

DAM SAFETY MANAGEMENT SYSTEMS – EFFECTIVE RISK MANAGEMENT

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ABSTRACT

The primary concern for any dam owner is to provide a service in the most efficient manner whilst managing risk. Structured dam safety management programs and risk assessments are widely adopted by owners to manage their dams in a whole-of-business context. These types of programs are also expected by dam safety regulators across Australia and internationally where the context is primarily the consideration of life safety and third party impacts.

Dam owners can range from large to small public or private organisations or in some cases to individuals. Each organisation will have different governance and management arrangements, corporate objectives and operating environments, overall business drivers, financial capacity, technical capability and risk appetites.

Larger dam owners may have a significant portfolio of dams, be well informed and have access to the internal and external technical skills necessary to take informed dam safety and management decisions whereas for many organisations the ownership of a dam and its associated responsibilities and liabilities may not be well understood.

However, irrespective of the nature of a business owning or with responsibility for a dam, there are fundamental principles which should be followed to ensure that an appropriate level of dam safety management is undertaken to support and protect not only that business but also the affected community and environment.

As with any other business process, it is essential to document and follow a well-considered, logical, reportable and auditable system for dam safety management to ensure that business objectives are being achieved and that all risks are being effectively managed. A well designed and diligently managed Dam Safety Management System will ensure that a dam owner manages its dams in an effective and efficient way and that all corporate governance, risk, technical management and regulatory issues are addressed. Documentation of these systems and processes is also an important element in ensuring the sustainability of future industry capability.

Keywords: Risk Management, Dam Safety, Business Management

INTRODUCTION

All businesses strive to reliably deliver their business objectives and value for their stakeholders. Typically, a key aspect of the processes to deliver value is to devise and implement management systems to ensure that all steps in critical processes are specified, responsibilities assigned and performance monitored. In the modern business

environment, management systems are supported by enterprise risk management to minimise the likelihood of the overall business objectives not being achieved.

In Australia, risk assessment is now commonly used to provide a rational process to determine the current safety status of dams and if there is a deficiency to assist in deciding the scope of works required to achieve a tolerable level of risk.

Risk assessment has provided dam owners with a powerful decision making tool for management of the major physical components of dams. However, this is only one aspect of dam safety and the business may not have in place all of the components required for truly effective risk management of all aspects of dam safety. For example, perhaps not all of the requirements of the regulator are specified, resourced and audited within a management system.

The challenge for dam owners is to recognise all the relevant aspects of dam safety and implement an overarching management system, supported by risk management, to ensure that the business objectives for dam safety, alongside all other business objectives, are reliably met.

Organisations that manage dams must meet all the expectations of their stakeholders if the enterprise is to prosper. The stakeholders can consist of Company shareholders, Government and its representatives, Regulators, users of the benefits derived from the dam (both commercial and public) and those that would be impacted should water releases not be controlled in a safe manner.

Shareholders will expect and demand that the organisation operate effectively (the right activities are undertaken) and efficiently (the activities are undertaken in a cost effective way), so that shareholder value is maximised. The Board will want to ensure that performance is continually improved, due diligence and duty of care are demonstrated and compliance requirements are met.

Over recent times, the concept of the term “social license” has been used to describe the need for the ongoing support of the community and other stakeholders that are not directly involved in the benefits derived from the business related activities. Just as failure to manage the regulatory license can lead to severe business implications, failure to manage the social license can lead to high social and political risk to continuing operations. Where a dam is seen as a hazard by non-beneficiaries this concept can be particularly relevant.

Managers must not only ensure that the enterprise is managed effectively and efficiently, but must also be able to consistently demonstrate to all stakeholders that there is a systematic approach to managing the risks associated with that enterprise.

BUSINESS PRINCIPLES

Typically, Business Planning for an organisation involves the definition of the Mission Statement, or primary “reason for being”. This is then supported by Principles which define the direction or key outcomes for the business. The ways in which the outcomes will be achieved are then often articulated in a number of strategies with accompanying action plans.

Obviously the degree of business planning and approach will vary from business to business. However, the general principle is that for a business to succeed and prosper there needs to be a very clear understanding of what it is that is trying to be achieved, and how it is to be done. As with any venture, proper planning and monitoring of implementation are essential ingredients for a successful outcome.

These general principles apply equally to businesses which are responsible for the management of dams and therefore to the management of the dams within the overall business planning context for the organisation, whether publically or privately owned.

The relationship between the overall corporate environment and the management of a dam is shown on Figure 1 – “Planning Process for Business Management of Dams”. This shows the hierarchical nature of business planning and the relationship between Corporate Objectives and Resource Requirements.

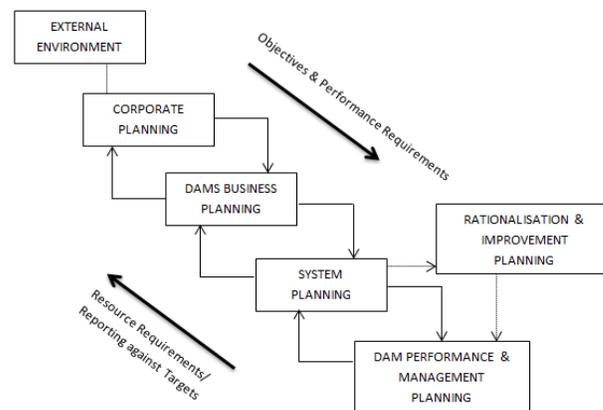


Figure 1. Planning Process for Business Management of Dams

At each level or area of business planning, the preceding or higher level of planning specifies objectives and performance requirements. Similarly, resources requirements required to achieve these objectives and performance requirements are specified by the following or lower level of planning. There is also a requirement to monitor and report on what is actually achieved against the specified performance requirements, which is a function rolling upwards, where each business segment or function should eventually report against an element in the corporate plan. The arrows on Figure 1 show these relationships.

There are six discrete areas of business planning shown. Depending upon the nature of the dam owning organisation and the scale of its dam assets, there may be a different emphasis placed on one or more of the business planning areas shown, or some may not exist at all.

MANAGEMENT SYSTEMS

In modern businesses, a systematic approach to achieving business objectives is seen as essential if the objectives are to be reliably achieved. In the draft ICOLD Bulletin on Dam Safety Management: Operational Phase of the Dam Life Cycle, a management system is described as:

“... the method by which operational activities are carried out and the integrity of the industrial activity is assured. Broadly, the management system establishes a systematic and consistent way of transforming an operating organization’s values, principles, policies and procedures into the products or outputs of industrial or commercial activities, through a set of linked sub-activities, as illustrated in Figure 2.

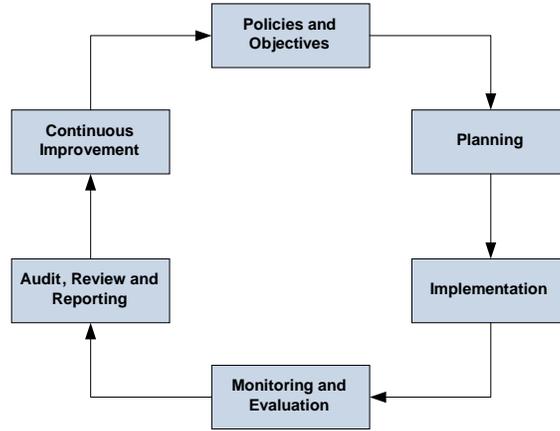


Figure 2. Elements of a Management System

Policies and Objectives should set a clear direction to follow in achieving all of the goals of the organization.

Planning sets objectives and targets to be achieved, develops plans for implementation, and defines performance standards.

Implementation activities put in place an effective management structure and system of procedures that ensure that the objectives are achieved.

Monitoring and Evaluation of performance provides information on the effectiveness of the activity and whether the management system is maintaining operation within its defined objectives.

Audit, Review and Reporting provides a systematic review of performance, based on information collected in Monitoring and Evaluation, with additional data provided by independent audits..

Continual Improvement uses the results of Performance Monitoring and Evaluation along with results from Audit, Review and Reporting, to make adjustments and improvements in the policies and processes.”

It is common for businesses to have several management systems to support its operations. Examples are:

Table 1. Business System Examples

Health, Safety and Environment	Human Resource Management
Risk Management	Project Management
Financial Management	Business Continuity
Customer and Stakeholder Management	Procurement

While it is advantageous to integrate these system across the business with an “integrated management system” this is a complex undertaking and generally only practical for very large organisations.

Where the management systems are not integrated, it is usually recommended that particular care is taken to ensure that there are no overlapping or missing accountabilities between the management structures that support the individual systems.

DAM SAFETY MANAGEMENT

Around the world, there are many guidelines available setting out the recommended practices for dam safety management.

In Australia, for example, the Australian National Committee on Large Dams (ANCOLD) has published its Dam Safety Management Guidelines, 2003. In these Guidelines the objective of Dam Safety Management is stated as:

“... to protect life, property (eg community infrastructure, dam) and the environment from the failure of any dam. This objective can be achieved by implementing and maintaining an appropriate dam safety program.”

Figure 2.1 in the ANCOLD Guidelines which is reproduced as Figure 3 below provides an outline of the structure of a dam safety program.

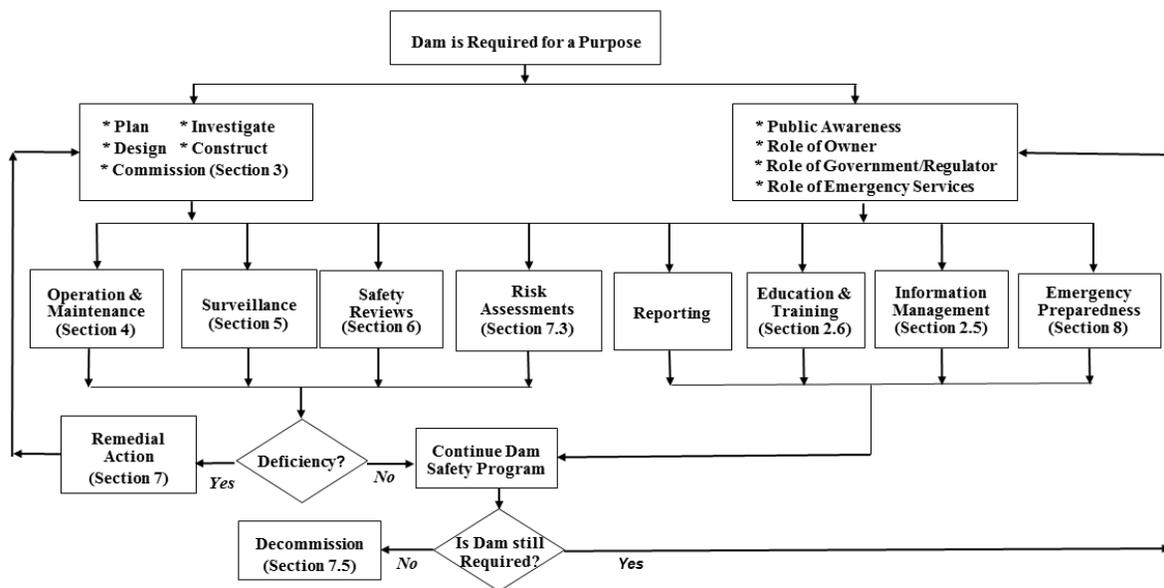


Figure 3. Elements of a Dam Safety Program (from ANCOLD)

The ANCOLD outline for a dam safety program is typical of many countries and jurisdictions. In draft ICOLD Bulletin 154, the following diagram is provided to describe the Dam Safety Activities to be managed:

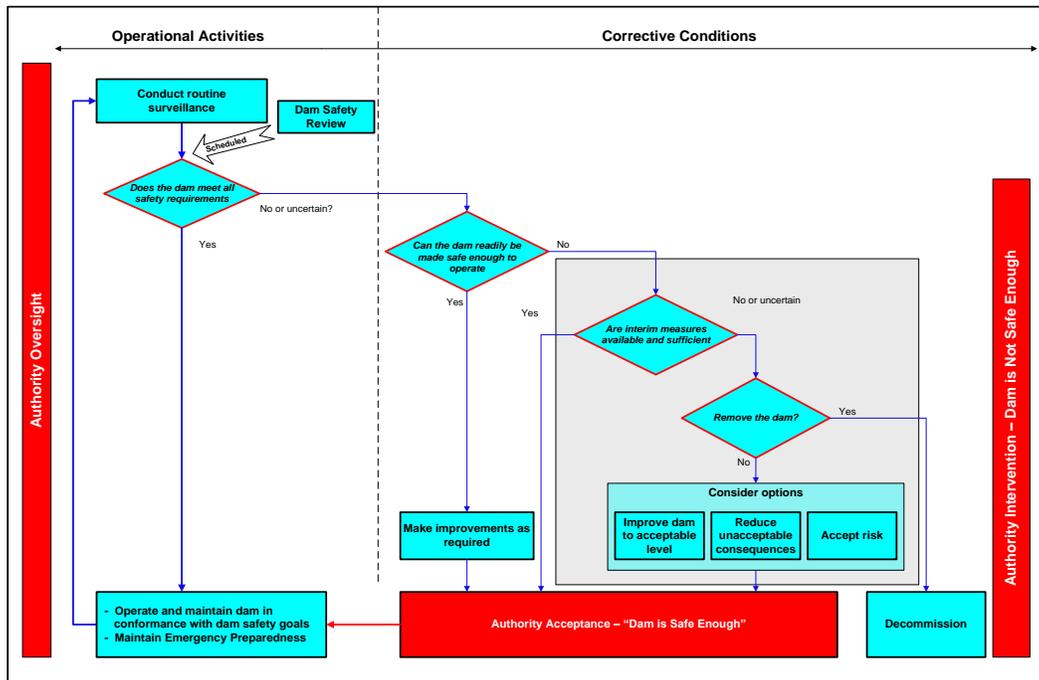


Figure 4. Dam Safety Activities (from ICOLD)

DAM SAFETY MANAGEMENT SYSTEM

Typically, dam owners have, to varying degrees, methods and processes to manage the various elements of their dam safety programs. These methods and processes will be based on similar guidelines to the ANCOLD and ICOLD guidelines discussed above, but established within the regulatory and governance framework of the jurisdiction within which the dam owner operates.

What can be missing from the management arrangements are three important factors:

1. The setting of the dam safety management arrangements within a complete system,
2. The linkage of the dam safety management arrangements to the remainder of the business, and
3. The establishment of a dam safety culture within the business similar to the modern approach to workplace health and safety where businesses strive to develop a culture whereby at every level *“safety matters in this business”*.

The systematic approach to dam safety management should address these three issues and ensure the reliability of the management arrangements to minimise the likelihood of undesirable events adversely impacting on the safety of dams in the owner’s portfolio.

For example, if the management arrangements currently in place for engineering, maintenance or operations activities are seen as representing some of the barriers to an undesirable event or to mitigate the consequences of the event (see Figure 5), then it is possible, if the management arrangements are not controlled sufficiently, that there will be “holes” in some barriers (the “swiss cheese” effect).

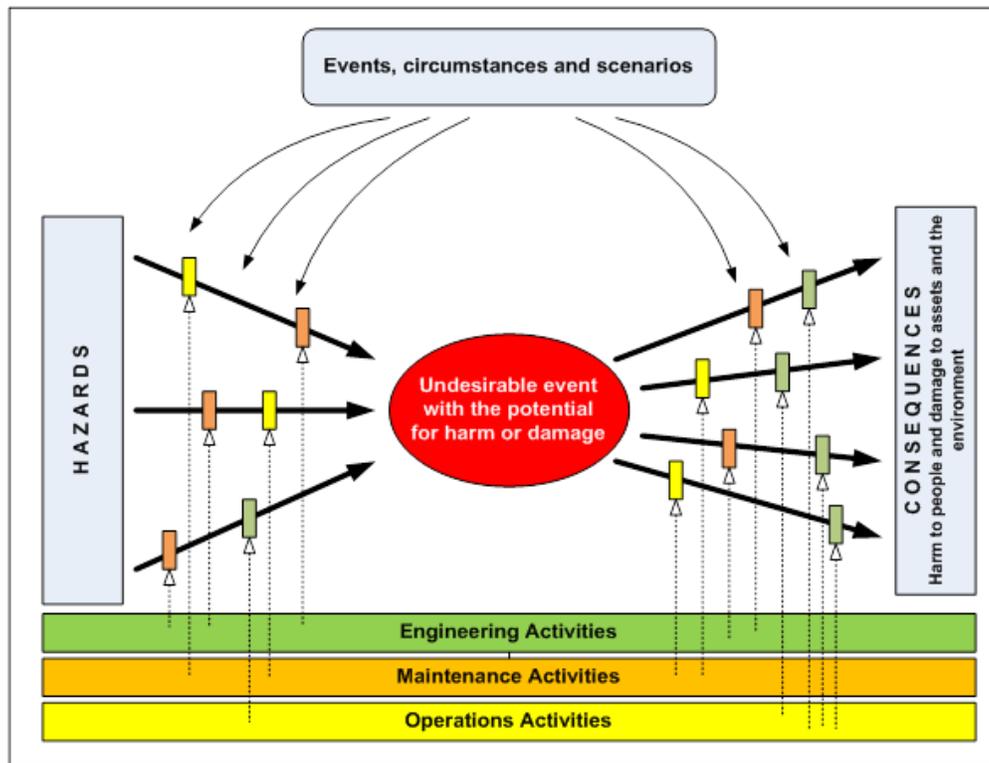


Figure 5. “Bow Tie” Risk Management Model (from ICOLD)

Another way of looking at this issue is to consider that if the application of appropriate technologies establishes barriers to reduce the likelihood of an incident occurring to a certain level and management arrangements reduce the number of “holes” in those barriers, then a management system implemented within a dam safety culture will further reduce the likelihood of an incident occurring.

Presented simply:

- There are engineering, maintenance and operational activities that must be carried out by staff following established procedures with clear accountabilities;
- The next level of management must create the accountabilities and business systems, linked into the business-as-usual, to ensure that the activities are carried out; and,
- Senior management must ensure that the safety culture is established within the organisation (i.e. that establishing a well-functioning system and ensuring it is implemented, monitored and continually improved, is important to this business).

At a basic level, the establishment of Dam Safety Management System (DSMS) will involve the following components (with reference to the elements of a management system outlined above):

Policies and Objectives

- Context – Regulatory and Strategic
- Dam Safety Policy setting clear direction for the organisation
- Dam Business strategic plan and objectives

Planning

- System Objectives and Targets
- Operations Plan – normal and flood
- Maintenance, Inspection and Testing Plan
- Surveillance Plan
- Safety Review Plan
- Dam Safety Emergency Plan
- Stakeholder Management Plan

Implementation

- Organisational Structure
- Roles and Responsibilities
- Information Management and Reporting
- Change Management
- Training, Deployment and Succession

Risk Management

- Enterprise risk management system
- Use of risk assessment for risk management at dams

Monitor and Evaluate

- Measure effectiveness of DSMS against performance standards

Audit and Review

- Systematic review of data from internal monitoring and external audits
- Compare with other businesses and best practice

Continuous Improvement

- Information from internal and external reviews used to improve system

Each of these components must be established within a single coherent auditable system that can be readily produced as “how we manage dam safety” in this business. The Dam Safety Management System is fundamentally intended to satisfy the dam owner’s corporate and business objectives, governance responsibilities and risk management processes. If properly designed and implemented it should then satisfy any external government or regulatory requirements.

A fully integrated Dam Safety Management System which documents processes and procedures and the fundamental concepts and objectives of dam safety management in the total organisational context also has a valuable role in ensuring continuity of

corporate knowledge and organisational intellectual property (IP) which could otherwise be lost as individuals move from organisations.

Organisational knowledge and IP management is a particularly important aspect of a Dam Safety Management System as it assists in knowledge transfer, staff training and development and minimises risks posed by the potential loss of specific skills and experiences from an organisation. This is particularly important at a time of generational change in the dams industry, including organisational restructuring, experienced staff retirements and greater workplace mobility for younger staff.

EXAMPLES AND EXPERIENCES

The authors have worked with several dam owners across Australia of varying sizes and with a diverse range of corporate objectives, regulatory, governance, operational environments and technical capability. The authors have noted that each dam owner has its own unique business model and also varying degrees of capacity in the technical aspects of dams' management and in the broader areas of business management and corporate governance.

In developing the concept and detail of a Dam Safety Management System, it has been recognised that the important first step is to assess basic operational and business data from the dam owner. The process of developing a Dam Safety Management System can then commence with a comprehensive audit of existing systems and processes against corporate and regulatory objectives and industry standards.

This audit should include an assessment of the dam portfolio in a whole of business sense, as well as the development of an understanding of overall governance and business management objectives. The results of the audit will allow a gap analysis of existing systems and processes and development of an integrated approach to managing dam safety within the business, which can then be developed and implemented as an ongoing Dam Safety Management System.

Typical Dam Safety Management System documentation should include two primary components – the Implementation Framework and Supporting Documentation, comprising the information set out in Table 2 below.

In the authors' experience, when a systematic approach to dam safety management is implemented within a whole of business context, adopting not only technical dam safety requirements but also modern business and governance practices, dam safety risks can be better managed and overall business performance improved.

It has also been demonstrated that the implementation of a Dam Safety Management System which is designed to maximise business efficiency and to reduce enterprise risk, will almost certainly satisfy corporate governance obligations and any regulatory requirements. A properly designed and implemented Dam Safety Management System will enable a structured and auditable approach to be implemented to ensure that all the necessary technical, management, governance and corporate objectives can be met.

Table 2. Dam Safety Management System Components

Implementation Framework	Supporting Documentation
Dam Safety Policy	Dam Safety Data Book
Dam Safety Legal Framework and Requirements	Operations Plans – Normal and Flood
Background and Organisational Context	Maintenance, Inspection and Testing Plans
General Operating Guidelines	Surveillance Plan
Risk Management Principles	Safety Review Plan
System Objectives and Targets	Business Continuity Plan
System Elements and Relationships	Dam Safety Emergency Plan
Information Management and Reporting	Security Plan
Key Performance Indicators	Stakeholder Management Plan
Responsibility Assignment Matrix	
Individual Task Assignments	
Education and Training Requirements	
Change Management Processes	
Audit and Review Processes	

CONCLUSIONS

It is widely recognised that to assure appropriate levels of dam safety, high level technical skills and experience are absolutely necessary. However, in an increasingly complex operating environment, subject to commercial and social pressures, it is also essential that up to date business management and governance arrangements are in place.

In the modern commercial environment, up to date business management arrangements consist of a systematic approach to the delivery of desired organisational outcomes with clear procedures and accountabilities. For dam safety, this is the Dam Safety Management System.

In the authors' experience, the application of a systems approach to dam safety management is essential for a dam owner to be able to demonstrate due diligence in relation to the delivery of dam safety. Further it has been shown to provide organisational benefits beyond the achievement of dam safety objectives, through greater organisational integration, leading the establishment of a safety culture and clarity for staff in defining position expectations.

Wider benefits from a Dam Safety Management System include continuity of corporate skills and experience, staff development and knowledge transfer.

A Dam Safety Management System is ideally constructed by professionals possessing both technical and management skills and experience. This should include experience in strategic business planning, operations, management and corporate governance as well as technical and practical dams engineering skills.

ACKNOWLEDGEMENTS

The Authors would like to acknowledge ANCOLD Chairman Mr Ian Landon-Jones and ICOLD Committee on Dam Safety Chairman Dr Andy Zielinski for permission to use extracts of ANCOLD and ICOLD material.

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