Using the *Internet* to *quickly, effectively, and inexpensively* manage Environmental, Health & Safety Issues.

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ABSTRACT

Until recently, companies managed their environmental, health and safety EHS requirements through traditional paper file and pile means, via a collection of small, independent software products, or through costly client-server information management systems. Due to several market factors, including increased competition, globalization of developing countries' businesses, and regulatory influences, most companies will have to develop strategies and systems to accomplish more efficient EHS management in order to maintain profitability and market share without increasing staff size.

Innovative technology available through the Internet allows companies to now manage *all* of their EHS issues more *easily* and *affordably* than ever before. In fact, the Internet solutions allow companies to view EHS management as a business asset instead of a business liability (i.e., cost) by lowering worker compensation insurance premiums through proper loss control techniques.

This paper will focus on the benefits of the utilization of internet-based EHS subscription products to enhance EHS work practices within a business.

Specifically, you will learn about the:

- Benefits and Issues of Internet Technology for EHS management. Costs, deployment, support and maintenance of subscription products will be discussed.

- Strategies for managing OSHA and EPA record keeping and reporting requirements. You will learn how to build a management program of company-specific policies and procedures that interact with on-line, interactive training modules; free chemical tracking databases; EHS reporting systems; regulatory sites; EHS bulletin boards; and general EHS policies, procedures, and guidance documents…with just a couple mouse clicks.

- Tools for Risk Management, Compliance Tracking, Work Practice (Efficiency) Enhancement, and Strategic Business Planning. Specific examples of reducing worker compensation premiums will be provided to demonstrate how EHS management can be viewed as a business asset instead of a business liability (i.e., cost).

INTRODUCTION

Over the last decade, the amount of environmental requirements that facilities must comply with has grown exponentially. The requirements include numerous record keeping, reporting, testing, monitoring, and data manipulation tasks that most facilities find difficult to perform based on current staffing. Due to several market factors, including increased competition, globalization of developing countries' businesses, and regulatory influences, most facilities will have to develop strategies and systems to accomplish more efficient environmental, health and safety compliance without increasing staff size.

EHS Management Information Systems first became popular in the petroleum and process industries because of more restrictive environmental regulatory requirements. Other industries have also recognized that these systems are an effective solution to managing their complex compliance requirements. The business drivers in these market segments will all but force companies to adopt highly efficient environmental, health and safety compliance schemes. Compliance and other benefits can be affordably and conveniently achieved by use of Web-delivered EHS services and products.

EHS MANAGEMENT BENEFITS

The first key decision to determining whether benefits can be achieved at a facility by implementing a EHS system is obviously deciding whether the system is necessary or desired for facility operations. Although the decision process may seem to be simple at the onset, consideration of only one facet of benefits may result in under-utilization or eventual disbanding of the system. For example, many companies may decide to implement a system strictly for augmentation of compliance activities. Compliance tracking systems can assist the EHS professional by alerting them to imminent deadlines for activities and storing the requirements from all their permits in one, easy-to-find location. While this is a valid reason for system utilization, there are numerous other facets that should be considered when deciding to utilize an EHS system.

A four-pronged matrix that is depicted in Figure 1 identifies the various categories of benefits that can be realized by the general electronic management of EHS information. This matrix identifies two key scales, the timing scale and the perceived importance scale that delineate four categories of benefits. A task that is responded to on a day-to-day basis falls on the tactical end of the timing scale. A certain amount of urgency is associated with these tasks. A task that occurs on an as-needed basis falls to the strategic end of the timing scale. Tasks, whose level of performance may affect the ability of the organization to *operate*, fall on the business imperative end of the perceived importance scale. Tasks, whose level of performance may affect the ability of the organization to operate *competitively*, fall on the business functional end of the perceived importance scale. Based on these scales, the categories for EHS system benefits fall into compliance, risk management, efficiency, and business planning aspects. Some examples of benefits in each category are provided in Table 1.

Figure 1. EHS Management Benefit Categories

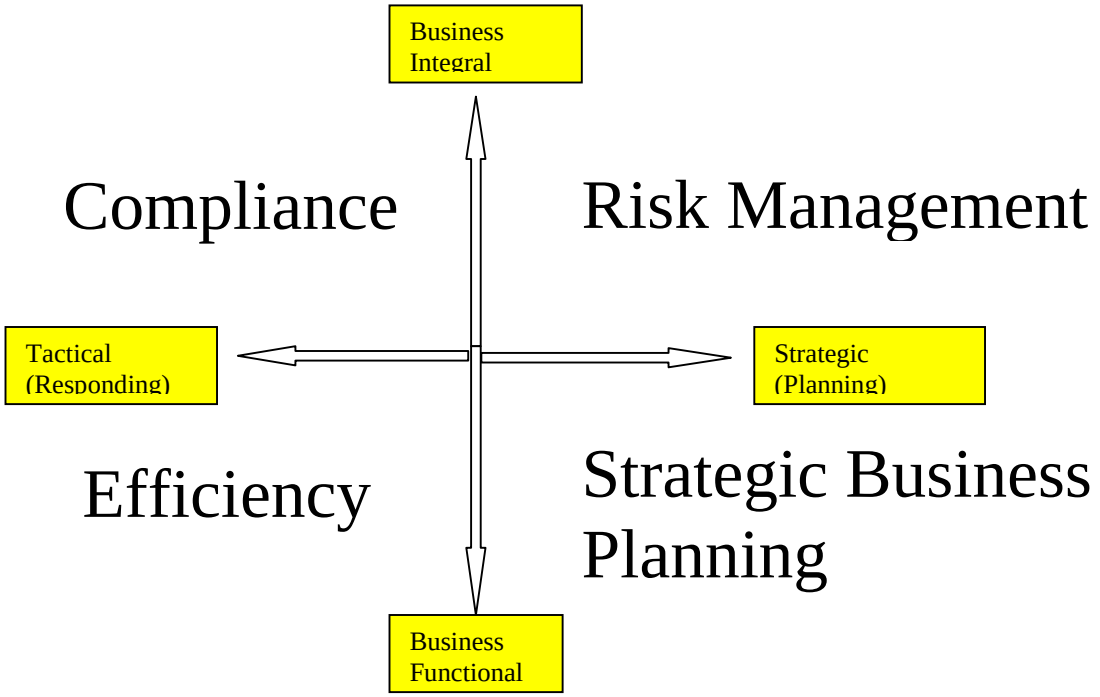

Table 1. Benefits of EHS Management

Category	**Feature**	**Benefit**
Compliance	Permit Tracking Task Management Information Management	Permit requirements are stored in one, easy-to-find location. There is less disruption to the business if people transition to other positions. The system can provide a repository for documentation in support of compliance activities (i.e., "audit trail"). Compliance tracking systems can alert the EHS professional about imminent deadlines for compliance activities. Thus, the EHS professional can more effectively plan for upcoming activities. Within a properly implemented and tested system, there are fewer possibilities for errors due to using data from the "wrong" database, using outdated information, performing complex calculations by hand. Several aspects of the ISO 14001 program can be augmented by a system, including a training tracking module.

Category	Feature	Benefit
Efficiency	Report Preparation Data Calculations	A system can automate repetitive tasks, such as Environmental Management Information Systems calculations and report preparation. A system can assist with data intensive tasks by reducing the paper information flow across a staff member's desk. Instead the data can be fed directly from one system into another system, thus reducing data volume. In addition, the system can be set up (i.e., configured) to perform many of the data calculations and manipulations automatically. A system can assist with time intensive tasks by reducing the occurrence of hand-completed forms and data gathering. A system can promote productivity by consolidating tasks. In some businesses, EHSmanager.com has found instances where the same data were entered two to three times into disparate systems to achieve the same end result. For example, monitored lab results may be entered into the lab information system. A hard copy report is provided to the environmental professional who logs the monitoring data into a calculational program to achieve summary results. A hard copy of the report is provided to an environmental professional who retypes both the monitoring data and the results into a report format for submittal. A system will enhance consistency of the data used in the reporting. If only one value for each parameter is stored in the database, then the environmental professional will not need to spend time determining and documenting the correct value to use. The System will consolidate relevant data into one location for ease of retrieval.

Category	Feature	Benefit
Business Strategic Planning		A system having the capability of querying data across different business units and establishing trends can be used to predict future values of parameters and alert the business to possible problems prior to their occurrence. In addition, the corporate level can determine if there are anomalies in the business flow and processes from one unit to another. This backcasting and forecasting ability will allow corporate managers to divert resources to those areas that can most effectively enhance business performance. Corporate managers will be able to view data from multiple business areas at the same time. They will not have to run the information request through multiple chains of command. When all of the tasks and requirements necessary to ensure continuity in the business are located in one place, it is easy to identify the comprehensive list of activities required of a business organization. This will allow for more accurate and timely resource planning. Standardization of information collection, retrieval, and manipulation reduces learning curve time for newer employees and subcontractors.
Risk Management		A system can be used to determine which business unit or processes have higher exposure to liability in the company. Worker's Compensation premiums can be lowered by identifying high incident departments and providing preventative measures. A system can be used to manage business continuity interruptions. A risk management package can effectively contain notification systems, planning procedures, and incident analyses that can minimize unnecessary legal exposure.

Most organizations concentrate on the day to day compliance activities associated with EHS, including reporting, record keeping, and emissions quantifications. As additional resources, including staff, computer, and monetary, become available to the organization, the EHS management focus spreads to efficiency and then into the strategic areas of risk management and business planning.

The National Environmental Management Congress has estimated that the installation and utilization of a system will result in a 100 percent improvement in engineering productivity. Specifically, they estimated that current 30 percent allotment that an engineer may spend performing job-related tasks will be increased to 60 percent by reducing time spent "chasing data" (15%), manipulating software (5%), attending meetings and travel (5%), and producing reports (5%).[1]

As discussed in the later section, titled "Using the Internet to Manage EHS", the proliferation of the Internet and Web-delivered EHS products and services have allowed companies to affordably, conveniently, and quickly access the resources necessary to experience both the strategic and tactical advantages of EHS management.

THE INTERNET AND EHS

The next several sections of this paper discuss the EHS management in relation to its delivery and utilization over the Internet.

Proliferation of the Internet

The World Wide Web has quickly become one of the most effective mechanisms at reaching large populations with real-time information. For example, it took a span of 38 years from the inception of the radio to reach 50 million users, the number generally regarded as the widespread acceptance threshold.[2] The same number of users were reached by personal computers and the World Wide Web in 16 and 4 years, respectively.[2] It has been estimated that the number of internet hosts rose from four in 1969 to over 56 million in late 1999.[3] The World Wide Web has followed course with the increase of web sites from 130 in 1993 to over 9 million in late 1999.[3]

As a result of the widespread proliferation of the Internet, this mechanism has quickly become one of the best ways of accessing and using environmental, health and safety information. OSHA and the EPA have spent millions of dollars web enabling regulatory standards, guidance documents and compliance data for use by the general public. They have established a link path conformity that allows an organization to insert regulatory information within documents. This standardization is one of the foundations for building a robust EHS management information system.

The Internet and the applications available on the Internet have made it possible for EHS professionals and other professionals affected by EHS issues to enjoy:

- Faster Startup of Use of an EHS system: Generally, no installation process is needed at all.
- Higher accessibility by professionals: Anyone who has an Internet Service Provider, a Web browser, and the system's password can generally access the system. No special software is needed on the professional's machine.
- Lower Total Cost of Ownership: No expensive hardware or high-cost maintenance contracts are needed. The subscription model of paying by the month means that the business does not have to find substantial capital to purchase the system. The delivery method of the Internet means the overall cost of providing the system to the business is lower than a standard client-server system.
- Up-To-Date: Version enhancements are simply made on the Internet server, not needing to be sent to each individual company, which is often a very lengthy process.
- Ease-of-Use: User generally can begin using the system with minimal or no training because the system is patterned off of the standard browser model.

Using the Internet to Manage EHS

The previous benchmark for good EHS systems were whether they were effective for collecting corporate EHS associated information, automating reporting tasks, and assisting with compliance tracking. This benchmark required that a system predominantly possess adequate technological features and some EHS content. The content was generally limited to the system's modularization of the EHS information.

With many company EHS functions now being assessed against the bottom line, the new benchmark for EHS systems has moved from compliance to prevention, from tactical to strategic business work processes. Thus, a good system will contain four components including, technology, content, accountability, and acceptability, the latter two of which were not included in the earlier systems. Accountability refers to the system of containing some mechanism to track trends in information and provide feedback to the user if performance criteria (e.g., an "in compliance" status) is not being met. Acceptability means the ability of all system users, from the remote site professionals to the corporate EHS personnel, to access the system and the desire of the users to continue its use.

A system having all four components of content, technology, accountability, and acceptability will have effectively met the needs of business to manage their EHS requirements. Each of these components must be evaluated in terms of a business's work process to determine how *well* the system will assist the business in EHS management. Table 2 describes the different aspects of a business's work process and provides criteria for evaluating how well the system meets the content, technology, acceptability, and accountability components. Specific examples of how internet delivered products meet these criteria are provided in the following paragraphs.

Table 2. Relation of Work Practice Integration and System Component Consideration

Work Process	EHS Areas Affected	Component
Policies	Regulations, Company Best Practices and Guidelines, ISO14001	C-comprehensive, accurate, updateable T-links to pertinent sites, distributable A-Plain English and word-for-word regulations, accessible At- Tracks staff who have read policies
Practice	Emissions Calculations Monitoring, Testing Data Collection Reporting	C-Data collection and manipulation follows procedures and work flow T-Calculation, retrieval, storage, and reporting functionality A-Follows existing workflow, fast, easy At-Shows trends in data
Peripherals	Training, Consulting Services	C-Accurate, targeted for need, easy to procure T-System allows integrated training, consulting, other EHS services without having to exit. A-Affordability, ability to train users at convenience and for specific need At-Training database to track needs, courses taken, and proficiency
Portals	E-commerce, Staffing	C-One-stop shopping, comprehensive, value-added T-System allows integrated e-commerce and other EHS services without having to exit. A-Affordability, drill-down ease, purchase ease At-System helps select compliant products for the specific need.
Performance	Roll-up Reporting, Task & Compliance Flagging	C-Provides performance criteria T-Assesses results against performance criteria, allows modification based on results A-Right security, right levels of access and rollup reporting. Flagging issues in a timely fashion. At-Allows responsible officials to see results and provide instruction to direct reports.
Program Reevaluation	This aspect of the work process involves reevaluation of how the system is being utilized and whether modifications need to be made at the system level or in the work process level.	
C= Content, T = Technology, A= Acceptability, At= Accountability		

Policies

Managing EHS requires incorporating information from many government agencies, such as; OSHA, EPA, DOT, NIOSH, CDC, BLS, DOL, MSHA, FDA, FEMA, etc. The key is first understanding the regulatory components that a given organization is required to meet and then incorporating these agency links into written programs, policies and procedures. Services such as BNA, CCH, BLR and Thompson are still available that provide these regulations on CD and even through the internet. Their cost however can be prohibitive for a company particularly when this information is free from the government.

For most companies managing Material Safety Data Sheets (MSDS) has been and is still a daunting task. Many different entities provide MSDS's online. The Department of Commerce, Chemical Manufacturers, Universities and private companies are all resources that can be accessed through the Internet to build and maintain an Internet library of company MSDS's. These repositories are quite variable in size and format for example; the University of Vermont has about 325,000 MSDS's that are a mirror to the Department of Commerce. They have both ANSI 16 part format and a standardized RTF for these MSDS's. Companies still need to ensure they have the most recent version but there are tools that can automatically electronically update these repositories as manufacturers and distributors make changes.

Universities are a warehouse of information regarding EHS issues and procedures. They are a great resource to access written programs, policies and procedures to adopt and/or adapt into company specific programs, policies and procedures. Most of their information is free and readily accessible.

Many foreign governments have web enabled their regulations and provide guidance information much like the United States. One could argue that many foreign government sites are more user friendly and comprehensive than the US sites. Regardless, if a company is doing business in another country it would be wise to review that countries regulations and there is no better place to access this information than over the Internet.

Associations and organizations have long been actively involved in promoting and advancing EHS management. Organizations such as: ACGIH, ASSE, NSC, ANSI etc. are often times at the forefront of information regarding EHS issues that are either to complex or political for the government to manage. Case in point, ergonomics has long been recognized by these organizations as an extremely important aspect of health and safety management. OSHA has recognized this as well but due to the political nature and bureaucratic infrastructure they must adhere to, it has taken 7 years to begin a process of promulgating a standard to address this costly issue.

Practices

Practices include the organization's ability to collect, store, manipulate, and retrieve the information it needs to manage EHS requirements. Historically, the standard client-server products available on the market have been capable of storing and retrieving the EHS information. In many cases, the applications were developed for the EHS corporate user, and as a result, the data collection and retrieval abilities for remote users were limited to uploading or downloading e-mail messages with the relevant information. In more sophisticated cases, a Web interface may have been custom developed as an add-on to the application.

The Internet allows remote users to easily access a Web-delivered EHS management system in the familiar browser environment and input monitoring results and other data directly into the database without an intermediate transaction. Additionally, the remote user has the ability (with the appropriate security privileges) to view the data available in the system.

Several major initiatives are currently underway designed to make the wireless Web ready for e-business. The implication of this wireless revolution means that transactions over the Web, including data input into EHS management systems, will be able to be performed with wireless devices instead of PCs, effectively eliminating all technological barriers to system utilization. EHS management systems that are not web delivered will continue to face the barriers of accessibility and system maintenance as each user would have the maintain the application on their PC.

Peripherals

Many private companies provide a host of services and value add tools for organizations to use in managing EHS. The Internet allows many organizations to have access to talented professionals that can provide consulting services, loss control services, training, and management expertise formally unavailable. The Internet can be a catalyst for companies to access this talent. Integrating links to these professionals and using electronic mail to answer questions and concerns is just another powerful advantage of the Internet.

Portals

Although the Internet has been used heavily for e-commerce in the business-to-customer sector, it has only been recently that businesses are utilizing this tool for business-to-business commerce. An effective EHS management program will consider not only the work process, but also the products and equipment utilized in the process. For example, proper chemical management allows a business to buy the appropriate chemicals at the appropriate times, thereby reducing operating costs from an overstocked or expired inventory, or eliminating excess controls or reporting by switching to a compliant product. The Internet now allows businesses to transact EHS purchases in a convenient, cost-effective manner.

Performance

With several regulatory programs, the responsibility for compliance has been pushed up the corporation as in the Clean Air Act Amendment's Title V Program which requires a certification of compliance by a responsible official. Thus, the need to disseminate information throughout all levels of the organization is critical for EHS management. A good EHS management system should allow the user to access the information across the organization, assess it against the business's performance indicators (e.g., a permit limit, toxic chemical release amounts), and then allow the user to alter its approach and accommodate this in the system.

The Internet allows ease in accessing data. However, each individual Web-based EHS system should be assessed to determine its capability in assessing performance. In addition, because Web-based companies are seemingly "sprouting" over night, it is of equal importance to assess the quality of the application provider as well as the EHS system in determining if the EHS system meets the four key components of a good system and addresses the business's work process.

Application Software Providers (ASP's)

The Internet provides a venue whereby companies can access information and receive demonstrations of software products to improve the ability of a company to manage the many facets of EHS management. Care should be taken by companies to understand who these application software providers are and what their expertise was and currently is in EHS management. If we think of the Internet as a storefront it is important to know who the owners are, what part of town they are doing business in and what their target population is that their products/services are marketed to.

Another aspect of evaluating an ASP is to review the partners that combine to support or enhance the software. Partners that have invested into the success of the software have usually spent a great deal time and money analyzing the software, their investment can represent validation of the quality of the application.

Application Software Providers can also be evaluated based on the depth and breath of their products and services. This may indicate the commitment that the organization has as well as the expertise on staff. The more depth and breath the more likely the ASP will have a better understanding of a total solution and the array of needs that could be needed by an organization (customer).

Understanding the market that is being targeted by an organization can also be an indicator of the usability of the product. Smaller companies need depth and breath, just as any large company, but often need software that has specifically being engineered to be easy to use. For many large companies this is considered a positive attribute. It is also important to evaluate the capacity of software. Large corporations often need a considerable amount of storage capacity and bandwidth. It is recommended that careful consideration be paid to understanding the storage and use needs of a corporation.

Software Solutions

At the heart of the matter is the software. Ultimately, it is the software that organizations use to manage their sometimes complex span of regulatory and corporate needs. An assessment of the specific needs of an organization in terms of regulatory requirements and functional needs should be conducted. With this checklist approach the components of software can be evaluated as to it's meeting the specific needs of the company.

Programs, policies and procedures are generally an integral part of any EHS management program. These documents should have certain attributes that lend them to the specific organization. Have they been written satisfy regulatory requirements and incorporate a style that is easily understood and functional? This is an important question that should be asked of any EHS software solution. Many programs lack the "good business practices" aspect of these written plans and therefore require a considerable amount of customization. The cornerstone of the written program is its functionality and its ability to be integrated within a company.

Written programs should also include the appropriate regulatory links within the documents. This provides a quick reference tool and when placed in context within a policy or procedure can support a better understanding of the intent of the regulatory requirement. Supporting links should also be incorporated within the text. For example: when a reference is made to a MSDS management inventory a link should be provided to take the user right to that database. The ability to toggle back and forth between regulatory reference and supporting databases is a powerful capability.

If the written program is the heart of an EHS management program, databases are the soul. Databases are the tools that allow programs, policies and procedures to be implemented within an organization. For example: It is one thing for a written program, that meets a regulatory requirement, to specify that MSDS's are inventoried and made accessible to employees. It is quite another to provide the database that allows this to happen. Careful review of the types and complexity of databases that are needed by an organization should be made. At a minimum, general industry health and safety databases should include; MSDS chemical management database (linked to MSDS repositories)

Lockout/Tagout databases
Confined Space Database
Job Hazard Analysis Database
Fire Extinguisher and Control Equipment Database
Accident/Injury/Illness Reporting and Record keeping Database
Employee Database
Training Database
Auditing Database

From an environmental management standpoint databases should include at a minimum:

Air Emissions Management Database
Compliance Tracking and Auditing Database
Storm Water and Wastewater Tracking Database
RCRA Hazardous Waste Management Database
SARA Reporting and Record keeping Database
TSCA Management Database

As the Federal government and individual States become more and more Internet literate the more capabilities that organizations will have to be able to electronically submit the necessary compliance documentation. Insure that the software that is under consideration has the capability and support to include these enhancements, as this functionality becomes available.

Also consider the availability of a bulletin board or communications tool between corporate and individual locations. This can be a useful way to send directives to individuals that are accountable for managing certain aspects of EHS and a way to document these communications.

Functionality

The Internet allows information about EHS management to be accessible to anyone within an organization anywhere in the world. Managing EHS over the Internet however requires that there is adequate security built into the software to protect sensitive information and enhance functionality. For example, just as any employee can view information so can your insurance company, a regulatory agency or your attorney. This can be a powerful tool but must be managed carefully.

Other types of functionality that should be considered include:

Mass Updates
Drop down menus
Search Capability
Text editing capability
Data importing capability
EHS Library accessibility
Frequently asked questions database
Launching training programs
User managed access
Cross platform integration capability

CONCLUSION

The Internet provides a powerful and increasingly more ubiquitous tool that can be used for EHS management. Web-delivered EHS systems allow the end user to manage EHS requirements and data in an affordable manner, with generally shorter startup schedules, lower costs, higher accessibility, and user retention than traditional client-server systems. A good EHS system will provide robust content, technology, and allow for accountability and acceptability throughout the organization. Each aspect of the business's EHS work process, including its policies, practices, and other related activities such as training should be addressed by the system in a comprehensive, user-friendly fashion. A Web-based EHS system is able to meet these criteria.

REFERENCES

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KEY WORDS

Internet
EHS Management
Web-Delivered EHS
EHS Software
Application Service Provider
Compliance