

CO2CRC Otway Project – Long term liability and the regulatory context

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Presentation Outline

- Overview of CO2CRC Otway Project
- Legislative/Regulatory Setting
- Transfer of Liability for injected CO₂
- Technical considerations for regulators on monitoring thresholds
- Risk Assessment

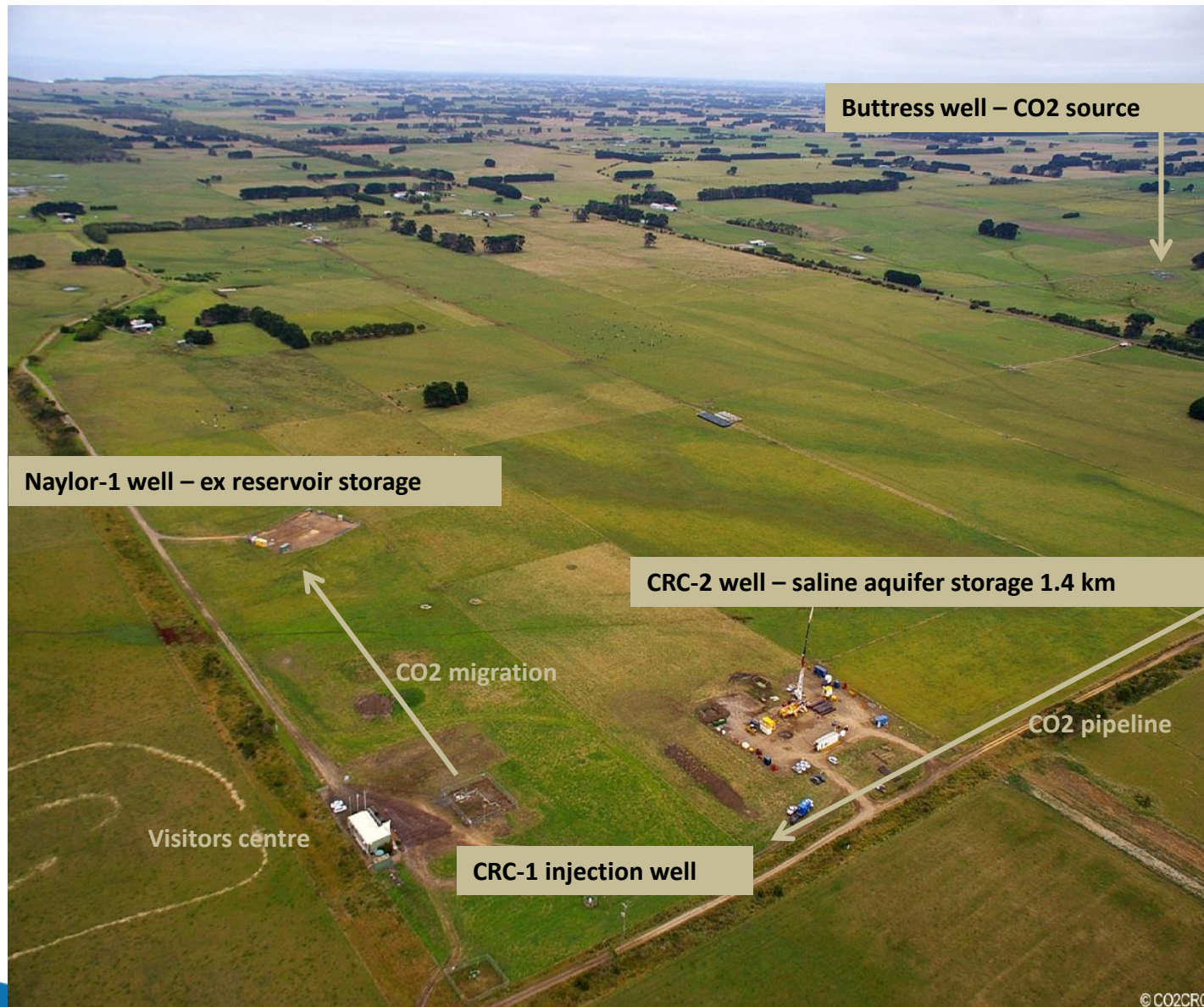
The CO2CRC Otway Project

- Australia's only Sequestration Facility
- One of few operational sequestration sites in the world
- Operating since 2008
- Research and injection into depleted hydrocarbon reservoir (Stage 1)
- Research and injection into saline aquifer (Stage 2)
- Concept, research and facilities provide blueprints to other CCS projects
- Will remain Australia's only CO₂ injection site at least until 2016.
- Unique research facility with global collaboration

Overarching Otway Project Principles

- Ensure human health and safety is protected at all times
- Safeguard ecosystems throughout project
- Ensure no impact to underground sources of drinking water and other resources
- Engage openly with community
- Comply with regulations
- Meet project objectives

CO2CRC Otway Project from the air...



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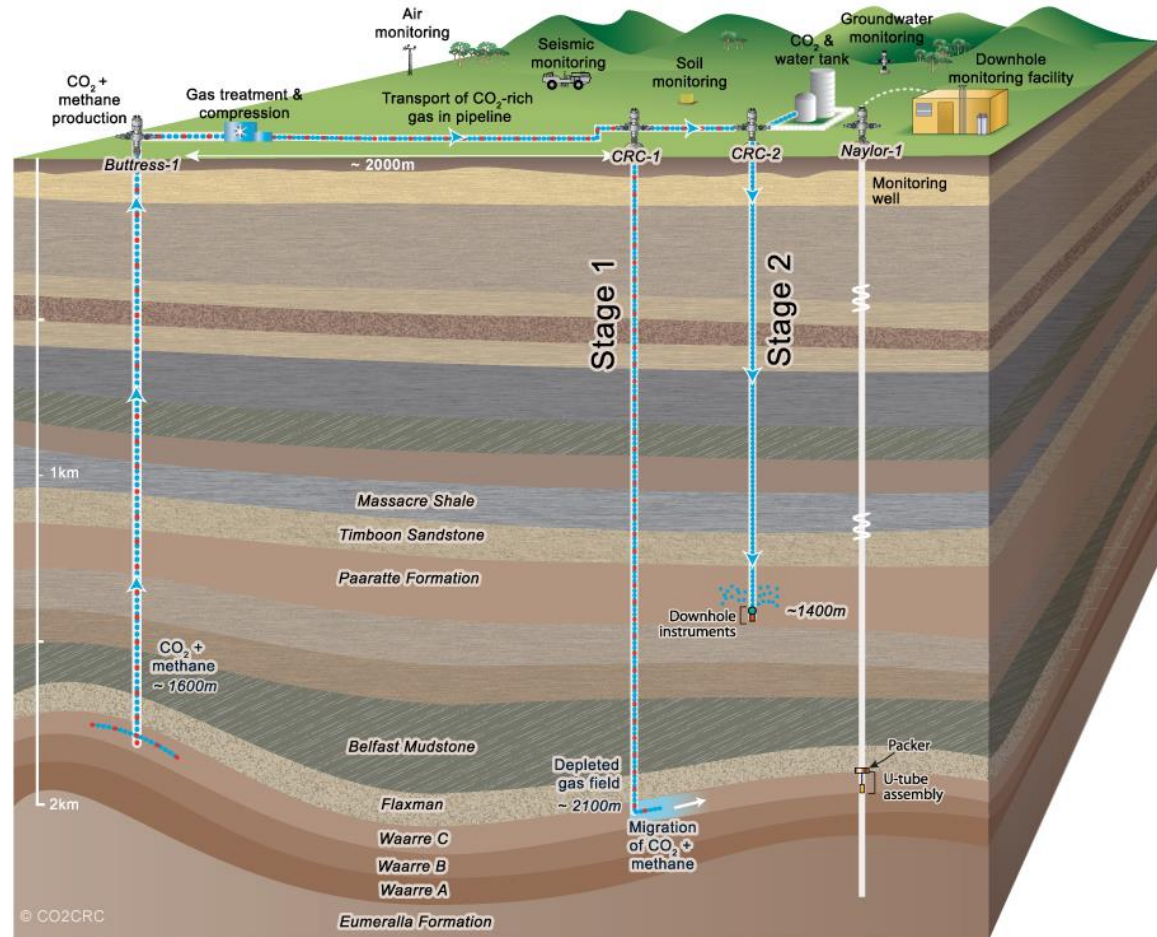
The CO2CRC Otway Project

- **Stage 1: 2004 – 2009**

- ✓ Demonstrated safe transport, injection and storage of CO₂ into a depleted gas reservoir

- **Stage 2: 2009 – 2019**

- ✓ Demonstrate safe injection into a saline formation



Core Enabling Legislation – CO2CRC Otway Project

Environmental Portfolio Approvals

- *Environment Protection Act 1970 - Research Demonstration & Development*

Impact Assessment and Planning Approvals

- *Environment Protection and Biodiversity Act 1999 - not a controlled action*
- *Environmental Effects Act 1978 - no environment effects statement*
- *Planning and Environment Act 1987 - planning scheme amended*

Petroleum Portfolio Approvals

- *Petroleum Act 1998 - various petroleum related activities approved*

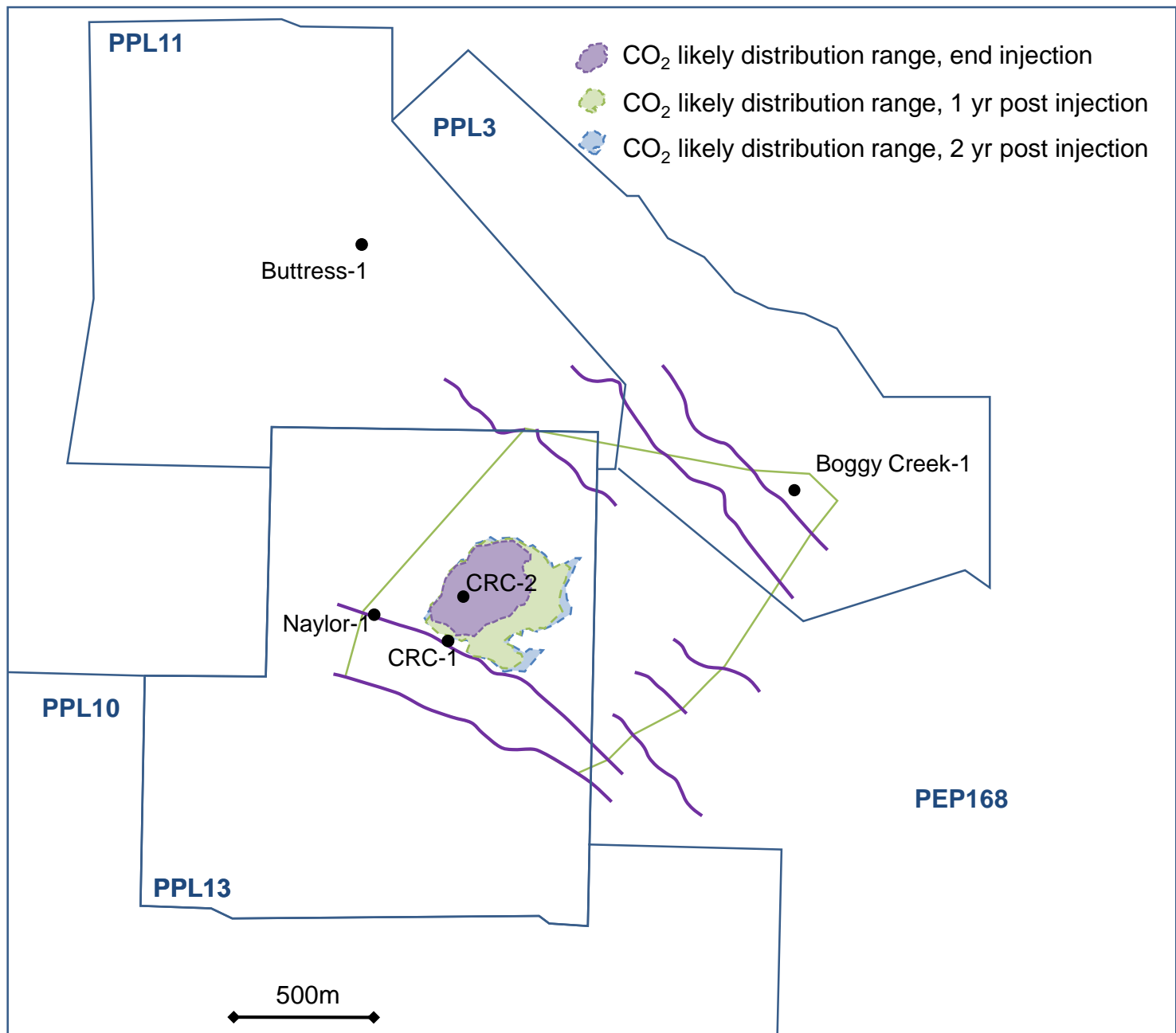
Water Portfolio Approvals

- *Water Act 1989 - various drilling and injection activities approved*

Land Access

- *Planning and Environment Act 1987*
- *Land Acquisition and Compensation Act 1986*

& Common Law



Key Performance Indicators

for EPA RD&D permit in absence of Greenhouse Gas Legislation

Injection into depleted gas reservoir

- Establish injection, migration and uncertainty models
- Assess environmental impacts within permit bounds
- Injection migration within permit bounds
- Verify stable plume within model prediction
- Demonstrate no evidence of injected CO₂ at the surface up to two years
- Demonstrate no evidence of injected CO₂ at the surface up to *another* two years
- Decommission the site

Injection into saline aquifer

- Models built pre-drilling for well location selection
- Well results consistent with model predictions
- Well based activities in accordance with State OHS rules
- No unexplained anomalies through monitoring program
- Decommission as per DPI criteria (Petroleum Act)

Transfer of Liability

1. Transfer under EPA RD&D Permit

- Comply with negotiated Key Performance Indicators

2. Transfer under Petroleum Act

- Removal of all infrastructure from site
- Sealing wells
- Rehabilitating the surface

3. Relinquish permits or transfer to other entity


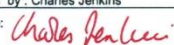
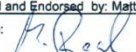
- \$50k bonds associated per permit – CO2CRC holds two Petroleum Production Permits



CERTIFICATE OF COMPLIANCE

OTWAY PROJECT KPI's - Stage 1

KPI No.	KPI Phase	KPI Description	Status
1.	1A	Establish injection and migration models and uncertainties.	Completed. These models informed the drilling of CRC-1
2.	1B	Assess environmental impacts within SEPP bounds.	Completed. The monitoring program has found no environmental impacts.
3.	1B	Evaluate Injection/Migration within prediction bounds.	Completed. Monitoring results are consistent with predictions.
4.	2	Verify stable plume within model prediction	Completed. Monitoring results are consistent with the predicted stable plume within the Naylor structure.

Proposed by : Rajindar Singh	Date: 16th Feb 2012
Signature: 	Dept: CO2CRC Operations
Proposed by : Charles Jenkins	Date: 16/2/12
Signature: 	Dept: CSIRO / CO2CRC
Reviewed and Endorsed by: Matthias Raab	Date: 5/3/12
Signature: 	Dept: CO2CRC Storage Program

MMV – what are we up against?

Accepted leakage of 1% over 1000 years as per European CCS Directive

Injection	1 year	10 years	50 years	100 years	1000 years
100,000	1	10	50	100	1,000
1,000,000	10	100	500	1,000	10,000
10,000,000	100	1,000	5,000	10,000	100,000
50,000,000	500	5,000	25,000	50,000	500,000
100,000,000	1,000	10,000	50,000	100,000	1,000,000
1,000,000,000	10,000	100,000	500,000	1,000,000	10,000,000

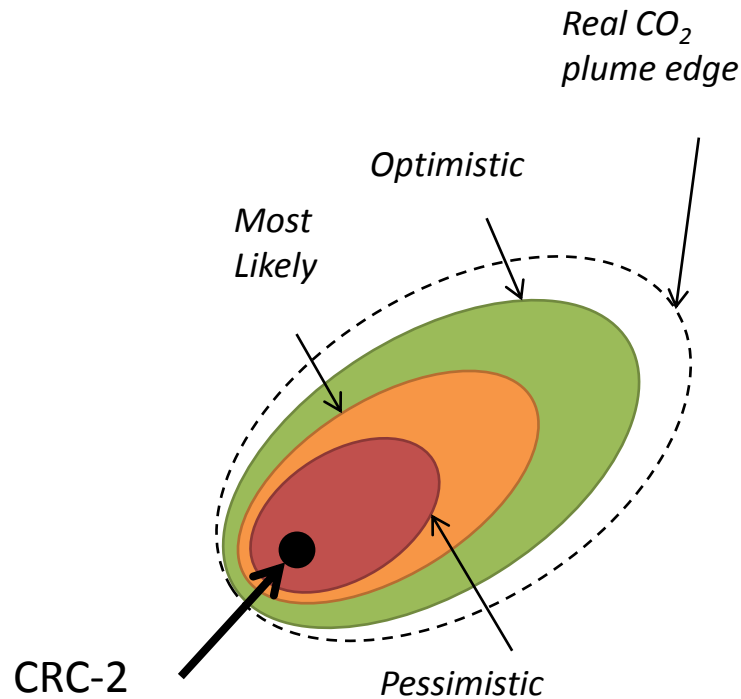
MMV – thresholds

Accepted leakage of 1% over 1000 years as per European CCS Directive

Injection	1 year	10 years	50 years	100 years	1000 years
100,000	1	10	50	100	1,000
1,000,000	10	100	500	1,000	10,000
10,000,000	100	1,000	5,000	10,000	100,000
50,000,000	500	5,000	25,000	50,000	500,000
100,000,000	1,000	10,000	50,000	100,000	1,000,000
1,000,000,000	10,000	100,000	500,000	1,000,000	10,000,000

Very high resolution technology required to confirm conformance and quantify stored volume

Understanding a CO₂ plume



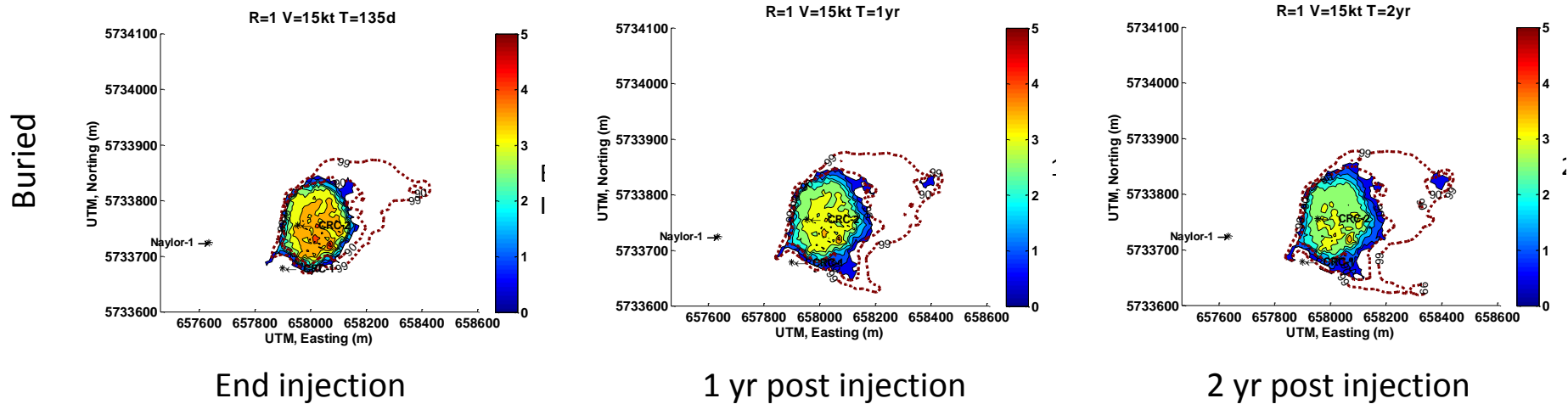
- Improving Seismic Detection Limits
- Demonstrating Plume Stabilisation
- 910 Geophones over 1km²
- Increasing Technology Thresholds
- Reducing Surface Footprint
- Reducing Cost

What happens to CO₂ over time?

Timeline	Mobile (%)	Residually trapped (%)	Dissolved (%)
End injection	36	36	28
1 yr	21	37	42
10 yr	18	35	47
20 yrs	18	34	48
100 yrs	12	26	62

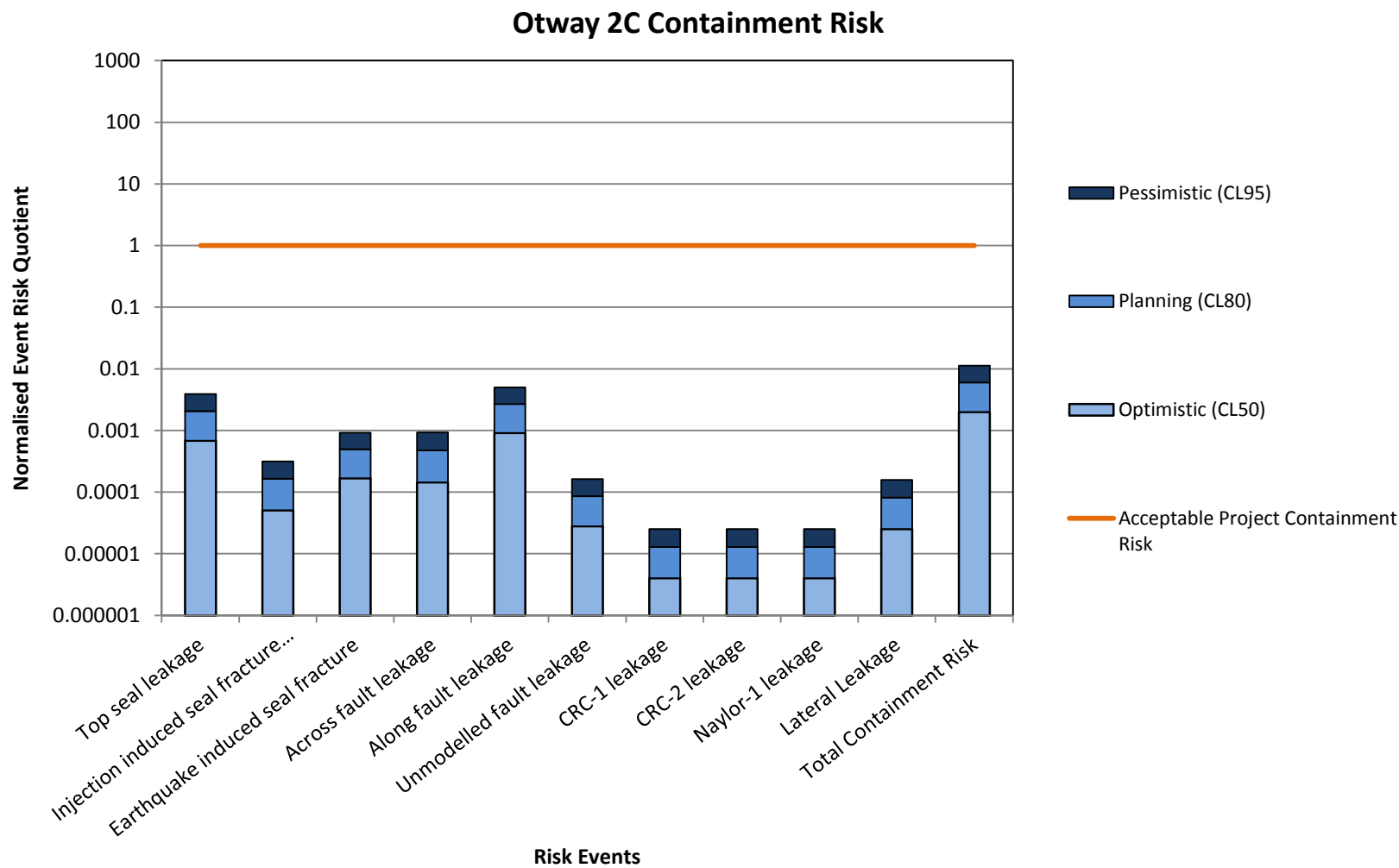
Example calculation from the CO₂CRC Otway Stage 2C Project. These parameters are depending on characteristics of storage reservoir and are ONLY representative for the reservoir modelled.

Regulated edge of plume vs detectability



Amplitude of time lapse signal

Containment Risk Analysis



Conclusions

- The “experience of regulation” for an operator may change, even if regulations do not change, because of events elsewhere.
- Future proofing management and reporting is a very significant overhead.
- Essential to argue for correct “framing” of issues – regulation elsewhere, issues tolerated elsewhere.
- Energy is a big issue and will be political. We have to deal with this reality constantly, and be prepared for it as well.
- Careful negotiations are required to avoid precedencies for both, operators and regulators.

Participants



Supporting Partners

