

OBJECTIVE 2

Technical

Our Objective – ‘Provide technical guidelines and training that meet and advance good practice’

Guidelines

The process of preparing a guideline requires considerable voluntary effort by a number of busy professionals over an extended period. The following sections provide an update from each of the working groups. The following key points provide a summary of the activity for this year:

- The Guidelines on Tailings Dams – Planning, Design, Construction, Operation and Closure – Revision 1 was published in July 2019.
- The Guidelines on Geotechnical Investigations of Dams, their Foundations, and Appurtenant Structures was published in May 2020.
- A Guideline on Design, Construction and Operations & Maintenance of Retarding Basins is nearing completion and will shortly be circulated for industry comment.
- The updated Guidelines on Selection of Acceptable Flood Capacity is close to final and will also be available for comment in the near future.
- Good progress has been made on the updated Guidelines on Risk Assessment with the working group actively pursuing resolution of a few difficult technical issues prior to circulating the document for comment.
- An update of the Guidelines on Dam Safety Management has also commenced.

Guideline	Status	Convenor
Design Criteria for Concrete Arch Dams	New guideline in preparation	Marius Jonker
Consequence Categories for Dams (2012)	Watching Brief	David Ryan
Dam break modelling and Consequence Assessment	New guideline in preparation	David Stephens
Dam Instrumentation & Monitoring Systems (1983)	Under review	Cassandra Turner
Dam Safety Emergency Plans and Emergency Management	New guideline in preparation	Angus Paton
Dam Safety Management (2003)	Updated guideline in preparation.	David Stewart
Design Criteria for Concrete Gravity Dams (2013)	Watching Brief	David Ryan
Design of Dams and Appurtenant Structures for Earthquake (2019)	Guideline published in 2019.	Steven O'Brien
Design, Construction, Operation of Retarding Basins-Wetlands and Large Ornamental Lakes	Draft Guideline prepared for comment by Executive Committee.	Richard Rodd
Geotechnical Investigations of Dams, their Foundations, and Appurtenant Structures (2019)	Guideline published	Robin Fell
Outlet Works for dams	New guideline in preparation.	Marius Jonker
Risk Assessment (2003)	Draft Guideline almost complete – to be circulated to reference group.	Shane McGrath
Selection of Acceptable Flood Capacity (2000)	Updated Guideline in final stages of preparation. Old version still available.	Peter Hill
Strengthening and Raising Concrete Gravity Dams (1992)	Under Review. Still available for sale.	Richard Rodd
Tailings Dams Revision 1 (2019)	Revision 1 published in 2019. Major review in light of global tailings standard underway.	David Brett
Environmental Management of Dams (2001)	Existing. Will remain for sale.	Saint Rooks
Regulation and Practice for the Environmental Management of Dams in Australia (2014)	Watching Brief to be established.	Saint Rooks

With a number of new guidelines currently under being prepared and several others under review, the contribution of convenors, working and reference groups and reviewers is significant. The strength of ANCOLD guidelines is in part derived from the wide-ranging contributions of the ANCOLD membership. These collaborative efforts ensure the breadth of industry practice is considered, contentious issues are debated and the end products are held in high regard both in Australia and on the international stage. This cannot be achieved with this significant effort and ANCOLD extends its thanks to all contributors.

Despite the increasing demands on people's time, it is encouraging to see the keen interest expressed by the large number of people willing to participate in this key and important activity of ANCOLD.

Draft guidelines are issued for comment by the membership and subject to Australian expert review before publishing. International expert review is often undertaken subject to the advice of working groups and at the discretion of the Executive. Purchase of guidelines can be made via the website or directly from the Secretariat.

Guideline Working Group Reports

Guidelines on Design Criteria for Concrete Arch Dams (New)

New guidelines are being developed to formalise the design criteria for concrete arch dams, which complement the existing Guidelines on Design Criteria for Concrete Gravity Dams (2013). The Guidelines focus only on aspects that are different in arch dams and their foundations. Over the past year, the Working Group has convened on a monthly basis via MS Teams with the current drive to review and amend the first draft to ensure it is consistent with the latest ANCOLD guidelines (Guidelines for Geotechnical Investigations of Dams, their Foundations and Appurtenant Structures (May 2020), and the Guidelines for Design of Dams and Appurtenant Structures for Earthquake (July 2019)), as well as recent publications on arch dams by FERC (2018) and on RCC dams by ICOLD (2019).

Marius Jonker

Convenor

Membership of the Working Group	Company
Marius Jonker (Convenor)	Aurecon (VIC)
Francisco Lopez	SMEC (VIC)
Dr Radin Espandar	Entura (VIC)
Technical Review Panel	
Brian Cooper	Brian Cooper Consulting (NSW)
International Expert Review	
Dr Yusof Ghanaat	Quest Structures (USA)

Guidelines on the Consequence Categories for Dams (Watching Brief)

INTRODUCTION

The current version of the Guidelines on the Consequence Categories for Dams was published in September 2012. The purpose of the guidelines is to provide a consistent method of categorising the consequences of dam failure so that resources can be allocated according to the potential effects of failure of the dam on the general community.

A Watching Brief Committee was appointed by the ANCOLD Executive in 2014 to monitor industry trends both nationally and abroad and assess the currency of the existing guidelines against any change in approach to consequence assessment.

ONGOING INVESTIGATIONS

The last amendment to the Guidelines was accepted by the ANCOLD Executive in 2015 which was also detailed in the 2015 Annual Report. Since that time, there has been no further queries on the Guidelines or identified need for further amendment.

The Watching Brief committee continues to maintain surveillance on matters associated with the guideline and is willing to accept any suggestions or comments that may assist with ensuring the guidelines reflect current industry trends..

David Ryan

Convenor

Membership of the Working Group	Company
David Ryan (Convenor)	Stantec, Australia

Guidelines on Dambreak Modelling and Consequence Assessment

Significant progress has been made on first drafts of a number of sections of the dambreak modelling and consequence assessment guidelines. The first section of the document (focused on dambreak modelling) is largely complete, and progress is being made on subsequent sections relating to consequence assessment. A reference group composed of 16 representatives from dam owners, regulators and consultants has also been assembled and will start to provide input on draft sections over the coming months.

David Stephens

Convenor

Membership of the Working Group	Company
David Stephens	HARC
Michel Raymond	Seqwater
Michael Smith	Watercorp
Andrew Northfield	HARC
Kevin Bartlett	DEWS
Rob Fowden	DEWS
Tim Rhodes	SMEC

Technical Review Panel

There is a reference group of 16 people representing a mix of dam owners, consultants and regulators across all states.

International Expert Review

To be determined

Guidelines on Dam Instrumentation & Monitoring Systems (Watching Brief)

The Watching Brief for the Dam Instrumentation and Monitoring Systems Guidelines (1983) was established following the Dam Instrumentation Workshop and continues to scan for information and topical developments related to the monitoring of dams using a range of instrumentation techniques.

Whilst the 1983 guidelines were comprehensive for their time, they are also the oldest ANCOLD guidelines and celebrated their 37th anniversary this year. They still present a reasonable framework for dam instrumentation and contain useful factual information on the instrumentation of that era, much of which is still generating data at existing dams.

It is felt that the guidelines could be updated to reflect new technologies available, and developments in real time remote monitoring of dams, but no work on this has commenced, pending the outcomes of the update of the 2003 Guidelines on Dam Safety Management, which are closely linked. A Working Group formed in April 2017 to look at reviewing and updating Dam Safety Management Guidelines. This working group will include consideration of the linkages between the two documents, and the future of the Dam Instrumentation and Monitoring Systems Guidelines.

Convenorship of this working group will be transferred from Chris Topham to Cassandra Turner of Hydro Tasmania subject to endorsement by the ANCOLD Executive. Any members wishing to contribute papers, views, or information to the watching brief should contact Cassandra Turner at Cassandra.Turner@hydro.com.au.

As it is still considered a relevant document, the 1983 version of the guideline has been reprinted and can be purchased via the online shopping cart on the Guidelines page.

Cassandra Turner

Convenor

Membership of the Working Group	Company
Cassandra Turner	Hydro Tasmania

Guidelines on Dam Safety Emergency Plans and Emergency Management

Good progress has been made in drafting the guideline sections following the new structure. Work has started to incorporate these sections into a single draft document ready for the Reference Group to review later this year..

Angus Paton

Convenor

Membership of the Working Group	Company
Angus Paton	Murray-Darling Basin Authority
John Tibaldi	Seqwater
Siraj Perera	Department of Environment, Land, Water and Planning
Jonathon Reid	SMEC
Neil Smith	Hydro Tasmania
Reference Group	
The membership of the Reference Group is to be reviewed.	
International Expert Review	
To be decided	

Guidelines on Dam Safety Management (Updating Guideline)

The ANCOLD Guidelines on Dam Safety Management were published in 2003 and have become the cornerstone for good practice in dam safety management in Australia and are widely used and cited internationally. While the intention of the current review is to update the Guidelines, they remain very relevant and outline the basis for good dam safety management practice.

There have been a number of changes in industry practice since the original guidelines was produced and these will be reflected in the current revision. These include:

- A strengthening focus on governance and management arrangements for dams including some changes in regulatory environments and the consideration of dam safety management systems;
- The increased use and acceptance of risk-based approaches to dam safety management, specifically for surveillance and monitoring activities;
- Recognition of the use of electronic based systems for data and record storage including the use of integrated asset management systems by many dam owners;
- Developments in dam break, consequence assessments, risk assessment and safety reviews; and
- Relationships with existing and planned ANCOLD Guidelines.

Consideration is also being given to separating the guidelines into the technical aspects of a dam safety program and the broader governance responsibilities of dam management. The proposed revision will also consider changes to dam safety regulatory arrangements, the issues raised and covered by various state-based dam safety guidelines and lessons learned from recent legal cases.

The Executive has been asked to consider the proposed form of these revisions and confirm members of a suitable working group to complete the revision of the guidelines.

David Stewart

Convenor

Membership of the Working Group	Company
To be confirmed by Executive	
Reference Group	
To be confirmed by Executive	
International Expert Review	
To be confirmed by Executive	

Guidelines on the Design Criteria for Concrete Gravity Dams (Watching Brief)

INTRODUCTION

The current Guidelines on the Design Criteria for Concrete Gravity Dams were published in September 2013. A Watching Brief Committee was appointed by the ANCOLD Executive the following year to monitor industry trends both nationally and abroad and assess the currency of the existing guidelines against any change in approach to the design criteria we have adopted.

ONGOING INVESTIGATIONS

In the last twelve months, no query or request for change to the document by ANCOLD members or users of the Guidelines has been received. However, the committee is willing to accept any comments on the Guidelines for future consideration.

Surveillance on matters associated with the guidelines, including progress on relevant ICOLD Bulletins will continue to be maintained.

David Ryan

Convenor

Membership of the Working Group	Company
David Ryan (Convenor)	Stantec, Australia
Michael Somerford	Water Corporation, West Australia

Guidelines on Design of Dams and Appurtenant Structures for Earthquake

The update last year documented the revised guideline process and included that the revised guideline was issued in June 2019 and is available for purchase.

As the revised guideline has been issued there are no updates this year.

Steve O'Brien

Convenor

Membership of the Working Group	Company
Steven O'Brien (Convenor)	AECOM

Guidelines on the Design, Construction, Operation of Retarding Basins- Wetlands and Large Ornamental Lakes (New Guideline)

After several periods of inactivity, the Draft of the Guideline is with the ANCOLD Executive for comment prior to being published. It should be available during the final quarter of the year.

Richard Rodd

Convenor

Membership of the Working Group	Affiliation
Mark Arnold	Melbourne Water
Norm Himsley	Consultant
Kelly Maslin	Jacobs
Richard Rodd	Richard Rodd & Assoc. P/L
Technical Review Panel	
Phil Cummins	
International Expert Review	
Not Required	

Guidelines on Geotechnical Investigations of Dams, their Foundations, and Appurtenant Structures

The Guideline is complete and was published in May 2020.

The Working Group has finished its work and can be disbanded.

Robin Fell

Convenor

Membership of the Working Group	Company
Emeritus Professor Robin Fell, Chairman	School of Civil and Environmental Engineering, University New South Wales, Sydney
Dr Gavan Hunter	Technical Director Dam Engineering, AECOM, Melbourne
Mr Paul Southcott	Specialist Civil Engineer, Entura, Hobart.
Mr Geoff Eades	Consulting Engineering Geologist (retired), Brisbane.
Mr Alan Moon	Consulting Engineering Geologist, Adelaide.
Mr Andrew Barclay	Principal Engineering Geologist, GHD, Canberra.
Mr Deryk Forster	Principal Engineering Geologist, SMEC Australia, Brisbane.
Mr Barton Maher	Principal Engineer Storage Planning, SEQWater, Brisbane.
Mr Neil Smith	Dam Safety Manager, Hydro Tasmania, Hobart.
Mr Richard Rodd	Richard Rodd and Associates, Albury/Wodonga.
Technical Review Panel	
Mr Philip Cummins	Consultant
Mr Alan White	Senior Engineer Dam Safety, TasWater
Mr Norm Himsley	NSW Dams Safety Committee and Consultant
International Expert Review	None required

Guidelines on Outlet Works for Dams (New)

New guidelines are being developed on outlet works for dams. The guidelines comprise a suite of ten standalone Practice Notes that cover the design, procurement, construction, installation, commissioning, operation, maintenance, rehabilitation, upgrade and risks of dam outlet works. In addition, the Practice Notes cover the civil, structural, mechanical, electrical and control elements in outlet works systems. The Working Group has prioritised the Practice Notes with the current drive during monthly Skype and Teams meetings over the past year, to complete the Practice Notes on Rehabilitation, Modernization & Upgrade, the Practice Notes on Operation & Maintenance, and the Practice Notes on Outlet Works Risks.

Marius Jonker

Convenor

Membership of the Working Group	Company
Marius Jonker	Aurecon (VIC)
Glen Hobbs	Glen Hobbs & Associates (NSW)
Frank Nitzsche	GHD Pty Ltd (NSW)
David Law	Entura (TAS)
Reference Group	
Brian Simmons	WaterNSW
Charlie Curro	Department of Public Works (NSW)
David Ryan	Stantec (QLD)
Rod Mauger	Australian Asset Engineering (VIC)
Trevor Lange	Goulburn-Murray Water (VIC)
Alex Gower	Water Corporation (WA)
Additional Members	
Pieter van Breda	Project Manager
Michel Raymond	Executive Committee Liaison
Technical Review Panel	
Marty Gross (Electrical)	Retired from Hydro Tas (TAS)
Brian Cooper (Civil)	Brian Cooper Consulting (NSW)
International Expert Review	
Vacant	

Guidelines on Risk Assessment

Immediately prior to the 2015 Annual Conference a workshop was held to seek feedback from Members on the proposed content for the updated Guidelines on Risk Assessment.

Several submissions were subsequently received and the Working Group met to consider them in February 2016. Progress by the working group since that time has been mixed and the completion of responses to feedback and development of the draft update has been considerably delayed.

However, I am now able to report that the draft Guideline will be issued to the reference group for its consideration and feedback in the near future. Once this process has been completed, the draft will be finalised for the Executive.

Shane McGrath

Convenor

Membership of the Working Group	Company
Shane McGrath	SGM Consulting
Malcolm Barker	GHD
Emeritus Professor Robin Fell	UNSW Global Consulting
Mark Foster	AECOM
Peter Hill	HARC
Len McDonald	Retired

Reference Group	
Graeme Bell	Siraj Perera
Peter Allen	Michael Somerford
Gamini Adikari	Angus Paton
Mark Arnold	Paul Southcott
Andrew Reynolds	Barton Maher
Ian Landon-Jones	David Ryan
Chris Topham	Andrew Richardson
Kelly Maslin	Bruce Duncan
Brian Cooper	Glen Hobbs

International Expert Review

The Executive has determined that international review is not required for the update of this guideline.

Selection of Acceptable Flood Capacity (Revised Guideline)

The ANCOLD Guidelines on Selection of Acceptable Flood Capacity (AFC) were published in 2000 and provide guidance on the selection of design flood capacities for dams. A Working Group was established in early 2014 and is supported by a Reference Group representing owners, consultants and regulators from around Australia.

To date the revision has involved:

- Working Group prepared a discussion paper on the proposed scope of the revision
- Workshop held with Reference Group in October 2014 to review the discussion paper
- Workshop held at the November 2015 ANCOLD Conference to outline the principles of the revision and test the proposed changes.
- Working Group then incorporated the feedback from the workshop and prepared a full draft of the new guideline
- full draft guidelines were reviewed by the Reference Group in mid-2016 and feedback incorporated
- an overview of the guideline was presented at the 2016 ANCOLD Conference Workshop
- the draft guideline was reviewed by the 2 Australian peer reviewers in early-2017 and feedback incorporated
- the updated draft was then reviewed by Reference Group
- Completed a full draft which addressed final comments by Reference Group

Development of the guidelines slowed over the last couple of years, however the draft guidelines are now available for final review by the International Peer Reviewers and the broader ANCOLD community.

Peter Hill

Convenor

Membership of the Working Group	Company
Peter Hill	HARC
Fiona Ling	WMAwater
Michel Raymond	Seqwater
Andrew Reynolds	Murray-Darling Basin Authority
Michael Somerford	Water Corporation WA
Reference Group	
Peter Allen	Queensland Department of Energy and Water Supply
Mark Arnold	Melbourne Water
Malcolm Barker	GHD
Peter Cloke	NSW Urban Water Services
Janice Green	Bureau of Meteorology
Norm Himsley	Consultant, formerly NSW Dams Safety Committee
Barton Maher	Seqwater
Joe Matthews	Southern Rural Water
Shane McGrath	SGM Consulting
Nanda Nandakumar	WaterNSW - died May 2020
Angus Paton	Murray-Darling Basin Authority, formerly SA Water
Siraj Perera	Victorian Department of Environment, Land, Water and Planning
Michael Thornton	Snowy Hydro Limited
Independent Reviewers	
Rory Nathan	University of Melbourne
Phil Cummins	Australian Dams and Water Consultants

Guidelines on Tailings Dams - planning, design, construction, operation and closure)

The revisions to the guidelines were published in November 2019. The committee is now preparing for further major review due to the recent publication of the Global Tailings Standard (GTS) and pending ICMM and ICOLD guidelines. Expressions of interest have been called for volunteers for the working group and also an expanded Tailings Interest Group. The intention is to reinvigorate the working group and broaden the involvement of stakeholders. We have had a good response and the current working group will be considering potential changes leading up to the AGM.

Following a high level review of the GTS I am pleased to say that Australian practice/guidelines and regulatory requirements already align very well with the GTS and I don't think there will be any major upheaval to practice typically already followed by Australian miners.

From a technical view-point our ANCOLD Guidelines already address most of the issues identified in the GTS and are potentially more stringent in some design parameters. There are some governance matters which are potentially different to practice in smaller miners but once again, these are already generally covered in our guidelines but sometimes with different terms being used. Some key items are described below:

- **Project Definition (3.2)** – New projects are to be assessed on the basis of multi-criteria analysis (MCA) to consider sites, technologies and strategies with the aim of minimising risk to people and minimising above ground storage. The MCA needs to be endorsed by the accountable executive. This clause is aimed at attempting to make sure that decisions are based on properly considering risks and not necessarily always going with cheapest option. This practice would be generally used already in industry so should not have too much impact;
- **Consequence Classification (4.1)** - The table of Consequence Classification is pretty much directly in line with Australian guidelines (as ANCOLD have been involved with assisting GTS with the development). There is some difference with the High A, High B and High C consequence categories used in Australia being replaced by

High and Very High. This will mean some slight change to classification for dams currently assessed as High B and High A, which are likely to be reclassified as Very High. There could be cases where High B is dropped to High and High A increases to Extreme. Overall this is unlikely to change the designs in any material way. A potentially challenging issue could be the judgement of “credible failure modes” under the GTS whereas the Australian system assumes failure from any cause to assess consequence classification. This could lead to lower consequence classifications if operators could argue that failure was not credible. This issue is being reviewed by ICOLD and will eventually be considered by ANCOLD in any updating of our guidelines;

- **Design Basis Flexibility (4.2)** – The GTS requires designs to be based either on the Extreme Classification or to be assessed to demonstrate that any design to a lower classification can be upgraded to meet Extreme requirements in a feasible manner. This could be problematic for some operations, but is covered somewhat in existing ANCOLD guidelines which require tailings dams to meet extreme design parameters at closure;
- **Design Loadings (Table 2 and Table 3)** - there is some departure from the current Australian design practice with the design loadings provided in Tables 2 and 3. Flood design requirements are lower than Australian requirements for High, Very High and Extreme. Earthquake design requirements are similar but worded differently. In both cases the GTS provides the requirement that local jurisdictions will apply so this shouldn't cause concern. ANCOLD will most likely consider the need for any update in due course.
- **Design for brittle, contractive materials (4.6)** – the GTS requires conservative parameters;
- **Closure Planning (5.6)** – The GTS requires closure planning to confirm feasibility. This could mean more detailed closure planning than currently done by many operators. However, this has been a focus of Australian guidelines and shouldn't be a surprise.
- **Governance (Topic V)** – There is a strong governance focus to the GTS with Accountable Executive (AE), Responsible Tailings Facility Engineer (RTFE), Engineer of Record (EoR) and Independent Tailings Review Boards (ITRB), defined. These roles have been identified in Australian guidelines, albeit with different terms used. However, these requirements may be now put more strongly and could lead Australian operators to review their governance structure, which could lead to stresses on the existing technical capacity in Australia with increased demand for services. It is noted that several Australian operations are already developing EoR structures.
- **Risk Assessment (10)** – The GTS has a focus on risk management and requires a multi-disciplines team to undertake a formal risk assessment at least every 3 years. This is common practice but not so specifically defined in guidelines;
- **Dam Safety Reviews (DSR)** – The GTS requires Dam Safety Reviews at least every 5 years. In Australian terms a DSR is similar to a Comprehensive Inspection specified to be every 2 years for High or above or 5 years for Significant Consequence Classification. This might be another matter which ANCOLD is likely to address but should not be different to typical practice already in Australia.
- **Training** – The GTS puts a lot of emphasis on the need for training and there are various options emerging within the industry in Australia for trainings at various levels.

In summary, there are some minor new issues to be considered by Australian operators in meeting the requirements of the GTS but nothing that jumps out as of major concern or difficulty.

Looking forward to robust discussions of these issues over the next 12 months

David Brett

Convenor

Membership of the Working Group	Company
David Brett, (Convener)	Senior Technical Director, Water and Waste Management - GHD Pty Ltd
Imran Gillani	Principal Adviser, Tailings, Technology and Innovation - Rio Tinto
Keith Seddon	Principal Engineer - ATC Williams Pty Ltd
Norm Himsley	Consultant and Member - NSW Dam Safety Committee
Dr Bruce Brown	Chief Adviser, Tailings and Dams, Technology and Innovation - Rio Tinto
Professor Andy Fourie	Professor of Civil Engineering - The University of Western Australia
Professor David Williams	Professor of Geomechanics - The University of Queensland
Jiri Herza	Technical Director - GHD Pty Ltd, Australia
Faye Akbar	Principal Advisor – Tailings & Dams, Growth & Innovation, Rio Tinto
David Reid	Research Fellow, University of Western Australia
Justin Willis	Superintendent Dams, Responsible Dam Engineer TRS Olympic Dam, BHP
Jay Ranasooriya	Senior Geotechnical Engineer, Mines Safety Directorate, WA
Reviewers	
John Phillips	Principal Engineer - GHD Pty Ltd, Australia
Rob Williamson	Technical Consultant - Knight Piesold, South Africa
Annika Bjelkevik	Director – Tailings Consultants Scandinavia AB, Sweden
Harvey McLeod	Vice President - Klohn, Crippen Berger, Canada

Regulation & Practice for the Environmental Management of Dams in Australia

There was no update on this guideline in 2019/20.

Saint Rooks

Convener