

Towards Responsible Tailings Management: The MAC Trilogy

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MAC Tailings Working Group


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MAC

The Mining Association of Canada
L'Association minière du Canada

- 
- The Mining Association of Canada has, over the past 12 years, pursued continual improvement in tailings management by its member companies and the broader mining industry
 - This presentation outlines the MAC Tailings Management Framework, as put forth in the tailings management “trilogy”, and provides guidance for its implementation and application



The MAC tailings initiatives began out of realization that

- Tailings present a major business risk to the mining industry
- The risk needs to be better managed
- A series of major tailings failures around the world in the 1990's
 - while individually related to specific technical issues
 - were more fundamentally indicative of need for improved care and management practices by tailings dam and facility owners and operators





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Tailings present a major business risk to the mining industry

- Tailings failures can have major environmental impacts
- And, their impacts on the companies reach far beyond the cost of rehabilitating the mess
 - Some companies may never fully recover public or shareholder confidence after suffering major tailings failures.
- What are the costs of lost credibility?
 - Difficulty in accessing capital
 - Permitting and approvals hurdles
 - Reduced employee morale, public confidence



Several tailings failures...

- There have been several tailings failures
 - in Canada
 - at Canadian company sites overseas
 - and at other mining company sites internationally
- 83 reported significant tailings dam failures between 1961 and 2004
 - 65 between 1961 and 1996
 - 16 between 1997 and 2004
- Including several causing loss of life
 - El Cobre (Chile, 1965) - > 200 dead, town destroyed
 - Mir (Bulgaria, 1966) - unquantified loss of life
 - Bilbao (Spain, 1969) - unquantified loss of life
 - Mufulira (Zambia, 1970) - 89 miners dead
 - Bafokeng (S. Africa, 1974) - 12 miners dead
 - Mochikoshi #1 (Japan, 1978) - 1 dead
 - Arcturus (Zimbabwe, 1978) - 1 dead
 - Stava (Italy, 1985) - 268 dead
 - Jinduicheng (China, 1988) - 20 dead
 - Merriespruit (S. Africa, 1994) - 17 dead
 - Surigao del Norte (Philippines, 1995) - 12 dead



MAC over the past 12 years

- Initiated a Board-level Task Force to investigate and recommend initiatives to address performance of tailings facilities, which led to creation of the **Tailings Working Group**
- Established and continues to support the **Tailings Working Group**
 - works within the industry to promote safe and environmentally responsible tailings management practices
 - with membership and participation encompassing the breadth of Canadian mining companies and engineering companies involved in tailings
 - shares experience across companies
 - provides leadership to the broader mining community
 - develops and encourages industry “standards” for responsible management of tailings and water management facilities
- Promoted, and continues to promote responsible tailings management through publications, technical presentations and information exchange workshops
- Supports the efforts of the Canadian Dam Association and the development and implementation of the Canadian Dam Safety Guidelines



The MAC Tailings Working Group

- A collaborative effort of experts from across the Canadian mining industry
- With representation from:
 - executive offices
 - environmental services
 - site engineering / operations
 - engineering consultants

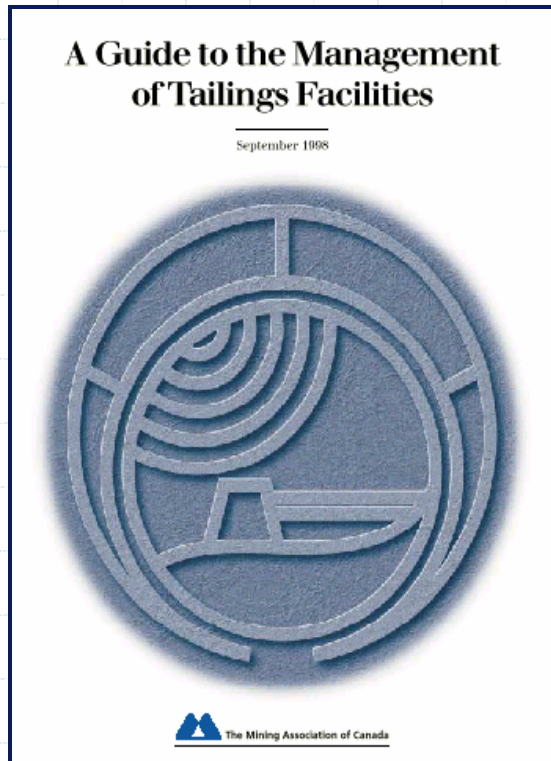


MAC Tailings Working Group

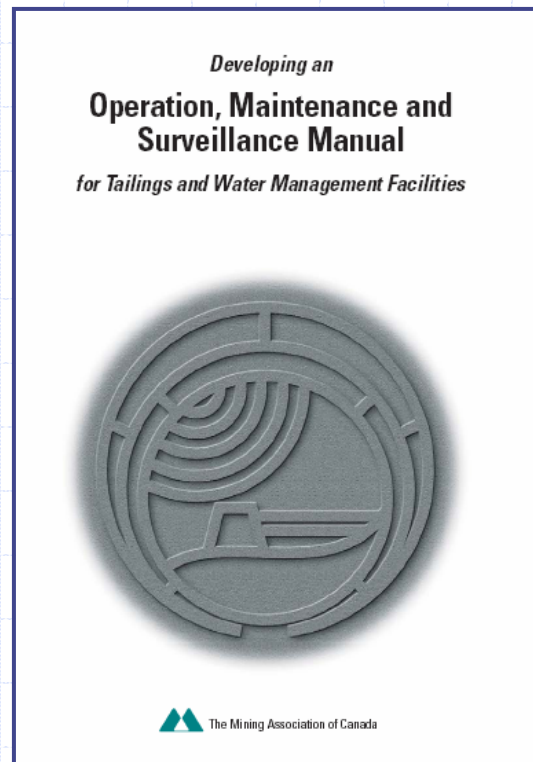
- The most visible work of the MAC Tailings Working Group has been the development of a three-volume set of guides, the Tailings Management Trilogy, to improve tailings management
 - **“A Guide to the Management of Tailings Facilities”**, initially published in 1998, updated edition to be published in 2009
 - **“Developing an Operation, Maintenance and Surveillance Manual for Tailings and Water Management Facilities”**, published in 2003
 - **“A Guide to Audit and Assessment of Tailings Facility Management”**, to be published in 2009
- All available in English, French and Spanish electronically and in hard copy



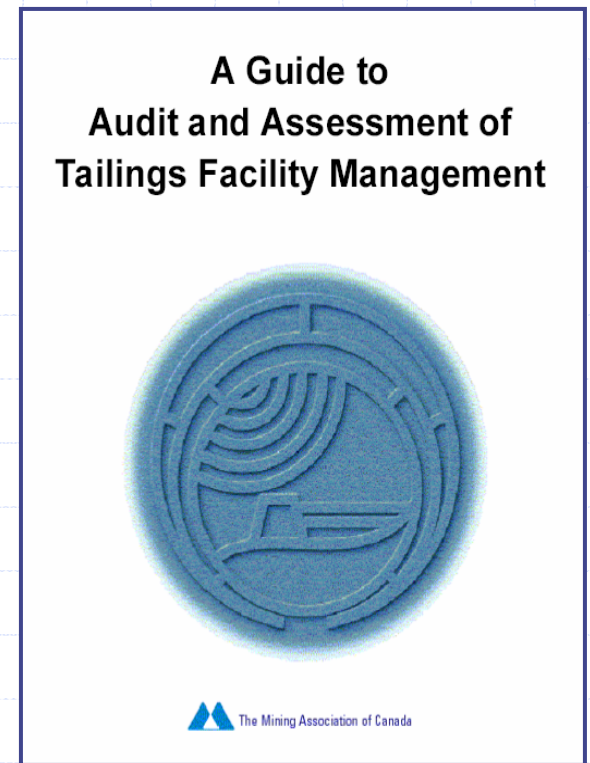
The Tailings Working Group Prepared Standards



1998
Updated 2008



2003



2008



The Tailings Management Guide

- *A Guide to the Management of Tailings Facilities* was developed to help companies implement tailings management systems that include environmental, health and safety criteria
- It presents
 - a **tailings management framework** of management principles, policies and objectives
 - **checklists** for implementing the framework through the life cycle of a tailings facility
- *Updated – publish early 2009*



The Tailings Management Framework

- The fundamental objective of the Tailings Management Framework is
 - to apply to tailings management
 - the level of discipline and thoroughness
 - that has normally been applied to engineering of tailings dams
- That is, it establishes the need for
 - identification and documentation of principles, policies, objectives, and regulatory and other criteria, including risk management, for tailings management
 - assignment and documentation of accountability and responsibility for delivery of tailings management, from senior executives to site operators
 - establishment and documentation of requirements for designing, constructing, operating and closing tailings facilities
 - establishment and documentation of requirements for approval of designs and operating procedures, and for making changes to those designs and procedures
 - planning from day one for eventual, acceptable decommissioning and closure
 - ensuring and documenting regular and periodic review and reporting of tailings management performance, in addition to technical performance
 - embedding the principle of continual improvement in tailings management

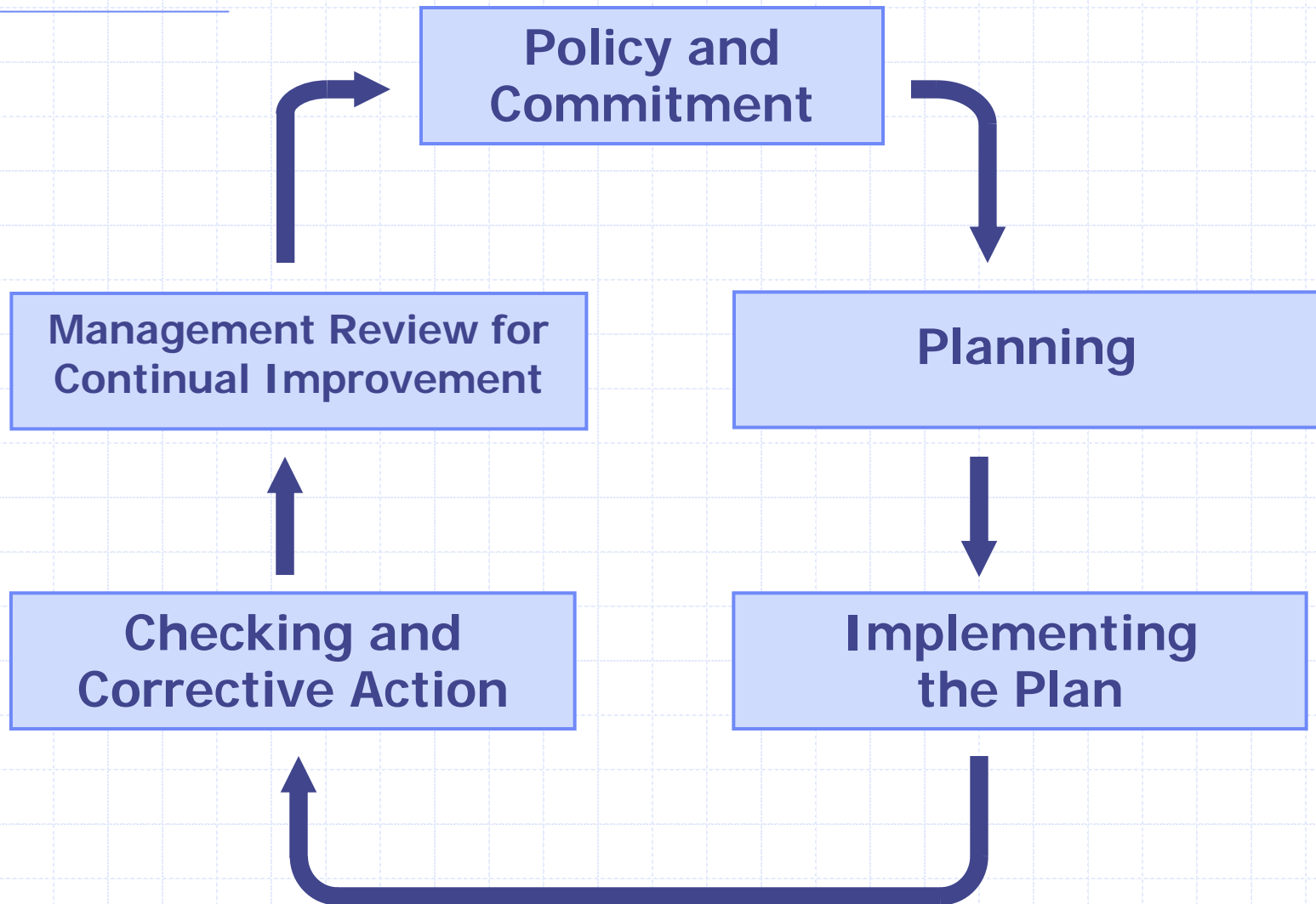


Applying the Tailings Management Framework

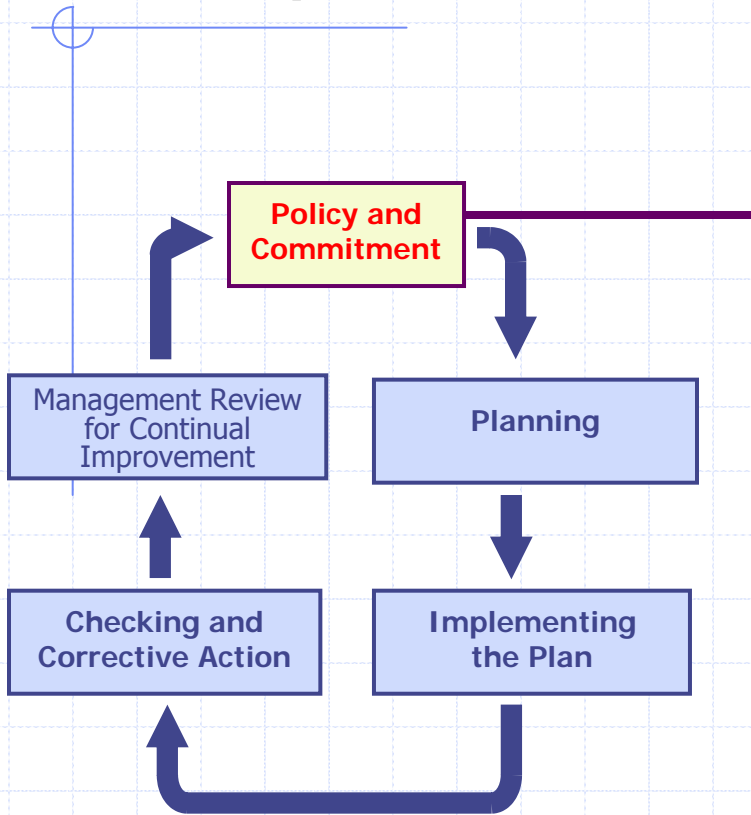
- The Framework includes a clear focus on documentation
- This is derived from the need
 - to not only do tailings management 'right'
 - but to establish a basis (documentation) to facilitate due diligence
 - And to be able to demonstrate through documented processes that tailings
 - have been ...are ...and will be managed 'right'
- It is recognized that
 - each tailings facility is unique
 - the tailings management framework must be customized to meet specific site conditions and requirements
- The *Guide* includes checklist templates to implement that customization while converting the Framework to an operable, site-specific tailings management system



A Framework to Manage Tailings Facilities



Policy and Commitment



Locate, design, construct, operate and close tailings facilities in a manner such that

All structures are stable

All solids and water are managed within the designated areas intended in the design

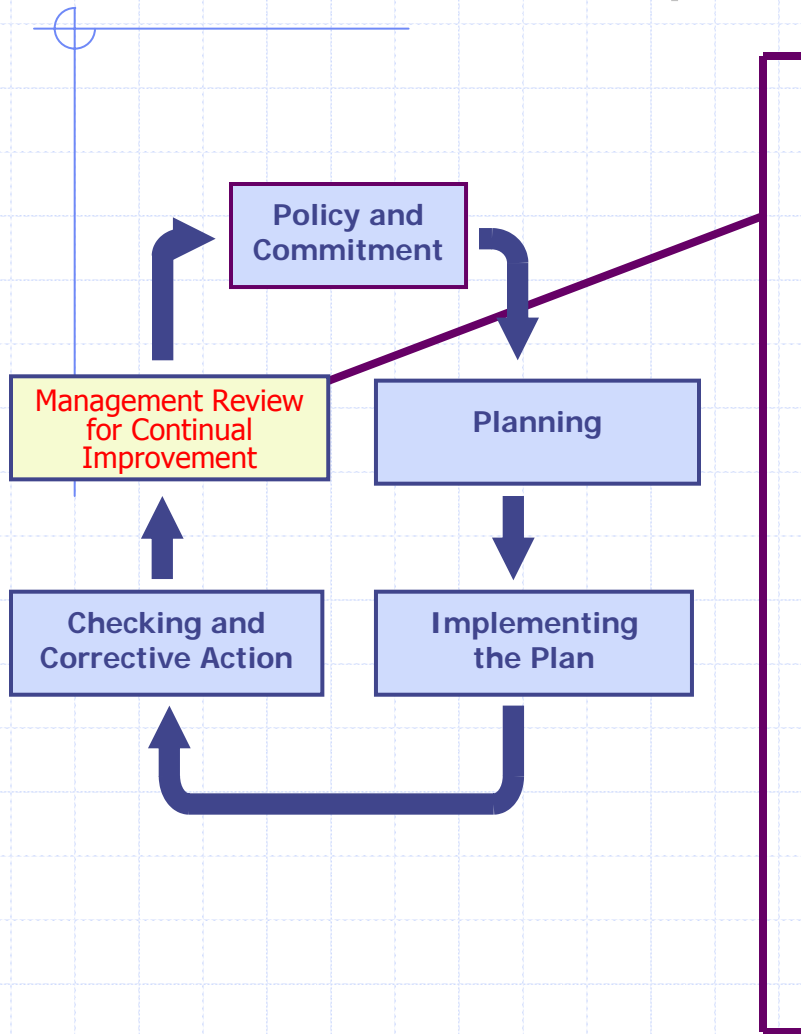
All structures are in compliance with company standards, the MAC TSM Guiding Principles, legislative requirements and commitments to stakeholders

Take responsibility through commitments and actions

Ongoing program of review and continual improvement



Management Review For Continual Improvement



Implement an annual management review of the adequacy of policies, objectives and performance of the tailings management framework

Ensure that the scope of this review is appropriate to the level of identified risk

Address possible need for changes

Encourage ongoing environmental and safety research to effect continual improvement



The Tailings Management Framework Applies Through the Full Life Cycle of a Tailings Facility

Site Selection
and Design

Construction

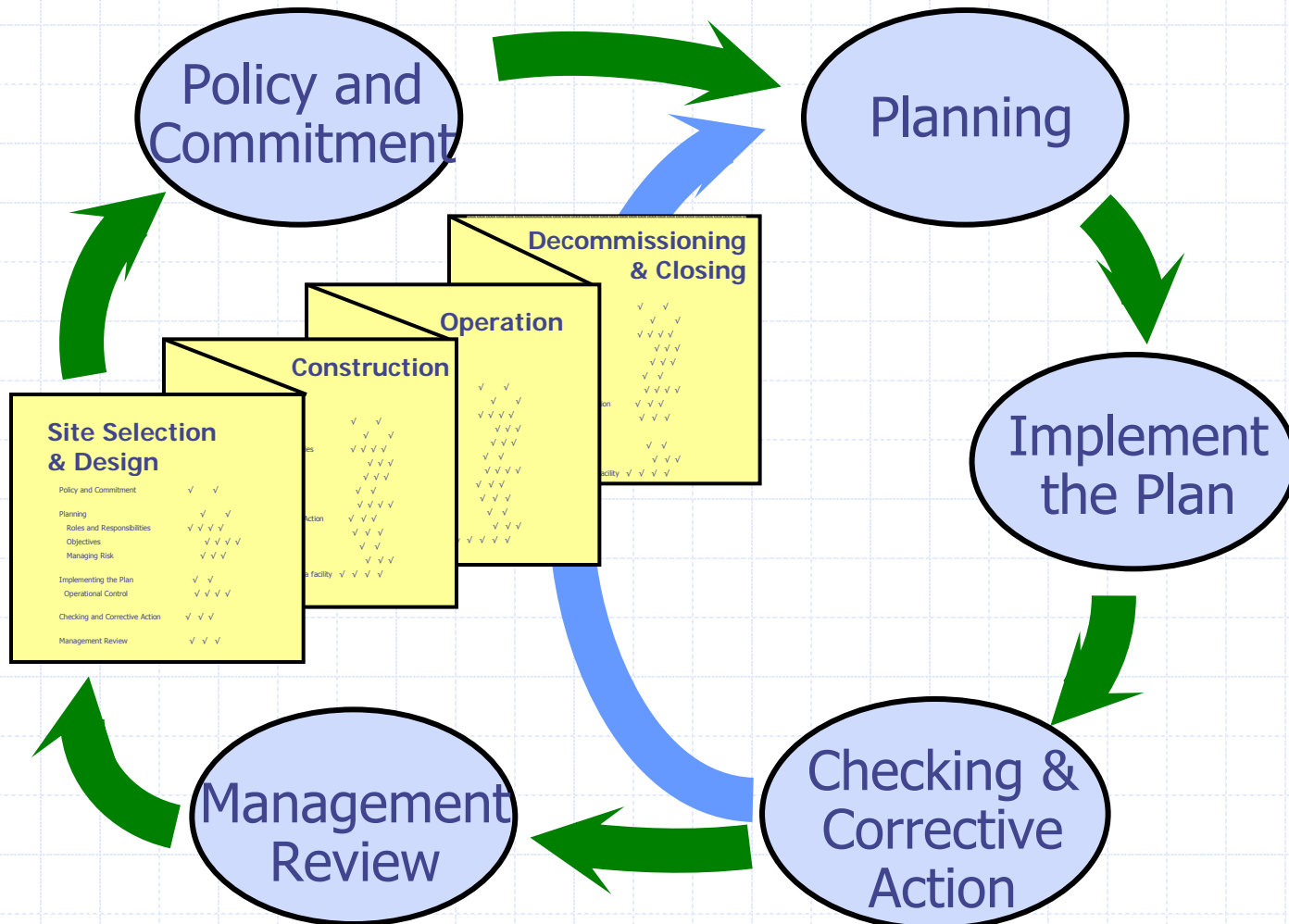
Operation

Decommissioning
and Closure

Time



Application of the Framework through the Life Cycle



How to Use the Guide - Checklists

- The tailings management framework can be applied through the full life cycle of a tailings facility
- Customized checklists are provided to facilitate customizing the Framework into a site-specific tailings management system
- Separate checklist templates are provided for
 - Site Selection and Design
 - Construction
 - Operation
 - Decommissioning and Closing



Checklist For Operating A Tailings Facility

Management Action	Responsibility	Performance Measure	Schedule	Technical Considerations	References
<i>Planning</i>					
<i>OBJECTIVES</i>					
Develop plans to operate in conformance with design, and to:					
<ul style="list-style-type: none"> meet legal requirements, operating licences, legislation, policies, codes of practice and commitments to stakeholders; integrate preparation for eventual decommissioning and closure into ongoing operations; 					
<ul style="list-style-type: none"> public health and safety; environmental impact; and information dissemination to external stakeholders. 					
For example, is there a water management plan in place?					
<i>PLANNING FOR OPERATION</i>					
Review design documents, as-built construction drawings, conceptual operating and closure plans, environmental assessment and commitments to stakeholders.				C D E	
Prepare, review and update on a regular basis detailed plans for operation of the tailings facility:					
<ul style="list-style-type: none"> water management plan; tailings deposition plan; 				C	
				C	

Assigning responsibility and authority for the management actions to individuals within the organization

Determining relevant performance measures to ensure that objectives are tracked and met

Identifying the schedule requirements

Referring to checked (✓) Technical Considerations as a basis for determining requirements, responsibilities and performance measures

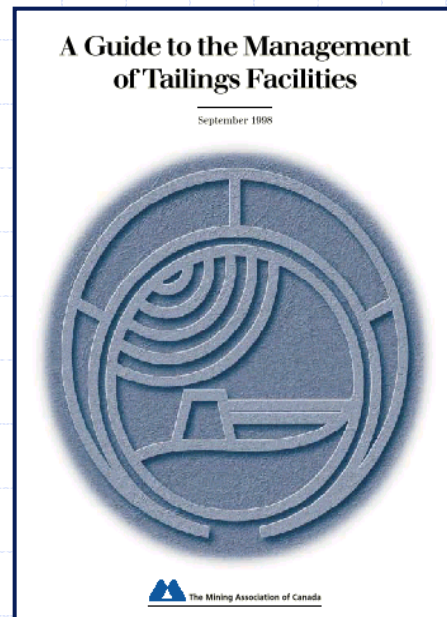
Adding references applicable to the site and operations in the form of company standards and procedures, environmental policies, regulatory and permit requirements, commitments to stakeholders and selected documentation



Using the Tailings Management *Guide*

Inputs

- Establish guiding principles
- Create a site specific framework
- Assign responsibilities
- Complete checklists



Outputs

- Gap analysis
- Formalized framework
- Management systems
- Position descriptions
- Continual improvement and environmentally responsible management of tailings
- Due diligence

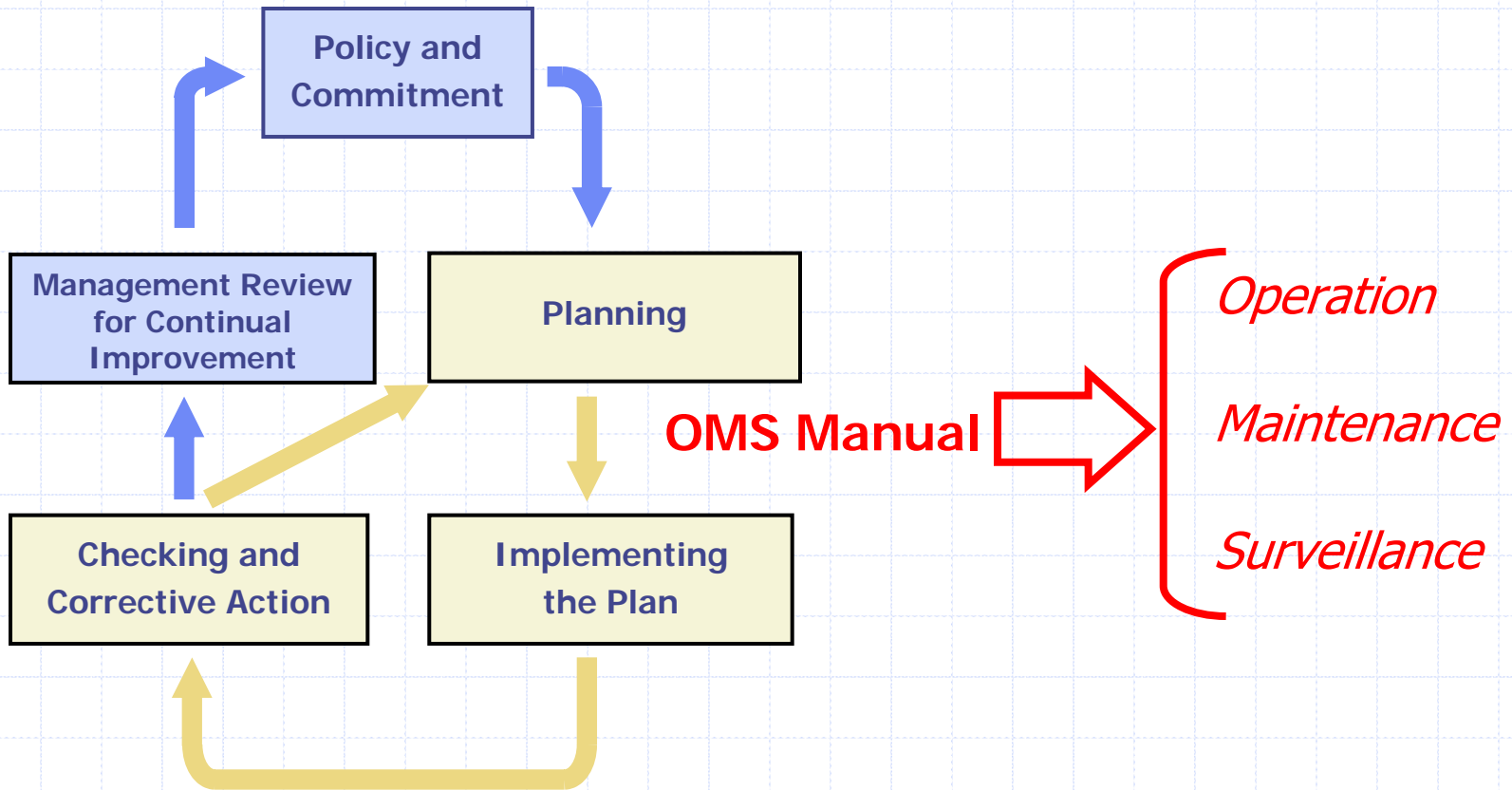


An OMS Manual

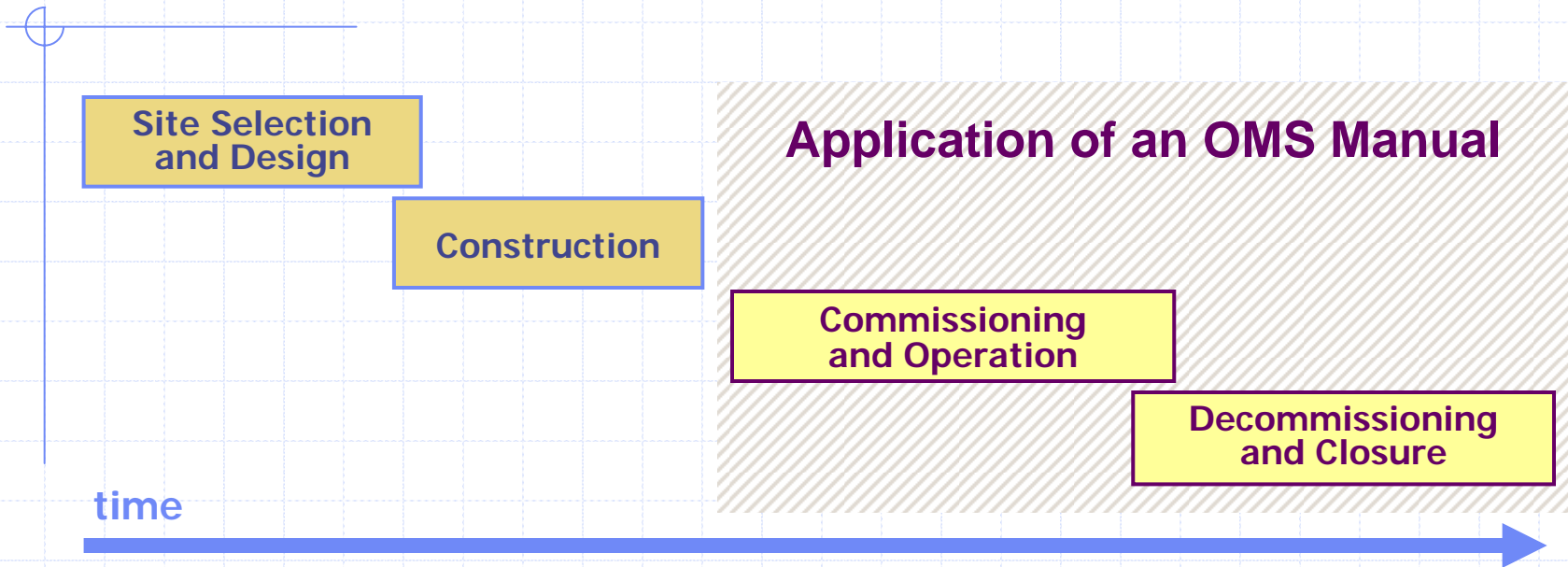
- The MAC guide **Developing an Operation, Maintenance and Surveillance Manual for Tailings and Water Management Facilities** was developed to help companies in their day-to-day tailings management, ensuring
 - roles and responsibilities of personnel assigned to the facility are defined
 - procedures required to operate, to maintain and to monitor performance (surveillance) of a facility, are documented so that the operations
 - meet regulatory and policy obligations
 - function in accordance with design
 - essential information and record-keeping requirements are identified
 - site experience is recorded so that it can be passed on to others
 - procedures and processes for managing risk ... and managing change are defined



An OMS Manual fits within the Tailings Management Framework



Planning Context for an OMS Manual



- OMS manuals should be applied at commissioning of a tailings or water management facility
- *Preparation of an OMS manual should begin with the facility design*



Outline of an OMS Manual

- Roles & Responsibilities
- Facility Description
- Operation
- Maintenance
- Surveillance
- Emergency Planning and Response



Roles & Responsibilities



Organization, Structure & Individual Responsibilities

Competency & Training

Managing Change

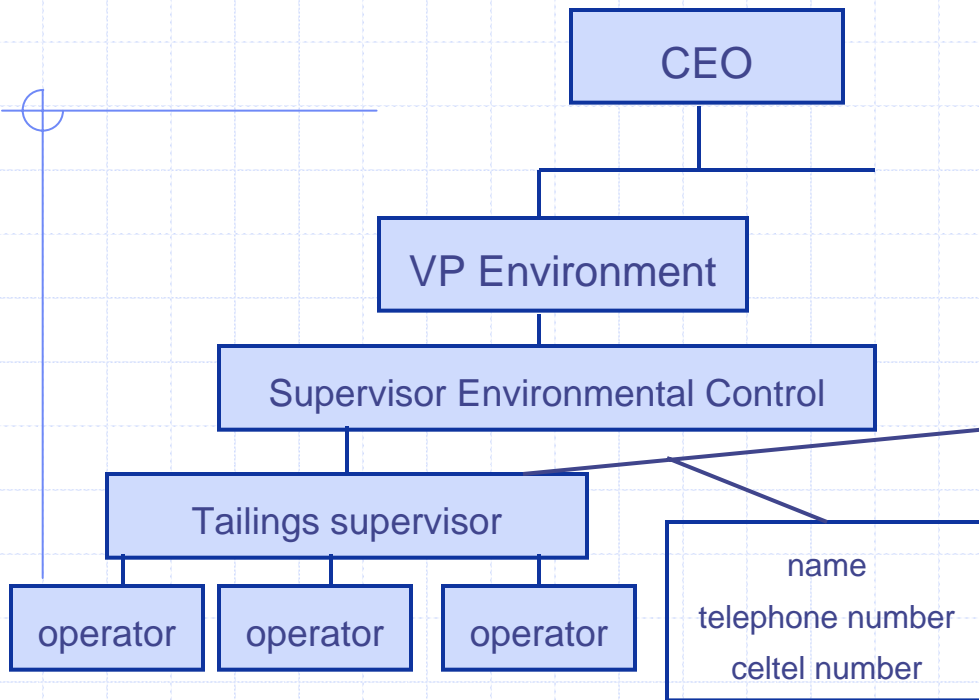
Has someone with fiscal authority been assigned responsibility?

Has the tailings management team been defined? Is a reporting protocol defined?

Is there a training program in place? Is there confirmation of the training?

Is there a system in place to track changes as people rotate?





Management Responsibilities

Reports to Supervisor Environmental Control
 Remain familiar with all aspects of FFTIS planning and operation.
 Plan tailings disposal including strategies for rehabilitation and closure.
 Delegate responsibilities to operators.

Qualifications

Professional Engineer, Technician etc.

Training

Minimum 10 years experience with operating tailings pond, Intimate knowledge with operating manual familiarity with training manual, external short course in geotechnical and hydrologic controls, OHSA, etc.

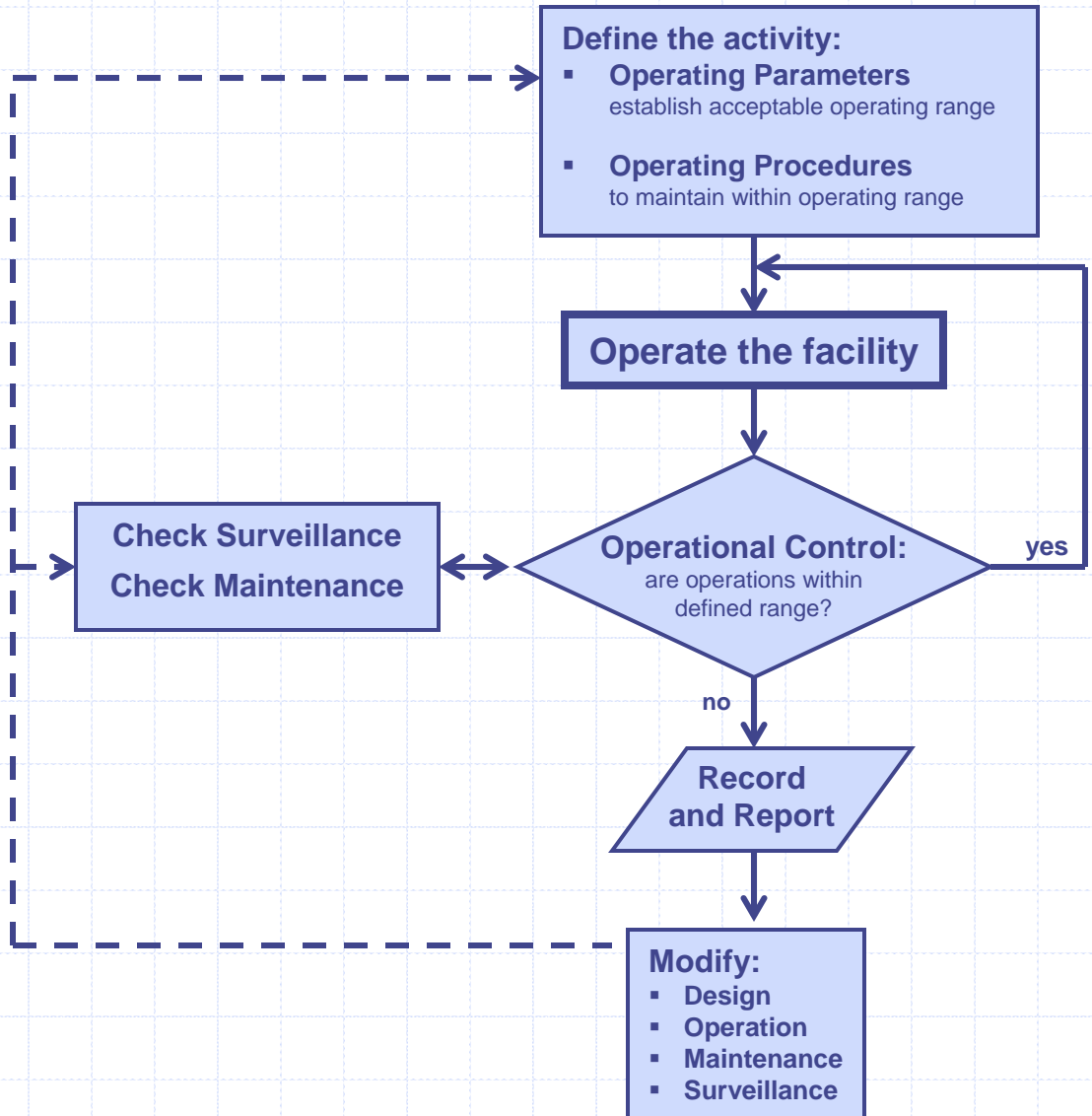
Operational Responsibilities

Coordinate activities to achieve compliance with environmental regulations.
 Development emergency contingency plans.
 ...

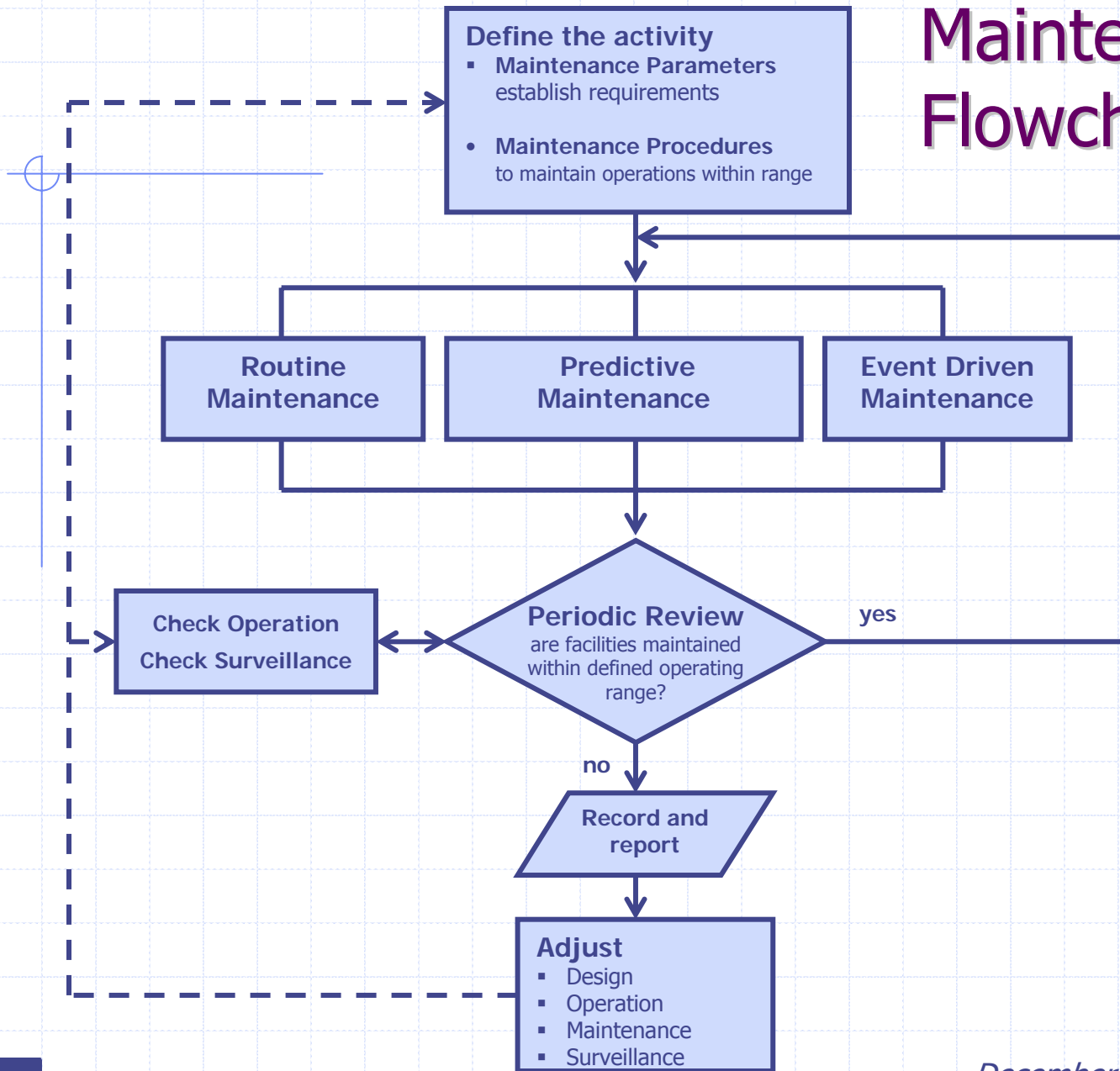


Operation Flowchart

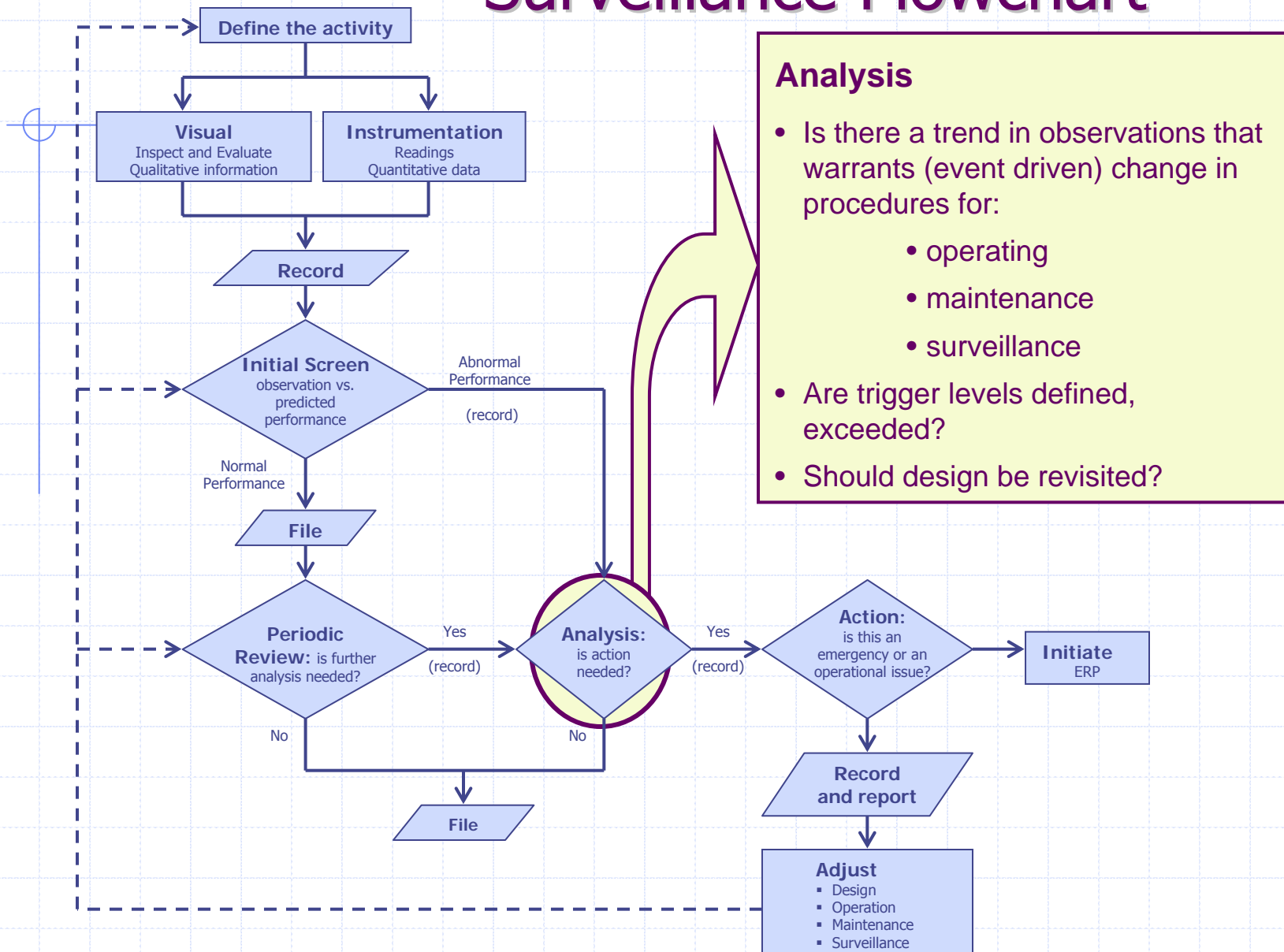
The guide provides flowcharts as a framework for each chapter of your OMS



Maintenance Flowchart



Surveillance Flowchart



Analysis

- Is there a trend in observations that warrants (event driven) change in procedures for:
 - operating
 - maintenance
 - surveillance
- Are trigger levels defined, exceeded?
- Should design be revisited?



OMS & Continual Improvement

- Development and implementation of an OMS Manual is a significant undertaking requiring involvement from individuals within, and from outside the organization; it is intended to pull together all operating criteria, parameters, and procedures related to structural integrity of the dam
- Evaluation of the OMS manual, its implementation, and its effectiveness should be incorporated into annual tailings management system reviews
- An OMS manual should be updated to correlate performance with expectations, design criteria and operating intent
 - annually, and
 - at times of significant change to facility parameters



Verification of Tailings Management

- MAC Tailings Working Group has developed a **A Guide to Audit and Assessment of Tailings Facility Management**
 - built on the Tailings Management Framework as presented in the *A Guide to the Management of Tailings Facilities*
 - includes both 'Audit' and 'Assessment' methodologies to measure the tailings management performance against the best practices contained in the *A Guide to the Management of Tailings Facilities*
 - site specific
 - step-by-step process
 - provides guidance to
 - auditors / assessors
 - operators (to prepare for an audit or assessment)
 - corporate management
 - supports
 - internal verification
 - External or 3rd party verification
 - planned publication release date – Winter 2009



Verification of Tailings Management, 2

- Two distinct and separate protocols are presented for the verification of tailings management system implementation: audit and assessment
 - **Audit** is formal, systematic and documented examination of an organization's or facility's conformance with explicit, agreed, prescribed criteria; which often include often requirements stipulated in law or regulation or, in the case of this Guide, the MAC tailings management framework
 - **Assessment** goes beyond measuring against stipulated criteria (audit), to incorporate professional judgement in an evaluation of the effectiveness, implementation, application and maintenance of a management system

- The protocols are presented as a series of questions for audit, and guiding statements for assessment, addressing the fundamentals
 - what elements of a tailings management system are in place
 - how they are organized and implemented
 - who has responsibility and accountability



Audit

- Seeks to evaluate and report on conformance or non-conformance with stipulated criteria based on the systematic collection and documentation of competent evidence
- Is not based on opinion, nor is it designed to determine root cause of deficiencies, or to evaluate management system effectiveness
- Examines the implementation of specific tailings management system components to test conformance with the MAC Tailings Management Framework
- Leads to yes / no responses to provided questions about the tailings management system



Assessment

- Starts with, and goes beyond measuring against stipulated criteria (audit)
- Incorporates professional judgement in an evaluation of the effectiveness, implementation, application and maintenance of the tailings management system
- The guide provides guidance to the rating of management process effectiveness, through illustrative examples of management process markers that
 - meet the minimum accepted threshold expectations, or
 - may be regarded as demonstrating leadership as a “best” practice
- Is driven by a concern for **quality** of system design and management process implementation
- Can identify system deficiencies and determine their root cause(s) to provide a basis for process improvement



In Summary: The MAC Tailings Management Trilogy

- Has been designed to
 - provide practical tools to help companies manage their tailings and water management facilities responsibly and safely
 - demonstrate this responsible management to regulators and the public
 - reflect the priorities of owners, managers and practitioners whose job it is to improve the safety and environmental performance of the mining industry in Canada and abroad
 - include a commitment to continual improvement in tailings management

- Provides a strong message to tailings facility owners, operators and contractors
 - the key to safe and environmentally responsible management of tailings
 - is consistent application of sound engineering capability
 - within an effective management framework
 - the guides provide the means to achieve the management side of this formula



Towards Sustainable Mining

- *A strategy for improving the mining industry's performance by aligning its actions with the priorities and values of Canadians.*
- *A process for finding common ground with our communities of interest, to build a better mining industry today and in the future.*
- *Since 2002*



TSM Guiding Principles

We will demonstrate leadership worldwide by:

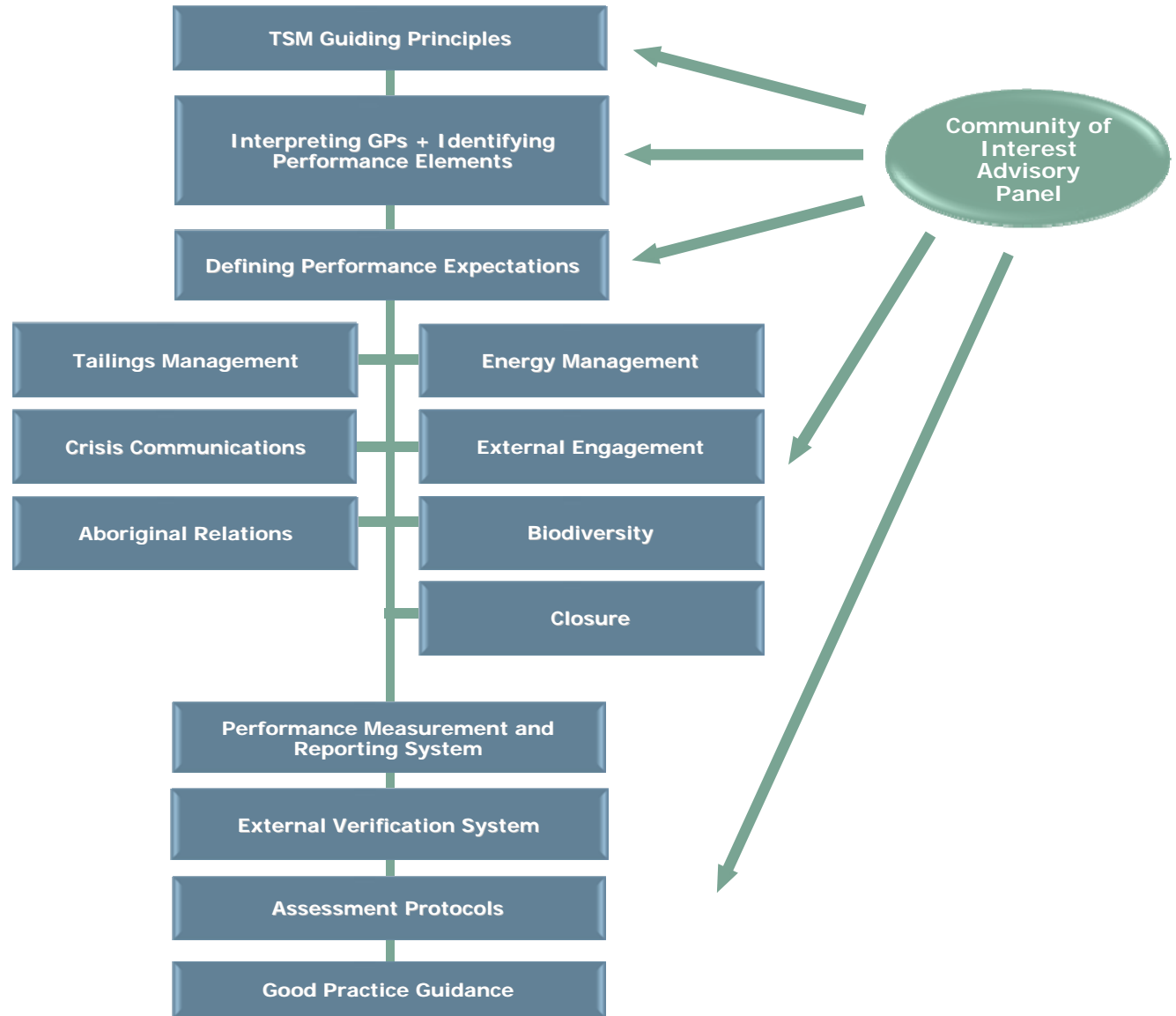
- Involving communities of interest in the design and implementation of our Towards Sustainable Mining initiative;
- Proactively seeking, engaging and supporting dialogue regarding our operations;
- Fostering leadership throughout our companies to achieve sustainable resource stewardship wherever we operate;
- Conducting all facets of our business with excellence, transparency and accountability;
- Protecting the health and safety of our employees, contractors and communities;
- Contributing to global initiatives to promote the production, use and recycling of metals and minerals in a safe and environmentally responsible manner;
- Seeking to minimize the impact of our operations on the environment and biodiversity, through all stages of development, from exploration to closure;
- Working with our communities of interest to address legacy issues, such as orphaned and abandoned mines;
- Practicing continuous improvement through the application of new technology, innovation and best practices in all facets of our operations.

In all aspects of our business and operations, we will:

- Respect human rights and treat those with whom we deal fairly and with dignity.
- Respect the cultures, customs and values of people with whom our operations interact.
- Recognize and respect the unique role, contribution and concerns of First Nation, Inuit and Metis and indigenous peoples worldwide
- Obtain and maintain business through ethical conduct.
- Comply with all laws and regulations in each country where we operate and apply the standards reflecting our adherence to these Guiding Principles and our adherence to best international practices.
- Support the capability of communities to participate in opportunities provided by new mining projects and existing operations.
- Be responsive to community priorities, needs and interests through all stages of mining exploration, development, operations and closure.
- Provide lasting benefits to local communities through self-sustaining programs to enhance the economic, environmental, social, educational and health care standards they enjoy.



TSM Program Architecture



TSM Elements and Indicators

Tailings Management	Energy Use and Greenhouse Gas (GHG) Emissions Management	External Outreach	Crisis Management Planning
Tailings management policy and commitment	Energy use management systems	Community of interest (COI) identification	Crisis management preparedness
Tailings management system	Energy use reporting systems	Effective COI engagement and dialogue	Review
Assigned accountability and responsibility for tailings management	Energy intensity performance target	COI response mechanism	Training
Annual tailings management review	GHG emissions management systems	Reporting	
Operation, maintenance and surveillance (OMS) manual	GHG emissions reporting systems		
	GHG emissions intensity performance target		



Tailings Working Group and TSM

- Under MAC's Towards Sustainable Mining (TSM) initiative, the TSM Guiding Principles have been translated into Performance Indicators that are
 - actionable
 - measurable
 - reportable and
 - verifiable
- The Tailings Working Group has developed Performance Indicators for tailings management, to assess implementation of key components of the Tailings Management Framework
- MAC members report against these Performance Indicators to assess tailings management practices across the industry



TSM Tailings Management Performance Indicators

1. Tailings management policy and commitment
2. Tailings management system
3. Assigned accountability and responsibility for tailings management
4. Annual tailings management review
5. Operation, maintenance and surveillance (OMS) manual



TSM Tailings Management Performance Assessment Criteria

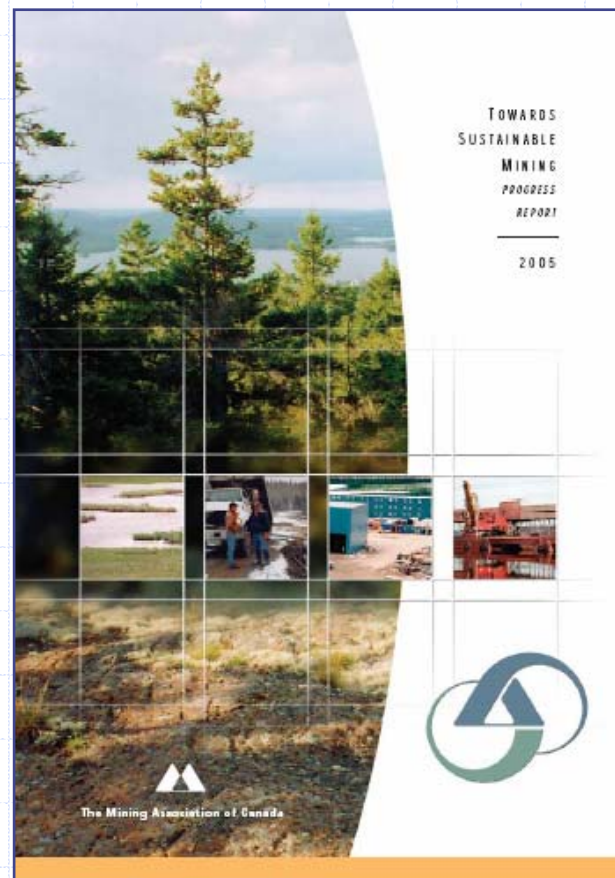
Common performance assessment criteria are applied for all tailings management
Performance Indicators

Level	Criteria
1	No systems in place; activities tend to be reactive; procedures may exist but they are not integrated into policies and management systems
2	Procedures exist but they are not fully consistent or documented; systems/processes planned and being developed
3	Systems/processes, in conformance with the tailings management framework as presented in MAC's A Guide to the Management of Tailings Facilities are developed and implemented
4	Systems/processes have been formally verified
5	Excellence and leadership is demonstrated through validation by external verification



What gets reported to the public?

- Public reporting of MAC member responses on performance indicators
 - Through MAC's TSM report (formerly the MAC Environmental Progress Report), released in January 2005
- "Aggregate" association-wide result based on TSM self assessments for all performance elements and all indicators for all member company operating facilities
- Canadian facility-level assessments also included
- Voluntary reporting of international facility performance (Inmet, IamGold and Breakwater (2009))
- Results externally verified
- 2007 data show performance improvement across majority of indicators.





➤ For additional information: www.mining.ca

