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KCP-613-5236
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Automated Accountability
of Hazardous Materials at
AlliedSignal Inc., Kansas City Division

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Published December 1993

Paper submitted to 17th Annual TRADE Conference
November 14-17, 1993
Indianapolis, IN

Technical Communications
Kansas City Division



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1. Overview

- **System Objective**

With the ever-increasing global awareness of environmental and health-related issues, compliance with regulatory requirements governing the storage and use of hazardous materials has become critical to a company's survival. The Department of Energy's (DOE) Kansas City Plant (KCP), currently operated by AlliedSignal Inc., has recognized this global trend and as a result has developed a comprehensive Hazardous Material Information System (HMIS). The purpose of this system is to provide a practical and automated method to collect, analyze, and distribute hazardous material information to DOE, KCP associates, and regulatory agencies. The drivers of the HMIS are compliance with OSHA Hazard Communications, SARA reporting, pollution prevention, waste minimization, control and tracking of hazards, and emergency response.

- **System Development - "A Historical Perspective"**

In 1987 KCP assigned a team of approximately 30 associates, representing a cross section of the plant population, to identify the regulatory and internal requirements for managing hazardous materials and began the HMIS development project. Due to the large scope of the project, it was divided into five phases representing distinct system deliverables, or modules. The first phase addressed the functions required to support management and dissemination of Material Safety Data Sheets (MSDS). This function was chosen as a foundation for the remainder of the project phases. The first phase of the project was implemented in September 1989. The second phase of the project involved implementation of a Hazardous Materials Inventory module. This phase was completed and made available to the plant population in August 1992. Development of the third phase of the project, the Hazardous Materials Tracking module, was completed in May 1993. The tracking functions were tested by a pilot group and are now ready for plant-wide implementation. The fourth phase of the project, addressing the management of hazardous waste, has been completed and is ready for implementation. The final phase of the project, Process Waste Assessment Support, is in the construction phase. This module of the HMIS is scheduled to be made available for testing in early 1994.

*Operated for the United States Department of Energy under Contract No. DE-ACO4-76-DP00613.

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2. Conceptual Design

The HMIS was divided into five system modules. It was determined that these modules could be developed separately, but integration was key to their overall success. This section briefly defines each of these system modules and how they integrate with each other to make up the complete HMIS.

- **MSDS Management System (What)**

OSHA's Hazard Communication (HAZCOM) legislation requires that companies must have an MSDS for every hazardous material that is used or in inventory at their plants. In addition, these MSDSs must be *readily* available to anyone who may be exposed to the hazardous material. This is the basic premise upon which the MSDS module was designed. The MSDS module provides for entry of manufacturers' MSDSs into a database on a local area network (LAN). These MSDSs are then reproduced from the master database and made available to the plant population in an unclassified IBM mainframe environment. The mainframe portion of the MSDS module provides search capabilities to the users of the system to assist them with locating the desired MSDS. These search capabilities include searching by manufacturer, material name, MSDS identification number, or internal material number. Upon locating the appropriate MSDS, the user then has the option of viewing the MSDS on-line, printing a hard copy of the MSDS on a distributed printer, or viewing hazard labeling information which is specific for that material.

- **Hazardous Material Inventory (How Much and Where)**

The Environmental Protection Agency (EPA) passed the Superfund Amendment Reauthorization Act (SARA) in 1986. This legislation requires that all companies, with some exceptions, must report the amounts of hazardous chemicals inventoried and used each year. The HM Inventory module of the HMIS captures the information necessary to comply with this legislative requirement. This module was designed to provide on-line, real time, system functions for entry and maintenance of hazardous material inventories. Each hazardous material inventory is identified by the unique combination of *Department Number, Inventory Type (M-Material, P-Process, and W-Hazardous Waste), Inventory Number (number used internally to identify chemicals, processes, and waste containers), and Location*. In addition to providing the capability to set up inventories and adjust (maintain) the current inventory quantity, an audit trail of activity against each inventory is captured. This module provides the capability to inquire regarding quantities of hazardous materials currently in inventory by department, inventory type, and number, or by location.

- **Hazardous Material Traceability (Tracking) (How it got there)**

The EPA's SARA legislation also requires information regarding the disposition of hazardous chemicals into various waste streams (air, land, and water). This disposition of chemicals must be calculated and reported, in pounds, for each reporting year. The HM Traceability or Tracking module was designed to address this regulatory requirement. This module of the system is designed around the basic accounting principle of debits and credits. Each time that a quantity of hazardous inventory is moved from one inventory to another, a transfer transaction is created. Each transaction has a *minus* and a *plus* side. The *minus* portion of the transaction is created when the hazardous inventory is transferred to inventory. The *plus* side is then completed when receipt is acknowledged into the target inventory.

- **Hazardous Waste Tracking (What happens to materials when they are discarded)**

Several areas of legislation deal directly and indirectly with the handling, treatment, and disposal of hazardous waste. Probably the most widely known of these is the Resource Conservation Recovery Act (RCRA). The Hazardous Waste Tracking module of the HMIS combines the flexibility and speed of barcode technology with the plant-wide access of the mainframe computer to meet business requirements. This module was developed in two separate sub-modules. The first of these resides on a personal computer and utilizes automated scales and barcode technology to label and measure hazardous waste. This system interfaces with the second sub-module. This portion of the system resides on the unclassified mainframe and leverages the existing HM Inventory and Tracking functions to provide management of hazardous waste inventory as it is being generated. The waste definition information is created on the PC and passed to the mainframe HMIS to support these HMIS functions.

- **Process Waste Assessment Support (What happens to it when we use it)**

In addition to the SARA and RCRA regulations, several other initiatives govern hazardous waste minimization. The Process Waste Assessment (PWA) program at the KCP was developed to address these waste minimization needs. The PWA module of the HMIS is designed to provide automated support to the KCP PWA program. This program will characterize all of the current production and nonproduction processes at the KCP that use or release hazardous chemicals. This characterization includes information regarding the type of process, the chemicals that go into the process, the chemicals that come out of the process, where they go, and information regarding options to the process (either input or methods) which would reduce the hazardous chemical releases or waste. This module of the system provides for capturing of this information and electronic production of PWA documents. In addition, this module provides the final piece required to automate the hazardous chemical release information required by SARA.

- **Additional Modules and Future Enhancements (To be evaluated)**

- *DOT Requirements*: This module will address the requirements of the Department of Transportation relating to the transportation of hazardous chemicals.
- *Integration with Existing Systems*: This module will address leveraging existing technologies and information systems to provide hazardous chemical inventory, movement, and release information, where applicable.
- *Barcode Technologies*: This system development effort will investigate the use of barcode and other advanced technologies in support of simplifying and streamlining the process of maintaining hazardous chemical inventories.
- *Scanned Image Support for MSDSs*: This project will investigate the feasibility of using optical scanning technology for inputting MSDS documents and providing ready plant-wide access in support of OSHA Right-to-Know legislation.

3. Experiences and Lessons Learned

- **Training Strategy**

The training program for the HMIS system was developed in a modular format, and each module was conducted as the corresponding system module was implemented. This method provides a more timely approach to system training. A graded approach to performance-based training was utilized. Each training module was accompanied by a job aid or user guide. Each training module provides the opportunity for associates to participate in a *hands-on* training session using the system. This provides an increased awareness and comfort level with the system prior to utilizing it in a "live" situation.

- **MSDS**

The target audience for this training module was the entire plant population. This represented the largest audience of all the HMIS training modules. All associates must have ready access to the information contained in MSDSs as specified in the HAZCOM regulation. Initial awareness training was given in a large presentation setting. Job aids for utilizing the system were distributed to the participants of these presentations. All associates were given the opportunity to enroll in *hands-on* workshops to supplement the system awareness portion of the training. The *hands-on* workshops provided associates the opportunity to log-on to the computer and execute the various MSDS system functions. This portion of the training module utilized both job aids and personalized attention.

- *HMITS (Inventory and Tracking)*

A "super user" approach was adopted to support training and implementation for the remainder of the HMIS modules. This approach requires that each department or business area designate one or more associates who would act as the "super user" or area expert for the system. They are trained with the intent that they will propagate their knowledge to those associates who would need to know this information. The justification for this training approach was twofold. One, unlike the MSDS module, not every associate is required to utilize these other system modules. Two, the "super user" approach was intended to address the time and resource requirements associated with plant-wide implementation. This training module was conducted in small groups of approximately 10 associates.

- **Issues to be Considered**

Issues or concerns to be associated with the implementation of a system with this scope can be categorized into two basic groups. These groups represent issues that are imposed upon a system from outside the organization (external) and those issues inherent to the organization's structure and culture (internal).

- *External*

Developing information systems to support regulatory requirements presents an increased opportunity for maturing requirements. By maturity of requirements, it is meant that regulations are typically dynamic by nature. Government regulations are in a constant state of evolution. Additional regulations are being issued at an ever-increasing rate while changes of existing regulations are just as dynamic. All of these changes will impact a system's design. In addition to maturity of requirements, external pressures exist to standardize formats, technical environments, coding schemes, and many other items associated with the management of hazardous materials. Every time a new standard or guidance is published, the system design must be altered to support these changes. This, in turn, requires updating of job aids and, in some cases, requires development of additional training sessions to support implementation.

- *Internal*

An organization's culture or paradigms, which have taken several years to develop, provide one of the largest opportunities for successful implementation of any information system. For these reasons, implementing change is an opportunity in any organization. It was once said that "the only person who welcomes change is a wet baby." This opportunity is magnified for those systems that require doing some process or function that is incremental to what is referred to as normal business. Being a relatively new area of concern, systems addressing environmental, safety, and health

issues deal with the issues surrounding culture and organizational paradigms. Other internal issues that must be addressed include items such as interfacing new systems with existing systems, data and data entry redundancy, new coding schemes, animosity associated with replacing existing systems, and availability of resources in the *lean and mean* business environment.

- **Lessons Learned**

- **Buy vs Build**

Today commercial off-the-shelf software (COTS) is available to meet almost any business requirement. Hazardous materials management is no exception. However, most of the hazardous-materials-related COTS in the marketplace today are targeted for the personal computing environment. In a manufacturing facility the size of the KCP, networking to support this platform represents additional opportunities. Some of these opportunities are costly and require significant implementation time. In addition, internal coding schemes to identify materials, as required by the DOE, are not supported, nor could they easily be supported by the COTS available when the HMIS was being developed. As previously mentioned in the *External Issues* section, maturity of requirements has also impacted the timely availability of COTS software in the environmental, safety, and health market.

- **Choosing a Training Strategy**

- The pilot group concept proved to be a good forum for resolving system design issues, testing training programs, and developing training and system user materials. Several changes were suggested and implemented due to the pilot group's recommendations.
- The documentation developed to supplement the HMIS implementation (systems user guide, quick reference, and on-line help facility) was a major contributor to the implementation's success. The systems user guide and quick reference provide a comprehensive, step-by-step guide to utilizing the system. The on-line help facility used by the HMIS is a comprehensive, window-based, on-line help facility. The on-line help provides for field level and screen or functional level help. However, it has been our experience that most users still tend to rely upon personal assistance rather than the documentation made available to them.
- The "super user" concept (train the trainer) did not work as expected. This was attributed primarily to lack of time and resources to transfer the expertise once the "super users" returned to the normal business. Another contributing factor was that all of the initially trained "super users" were not the appropriate associates for their representative groups. In many cases, supervisors attended the training sessions instead of the associates who were ultimately responsible for using the system.

- The performance-based workshop training used to support the MSDS system implementation proved to be very effective but required an extraordinary amount of training resource time to execute.

- **“If we had it to do all over again....”**

As the old adage states, “Hindsight is 20/20.” Some of the items which need to be addressed as new systems are developed will be the following.

- The training professionals need to be involved in the project at an earlier stage. This will provide a better understanding of the system design, thus providing better insight into communicating system functions during initial training.
- During the course of the HMIS system development, the project team was very dynamic. Out of the approximately 30 associates involved at the project’s inception, only one was still involved directly with the project at implementation time. This provided several communication opportunities and slowed development progress as a result of the learning curve associated with assimilating new project members.
- “Make hamburger out of sacred cows.” The inability to compromise existing paradigms surrounding the identification of chemicals has resulted in several system enhancements. If the items had been addressed in the early part of the system development life cycle, the resulting costs would have been significantly reduced.
- System development utilized many new technologies. However, training of the I/S development team was not done in a timely manner. This resulted in a significant increase in the system development time.
- The HMIS system has two distinct types of users. One is composed of associates who are responsible for responding to the regulatory requirements. These associates are concerned about the system output. The other users are those responsible for supplying the information to the system. During the system development process, significant involvement came from users concerned with the system output. However, those associates who are accountable for inputting the data were not consistently involved in the development process. This circumstance impacted acceptance of the system.

4. Contacts

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