

A Web-based Approach to Integrated Management Systems

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EXECUTIVE SUMMARY

Management Systems are powerful tools for businesses to manage their quality, environmental and occupational health and safety requirements. Where once these systems were considered as stand alone control mechanisms, industry is now opting to increase the efficiency of these documented systems through a more integrated approach. System integration offers a significant step forward, where there are similarities between system components, reducing duplication and administration costs and increasing efficiency.

Applying web-based technology further enhances the results of system integration by providing a user-friendly interface and a means for storing, accessing and manipulating large amounts of data across all areas of the business. The system can be extended to incorporate a range of business information systems such as process and operations information, asset management and human resources. A web-based system offers numerous advantages over paper-based alternatives, including user-friendly interfaces, ease of navigation, multiple user access, and access from remote locations.

This paper focuses on the case study implementation of such a system at Central Highlands Water (CHW).

CHW is Regional Water Authority in central Victoria servicing a population of 112,000 people. It operates ten wastewater treatment facilities and thirteen water treatment facilities. As part of an upgrade of its existing management systems, CHW opted to integrate, to the extent possible, its systems for water quality, environmental and occupational health and safety. In addition to integrating these systems they also chose to use a web-based framework as a navigation tool for accessing system documentation and records, also incorporating electronic operation and maintenance (O&M) manuals within the developed framework. While the companies management systems are integrated where they have common elements, the system has been designed so that CHW can achieve independent certification for each system under relevant ISO and Australian Standards.

KEY WORDS

Integrated Management System, web technology and Management Systems.

INTRODUCTION

Water Quality, Environmental and Occupational Health and Safety (OH&S) Management systems play an important role in today's water authorities. Increasing accountability for water quality, tighter environmental controls and tough safety requirements, mean companies cannot afford to be complacent in these areas. Management systems provide a framework to ensure companies minimise potential risks to their customers, employees and the environment.

This paper:

- Discusses briefly why water companies need management systems to provide a framework to minimise potential risks to their customers, employees and the environment.
- Illustrates the benefits associated with integrating management systems
- Discusses the use of web-based technology to provide a navigation framework for integrated management systems
- Suggests future applications of the web-based integrated management tool.
- Presents a case study of the development and implementation of an integrated management system at Central Highlands Water.

MANAGEMENT SYSTEMS IN WATER AUTHORITIES

Management systems provide the important framework to ensure water companies manage the quality of their product, the safety of their employees and the impact to the surrounding environment. Management systems are fundamentally concerned with what a company needs to do to manage the processes involved with water quality, environment and safety. Whilst different management systems have several unique elements, they also have many common ones such as policy development, documentation and reporting, auditing, emergency and awareness, operational procedures and process control and training and awareness.

Water Quality: Quality systems ensure that companies can satisfy customers on a consistent basis. In the water industry there has been several water quality management systems designed to address the unique needs of providing water to the community. The Framework for Management of Drinking Water Quality is a quality management framework that is designed specifically for the water industry. It incorporates a preventative risk management approach, which is comprehensive from catchment to tap. The framework provides guidance on a full range of issues that should be considered in the management and delivery of drinking water.

Environmental: Environmental management systems assist an organisation to meet the requirements of increasing government legislation and community expectations, in regards to the impact it has on the surrounding environment. In many cases, the introduction of an environmental management system can also aid cost savings, and reduction of environmental liability. ISO 14000 is the international Standards Organisations Environmental Management series. ISO14001 is the Environmental Management System component and outlines the management components for a company to ensure it minimises its risk to the surrounding environment.

Safety: Safety management systems allow an organization to demonstrate both internally and externally that they are able to systematically control occupational health and safety risks and hazards to each and every employee. The NZ/AS 4801 Occupational Health and Management Systems and Safety Map are safety management systems that are made up of several elements to ensure that the key occupational health and safety management issues within an organisation are identified, that systems are implemented to systematically identify and control hazards and that the potential for accidents to occur is minimized.

THE BENEFITS OF INTEGRATING MANAGEMENT SYSTEMS

For management systems to function effectively they need to be utilised by all members of an organisation. The management framework that each system subscribes to need to be incorporated into the daily activities of all employees. These systems will fail to protect companies from quality, environmental and safety non-conformances unless adopted by all employees and all requirements of the individual system are adhered to. Management is potentially liable if an incident occurs and they cannot demonstrate that there are systems in place and that all employees are using them correctly.

The first hurdle that many organisations face, is that adopting and certifying three individual management systems is not only a timely and costly exercise, it may also require employees to undertake similar tasks for the separate management systems. These tasks, especially where duplicated between systems can seem unnecessary and wasteful of employee resources; this evidently can lead to the failure of systems. To avoid this, many companies are understandably shying away from introducing more than one management system to their organisation, or they are opting for increased efficiency and integrating the various systems.

Integration of the water quality, environmental and OH&S management systems has been a way companies have reduced the dysfunctionality of three individual systems. The integration of management systems allows the common elements of the systems to be identified and merged as one, whilst still recognizing individual requirements that each system will have.

Other recognised benefits associated with integration of system include:

- Avoiding duplication or triplication of internal resources to administration and management of the systems;
- Reducing the costs and overlap associated with documenting separate systems for accreditation purposes;

- Reduction of risk – for example employees only requiring to access one set of work instructions to cover water quality, environment and OH&S issues related to a particular process;
- Enhanced corporate image – an IMS is seen as a clear indication of an organisation's commitment as a good corporate citizen; and

- o Improved organizational performance.

Systems Elements	System Area	Environment				Possible common elements
Policy and objectives		Env Po				Corporate policy
Responsibilities and leadership		Environ respon				General responsibilities
Procedures		Corpor proced				Integrated procedures
Needs Analysis		Legal require				Interested parties, stakeholders, government, community, contract review procedures
System Planning and Implementation		System Env Pr				Document control, incidents, corrective actions, emergency response
Hazards and						ment
Process and Management						asset
			Programs	management, plant safety management	Control, P&ID	Management Progs, Control of non-complying product
Monitoring and Measurement		Licenses and approvals monitoring	OH&S inspections	WQ monitoring		General monitoring procedures
Resource Allocation		Environmental training	OH&S training and competencies	Plant operator training		Site induction, needs analysis procedures
Communications		Complaints	OH&S committee, disputes	Customer communications		Communication lines and procedures
Review & Improvement		Env System audit	OH&S system audit	WQ system audit		IMS audit plan

Figure 1.1 – The integrated management system allows for particular elements to be merged from all three systems. It identifies that some elements may be unique to a system, have common elements with one other system or common elements will all of the systems.

HOW TO INTERGRATE MANAGEMENT SYSTEMS USING WEB-BASED TECHNOLOGY

When integrating management systems it is essential to provide a framework that is capable of storing all the system requirements without becoming cumbersome. The objective is to reduce and consolidate the amount of information and documentation that needs to be handled.

The first step to integrating management is to identify the common elements between each of the systems. A gap analysis of the individual systems is required to determine which elements can be combined. Table 1.1 illustrates the common system elements and indicates how they can be accessed horizontally within the IMS structure or vertically down through an independently certifiable management system.

Table 1.1 – Common elements of Management Systems

Once common elements are identified, a series of integrated procedures, work instructions, registers and other components of the management system are required to be written. It is important that the management systems are no longer viewed as individual systems. An Integrated management system requires all internal management practices to be combined into one system. For it to become an integral part of the company's management system there have to be linkages so that the boundaries between the processes are as seamless as possible.

Once the common elements are identified a framework is required in which the management systems are to be housed. By using a web-based interface the integrated system can be operated through a single interface. This single interface provides an enormous advantage over the conventional paper based system, both as an operational system and at the implementation phase.

When implementing management systems, they can be often difficult to integrate at the operational level. After they are written many manuals are shelved and if not used on a daily operational level, fail in what they are designed to do. When the system is easy to use and information is quick to access, operational staff are more likely to use the system elements. This leads to familiarity of the system requirements, and reduces risk of operators failing to follow instructions.

Through careful design considerations and a thorough understanding of the users needs, the advantages of the web-based interfaces are vast, and include:

- The ability to access information using a common web browser internally through the business or externally through the World Wide Web. For example this could allow customers to access water quality data;
- User friendly graphical interfaces, that incorporate photos, plans and drawings make data easier to access and easier to understand;
- Non linear access to information, to allow users to access material several ways as appropriate to the users needs;
- Can incorporate real time information or directly access databases to provide the latest information to the user. This can also include automatically collecting and manipulating data such as monitoring and graphing water quality data;
- Facilitates decentralization, which allows broader access to central databases to regional offices and vice versa.
- Referenced information can be directly access by hyperlinks in web documents eg. Regulatory requirements, reports, supplier information;
- Enhance quality control, as all data is in read only format, and updates or revisions can only made through a central location;
- Allows for storage of large amounts of data;
- Can be expanded to other business system to incorporate operations, human resources, asset management etc.

Central Highlands Water Case Study

CHW is a regional water authority in central Victoria who engaged Parsons Brinckerhoff to develop and integrate their environmental, OH&S and water quality management systems. They required the system to be operated on a daily basis by both operational and management staff and the system needed to be user friendly and was required to

extend to include a functional interface with electronic operation manuals already developed for the client by PB.

Design considerations for the system were carefully assessed. The system would need to be reliable, easy to administer, not require large ongoing maintenance costs or commitment to extensive IT resources, and allow for expansion or integration with other business information system if required, in the future.

The system was required for both management and operational purposes. Being an integrated system, much of the information generated through the management system is required to be used in every day operational activities. It was, recognised that the same information would be required to be accessed differently by different users. Whilst management generally needed to access information through procedures and other document-based means, the operators required access generally on a plant specific level.

It was therefore chosen to use a regional map as the front interface screen, which allowed users who required plan specific information to quickly identify the facility or plant of interest. There are also several menu bars that provided direct access to management systems, procedures and emergency information.

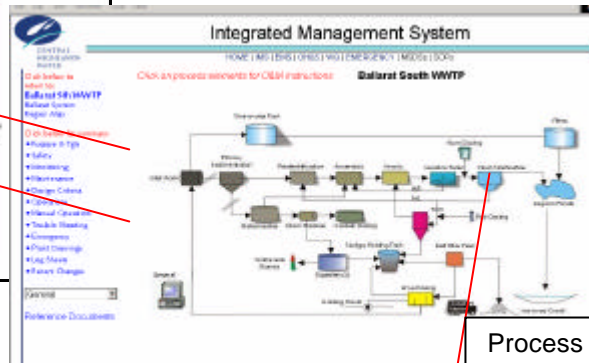
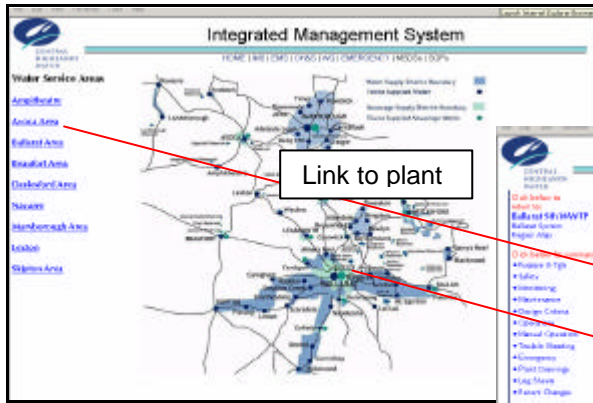
By clicking on the area on the map, the town locations listed down the left hand side or from one of the options in the tool bar located at the top of the page the user can quickly get to their desired location.

On the following pages are examples of how operators and management use the system. The examples illustrate how the system provides information on various levels and how data can be accessed through a number of routes. While a plant operator is most likely to access the information from the plant operation manuals, they are also able to step up through the system to access the management plans, procedures and policies from which the operating instructions stem.

On the other hand, an auditor is likely to start at the top level with the company policy, and step down through system procedures, management plans, monitoring requirements etc., to reach the operating and work instructions that take into account these requirements.

Operational Overview

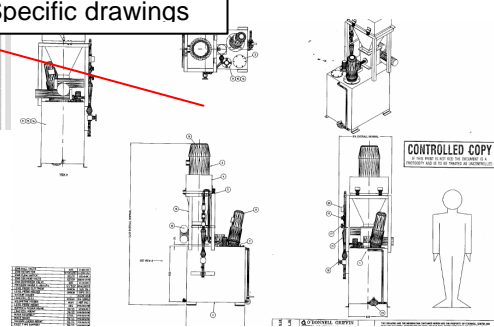
From an operational view, the user can access the data required for a specific plant with a few clicks of the mouse. From the regional map the user chooses a specific plant (or other infrastructure asset), about which they require information. Once they have chosen the asset, a process diagram depicting all elements of the asset, along with specific safety, environmental and water requirements appears. From this page the user can assess large amounts of information specific to the asset as well as company wide information including material safety data sheets (MSDS), standard operation procedures (SOPs) and emergency control. This page also links to the management system pages with detailed information regarding each of the systems. From the front interface page:



From the process element page the operator can access information such as environmental monitoring requirements, safety information, as well as operational information and references such as drawings and spare parts information.

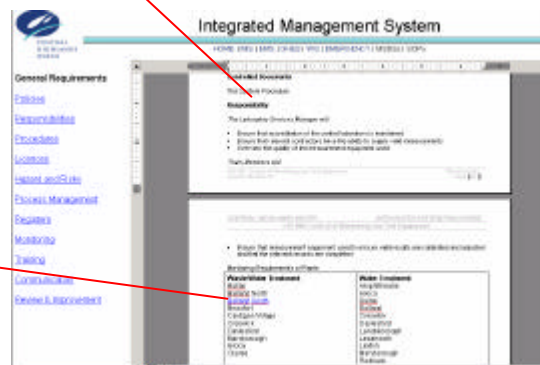
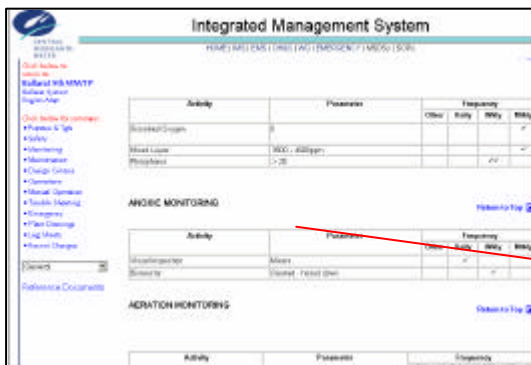
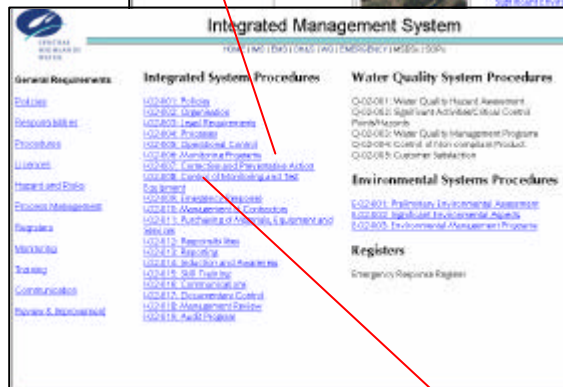
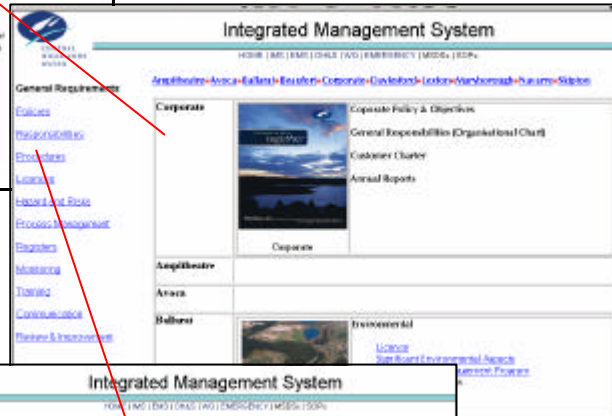
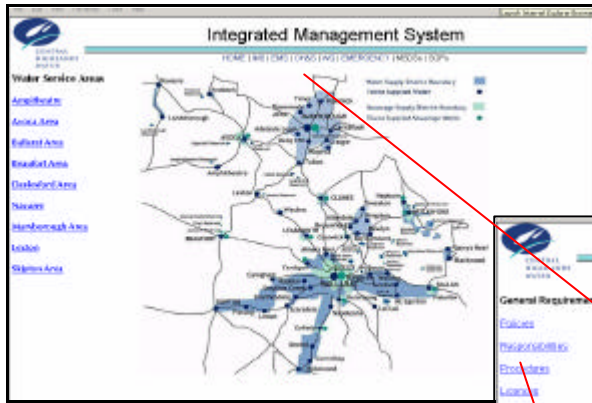
ITEMS	ITEMS
GENERAL ARRANGEMENT LINE DRAWING SYSTEM	WTF001001
PROCESS SCHEMATIC FLOCCULATED SYSTEM	WTF001002
LOADABLE CASE FOR CHLORINE BOTTLES	WTF001003
GENERAL ARRANGEMENT FLOCCULATED SYSTEM	WTF001004
MIXING TANKS FOR POLYMER SYSTEM	WTF001005
GENERAL ARRANGEMENT CHEMICAL DOSING BUILDING	WTF001006
PROCESS SCHEMATIC FLOCCULATED SYSTEM	WTF001007
PROCESS SCHEMATIC ALUM DOSING SYSTEM	WTF001008
PROCESS SCHEMATIC LINE DOSING SYSTEM	WTF001009
PROCESS SCHEMATIC POLY DOSING SYSTEM	WTF001010
GENERAL ARRANGEMENT DRYING UNIT (POLY)	WTF001011
MAIN PLANT DRUGS LINE DIAGRAM	SC001E10
MAIN SWITCHBOARD NOMINER SUPPLY CHANGEOVER	SC001E11
LINE SYSTEM DRUGS LINE DIAGRAM	SC001E12
POWER SUPPLIES CONTROL CIRCUIT DIAGRAM	SC001E13
MAIN PLANT ALL SYSTEM	SC001E14
WWT MAIN WASTEWATER PUMP CONTROL CIRCUIT DIAGRAM	SC001E15
WWT MAIN WASTEWATER PUMP CONTROL CIRCUIT DIAGRAM	SC001E16
WWT HIGH FT DUMP CONTROL CIRCUIT DIAGRAM	SC001E17

Specific drawings



Management Overview

From a managerial view, the user can access data required for the management system. From the regional map the user selects between integrated management page or they can select individual environment, quality or OH&S pages that list only the specific requirements for each system. The user is able to access data such as system procedures and where appropriate will link back to specific requirements for a specific plant. The example below illustrates the user identifying the management procedures for monitoring through the IMS procedures. The final link illustrates how the monitoring requirements for each plant can be accessed through the procedure.



FUTURE APPLICATIONS

There are many possibilities for further development of the integrated management system to incorporate other business systems such as asset management, human resources and financial software packages. The system could also be used to provide information to the public through the World Wide Web – such as access to annual reports, water quality data, media statements and company policies

As advancements in technology continue to evolve we will increasingly see developments to the efficiency of data communication and a greater diversity of multimedia applications as a means of communication. With such advances in technology, the future applications of web-based integrated management systems will

see water authorities with improved access to information for staff via a variety of differing means.

This improvement in flexibility of operations will allow for the Decentralization of work operations, allowing staff to work from home or small regional offices, whilst still having access to the full information resources of the organization. The use of palmtops and mobile phones as a way of accessing information will also be a possibility. Such mobile devices will be able to fully access web capabilities and therefore company information systems. An operator will be able to carry around in his back pocket all the management system requirements, plans and operational information of particular plant or asset.

“At desk” training of staff on ones own computer, of new changes or procedures via an interactive Web based presentation will become increasingly common. Multimedia presentations will become progressively easier to produce, and will have in built interaction with the participant. The system will also be able to track who has done the training and how well the participant did in responses to the training.

CONCLUSIONS

Water companies have a great responsibility in our community to provide consumers with high quality water, to meet all environmental requirements and to ensure the safety of their contractors and employees. It is these responsibilities that have led most water authorities to implement water quality, environmental and OH&S management systems into their daily operations.

Integration of management systems is a logical step for organizations that have are or seeking to implement one or more certifiable systems. The successful integration of management systems depends on a variety of factors, however the most important is acceptance and willingness to use by all members of staff. It is therefore essential for the integrated system to be easy to use, whilst still satisfying all the requirements of each management system.

Web-based integrated management systems have enormous benefits in improved operation through reduced resources allocation, reduction of risk, and the collection, distribution and management of business information. It also provides an extremely user-friendly interface for which the integrated management system can be housed.

With an ongoing technology advancements and continual improvement to the integrated management system framework the use of IMS coupled with web-based technology will have enormous benefits in the way water companies are able to manage their environmental, water quality and OH&S responsibilities.

ACKNOWLEDGEMENTS

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REFERENCES

Chapman, A, (2001), *Water on the Web*, AWA Operators Association Conference 2001, Bendigo, Victoria.

Rattray E, (2001) *Electronic Operating Manuals, An emerging professional Technical Paper*

Rogers, D, (2002), *Integrating Management – A web-based Approach, An emerging professional Technical Paper*