Fracking:
Updated Reading List
From 2013 Questions to 2024 Answers

> Addendum to **Confession-Box.org** essay on *Fracking Futures (2013)*
>
> These notes were written in summer 2013. As the site was dormant since 2013 this is a brief addendum.

SECTION 1 — *2024 Synthesis*

What we know now — 2024 answers to 2013 uncertainties

1. The Climate Question — Is shale gas better than coal?

Original 2013: uncertainty about net climate benefit due to incomplete methane data.

Now: Methane leakage of **0.2 to 3%** erases the advantage over coal. Super-emitters dominate: 0.06% of facilities drive 58% of basin emissions. Howarth (2024) models US LNG shipped to Europe/Asia as **33% worse than coal** over a 20-year GWP horizon.

> **How we know:** In 2013, methane data relied on bottom-up accounting. Top-down aerial and satellite remote sensing revealed that "super-emitters" dominate emissions—transforming tracking into real-time empirical surveillance.

2. Water and Waste — Where does the water go?

Original 2013: 15 to 50% returns as flowback; remainder unaccounted.

Now: Return rates remain under 50% (often <30%). The rest is imbibed into the formation—not migrating upward. Material risks shifted to surface operations: spills and management of produced water (TDS, heavy metals, BTEX, NORM).

3. Long-term Integrity & Seismicity

Now quantified: Sustained casing pressure: 11–12% Gulf of Mexico, 3.9% Alberta active wells. Methane from abandoned wells: 85–93 kt/yr in Canada. UK OGA (2019) concluded probability and magnitude of induced seismicity cannot be reliably predicted, leading to moratorium.

KEY NUMBERS 2024

2–3%
Leakage threshold where gas loses edge over coal (GWP20)

33% worse
US LNG vs coal footprint per Howarth 2024 model

<30%
Typical flowback recovery; remainder imbibed into shale

3.9% / 11–12%
Sustained casing pressure failure: Alberta / GoM

32%
Abandoned Alberta wells showing subsurface leak

2.9 ML
Preston New Road quake triggering UK moratorium

ADDENDUM IN BRIEF

Corrections:
(1) Upward migration—speculative; main risks are wellbores + spills.
(2) "No tech to clean"—inaccurate; reuse existed, freshwater treatment remains hard.
(3) Fracture randomness—stress contrast controls containment.
(4) Climate—0.2–3% threshold now quantified.
(5) Longevity—decline curves 70–85% in 3 yr not quantified in original.
(6) Seismicity—underestimated; TLS + 2.9 ML PNR → moratorium 2 Nov 2019.

Held up: 60-yr vs post-2000 distinction; chemical disclosure gaps; well integrity liabilities.

Addendum 2026: What this 2013 essay got wrong

ERRORS AND OVERSTATEMENTS

1. **Water fate — speculative upward migration.** Original suggested non-recovered fluid forces passageways to aquifers. Speculative in 2013 and now considered unlikely. Imbibition into ultra-low-permeability formation is demonstrated by pressure falloff. Primary demonstrated pathways for groundwater impact are wellbore integrity failure and surface spills, not deep fracture propagation [3].
2. **Flowback treatment — "no technology" claim.** Original claimed "no technology that allows for this mixture to be cleaned." Inaccurate even in 2013; physical-chemical treatment trains and fracturing reuse existed in US basins [6]. However, treatment to freshwater standards remains energy-intensive and leaves concentrated brine/NORM waste.
3. **Fracture description — stress controls omitted.** Essay described fractures as unpredictable without citing geomechanical stress controls. Modern literature shows fracture growth is constrained by in-situ stress contrast between geological layers; out-of-zone growth is contained, not unbounded.
4. **Climate comparison — clarified thresholds and super-emitters.** Original concluded insufficient data. By 2019–2024, the threshold was clarified: ~0.2% to 3% leakage erases coal advantage [2]. Top-down aerial/satellite surveys reveal basin leakage of 2–4% [7]. Howarth 2024 models LNG supply chain as 33% worse than coal over 20-yr GWP [1].
5. **Longevity — decline curves not quantified.** Skepticism about 20–40 year well lifespan was directionally correct but lacked data. Typical shale wells show 70–85% production decline in the first 3 years, requiring continuous new drilling to sustain field output.
6. **Policy & Seismicity — UK regulation and seismic risk.** Induced seismicity was underestimated in 2013. The UK Traffic Light System (0.5 ML threshold) and Preston New Road quakes (2.9 ML in Aug 2019) led the OGA to conclude induced seismicity cannot be reliably predicted [5], resulting in a permanent moratorium. In the US, federal EPA Clean Air Act rules tightened under Biden face ongoing revision and rollback efforts under the Trump administration [8].

WHAT HELD UP ON RE-REVIEW

- **Historical distinction:** Differentiation between 60-year-old vertical well stimulation and modern high-intensity post-2000 horizontal multi-stage fracturing remains accurate.
- **Chemical disclosure gaps:** Trade-secret protections in 2013 were documented; disclosure improved via FracFocus but proprietary gaps remain.
- **Well integrity as long-term liability:** Confirmed by data showing 11–12% GoM and 3.9% Alberta wells develop sustained casing pressure [3], while 32% of abandoned Alberta wells leak hydrocarbons [4].
- **Policy framing:** Separation of engineering feasibility ("can we frack?") from path dependency and policy decisions ("should gas be a bridge fuel?") remains key.

What to read next — curated list

1. **Howarth (2024)** — The greenhouse gas footprint of liquefied natural gas (LNG) exported from the United States. *Energy Sci. Eng.* Full lifecycle analysis including liquefaction, transport, and methane leakage. Central claim: 33% worse than coal over 20 years.

2. **Carbon Brief** — Explained: Fugitive methane emissions from natural gas production. Best non-technical synthesis of why bottom-up inventories miss super-emitters. Covers top-down vs bottom-up data and Permian Basin observations.

3. **PNAS / Lackey et al. (2021)** — Public data from three US states provide new insights into well integrity. *PNAS*. Large-scale review showing 3.9% of 316k Alberta wells and 11–12% GOM wells exhibit integrity failure.

4. **Environmental Science & Technology (2021)** — Methane Emissions from Abandoned Oil and Gas Wells in Canada and the US. Field measurements establishing 85–93 kt/yr methane liability from abandoned wells.

5. **UK Government / OGA (2019)** — Government ends support for fracking in England. Primary source statement following the Preston New Road 2.9 ML seismic event establishing the unpredictability of induced seismicity.

6. **Scanlon et al. (2020)** — Will Water Issues Constrain Oil and Gas Production in the U.S.?. *Environ. Sci. Technol.* Comprehensive analysis of water intensity vs produced water and surface handling risks.

7. **MethaneSAT / Remote Sensing** — Satellite observation of super-emitters and regional emissions. Top-down satellite technology providing high-resolution, asset-level transparency across US operations.

8. **US EPA / Regulatory Framework** — Clean Air Act Standards for the Oil and Natural Gas Industry. Federal performance standards mandating leak detection and flaring limits, subject to ongoing regulatory revisions and rollback efforts between presidential administrations.

A note on tone

The 2013 essay asked open questions. In 2024 we have better answers, but not final answers. Methane measurement improves yearly; well integrity data grows; water chemistry remains site-specific. This list is not anti-gas polemics — it is an update that the cleaner-than-coal claim requires a leakage rate most basins do not meet, that water risk moved from deep aquifers to surface handling, and that abandonment is a decades-long liability we are only beginning to quantify.