

# Legislative Requirements for Councils Dams Safety

by

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# Local Government Act

- 1974 Local Government Act amended to include “Safety of Dams Amendment”
- Enabled the then Minister for Public Works to make available a service to councils re:
  - Construction of new and mods to existing dams
  - Safety & Surveillance of dams

# Briseis dam failure 1922 Tas Only fatal dam failure in Oz



# LGA 1974 Amendment

- To be implemented through Public Works to develop a policy for this
- Policy covered providing FREE annual inspections by a dams engineer
- Compulsory review and approval of Concept Design Reports for dams
- Safety reviews at 5 year intervals to determine if dam needs upgrading .
- Development and implementation of a Dam safety Management program

# Inspections by **COMPETENT** Inspection Engineer is Vital



# LGA Dams Safety

- This was all before the Dams Safety Act of 1978!
- The standards worked to were from ANCOLD (Australian National Committee on Large Dams)
- An Inter-departmental Committee (IDC) consisting of all the heads of Government dam owning authorities was set up to review the dams

# Interdepartmental Committee

- This was to be chaired by the REPRESENTATIVE of Public Works who had the knowledge of all the Council dams
- Would help ensure safety and equity of treatment of Council dams
- They would deliberate on the Safety reviews and check them against DETERMINISTIC standards
- Operation and maintenance was (and is) still Council's responsibility

# Deficient Dams

- When a deficiency was Identified then Public Works would help to organise its being addressed
- PART funding was provided by the Treasury to cover the costs of upgradings
- First major upgrading was Dungowan dam



# First Council dam Upgrade



# Dams Safety Act 1978

- After tragic dam failures in the USA the state Government set up the Dam Safety Committee (DSC).
- This was developed from the previous Inter-Departmental Committee and consisted of representatives of each large dam owning authority in NSW.
- The objective of the Act was to ensure the safety of all prescribed dams under the Act, ie those whose failure would have major consequences.
- The Public Works member was supposed to be the Council representative

# Teton Failure



# Dams Safety Act

- It maintains a watch over owners dams by requiring surveillance reports at 5 year intervals. These were very similar to the IDC's safety reviews
- Deficiencies were highlighted and recommendations made and endorsed
- DSC was effectively the regulator and they set the standards required, based on ANCOLD which were largely based on US practise

# DSC Standards

- These were based on hazard ratings, ie the potential for death in the event of failure
- They made NO allowance for the MAGNITUDE of death. Thus a small Council dam with one family downstream was made to have the same level of standard as Warragamba dam.
- The standards were deterministic and no allowance was made for the risk of failure.
- This was begun to be amended when the illogicity was pointed out by Peter MacKenzie (of PWD) and the DSC and ANCOLD SLOWLY moved to risk based criteria

# DSC

- Members were nominated by the relevant Minister, based on their EXPERTISE in dams
- DSC had very small staff numbers whose responsibility it is to review incoming reports and submit summaries to the surveillance sub-committee (SSC).
- The SSC would then review the reports and summaries and make recommendations to the DSC who meet 9x/year

# DSC 2

- Heinrichs was invited onto the SSC in 1992 as a token Council rep and based on his expertise on council dams.
- When Public Works was split up in 1994 there was no longer a Council voice on the DSC although there was still a Public Works rep based on his dams consulting role with PWD's Dams & Civil group.
- By 1994 council dams were assisted by the then CALM's dams surveillance group as "Engineer" to Councils and the DSC was the "watchdog"

# 1993 LGA Amendment

- The 1974 Act was amended, and although inspections were not specifically required under the Act, it was claimed the powers of the Dams Surveillance group were strengthened.
- Section 60 approvals were required for new or modifications of dams at concept design stage
- Free inspections were still carried out as policy
- Some prescribed Flood Retarding basins were included in the program



# Risk Assessment

- Mackenzie, chairman of ANCOLD, organised a workshop in 1994 on acceptable risks for major infrastructure
- This followed the publication of ANCOLD's first Risk assessment guidelines (1994).
- These were updated in 2003 and the DSC indicated a willingness to incorporate partially the concept of risk assessment as an alternative to deterministic methods.

# Guidelines on Risk Assessment

October 2003



Australian National  
Committee on  
Large Dams Inc.



# ANCOLD

- ANCOLD also published guidelines on:
  1. Acceptable flood capacity
  2. Consequence Category assessment
- These guidelines REDUCED the deterministic requirements and allowed Risk Assessment as well, BUT

The deterministic (fallback) flood requirements were given as a range of probability events based on Consequence Category

# Consequence Category

Population at Risk	Severity of Damage and Loss			
	Negligible	Minor	Medium	Major
0	Very Low	Very Low	Low	Significant
1 to 10	Low Notes 1 and 4	Low Notes 4 and 5	Significant Note 5	High C Note 6
11 to 100	Note 1	Significant Notes 2 and 5	High C Note 6	High B Note 6
101 to 1000		Note 2	High A Note 6	High A Notes 6
>1000			Note 3	Extreme Note 6

# Vajont dam



# Vajont dam Consequence zone

## VAIONT ROCKSLIDE



The Town of  
Langaronne  
Before The  
Rock Slide



The Town of  
Langaronne  
After The  
Rock Slide



# DSC Guidelines

- The DSC produced its “Fallback” rules based on ANCOLD BUT adopted the conservative end of ANCOLD’s range which was about 10x more stringent.

FALLBACK FLOOD CAPACITY.

<u>IFHC RATING(i)</u>	<u>FLOOD AEP</u>
Extreme	PMF(ii)
High A	PMP Design Flood (ii)
High B	10 <sup>-4</sup> to PMP Design Flood or 10 <sup>-6</sup> , (ii)
High C	10 <sup>-4</sup> to PMP Design Flood or 10 <sup>-5</sup> , (iii)
Significant#	10 <sup>-3</sup> to 10 <sup>-4</sup>
Low*/Very Low	10 <sup>-2</sup> to 10 <sup>-3</sup>

# Some Good Justification for Conservatism

Length of Rainfall	Estimated PMP (mm)	Actual Heaviest Recorded Last 100 years (mm)
1 hour	300 - 400	175 Gosford
3 hours	400 - 700	300
6 hours	540 - 900	520 Dapto
1 day		900 Dorriggo





# DSC Approach

- Formulated a “balanced view” position paper on subject to go to Government in early 2004.
- Proposing staged implementation of risk aligned policies as an enhancement to standards-based policies.
- Risk framework to be based on Aust/NZ Standard 4360:1999 & ANCOLD Guidelines.

# DSC Approach

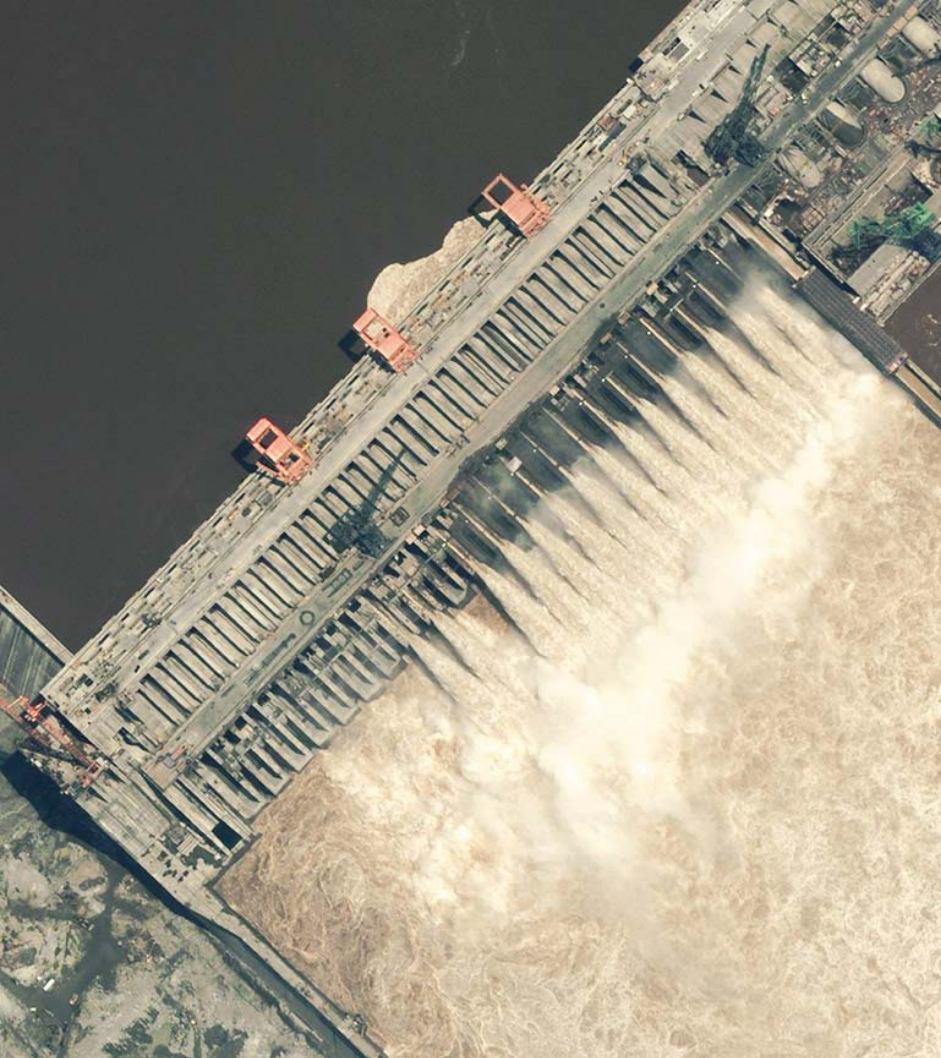
- DSC views risk assessment as valuable tool in decision making particularly for prioritisation of studies and setting programs.
- DSC will stress concept of continuous improvement and ALARP.
- Will require community consultation and acceptance for decisions involving risk assessment.

# DSC Approach

- Initial Information Sheet to be upgraded for risk considerations is DSC 11 on flood requirements.
- Require at least standards-based approach- can use RA to propose lesser standard or staged upgrade.
- Require community consultation and acceptance.
- Some High C dams already approved for sub PMF upgrades.

# In Case You're Bored already.....

## 3 Gorges Dam



# Government Approval

- In 2006 Cabinet approved the DSC's Risk Based Approach
- In 2008 a seminar was held following the development of the DSC's new DRAFT Guidance Sheets (attended by several Council engineers), after DSC called for comments from industry.
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# Official Use

- In June 2010 the DSC held a seminar, opened by Minister PHILLIP Costa to launch its new Guidance sheets, thus officially accepting risk assessment.



# DSC Goals

- Ensure risks from dams are tolerable
- Ensure dam risks are regularly reviewed and reduced where reasonably practicable
- Ensure intolerable dam risks eliminated as rapidly as possible
- Dam considered “safe” if it meets DSC requirements

# DSC Requirement

## Principle

D.3 when required to do so, a dam owner is to demonstrate that risks to public safety and other interests of the community are *tolerable*. To be *tolerable*, a risk must be *as low as reasonably practicable (ALARP)*. For *public safety risks*, risk boundaries – the *limit of tolerability* and the *negligible* level of risk – are relevant in applying the *ALARP* test.



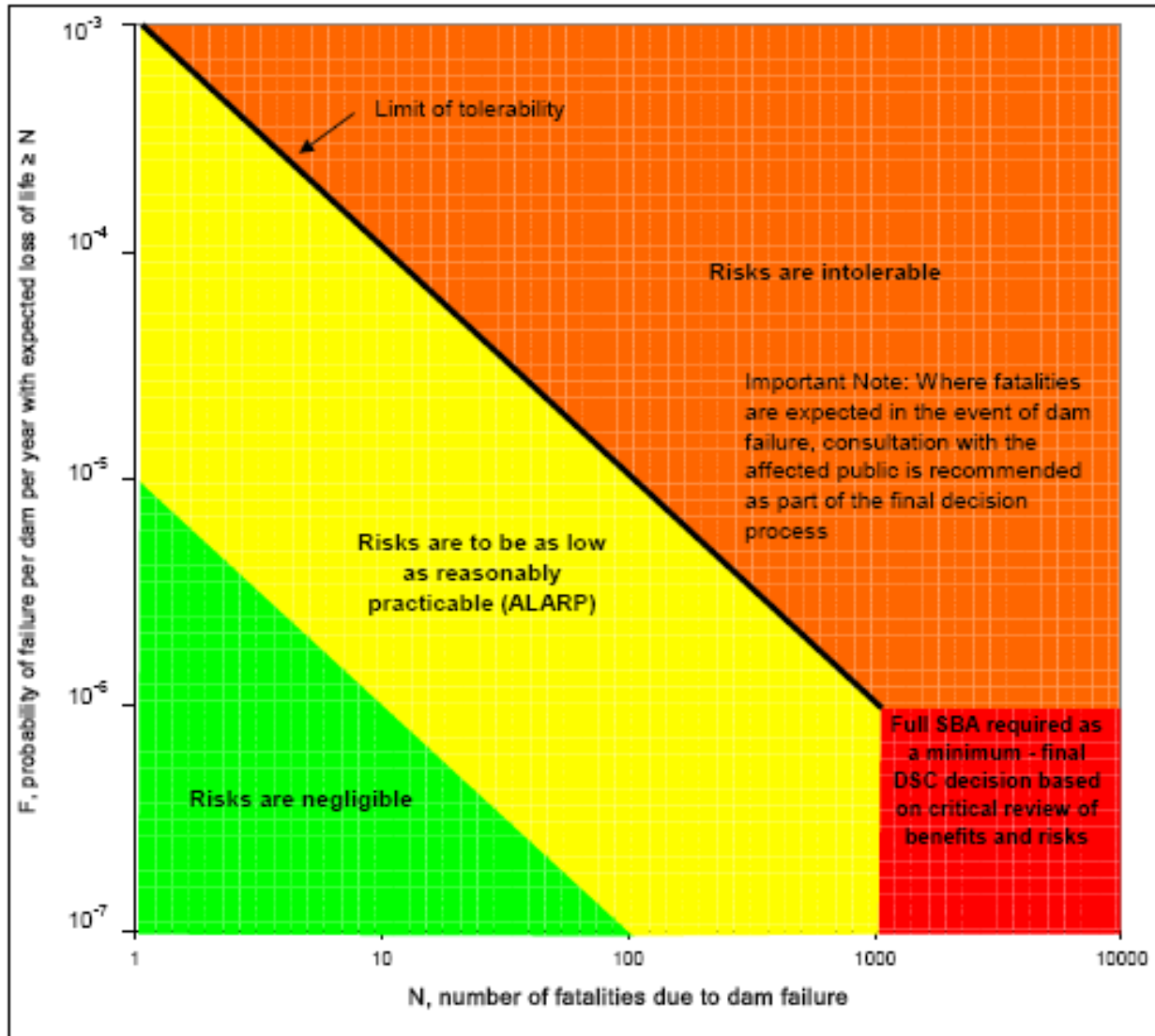
# Risk to Individual

- Existing dams -DSC *limit of tolerability* 1 in 10,000 per annum
- Proposed dams and augmentations -DSC *limit of tolerability* 1 in 100,000 per annum
- All dams and augmentations -DSC *negligible* risk is 1 in 1,000,000 per annum

# Societal Risk

- DSC requirement for *long-term* is that *societal risk* be below the *limit of tolerability* dictated by *ALARP* principle
- DSC has adopted a *negligible* level, two orders lower than (one hundredth of) the *limit of tolerability*
- the DSC regards the *negligible* level of risk as acceptably low

# Societal Risk Governance



# ALARP

- Owner to demonstrate risks are ALARP. DSC will judge owner's ALARP case on:
- Disproportion between sacrifice(money, time, trouble, effort) in safety improvement and risk reduction achieved.
- Level of risk remaining;
- Cost-effectiveness of safety improvement;
- societal concerns revealed by community consultation. THE STING IN THE TAIL!!!!!!!!!!!!!!

# DSC Tolerable Risk Practice

- Risks in *negligible zone*—DSC will NOT request safety improvement
- Risks in *intolerable zone*—DSC WILL request safety improvement as soon as reasonably practicable
- If risks are in *tolerability region*—lower urgency for improvement –risks to be ALARP -otherwise reduce to *negligible zone* in *long term*

# Progressive Improvement

## Principles

- E.2 implementation programs for safety improvements are subject to DSC review;
- E.3 safety improvements required by the DSC may be implemented progressively where that would promote more effective risk reduction for the community as regards risks from dams, but in such cases progressive implementation is subject to DSC review.

# Progressive Improvements

- **Objective: faster rate of risk reduction overall**
- **never a final sign-off on dam safety**
- **DSC accepts a dam as *safe enough for the time being***
- **after all *intolerable* risks are eliminated  
-re-visit to get risks *ALARP* or to  
*negligible zone***

# Immediate Risk Improvement





# Timeframe for Progressive Improvement

Stage	Aims	Indicative Timeframe for Completion of Safety Improvements <sup>(1)</sup>
<i>Short-term or Interim</i>	<ul style="list-style-type: none"> <li>To maximize safety, in a cost-effective manner, whilst planning proceeds for the later stages of improvement.</li> </ul>	<ul style="list-style-type: none"> <li>For a structural fix - <i>as soon as reasonably practicable</i>, but generally not longer than 2 years. Program to be agreed with DSC;</li> <li>For a non-structural fix, such as operating restrictions, warning and evacuation plans - <i>as soon as reasonably practicable</i>, but generally not longer than 1 year. Program to be agreed with DSC.</li> </ul>
<i>Medium-term</i>	<ul style="list-style-type: none"> <li>To reach a low but not ultimate level of risk.<sup>(2)</sup></li> <li>To reach risk levels below the <i>limit of tolerability</i>.<sup>(3)</sup></li> </ul>	<p><i>As soon as reasonably practicable</i>, but generally not longer than 10 years. Program to be agreed with DSC.</p>
<i>Long-term</i>	<ul style="list-style-type: none"> <li>To satisfy the DSC <i>starting point</i> deterministic safety level.<sup>(4)</sup></li> <li>To have risks below the <i>limit of tolerability</i> to the extent required by the <i>ALARP</i> principle.<sup>(5)</sup></li> <li>To satisfy national and international practice, if appropriate.<sup>(6)</sup></li> </ul>	<p><i>As soon as reasonably practicable</i>, but generally not longer than 20 years. Program to be agreed with DSC.</p>

# DSC Thus Far

- Can see tremendous amount of work been done by DSC.
- DSC's requirements for smaller dams have been REDUCED (Malpas dam Armidale...\$6M saved on unnecessary upgrade by using risk assessment)
- Logical basis of Cost/Consequences/Risk now being used in most cases
- BUT.....
- May still be too conservative?

# Legal Issues

## PREMISES

We live In a litigious society.

Sue them all.

IN THE CASE OF A CATASTROPHIC DAM FAILURE,

- EXTENSIVE LIABILITY WILL ENSUE
- ALMOST EVERYONE REMOTELY CONNECTED TO THE FACILITY WILL BE SUED
  - ARCHITECTS
  - ENGINEERS
  - DESIGNERS
  - CONTRACTORS
  - SUBCONTRACTORS
  - OWNERS
  - OPERATORS
  - INSPECTORS
  - REGULATORS
- OVERRIDING PURPOSE OF MODERN TORT LAW IS TO COMPENSATE INNOCENT VICTIMS FOR INJURIES CAUSED BY WRONGDOERS

RULES OF LAW VARY BY STATE / JURISDICTION

# Economics of Infrastructure Improvement

- DSC's charter ONLY allows it to be concerned with dams
- DSC and ANCOLD tends to be conservative due to the possibility of tort liability (hence ALARP)
- The principles of Equity (all society on equal footing in terms of risk faced), and Efficiency (ensuring expenditure directed to safety improvements achieve the greatest reduction in Risk) must be demonstrated.

# Hypothetical

- A dam has a population downstream of 20.
- Its spillway is deficient and to meet the DSC it needs to be upgraded to **beyond** the limit of tolerability of 1 in 100,000 risk at a cost of \$20M.
- Applying ALARP could mean EXTRA expenditure to reduce the risk further from 1 in 100,000 to SAY 1 in 1,000,000 at an extra cost of \$5M. This would be based on CSSL.

# Hypothetical 2

- The dam supplies water to a country town.
- That town needs a new wing to the hospital which can THEORETICALLY be built for the extra \$5M.
- On a risk basis what is likely to save more lives??????????
- If put to the community what would they vote for.
- NOTE the dam MUST be upgraded to the 1 in 100,00 level ASAP as the risk is currently 1 in 1000.

# Dams vs Health & Safety

- No community consultation has been done on this issue and it is certainly not clear that dams as a class deserve to be exempt from scrutiny in relation to prioritisation of the other safety needs of society.
- We need to face the issue of whether and how we should prioritise between dams and other health and safety needs

# ERA

- Economic Risk Assessment (ERA) in WA found that the ANCOLD guidelines appear to lead to a substantially larger amount spent on dam safety than on other areas of a dam owners safety improvements.
- ERA however, concluded that high level risks at dams **Must be Addressed**



# ERA Conclusion

- Another conclusion was the question of whether it is still acceptable for dams engineers to “set the safety Standards” and the prioritisation of improvements in isolation from other disciplines and the wider interests of society

# REVIEW of the DSC

- The DSC is currently under review.
- The Terms of Reference have not been made public.
- Water Directorate should play an ACTIVE role in the review

# Issues to get Addressed in the DSC Review

- Get a Council Representative on the DSC. (35% of Prescribed dams are owned by Councils)
- Try to ensure economic equity/efficiency in:
  - level of upgrading
  - dams vs other risks
- Who is on the review panel? Should Water Directorate be involved?
- Should flood levees be covered by the DSC?

# Issues 2

- Payment for DSC members
- What should be the COMPOSITION of the DSC? ( include an economist, lawyer, social scientist??)

# Add Levees?



# Questions???

