




जल शक्ति मंत्रालय
जल सहायता, नदी विकास और गंगा संरक्षण विभाग
भारत सरकार
MINISTRY OF JAL SHAKTI
DEPARTMENT OF WATER RESOURCES,
RIVERS DEVELOPMENT & GANGA REJUVENATION
GOVERNMENT OF INDIA





विद्युत मंत्रालय
MINISTRY OF
POWER

92ND ANNUAL MEETING & INTERNATIONAL SYMPOSIUM

ON DAMS FOR PEOPLE, WATER, ENVIRONMENT AND DEVELOPMENT
29TH SEP - 03RD OCT 2024 | NEW DELHI, INDIA

What could Tailings Facility Engineering look like in 2030?



Annika Bjelkevik, Tailings Consultants Scandinavia, SWEDEN
Andrew Witte , Klohn Crippen Berger, CANADA
Andy Small, Klohn Crippen Berger, CANADA

1

Why 2030?

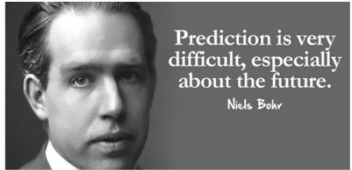
• Reflection on some of what has happened in the past 6 years:

Topic	2018	2024
Engineer of Record	Significant trepidation	Young engineers are viewing this as a viable career path
Surveillance	Some automation	Extensive automation and innovative technologies
Artificial Intelligence	Not prevalent	Playing a bigger role


• Opportunity to maintain the momentum that has been built


• Opportunity for more than “continuous improvement”

• We believe in significant advances in the next 6 years



Prediction is very difficult, especially about the future.
Niels Bohr





ICOLD 2024 – 92nd Annual Meeting – Symposium – Dams for People, Water, Environment & Development

2

Future Tailings Production and Storage



- Grades of ore bodies are reducing
- Leads to more tailings (annual growth of tailings greater than 3%)
- Repurposing old facilities
- More filtered tailings
- Lots of slurried facilities

ICOLD, TC L: world-wide registry with over 24,000 TSFs (Rana et al, 2024)



ICOLD 2024 – 92nd Annual Meeting – Symposium – Dams for People, Water, Environment & Development

3

Context



Efforts to reduce likelihood of catastrophic tailings failures:

- training,
- guidance documents,
- increased regulation,
- improved surveillance, etc.

Increases in computing power => complex analyses more efficient and use of artificial intelligence (AI)

⇒ **Demand for, AND on, qualified people**



ICOLD 2024 – 92nd Annual Meeting – Symposium – Dams for People, Water, Environment & Development

4

Tailings Facility Engineering



Author's definition:

- | | |
|---|---|
| <ul style="list-style-type: none"> - tailings milling and processing - tailings storage facility design - closure design - geotechnical engineering - hydrogeological engineering - hydrotechnical engineering - geology | <ul style="list-style-type: none"> - geochemistry - environmental protection - construction - operations - surveillance - risk assessment - governance |
|---|---|

- | | |
|---|-------------------------------------|
| Engineering and scientific studies | Field work (drilling, construction) |
| Lab analyses (testing and interpretation) | Modelling (simple to advanced) |



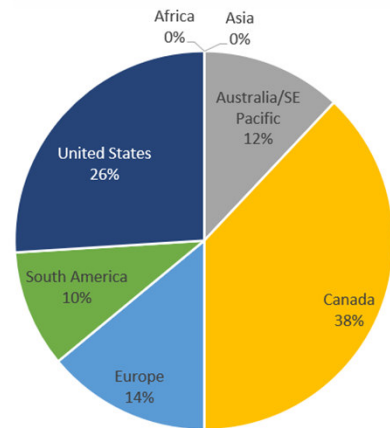
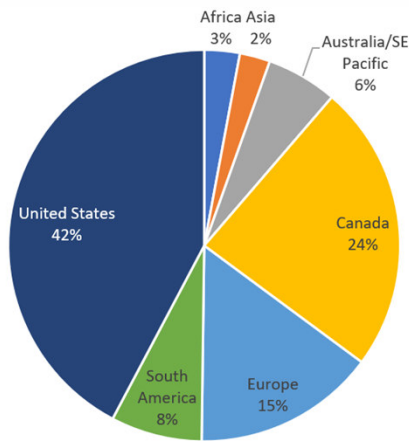
ICOLD 2024 – 92nd Annual Meeting – Symposium – Dams for People, Water, Environment & Development

5

Method – part 1



Survey: Colleagues/leaders invited v/s 60 responding



ICOLD 2024 – 92nd Annual Meeting – Symposium – Dams for People, Water, Environment & Development

6

Survey topics

1. Building competency and capacity
2. Tailings technologies and deposition
3. Closure strategies
4. Characterization of tailings and foundation soil
5. Surveillance of tailings facility performance
6. Design approaches for slope stability assessment
7. Guidance documents for tailings facility safety design
8. Artificial Intelligence



ICOLD 2024 – 92nd Annual Meeting – Symposium – Dams for People, Water, Environment & Development

7

Method – part 2

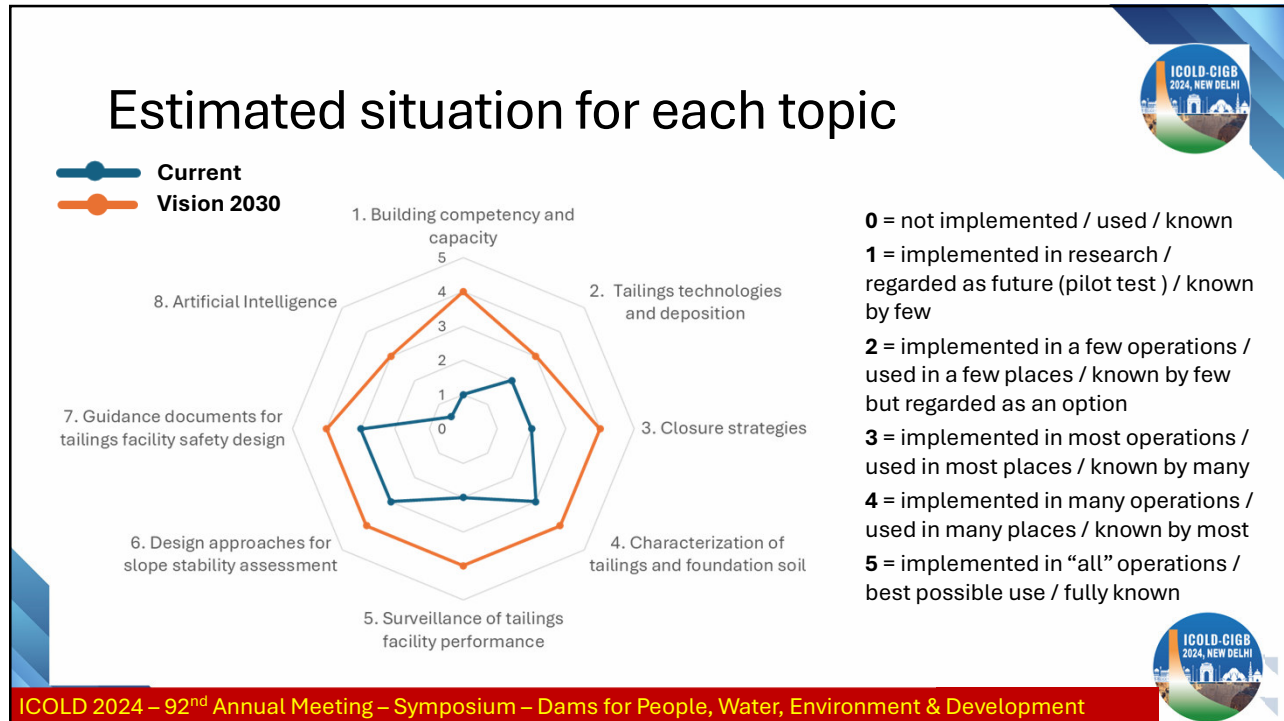
Discussions with experts & Audience input through presentations

Version	Forum	Location	Deliverable	Date (2024)	Presenter
1.0	Calgary Geotechnical Society	Calgary	Presentation	May 14	Andy
2.0	Edmonton Geotechnical Society	Edmonton	Presentation	May 16	Andy
3.0	Nova Scotia Mining	Nova Scotia	Presentation	July	Andy
4.0	ICOLD	India	Presentation and paper	September	Annika
5.0	Tailings and Mine Waste	Denver	Presentation and paper	November	Andrew
6.0	International Society of Soil Mechanics and Geotechnical Engineering	Chile	Presentation and paper	November	Andy

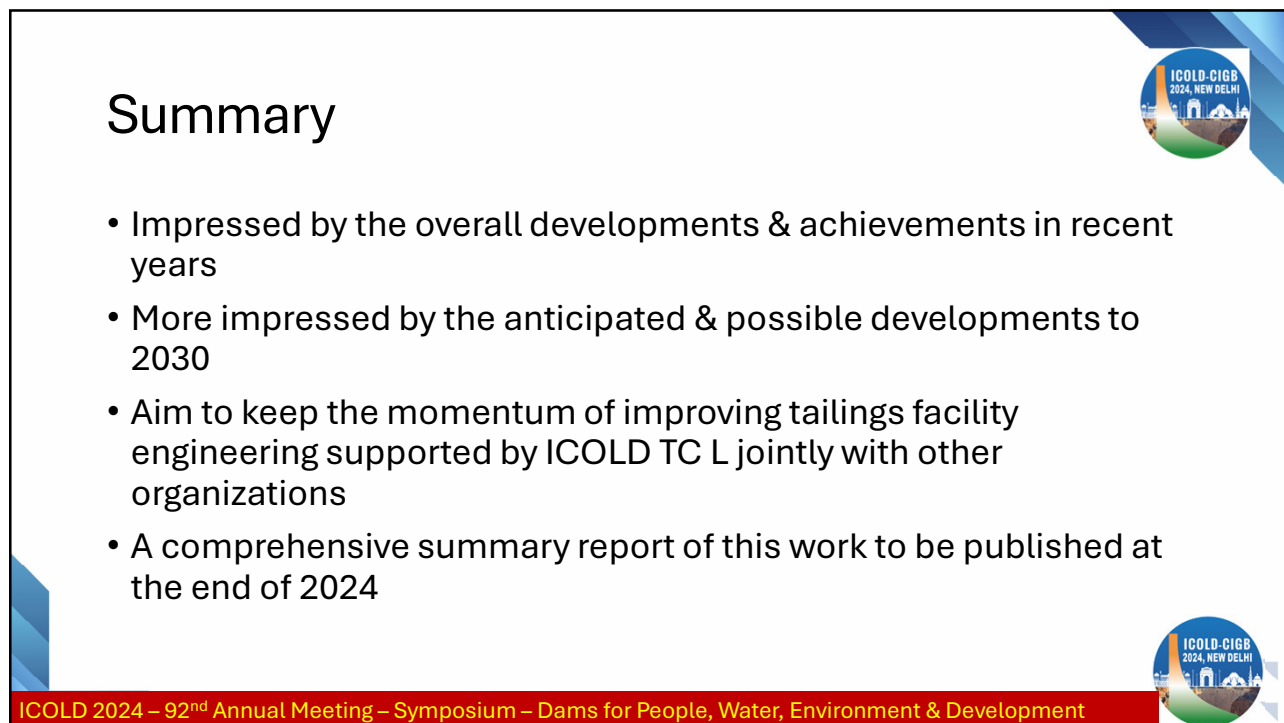


ICOLD 2024 – 92nd Annual Meeting – Symposium – Dams for People, Water, Environment & Development

8



9



10

