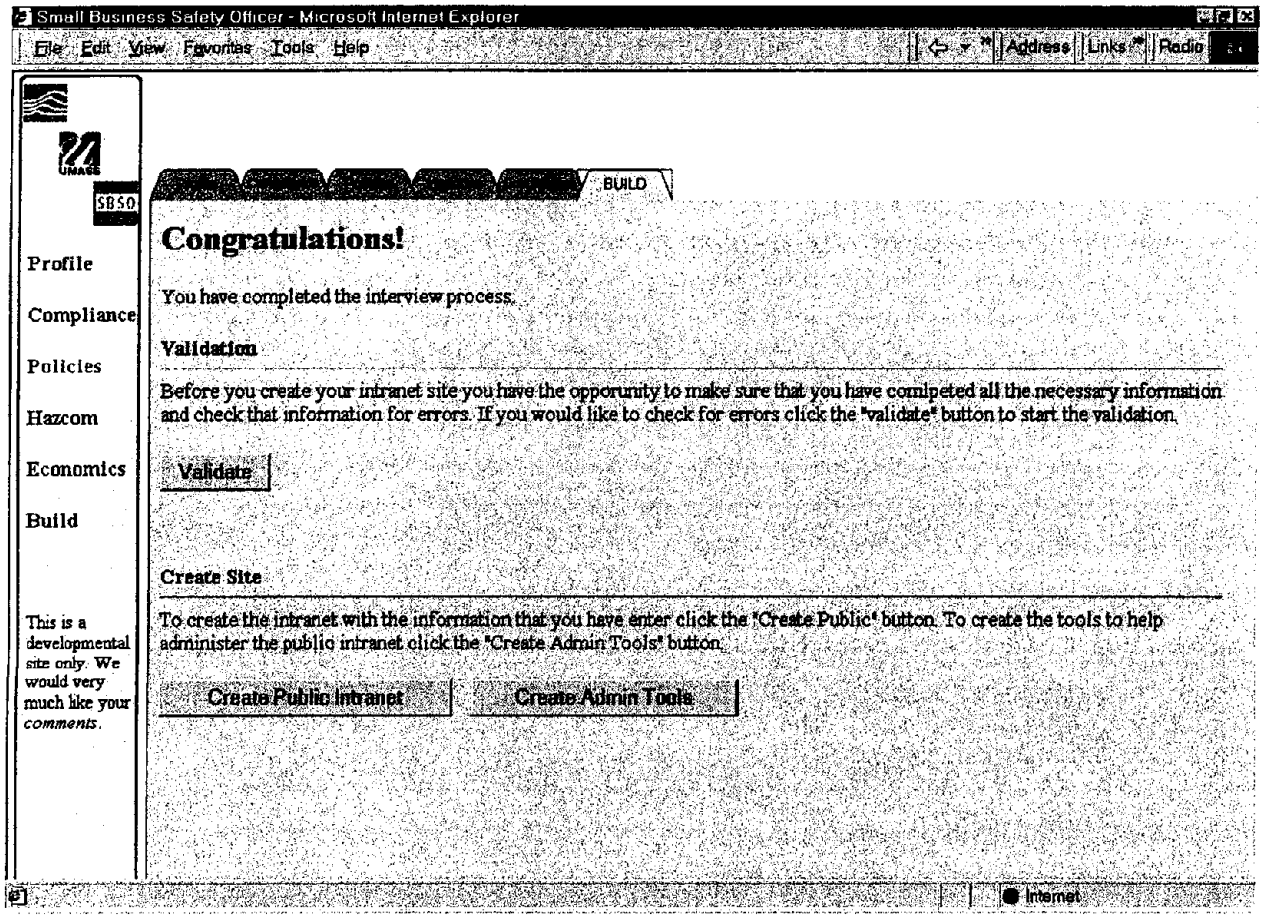


Figure 16. Building the SBSO Intranets.

4.3.1.3 Updating By Editing Inputs to "Initial Interview"

Updating Due To Changes In OSHA Regulations

Updates of our software will be required, because the OSHA regulations themselves are dynamic. Our intent is to provide a way to update the codification of OSHA regulations in our SBSO system, so that the SBSO Input Database can be updated with minimal interaction, and such that the web sites can be updated efficiently to provide refined policies and plans.

Changing Profile Information

Company profile information is regarded as dynamic in the SBSO system. This is why we maintain a database archive of SBSO Inputs along with date/time/person stamps. We envision a system that allows the user to review past data input entries, and update those entries singly or wholly. The links to those relevant entry values will be made through book marks, or by directly navigating to the entry, while the input values are defaulted to the last input value.

Changing Hazcom (Intranet Web Site Configuration) Information

Sometimes, users will want to update or improve their SBSO Employee Intranet or SBSO Administration Intranet even though their profile information is the same. In this instance, the user can proceed directly to the Hazcom tab or the Cost Saving tab, and launch the various

wizards that define the table of contents, define the web pages to be included, and create the web pages. The user can then create and test the Intranets, and update them without having to re-input the company profile information.

4.3.2 Employee (Public) Intranet Site

4.3.2.1 Overview

Using the "Initial Interview" software, a company's safety officer creates the "Employee (Public) Intranet Site". This site offers an organized and efficient presentation to employees allowing them to search, display, print, and annotate (form submission) the SBSO database. The Employee (Public) Intranet Site consists of:

- A Table of Contents on the Left-Hand-Side, currently implemented as an HTML file, and loaded in a frame of every page of the Employee Intranet.
- Many Second Layer (Second Tier) Web Pages either generated by the "Initial Interview" Create Web Page Wizard or user-supplied web page files.
- Access to public parts of the SBSO Generated Databases (e.g., Medical Record keeping, Accident Log, Training Log and Database, Safety Equipment Inventory Database and Maintenance/Inspection Log, Chemical Purchase and Inventory Database)
- Access to SBSO Generated Forms (e.g., Chemical Purchase, Experiment Evaluation, Chemical Disposal, Medical), and ability to electronically complete and submit those forms.
- Special Web Page Tools and Advisors

The information required for generating this site is acquired through our graphical user interface, the "Initial Interview." The Employee (Public) Intranet Site is implemented using a variety of software languages (e.g., HTML, ASP, Java, JavaScript, etc.) The web site architecture allows us to create a system that, among other utilities, will:

- Allow the casual user to browse a library of safety information, company policies, and procedures, and training information.
- Provide immediate access to Emergency Response information.
- Allow laboratory workers to readily access information about chemicals and chemical handling.
- Permit workers to review public records and submit medical, accident, and injury forms.
- Allow workers to access historical safety training material for review, distance-learning, etc.
- Display calendar of events (training sessions, inspections, etc.)
- Allow workers to subscribe to various notification services.

Navigation through the demo web site is completely accomplished through keyboard and mouse interaction and navigation tools on the browser. Hyperlinks are tied to text and buttons.

The demo version illustrates how a variety of web page layouts, including lists, text blocks, and tables, can be generated to provide access to the same material. This is not an attempt to be redundant, but an attempt to provide information in a way that is familiar to the

viewer, and we recognize that even a small business has much diversity in its staff. The workers will often differ greatly in their learning styles, their preferred organization, etc. By creating a web site with multiple avenues to the same information, we hope to overcome those barriers of individuality.

4.3.2.2 The Table of Contents

The Table of Contents for the Employee (Public) Intranet is shown below:

Table 2. Table of Contents for Demo Version of SBSO Employee Intranet

Demo Site Navigation

Employee Intranet Home
Administration Intranet Home
[SBSO Welcome]
[SBSO Interview]

Office Safety

Office Safety
Ergonomics

Laboratory Safety

Overview
Chemical Hygiene Plan
Chemical Policies/Handling
Ask-The-Chemist
Experiment Safety Evaluation Form

Emergency Response

Team
Plan
Evacuation
2000 Emergency Response Guidebook

Records

Report Incident
Medical
Downloadable Forms
Calendar

4.3.2.3 Demo Site Navigation

The Demo Site Navigation section is only included for the ease of reviewers assessing our site remotely. We do not intend to have this section in the final product; with the exception of the Home Page.

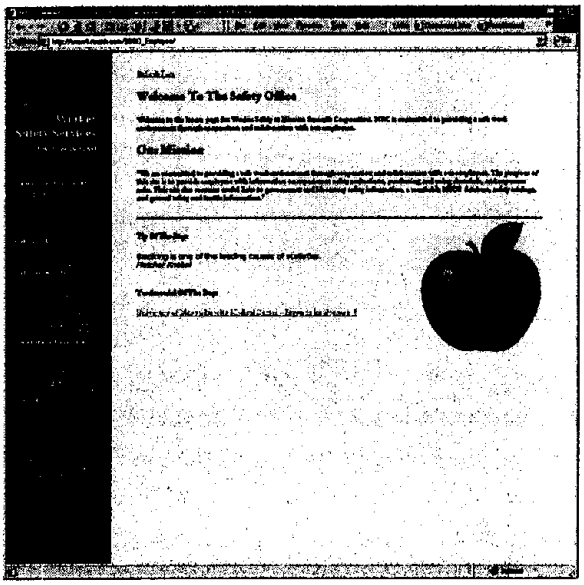


Figure 17. Employee (Public) Intranet Home Page

While the Home Page is the first screen shown each time the system is accessed, it is a Second Tier Web Pages. Second Tier Web Pages are generated by a wizard in the "Initial Interview" and include the standard features of a title, welcome message, horizontal bar, graphic, and a list of relevant links from the SBSO Input database. Here, during the initial interview the user input that the title for the Home Page was "Welcome to the Safety Office" and selected some welcome text information. An apple graphic was selected for the home page. Links were set as random links from a "Tip of the Day" database and a "Testimonial of the Day" database of links set during the Initial Interview and maintained via the Administration (Private) Intranet Site.

4.3.2.4 Office Safety

Purpose

We envision that all small businesses will want an Office Safety section in their Employee Intranet. In particular, ergonomics is a topic of current interest. Our Office Safety section includes information for training and adopting ergonomics practices without formal policy and without exorbitant costs. Here employees can learn intelligent ways of posturing their work behavior, and determine how to order future office furniture and equipment in order to minimize their MSD incidence rate.

Second Tier Web Pages

For the demo version, the Office Safety section has two Second Tier Web Pages. These include the standard features of a title, welcome message, horizontal bar, graphic, and a list of relevant links from the SBSO Input database. The links below are all off-site links. Some may

be selected from a list provided by the "Initial Interview" wizards, others may be user-defined resources.

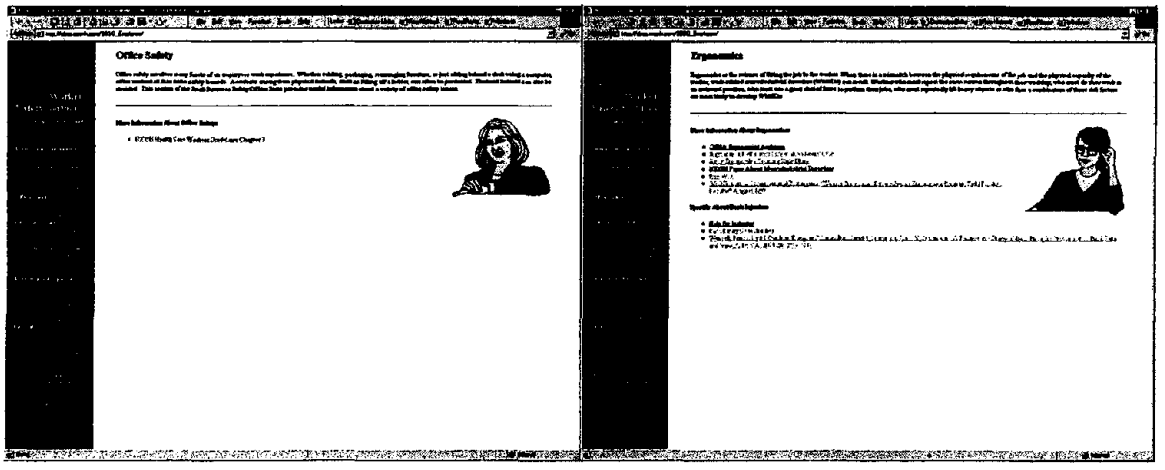


Figure 18. Office Safety Second Tier Web Pages

Database Plans and Policies Links

There are no links to SBSO plans or policies from the Office Safety section.

Database Form (Submission) Links

There are no links to SBSO forms from the Office Safety section.

User-Supplied Web Pages

There are no user-supplied web pages; the pages shown are envisioned as being generated by the "Initial Interview" site. However, one of the links on the Ergonomics page is to a HTML PowerPoint presentation entitled "Computer Ergonomics: U. S. Naval Hospital ROTA Spain, September 2000". Companies may already have PowerPoint presentations or other multimedia presentations (AVI files, etc.) that are in use for safety training or other information dissemination. Links to such files can be included on either second tier SBSO-generated web pages, or as user-supplied web pages accessed from the Table of Contents.

Special Web Page Tools

There are no links to SBSO special web page tools. We can envision that special tools, such as calculators for determining optimal weight loads, etc., could be generated to assist employees with ergonomics questions.

4.3.2.5 Laboratory Safety

Purpose

The purpose of the Laboratory Safety section is to provide laboratory workers with the ability to browse the following:

1. Company plans and policies related to laboratory safety.
2. OSHA regulations that prompted the verbiage of those plans and policies.
3. NIOSH Pocket Guide to Chemical Hazards

4. Forms (electronic submission) including the Experiment Safety Evaluation Form, Chemical Release Chart, Incident Report forms, and Disposal forms.
5. Browse information selected and defined during the "Initial Interview."

Currently, the browse information includes searchable government sites, searchable MSDS sheets, P2 advisors, and safety information.

These resources require that the laboratory worker be proactive, and acquire information while sitting at a terminal. We also envision resources that would allow the laboratory worker to query for chemical properties, etc., in a hands-off way (voice interactive) while working in the laboratory, and for the laboratory worker to subscribe to e-mail notification services. Our innovation for allowing the laboratory worker to define a personal profile and have new information "find the user" rather having the user always querying a set of external resources for new information, will significantly add value to this system.

Second Tier Web Pages

For the demo version, the Laboratory Safety section has three Second Tier Web Pages. These include the standard features of a title, welcome message, horizontal bar, graphic, and a list of relevant links from the SBSO Input database. The links below include on-site links to company plans, policies, forms, training information and off-site links.

The pages entitled "Laboratory Safety Overview' and "Chemical Handling Policies and Plans" illustrate two different ways of supplying the same information: first in block text format and second in table format. The links therein are to the company plans, policies and forms that govern the operations of their laboratory. A number of plans, policies and forms are included. Each of these can be packaged as web pages, PDF files, Word files, plain text files, or any combination of the above.

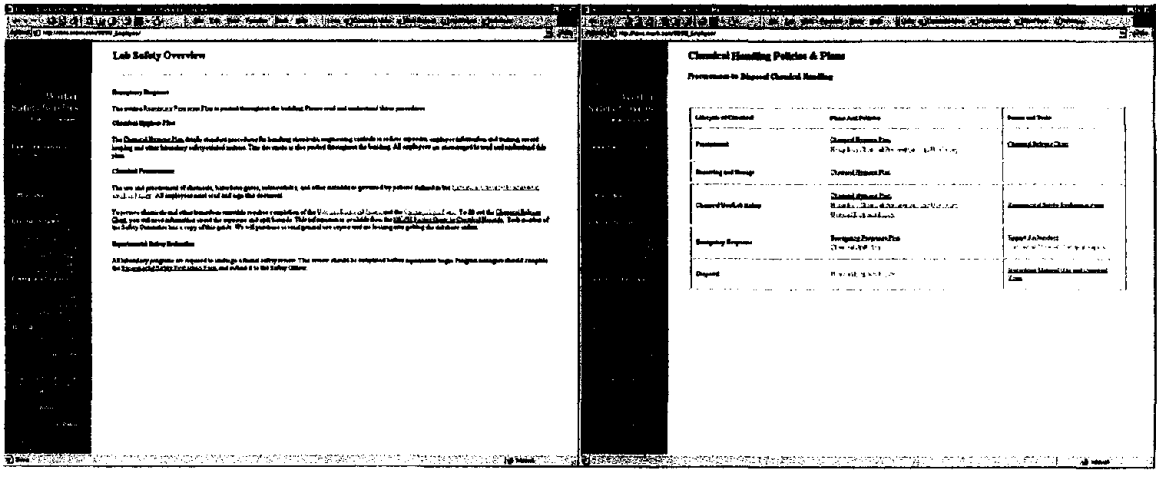


Figure 19. Laboratory Safety Second Tier Web Pages

A third second tier web page is created as a catchall for links to tools and resources regarding laboratory safety. The wizard provided many of the lists of relevant links from the SBSO Input database during creation, some could be provided by the user. The "About the

HAZCOM Regulations" link is to an in-house PowerPoint presentation entitled "An Introduction to Chemical Hazard Communication." Other links are to databases that can be searched and relevant government agency web sites.

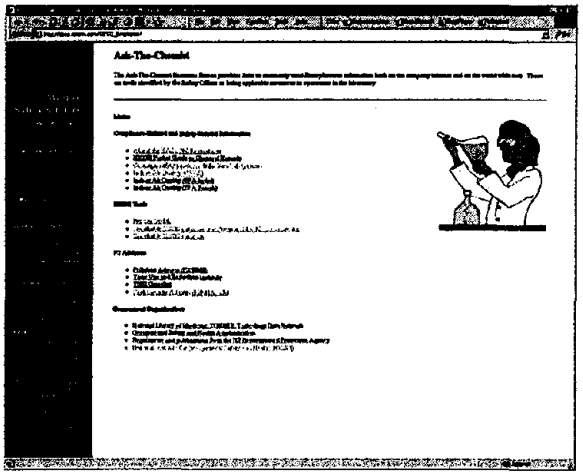


Figure 20. Laboratory Safety Second Tier Web Pages

Database Plans and Policies Links

In the demo version, we envision that person operating the "Initial Interview" anticipated that the "Chemical Hygiene Plan" would be a frequently accessed plan, and decided to include it as a direct link from the Table of Contents under the "Laboratory Safety" section.

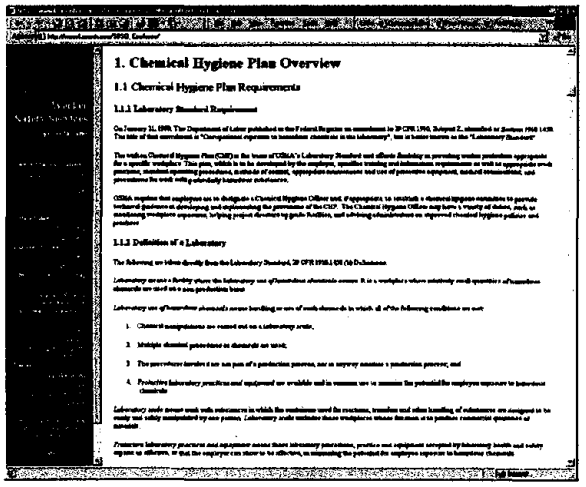


Figure 21. Laboratory Safety Database Plans And Policies Links Pages

Database Form (Submission) Links

In the demo version, we envision that person operating the "Initial Interview" anticipated that the "Experiment Safety Evaluation Form" would be a frequently accessed form, and decided to include it as a direct link from the Table of Contents under the "Laboratory Safety" section. By doing this, the laboratory worker is one-click away from beginning to complete a form electronically, and submitting that form electronically for review by the designated reviewers (safety officer, laboratory manager, hygiene officer, etc.). We envision that future versions could

also include advisors that would assist the worker in completing the form by supplying inputs automatically (such as chemical properties, etc.) and by alerting them to safety issues and policy issues identified by an expert system. This immediate feedback of common concerns to the laboratory worker will provide a cost savings to small businesses.

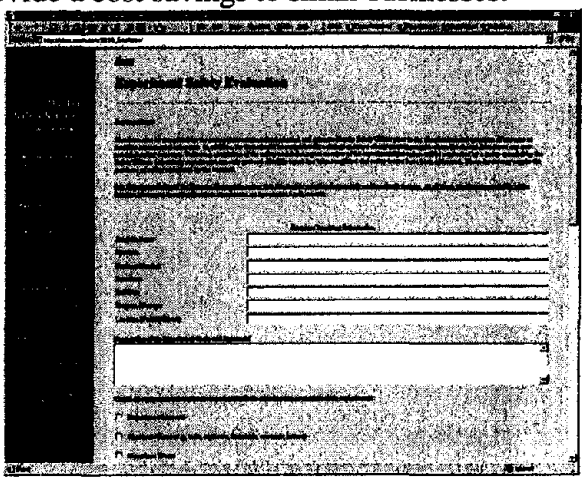


Figure 22. Laboratory Safety Database Form (Submission) Links Pages

User-Supplied Web Pages

There are no user-supplied web pages; the pages shown are envisioned as being generated by the "Initial Interview" site.

Special Web Page Tools And Advisors

There are no special web page tools or advisors.

4.3.2.6 Emergency Response

Purpose

An important aspect of the system is that it includes Emergency Response information. The demo version of the "Initial Interview" includes wizards and templates for creating an Emergency Response Plan and a Facility Evacuation Plan. The following are currently accessible via the SBSO Input database:

- Names and access information for the Emergency Response Team
- The Emergency Response Plan
- The Facility Evacuation Plan

We envision a future system that has advisors for:

- Establishing an Emergency Response Team
- Safety Equipment Inventory, Maintenance and Inspection Log
- Emergency Response Team Training Information and Log
- Establishing Chemical Spill Procedures for Small and Large Spills for new procurements

Second Tier Web Pages

For the demo version, the Laboratory Safety section has two Second Tier Web Pages. These include the standard features of a title, welcome message, horizontal bar, graphic, and a list of relevant links from the SBSO Input database. The links below are all off-site links. Some

may be selected from a list provided by the "Initial Interview" advisors, others may be user-defined resources.

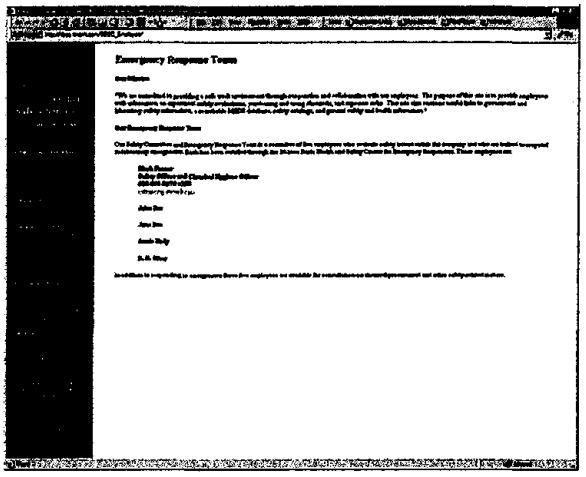


Figure 23. Laboratory Safety Second Tier Web Pages

Database Plans and Policies Links

In the demo version, we envision that person operating the "Initial Interview" anticipated that the "Emergency Response Plan" and the "Evacuation Plan" would be a frequently accessed plans or plans that one would need to find quickly, and decided to include them as direct links from the Table of Contents under the "Emergency Response" section. It should be noted that these plans can also be accessed through other screens including the Laboratory Safety Overview and the Chemical Handling Policies and Plans.

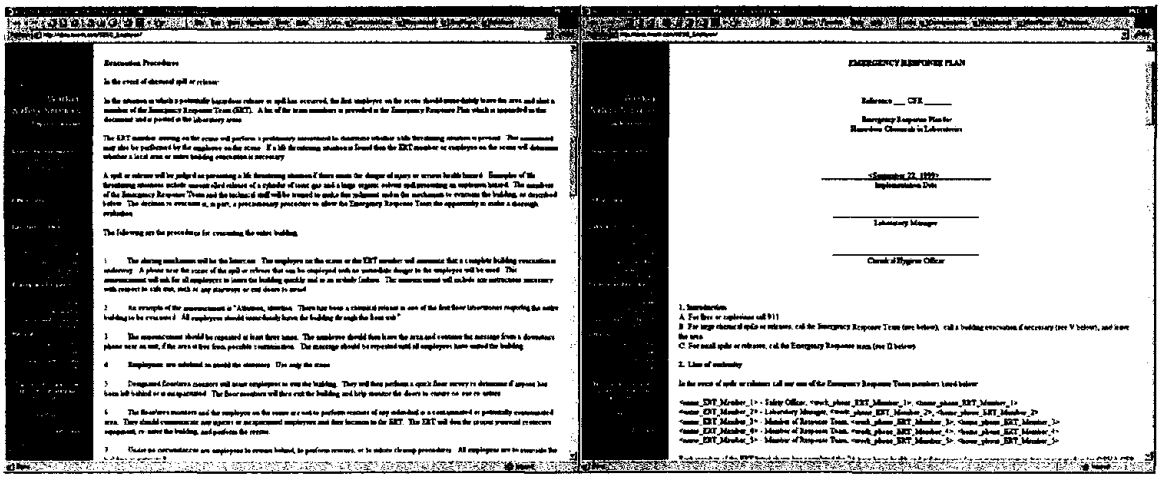


Figure 24. Laboratory Plans and Policies Pages

Database Form (Submission) Links

There are no links to SBSO forms from the Office Safety section.

User-Supplied Web Pages

The user has supplied a special web page entitled "Emergency Response Guidebook". It is envisioned that the user can create their own custom web pages, and have them included either on the Table of Contents (as this page was) or as links in second tier web pages. This link is to the "2000 Emergency Response Guidebook". We envision future tools and advisors that would access information in the guidebook and present it in a variety of ways and places to the users.

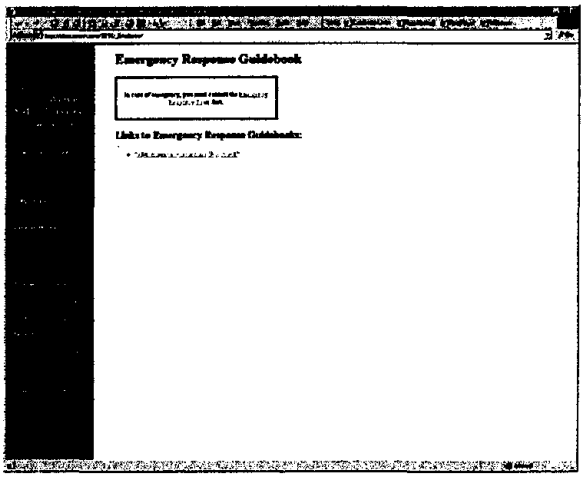


Figure 25. Laboratory Safety User-Supplied Pages

Special Web Page Tools And Advisors

There are no special web page tools or advisors.

4.3.2.7 Records

Purpose

The Records section is envisioned as one of the major cost-savings portions of the SBSO Employee Intranet. Here, companies can streamline their paperwork trail by efficiently organizing data electronically. The access via keyword, or date, or person's name, etc., will significantly reduce the time and cost for record retrieval over conventional file folders. We think that all small businesses will want to include a Records section in their SBSO Employee Intranet.

Second Tier Web Pages

For the demo version, the Records section has two Second Tier Web Pages. These include the standard features of a title, welcome message, horizontal bar, graphic, and a list of relevant links from the SBSO Input database. The links below are all off-site links. Some may be selected from a list provided by the "Initial Interview" advisors, others may be user-defined resources. In these forms, no horizontal line or graphic was selected. The set of "Downloadable Forms" is a list of all public access forms. Here, the employee can immediately access and complete forms such as the Experiment Safety Evaluation Form, or the Medical History Form, or the Incident Report Form.

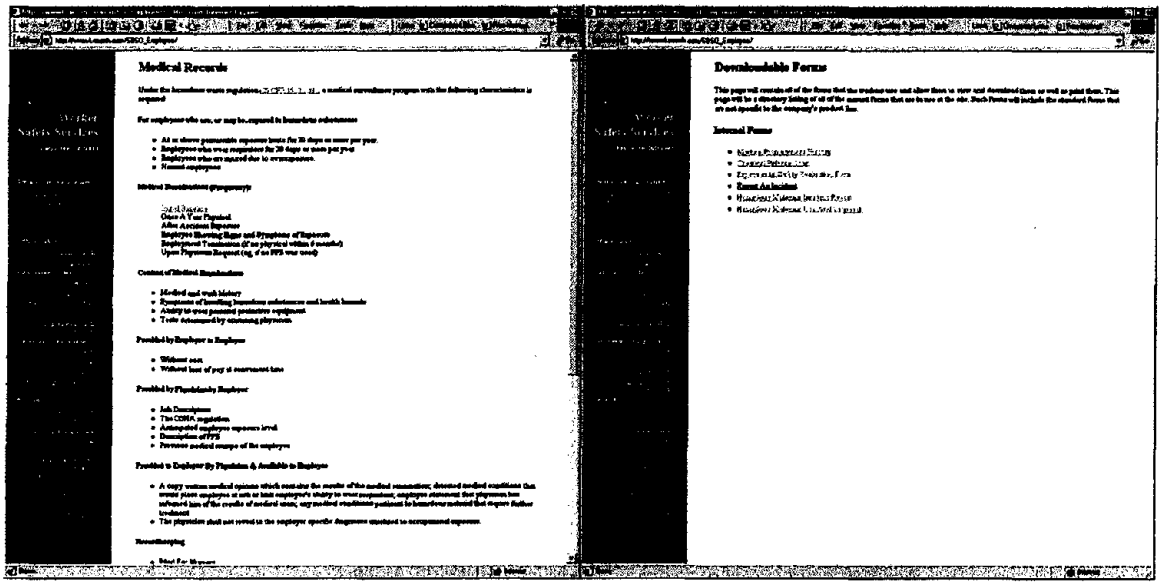


Figure 26. Records Second Tier Web Pages

Database Plans and Policies Links

There are no links to SBSO plans and policies from the Records section.

Database Form (Submission) Links

In the demo version, we envision that the person operating the "Initial Interview" anticipated that the "Report Incident Form" would be a frequently accessed form, and decided to include it as a direct link from the Table of Contents under the "Records" section. By doing this, the laboratory worker is one-click away from beginning to complete a form electronically, and submitting that form electronically for action by the appropriate personnel (medical officer, safety officer, laboratory manager, etc.). We envision that ease of form submission will improve company incidence tracking, and thus help companies improve their policies and training to overall reduce accidents.

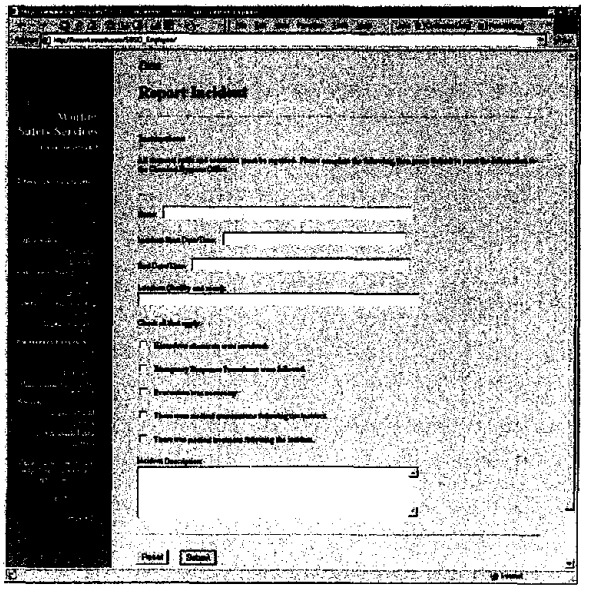


Figure 27. Records Database Form (Submission) Links

User-Supplied Web Pages

There are no user-supplied web pages; the pages shown are envisioned as being generated by the "Initial Interview" site.

Special Web Page Tools And Advisors

The Records section has the MRC Calendar tool, which accesses a database of events and links. For the demo, training session, scheduled inspections, and log information are listed on the calendar. We envision that a future version would allow the user to link to relevant log or training material directly from the calendar entry; and to maintain a personal calendar with entries that can be overlaid with the SBSO safety officer calendar information. The text search tool allows the user to perform a keyword search on the in-house intranet site. In future releases we envision that tools for browsing medical and inspection logs will be provided.

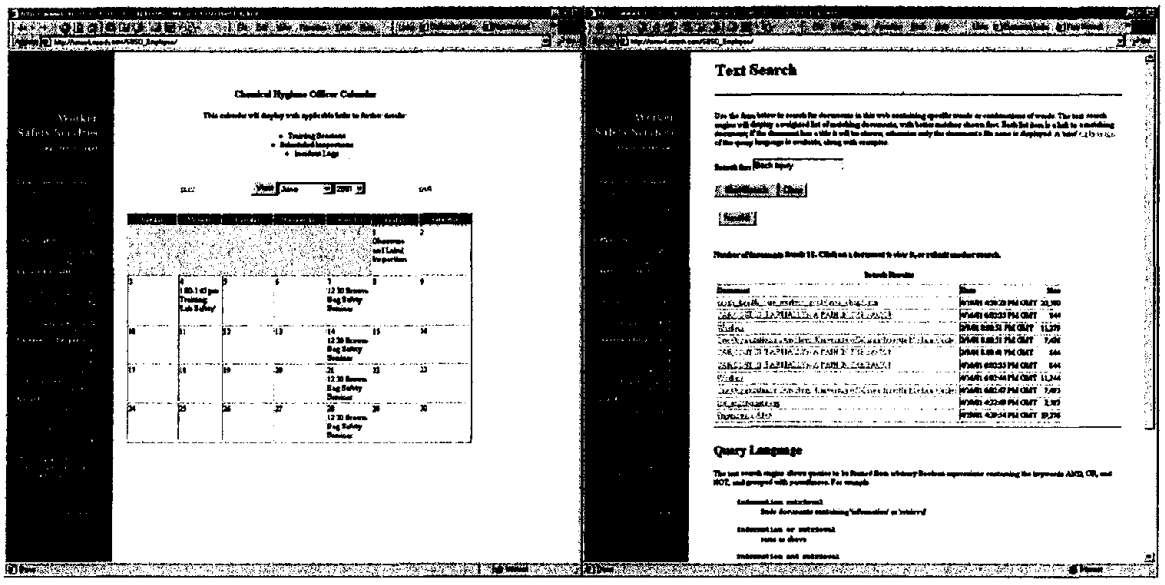


Figure 28. Records Special Web Page Tools and Advisors

4.3.2.8 Using the Employee (Public) Intranet

The intranet is invoked and run through a web browser such as Netscape or Microsoft Internet Explorer. Currently, all navigation is interactive and requires use of keyboard and mouse. Future versions will include voice navigation. Output is displayed within the browser graphically and includes static web pages, dynamic web pages (that access the SBSO Input Database or one of the SBSO generated databases (medical, calendar/log, chemical inventory, etc.), multimedia pages (tutorials that include audio-visual files such as "how to fit/wear a respirator" or "how to use a fume hood").

Whenever the system is invoked, the SBSO Employee (Public) Intranet Home page is displayed. From here, the user can access links on the Home Page or from the Table of Contents. Second Tier Web pages from the Table of Contents contain links to more resources and tools.

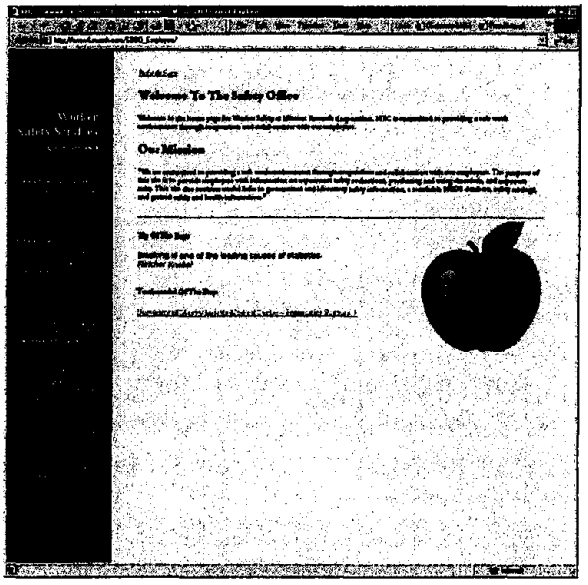


Figure 29. Employee (Public) Intranet Home Page

Consider the following use case. A laboratory worker wants to conduct an experiment that requires purchasing chemicals that are not currently in the inventory. First, the worker must submit for chemical procurement, a chemical release form, so that emergency response information is available before the chemical is acquired. While completing the form, it is determined that the required chemical is a hazardous chemical so P2 advisors are invoked that search for alternatives. The worker browses MSDS sheets and safety sheets pertinent to working with that chemical. After completing the appropriate safety forms and procurement forms, the worker begins to complete the experiment evaluation plan.

4.3.3 Administrative Intranet

4.3.3.1 Overview

Using the "Initial Interview" software, a company's safety officer creates the "Administrative (Private) Intranet Site". This site offers an organized and efficient presentation to an elite group (e.g., the CEO, the Chemical Hygiene Officer, the Safety Officer) allowing them to search, display, print, and annotate (form submission) the SBSO database. The Administrative (Private) Intranet Site consists of:

1. A Table of Contents on the Left-Hand-Side, currently implemented as an HTML file, and loaded in a frame of every page of the Administrative Intranet.
2. Many Second Layer (Second Tier) Web Pages either generated by the "Initial Interview" Create Web Page Wizard or user-supplied web page files.
3. Access to all parts of the SBSO Generated Databases (e.g., Medical Record keeping, Accident Log, Training Log and Database, Safety Equipment Inventory Database and Maintenance/Inspection Log, Chemical Purchase and Inventory Database) SBSO Form Processing Tools and the SBSO Generated Database Management Tools
4. Access to SBSO Generated Forms (e.g., Chemical Purchase, Experiment Evaluation, Chemical Disposal, Medical), and ability to electronically complete and submit those forms.

5. Special Web Page Tools and Advisors

The information required for generating this site is acquired through our graphical user interface, the "Initial Interview." The Administrative (Private) Intranet Site is implemented using a variety of software languages (e.g., HTML, ASP, Java, JavaScript, etc.) The web site architecture allows us to create a system that, among other utilities, will:

1. Allow the Safety Officer, and other company administrators, to browse a library of safety information, company policies, and procedures, and training information.
2. Archival management tools for the company policies, plans, forms.
3. Tools for managing inventory, inspections, logs, etc. of laboratory equipment, safety equipment, chemical inventory, and emergency response equipment.
4. Tools to review records and manage the medical, accident, and injury databases.
5. Manage the calendar of events (training sessions, inspections, etc.)

Navigation through the demo web site is completely accomplished through keyboard and mouse interaction and navigation tools on the browser. Hyperlinks are tied to text and buttons.

4.3.3.2 Table of Contents

The Table of Contents for the Administrative (Private) Intranet is shown below:

Table 3. Administrative Table of Contents

Demo Site Navigation

Administration Intranet Home
Employee Intranet Home
[SBSO Welcome]
[SBSO Interview]

Standards

Applicable OSHA Regulations
Download Links
OSHA HAZCOM Regulations

Library

Plans
Policies
Forms

Record Keeping

Log of Incident Reports
Log of Medical Conditions
Calendar
Report Incident

Cost Savings

P2 Advisors
Ask-The-Chemist

Information Transfer

Example

4.3.3.3 Demo Site Navigation

The Demo Site Navigation section is only included for the ease of reviewers assessing our site remotely. We do not intend to have this section in the final product; with the exception of the Home Page.

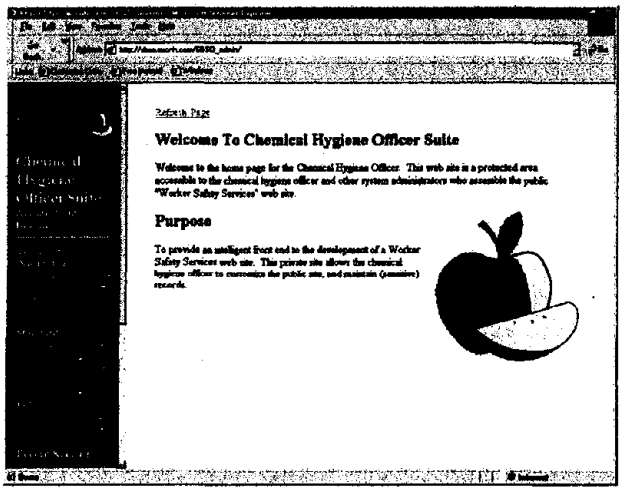


Figure 30. Administrative (Private) Intranet Home Page

While the Home Page is the first screen shown each time the system is accessed, it is a Second Tier Web Page. Second Tier Web Pages are generated by a wizard in the "Initial Interview" and include the standard features of a title, welcome message, horizontal bar, graphic, and a list of relevant links from the SBSO Input database. Here, during the initial interview the user input that the title for the Home Page was "Welcome to the Chemical Hygiene Officer Suite" and selected some welcome text information. An apple graphic was selected for the home page.

4.3.3.4 Standards

Purpose

We envision that all small businesses will want a Standards section in their Administrative Intranet. The Standards section provides lists of all the applicable OSHA regulations, and links to the CFR files. The applicable OSHA regulations were determined from the Company Profile and the OSHA Requirements Identification Wizard of the Initial Interview.

Second Tier Web Pages

For the demo version, the Standards section has two Second Tier Web Pages. These include the standard features of a title, welcome message, horizontal bar, graphic (none), and a list of relevant links from the SBSO Input database. The links below are all off-site links.

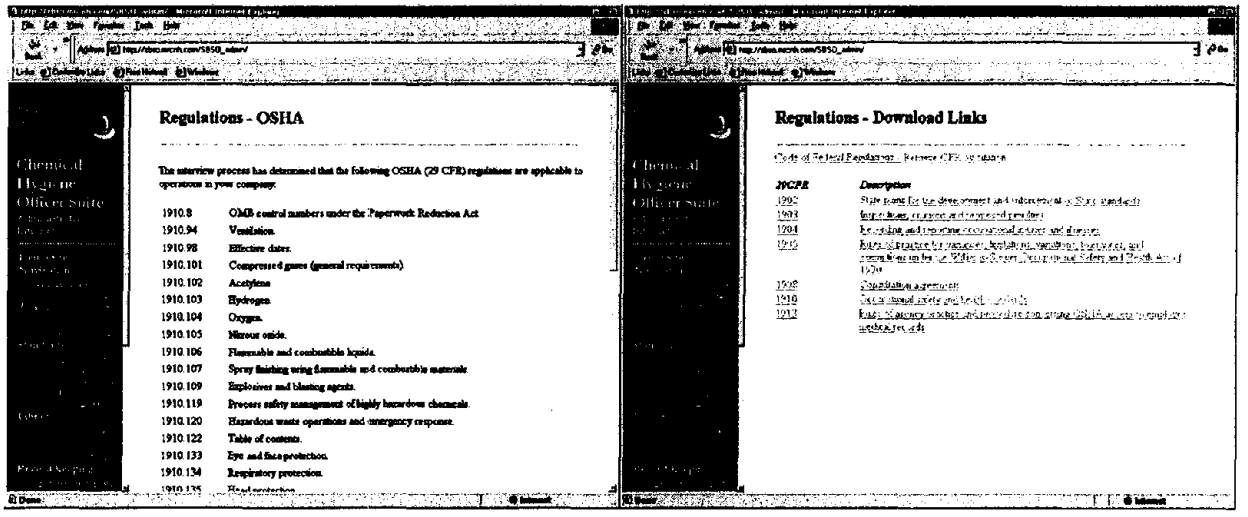


Figure 31. Standards Second Tier Web Pages

Database Plans and Policies Links

There are no links to SBSO plans or policies from the Standards section.

Database Form (Submission) Links

There are no links to SBSO forms from the Standards section.

User-Supplied Web Pages

For the demo version, the Standards section includes one user-defined page. Applicable OSHA regulations were determined from the Company Profile and the OSHA Requirements Identification Wizard of the Initial Interview. We envision our system as including both the exact, current, CFR text as well as rules in our expert system that codify that text. In this example, when on the Hazcom tab, the Initial Interview user created a web page from the CFR text and included a link to it from the Table of Contents. This would allow frequently accessed regulations to be immediately available from the site.

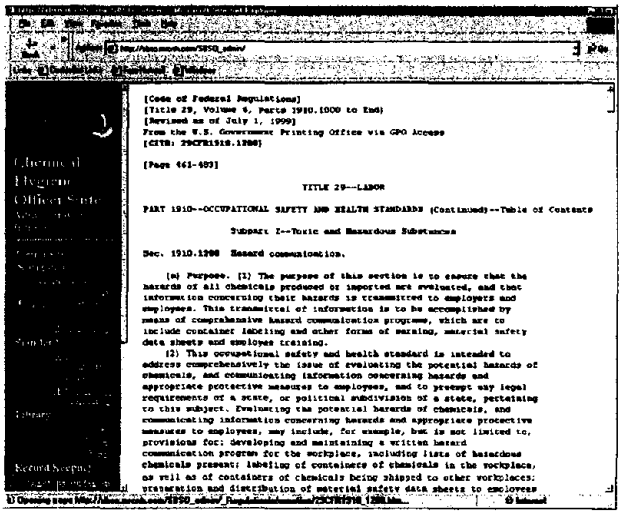


Figure 32. Standards User-Supplied Web Pages

Special Web Page Tools

There are no links to SBSO special web page tools. We can envision that special tools, such as special search engines for showing exactly the OSHA regulations citation and how it maps into the plans, policies, and forms.

4.3.3.5 Library

Purpose

We envision that all small businesses will want a Library section in their Administrative Intranet. The Library section provides tools for managing the archive of plans, policies, and forms.

Second Tier Web Pages

There are no links to Second Tier Web Pages in the Library section.

Database Plans and Policies Links

There are no links to SBSO plans or policies from the Library section in the Table of Contents.

Database Form (Submission) Links

There are no links to SBSO forms from the Library section in the Table of Contents.

User-Supplied Web Pages

No user-supplied web pages are provided in the demo version.

Special Web Page Tools

The demo version Administration site includes three Database management tools: the Plan Manager, the Policy Manager and the Form Manager. The three SBSO generated databases are created and populated by the Initial Interview section. These SBSO Plan Database includes a record for each plan. Each record consists of the plan's document filename, the location of the file in the SBSO system, the creation date, the creator's name, flags for whether or not each type of file (text, PDF, Word, HTML) exists, and a flag indicating whether or not the plan was automatically generated by the SBSO software or supplied by the user. Similar databases exist for the forms and policies. The management tools for the demo version allow records to be added or deleted from the database, and list the filenames with hyperlinks to the files.

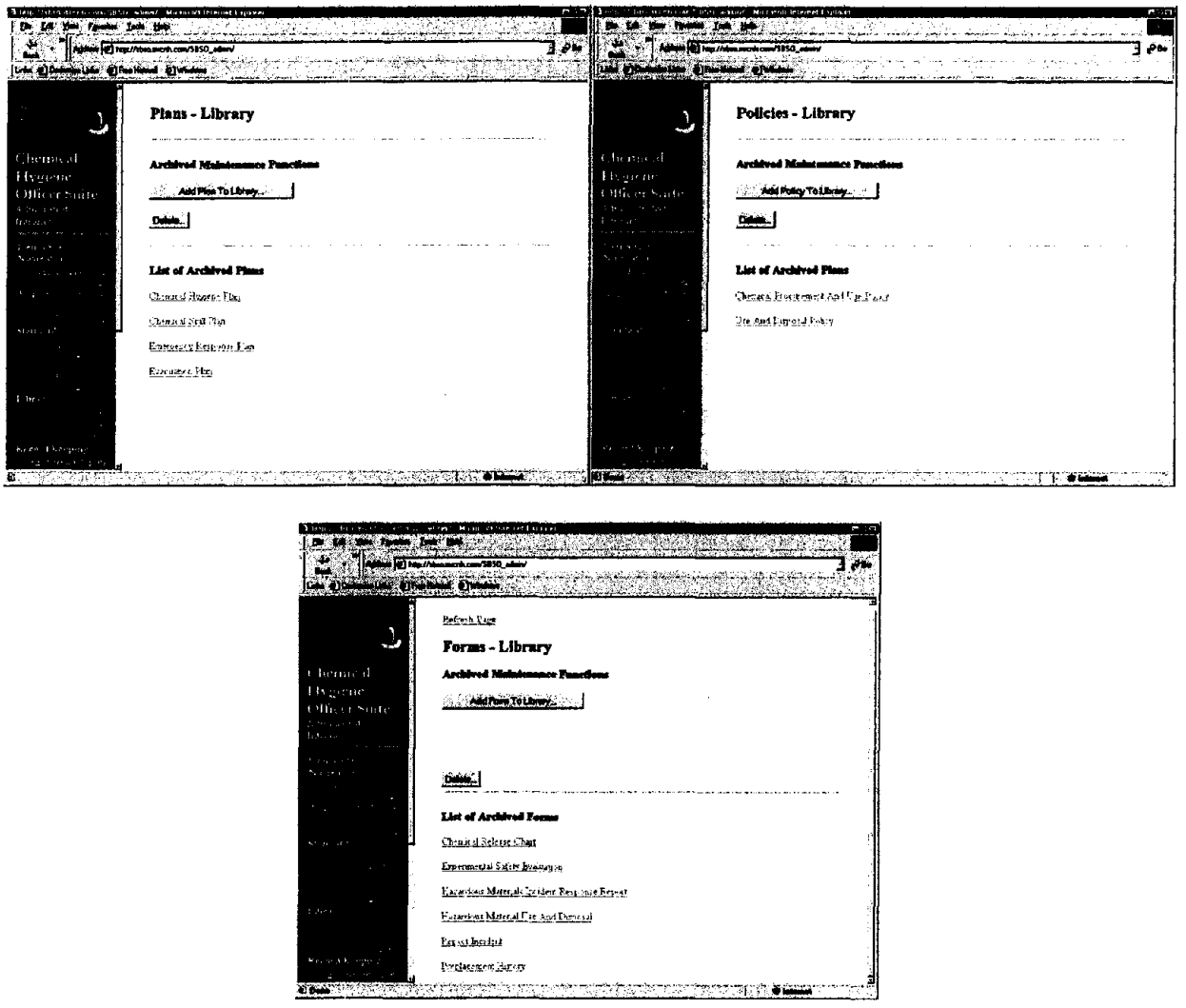


Figure 33. Library Special Web Page Tools

4.3.3.6 Record Keeping

Purpose

We envision that all small businesses will want a Record Keeping section in their Administrative Intranet. The Record Keeping section provides tools for managing the SBSO generated databases, including the Medical Record keeping, Accident Log, Training Log and Database, Safety Equipment Inventory Database and Maintenance/Inspection Log, Chemical Purchase and Inventory Database.

Second Tier Web Pages

There are no links to Second Tier Web Pages in the Record Keeping section.

Database Plans and Policies Links

There are no links to SBSO plans or policies from the Record Keeping section in the Table of Contents.

Database Form (Submission) Links

In the demo version, we envision that person operating the "Initial Interview" anticipated that the "Report Incident Form" would be a frequently accessed form, and decided to include it as a direct link from the Table of Contents under the "Records" section. By doing this, the Safety Officer is one-click away from beginning to complete a form electronically, and submitting that form electronically for action by the appropriate personnel (presumably, himself, but this streamlines the processing of that form from receipt to investigation to log file to database records pertaining to the incident). We envision that ease of form submission will improve company incidence tracking, and thus help companies improve their policies and training to overall reduce accidents.

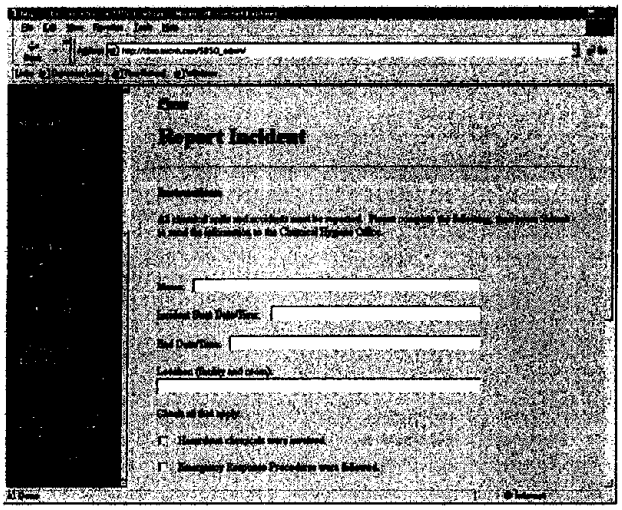


Figure 34. Forms Accessible in the Administrative Table of Contents Record Keeping Section

User-Supplied Web Pages

No user-supplied web pages are in the demo version.

Special Web Page Tools

The demo version Record Keeping section of the Administration site provides tools for managing the SBSO generated databases, including the Medical Record keeping, Accident Log. There are no demo versions of the databases. These databases will be somewhat more complex because they will require some cross-referencing, in other words, some of the medical records, but not all, will reference incidence records. Incidence records will probably reference other records. Tools for browsing, printing, editing, and adding records will be added to these pages.

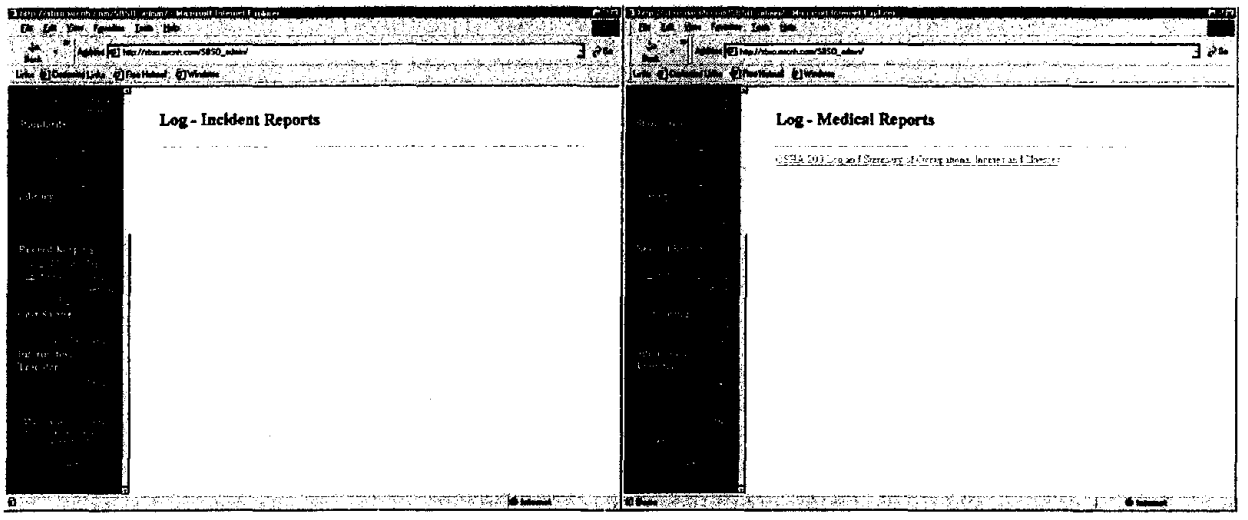


Figure 35. Record Keeping Special Web Page Tools - SBSO Generated Database Management

Our calendar tool will manage a database of calendar events. Each calendar event record can optionally include a link so that when it is displayed, a mouse click will bring the user to a web page describing that event. This will be particularly useful for training events. The calendar event record also has a type field so that it can be flagged as being a training event or an inspection, etc. Then the calendar display tool can be modified to display records of a particular type (or set of types).

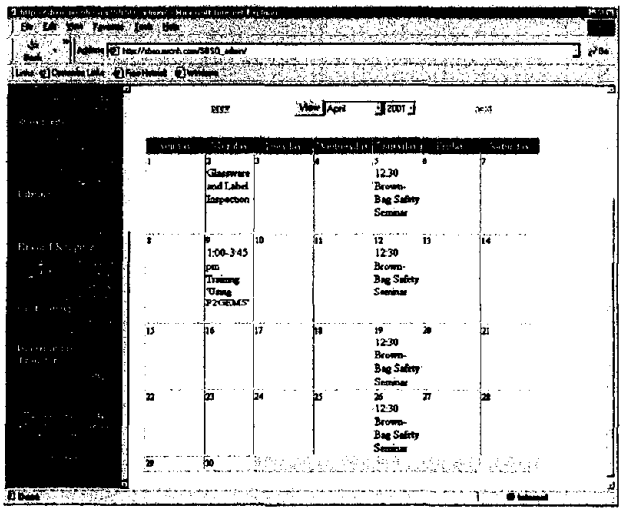


Figure 36. Record Keeping Special Web Page Tools - Calendar

4.3.3.7 Cost Saving

Purpose

We envision that all small businesses will want a Cost Savings section in their Administrative Intranet. The Cost Savings section provides lists of links to resources that assist in reducing operating expenses and/or minimizing accident costs.

Second Tier Web Pages

For the demo version, the Cost Savings section has two Second Tier Web Pages. These include the standard features of a title, welcome message, horizontal bar, graphic, and a list of relevant links from the SBSO Input database. The links below include on-site links to company plans, policies, forms, training information and off-site links.

The page entitled "Saving Money - P2 Advisors" includes a list of links to cost savings resource including P2GEMS, P2OASYS, and P2FINANCE. The page entitled "Ask-the-Chemist", also available from the Employee (Public) site, is created as a catchall for links to tools and resources regarding laboratory safety. The wizard provided many of the lists of relevant links from the SBSO Input database during creation, some could be provided by the user. The "About the HAZCOM Regulations" link is to an in-house PowerPoint presentation entitled "An Introduction to Chemical Hazard Communication." Other links are to databases that can be searched and relevant government agency web sites.

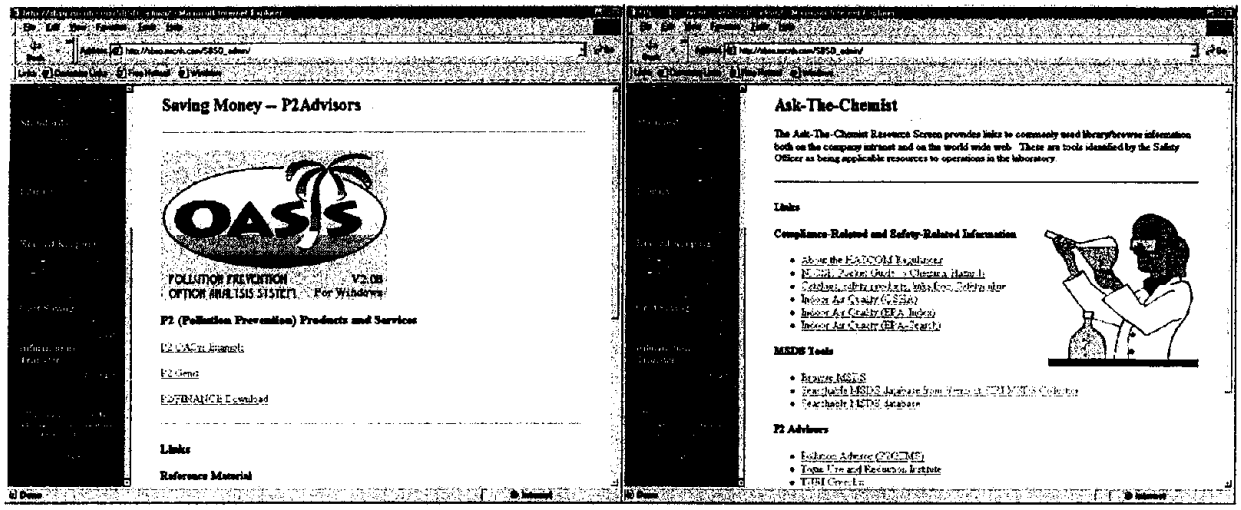


Figure 37. Second Tier Web Pages of the Cost Savings Section

Database Plans and Policies Links

There are no links to SBSO plans or policies from the Cost Savings section.

Database Form (Submission) Links

There are no links to SBSO forms from the Cost Savings section.

User-Supplied Web Pages

There are no user-supplied web pages here in the demo version.

Special Web Page Tools

There are no special web page tools in the demo version; however we envision tools that enable the P2 advisors to be used as background processes advising the user when they are searching or filling in forms, etc.

4.3.3.8 Information Transfer

Purpose

The Information Transfer section was sparked by our discussions with Kluber. Here, we recognize that companies will want to maintain proprietary databases of chemicals, be able to search chemicals on various fields, and create printouts, shipping inserts, etc.

Second Tier Web Pages

There are no links to second tier web pages from the Information Transfer section of the Table of Contents.

Database Plans and Policies Links

There are no links to SBSO plans or policies from the Information Transfer section.

Database Form (Submission) Links

There are no links to SBSO forms from the Information Transfer section.

User-Supplied Web Pages

There are no user-supplied web pages here in the demo version.

Special Web Page Tools

Our Information Transfer tool is an efficient way of doing database searches on a proprietary chemical database. Here predefined queries automatically fill in search fields to list, for example, the "RMP Substances" list or the "Sara 313" list. Optionally, the output of the search can be e-mailed to the user, further streamlining operations. The user can elect to create his own specific search strings via the checkbox fields.

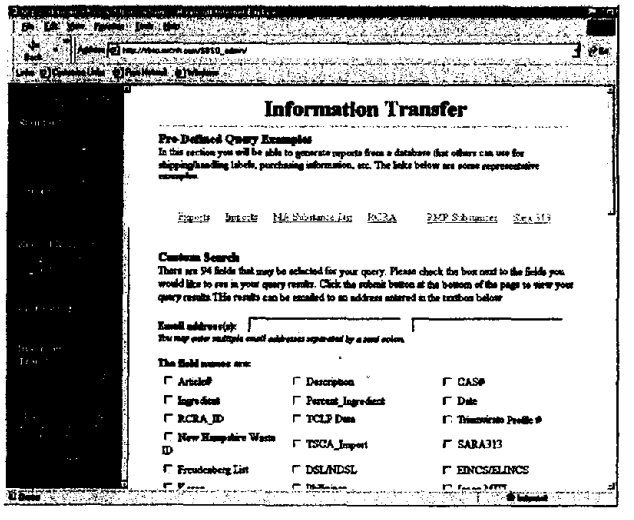


Figure 38. Information Transfer Tool

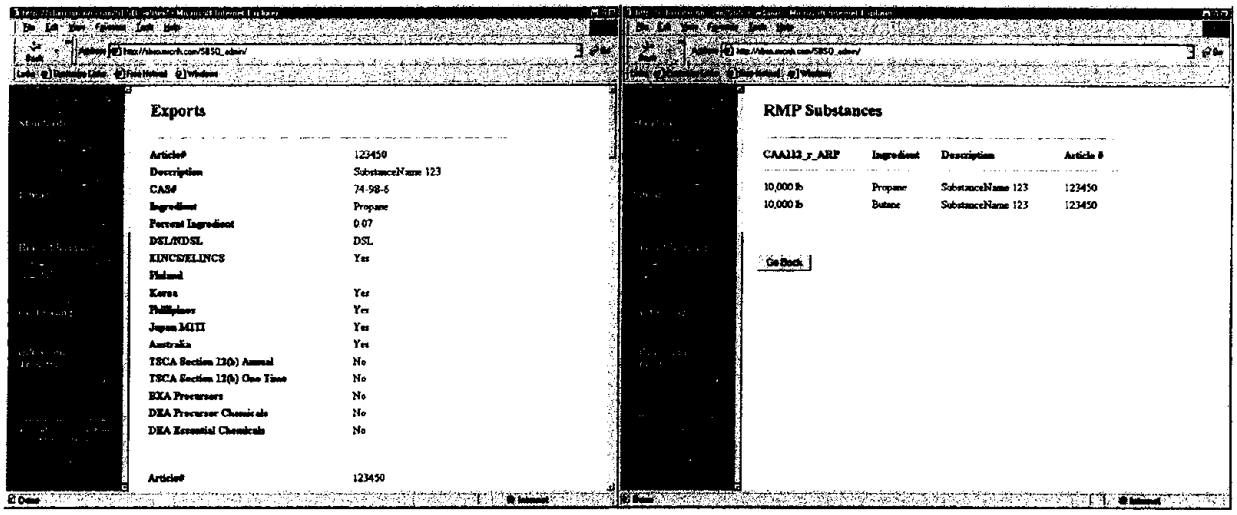


Figure 39. Example Search Results Produced By The Information Transfer Tool

4.3.3.9 Using the Administrative Site

The intranet is invoked and run through a web browser such as Netscape or Microsoft Internet Explorer. Currently, all navigation is interactive and requires use of keyboard and mouse. Future versions will include voice navigation. Output is displayed within the browser graphically and includes static web pages, dynamic web pages (that access the SBSO Input Database or one of the SBSO generated databases (medical, calendar/log, chemical inventory, etc.), multimedia pages (tutorials that include audio-visual files such as how to fit/where a respirator or how to use a fume hood).

Whenever the system is invoked, a login screen requiring password is displayed, then the SBSO Administration (Private) Intranet Home page is displayed. From here, the user can access links on the Home Page or from the Table of Contents. Second Tier Web pages from the Table of Contents contain links to more resources and tools.

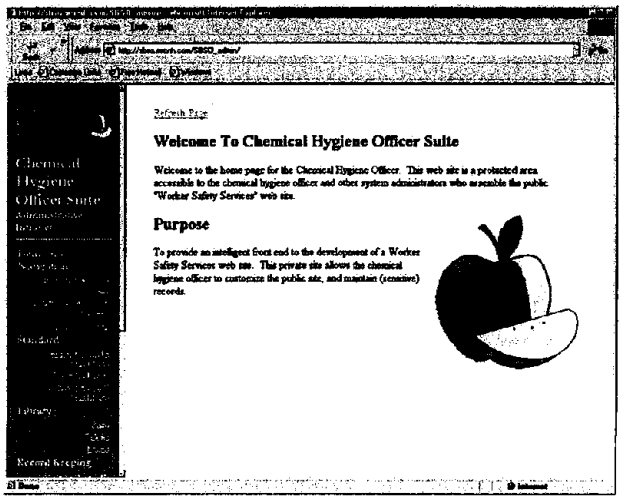


Figure 40. Administrative (Private) Intranet Home Page.

Consider the following use case. A safety officer wants to update his records to include three new planned training sessions, and then the results of his latest inspection of glassware. Navigating to the calendar tool, he clicks the dates for the new entries and populates the database of calendar events with dates, times, places, and event titles, and links to resources regarding the events. (Automatically, all employees who have subscribed to notification of calendar events are e-mailed with announcements of the latest entries). Next the administrator navigates to the inspection log then enters his notes into the inspection database. He might compare this latest record to previous. (Automatically, select members of the staff receive e-mail regarding this entry).

4.3.3.10 Worker Safety and Health Evaluation Tool - P2OASys

The P2OASys (Pollution Prevention Options Analysis System) is designed to assist companies in conducting more comprehensive and systematic environmental and worker health and safety analyses of their pollution prevention and toxics use reduction (P2/TUR) options. It is primarily intended to assist companies in identifying potential hazards associated with current or proposed processes and choosing the most environmentally safe alternative which is most protective of worker health and safety. Currently, it is written in Microsoft ® Excel.

When considering P2/TUR options, a company must not only consider technical and economic feasibility, it should also consider the potential worker health and safety impacts. Technical and economic feasibility analyses are generally facility and process specific and many companies have internal or industry guidelines for process/product performance. Little guidance, however, has been available to companies concerning health and safety analysis of P2/TUR options. This critical component of the P2/TUR analysis has been addressed through the creation of the P2OASys by the Toxics Use Reduction Institute (TURI) of Massachusetts.

While assessment of the technical and economic feasibility of P2/TUR options is relatively straightforward, assessment and comparison of the environmental and worker health and safety performance of P2/TUR options is very challenging - especially for smaller companies with few resources for such evaluations. The lack of a systematic tool to assess, rank, and choose feasible alternatives can potentially hinder or discourage P2/TUR efforts or lead to the introduction of alternatives with unforeseen environmental, worker, or public health impacts. While numerous chemical evaluation schemes have been developed, most suffer from: (1) complex formulas; (2) excessive data demands; (3) a failure to incorporate worker health and safety impacts; and (4) the ability to evaluate only single substance, and not mixtures or processes. These problems seriously limit the application of these schemes by small and medium-sized companies.

The P2OASys will assist companies in two ways: (1) to examine systematically the potential environmental and worker impacts of TUR options in a comprehensive manner, examining the impacts of process changes, rather than simply those of chemical changes; and (2) to compare TUR options with the company's current process based on quantitative and qualitative factors. Only after a company has considered the full range of potential consequences of a process and its alternatives can informed decision-making take place.

The Need for P2OASys

Toxics use reduction does not consist only of changes in chemical use or waste*: it also includes process changes*. TUR does not consist only of chemical input substitution. Product reformulation, production unit redesign, modification, or modernization, integral recycling, or improved operation and maintenance are also considered toxics use reduction techniques. Each of these can pose various hazards to worker health and safety. Most often, when environmental or health and safety analyses of TUR options are conducted in facilities, they are usually ad hoc chemical analyses, based on information provided by vendors or on Material Safety Data Sheets (MSDS). However, a chemical or process change can often lead to substantial changes in process operations, production protocol, and work habits. For example, the substitution of an aqueous solvent for a chlorinated one may reduce worker exposure to a dangerous chemical, but also may increase the need for physical removal of oils or contaminants from a surface, thus increasing the potential for upper extremity injuries among workers.

The P2OASys incorporates a wide variety of both qualitative and quantitative information about processes and chemicals to produce a combined hazard score for a company's current process and identified alternatives. This Final Hazard Score includes consideration of acute and human health effects, physical hazards, environmental hazards, and chemical properties. Hazard scores can then be compared and ranked. Considered along with information from economic and technical analyses, the company can then choose the "best" option for its particular situation.

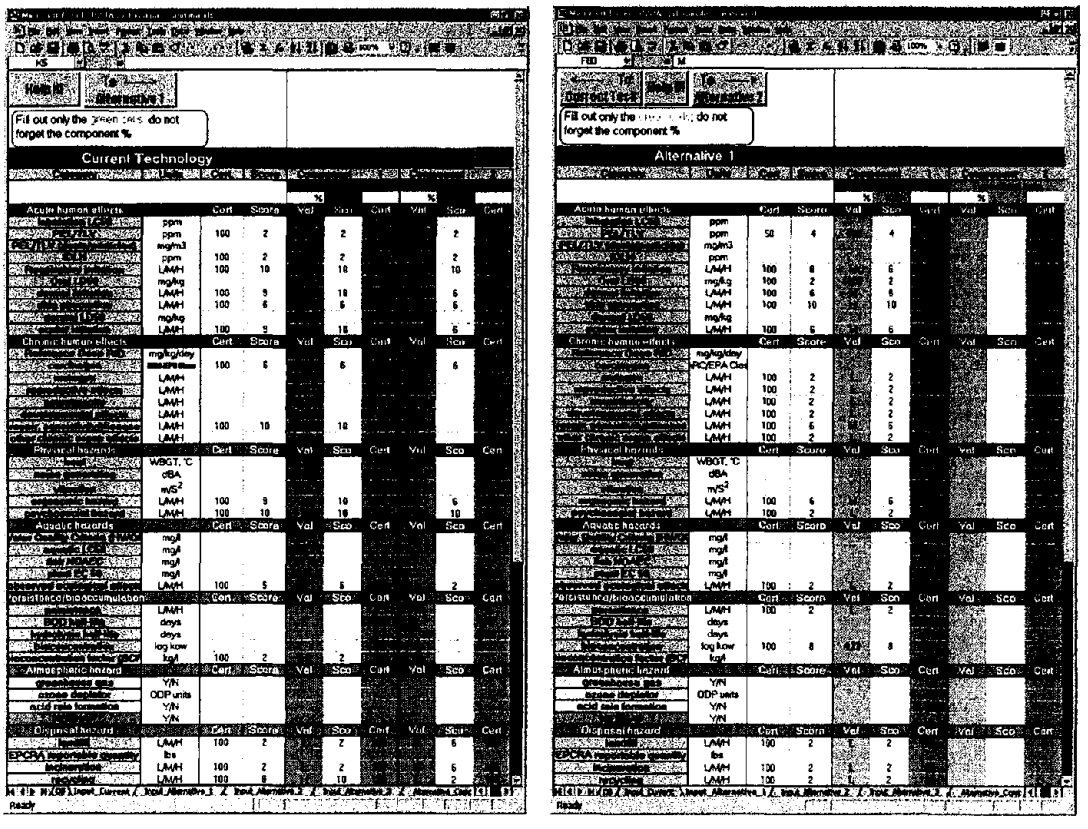


Figure 41. Inputs to P2OASys

After entering data in the following categories, the P2OASys prepares a comparative analysis table and hazard score table.

Elements for data input:

1. Acute human effects
2. Chronic human effects
3. Physical hazards
4. Aquatic hazard
5. Persistence/bioaccumulation
6. Atmospheric hazard
7. Disposal hazard
8. Chemical hazard
9. Energy/resource use
10. Product hazard
11. Exposure potential

The evaluation criteria within these eleven categories are both quantitative and qualitative in nature. Most of these evaluation criteria refer to chemical characteristics and hazards, but some refer specifically to process characteristics and hazards. For quantitative criteria, the user enters actual numerical values (e.g., the Permissible Exposure Limit or PEL for a chemical). For qualitative criteria, the user enters a value of low, low/moderate, moderate, moderate/high or high.

Once the data is entered, the P2OASys prepares a Comparative Analysis table for each evaluation criteria for the current process and P2/TUR options. This allows the user to compare criteria values between the current process and alternatives. It also prepares the Hazard Score table, calculates sub-total scores for each category of evaluation criteria as well as a Final Hazard Score, a relative indicator of the environmental and occupational health and safety hazards posed by the current process and each P2/TUR option analyzed. The Hazard Score Table also provides a weighted Final Hazard Score, taking into account availability of information and uncertainty in the values for each evaluation criterion. In the Hazard Score Table, the user has the opportunity to weight specific hazard categories (e.g., chronic human effects).

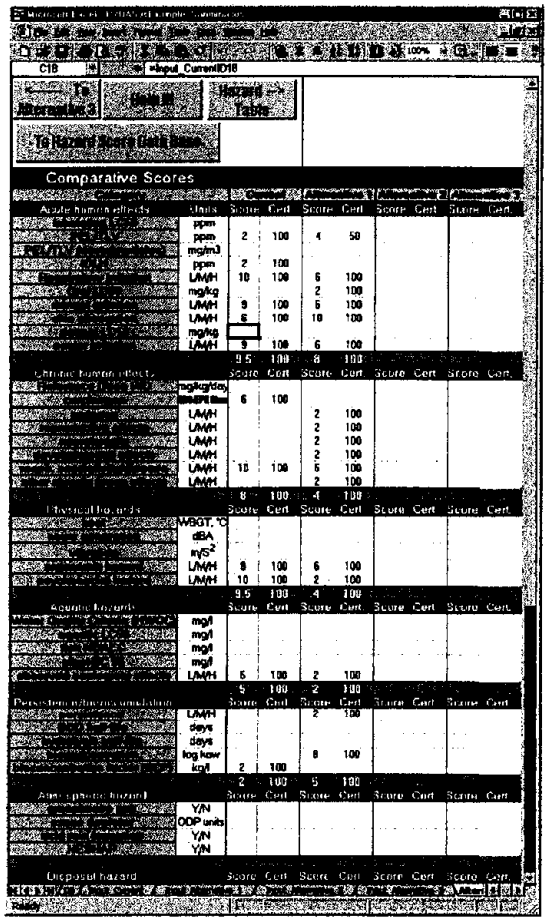


Figure 42. Detailed Output from P2OASys Provides Category-By-Category Risk Assessment for Current and Alternative Substances

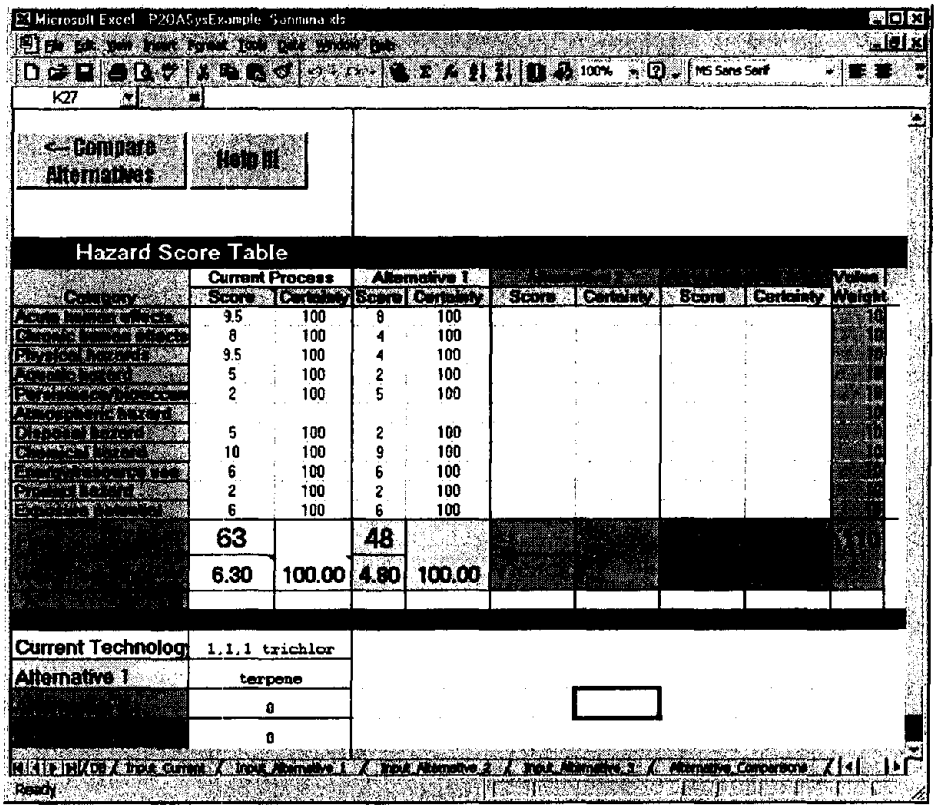


Figure 43. Summarized Output from P2OASys Provides Overall Hazard Score for Current and Alternative Chemicals

Summary

The P2OASys is designed to help companies think more comprehensively and systematically about the potential environmental *and* worker health and safety consequences of a current process and identified P2/TUR option. It has been designed for flexibility and adaptability to each company's individual process situation, decision-making priorities, information needs, and resources to obtain information. It has takes into consideration the financial and human resource limitations of small and medium sized companies.

The following list presents some guidance regarding what P2OASys can do and what it cannot do:

P2OASYS cannot:

1. Ensure the absolute safety of a TUR option. The hazard score is based only upon the information which is input into the P2OASYS analysis. Also, information may not be available about certain process hazards or these hazards may not have yet been discovered.

2. Provide an estimate of risk of injury or probability of hazard from a process. P2OASYS is a hazard assessment scheme (e.g., it identifies and quantifies potential hazards) which

incorporates only qualitative information about potential worker, environmental, or public exposure. Risk is a function of both hazard and exposure. Thus, the company needs to consider the extent of potential worker and environmental exposure separately when evaluating TUR options. Also, P2OASYS cannot give any indication the probability of identified hazard actually occurring or its severity in any particular situation.

P2OASYS can:

1. Assist companies in evaluating the environmental and worker health and safety consequences of TUR options, by providing a systematic and comprehensive framework for options analysis.

2. Assist companies in thinking more holistically about the range of potential process and chemical hazards. P2OASYS provides an extensive list of the types of information that should be considered when evaluating a process. The analysis will aid the company in identifying hazards and on-going monitoring needs and prioritizing interventions to reduce or eliminate hazards.

3. Provide a numerical estimate of process hazard, based on the information that is available for or incorporated into the analysis.

4. In conjunction with professional judgment, provide guidance on choosing the "best" TUR options from an environmental and health and safety perspective.

5. Help companies identify and avoid TUR options that may produce hazards after implementation.

Once the P2OASYS analysis is completed, the job of ensuring worker and environmental health and safety does not end. On-going monitoring is necessary to identify, evaluate, and remedy potential worker and environmental hazards that may have been overlooked in the analysis.

4.3.3.11 Pollution Prevention (P2) Advisor – P2GEMS

P2 GEMS is an Internet search tool for facility planners, engineers, and managers who are looking for technical, process, and materials management information on the Web. P2 GEMS lets you search by keyword or by selecting one of four categories: product or industry, chemical or waste, management tools, or process.

Example - Methylene Chloride Vapor Degreasing (P2 GEMS)

The following site was yielded using the Search by Keyword option with words "methylene chloride" or using the Search by Category option (Search by Category → Chemical or Waste → Methylene Chloride):

Amoco Performance Products, Inc. P2 Case Study

(http://www.epa.state.oh.us/opp/gov/fact17.html)

The following text was excerpted from the web page:
Pollution Prevention Activities

Amoco Performance Products has demonstrated its environmental commitment through a successful, strategic approach to pollution prevention.

As part of its continuous improvement process, Amoco formed teams to evaluate environmental releases to the air and water and will be forming a team for land releases. These teams are responsible for identifying pollution prevention opportunities.

As a result of these efforts, Amoco has reduced air emissions by nearly 40% from 1990 to 1992. This reduction was achieved through the implementation of several projects and new operational and managerial practices.

In order to decrease air emissions, Amoco undertook two vent consolidation projects. In addition to reducing air emissions, these projects facilitate the collection and recycling of solvents.

The company has also reduced the use of methyl chloride solvent through process improvements and procedural changes. This decrease in the use of methyl chloride will enable the company to avoid installing an incinerator while still doubling the production of polysulfone. By meeting the state's toxic policy without installing an incinerator, Amoco saves $1,200,000 in capital and $445,000 in annual expenses.

Amoco also upgraded both filtering equipment and extruders in order to reduce point source and fugitive emissions.

Short term benefits from these pollution prevention projects include compliance with existing permit conditions, capital and maintenance cost avoidances associated with compliance methods, environmental benefit and an enhanced public image of Amoco as a good corporate citizen.

Amoco Performance Products, Inc., has also reduced its solid and hazardous waste generation through its team approach.

Amoco's Research and Development and Marietta personnel concluded that the chlorobenzene, which had been previously incinerated, could be reclaimed and reused in the production process. By reusing the chlorobenzene, Amoco has eliminated approximately 500,000 lbs/year of hazardous waste, and saved nearly $115,000 per year.

The company discontinued the use of cadmium-based pigments after conducting an extensive study on non-cadmium based pigments. By substituting a non-cadmium based pigment, Amoco was able to reclassify the waste stream as non-hazardous, and eliminate approximately 38,000 lbs/year (73 drums) of hazardous waste at an estimated cost savings of $10,000 per year.

Amoco's recycling of paper, pallets and metals has reduced the amount of solid waste landfilled by approximately 50%. By cutting its solid waste in half, Amoco has avoided even higher tipping fees.

Short term benefits from these pollution prevention projects include capital and maintenance cost avoidances, reductions in hazardous waste transportation and disposal costs, and reductions in

emissions reported under the Toxic Release Inventory. Long term benefits include annual cost avoidance, environmental benefit and enhanced corporate image.

Amoco Performance Products has decreased water usage from 600,000 gallons per day to 300,000 gallons per day. Amoco continues to search for methods to reduce water use or to reuse water in other processes in the plant.

Looking Ahead

Amoco intends to reduce fugitive emissions through monitoring programs in both process units. These fugitive monitoring programs will pro-actively reduce future emissions and emissions estimates. Furthermore, Amoco plans to reduce VOC (volatile organic compounds) point source emissions by the following methods:

- route remaining tank vents to existing control devices;
- implement process and operational improvements in the filtering system;
- route all remaining VOC process point sources from both units to existing control devices;

Amoco will also continue to evaluate reduction of methyl chloride usage, primarily in the Multipurpose Polymer Unit, by implementing process, operational and mechanical improvements. As methyl chloride use is reduced, associated emissions will be reduced.

For More Information

Amoco Performance Products, Inc.
P.O. Box 446
Marietta, OH 45750
Francisco J. Vacas
(614) 374-6187

The following site was yielded using the Search by Category option using the Search by Category option (Search by Category → Process → Cleaning):

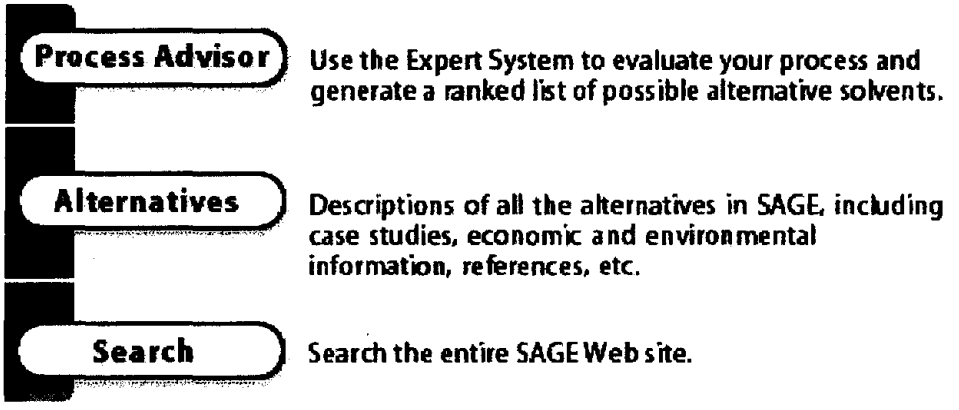
SAGE
(http://clean.rti.org/)

The following text was excerpted from the web site (from the main page, by clicking "Alternatives", and by Search for methylene chloride):

This document is one of a series of information circulars Ohio EPA has prepared on pollution prevention. For more information, call the Office of Pollution Prevention at (614) 644-3469.

SAGE is a comprehensive guide designed to provide pollution prevention information on solvent and process alternatives for parts cleaning and degreasing. SAGE does not recommend any ozone depleting chemicals.

SAGE was developed by the Surface Cleaning Program at Research Triangle Institute in cooperation with the U.S. EPA Air Pollution Prevention and Control Division (APPCD).



Alternatives

Solvent Alternatives

- Acetone
- Acidic Aqueous
- Alcohol
- Alkaline Aqueous
- Aqueous Additives
  - Builders
  - Chelating agents
  - Emulsifiers
  - Inhibiting agents
  - Sequestering agents
  - Surfactants
- Dibasic Esters
- Ethyl Lactate
- Glycol Ethers
- N-methylpyrollidone
- Neutral Aqueous
- Petroleum Distillates
- Pure Water
- Terpenes

Process Alternatives

- Abrasives
- Brushing
- CO2 Pellets
- CO2 Snow
- High Pressure Sprays
- Immersion
- Laser Ablation
- Low Pressure Sprays
- Megasonics
- Plasma
- Power Washers
- Semiaqueous
- Steam
- Supercritical Fluids
- Ultrasonics
- UV/Ozone
- Wiping
- Xenon Flash Lamp

Glycol Ethers

Case Studies

ITT Telecom, Raleigh, NC, has eliminated TCA and methylene chloride based photoresist and replaced it with a photoresist that can be clean with water. The new photoresist is glycol ether based and miscible in water. ITT Telecom finds the new process reduces disposal cost, raw material cost, and operating cost. ITT is also benefiting from improved product quality and production time.

Hunt, Gary, et al, eds., Elimination of Solvent-Based System Reduces Costs and Improves Product Quality at Telecommunications Plant, Case Summaries of Waste Reduction by Industries in the Southeast, North Carolina Department of Natural Resources and Community Development, July 1989, p. 49.

By switching to low volatility fountain solution, Neyler Color-Lith in Waukesha, Wisconsin reduced VOC emissions in its pressroom by 95%. The new fountain solution which contains glycols, glycol ethers, and surfactants allows increased use of water-based cleaners in the pressroom.

Pferdehirt, Wayne P., Roll the Presses But Hold the Wastes: P2 and the Printing Industry, Pollution Prevention Review, Autumn 1993, p. 449.

Lockheed Fort Worth Company, Fort Worth, Texas (formerly General Dynamics Fort Worth Division) has substituted low vapor pressure solvent and aqueous cleaning for CFC-113 in all aspects of aircraft manufacturing. The low vapor pressure solvent, FMS-2004 or Dynamold DS-104, is a blend of propylene glycol methyl ether acetate, isoparaffins, and butyl acetate. The vapor pressure is 3.5 mm Hg and the flash point is 104 ° F. The solvent is effective on a variety of organic soils and is used for wipe cleaning the surfaces of aircraft components and assemblies. Used rags are bagged, drummed and used as a supplemental fuel source. Less critical cleaning of assembled components and complete aircraft is accomplished by a variety of aqueous spray methods. These methods were fully implemented in September, 1992 and have completely eliminated CFC emissions. The following reductions have also been realized: solvent use-70%; solvent cost-87%; VOC emissions-76%; and total air emissions-96%.

Evanoff, Stephen P./Environmental Resources Management, Case Study #4: Substitution of Low Vapor Pressure Organic Solvents and Aqueous Cleaners for CFC-113 Based Cleaning Solvents, EPA/ICOLP Eliminating CFC-113 and Methyl Chloroform in Aircraft Maintenance Procedures, EPA-430-B-93-006, October 1993, pp. 163-167.

4.3.3.12 Greenlist - The Public Access Catalog at TURI's Library

This interface is a flexible means of access to our library's list of publications concerning toxic chemicals, toxics use reduction or pollution prevention, environmental management, related governmental regulations, policies and legislation. Additionally, the Greenlist contains numerous materials on community issues, public health, and sustainability.

Methylene Chloride Vapor Degreasing (Greenlist)

Eleven records were retrieved using the Search Now option with words "methylene chloride" AND "cleaning". Five best references were chosen using the Full Record that includes abstracts to get more information. A user will contact the Toxics Use Reduction Institute's Technology Transfer Center Library for more information. The following text was excerpted from the retrieved Full Record of those five references:

Author: Quitmeyer, J.
Corporate author: Pollution Engineering
Title: Aqueous Cleaners Challenge Chlorinated Solvents
Year: 1991
Abstract: Water-based cleaners do an effective job cleaning metal parts without the hazardous waste and worker health concerns of solvent degreasers.
Notes: No. of pages - 4 Reprinted from Pollution Engineering, December, 1991
Shelf code: Cci.Dfm.564

Author: Pulido, Patricia
Corporate author: BPA International
Title: Development of a Low-temperature Methylene Chloride-free Paint Stripper Safe for Aluminum Surfaces
Year: 1999
Abstract: A methylene chloride-free stripping technology that effectively strips powder paints from steel and aluminum surfaces at temperatures of 100 to 140 degrees Fahrenheit has been developed. This stripper performs as well as or better than methylene chloride-based and hot alkaline strippers on various powder paints. The development satisfies pressing needs for industries seeking an environmentally safe alternative to effective hot alkaline and chlorinated solvent strippers. This stripping technology offers significant advantages for manufacturers who need to remove organic coatings from parts and assemblies.
Notes: Magazine on the shelf
Shelf code:

Author: Thomas, K. Laplante, J. Buckley, A.
Corporate author: Toxics Use Reduction Institute Office of Technical Assistance for Toxics Use Reduction
Title: Guidebook of Part Cleaning Alternatives: Making Cleaning Greener in Massachusetts
Year: 1997
Abstract: This guidebook is intended to assist in the identification and evaluation of options and in the final selection of the most cost effective and technically feasible cleaning system that will not compromise worker health and safety or environmental protection.
Notes: No. of sections - 5 Appendices A-I TURI/OTA Survey and Results http://www.turi.org
Shelf code: Cch.Kjd.777

Author: Hoffman, D.J.
Corporate author: Grady White Boats Inc.
Title: Solvent Substitution To Reduce Air Emissions for the FRP Industry
Year: 2000
Abstract: The purpose of this report is to supply information to users of acetone or other volatile organic solvents so that they may decide for themselves the replacement solvent that is suitable for their use. This report in no way favors one solvent manufacturer or another, it only points to which solvent would be best suited in our particular

application. All users of these or any other solvents must test their solvents under their own specific conditions to see if they are usable, cost-effective and practical for their use.
Notes: No. of pages - 39
Shelf code: Cck.Bsb.728

Author:
Corporate author: Jacobs Engineering Group Inc.
Title: Source Reduction and Recycling of Halogenated Solvents in Paint Stripping - Technical support document
Year: 1992
Abstract: This document is part of a 12-volume report on research performed by the Source Reduction Research Partnership (SRRP) over the last five years. The report as a whole, entitled Potential for Source Reduction and Recycling of Halogenated Solvents, covers a wide range of industries.
The Summary Report of this project which is available separately, gives an overview and the results of the research as a whole. This is one of ten Technical Support Documents covering each of the ten solvent-using industries and operations (listed below). The full report also includes a separates Life Cycle Inventory and Tradeoff Analysis, covering issues that arise in the comparison of existing halogenated solvent uses with potential alternatives. The ten categories of solvent-using industries and operations are :

* Adhesives * Flexible Foam
* Aerosols * Paint Stripping
* Chemical Intermediates * Parts Cleaning
* Dry Cleaning * Pharmaceuticals
* Electronics * Textiles

Notes: No. of pages - 71 No. of chapters - 6
Shelf code: Csc.Dfm.736

4.3.4 Presentation to the Northeast Business Environmental Network

The Northeast Business Environmental Network (NBEN, www.nben.org) is a non-profit organization that offers an active network of EH&S professionals in the New England area. Through online information, outreach services and frequent workshops, meetings, and seminars, NBEN seeks to foster information exchange and learning to facilitate worker safety and health and environmental management systems. The workshops present a unique opportunity for both members and non-members to network with peers in government, business, technical assistance, and non-profit organizations.

NBEN has a membership of over 60 small and large companies located in New England. Typically, about 15-20 of these companies send representatives to the workshops. Small Business Safety Officer was demonstrated at two NBEN workshops in March, 2001. On March 22, we demonstrated our capabilities at Malden Mills in Lawrence, MA and on March 27 we presented SBSO at the workshop at Verizon in Framingham, MA. The attendance at each workshop was 20-30 people representing 15-20 companies.

We also provided several companies with usernames and passwords to preview the prototype site. Those companies that asked for and received preview accounts are shown in the table below:

Table 4. Companies That Have Previewed the Small Business Safety Officer Prototype

Company Name	Company Description
Verizon	Telecommunications
C.F. Jameson & Co. Inc.	Leading manufacturer of high quality protective and decorative finishes and coating systems.
Bell Atlantic Network Services	Connectivity network-based services
Worldcom	Long distance, internet access, networking technology and hosting services
Teknor Apex	The leading manufacturer of floor matting, cutting boards, and hot water hose for several commercial markets
Heidelberg Web Systems	Web offset printing presses and related equipment
Kluber Lubrication	Manufacturer and distributor of specialty lubricants and greases
Perkin Elmer	Global provider of analytical instruments & detection systems
NetCompliance	Internet based compliance solutions
Capaccio Environmental Engineering, Inc.	Environmental consulting firm
Bureau of National Affairs	Safety and health information and documents
Genzyme Corporation	Biotechnology
Sanmina	PCB manufacturer

The evaluations of the prototype were accomplished principally at the NBEN meetings. The principal questions from the audience focused on whether the software could be extended to other types of businesses or operations, what business model will be employed for distributing the software, what other kinds of process alternative and cost savings tools can be added, and how can the software be developed for users with highly varied educational backgrounds and different computer literacy levels.

4.3.5 Evaluation by Kluber Lubrication

Kluber Lubrication (www.kluber.com) is a German-held International producer and distributor of specialized lubricants and greases. The facility in Londonderry, NH has approximately 150 employees and they manufacture specialty formulations as well as re-distribute imported product. The facility has a manufacturing floor, an on-site laboratory where they perform principally quality assurance testing, a warehouse for product storage and a shipping and receiving dock. They have a Safety and Health professional on staff who is responsible for keeping the company OSHA compliant.

The company does not yet have an intranet and the majority of safety and health information and compliance documentation is paper-based. Kluber is interested in Small Business Safety Officer because they recognize that implementing a broad-based electronic safety and health information system is needed and they are also interested in some of the advisor tools and capabilities. During the course of this program we made three site visits to the Londonderry facility and discussed Kluber's unique requirements. We demonstrated the prototype on a laptop and also provided Kluber with username and password access.

Some of the content of Small Business Safety Officer has been influenced by our discussions with Kluber. In fact, one of the key features of the administrative internet site has been specifically designed to address some of Kluber's needs. The portion of the web site we designed for Kluber falls under the "Information Transfer" heading. One of Kluber's stated needs was the ability to access a company proprietary database for specific categories and data necessary to ship product in the United States and abroad. We asked Kluber for a non-proprietary database containing the same number of fields and non-proprietary but representative data to interface to our administrative side. The results are shown under the "Example" subheading. The web interface we've created is shown below.

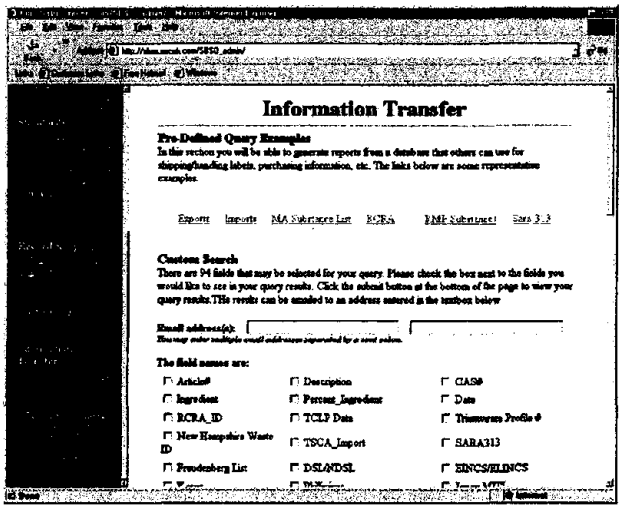


Figure 44. Information Transfer

The sample Kluber database is connected to this page which allows access to single and multiple field data retrieval and formatted forwarding via email. Kluber specified this arrangement because the database is located only on a single machine, only select fields needed to be forwarded to the shipping department and email is the preferred distribution method because Kluber has Internet access but no Intranet.

The site shown above is fully functional although the database is a mock-up only. Nevertheless, the site already contains the full functionality desired by Kluber. An example of several fields chosen from the database and forwarded to a desired recipient via a formatted email message is shown below.

Subj: **SBSO Custom Query Results**
Date: 6/12/2001 1:08:18 PM Eastern Daylight Time
From: SBSO_Demo@mrcnh.com
To: armeka@mediaone.net, mfraser@mrcnh.com

74-98-6	Propane	None
106-97-8	Butane	None
872-50-4	N-methylpyrrolidone	None
67-64-1	Acetone	None
60164-51-4	Oil, Fluorinated polyether	None
9002-84-0	PTFE	None
17265-14-4	Disodiumsebacate	None

Figure 45. Information Transfer Formatted Email

Kluber has been very satisfied with our collaboration. A letter confirming this plus their desire to continue our relationship in Phase II is currently being drafted and will be submitted with the Phase II proposal. Kluber has asked MRC to adapt both the administrative and public (employee) to Kluber's format, to host the sites at MRC and to provide Internet access to all of the Londonderry employees. The reason for MRC hosting the site is that Kluber does not yet have a server-based Intranet. Because many of the employees are not fully educated in browser tools, we anticipate that we will need to create a screen icon to automatically launch Internet Explorer and connect to the site.

We are indebted to Kluber for their involvement. They have helped us to better understand user needs including the need for specialized information handling. Additionally, they have indicated another type of user access. For those companies that do not have Intranet capability, the Small Business Safety Officer business plan must accommodate the ability to host the generated websites remotely and confidentially.

4.3.6 Evaluation by Sanmina

Sanmina is a producer of printed circuit boards. Founded in 1980, Sanmina is a leading global contract manufacturer providing a full spectrum of vertically integrated services to the electronics manufacturing services (EMS) market. Sanmina offers a total manufacturing solution, which encompasses engineering design, fabrication of bare boards, cable assemblies, enclosures, complete system integration and test as well as global order fulfillment, provides customers with quality products and services on a quick-turn, cost effective basis.

With total global sales of $4B, Sanmina is a large company. The Derry, NH facility employs approximately 150 people and it performs custom PCB manufacturing. We became involved with the Derry Sanmina facility through our consultant, Karla Armenti who has performed safety and health consulting for them. We performed one site visit to evaluate their safety and health needs. The outcome was somewhat surprising. Although the Derry office is part of a large, multi-National Corporation they do have unique needs that cannot be met from

Corporate-wide resources. From this experience we've learned that the distinction between large and small companies is really an issue of resources not overall Corporate size. In fact, satellite offices of large companies look very much like small businesses in their safety and health resources and requirements.

The challenging issue facing the Derry office was the difficulty in finding toxicity data. Companies that are at the manufacturing leading edge always encounter chemicals for which the toxicity data is either hard to find, limited or incomplete. Yet, these data are essential to ship chemicals both in the US and abroad. The office Safety and Health professional at Sanmina would like to see Small Business Safety Officer help generate toxicity data forms and provide tools to help businesses find toxicity data over the Internet. For Sanmina, we prepared an on-line form for the Safety Officer to enter the necessary toxicity data. This form is shown below.

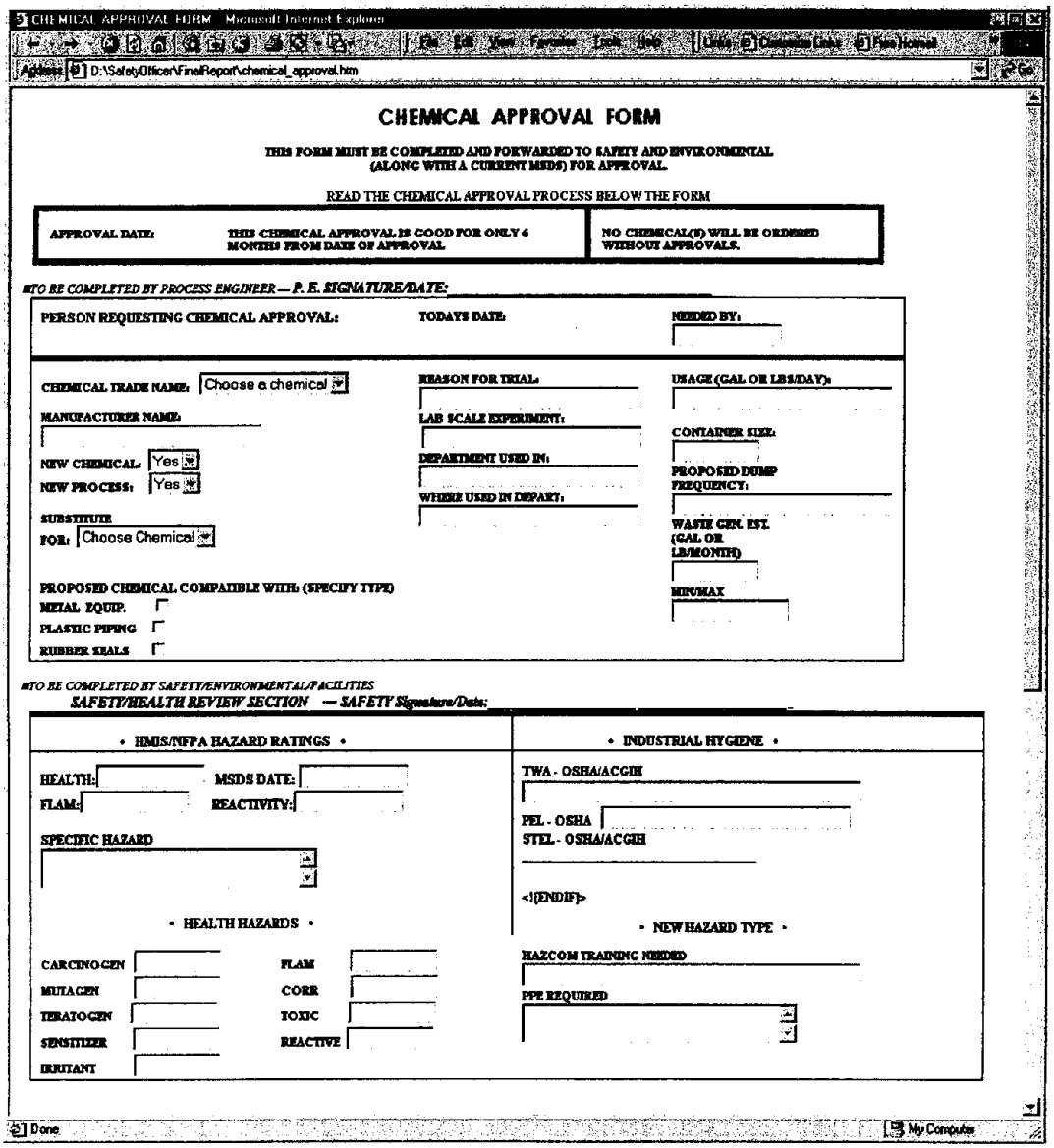


Figure 46. On-line Chemical Approval Form Prepared for Sanmina

The form shown above has not yet been incorporated into Small Business Safety Officer but this will occur in Phase II. Sanmina was satisfied with our collaboration but halfway through the program, the company re-organized their Worker safety and Health function and we lost our company contact. For Phase II we plan to re-establish contact with Sanmina or replace this interaction with a small business.

4.3.7 Evaluation by the University of Massachusetts Lowell

The University of Massachusetts Lowell (Janet Clark) has performed a detailed evaluation of the Interview section of the prototype. Janet suggests changing the Tab titles to be Profile, Compliance, Policies, Communications, Cost Savings, and Build (they currently are Profile, OSHA, Compliance, Policies, Hazcom, Economics, and Build). It seems logical to put OSHA under Compliance, still prominently featured.

The first tab, "Profile"is designed to be an introduction to all of the tab sections, connected by a "wizard". The introductory paragraph explains this. Janet suggests a more plain language approach might be as follows,-"You are beginning an interview process which will be used to generate a new web site on your company intranet, designed for employees. It will feature Safety and Health information needed to perform jobs in a safe manner. The finished intranet site will also contain company forms and polices required by the regulations pertaining to your facility.

Section 1 - Company Profile
Section 2 - Compliance (hyperlink to)
Section 3 - Policies (Hyperlink to)
Section 4 - Planning
Section 5 - Procedures
Section 6 - Training
Section 7 - Records
Section 8 - Communication (hyperlink to)

Section 1 - Company Profile
1-1 Company Name and Address
1-2 Company Type (Move warehouse, lab and chemicals questions to planning Section2)
1-3 Site layout showing critical areas
(scanned images, list of labs, storage areas etc)
1-4 Company Policies (hyper-link to this tab)

Section 2 - Compliance (hyperlink to)
2-1 The Small Business Safety Officer has determined that the following Codes of Federal Regulations apply to your company.
2-2 The Small Business Safety Officer has determined that the following International Regulations apply to your company.
2-3 The Small Business Safety Officer has determined that the following State Regulations apply to your company.
2-4 Would you like to designate other regulations ?

Section 3 - Policies (Hyperlink to)
3-1 What is your company H & S policy?
3-2 What other company policies or codes of conduct influence your H & S program (Responsible Care, CERES, Trade, etc)

3-3 The Small Business Safety Officer has determined that your company is subject to the Laboratory Standard under CFR 1910.129. The following policies, as is required under this regulation, can be genereated. Please check all that you would like the Small Business Safety Officer to help you in preparing:

3-4 The Small Business Safety Officer has determined that your company is subject to the...

Section 4 - Planning
4-1 Does your company have an Environmental Management System? (If yes, hyperlink to a separate form from here on, to be created in the next phase. The following is more generic)
4-2 Who is responsible for managing H & S programs?
4-3 What activities are of concern to the H & S program? (Processes or services, should generate a list of activities with concerns also identified)
4-4 What are priority concerns?
4-5 What are program objectives and measurable targets for addressing these priority concerns?
4-6 List the projects to be undertaken, including project leaders and a schedule for action.
4-7 What monitoring and measurement will be undertaken?
4-8 Will you do audits? (Procedures, checklist, reports)
4-9 Would you like to track nonconformance and corrective action?
4-10 How will management review be undertaken? (How, who, when, what)

Section 5 - Procedures
5-1 What procedures are important to H & S?(Pull down of Hygiene Plan table of contents) (Does this include materials management and recycling?)
5-2 Would you like to review and edit these procedures?
5-3 What control measures are needed? (Pull down)
5-4 Would you like to review and edit these control measures?

Section 6 - Training
6-1 What training is required? (Pull down)
6-2 Which employees will receive this training?
6-3 Would you like to schedule training?

Section 7 - Records and Logs
7-1 What records would you like to keep? (Pull down)
7-2 Who is responsible for keeping these records?
7-3 Who can see these records?
7-4 Would you like to review and edit these records forms?

Section 8 - Communication
This section allow the company to control and direct information flow to employees.

The SBSO has determined that your company is responsible for the following communications to employees:

4.4 Conclusions and Phase II Goals

4.4.1 Conclusions

We have determined that "Small Business Safety Officer" has the potential to improve safety and health for millions of US workers. In our presentations to approximately a dozen companies and through direct demonstrations to two New Hampshire businesses, we have found that there is a significant need for this kind of product. Both small and large businesses have an ongoing need for safety and health information on issues relevant to their operations. In general, there is a significant frustration that critical information is hard to find, that it is not centrally located and has to be extracted from disparate sources, and that it often requires subject matter experts to locate and interpret.

We have learned that the distinction between large and small businesses has little to do with sales and more to do with resources. Many large companies have a staff dedicated to safety and health but most small companies and even branch offices of large companies do not. Each facility, however, has unique requirements and is seeking solutions specific to their business operations.

Helping companies develop tailored solutions to their safety issues and procedures is one of the keys to success. The other is to provide cost-savings and other process evaluation tools that will integrate safety and health into their overall business process. This will have a dual payoff. First, it properly integrates safety and health into the business process and, second, it allows fundamental economic analyses that will allow proactive process alternatives to be identified.

This approach will still retain worker safety and health emphasis from a regulatory perspective. However, it will introduce a new set of incentives for businesses to incorporate, update and upgrade worker safety and health practices.

What Businesses Need

From our on-site visits and collaboration with two businesses and from discussions with more than a dozen others at the Northeast Business Environmental Network meetings, we have learned a great deal about what businesses need to address Worker Safety and Health. There is a significant frustration that critical information is hard to find, that it is not centrally located and has to be extracted from disparate sources, and that it often requires subject matter experts to locate and interpret. Businesses, both large and small, are seeking worker safety and health solutions tailored to their business processes.

Businesses are anxious to have process evaluation tools that can help them find cheaper, better, safer alternatives. Incorporating economics into a worker safety and health tool will enable companies to be proactive in improving their practices.

4.4.2 Phase II Design

The design of Small Business Safety Officer must incorporate the diversity of businesses. The system must be dynamic. It must also have the ability to refine and revise Plans, Policies

and Forms because business operations change continually. Users want information to find them rather than the other way around. A tool that addresses more than regulatory issues alone is needed to promulgate worker safety and health.

In terms of implementing Small Business Safety Officer, we will need to consider a subscription arrangement. This will allow more frequent updates and revisions to be "pushed" to the users. We will also need to consider hosting company websites remotely for those firms that do not have an Intranet.

To effectively communicate worker safety and health, the product must also follow an effective communication model. The model we have developed, called Personalized Web Portals, allows individuals to customize and personalize information to facilitate understanding. To provide users with the extensive database needed to address their diverse needs, Small Business Safety Officer will need to access additional databases. We are currently discussing such an arrangement with the Bureau of National Affairs.

We have developed several innovations for Small Business Safety Officer to ensure that companies will not only purchase it but also use it regularly. First, we have developed an easy-to-use interview process for initial implementation. Second, we have incorporated several process alternative and cost savings advisors that will facilitate integration of worker safety and health practices into a company's overall business processes. Third, the system is being designed to allow companies to custom design the final tools to address their specialized needs. Fourth, we are developing the tools to be consistent with a new communication model called Personalized Web Portals that allows users to format and customize information to facilitate understanding. And, finally, frequent use of the tools is being ensured by providing connection to extensive databases with automated extraction and presentation of information of relevance to all users defined by their own preferences.

4.4.3 Commercialization

The keys to OSHA/NIOSH and commercial success of this software product are through three identical steps:

- The product must address a large number of U.S. workers
- The product must effectively protect their health and safety
- The product must be used and distributed in large numbers

By targeting small businesses, we have chosen the largest U.S. business sector. Thus, the proposed software program will address the health and safety of millions of American workers. The second point will be resolved by writing the program to comprehensively address the most important health and safety issue, which is establishing an OSHA compliance infrastructure where one did not previously exist. This software will act as the safety officer for very small companies and as an advisor for larger firms. In both cases, the program will serve to sensitize and educate the company about health and safety issues and it will provide extensive links and further information regarding other products, training information etc.

Effective use and distribution of the product is the most challenging obstacle. Many small companies consider regulatory compliance to be both an unnecessary administrative headache and a discretionary business expense they cannot afford until their financial position is better established. It is not that businesses actively seek to be non-compliant, it is more appropriate to say that they do not actively seek compliance due to the perceived costs and work involved.

Considering the attitudes and business pressures described above, the marketing strategy for this software product will be crucial to its success. It cannot be marketed solely on health and safety merits as this will not successfully convince enough small businesses to purchase it. Additional motivations will be required. These are cost savings due to reduced lost worker time, protection from prosecution and reduction of short and long-term liability. Full realization by small company Presidents and CEO's that they can be held personally liable for workers injuries or fatalities in addition to the fact that the financial fate of their companies could be threatened should substantially encourage compliance.

This message, however, cannot be too heavy-handed as it may carry too much negativity. We will consult with marketing specialists for advice on the best way to employ this kind of marketing strategy. If the marketing costs are allowable, this effort will be performed under a consulting arrangement in Phase II.

One advantage we have is that the compliance implementation tool "Small Business Safety Officer" will be a product developed for small businesses by a small business. This will be emphasized in the marketing strategy as it will help to overcome market barriers.

The final step is an effective manufacturing and distribution arrangement implemented through a realistic commercialization plan. The proposed program is a collaboration between Mission Research Corporation and the Toxic Use Reduction Institute at the University of Massachusetts – Lowell. There are three possible business arrangements we could follow: licensing the product to an established health and safety firm, performing the commercialization entirely within Mission Research Corporation, or forming a joint venture or limited liability corporation to pursue the product independently.

Of the three possible avenues described above, the most attractive from a business perspective is a joint venture between MRC and the University of Massachusetts – Lowell (UML). UML has ongoing and active interests in this field and maintains separate office space off-campus in renovated mill buildings. Using this office space and employing part-time student labor, a low overhead business framework could be readily established. Our current plans are to pursue this avenue with UML after we have reached an agreement on shared equity and investment in the joint venture.

One of the issues to be investigated during the course of the commercialization process is the projected cost of the product. The prices of hard copy compliance information vary from about $400 to several thousand dollars. The price of the "Small Company Safety Officer" will fall within this range, with a preference towards the lower price range to make it affordable to the

target consumers. The specific value will be determined by the economics of the commercial business arrangement.

There is already a significant amount of hard copy, video and software products associated with safety and health. The vast majority of these, however, are highly specialized to specific topics. This product seeks to be the first reference and tool for those companies unfamiliar with the law. We know of no product that effectively answers the questions, "Where do I start to be OSHA compliant?", or "What else do I need?". The "Small Business Safety Officer" product will fill this niche. Extensive links and references will be provided to other products that can provide more detailed advice and direction.

Because OSHA regulations change over time and work practices are continually improved to reduce health and safety risks, updates to the 'Small Business safety Officer" program are planned. This will likely be every two years.

Historically, companies have treated their policies and procedures as "static" with printed texts in binders. What they needed to do and didn't was label these policies with expiration dates and view their policies as being temporary and dependent on dynamic data. This new approach that we are proposing can handle the dynamic aspects of occupational health and safety.

We can handle the dynamic data defined by the projects: the chemicals currently on the shelf, the chemical processing and activities done by the company on a specific date. We can handle the dynamic data defined by the company: the names of key personnel, the corporate structure/hierarchy, the locations of lab facilities, the storage policies, etc. We can handle the dynamic data defined externally to the company: OSHA regulations, new MSDS facts, etc.

Traditional approaches to occupational health and safety have failed in both large and small businesses because they rely on static data -- assuming that their knowledge base is perfect and has complete definition before-during-and-after a workforce engagement. Our approach does recognize the fact that these policies have a built-in shelf life and that they expire as new knowledge about workplace safety becomes known.

5.0 ACKNOWLEDGMENTS

We are deeply indebted to Kluber Lubrication and Sanmina for their cooperation and participation in this program. The folks we would like to thank at Kluber are Joel Garrett, Nathan Kimball, Joan Woodlee and Eileen Knight. We are also indebted to Lee Wimot of Sanmina.

We are also grateful for the hospitability provided by the Northeast Business Environmental Network (NBEN) and for the opportunity to demo Small Business Safety Officer at two of their workshops.

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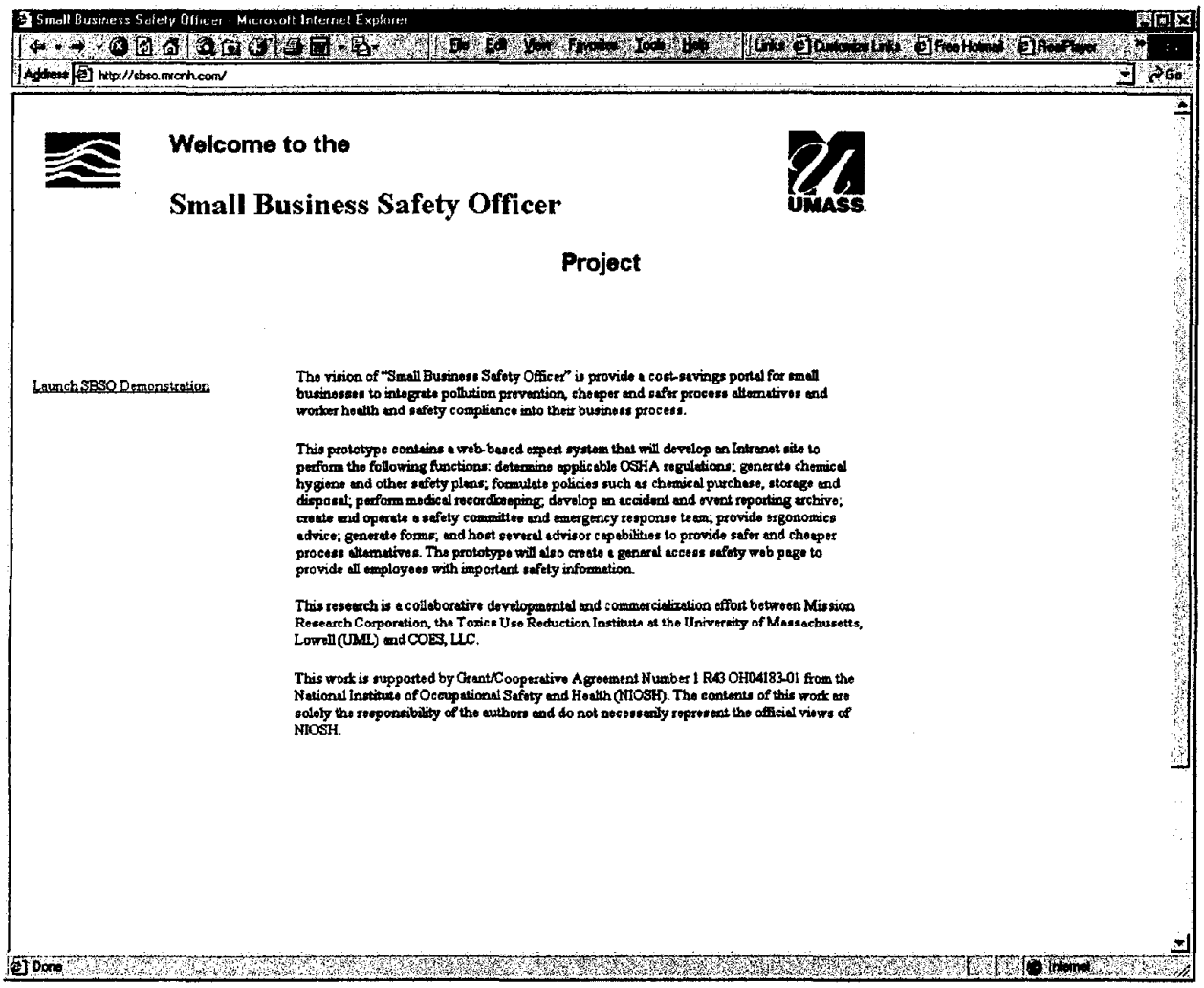
7.0 APPENDICES

Appendix A Small Business Safety Officer Introduction Page

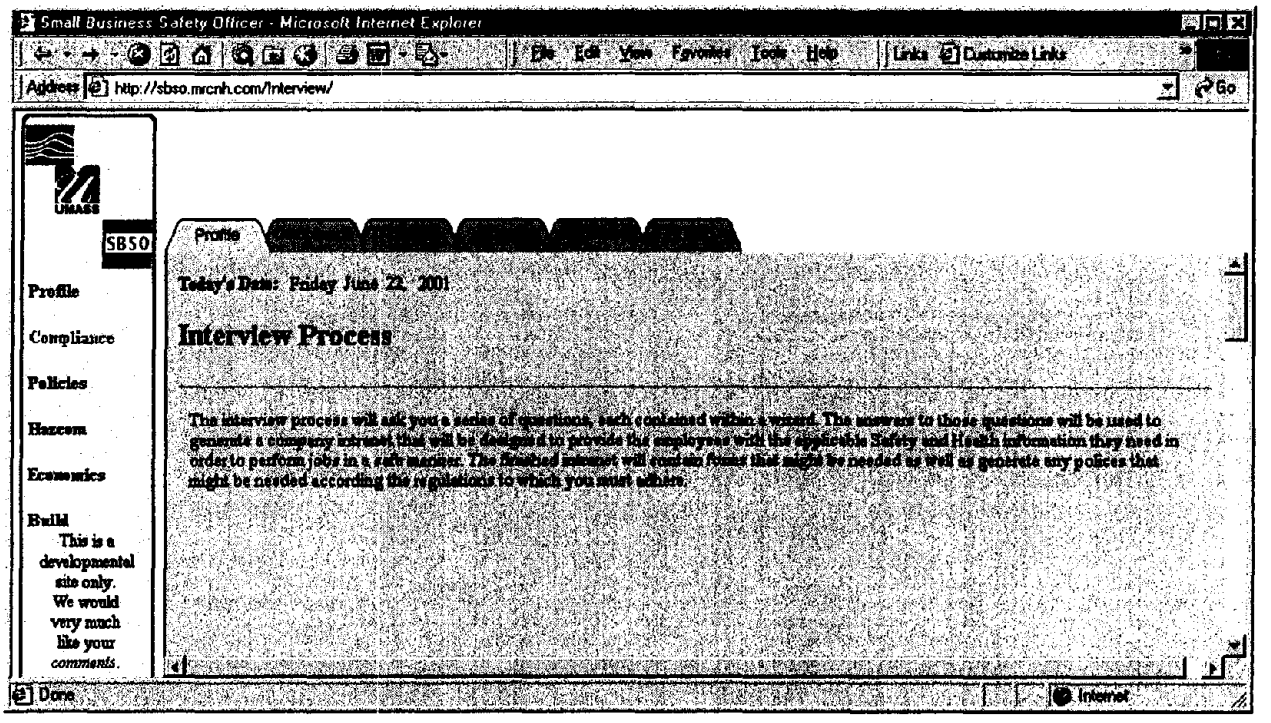


Goal: The purpose of this page is to serve as an introduction to the demonstration site. When the user enters the username and password, this is the first page they see.

Content: The content is principally text as shown, describing the overall philosophy of the software product. We emphasize in the first paragraph that Small Business Safety Officer integrates pollution prevention, cheaper and safer process alternatives and worker safety and health into an overall cost-savings portal. Presented at the bottom of the page (not shown in the screen shot above) is an acknowledgement of NIOSH support,- "This work is supported by Grant/Cooperative Agreement Number 1 R43 OH04183-01 from the National Institute of Occupational Safety and Health (NIOSH). The contents of this work are solely the responsibility of the authors and do not necessarily represent the official views of NIOSH."

Additional Functionality: The only other functionality on this page is the "Launch SBSO Demonstration" link that takes users directly to the SBSO Interview home page.

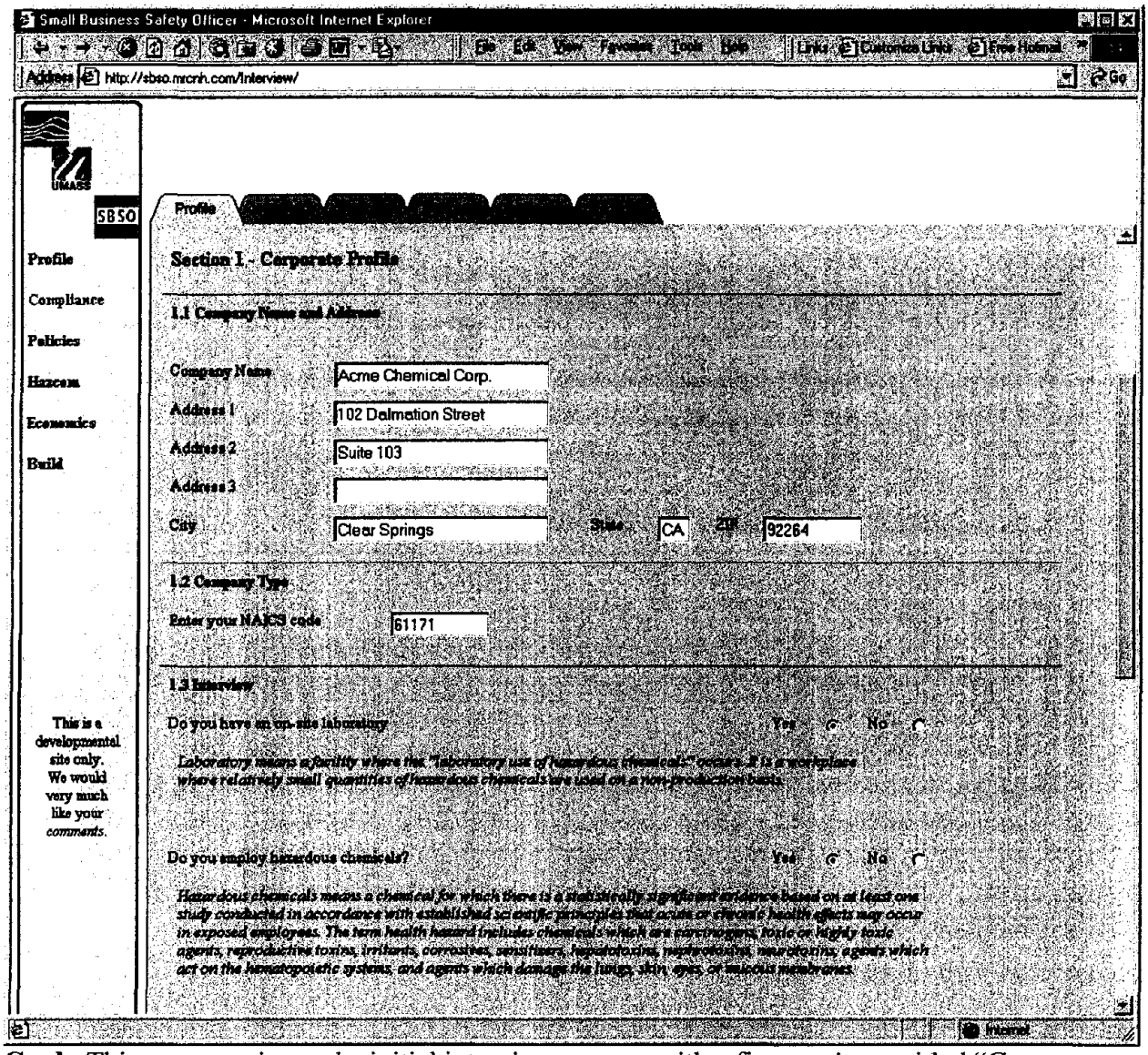
Appendix B Small Business Safety Officer Initial Interview



Goal: This is the home page of the SBSO interview process. The site is laid out as an extensive interview process to identify the applicable OSHA regulations and to capture the user's needs for the employee safety intranet and the administrative intranet. The input values are archived in a database. The output of the Interview process is the generation of the employee safety (public) intranet and the

Content: The "Profile" tab extracts generic information about the company and specific details such that an accurate determination of the applicable OSHA regulations can be made. Shown above is some introductory text and the start of the interview process.

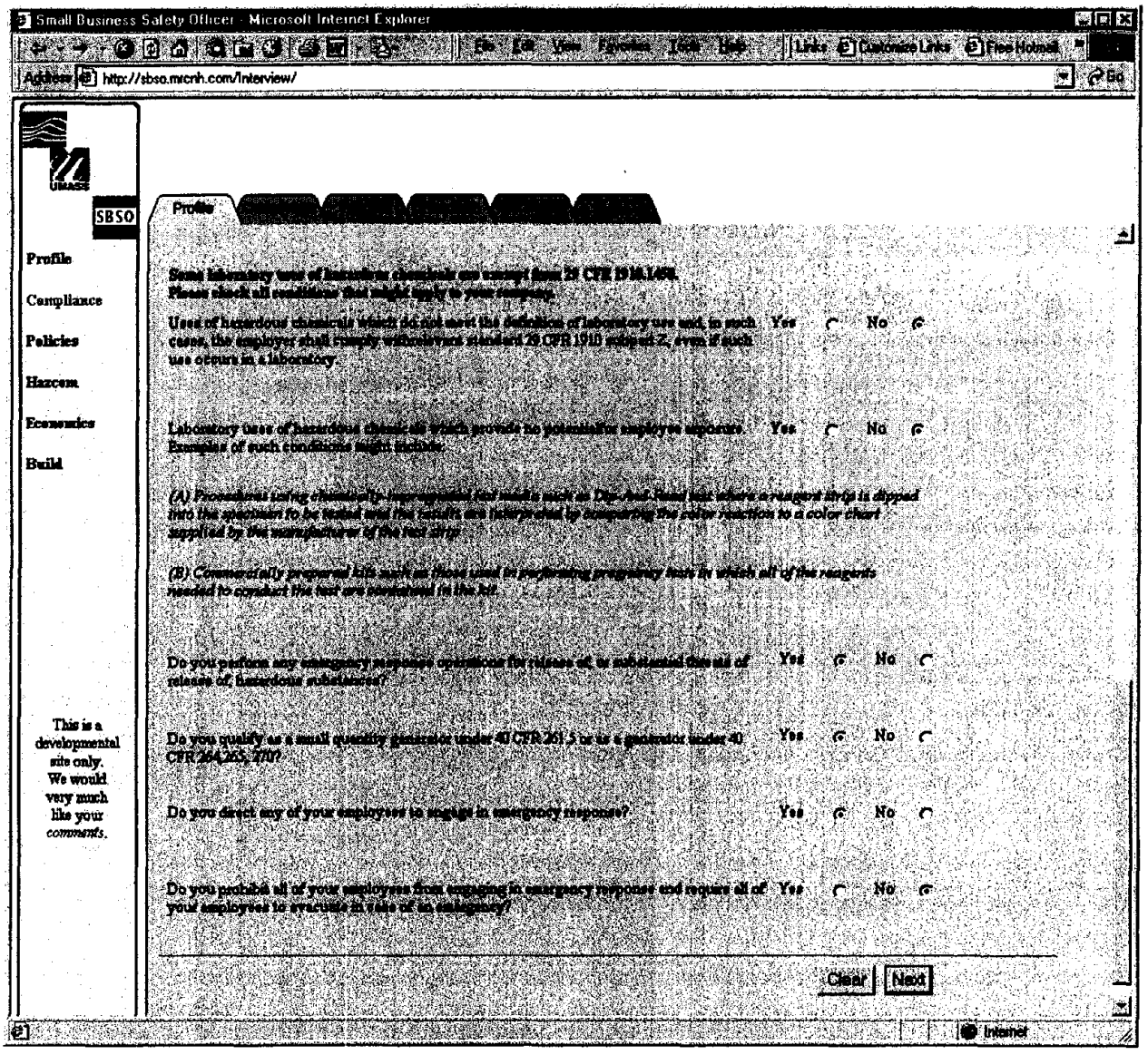
Additional Functionality: The "Profile" tab has several pages. The user navigates through the "Profile" tab completing each page and clicking on "next" which automatically takes them to the next page. Optionally, the user can navigate to other portions of the interview by selecting any tab: "Profile" "Compliance" "Policies" "Hazcom", etc. The user inputs required data via standard graphical controls (text boxes, list boxes, radio buttons, and check boxes). This input is archived in a database of user inputs and is sent to an expert system which uses rapid pattern matching against rules that codify the OSHA regulations. The expert system then determines the user's needs for compliance and makes recommendations for generating plans, policies and forms and for the graphical layout of the public (employee) intranet and the private (administrative) intranet.



Goal: This page continues the initial interview process with a first section entitled "Corporate Profile". The goal of this interview is to determine what OSHA regulations apply to the company and what compliance plans, policies and programs are required by OSHA. The output of this interview is a list of the plans, policies and programs, complete with references to the applicable OSHA regulation(s).

Content: The questions shown beginning in Section 1.3 have been taken verbatim from OSHA 29 CFR. These questions require only yes or no answers. We have provided radio buttons to permit only one answer and the page is linked to an underlying database to track responses and compare the answers to the OSHA regulations. The answers shown above will be typical of those firms having an on-site laboratory employing hazardous chemicals.

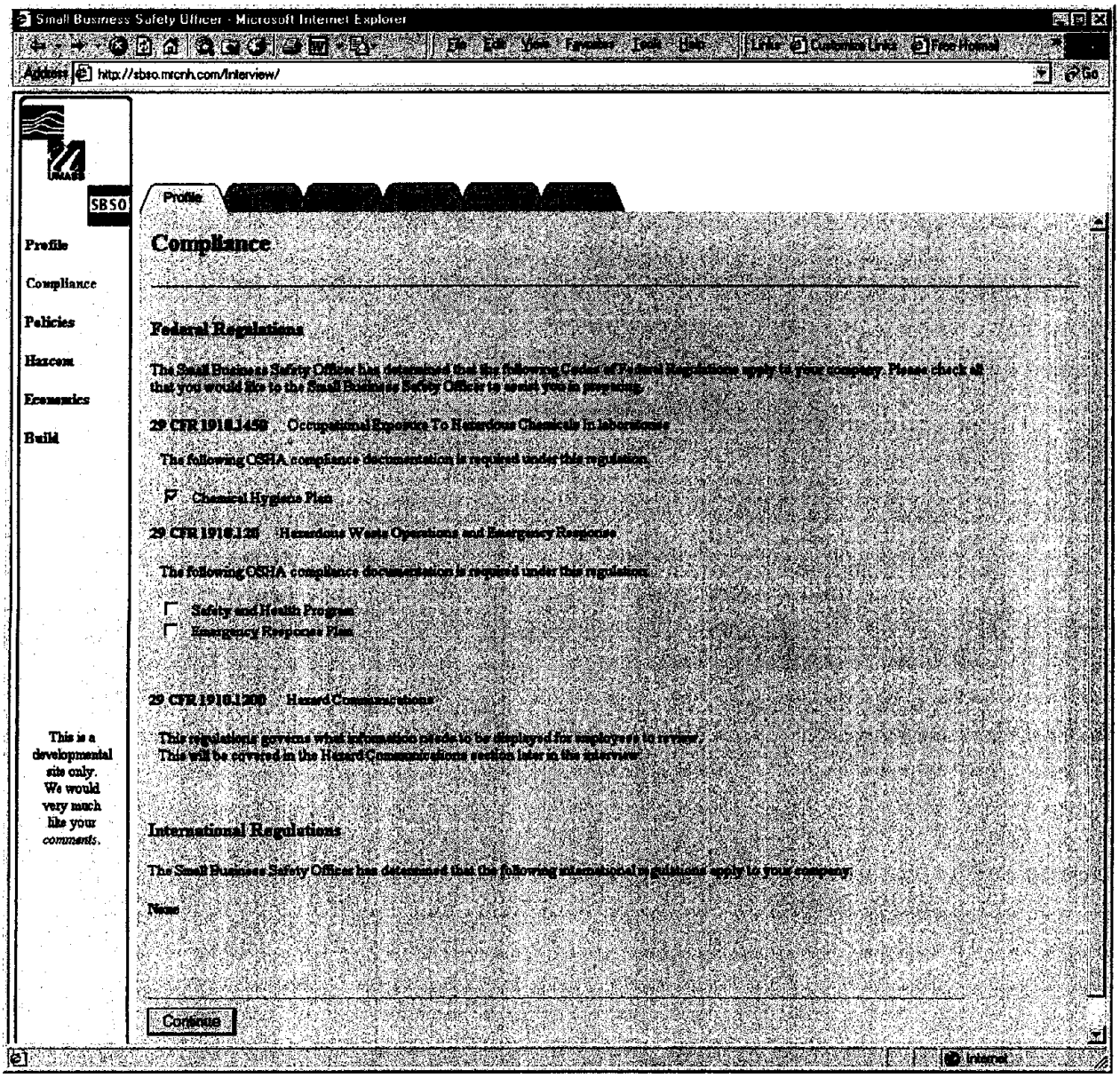
Additional Functionality: Additional, layered help screens are envisioned to guide users through this process. Since many users may be familiar with their NAICS code, we have added this entry to help focus both the queries and the help functions.



Goal: This page completes the initial interview entitled "Corporate Profile" under the "Profile" tab. When the user clicks "Next" he/she is sent to the "Compliance" page of the "Profile" tab, where the applicable regulations have been determined.

Content: The questions completing this section determine whether the business is a small quantity generator and whether the business performs its own emergency response functions.

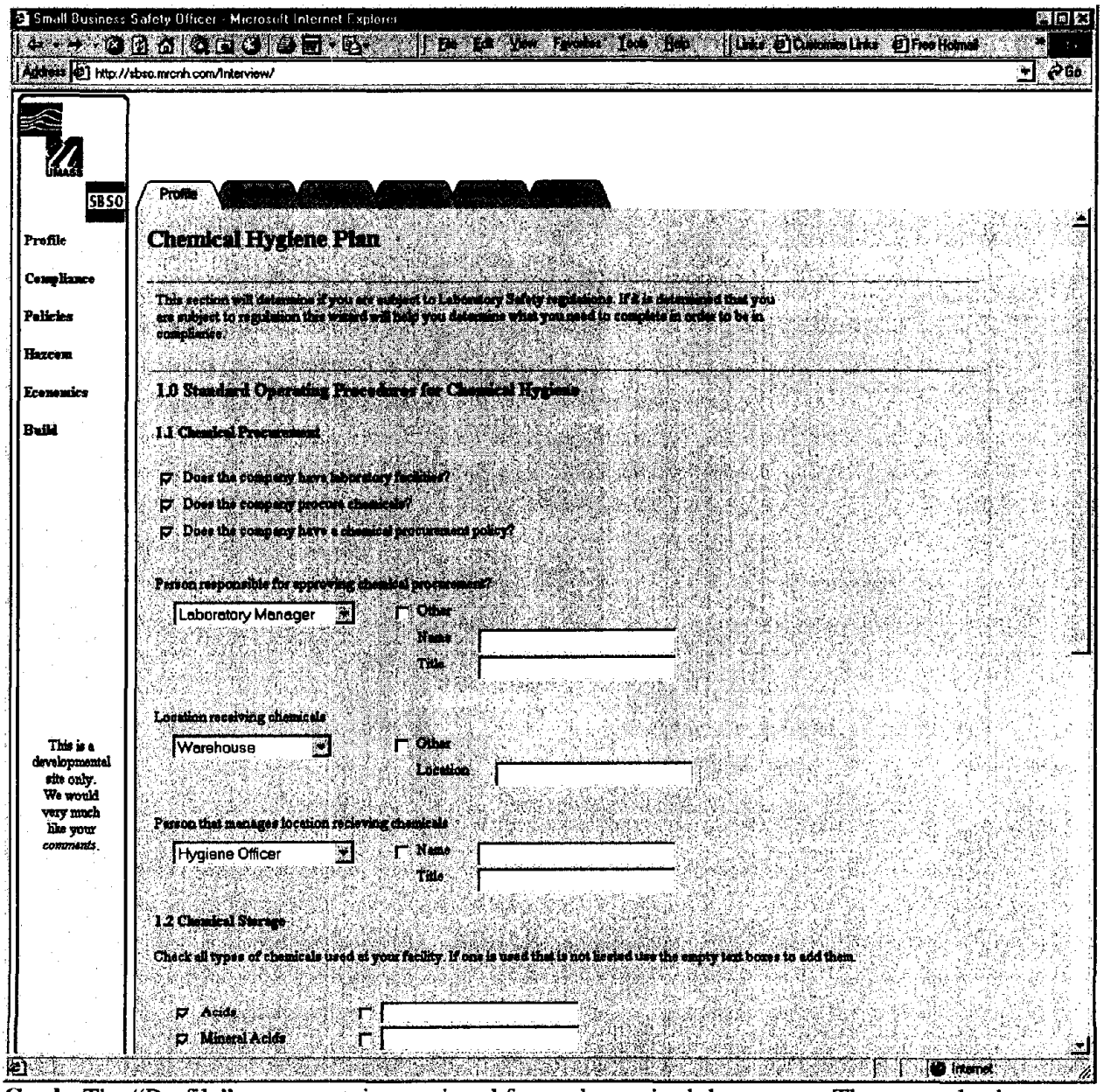
Additional Functionality: None. Plans for Phase II include adding to this section extensively with multi-layered screens and extensive help functions. The ultimate goal will be to enable a first-time user with little or no experience to navigate this section correctly.



Goal: This is the next page of the "Profile" tab. Based on the interview results from the previous section, the SBSO software has determined the applicable OSHA federal regulations. The user can use SBSO simply to identify relevant regulations. SBSO also provides assistance in developing the required documentation. By clicking on the boxes, the user selects the option for guided creation of compliance documentation. When the "Continue" button is clicked, wizards are launched for each plan/policy that the user selects.

Content: From the answers provided in the previous section, the SBSO software has determined that the following regulations apply: 29 CFR 1910.1450, 120 and 1200. The user can check all, some or none of these. For those that are checked, a wizard will be launched to step the user through another interview to produce the required documentation. For the example shown on the next page, we have assumed that the user has checked the "Chemical Hygiene Plan" box.

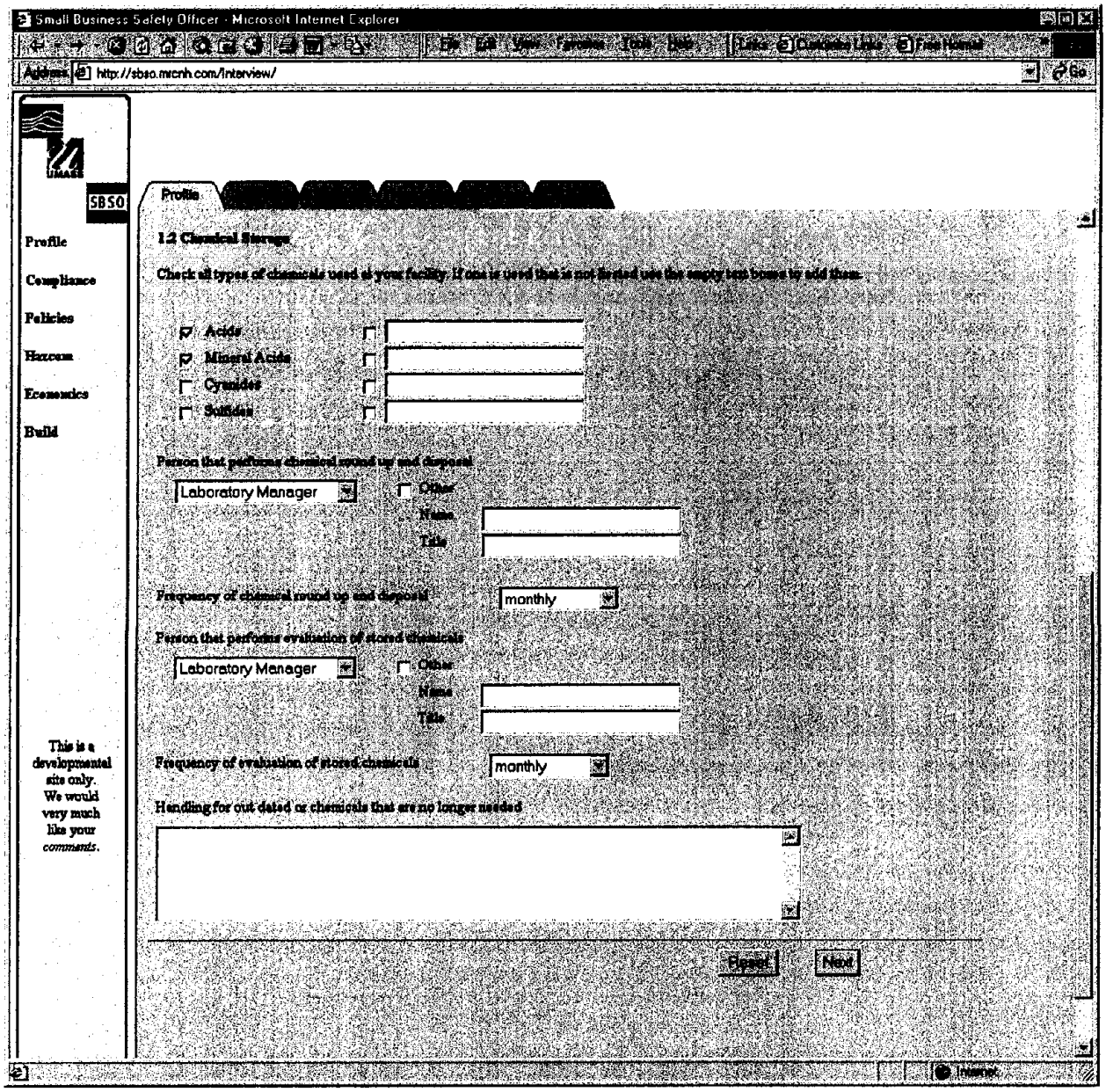
Additional Functionality: Plans for future upgrades include the addition of state and international regulations.



Goal: The "Profile" page contains a wizard for each required document. The example shown above is for the preparation of a Chemical Hygiene Plan. Preparation is based on an interview process and users may store intermediate results, come back and edit or go to the document directly for editing.

Content: The generic document outline and format has already been laid out. As the user enters the fields, the document is populated "on the fly". Fields may be cleared for revisions or data may be re-entered as desired. The logic will be laid out to ensure consistency and compatibility throughout for the entire document.

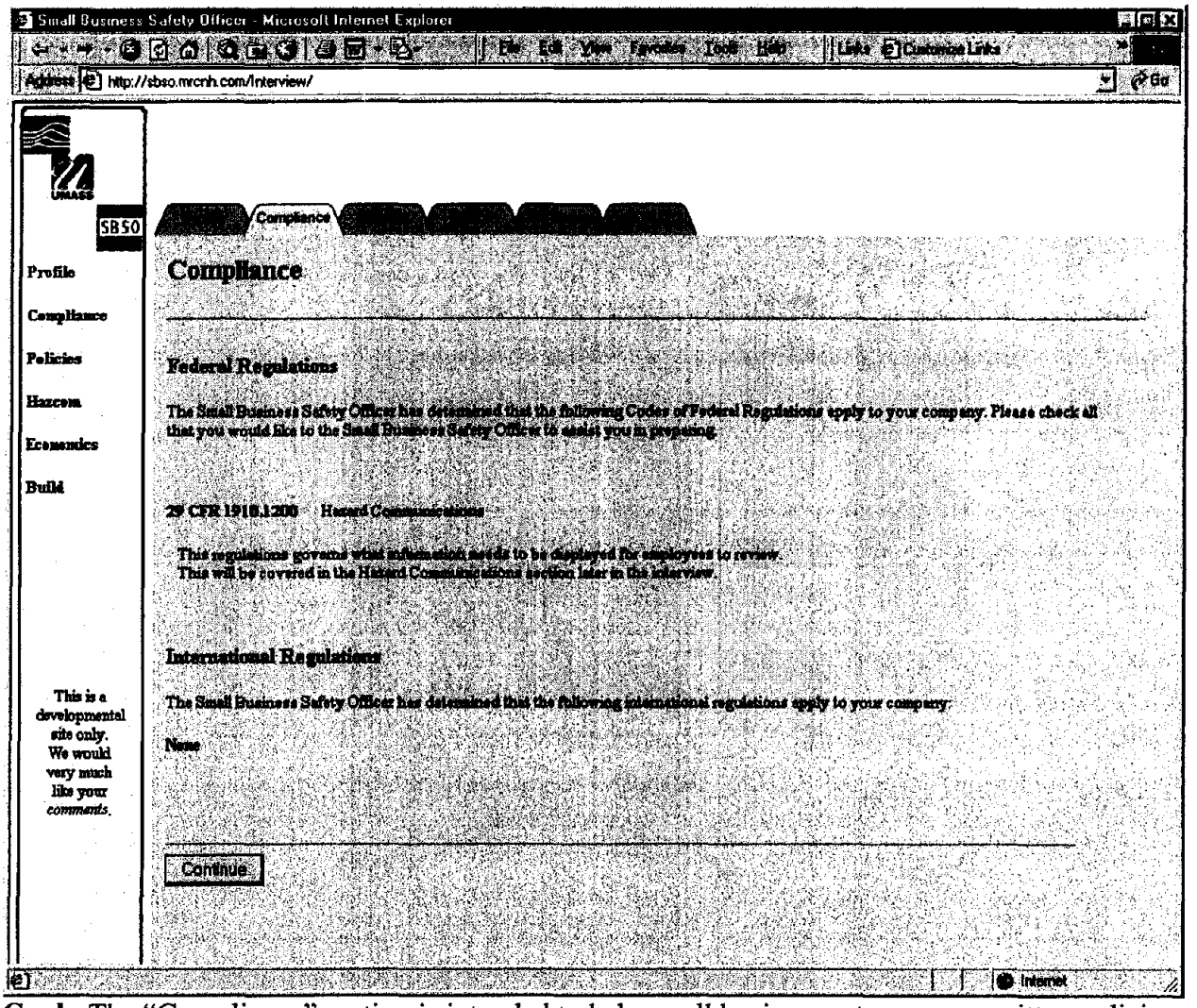
Additional Functionality: The "Build" tab includes a button for error checking the entire site and user-entered responses. One concept we may implement in Phase II is the ability for the users to perform the error checking at the individual wizard level.



Goal: This page completes the mock-up for the Chemical Hygiene Plan interview process. Pressing "Next" generates a template Chemical Hygiene Plan.

Content: The content includes material necessary to complete the Plan such as who handles chemical disposal, the frequency of stored chemical evaluation, who performs the assessment and the procedures for handling out-dated chemicals or chemicals no longer needed.

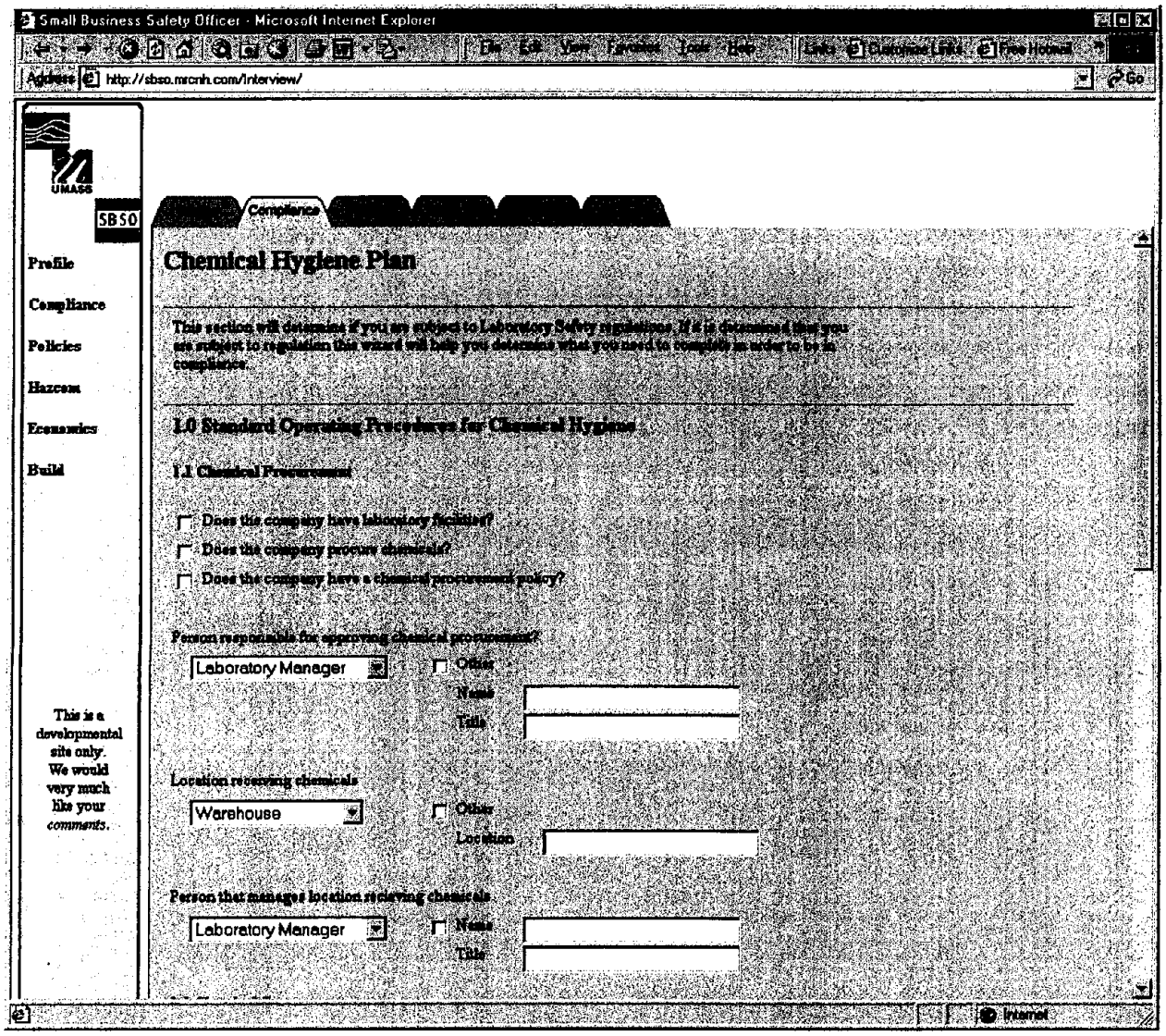
Additional Functionality: In Phase II this mock-up will be completed in its entirety to allow the user to complete the interview and generate a complete, customized Chemical Hygiene Plan.



Goal: The "Compliance" section is intended to help small businesses to prepare written policies and other documents supporting the plans already prepared. The "Profile" section determines applicable regulations and required documents. Optionally, the wizards in the "Profile" section use inputs from the user to generate template plans, policies, and other documentation. The "Compliance" section allows the user to customize these documents or alternatively directly supply digital versions they already have, but would like included in the database and on the intranets.

Content: Automatic checking with the plans will ensure compatibility between the documents.

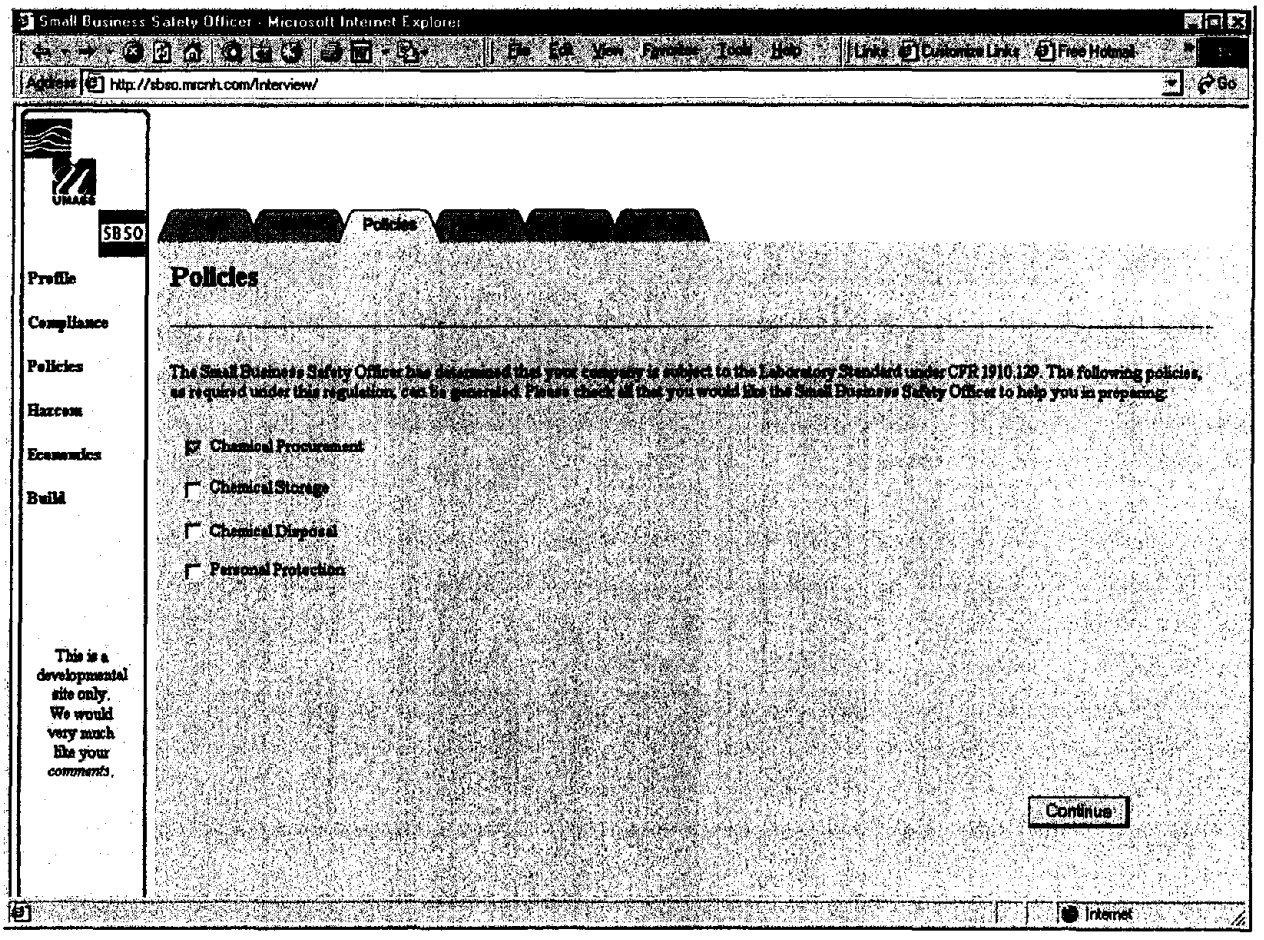
Additional Functionality: We also intend to provide a menu button allowing users to access this document preparation section separately. This will allow expert users to go here directly. The menu will provide the user with the complete list of policy wizards to enable them to choose ones they may not have considered. Thus, the wizards are available also from the compliance section. We will add a menu bar that allows users to go directly to documents and forms, view them in their completed format, and print/save them as desired. Also "bookmarks" will be added to jump to "volatile" data such as names of employees acting in various positions, list of procured chemicals, customer database, etc.



Goal: The "Compliance" section can also launch the wizards for creating the plans. Here the compliance tab has launched the Chemical Hygiene Plan wizard. It's functionality is the same as with the "Profile" tab.

Content: The current content is the layout for preparing a Chemical Hygiene Plan.

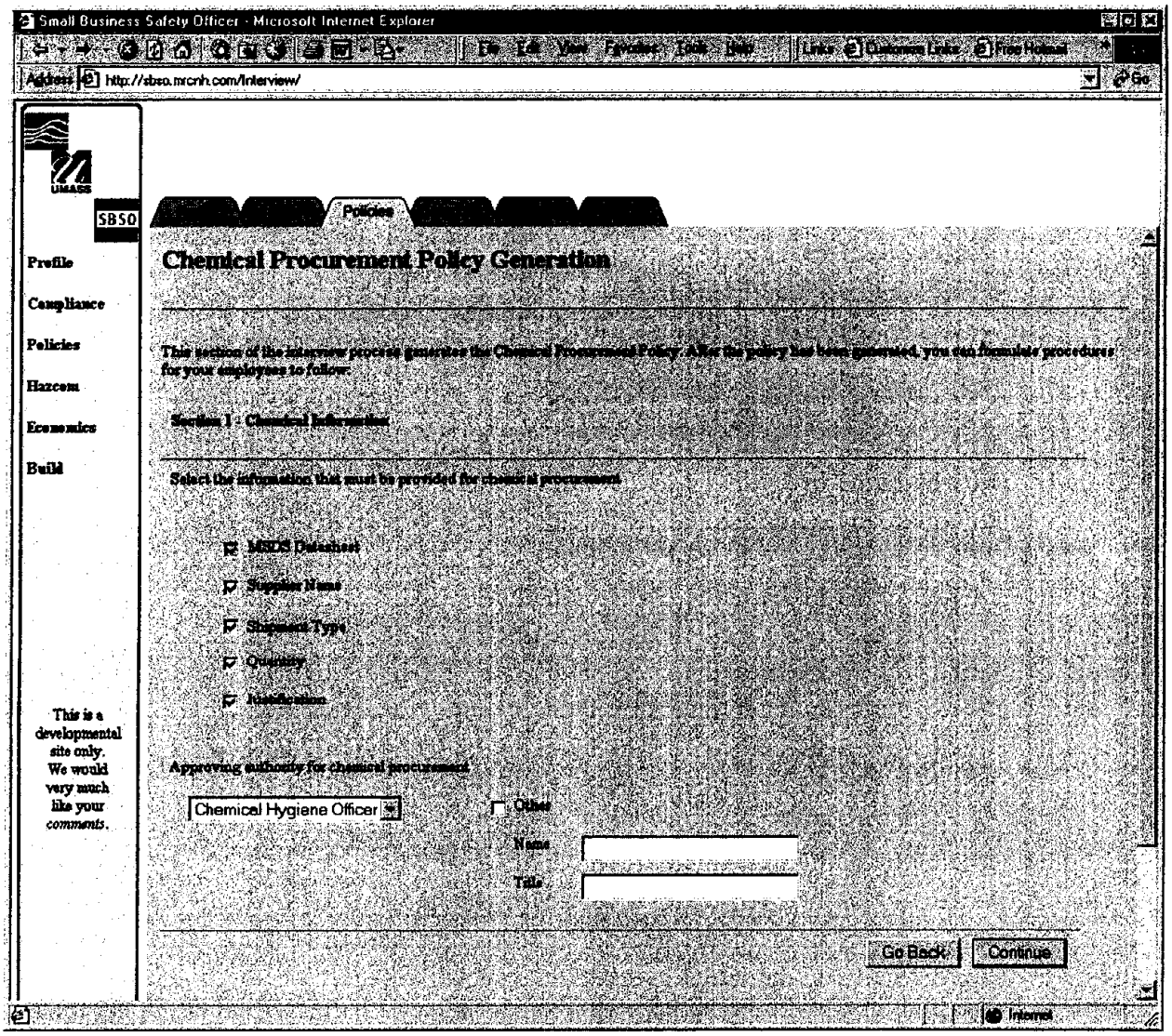
Additional Functionality: Additional planned functionality includes direct form access and Help functions.



Goal: This section is intended to help small businesses prepare written policies and other documents supporting the plans already prepared. The example shown above showing chemical procurement, chemical storage, chemical disposal and personal protection is illustrative only.

Content: As with the compliance section, every box that is checked launches a wizard employing an interview process to establish the content and format of the policy. Automatic checking with the plans will ensure compatibility between the documents.

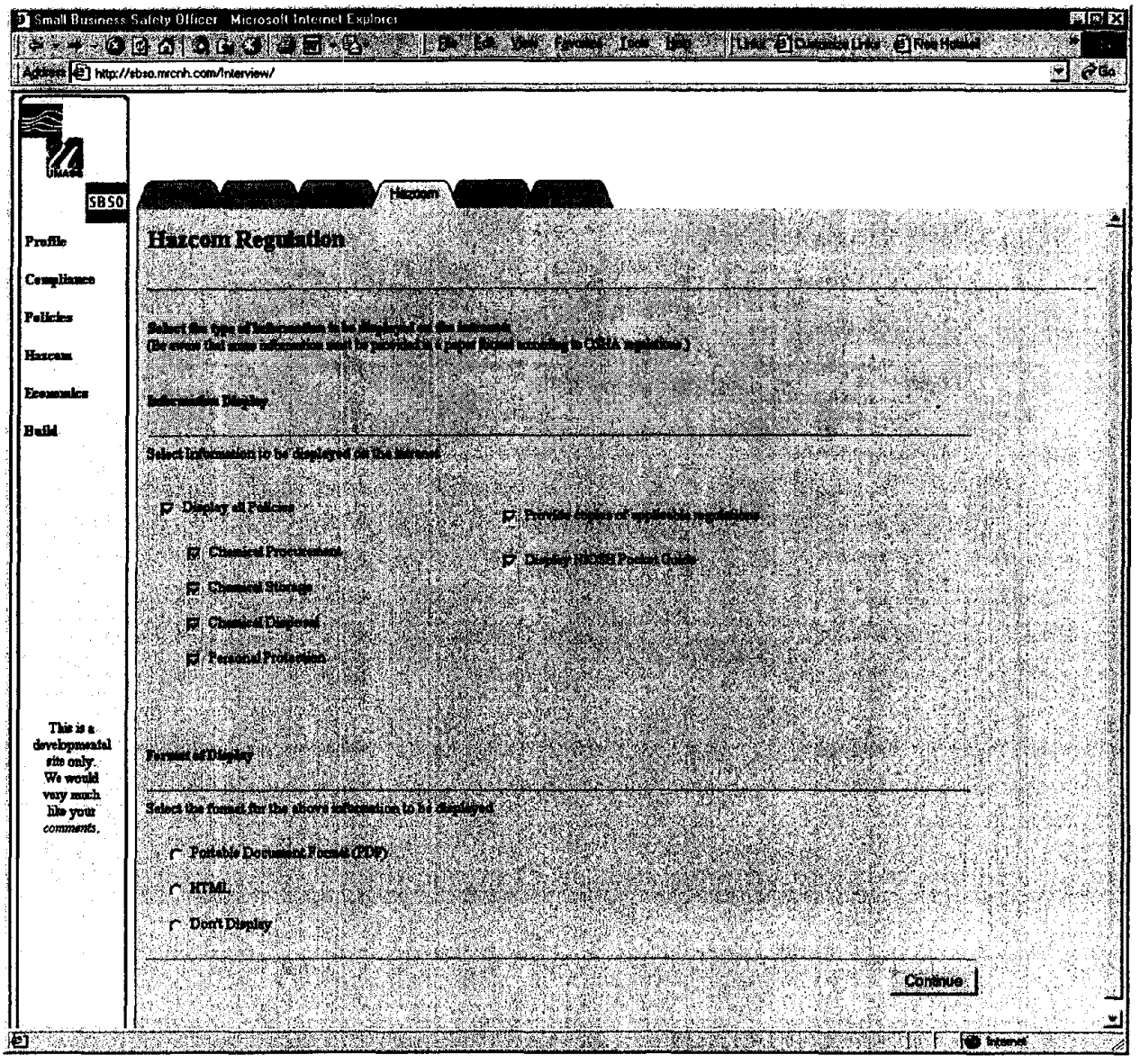
Additional Functionality: As with the compliance plan section, we also intend to provide a menu button allowing users to access this document preparation section separately. This will allow expert users to go here directly. The menu will provide the user with the complete list of policy wizards to enable them to choose ones they may not have considered.



Goal: The example shown above has been set up for the generation of a chemical procurement policy.

Content: The wizard walks the user through the process of laying out the contents of the policy through radio button or check box responses and text entries.

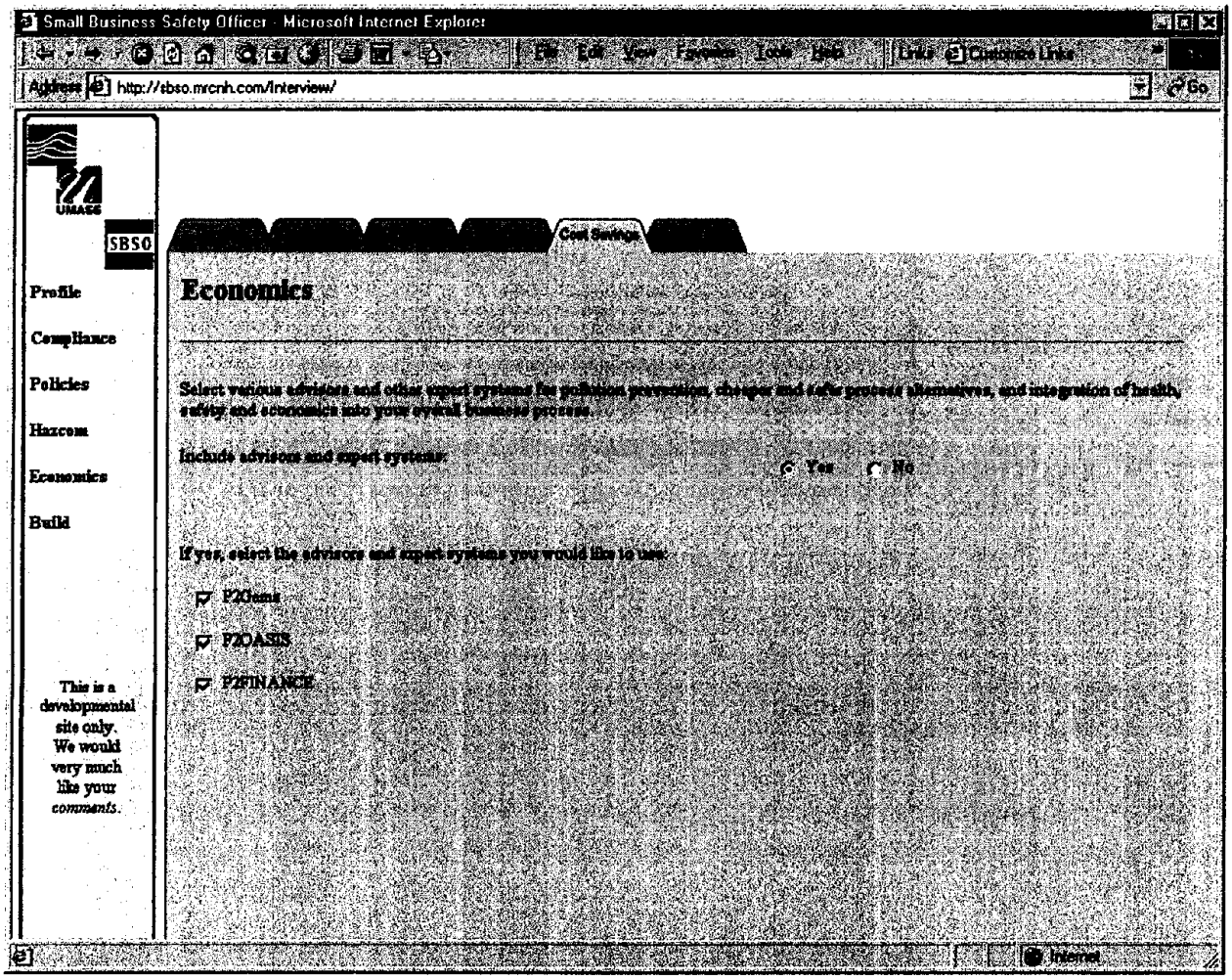
Additional Functionality: Only a fraction of the entire process is shown above. The rest of the wizard is on the remainder of this screen and on others. At the end of the interview, the user will have the ability to view, print and save the finished document. We plan to provide multiple publishing methods, including HTML, text and PDF format. We plan to provide a database for maintaining an archive of plans, policies and forms. This database will be populated by the Safety Officer via the SBSO Interview Process. The resulting employee intranet and administrative intranet would then access that database to inform employees about the policies, plans and forms and provide employees with access to those documents and an electronic way to complete forms.



Goal: The goal of the Hazcom section is to determine the form and format of the information to present to the employees. Since the principal mechanism is through the employee intranet, this section is currently focused on laying out that tool.

Content: The content currently addresses the complement of plans, policies and other documents to include on the intranet site. Since each business has differing requirements and security needs, the selections range from no documents whatsoever (i.e., these will remain in paper form only) to site inclusion in fully portable format.

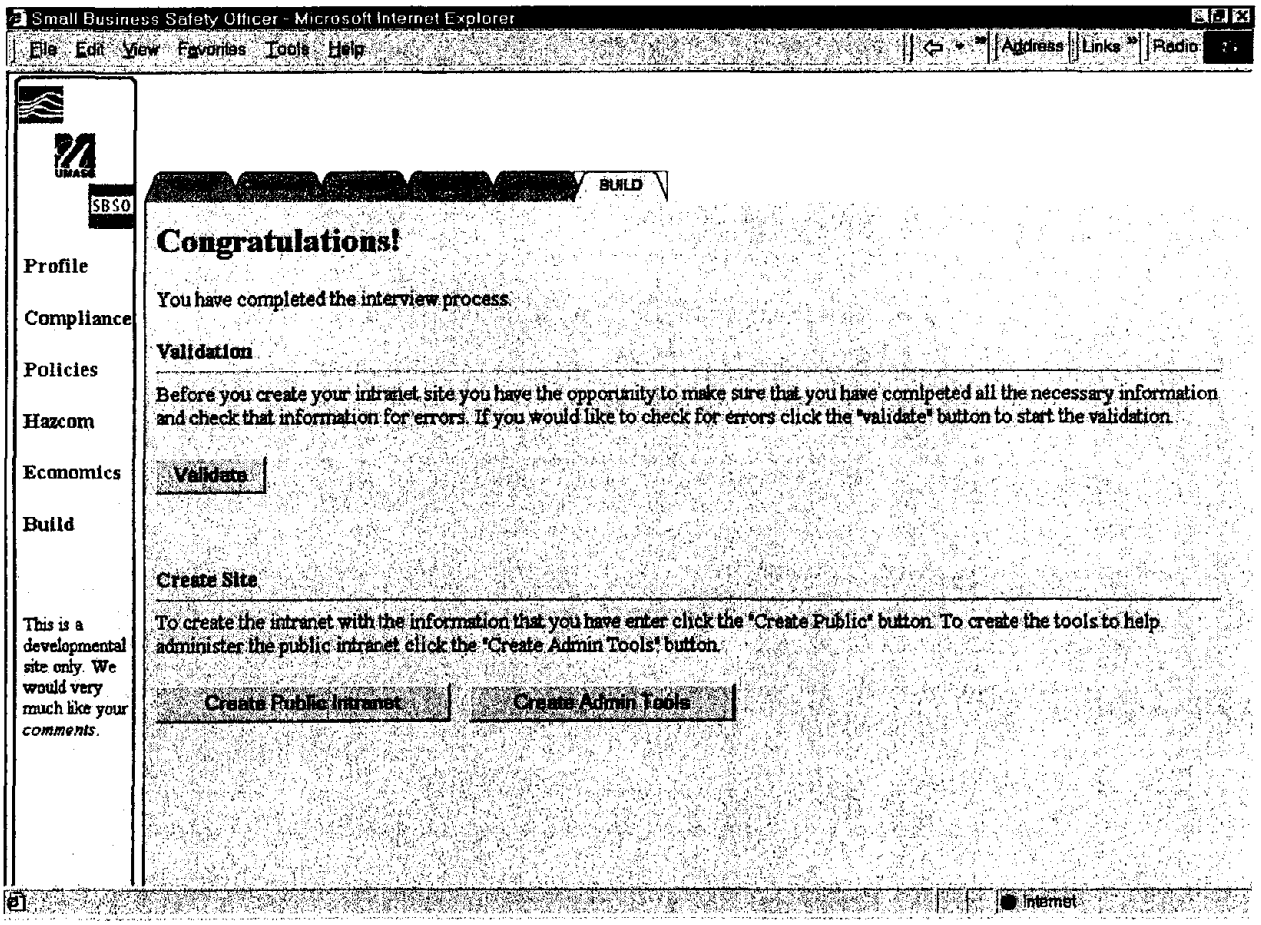
Additional Functionality: Additional functionality not yet included is the capability to lay out the content of the menu bars, personalize the site presentation and upload company logos. The methodology for employee access also needs to be addressed here. This can range from unrestricted access from a centralized server to password access to a remote host.



Goal: The cost-savings section is a centerpiece of Small Business safety Officer. We noted in the introduction page that Small Business Safety Officer is a cost-savings portal integrating pollution prevention, cheaper and safer process alternatives and worker safety and health. To accomplish these goals, we need to provide users with cost-savings expert advisors. We currently have three: P2Gems, P2Oasys and P2Finance.

Content: The advisors that are selected will be included in the administrative tools intranet site.

Additional Functionality: In Phase II, additional cost savings and pollution prevention tools will be added. Our goal is to provide users with the ability to determine procurement-to-disposal cost estimates associated with hazardous chemicals – before they procure! – and to provide interfaces to tools that would recommend safer and/or cheaper chemicals. We want our SBSO tool to not only assist companies to become compliant with OSHA regulations but also to enable companies to develop sound business plans with long-term cost and safety optimization goals.

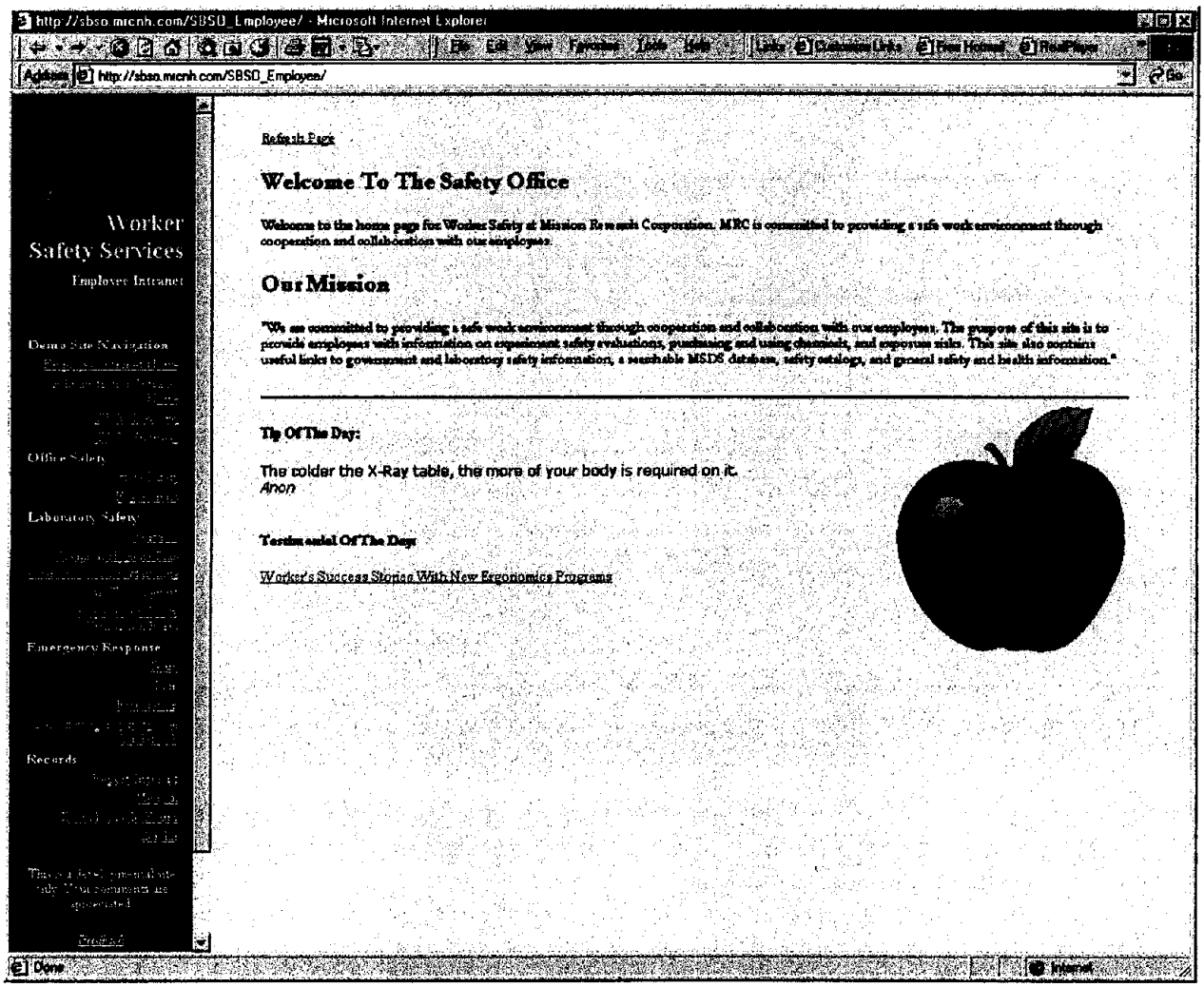


Goal: The "Build" tab completes the interview process. The goal of this section is to perform an overall interview validation or error checking and to launch the construction of the public intranet site and the administrative tool site.

Content: The current capabilities include the error checking and site creation buttons. Once the "Create" buttons are clicked, the intranet sites are launched.

Additional Functionality: Future capabilities needed for the fully functional site may include specification and address of the server (local or remote), access restrictions, authorized user lists and other practical issues.

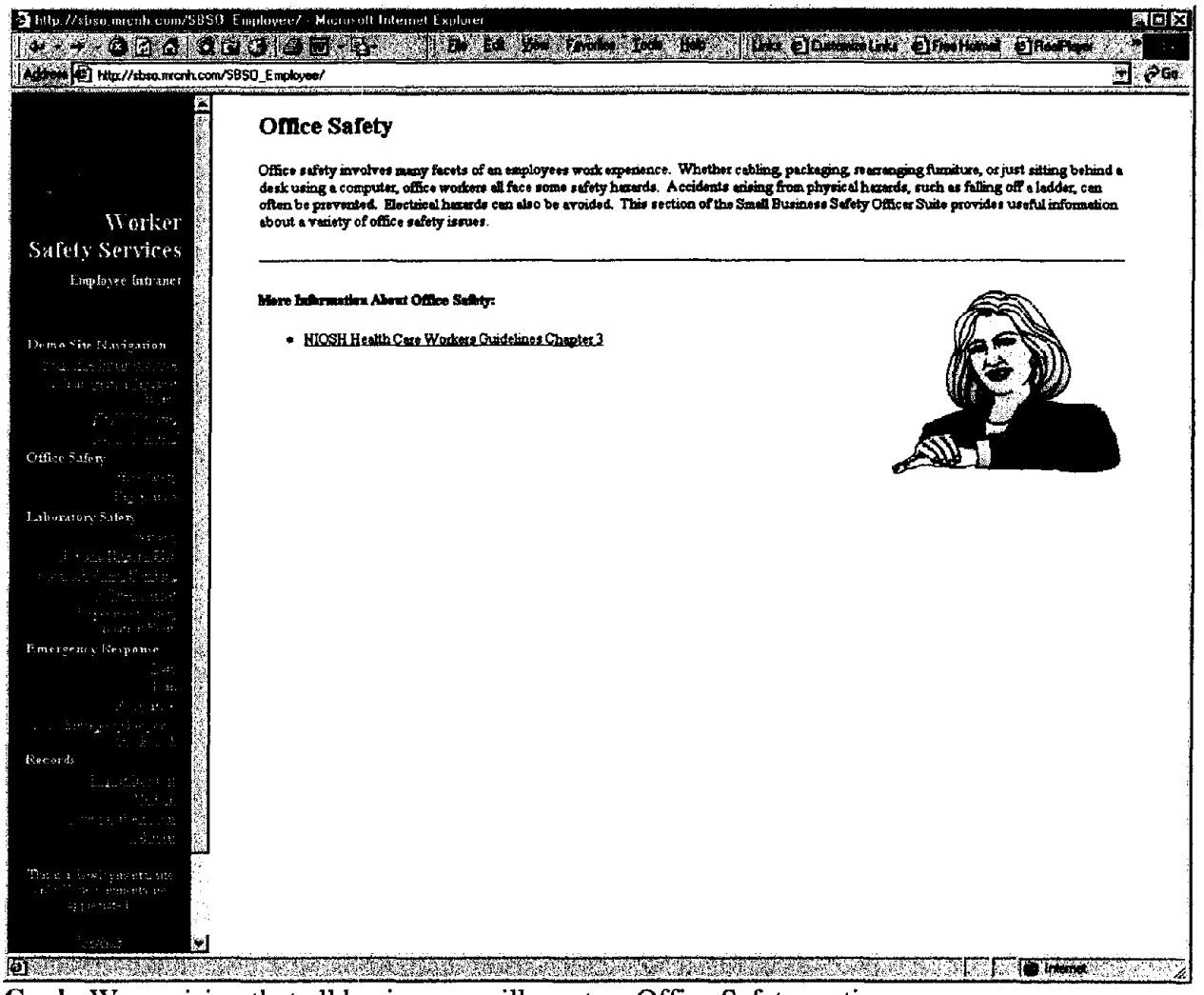
Appendix C Small Business Safety Officer Public (Employee) Intranet



Goal: This is the home page of the public intranet site. From here, employees can navigate to the rest of the site using the links on the left. The first portion of the navigation bar shown here under the title "Demo site" is intended for moving around the various demonstration areas. This portion of the navigation bar will not be included in the final product. Table of Contents Sections such as "Office Safety," "Laboratory Safety," etc., are determined during the Interview Process.

Content: The content shown above includes the home page introduction material consisting of the mission statement and "fresh" material consisting of safety tips and advice randomly extracted from an extensive database. The public intranet site is chiefly comprised of library or browse information with limited user interaction. We envision employees also being able to fill out forms electronically via this intranet.

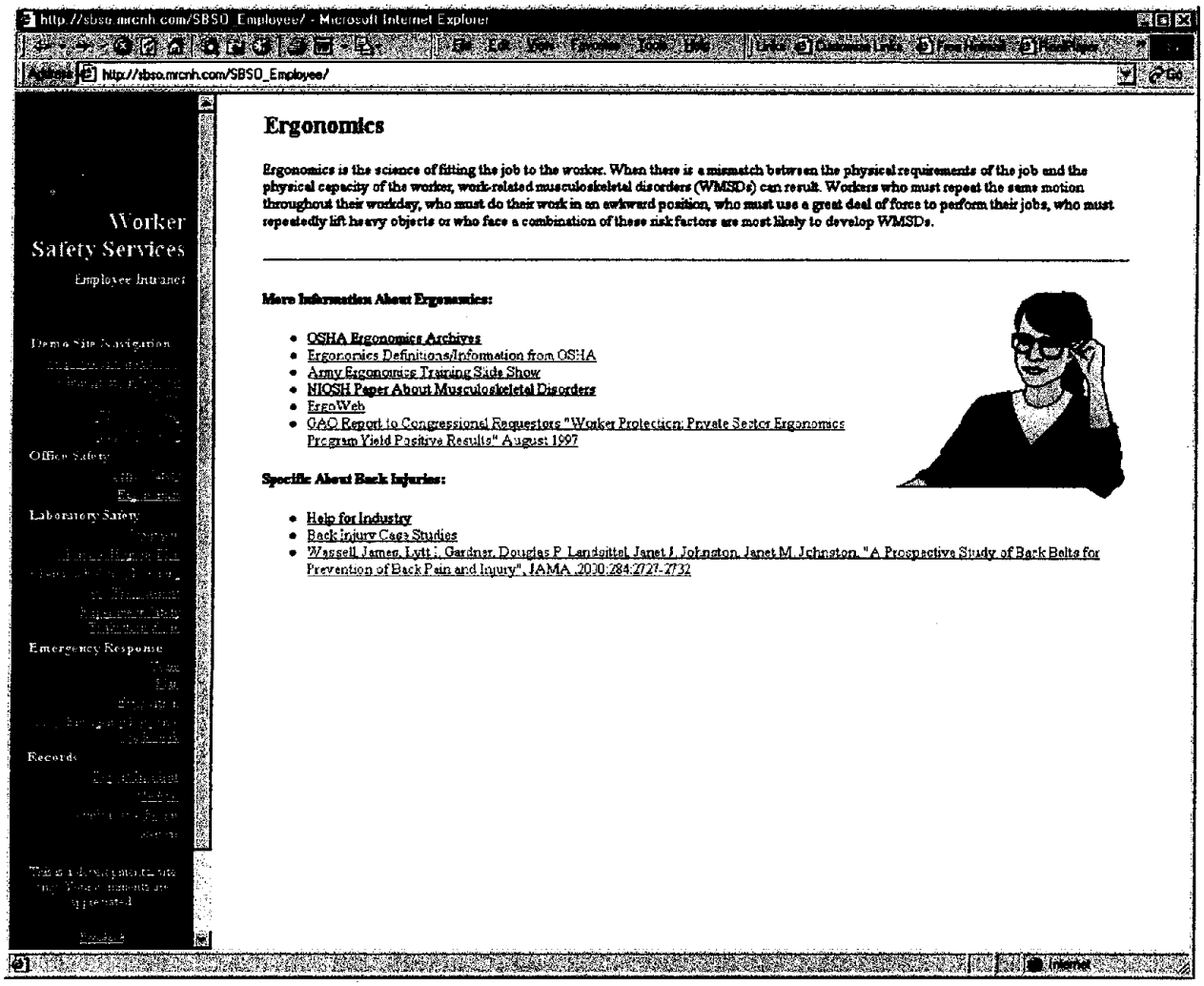
Additional Functionality: Employees navigate the site through the navigation bar (table of contents) on the left, and links on the top table of contents pages.



Goal: We envision that all businesses will want an Office Safety section.

Content: The generic layout of our categorical data is a title, a welcome message, a horizontal bar, a list of applicable links to intranet and internet resources (in bullet list, paragraph or table format), and a right-hand-side graphic. The content and selection of these layout features is set in the interview process. The content here shows our generic welcome statement and the links/tools section contains only the NIOSH Health Care Workers Guidelines. We envision that the during the interview process, the user would 1) select from sample welcome statements or input their own, 2) select from our list of applicable source information that we identify on the basis of company needs, and 3) add their own "Office Safety" links to that list to customize their intranet. The user links could be to resources they provide internally or to resources they've found on the world wide web. The statement and relevant resource links would be added to a list in the database populated by the interview process. When the "Office Safety" page is clicked in the employee intranet, reading the database information dynamically creates the page.

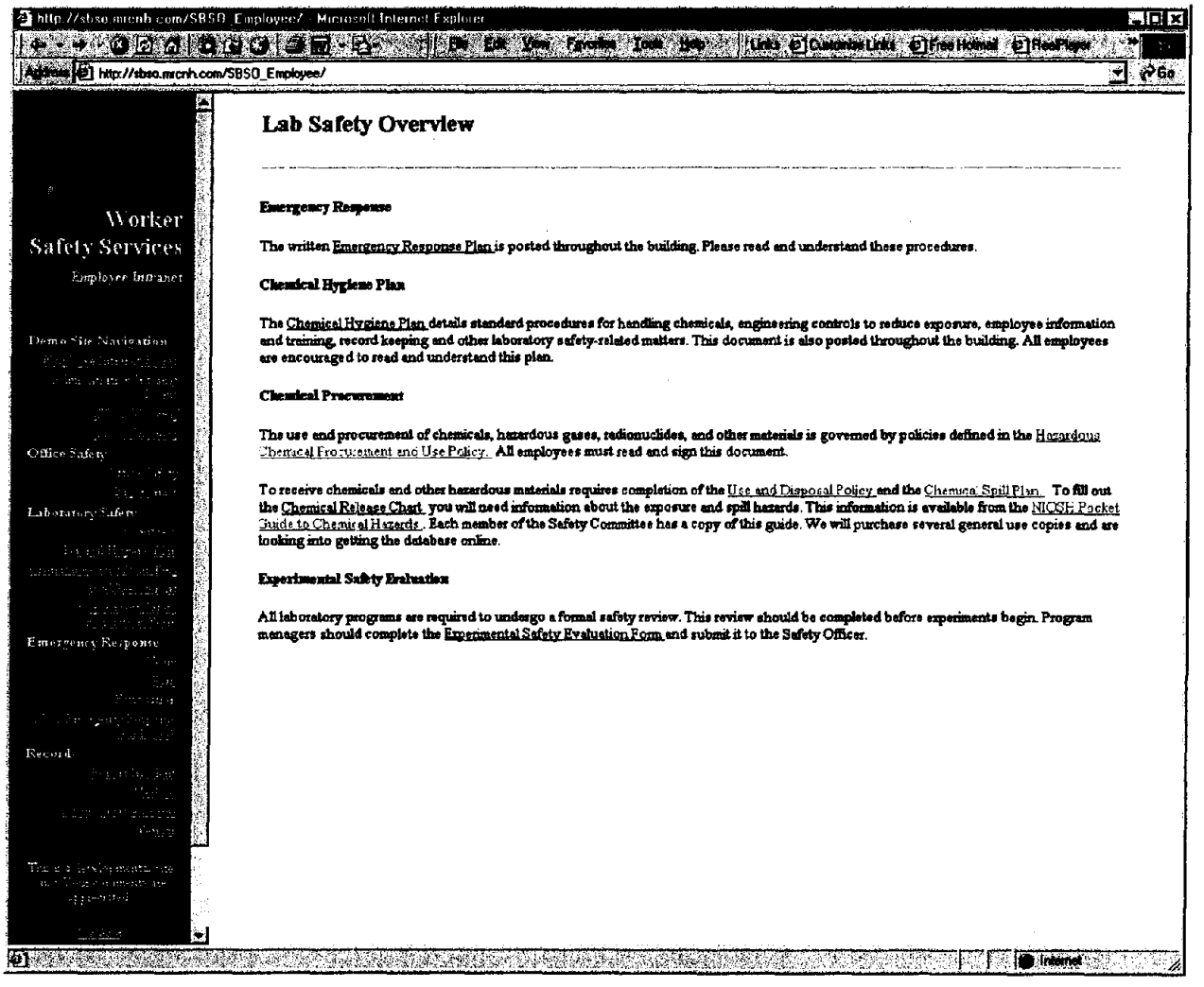
Additional Functionality: The navigation bar on the left currently contains topics in each of four categories: Office Safety, Laboratory Safety, Emergency Response, and Records. Inclusion or exclusion of these general categories, their subtopics, and their content may change depending upon user selections in the interview.



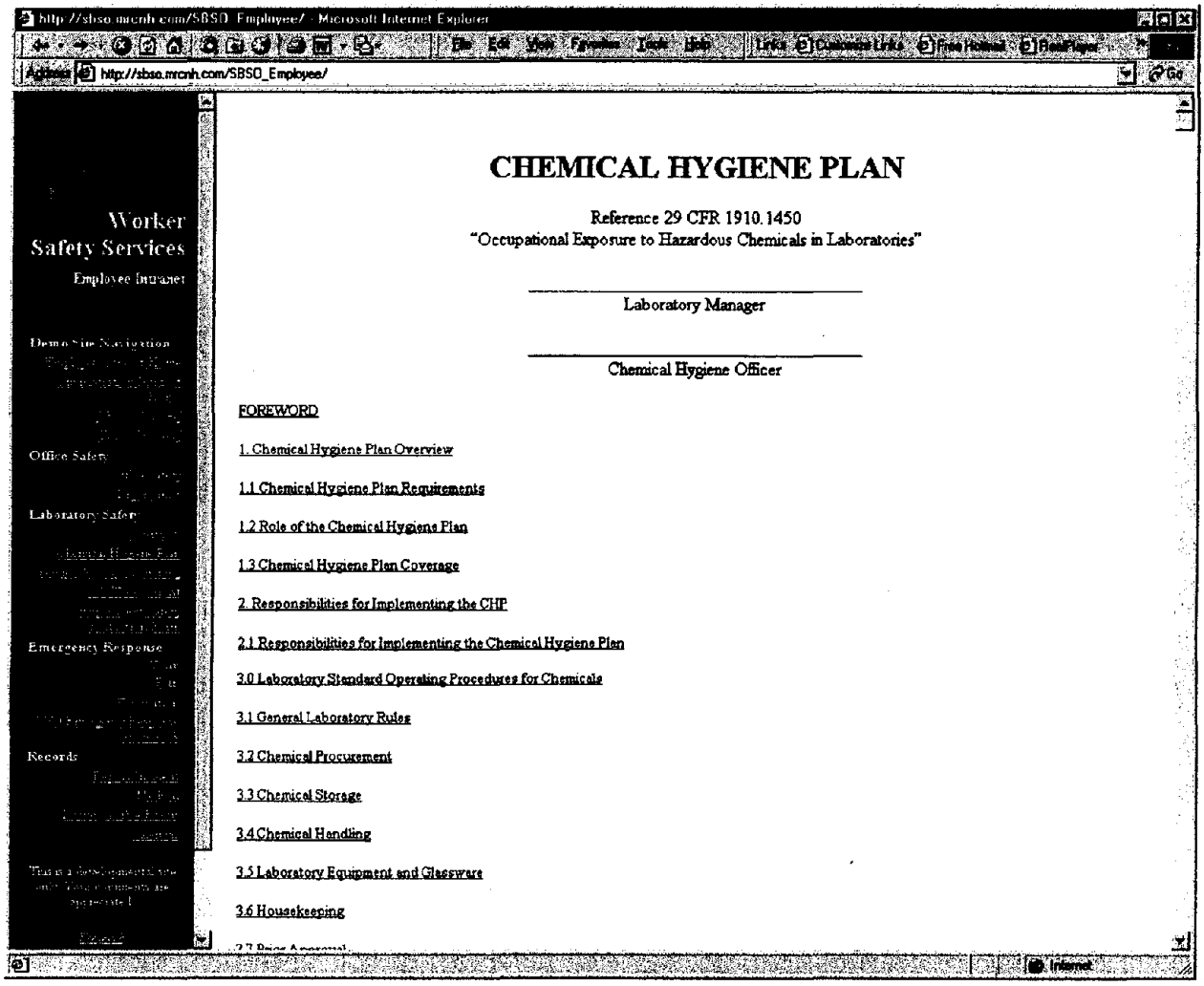
Goal: The pages dedicated to Office Safety are critical because they impact the greatest number of workers. Foremost among the office safety concerns is ergonomics. An entire page with multiple links is provided to present this important subject.

Content: Again, we provide a generic welcome statement, however, the user can customize this during the interview process. The content presented is includes to material available from the OSHA website and other resources like a slideshow on the subject produced by the US Army. The content also shows representative output of a user that has a specific interest in back injuries – perhaps a common problem at their site.

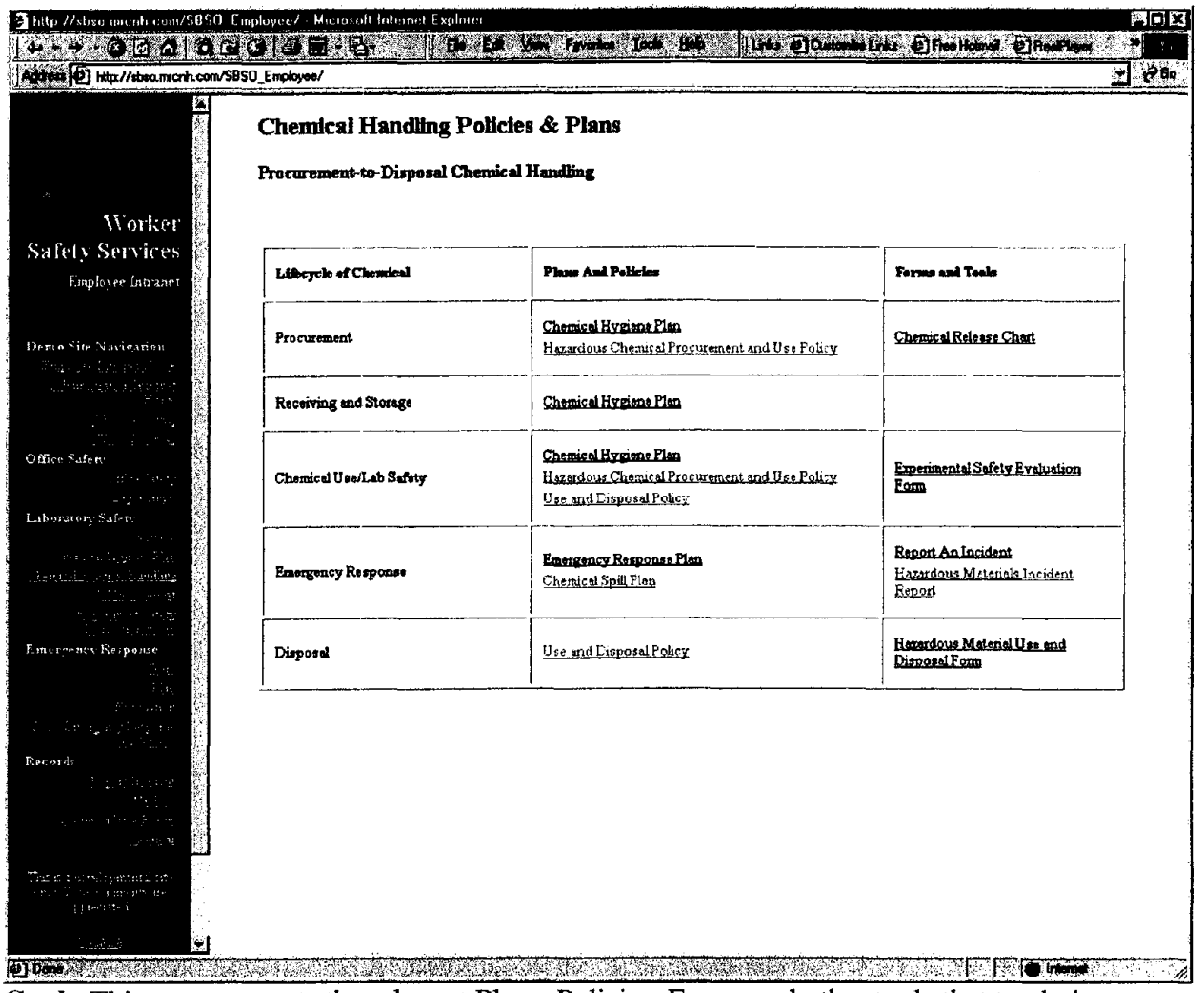
Additional Functionality: The navigation bar on the left currently contains topics in each of four categories: Office Safety, Laboratory Safety, Emergency Response, and Records. We presently plan to retain these general categories but the subtopics and their content may change depending upon user selections in the interview.



Goal: The Laboratory Safety home page provides an overview of lab safety procedures and regulations with the documents hyperlinked.
Content: The page contains text and hyperlinked documents in the areas of Emergency Response, Chemical Hygiene, Chemical Procurements, and Experimental Safety Evaluation. The content is established during the interview process; here the user selected "Lab Safety Overview" for the title, no (excluded) welcome message, and no (excluded) right-hand-side graphic. For the related links and resources, the user selected a paragraph format instead of a bulleted list of links. For this style, the user had to have some knowledge of html to create the text blocks that are displayed with their links. This resource was then archived along with all the other data input during the interview process.
Additional Functionality: This page is oriented towards employees who have a preference for text. A tabular representation of much of the same information is presented on the Chemical Policies/Handling policies. On that page, the policies and plans are presented with respect to a chemical use life cycle. Multiple formats to present the same information are often necessary for understanding by a diverse audience.



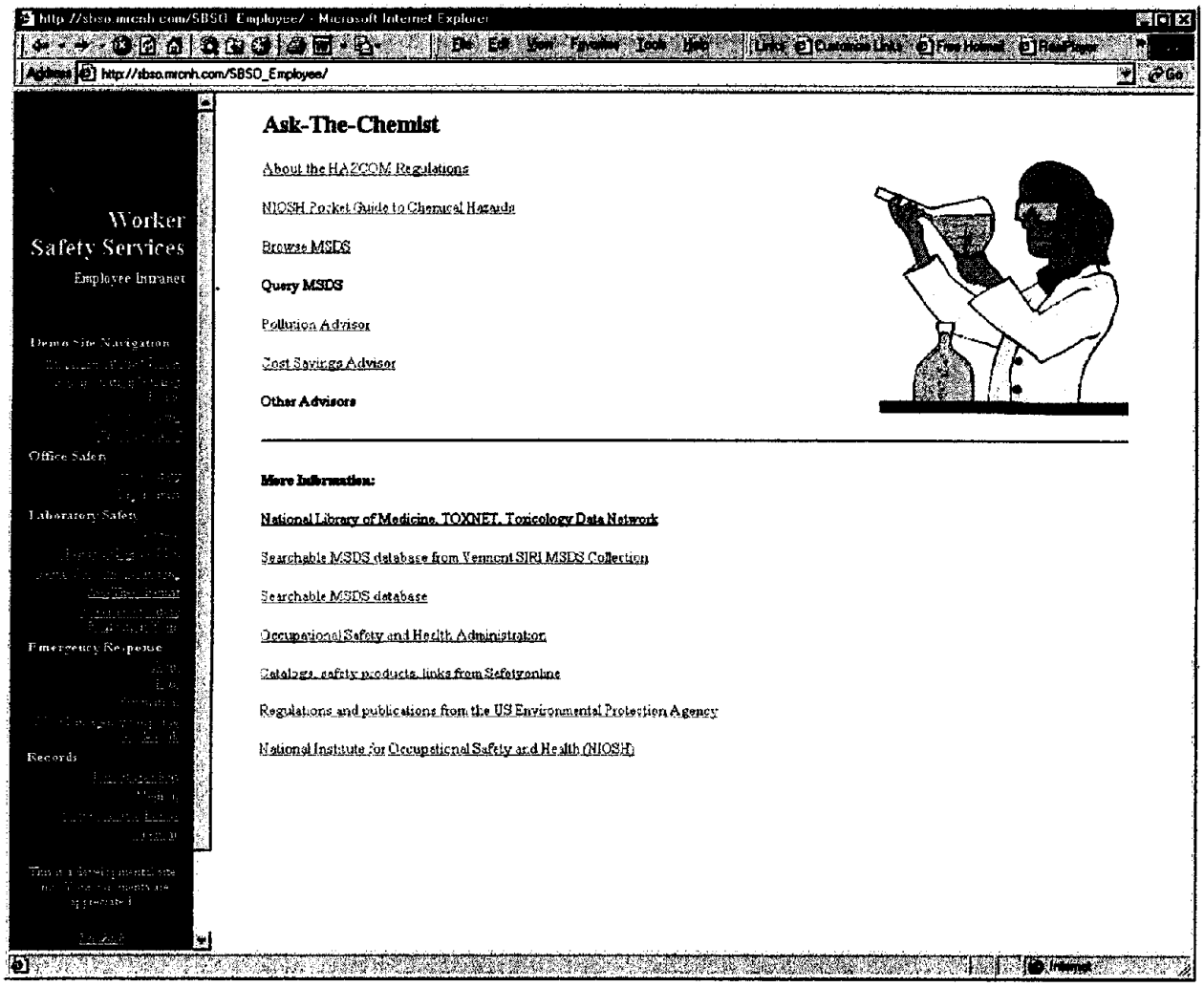
Goal: Display of the user-prepared Chemical Hygiene Plan is one of the most important features of the Public (Employee) Intranet site. The interview process will enable the company representative to tailor a plan for their business and to include as much detail as desired. The interview process also allows the user to provide access to important documents directly from the table of contents (as shown here) as well as from resource links on other pages (links to this page are provided on the "Overview" and "Chemical Policies/Handling" pages, also).
Content: The plan shown above is fully 37 pages long and has been converted to HTML for ease of navigation. The major sections in the plan have been hyperlinked to enable the employees to move around freely. Companies will have the option of presenting the plans in this format or as PDF files.
Additional Functionality: One of the most important features of the plans and derived policies is that the Small Business Safety Officer software will track them and ensure their compatibility. Thus, a Chemical Purchase and Disposal Policy will be fully consistent and directly traceable to the Chemical Hygiene Plan. The same will be true of the other Plans and Policies the software will create.



Goal: This page presents the relevant Plans, Policies, Forms and other tools that track the lifecycle of a chemical or product. What is shown above is for a Research Laboratory that purchases and uses hazardous chemicals but disposes of them rather than generating and shipping products. For the case of a production facility, additional columns for shipping, labeling and other needs would be added.

Content: The content tracks a chemical from procurement, receiving and storage, use in the laboratory, procedures in the event of accidental release and disposal. All the Plans, Policies, Forms and other tools necessary for employee awareness and/or direct use are hyperlinked in the columns. If the employer chooses, the forms may be downloadable or on-line for easier tracking.

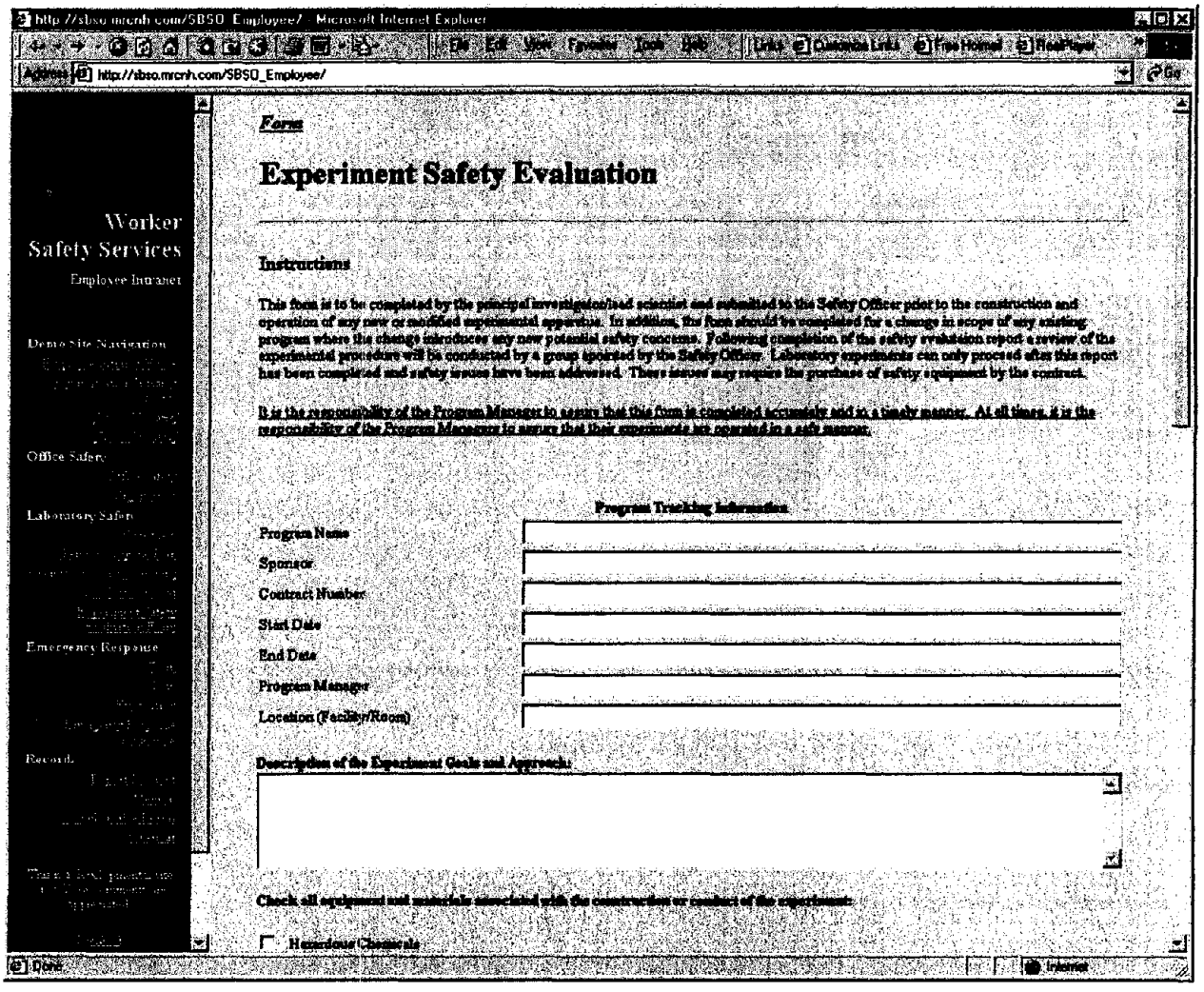
Additional Functionality: For Phase II features will include: the ability of the employer to revise Plans, Policies and Forms and "push" these to the Public site; a search mechanism on a chemical or keyword procedure to enable the employee to search this local library. For example, an employee wishing to order a hazardous chemical could run the search of that chemical and determine that it can be ordered with an on-line form, that it must be stored in an explosion proof cabinet, that its use does not require a respirator but will require a hood and gloves, that if spilled in small quantities the employee can clean it up with material in the spill control cabinet and, finally, that disposal may be via the organic disposal drum located on the loading dock.



Goal: Employees will also require a set of tools and links to research safety issues on their own. This intent of this page is to provide that capability.

Content: The current content includes an MSDS database, a pollution prevention advisor (P2Gems), an economics advisor (P2Finance) and an extensive set of links including EPA, NIOSH, OSHA, TOXNET, safety catalogs, etc. In this example, during the interview process, the user replaced the welcome screen with a list of commonly access links.

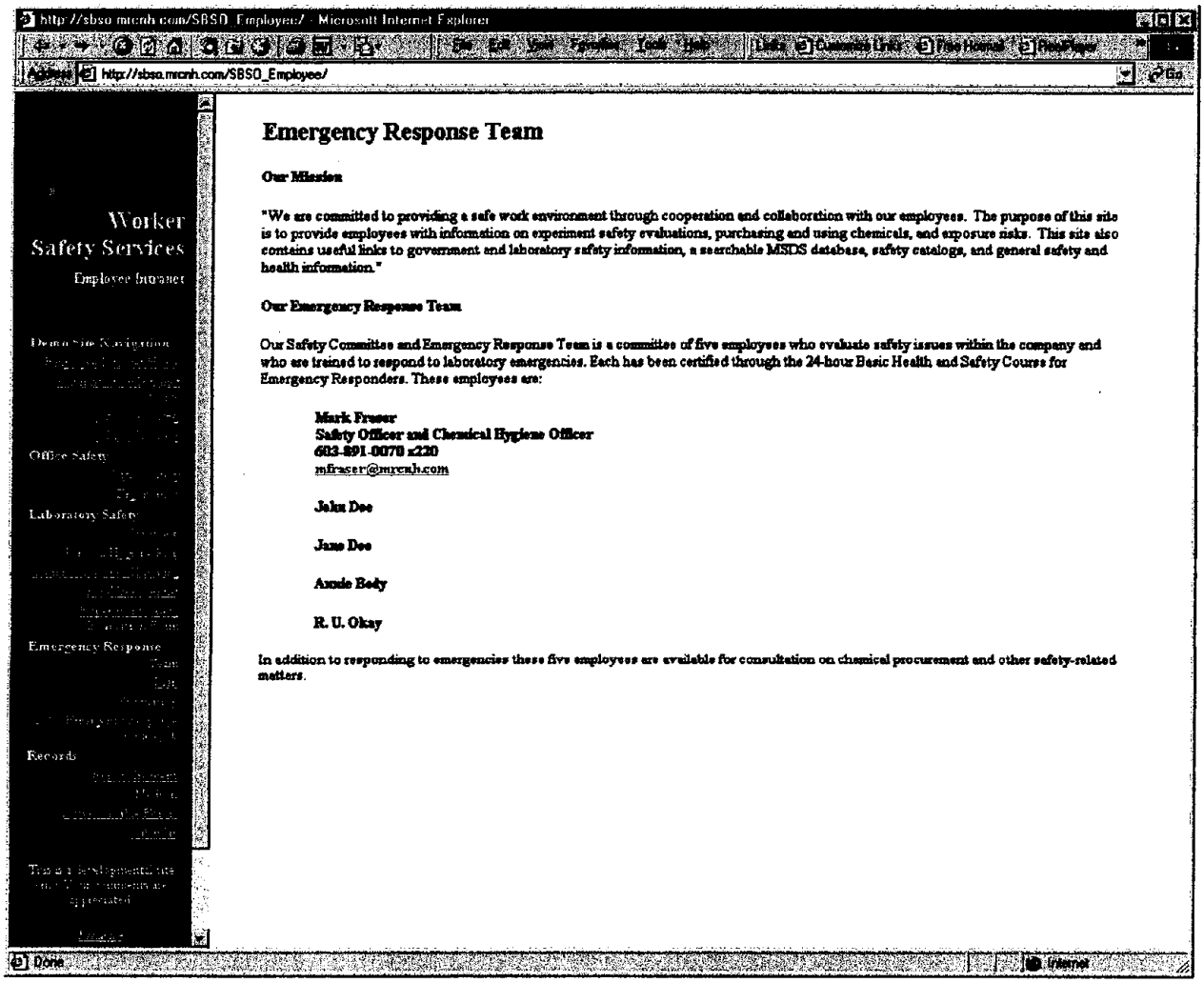
Additional Functionality: This page is the place to add additional search engines to dynamic databases or information services. This will allow both interactive search and retrieval as well as automated information retrieval. The latter falls under one of our communication goals of "having important information find the user" rather than the other way around.



Goal: Since this prototype is intended for small businesses subject to the Laboratory Standard, the Public site requires an Experiment Safety Evaluation Form. This is intended for those R&D firms that perform experimental research on-site.

Content: The form shown above is in abbreviated format, but most of the principal fields are present. The form may be prepared on-line, submitted to the Chemical Hygiene Officer (CHO) on-line, approved by the CHO on-line and stored on-line.

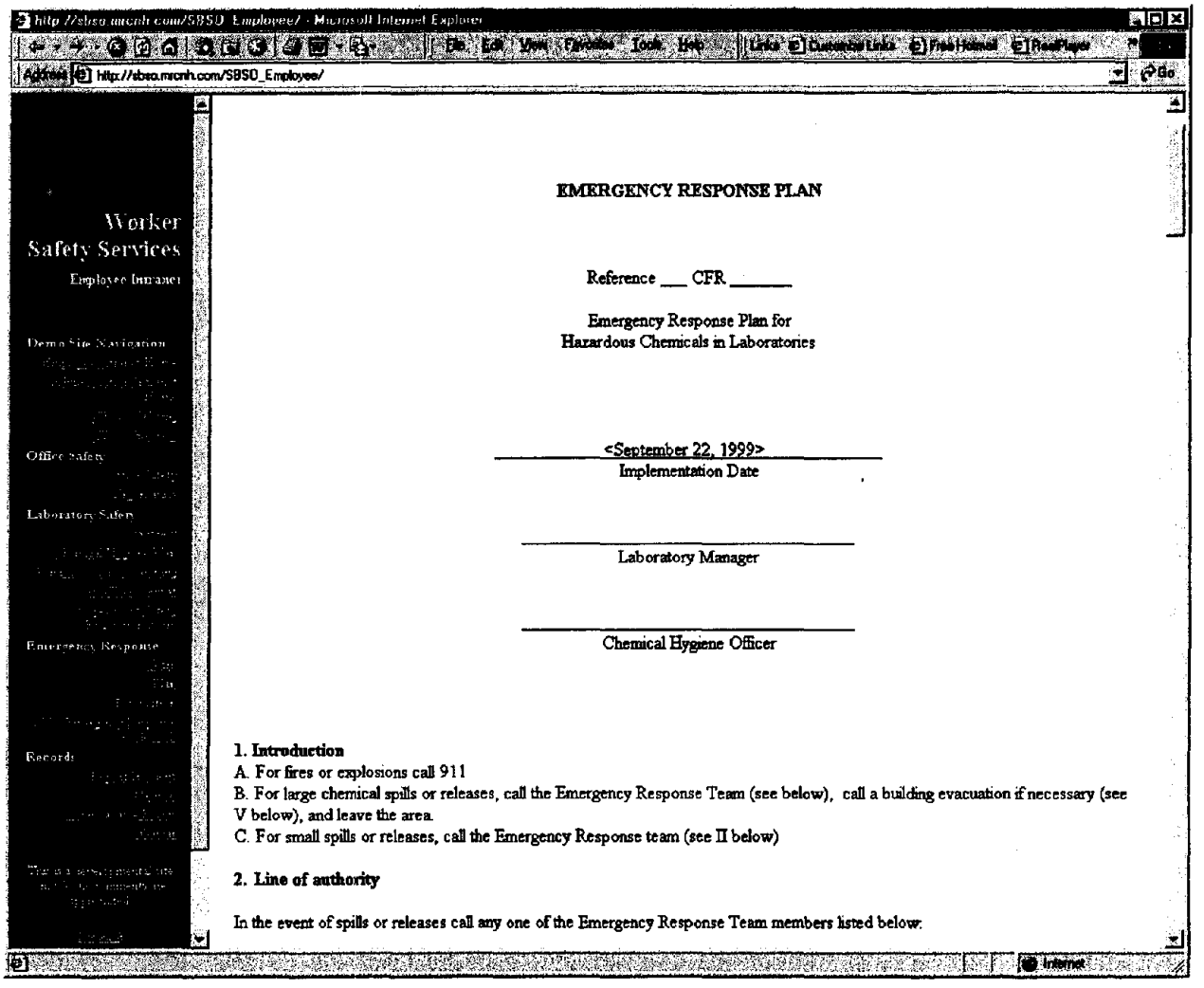
Additional Functionality: Additional fields specifying the identity of the chemicals, spill procedures, physical hazards and other safety issues will be added. Also to be included is the button for on-line submittal and an electronic signature capability.



Goal: The presentation of Emergency Response information is one of the most important features of the Public site. In the section, employees can read and understand what to do in case of an emergency.

Content: The Emergency Response Team page presents a mission statement and the names, phone numbers and email addresses of the ERT.

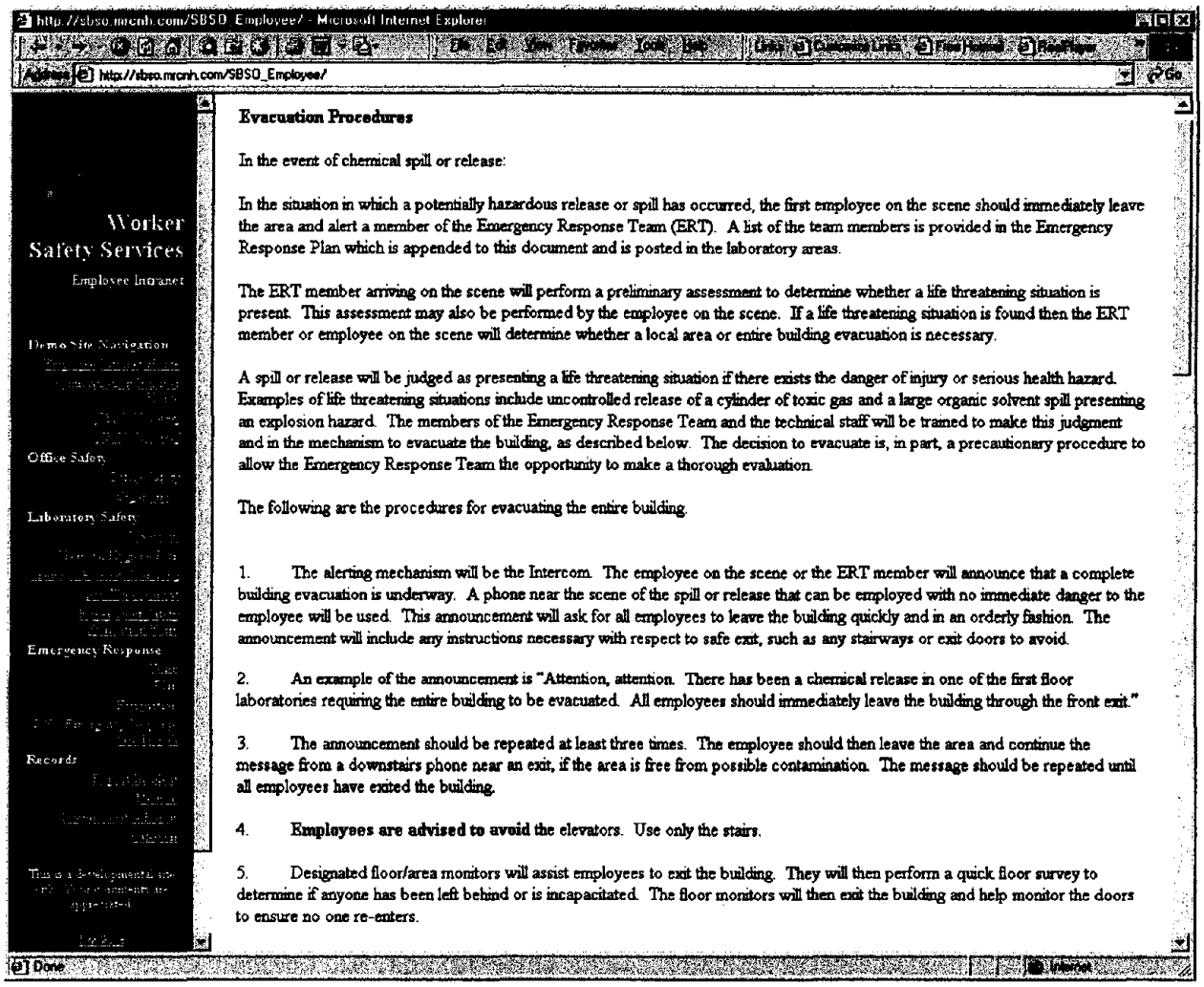
Additional Functionality: An additional feature that could be added to this page is a synopsis of the Emergency Response Plan with hyperlinked documents. The more extensive documents, the Plan itself and the Evacuation Plan are presented on subsequent pages in detail.



Goal: The entire Emergency Response Plan in downloadable or pintable format (Word 2000) is presented on this page.

Content: The sample Emergency Response Plan shown here is six pages long and includes: An Introduction, Line of Authority, phone numbers for External Emergency Assistance, Emergency Action Procedures (from hazard assessment through cleanup and safe return), Evacuation Instructions, and Location of MSDS sheets.

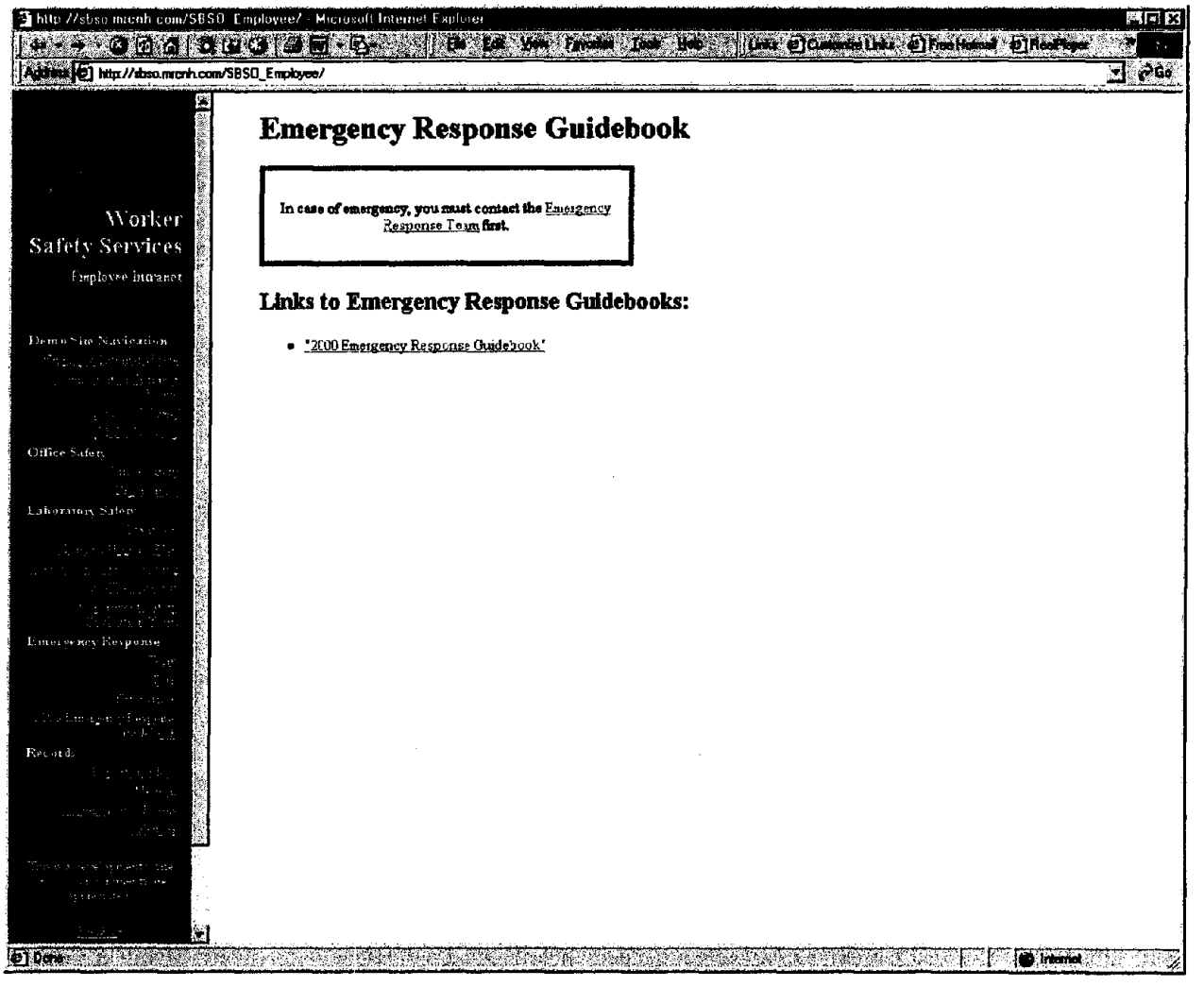
Additional Functionality: To complete this document the embedded links to other Forms and Plans need to be completed. The first page should also have a hyperlinked table of contents to take employees quickly to the sections of interest.



Goal: This page presents the Evacuation Procedure from the Emergency Response Plan. Considering the importance of this information and the fact that exiting the building in a safe and timely fashion is the only responsibility of the bulk of the employees, it is presented here as well.

Content: The content provides the mechanism for alerting employees through the mechanisms for safe return notification.

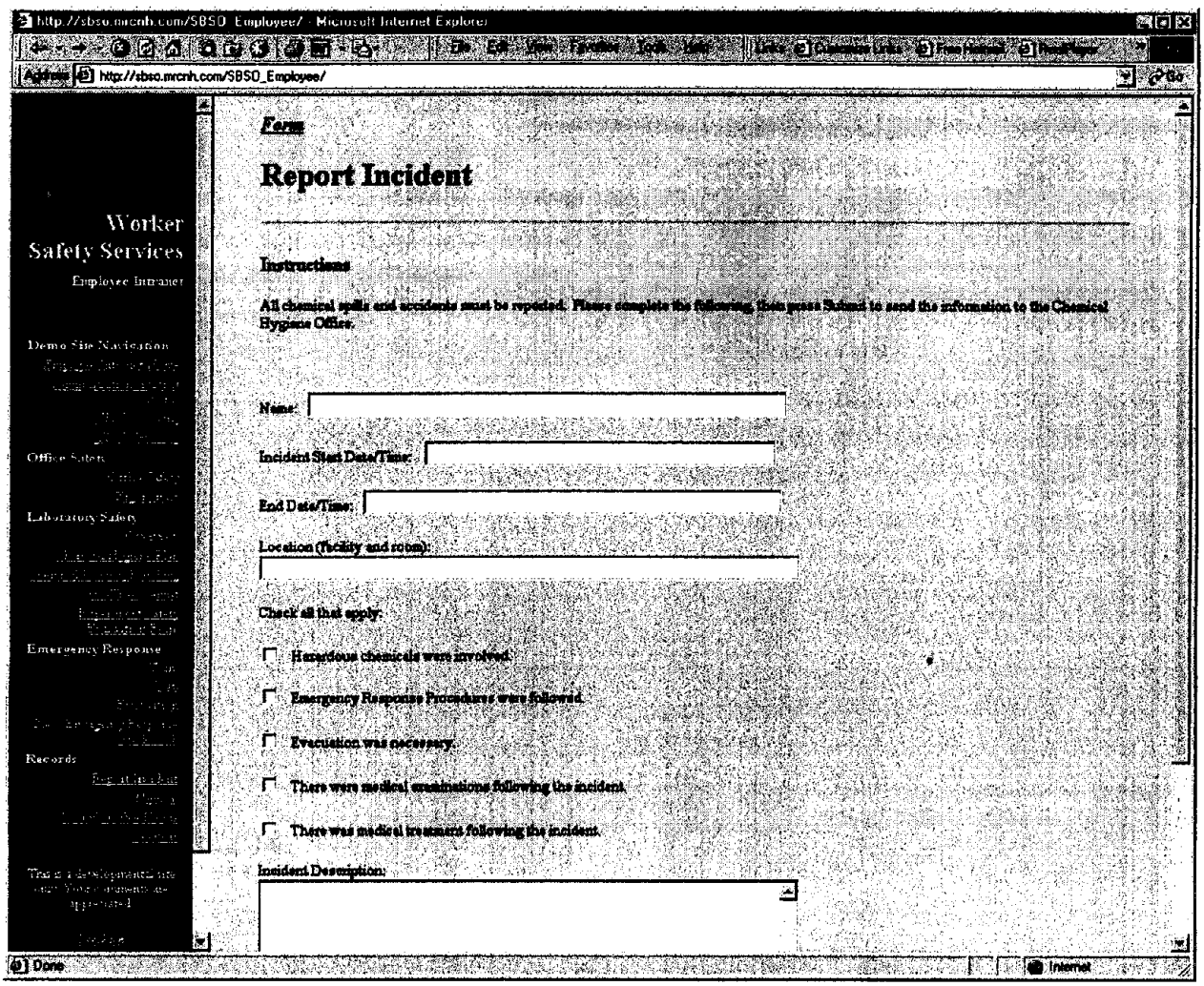
Additional Functionality: This page could also contain links to uploads of the business floor plans showing exits and escape routes.



Goal: This page is a placeholder for advanced tools for use by the Emergency Response Team. The content currently is limited to a link to the ERG2000 Emergency Response Guidebook.

Content: The Emergency Response Guidebook (ERG2000) was developed jointly by the US Department of Transportation, Transport Canada, and the Secretariat of Communications and Transportation of Mexico (SCT) for use by firefighters, police, and other emergency services personnel who may be the first to arrive at the scene of a transportation incident involving a hazardous material. It is primarily a guide to aid first responders in (1) quickly identifying the specific or generic classification of the material(s) involved in the incident, and (2) protecting themselves and the general public during this initial response phase of the incident. The ERG is updated every three years to accommodate new products and technology.

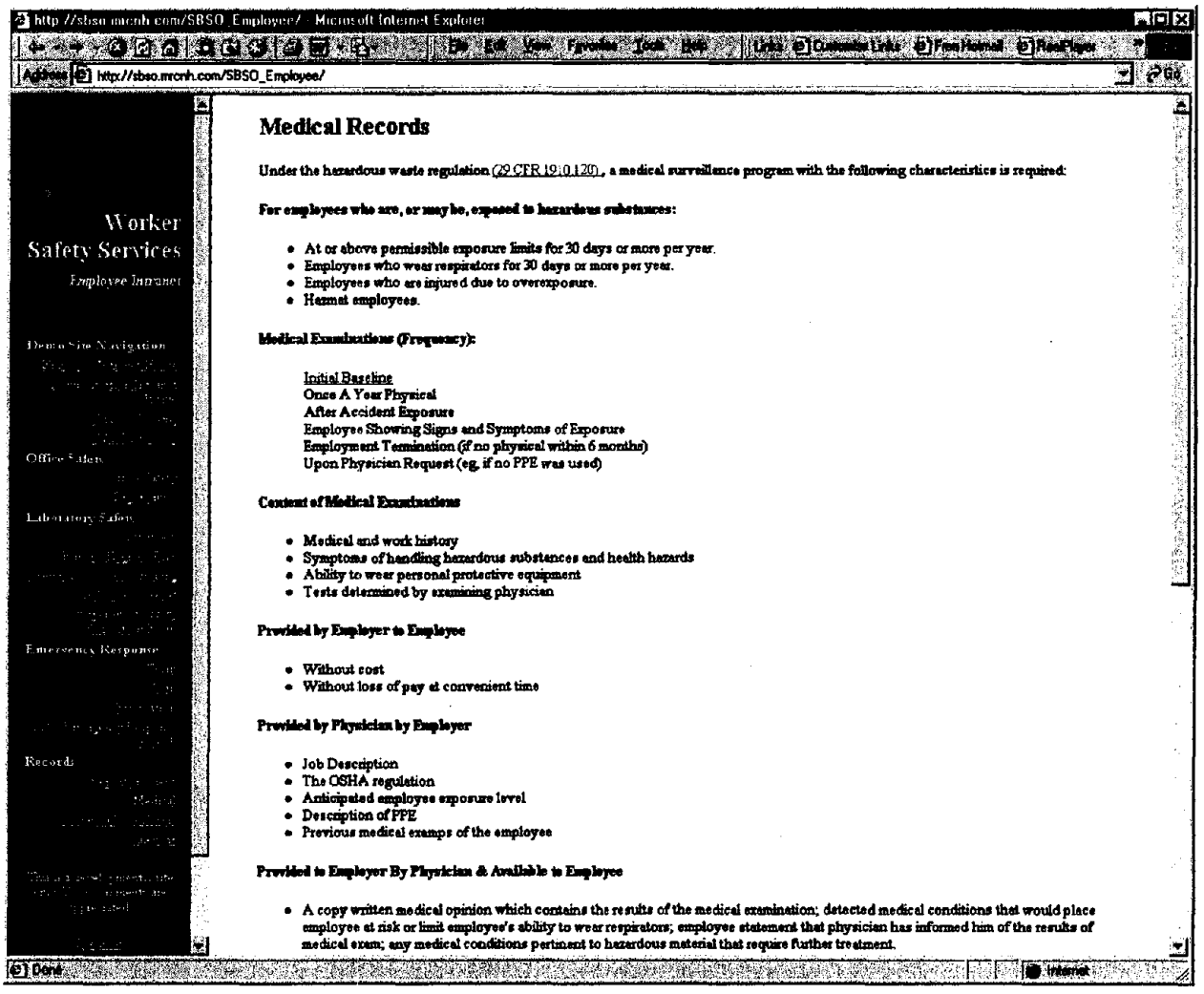
Additional Functionality: Additional tools need to be added to this page such as access to hazard databases, toxicity data, the NIOSH pocket guide and other useful tools.



Goal: This page is a mock-up of an on-line form that will allow employees to record and report an incident or accident.

Content: The present content provides text entry for the employee name, incident time frame, an indication of whether hazardous chemicals were involved, radio buttons querying whether evacuation was necessary and whether any injuries resulted, and a text entry screen for a description of the incident. When the submit button is pushed the report is sent to the Chemical Hygiene Officer and any other company officials identified during the setup process.

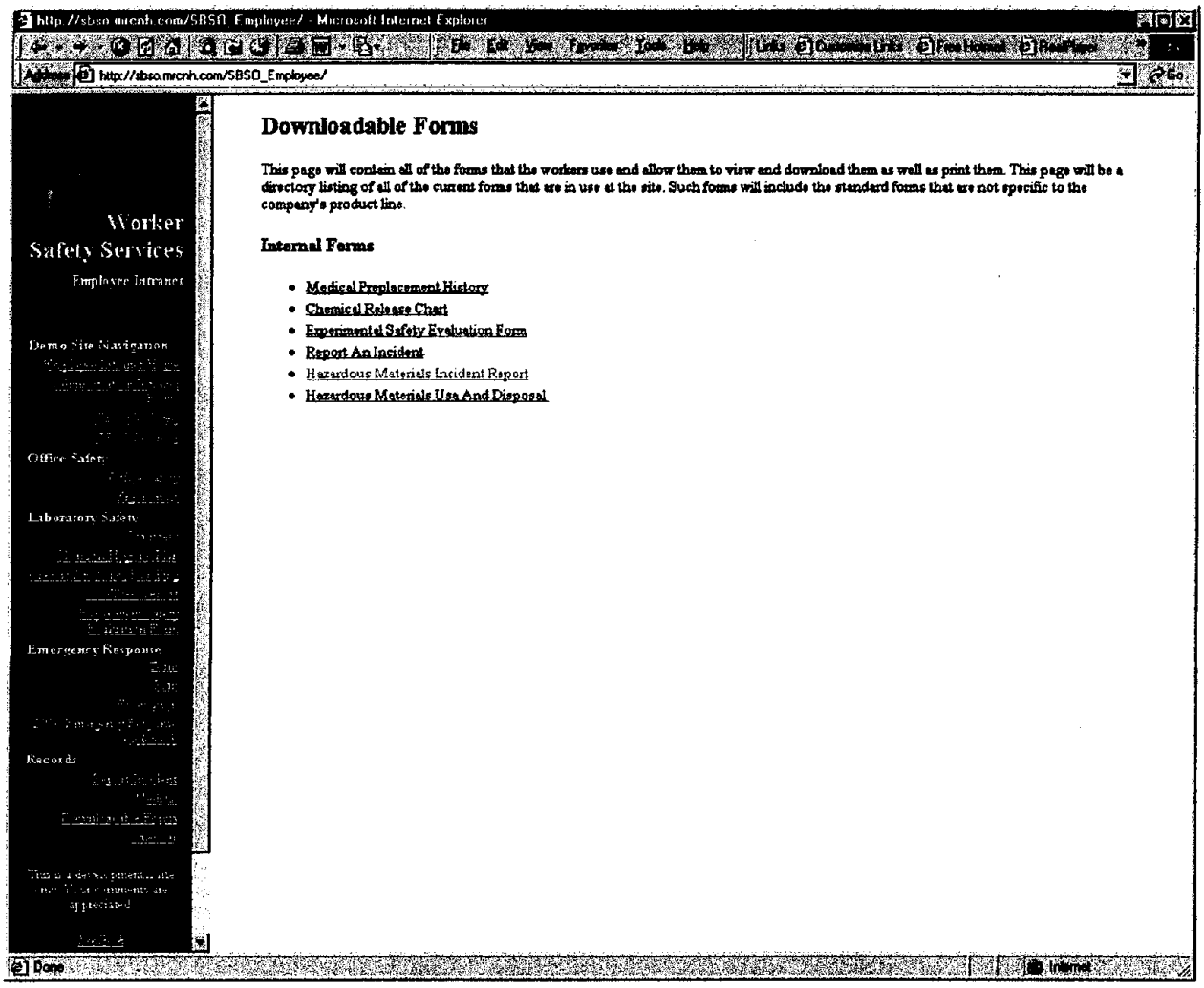
Additional Functionality: We envision a more detailed on-line screen for Phase II with the form given an identification number and the form stored in a database.



Goal: The goal of this page is to provide the employee with a synopsis of medical examinations, record keeping and other related matters. The intent is to keep the employee informed of the examinations provided by the company, the extent of company responsibility and the responsibilities of the individual employee.

Content: The present content is generic, describing a typical medical program at a small business that would include regular physicals. The topics shown above include information on the requirement for a medical program, the nature and frequency of medical examinations, the content of the medical exams and a description of what is provided by the employer top the employee.

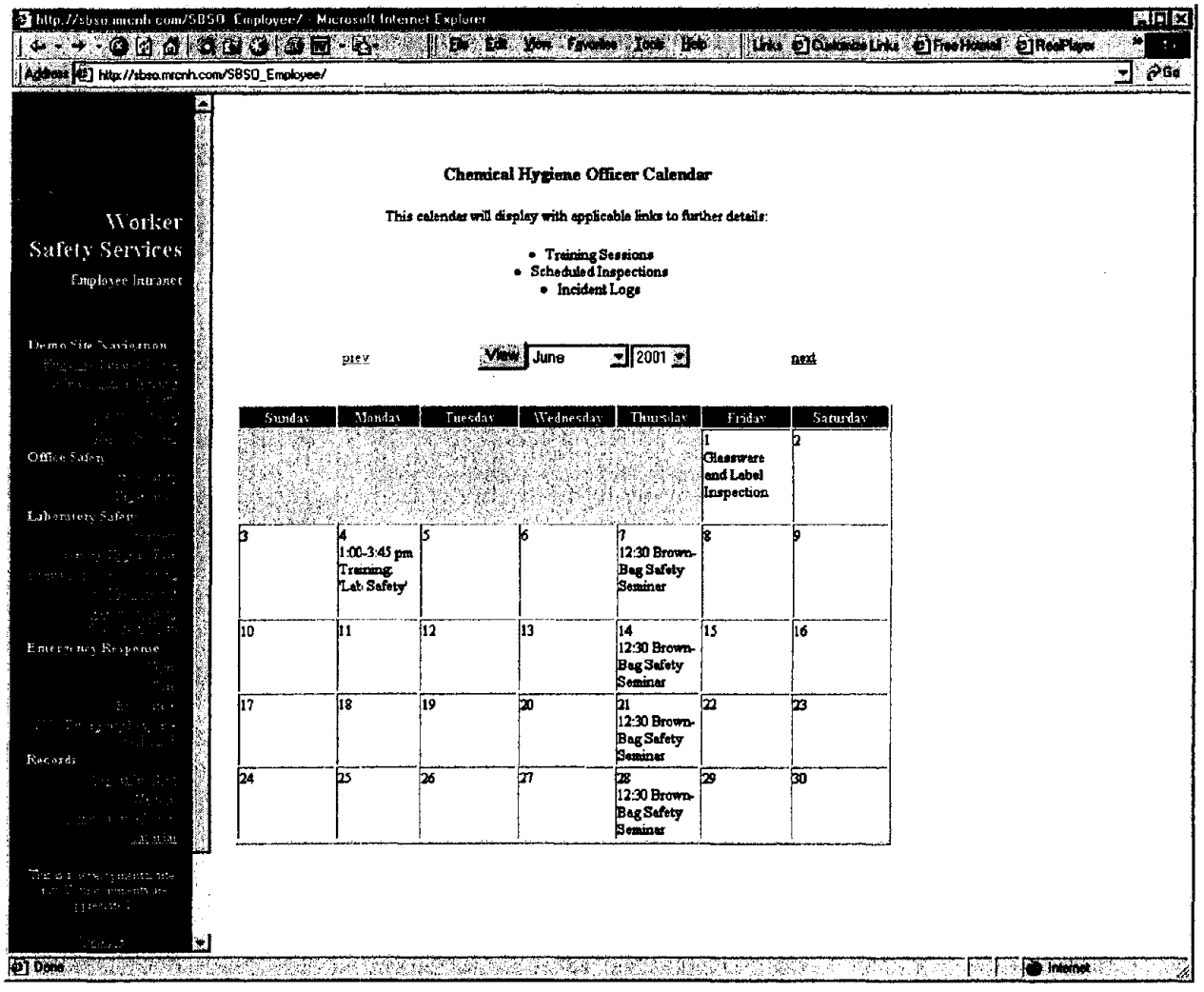
Additional Functionality: The additional content that is not viewable in the screen shot above is material on the topics of information provided to the employer by the Physician available to the employee, record keeping and medical records access. Additional material or content that could be added may be a calendar or text record of past and scheduled medical exams for the employee (this information must be provided on a confidential basis).



Goal: The purpose of this is to provide a library of on-line and downloadable forms.

Content: The content will be determined by the administrative user during the interview process. For this prototype we have included the incident report, the experimental safety evaluation, the pre-placement history forms, and other forms created during the interview process and archived in the database of user inputs.

Additional Functionality: Additional forms and organizational layouts will be considered for Phase II. Links to some forms are also included by category for example in tabular format in the "Chemical Policies/Handling" section, in paragraph format in the "Medical" section, and elsewhere cross-referenced in plans, etc. This page displays, in a generic way, a list of all forms accessible through the public intranet, and provides one of many convenient ways to find an often-used form quickly. Whether or not a form is available on the public intranet is determined during the interview process, and that flag is set in the database of user inputs.

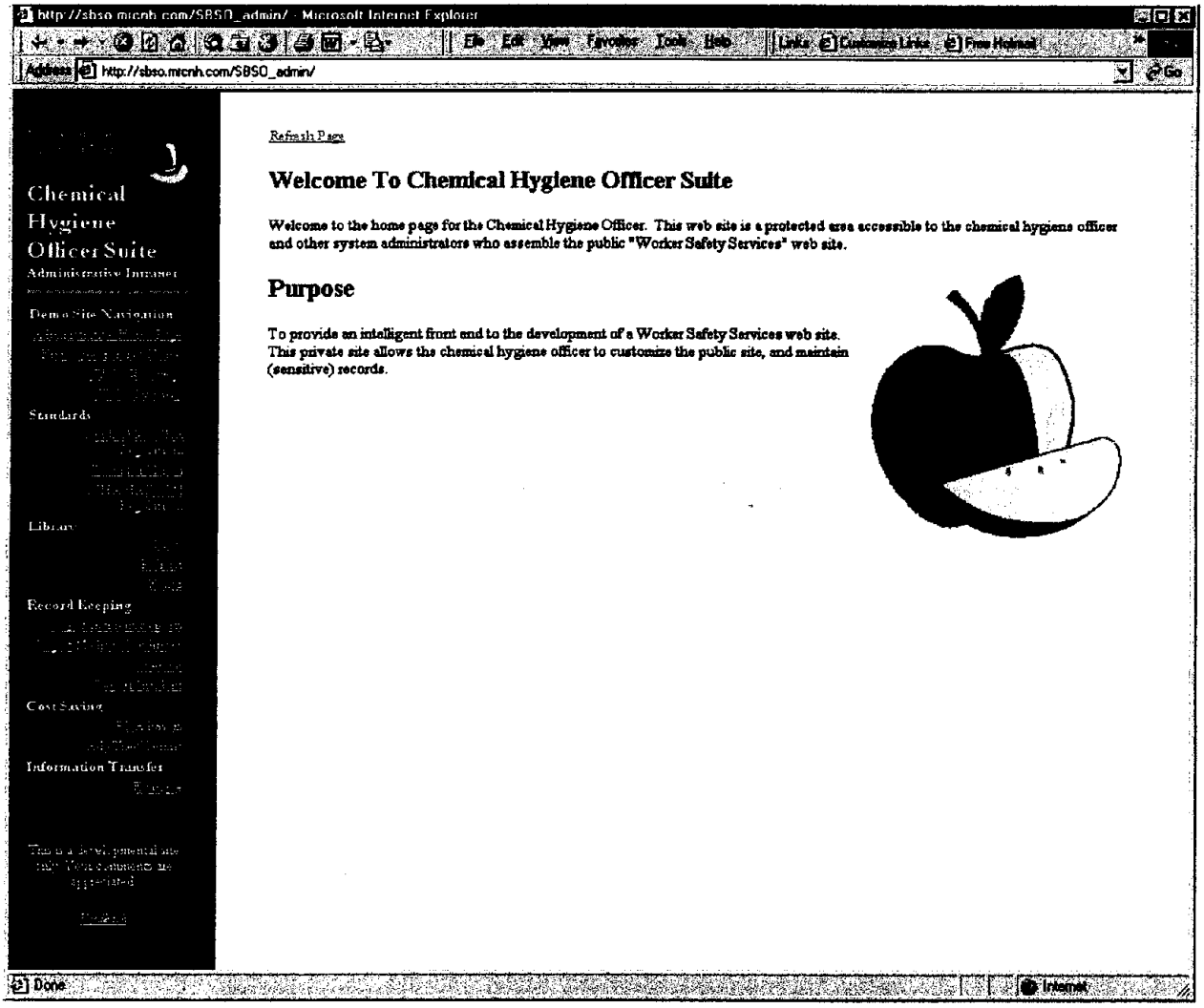


Goal: Employees will benefit substantially from knowing both the short term and long term schedule of inspections and other safety activities. The calendar shown above provides this capability.

Content: The content is a fully functional calendar with displayed text that employees can navigate month-by-month or year-by-year. The calendar will be populated by company management (such as the Chemical Hygiene Officer) and will be viewable only by the employees.

Additional Functionality: The calendar tool accesses a database of scheduled and past events with relevant links to logs and record keeping sections or training information. The inputs to the calendar tool are generated in the administrative intranet, not by the employee intranet. However, we envision that our calendar tool could be tailored to allow individual employees with their own log-ins to display their own personal data and links to be viewed with the administration database.

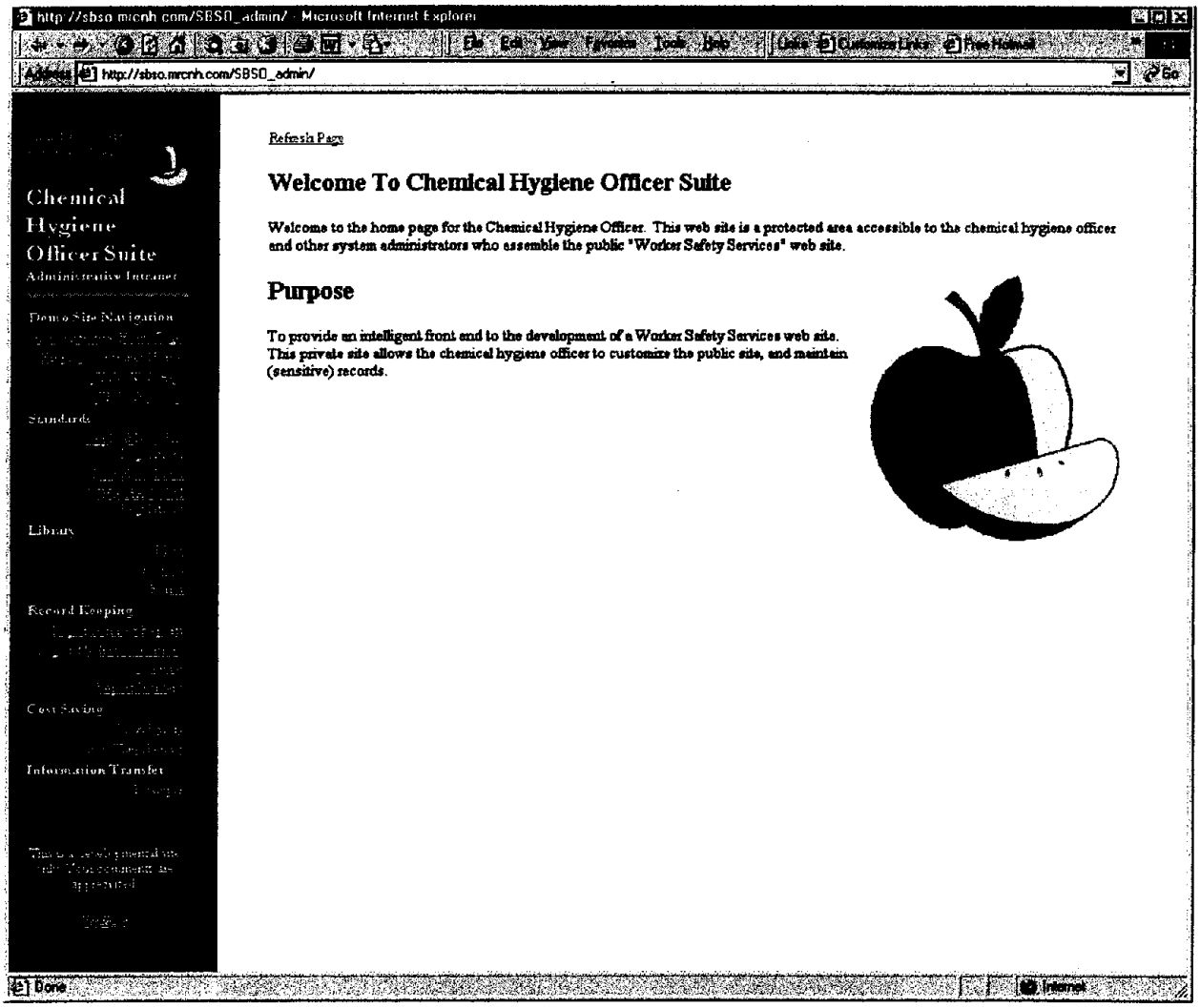
Appendix D Small Business Safety Officer Administrative Intranet



Goal: This is the home page of the Administrative website. The intended users of this site will be limited to those individuals who have been approved by company management. This list is anticipated to include the Chemical Hygiene and/or Safety Officer, key corporate officials and members of the Emergency Response Team.

Content: The content is currently limited to introductory material

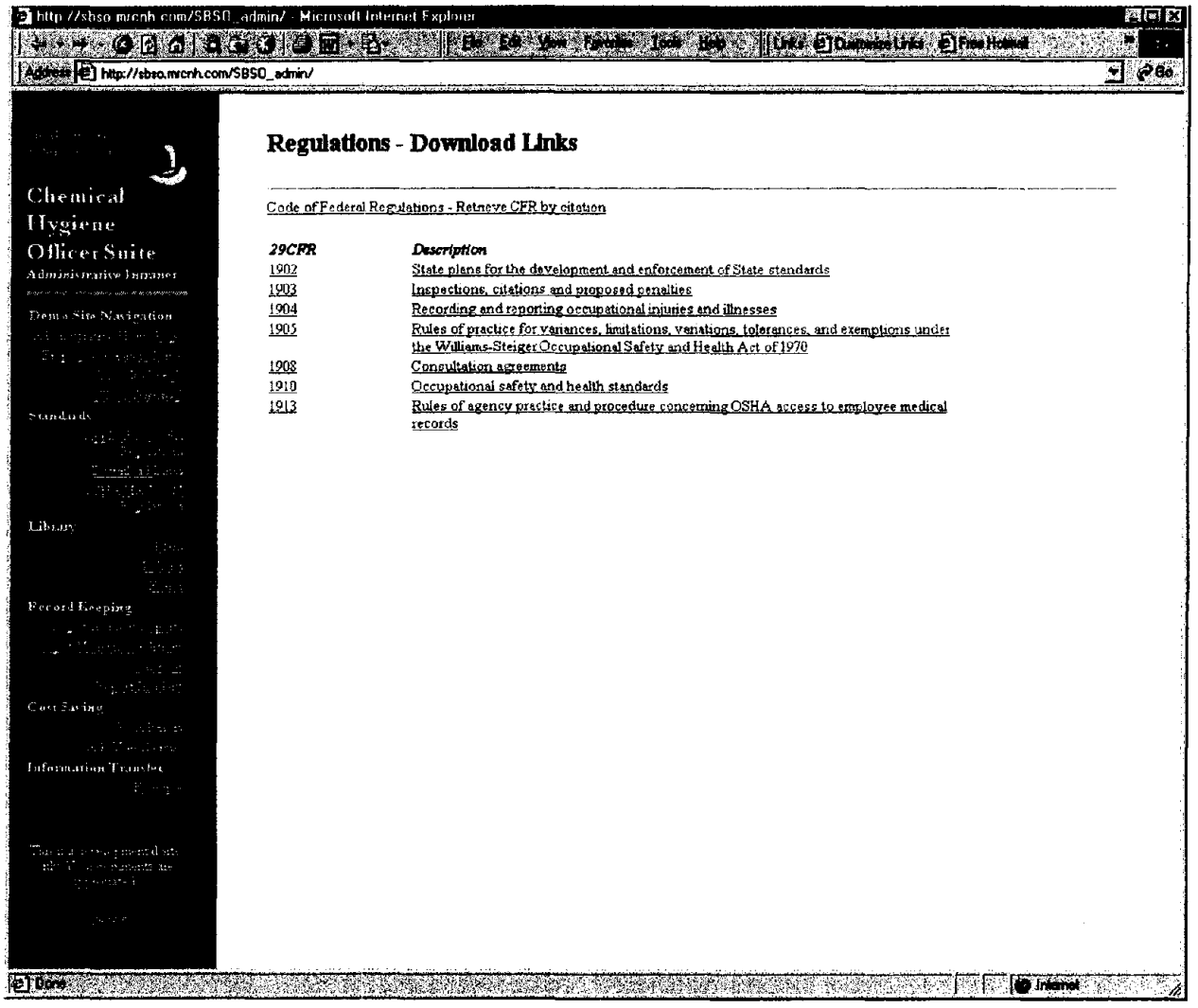
Additional Functionality: Additional content planned for Phase II would be interfacing Small Business Safety Officer to one or more information databases and, using keywords and profiles, do automated search as displays. This fulfills one of our goals to "have information find the user" rather than the other way around. The other planned modification to this page will be the ability for the Chemical Hygiene Officer to personalize and customize it to provide the information content and presentation format they desire.



Goal: This page is the first under the "Standards" heading. It provides a complete list of the applicable OSHA regulations as determined through the interview process.

Content: The content is presently text showing the standard number and its OSHA title.

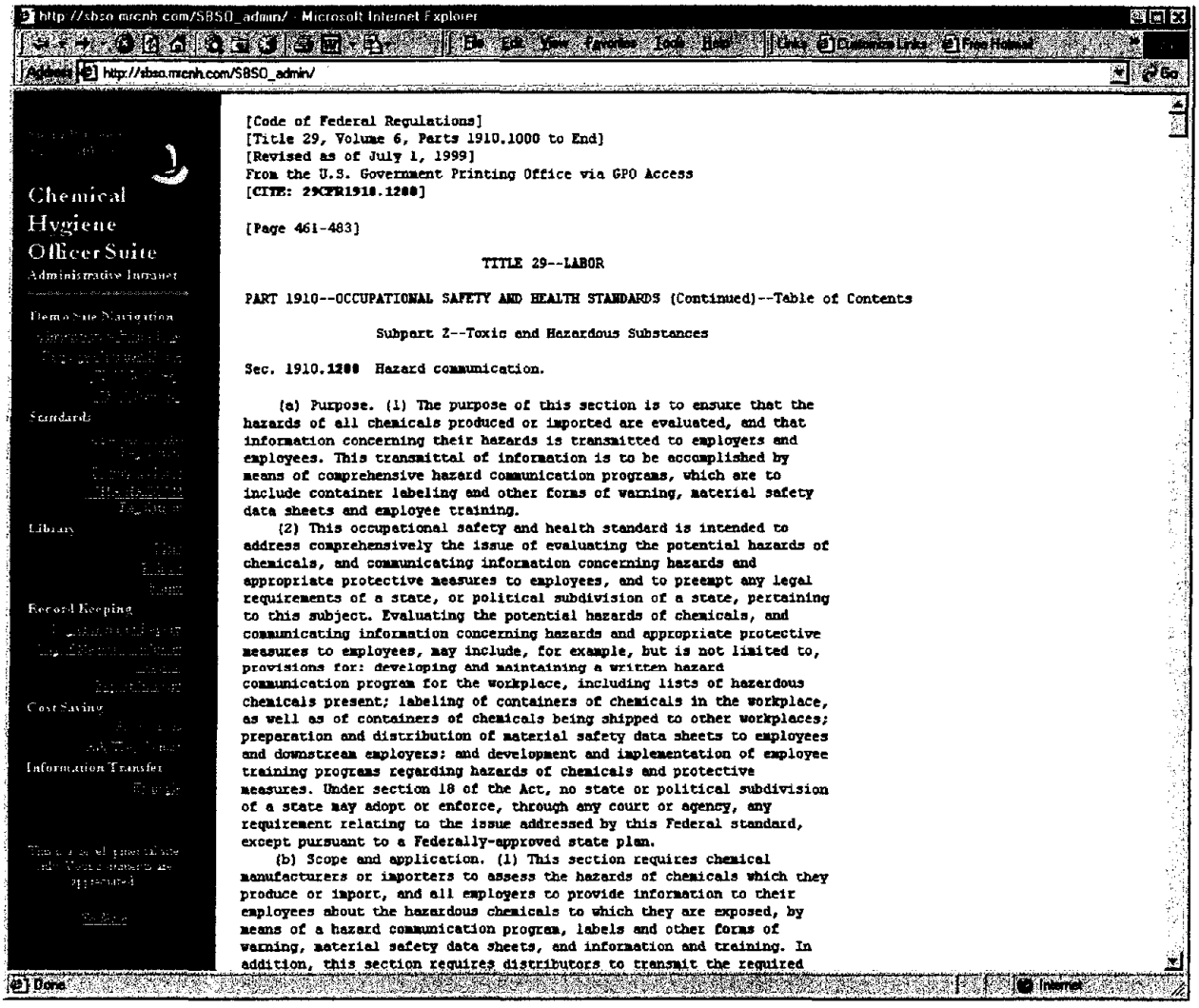
Additional Functionality: We are considering another presentation form for Phase II. This could be a tabular presentation correlating business practices and activities to the relevant codes. This form of presentation is more intuitive for the business because their view of the regulations follows this train of thought, i.e. I'm using hydrogen cyanide in this process therefore I must follow the respiratory protection standard, etc. We anticipate that such a table would be hyperlinked to the relevant text in the Chemical Hygiene Plan and to the OSHA regulations.



Goal: The intent of this page is to provide the user with a means to search the OSHA CFR documents.

Content: All the documents from 29 CFR 1902 through 1913 are provided here. They can be accessed in text and in PDF format.

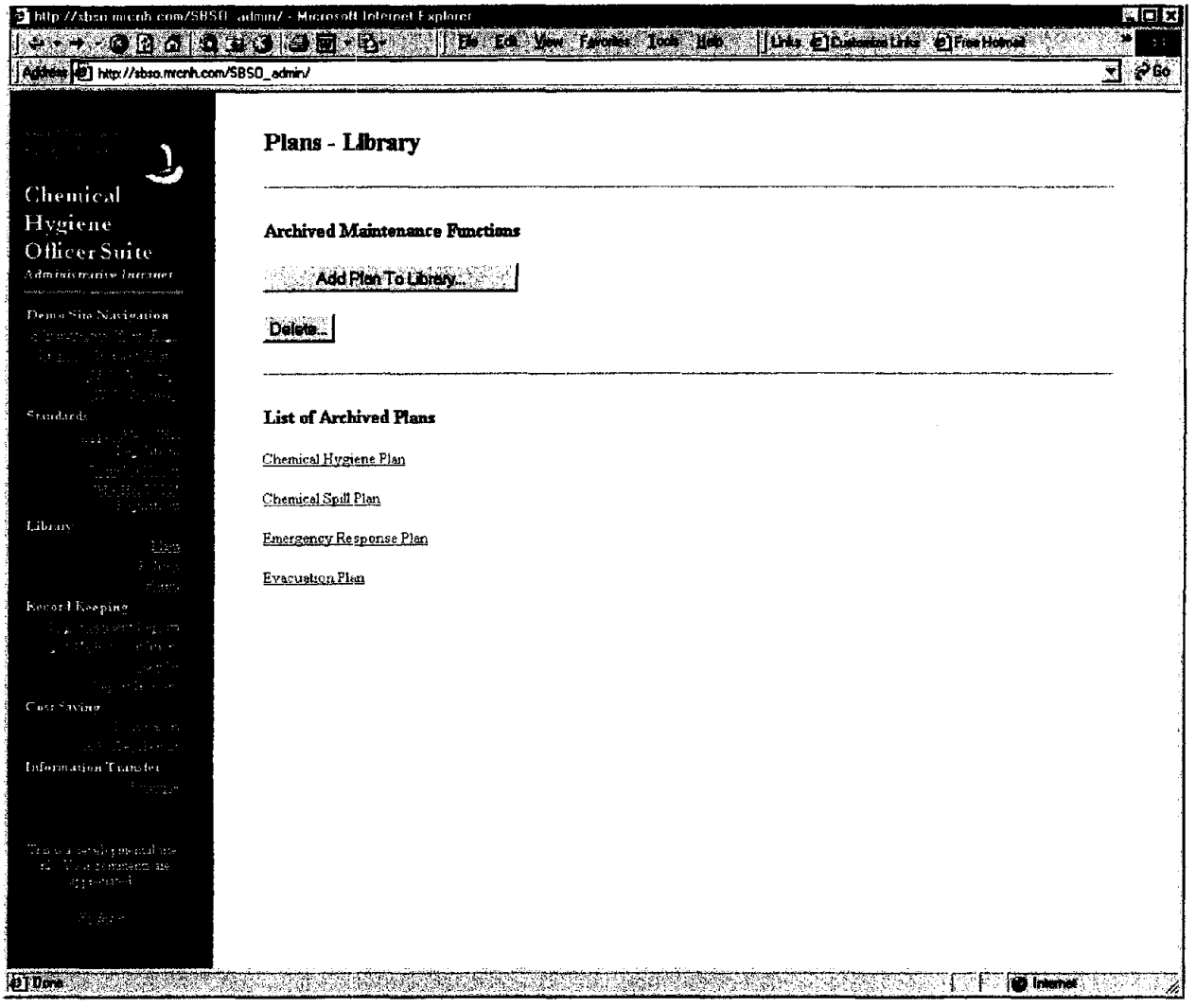
Additional Functionality: Clicking on the links above takes the user to our own summary pages from which the text and PDF forms can be downloaded. The document icons are located immediately to the left of the subsection number and the standard title.



Goal: Given the importance of the Hazard Communication standard, we have provided it here in its entirety.

Content: The content is in HTML format and it has been obtained directly from the GPO website.

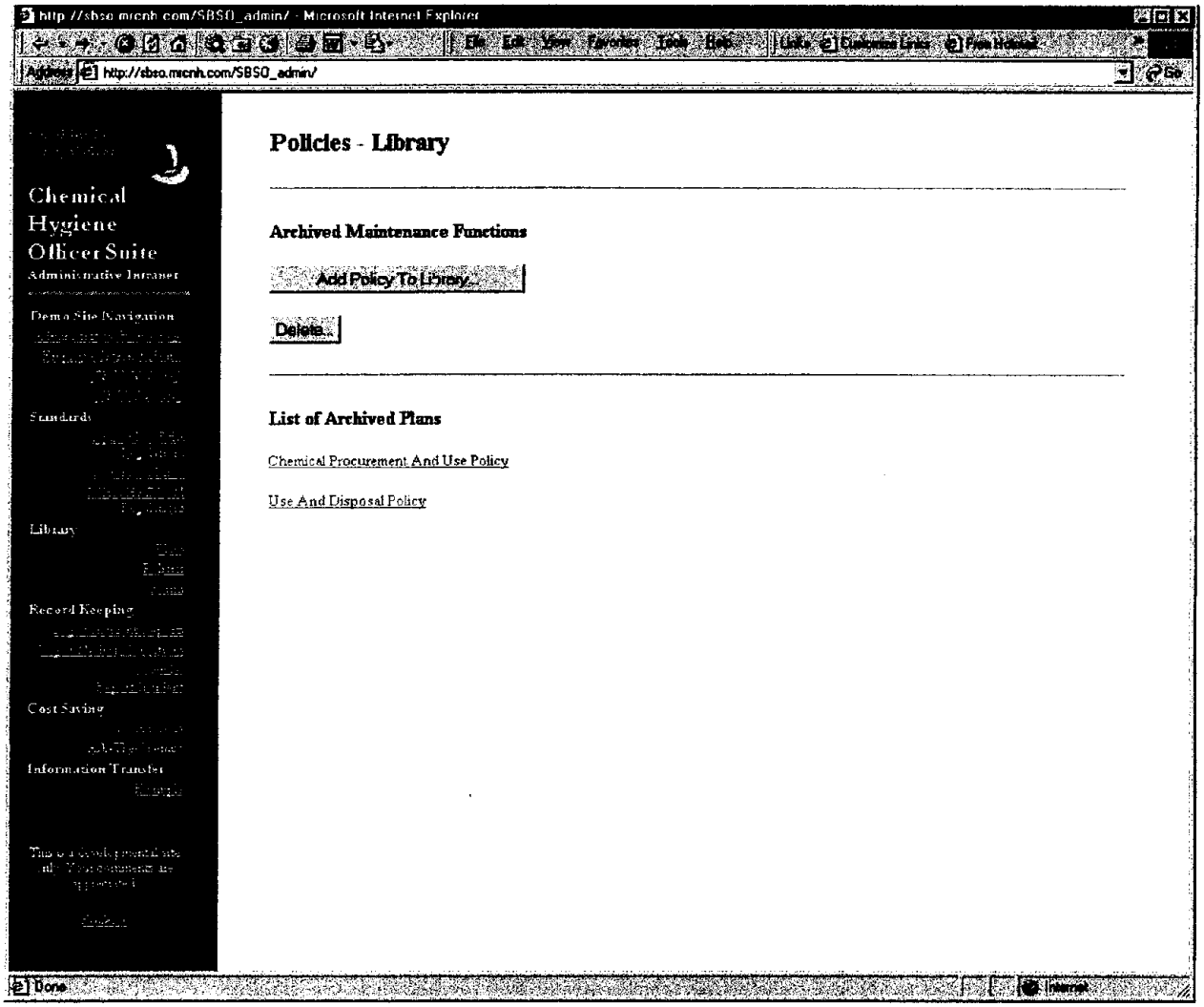
Additional Functionality: Presenting it in this format allows the user to employ the "Find" capability of his web browser to locate key words and phrases. As the library associated with this tool grows, an advanced Search capability will be considered to enable users to find key issues quickly.



Goal: The purpose of this page is to provide a complete library of the Plans prepared during the interview process and to provide a means to modify and add to them.

Content: The content includes a hyperlinked listing of all the Plans. For this prototype, the Plans include the Chemical Hygiene Plan, a Chemical Spill Plan, the Emergency Response Plan and the Evacuation Plan.

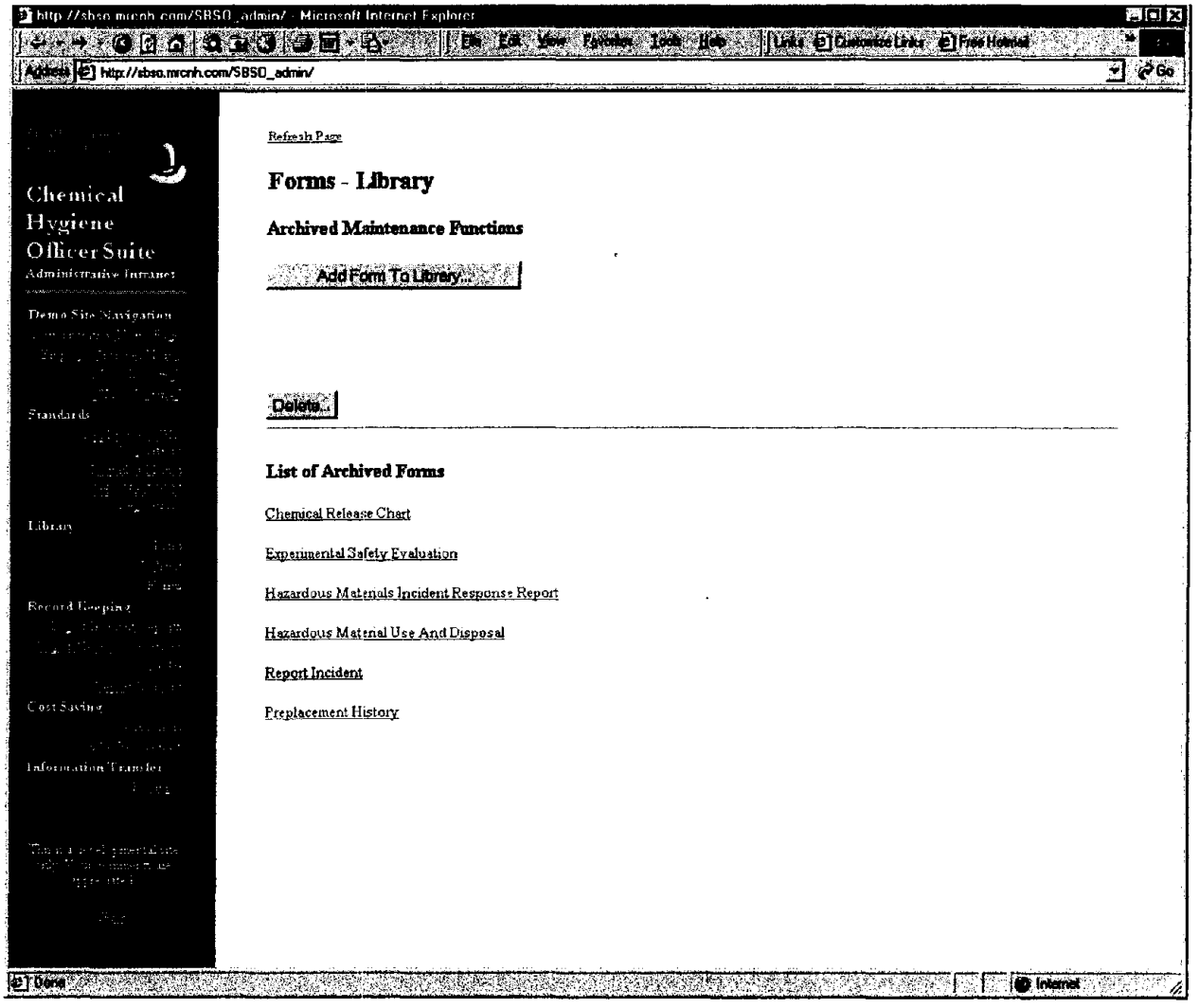
Additional Functionality: The buttons at top allow the user access to tools to modify (including deletion) the current plans or to prepare new plans. We consider this to be an essential capability because businesses are not static. Their processes change all the time. Thus, some means to periodically re-evaluate their Plans and to modify them to be current is critically important.



Goal: The purpose of this page is to provide a complete library of the Policies prepared during the interview process and to provide a means to modify and add to them. Policies delineate the business practices and methodologies that are consistent with the content of the Plans. Some companies rely entirely on the Plans alone while others require carefully worded policies to interpret the Plans to their workforce. We are providing the tools for both extremes.

Content: The content includes a hyperlinked listing of all the Policies. For this prototype, the Policies include the Procurement and Use Policy and a Use and Disposal Policy.

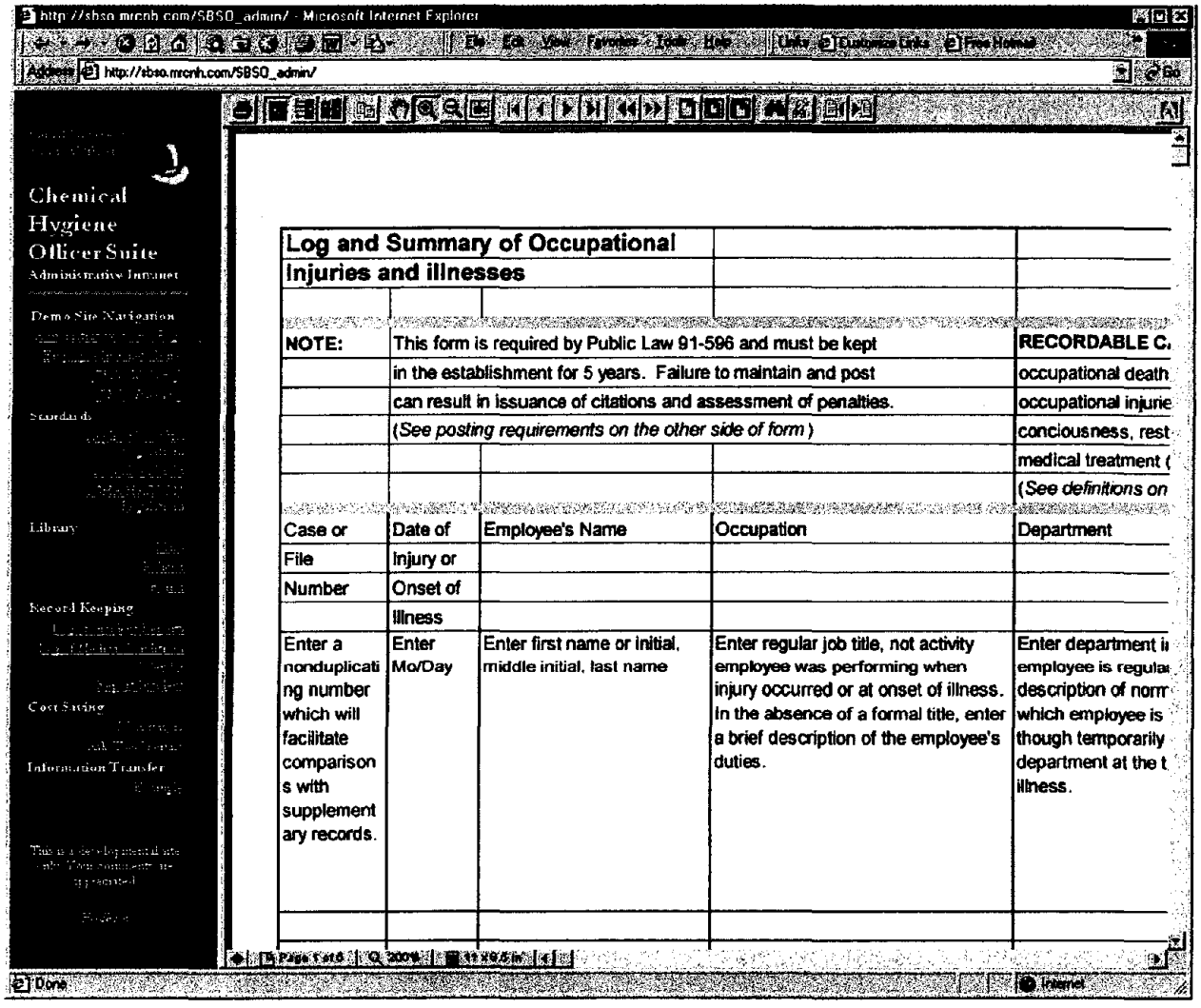
Additional Functionality: The buttons at top allow the user access to tools to modify (including deletion) the current policies or to prepare new policies. A means to periodically re-evaluate Policies and to modify them to be current is critically important.



Goal: The purpose of this page is to provide a complete library of the Forms prepared during the interview process and to provide a means to modify and add to them. Forms are the documentation and approval trail of various hygiene-related business activities.

Content: The content includes a hyperlinked listing of all the Forms. For this prototype, the Forms include the Chemical Release Form, the Experimental Safety Form, an Incident Response Report, a Hazardous Material Use and Disposal Form and a Pre-placement History Medical Form.

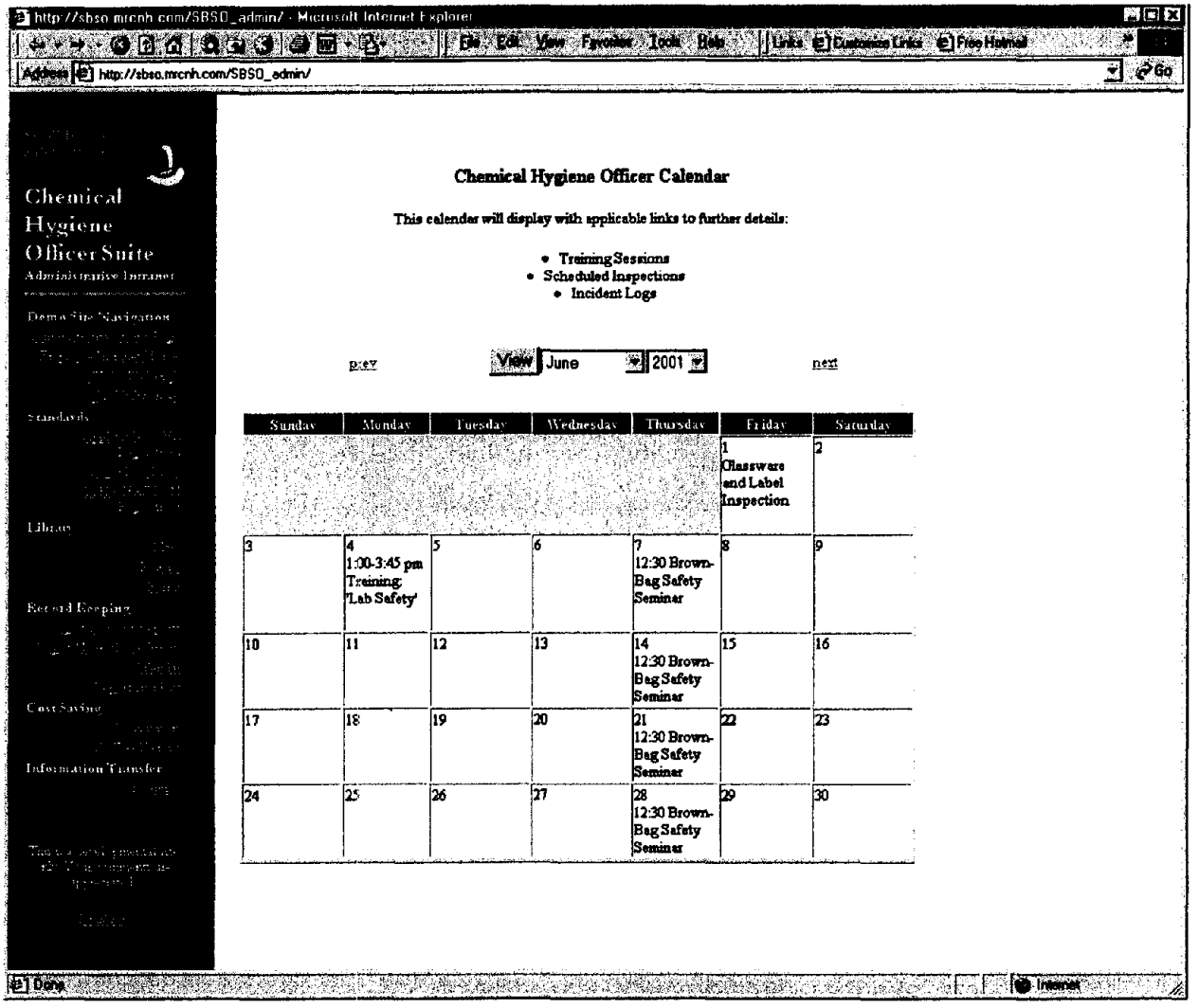
Additional Functionality: The buttons at top allow the user access to tools to modify (including deletion) the current forms or to prepare new forms. A means to periodically re-evaluate the various forms and to modify them to be current is critically important.



Goal: The navigation bar on the left of the page shows a section entitled "Record Keeping". The Log of Medical Conditions, that includes the OSHA 200 log shown above, and the Log of Incident Reports are two key components in this section. The intent is to provide a readily accessible repository for these logs.

Content: The OSHA 200 log form is the only substantive content in these two areas currently. When deployed, we anticipate that the Chemical Hygiene Officer will have an "In" box for reports and incidents under evaluation and a log of historical and resolved reports that could be indexed by keyword or chronologically.

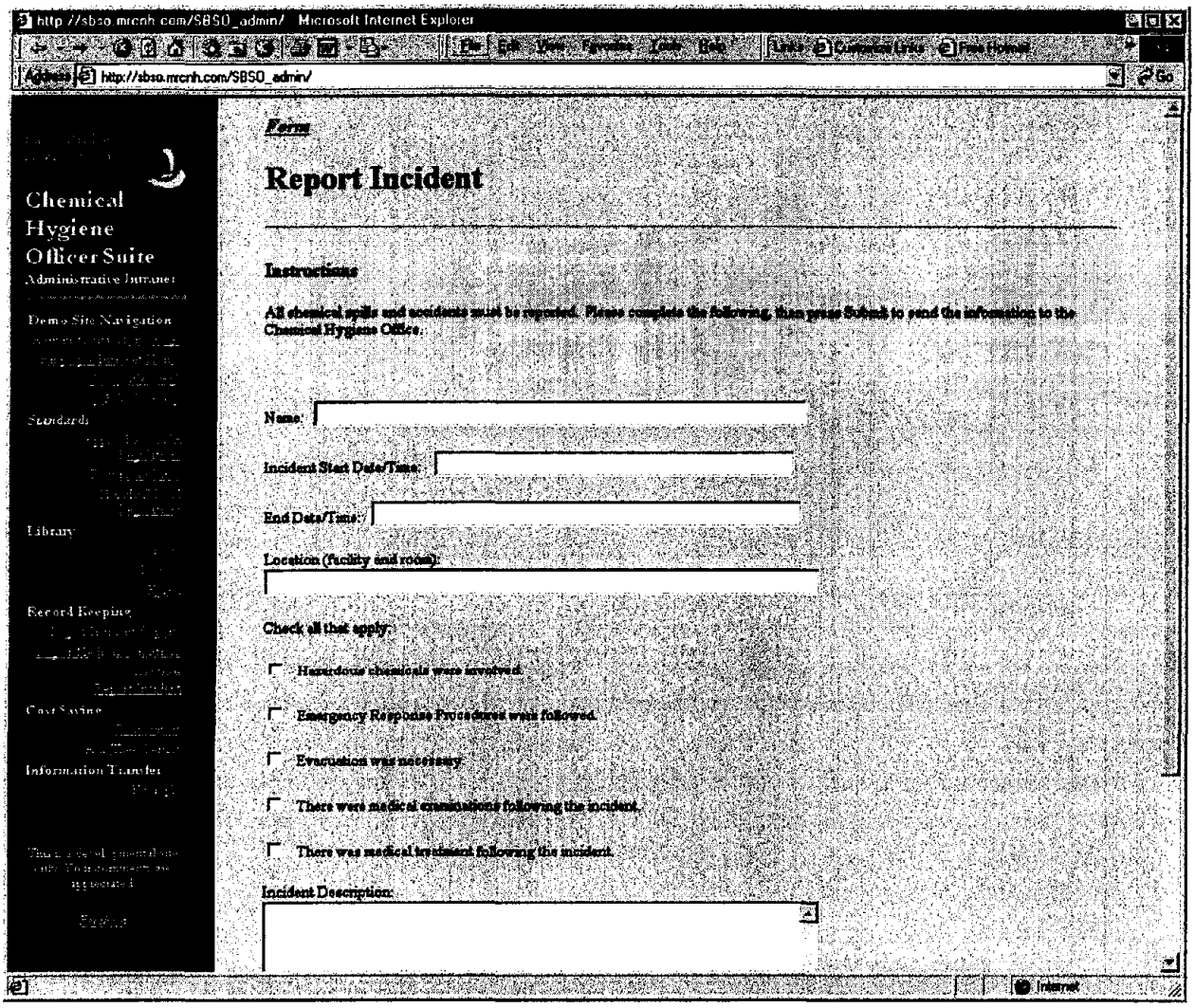
Additional Functionality: Logs or libraries of schedules, training, equipment, inspections, forms and other information could also be stored in this section. Including these issues into the design will be an issue for Phase II.



Goal: The page presents the safety calendar that will contain schedules for training, inspections, evacuation drills and other safety-related matters

Content: The content is a fully functional, multiple year, multiple month calendar that can be accessed and altered by the Chemical Hygiene Officer. Select data and changes can then be "pushed" to the public (employee) site.

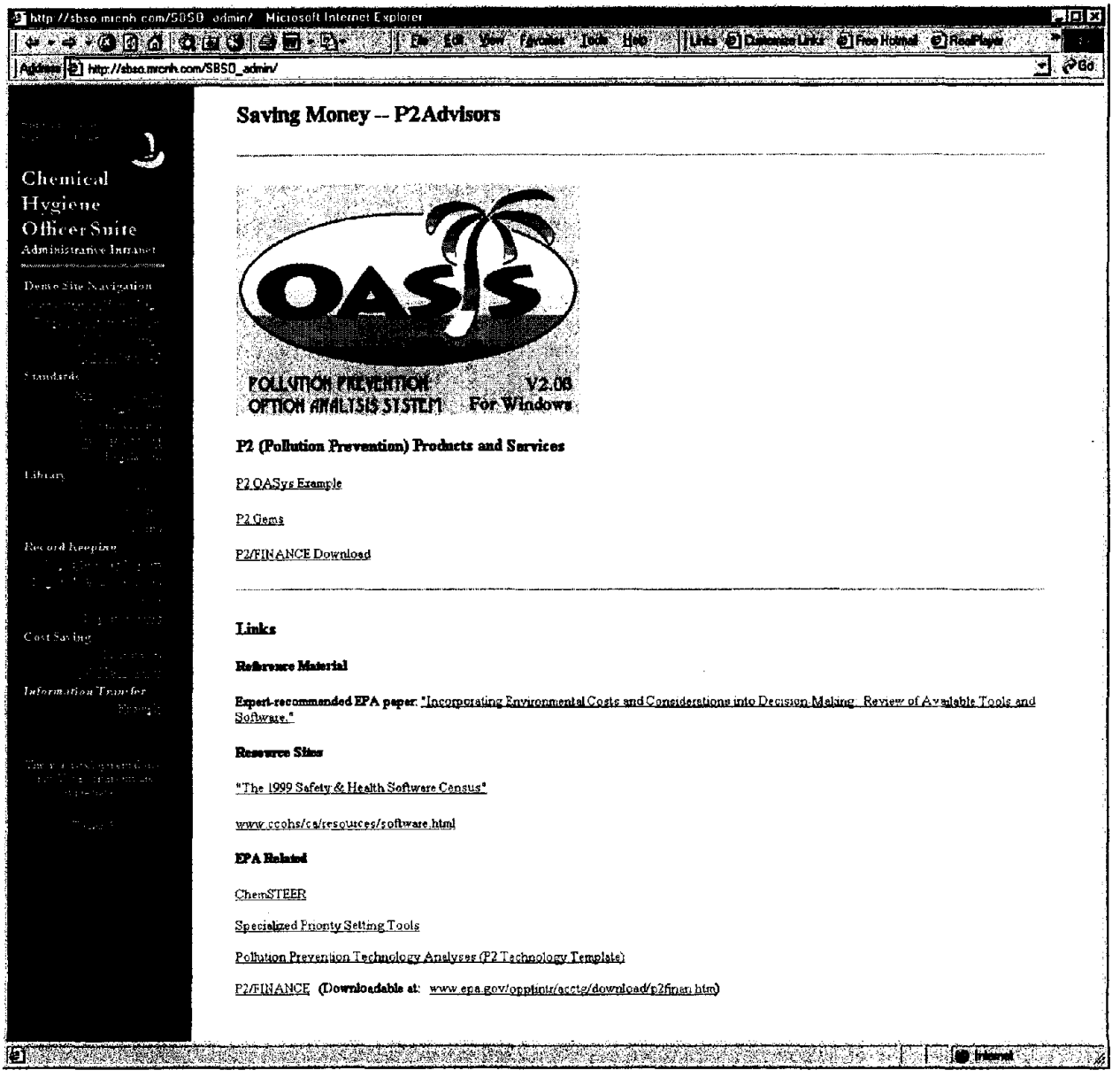
Additional Functionality: Additional capabilities we are considering include simple templates and menu choices for entering data and automated notification, electronic notification of inspections and other key dates to the affected employees and managers.



Goal: Nearly all the content on the public (employee) side must have a mirror image on the administrative web site. The Incident Report shown above is one such example.

Content: The Chemical Hygiene Officer will use this downloadable, on-line form to record accidents or other incidents from cause through resolution. The completed form will then be migrated electronically into the log.

Additional Functionality: Mechanisms for electronic signatures of corporate officials will be considered.

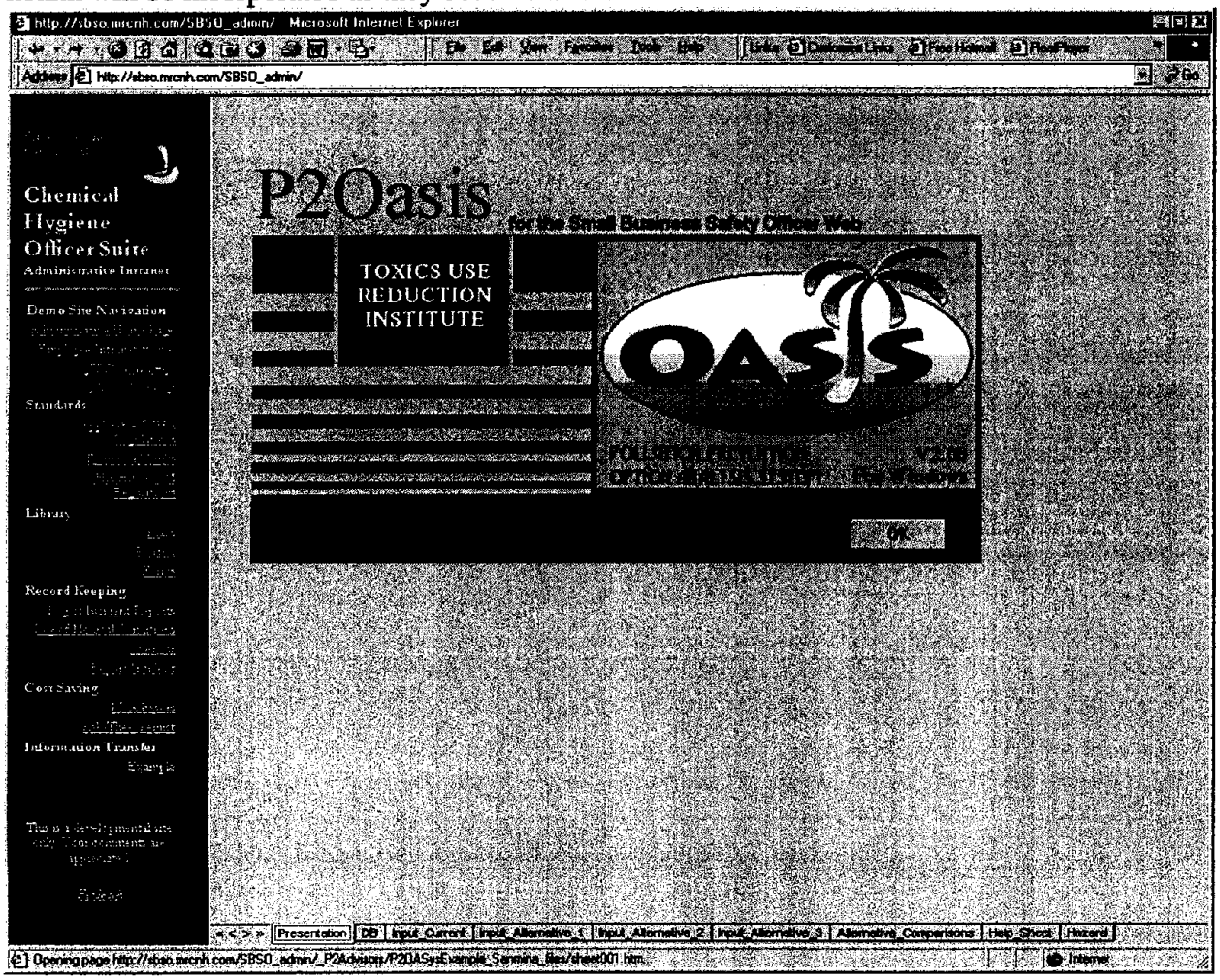


Goal: The vision of "Small Business Safety Officer" is to provide a cost-savings portal for small businesses to integrate pollution prevention, cheaper and safer process alternatives and worker health and safety compliance into their business process. This section of the administrative site provides some of the deployed tools we envision will help small businesses save money, protect the environment and provide for a safer work environment.

Content: This is the introductory page providing the portal to P2Oasys, P2Gems and P2Finance. P2Oasys (Pollution Prevention Options Analysis System) is designed to assist companies in conducting more comprehensive and systematic environmental and worker health and safety analyses of their pollution prevention and toxics use reduction (P2/TUR) options. It is primarily intended to assist companies in identifying potential hazards associated with current or proposed processes and choosing the most environmentally safe alternative which is most protective of worker health and safety. P2Gems is a tool to facilitate chemical substitution, process redesign,

product reformulation, improved operations and maintenance, and/or in-process recycling. P2Finance is a spreadsheet software application for conducting financial evaluations of current and potential investments. It is unique among capital budgeting tools, because it expressly addresses traditional obstacles to the financial justification of pollution prevention (P2) investments.

Additional Functionality: Additional tools emphasizing ergonomics and worker safety and health will be incorporated as they become available.

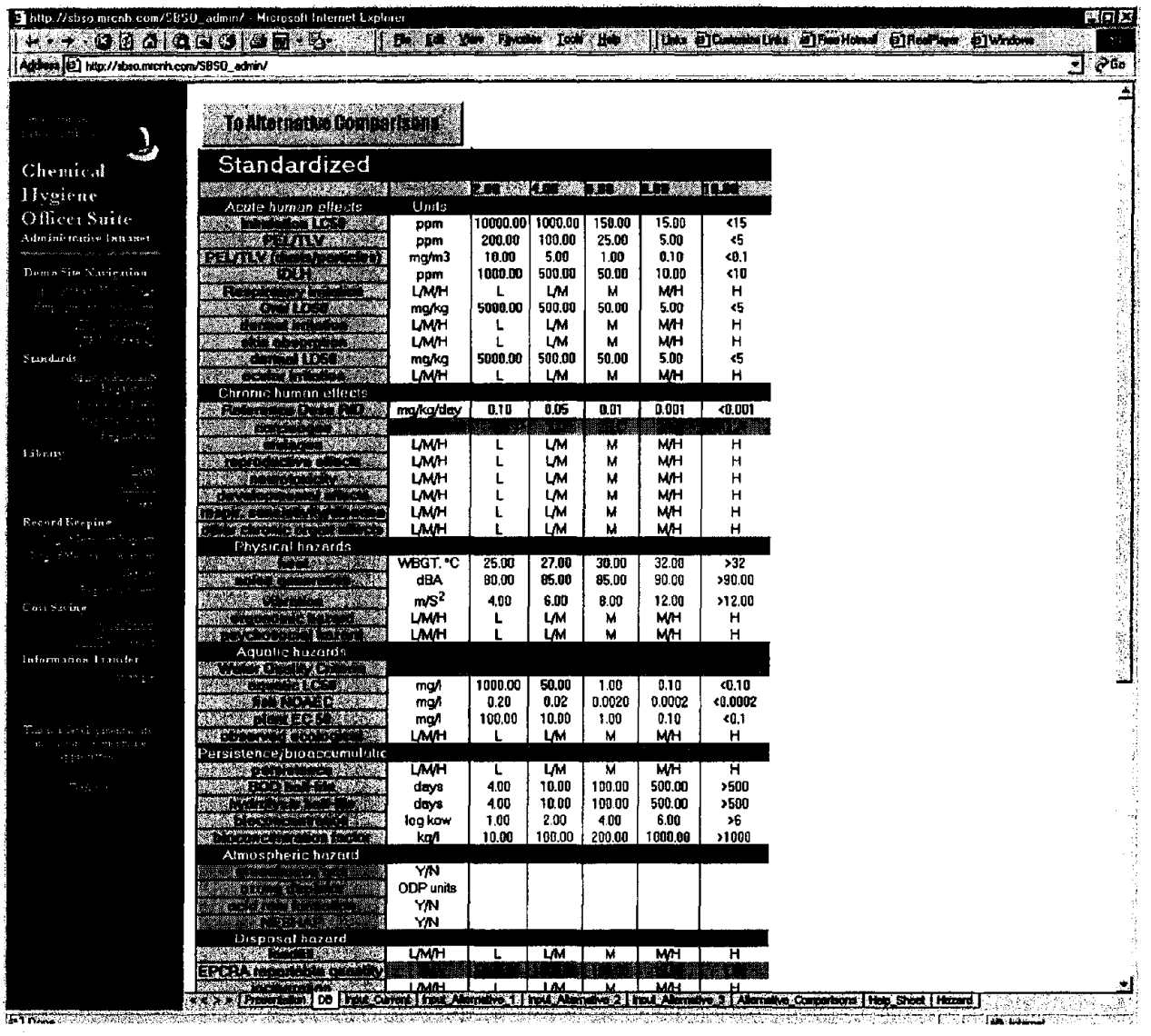


Goal: This page is the introductory page to P2Oasys. The user will navigate the system through the tool bar at the bottom of the page.

Content: The content is the fully deployed P2Oasys product as prototyped by TURI. The product is in an EXCEL spreadsheet format that has been integrated into Small Business Safety Officer. For an example, we have included the data for comparison between two solvent cleaning alternatives.

Additional Functionality: As we describe in the body of the report, a considerable amount of development completion will be necessary to make P2Oasys a fully functional tool. When

complete, however, it will be the first to fully integrate economics, pollution prevention and worker safety and health into a single package.

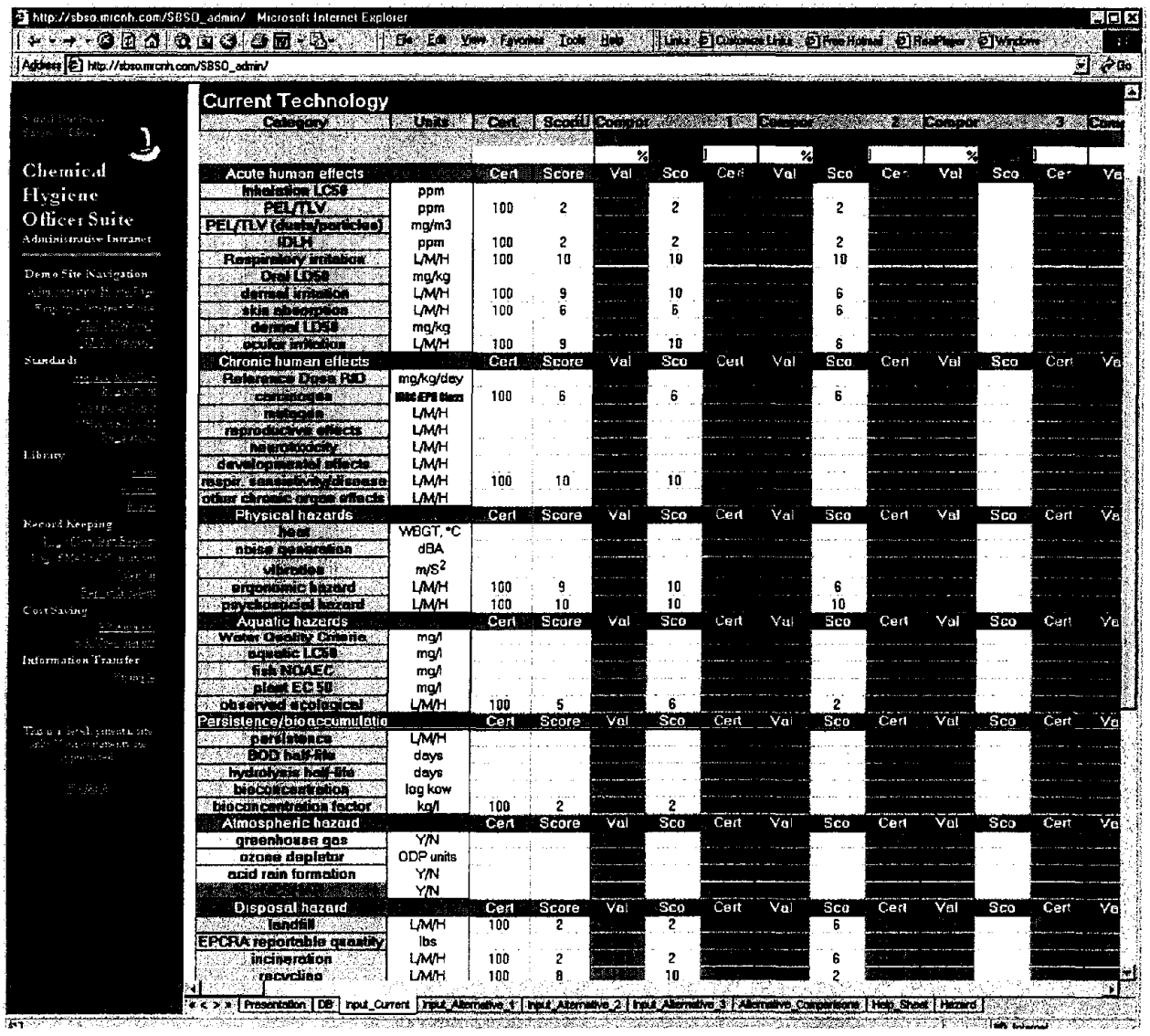


Acute human effects	Units					
	ppm	10000.00	1000.00	150.00	15.00	<15
	ppm	200.00	100.00	25.00	5.00	<5
	mg/m3	10.00	5.00	1.00	0.10	<0.1
	ppm	1000.00	500.00	50.00	10.00	<10
	L/M/H	L	L/M	M	M/H	H
	mg/kg	5000.00	500.00	50.00	5.00	<5
	L/M/H	L	L/M	M	M/H	H
	L/M/H	L	L/M	M	M/H	H
	mg/kg	5000.00	500.00	50.00	5.00	<5
	L/M/H	L	L/M	M	M/H	H
Chronic human effects						
	mg/kg/day	0.10	0.05	0.01	0.001	<0.001
	L/M/H	L	L/M	M	M/H	H
	L/M/H	L	L/M	M	M/H	H
	L/M/H	L	L/M	M	M/H	H
	L/M/H	L	L/M	M	M/H	H
	L/M/H	L	L/M	M	M/H	H
	L/M/H	L	L/M	M	M/H	H
Physical hazards						
	WBGT, °C	25.00	27.00	30.00	32.00	>32
	dBA	80.00	85.00	85.00	90.00	>90.00
	m/S²	4.00	6.00	8.00	12.00	>12.00
	L/M/H	L	L/M	M	M/H	H
	L/M/H	L	L/M	M	M/H	H
Aquatic hazards						
	mg/l	1000.00	50.00	1.00	0.10	<0.10
	mg/l	0.20	0.02	0.0020	0.0002	<0.0002
	mg/l	100.00	10.00	1.00	0.10	<0.1
	L/M/H	L	L/M	M	M/H	H
Persistence/bioaccumulatic						
	L/M/H	L	L/M	M	M/H	H
	days	4.00	10.00	100.00	500.00	>500
	days	4.00	10.00	100.00	500.00	>500
	log kow	1.00	2.00	4.00	6.00	>6
	kg/l	10.00	100.00	200.00	1000.00	>1000
Atmospheric hazard						
	Y/N					
	ODP units					
	Y/N					
	Y/N					
Disposal hazard						
	L/M/H	L	L/M	M	M/H	H
	L/M/H	L	L/M	M	M/H	H

Goal: This page presents the quantitative correlation of the numerical score that will be assigned to each chemical to be compared. For each property on the left ranging from human effects to economics to environmental release hazards, a score of 2-10 is associated with increasing values. The correlations can be adjusted by the user.

Content: The list of properties is quite extensive and only a subset is shown here.

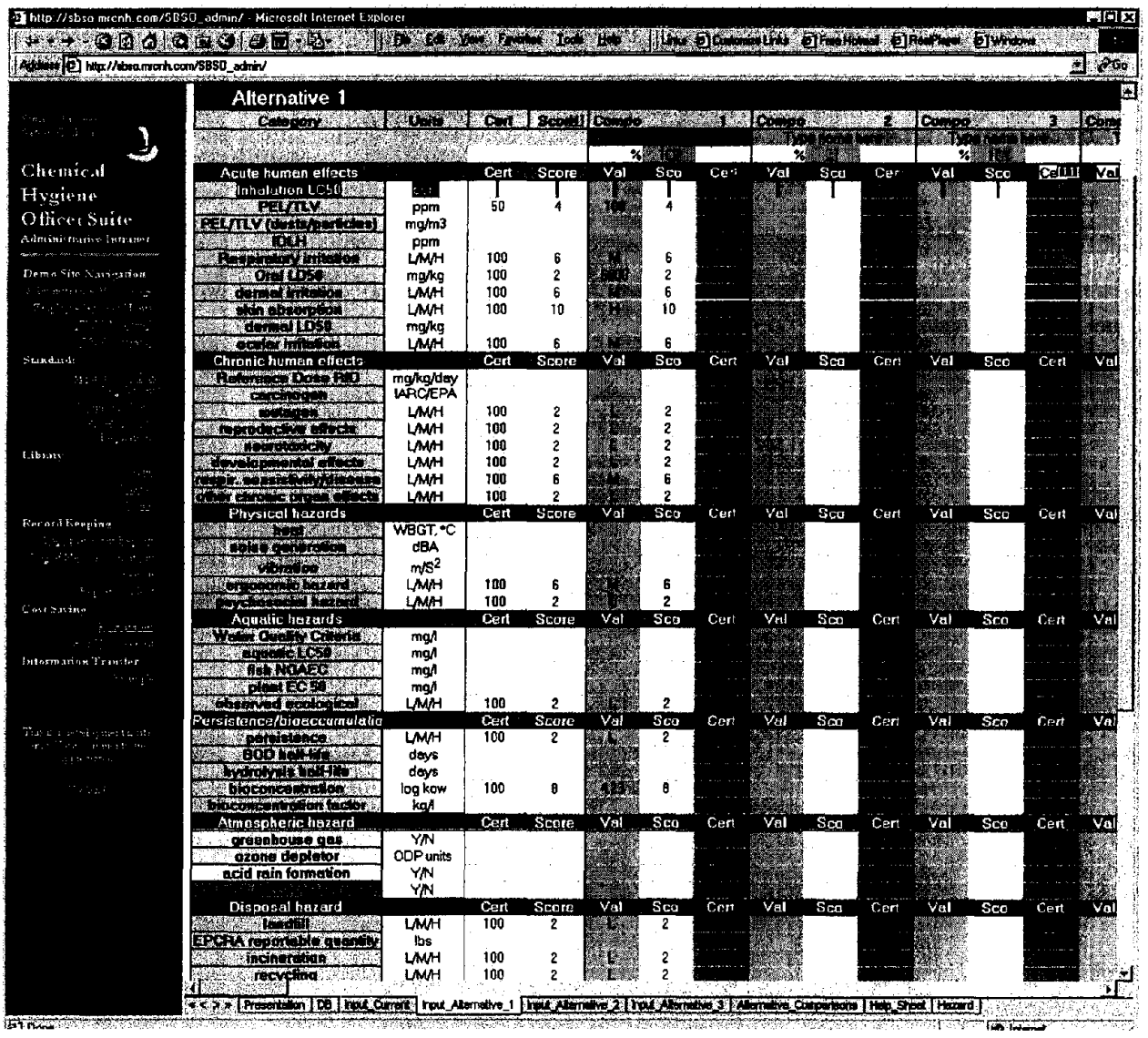
Additional Functionality: We will consider the upgrades described in the body of the report as well as user interface issues.



Goal: This page shows the data for a cleaning solution composed of 1,1,1-tricloroethane (80% mixture) and isopropyl alcohol (20%). As shown above, the data are being entered in the "Input_Current" page.

Content: The user currently enters these data by hand into the appropriate columns.

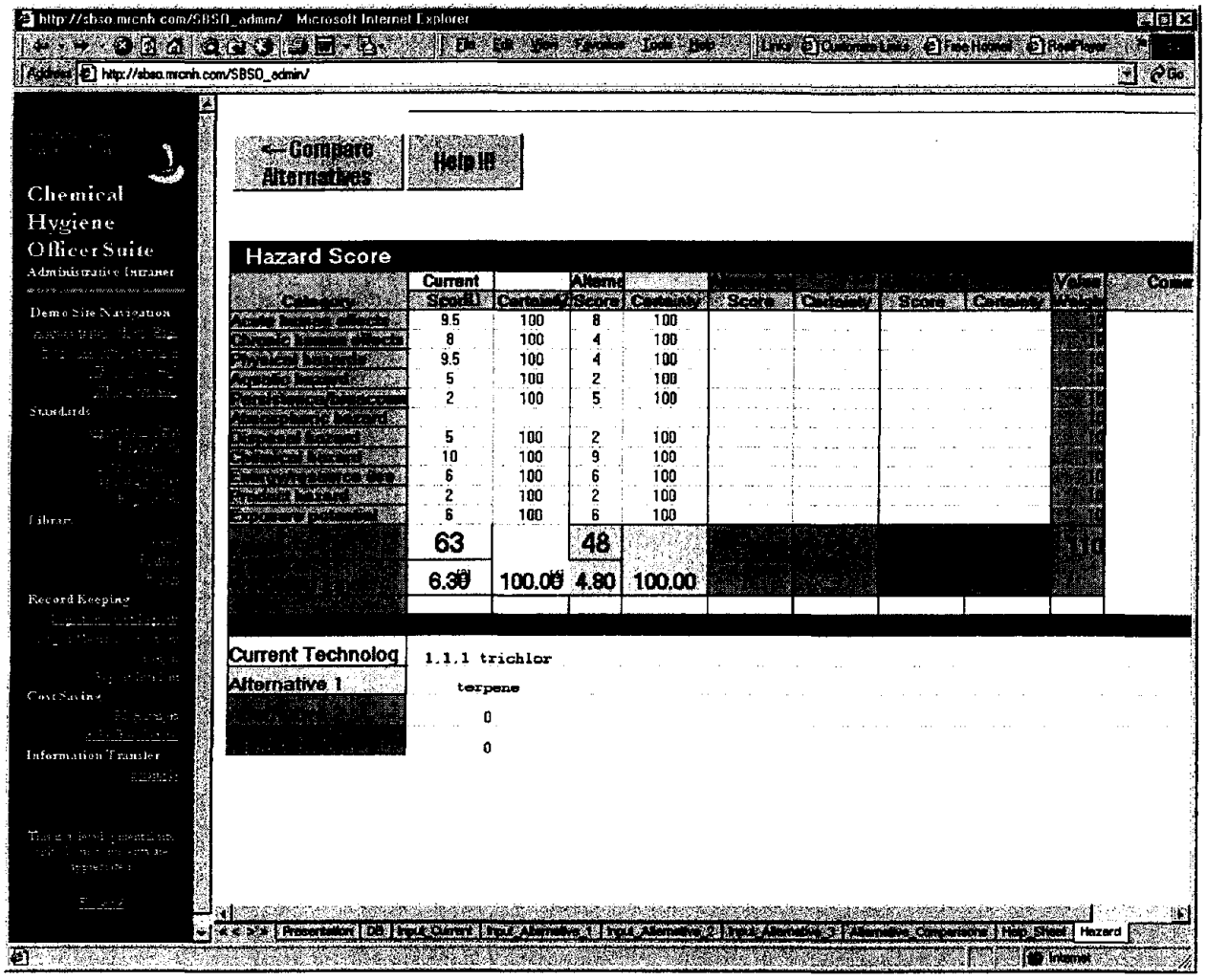
Additional Functionality: Direct links to chemical databases will be considered to make this process simpler.



Goal: The page shows the data being entered for the considered alternative, a terpene hydrocarbon mixture. Although one may think that the terpene is a preferable alternative from an exposure perspective, it does have higher flammability and bioconcentration hazards that must be considered.

Content: As on the previous page, the data are entered manually into the spreadsheet page.

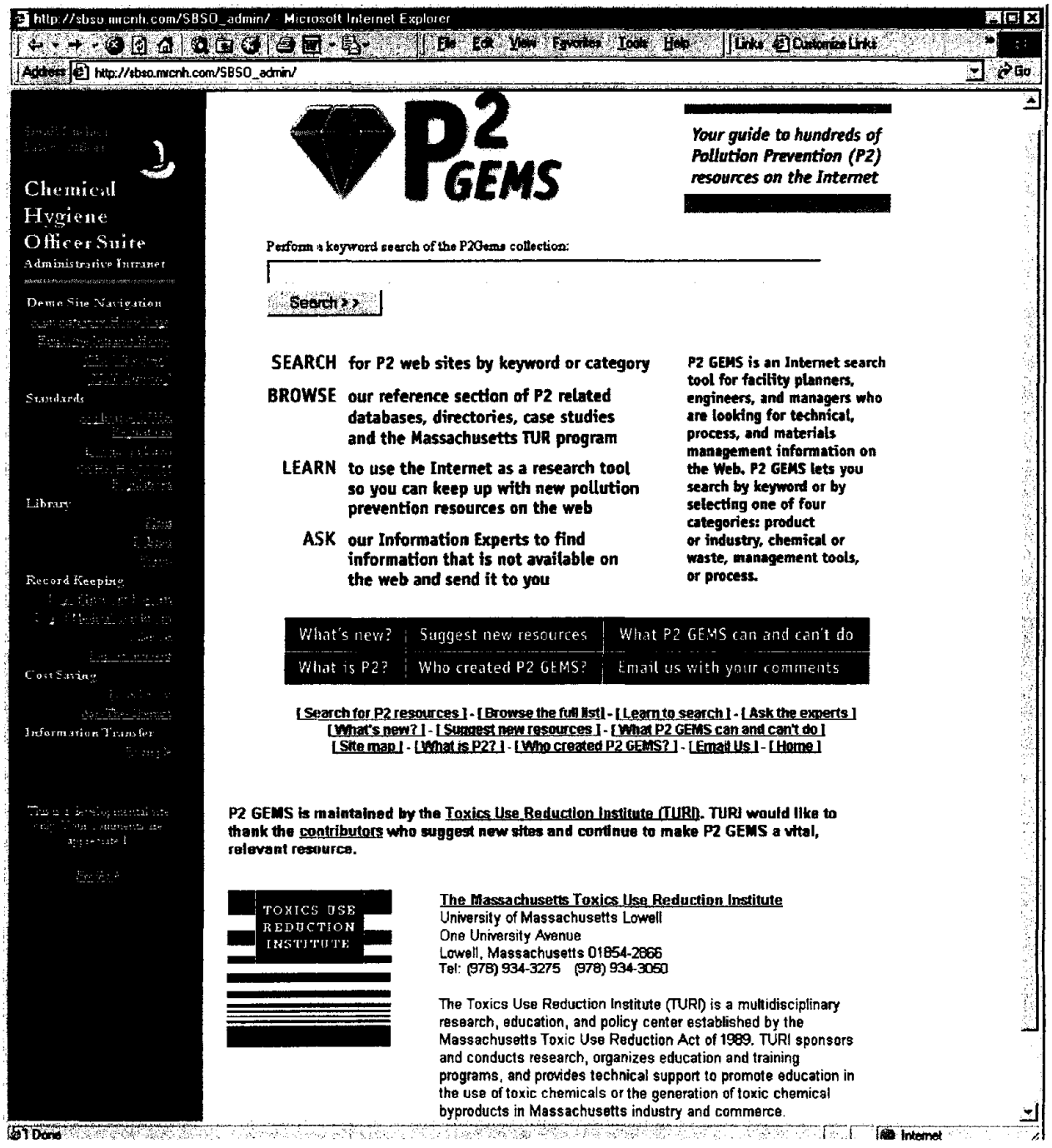
Additional Functionality: Direct links to chemical databases will be considered to make this process simpler.



Goal: This page shows the numerical comparison. Here, the lower the score the better the alternative. For simplicity, only the general topic areas are shown

Content: The results show a lower score for the terpene alternative which fared better in every category except persistence/bioaccumulation.

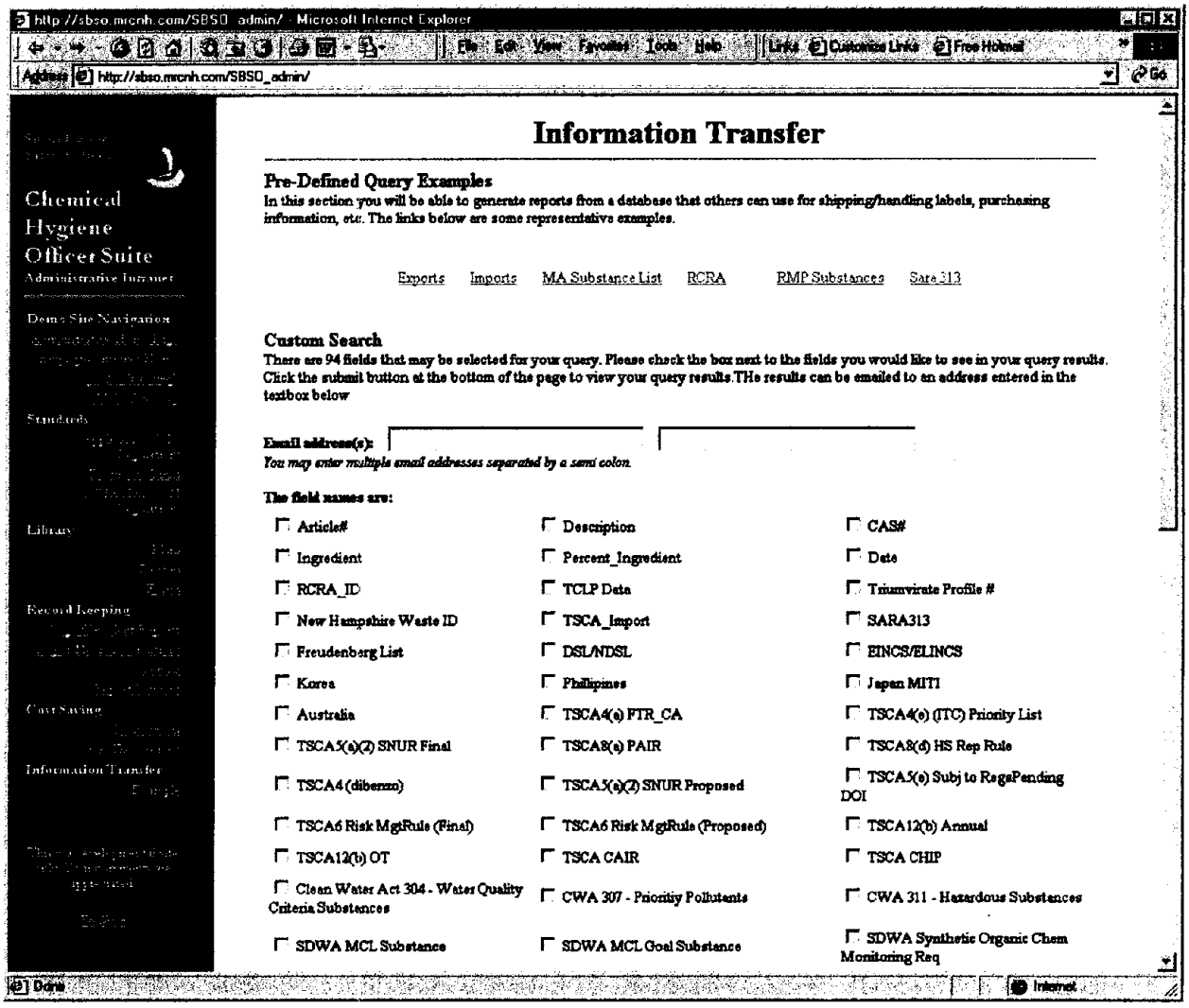
Additional Functionality: We will consider a graphical representation of these results for those users who understand issues best when they are presented visually.



Goal: This page is the P2Gems interface. Pollution Prevention (P2) is a strategy of material use, processing, and management that reduces or eliminates the creation of pollutants and waste at the source--prior to recycling, treatment or disposal. P2 is also referred to as source reduction. Toxics Use Reduction (TUR) is similar in concept to P2, but more highly focused on toxic chemicals. P2 and TUR can be achieved through chemical substitution, process redesign, product reformulation, improved operations and maintenance, and/or in-process recycling. Facility planning is a systematic approach to P2 implementation that consists of quantifying chemical use and waste generation, P2 options identification and evaluation, goal setting, and progress assessment.

Content: The content is the complete, fully functional P2Gems site.

Additional Functionality: No additional capabilities are planned at this time.



Goal: Finding, interpreting and moving information is one of the key features of Small Business Safety Officer. In the example shown here, we have integrated a sample database obtained from our test site, Kluber Lubrication, with key field search ability to enable select fields to be extracted and forwarded to individuals (such as shipping clerks) via email.

Content: The integrated database is not shown because of its proprietary content. The capability is illustrative, however, for what this tool could do for other applications and other companies.

Additional Functionality: In a deployed tool, this page would integrate a database directly and will enable point-and-click selection of fields for use, analysis, or electronic transfer.

8.0 PUBLICATIONS

Present

None

Anticipated Future

We are currently considering submitting a paper describing the Small Business Safety Officer innovations and architecture to a journal specializing in Occupational Safety and Health.

9.0 FINAL INVENTION STATEMENT

Although no inventions were conceived under this Phase I contract, we believe that patentable technologies may be developed under Phase II. We will re-evaluate our proprietary position during the course of the Phase II effort.

10.0 EQUIPMENT INVENTORY

Item Description	Serial Number	Acquisition Date	Cost	% Of Fed. Funds	Condition
Gateway Solo 5300 XL Notebook - 14.1" XGA TFT Color Display - Integrated 10/100 Ethernet & V.90 56K Modem - 3 year Parts & Labor Limited Warranty - Microsoft Windows 2000 Pro - 12.25 x 9.98 x 1.38 inch, approximate weight 4.93b - 10GB Ultra ATA hard drive - Integrated 16-bit Sound, Stereo Speakers Internal Microphone, Headphone/Speaker Jack, Line-in and Line-out Mic Jacks - FCC Class B, UL and CSA Certified - Intel Pentium III Processor 650 MHz with Intel SpeedStep Technology - 256 MB (2-128MB Modules) SDRAM - S3 Savage IX 2X AGP Graphics Controller with integrated 8MB SGRAM - Norton Anti-Virus Software - Intel LANDesk Client Manager Software v6.1 - Full Size 86-Key Keyboard - EZ Pad Pointing Device - Modular LS-120/Super Disk Drive - Two Type II or One Type II PC Card Slots - Modular 2x/4x/24x Recordable CDRW Drive - VGA, ECP Parallel, Serial, USB, NTSC/PAL video Out, Power Input, 240-pin Docking Connector - High-Capacity Lithium Ion Battery	0022568104 BQB01043290 P/N 3500729 Sec S/N: 5082AR104906	2/22/01	$2,721	1.8%	New

11.0 FINANCIAL STATUS REPORT

To be submitted at a later date.