

Class VI Financial Assurance Valuation

A Carbon Sequestration Project Fatal Flaw?

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Presentation Objective and Agenda

- **For Class VI activities, review the relationship between:**
 - CFR Title 40, §146.85 Financial Assurance (FA) Project obligations;
 - Class VI Project FA risk evaluation; and
 - Operator financial & risk priorities for Class VI participation.
- **Observe an FA risk evaluation method that:**
 - Unnecessarily escalates FA-pricing; and
 - Endangers Operator Class VI Projects' participation.
- **Suggest analysis to better assess FA risk evaluation that:**
 - Appeals to Operator financial & risk priorities; and
 - Delivers FA-pricing a Class VI participating Operator can support & manage.

Legal stuff: Note this presentation is for general and informational purposes only and should not be substituted for consultation with appropriate technical, financial, or legal counsel nor for assessment from, and the advice of, your organization's regulatory compliance team.

Operator and Regulators' Class VI Opportunities

We're all in this together: jointly, we're developing an approach that provides opportunities & benefits for **Regulators/Taxpayers and Operators.**

Cooperation for mutual benefit, a survival strategy very common in natural systems, is one that humanity needs to emulate.

Eugene Odum

- **Class VI Permit** criteria are in-place and form a basis & framework for **Regulator-Operator cooperative-collaborative CO₂ sequestration.**
- As **Regulators** and **Operators** manage Class VI Projects, jointly **we have opportunity – and even responsibility** - to create an efficient & workable system for **achieving CO₂ sequestration goals.**

To that end, what can we do to promote Class VI Permitting, appropriately manage Class VI risk, and make projects **attractive to Regulators and to Operators?**

Operator Class VI Opportunity & Risk

Opportunities:

- Technical: technologies development;
- Operational: existing infrastructure use, existing operations leveraging;
- Strategic: value-chain development, capabilities diversification;
- Monetized CO₂ Credits: tax credits (45Q, etc.), emission-offsets credits;
- Reputational: financial strength, ESG;
- Financial: revenue, profit, credit;
- Cultural: Corporate goals, directives.

Risks:

- Technical: CO₂ stream, geology, hydrology, technology, infrastructure;
- Operational: planning, execution;
- Legal: new legislation, regulation drift;
- Political: regime/policy change;
- Market: labor, materials, equipment;
- Reputational: credit worthiness, ESG;
- **Financial: profitability** affected by Operator **Financial Assurance** obligations to Regulators/the Taxpayer.

Class VI Projects and Operator Participation

- **Class VI projects** involve **significant uncertainty** surrounding technical assessment, planning, CAPEX, and future OPEX.
- **Operators familiar** with the technical challenges, finance, & risk features of subsurface infrastructure projects' scale, scope, & timing are those **best able to deliver Class VI projects**.
- For corporate **financial performance**, such Operators consider **Class VI project participation** in the context of a portfolio of competing opportunities: i.e., **similar, hopefully profitable infrastructure projects**.

Class VI Projects and Operator Participation

- Here's a question: Why would a Operator invest in Class VI opportunities when it **sees as much or more profit in otherwise less-risky and more-familiar projects?**
- Here's another: Are there **specific obligations** attached to Class VI Permitting that comparatively challenge Operator participation? **Are they risky?**
- And lastly: If risky, then as **typically and currently evaluated**, do these **obligations accurately reflect** the risk they represent?

Class VI Financial Assurance

- **EPA's UIC Program invites Operators** - to participate in CO₂ geologic sequestration (**Class VI**) projects.
- **40 CFR §146.85 Financial Responsibility** (a.k.a. **Financial Assurance** or **FA**) aims to protect the Taxpayer from endangerment to USDW resulting from Class VI activities that include:
 - §146.84 **Corrective Action (CA)**;
 - §146.92 **Injection Well Plugging**;
 - §146.93 **Post Injection Site Care & Site Closure (PISC)**;
 - §146.94 **Emergency & Remedial Response (ERR)**.

CLASS VI FINANCIAL ASSURANCE

From Regulators' perspectives, and to **indemnify the Taxpayer** from **USDW endangerment**, Operator-employed **FA qualifying-instrument(s)** should be some covering **set** of:

- Trust Funding;
- Surety Bonding;
- Letters of Credit;
- Insurance;
- Self Insurance (with prescribed *Financial Testing & Corporate Guarantees*); and
- Escrow Accounts.

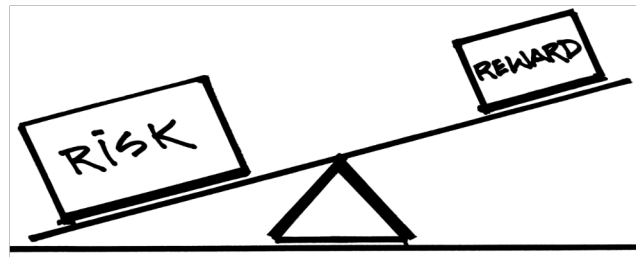


Class VI Project FA Estimates

- **FA coverage** must be **estimated** by a 3rd-party technical or engineering Operator, then approved by the Class VI Regulator.
- **Emergency and Remedial Response (ERR)** commonly represents the **costliest FA estimate**, usually many times the sum of *CA, Injection Well Plugging, & PISC* together.
- FA activities' estimates **tend far-reaching** in scale, scope, & time (event impact) while **remaining uncertain** about likelihood (event probability).
- Contemporary Class VI Project FA indemnity estimates vary widely, but can and have been **priced up to** a range of **\$100 million**.

Operator Priorities & Project Cancellation

- For Operator projects' comparisons, **the priority** remains **discounted risk-based financial reward**.
- For an Operator, **high-priced, long-term FA indemnification** suggests **more risk** and **less reward** than otherwise familiar infrastructure projects.
- **FA-pricing** has caused otherwise technically-viable **Projects' cancellation**. By definition, it has become a Class VI **fatal flaw**.

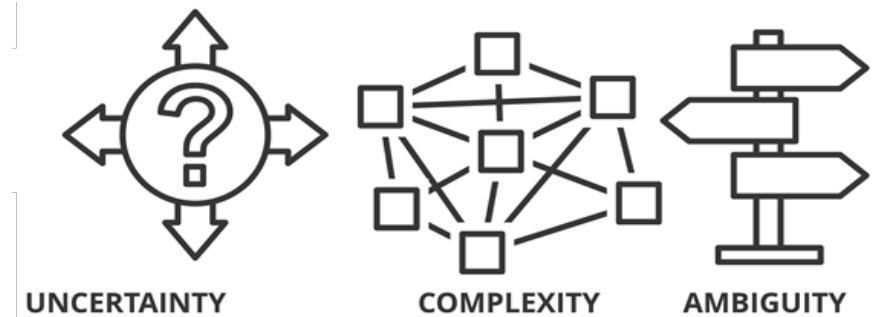


An FA Problem with Risk Evaluation

- Commonly, for infrastructure projects, **risk** is estimated as event **(impact X probability)**.
- This brings relevance & reality to projects' risk-based evaluation by **down-scaling** the importance & risk of **improbable events**.
- However, for Class VI **FA**, risk event **probability** is often ignored & instead replaced by something closer-to risk event **certainty**.
- As a result ... for high-impact (but otherwise **low probability**) events, **risk escalates** and the Class VI **FA-price rises**.
- **What can be done to tame this rise?**

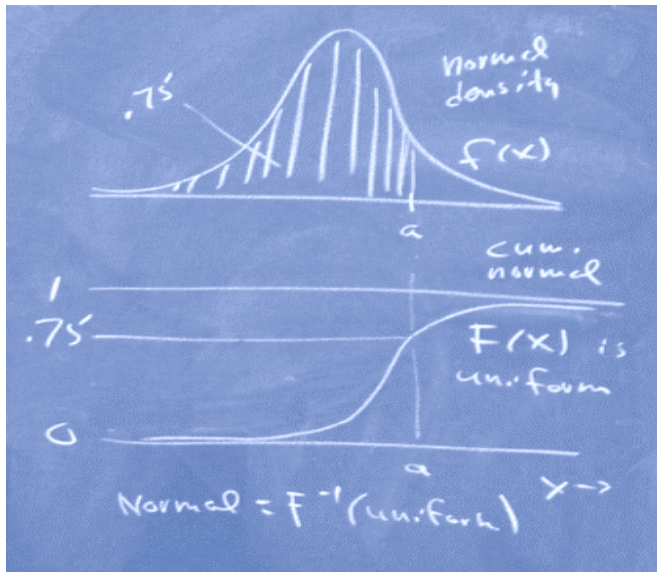
Eliminate FA Determinate Analyses

- FA risk estimation explicitly **focuses on future** – sometimes distant future – Class VI operational and/or technical uncertainties.
- Employing determinate methods (e.g., scenarios analyses) merely **transforms future uncertainties into biased, partial pictures** of future FA risk.
- Determinate methods **do not easily/efficiently depict change nor do they provide clarity on the riskiness of event variables.**
- Determinate risk analysis hardwires event probability - often into intimidating certainty. **Fatally flawed FA pricing can follow.**



Employ FA Stochastic Analyses

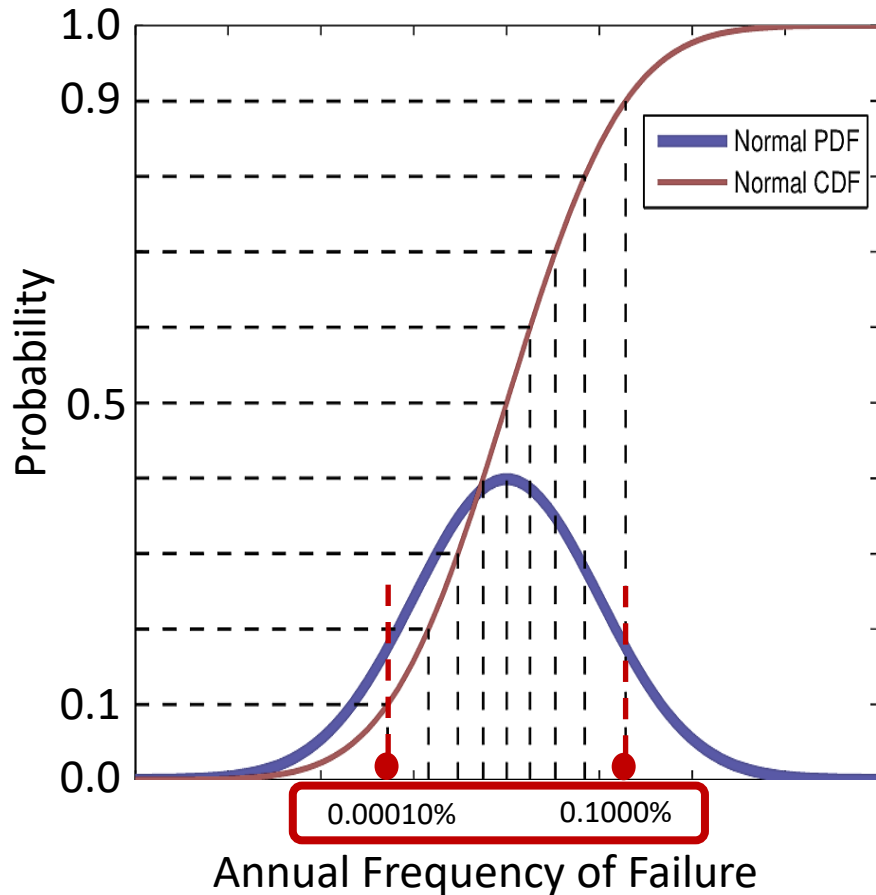
- For improved risk evaluation and FA pricing, consider employing event **probabilities & stochastic analysis**: e.g. Monte Carlo methods (MC).



- Central to MC, instead of single determinate output, probabilistic risk-evaluation provides a **range of probable** FA-price outcomes.
- MC models are particularly applied in developing and forecasting detailed and ranged-estimates of **future risk**.
- MC results can efficiently show the **underlying FA price riskiness** of an MC input variable; and how that **risk changes with input**.

Employ FA Stochastic Analyses (MC)

Probability Density Function (PDF) & Cumulative Distribution Function (CDF)



Risk Event Probabilities of Occurrence: developed from *FutureGen* data

Risk Event	Event Description	Annual Frequency of Failure (Single Item)	
		Low Estimate P10	High Estimate P90
1	Wellhead equipment failure	0.0010%	0.0030%
2	Upward rapid leakage through installed well	0.00010%	0.0010%
3	Upward slow leakage through installed well	0.00010%	0.0010%
4	Upward rapid leakage through transecting well	0.00010%	0.1000%
5	Upward slow leakage through transecting well	0.00010%	0.1000%
6	Leaks due to undocumented wells, high rate	0.0010%	0.1000%
7	Leaks due to undocumented wells, low rate	0.0010%	0.1000%
8	Upward rapid leakage through caprock	0.000000035%	0.000000105%
9	Upward slow leakage through caprock	0.0105%	0.0175%
10	Release through existing faults	0.0000035%	0.0000105%
11	Release through induced faults	0.0000035%	0.0000105%

Stochastic Modeling Class VI Benefits

- Generally, Stochastic modeling explicitly **dissects and transforms otherwise-fuzzy uncertainties** with relevant and statistical methods to produce estimates of event **probabilities**.
- Stochastic modeling supports detailed **analysis & application of risk events' probabilities**. This beneficially facilitates **judicious, discriminating risk estimation** and **FA-pricing**.
- Released from determinate analysis, risk escalation can be **better-managed** and FA-pricing **brought under control**.
- FA-pricing **fatal flawing is minimized**. Operators can **support and manage** FA pricing and **participate in Class VI Projects**.

In Summary ...

- Capable Operators assess infrastructure project participation in the context of **competing projects' opportunities**.
- Operator project focus is on **comparative risk-based profit/loss**.
- Class VI projects reflect **significant uncertainties** generating **risk**.
- Despite **risk** in Class VI Project FA events, **often** they **are not assessed probabilistically**, but instead, **determinately**.
- **Determinately-high** risk evaluation and FA-pricing has led to Class VI **Projects' cancelation**; and can become a Class VI **fatal flaw**.
- **Stochastic modeling** can help manage risk evaluation, improve FA pricing & **support Operator Class VI Project participation**.

A silhouette of an oil rig is shown against a sunset sky. The rig is a tall, lattice-structured tower with various platforms and ladders. The sun is low on the horizon, creating a bright glow behind the rig and casting long shadows. The sky is a mix of orange, yellow, and grey. A blue horizontal bar is overlaid on the top right of the image, containing the text 'Questions & Discussion'.

Questions & Discussion

Thank You!

Petrotek Corporation, February 2024

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