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U.S. Early Plugging of Marginal Oil and Gas Wells Protocol V1.0

Workgroup Meeting #5

March 11, 2026

Housekeeping



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- Observers are in listen-only mode.



- Workgroup members should actively participate throughout the meeting



- We will follow up via email to answer any questions not addressed during the meeting.



- The slides and a recording of the presentation will be posted online on the protocol webpage.

Introduction

Reserve Staff

Rachel Mooney – Manager, Protocol Development (development lead)

Jon Remucal – Director, Protocol Development

Partial Technical Support

Partial technical support was provided by ClimateWells, in collaboration with the Rocky Mountain Institute, EcoEngineers, and Netherland, Sewell & Associates.

Workgroup Introductions

- Raise your hand on Zoom and we will call on each member in order on Zoom
- Please briefly introduce yourself, your organization, and your experience as it relates to the development of this protocol

Dan Arthur , ALL Consulting	Jay Wintergreen , First Environment, Inc.
Arjun Patney , Avondale Private Capital	John W. Brooke , Franklin Well Services, LLC
Heather Rogers , California Resources Corporation	Michael Moorhead , PermCap-GHG LLC
Puneet Chhabra , Carbon Containment Lab	Jason Seneker , Seneker & Associates, LLC
Reid Calhoon , ClimateWells	Beth Bader , SES Inc
Miguel Angel Freyermuth Corona , EcoEngineers	Issaí Medellín , TÜV SÜD America Inc.
Margaret Coleman , Environmental Defense Fund	Marc Perez , ZeroWells

Protocol Development Process & Timeline

Milestone	Date
Public Scoping Webinar	November 25, 2025
Statements of Interest Form (Workgroup)	December 1, 2025
Formation of workgroup	December 9, 2025
First workgroup meeting	January 7, 2026
Second workgroup meeting	January 15, 2026
Third workgroup meeting	February 17, 2026
Comments on Eligibility	February 27, 2026
Fourth workgroup meeting	March 3, 2026
Fifth workgroup meeting	March 11, 2026
Public comment period	TBD – April/May 2026
Protocol presented to Reserve Board for approval	TBD – June 2026

AGENDA ►

- Discussion of key considerations for the protocol
 - Start date and secondary effects
 - GHG assessment boundary
 - Leakage Adjustment
- Next steps



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START DATE AND SECONDARY EFFECTS

Start Date Proposal

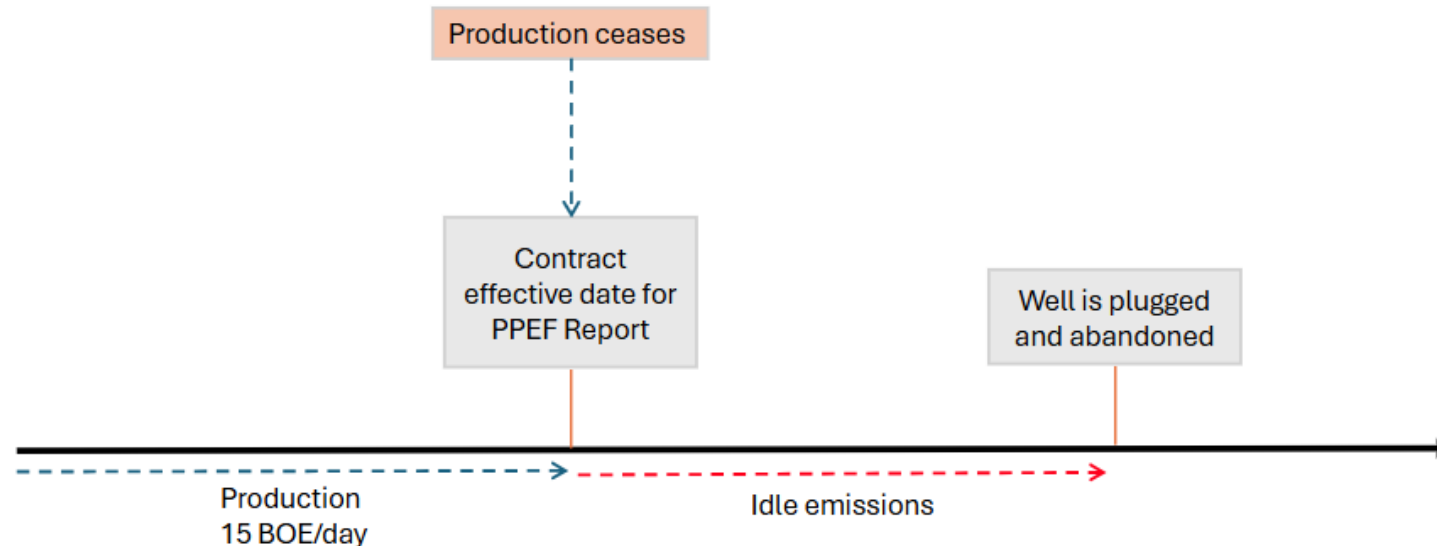
- Start date is defined as the date on which production ceases. Which may be:
 - Scenario 1: Contract effective date for PPEF report
 - Scenario 2: Well is P&A
 - a. Production increases relative to baseline
 - b. Production remains at baseline levels
 - c. Production decreases relative to baseline levels
 - Scenario 3: Date between contract effective date and P&A
- Upcoming slides will cover proposal to address secondary effects

Scenario 1: Contract Effective Date

Project start date is defined as the date on which production ceases, which may be either

1. Contract effective date for the PPEF report
2. Date well is P&A

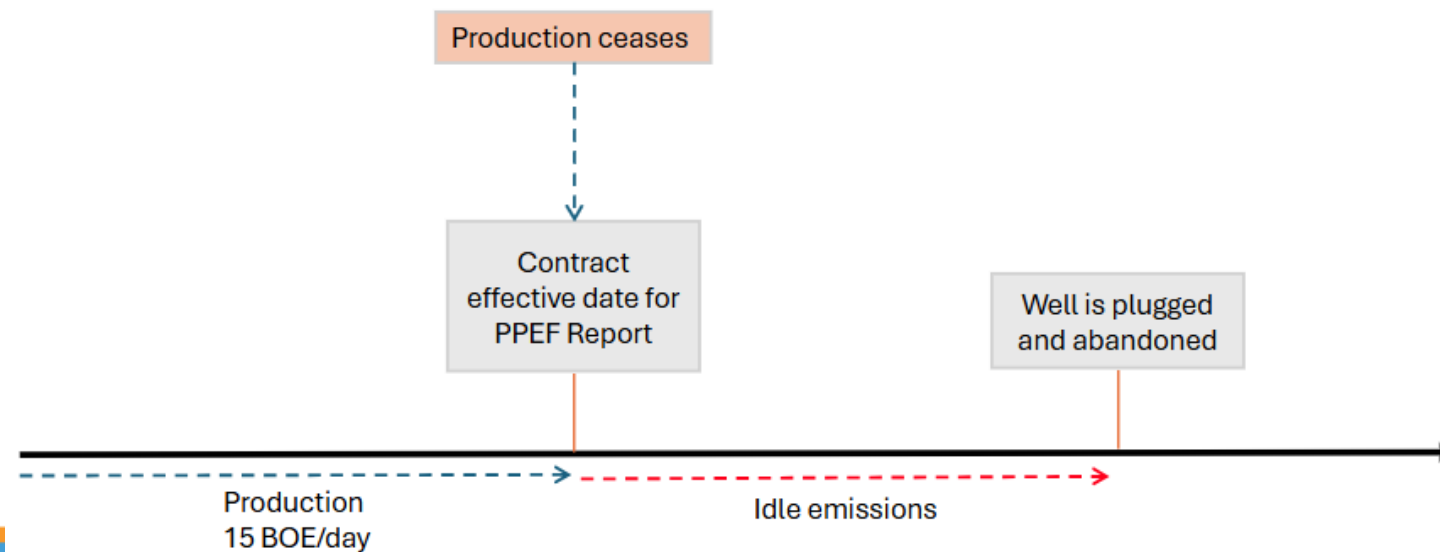
- Scenario 1 – production ceases on the contract effective date with PPEF
 - Secondary effect: marginal well becomes an idle well, resulting in emissions
 - Idle emissions are deducted from the initial reporting period



Accounting for Idle Emissions

If a well operator ceases production prior to the well being plugged, then the well will emit methane while it remains idle. How should the protocol consider this secondary effect?

- [California Energy Commission](#) found idle wells emit 5.6 gCH₄/hr (0.00484 tCO₂e/day)
- Assuming avg emissions intensity 0.518 tCO₂e/BOE, a well producing 15 BOE/day would emit 7.77 tCO₂e/day. Difference between idle emissions and continued production is 0.062%
- Should it be included despite being de minimis?



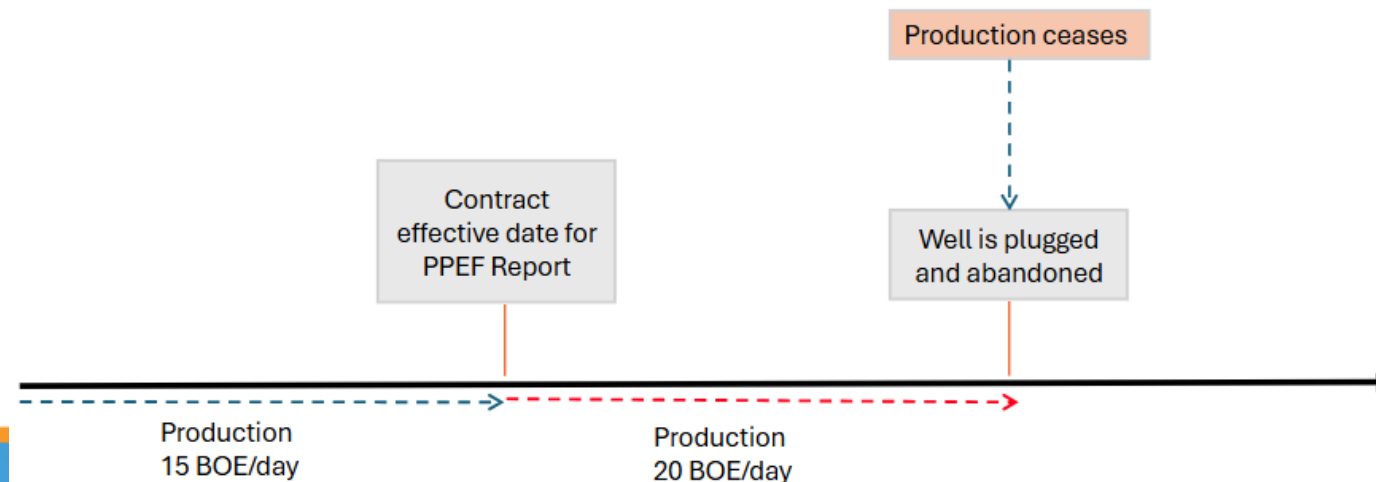
Scenario 2a: Well P&A and Increased Production

Project start date is defined as the date on which production ceases, which may be either

1. Contract effective date for the PPEF report OR
2. Date well is P&A

➤ Scenario 2a – production increases prior to P&A

- Secondary effect: marginal well increases production to extract more hydrocarbons prior to plugging
- Total production volumes are deducted from the PPEF evaluation
- Emissions from increased production compared to avg. daily production over previous 3 years is deducted from initial reporting period (approach discussed in quant section)

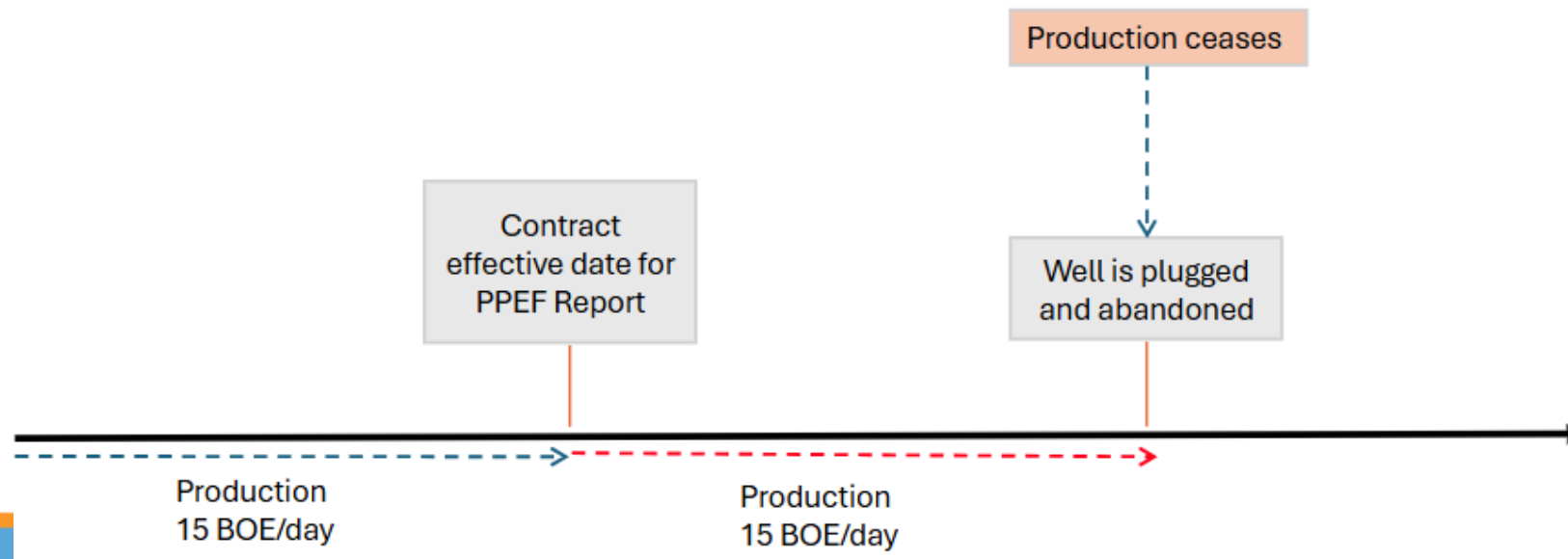


Scenario 2b: Well P&A and Baseline Production

Project start date is defined as the date on which production ceases, which may be either

1. Contract effective date for the PPEF report OR
2. Date well is P&A

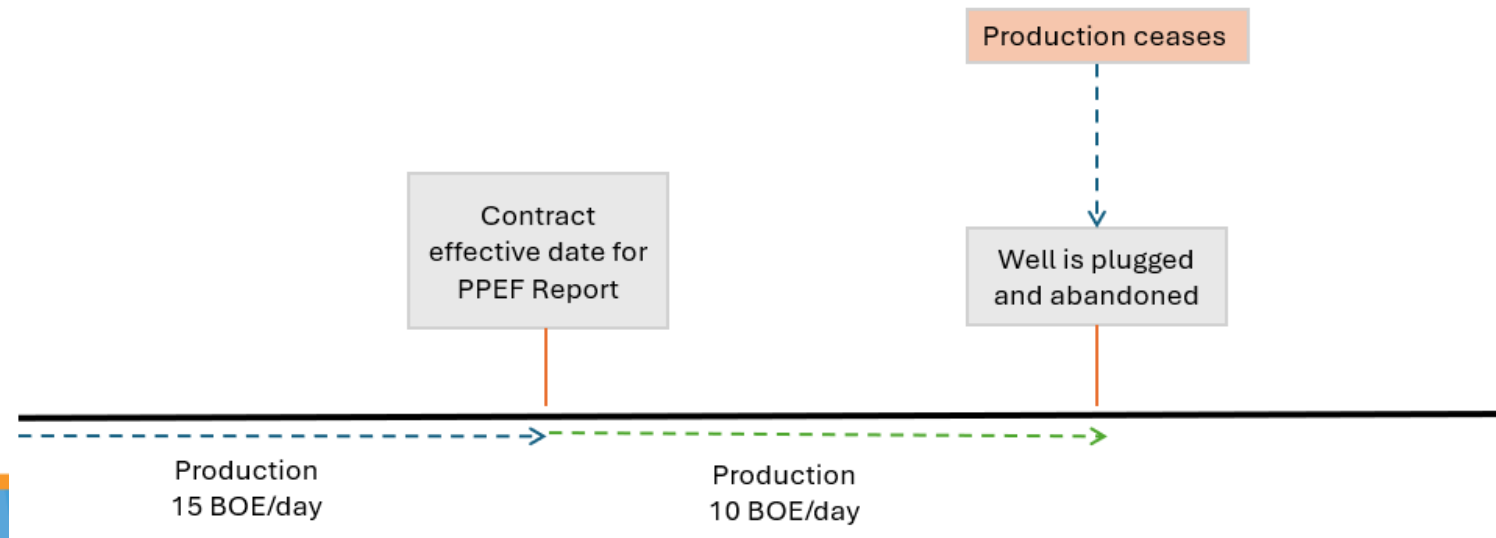
- Scenario 2b – production continues at baseline levels prior to well P&A
 - Secondary effect: none
 - Total production volumes are deducted from the PPEF evaluation



Scenario 2c: Well P&A and Baseline Production

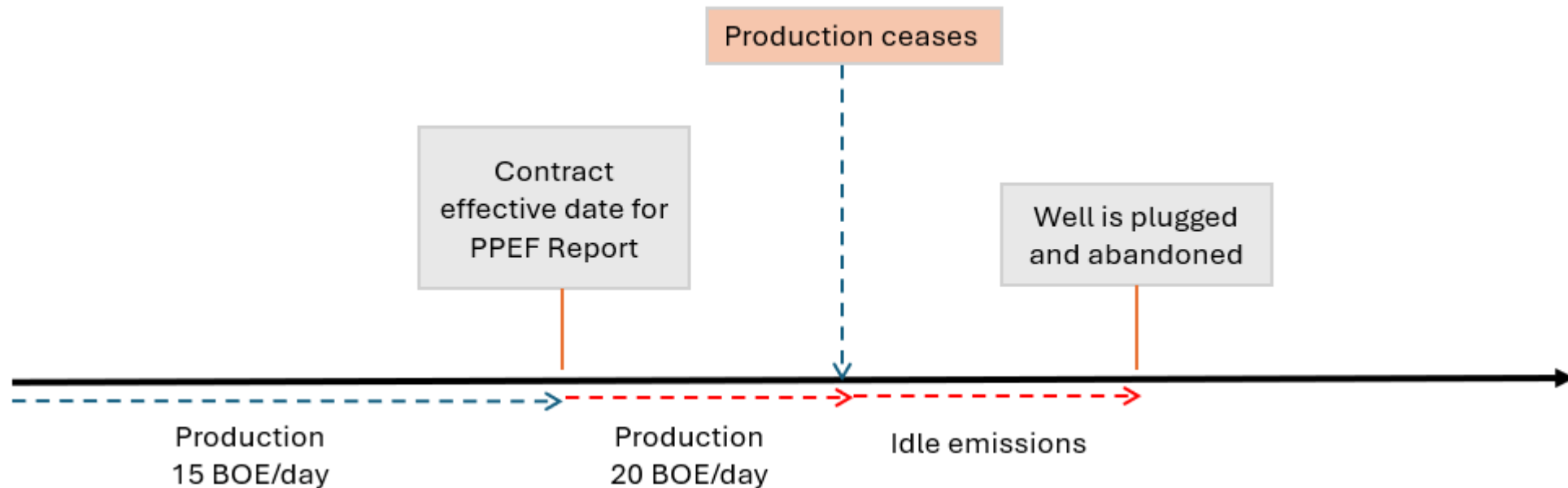
Project start date is defined as the date on which production ceases, which may be either

1. Contract effective date for the PPEF report OR
 2. Date well is P&A
- Scenario 2c – production decreases below baseline levels prior to well P&A
 - Secondary effect: decreased emissions relative to the baseline
 - Total production volumes are deducted from the PPEF evaluation
 - Decreased emissions prior to P&A not eligible for crediting



Scenario 3: Hybrid

- Scenario 3 – production ceases after the contract effective date but before the well is plugged
- Total production volumes are deducted from the PPEF evaluation
- Initial reporting period deduction(s) will be accounted for according to a combination of scenario 1 or scenario 2a-c





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KEY CONSIDERATIONS FOR PROTOCOL DEVELOPMENT

GHG Assessment Boundary

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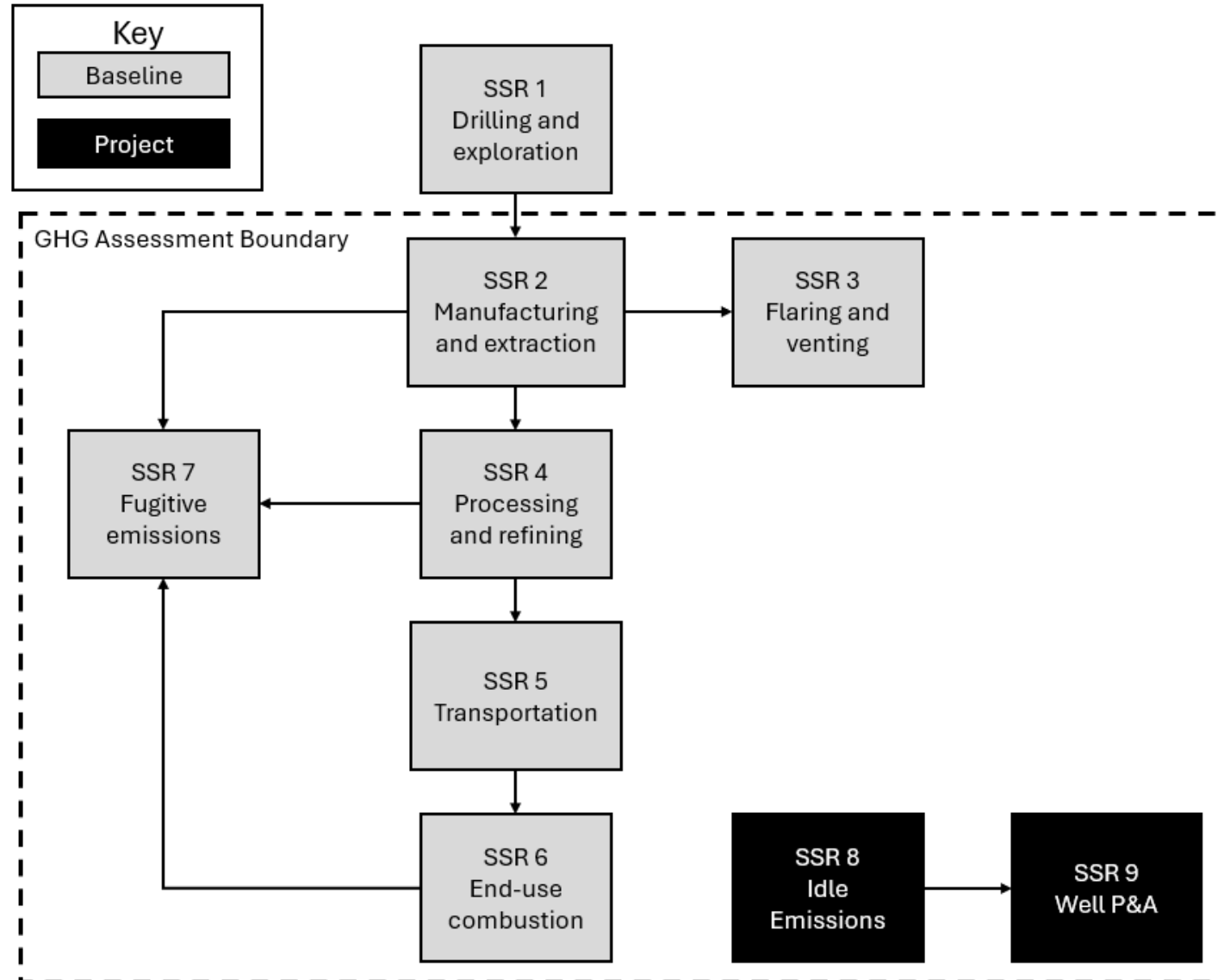
Purpose: identify all relevant sources, sinks, and reservoirs (SSRs) of GHGs applicable to the baseline and project scenarios

- Baseline SSRs represent that would occur in absence of the proposed project activity
- Project SSRs represent emissions from implementing the project activity

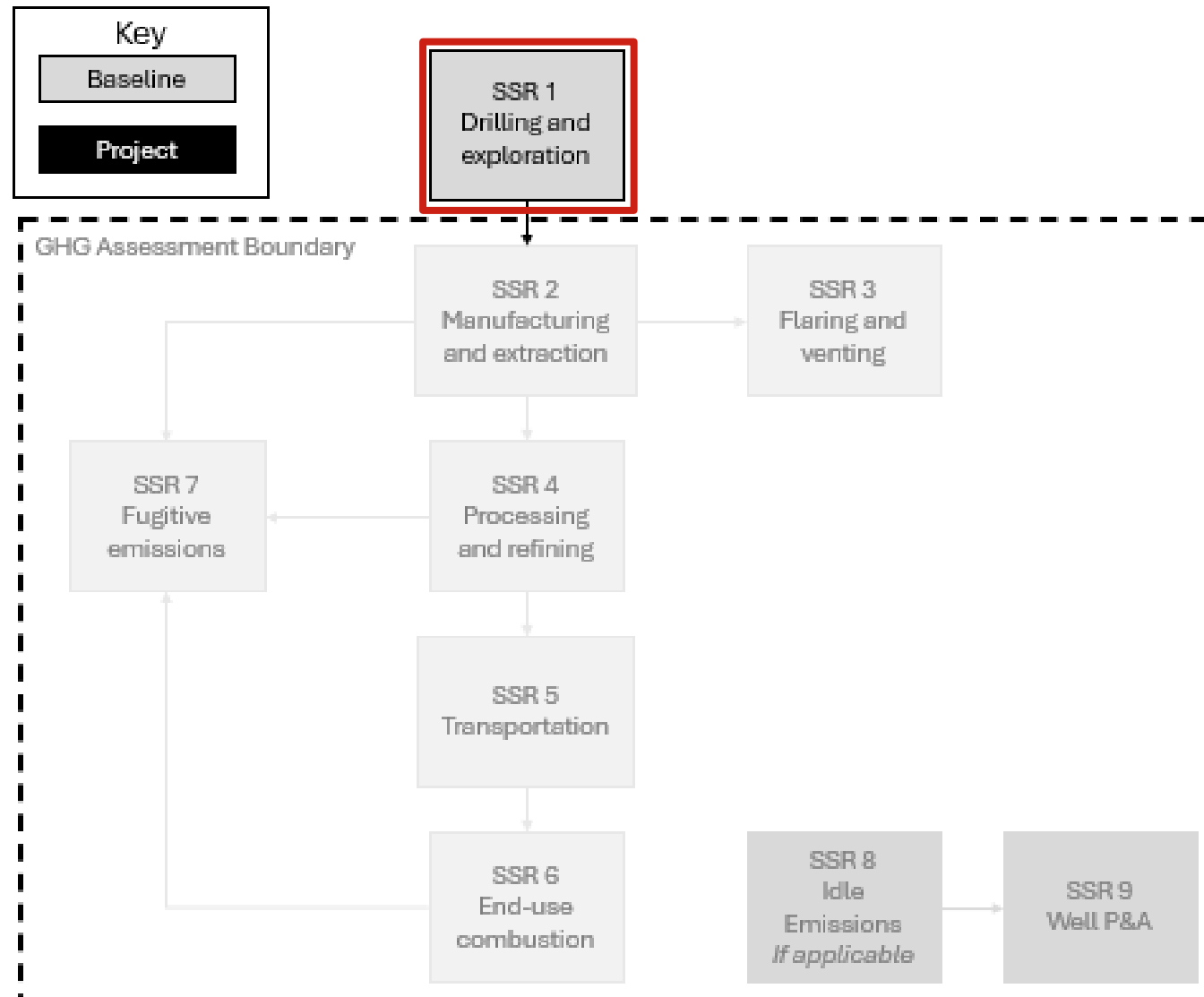
Identified SSRs and associated GHGs are then excluded or included in quantification

- Included if project activity will have a significant impact on associated GHG emissions
- Excluded if:
 - Doing so is conservative
 - Can be assumed to be equal in the baseline and project
 - Project would result in decrease in emissions
 - Emissions are de minimis (all excluded emissions <5% of total)

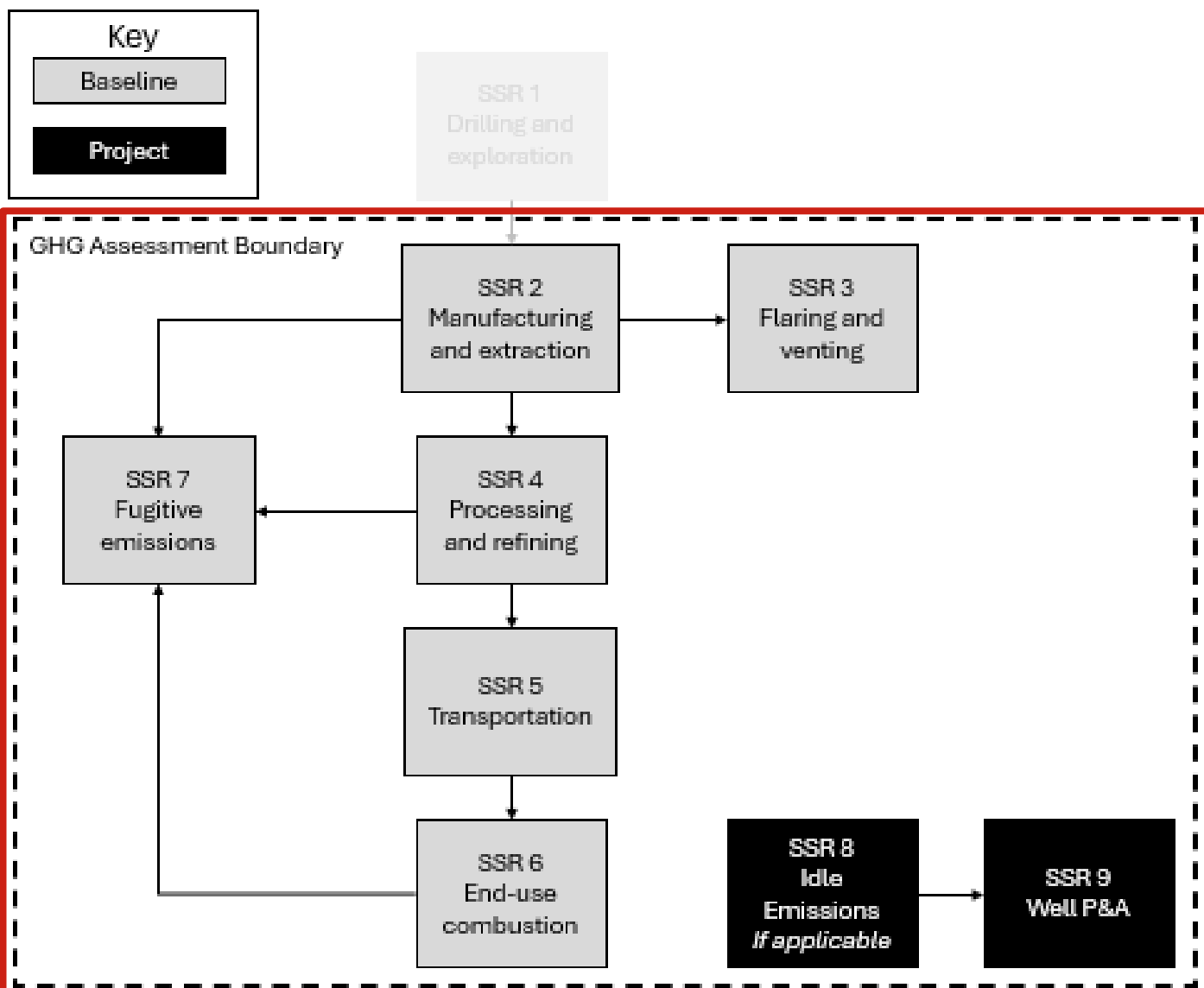
GHG Assessment Boundary



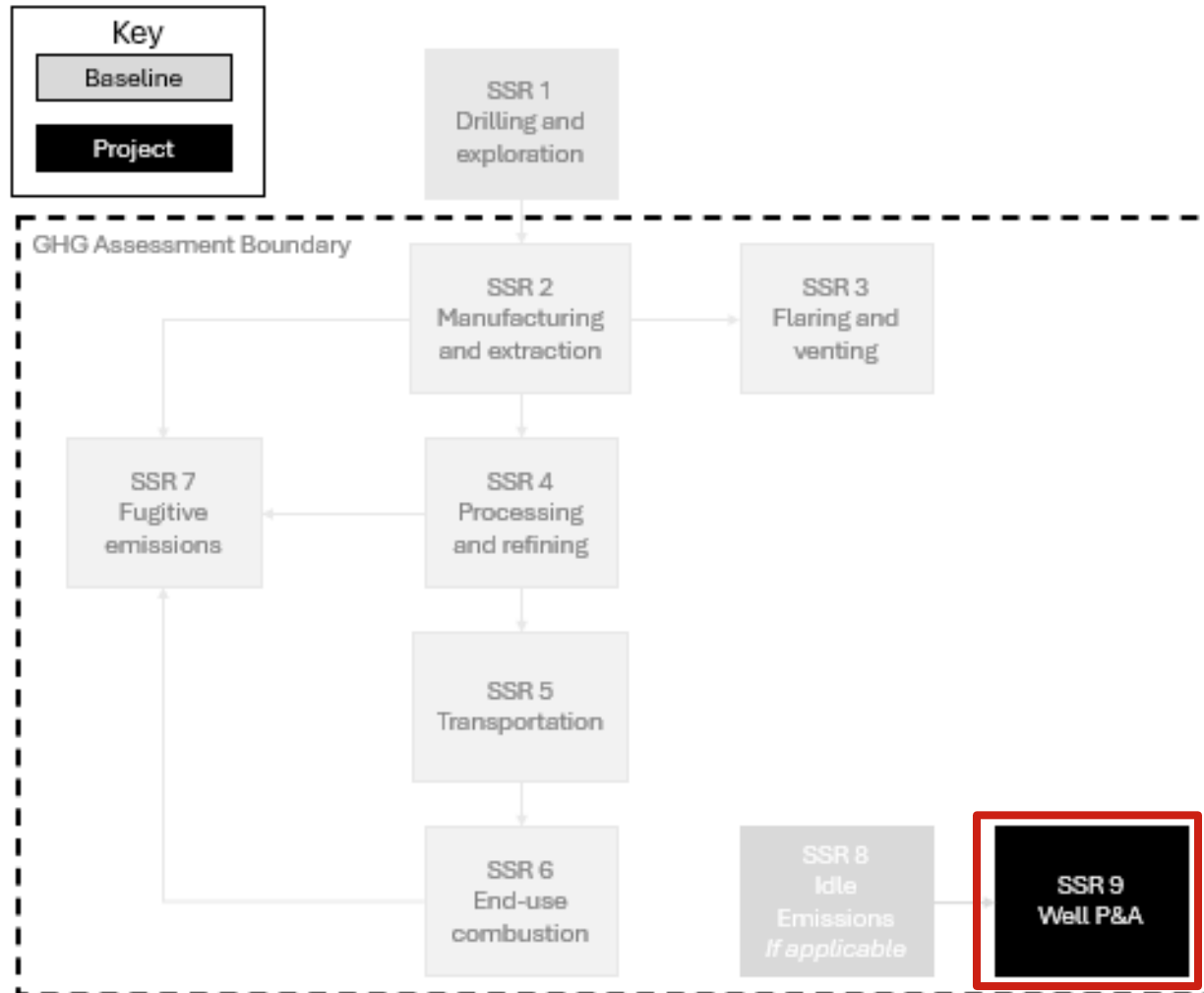
Proposed Excluded SSR: Drilling & Exploration



Proposed Included SSRs



P&A Emissions



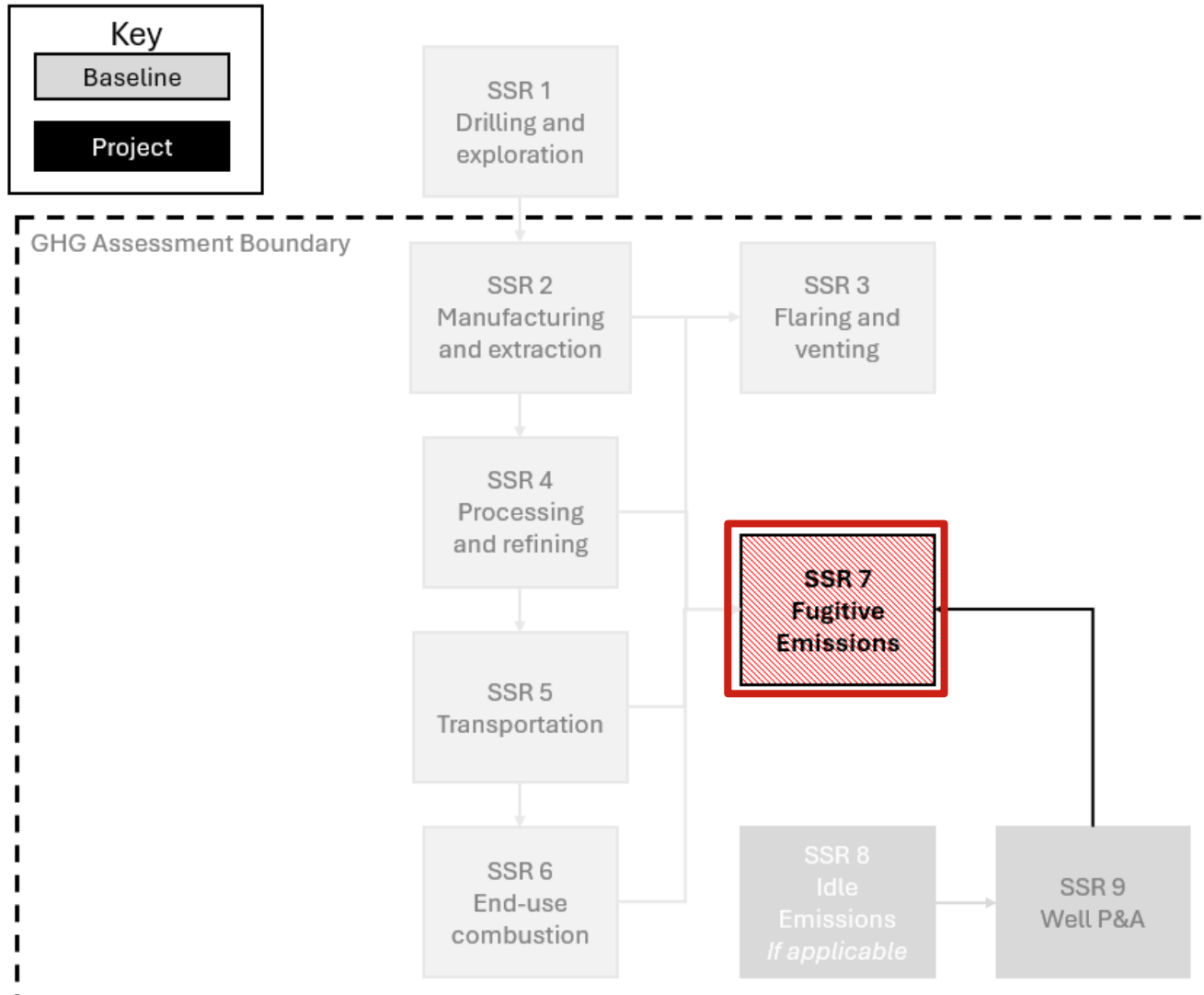
Draft Proposal assumes that the well will be P&A in the future, resulting in the emissions being equal in the baseline and project. However, wells may have other fates (e.g., O&A, repurposed).

- Is assuming plugging will occur later appropriate?

To conservatively estimate project emissions, should P&A emissions be included?

- Embodied emissions of the plugging materials?
 - ✓ Quantity x emission factor
- Emissions resulting from fossil fuel use from the plugging equipment?
 - ✓ Quantity x emission factor

Fugitive Emissions Post-Plugging



P&A can prevent GHGs from leaking into the atmosphere and prevent air and water pollution. However, it may not be 100% effective, resulting in emissions. Should fugitive emissions post-plugging be considered in the project boundary?

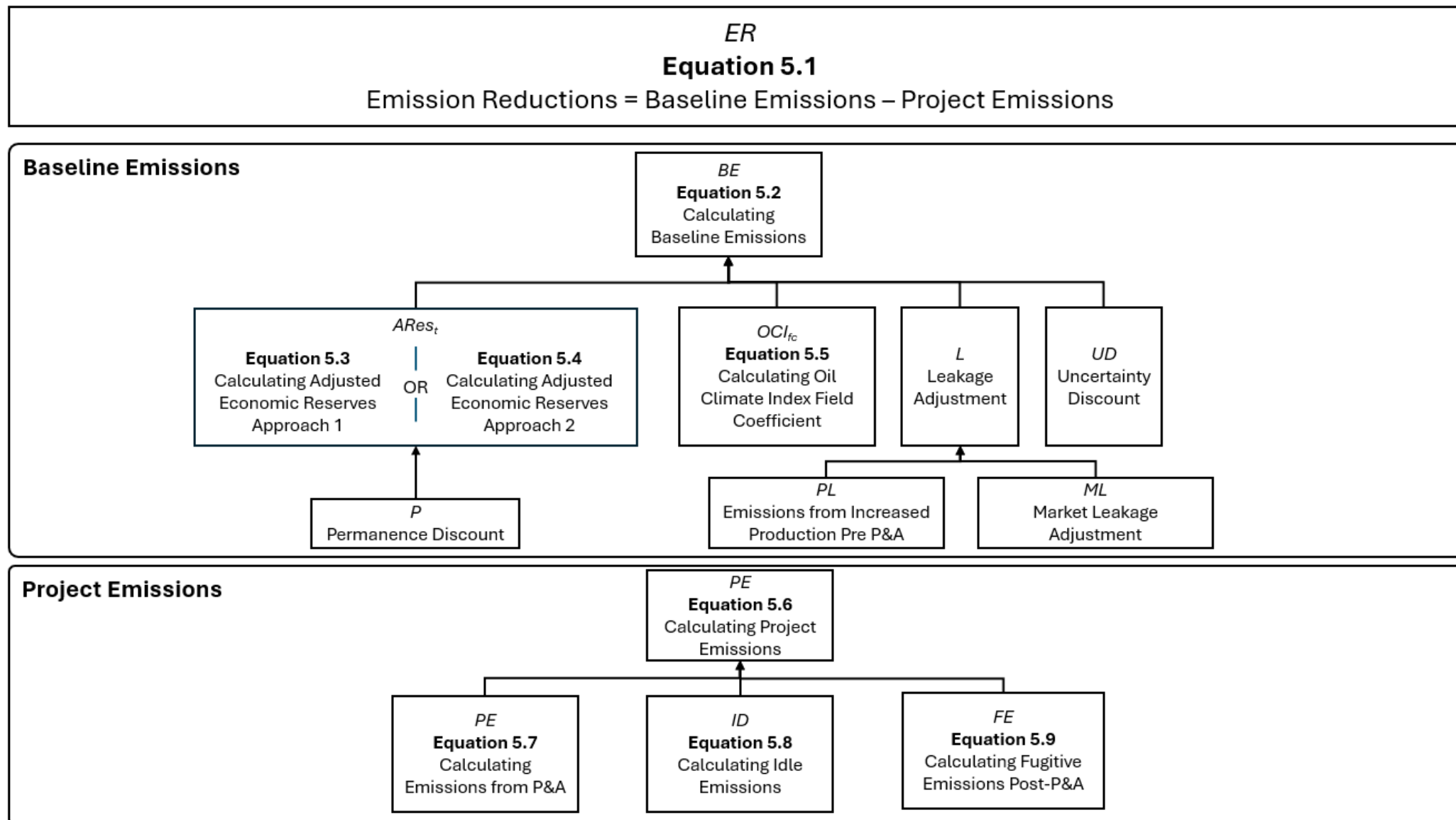
- If yes, ongoing direct monitoring would be required. Approaches include:
 - High Flow Sampling
 - Flux Chambers
 - Emission Rate Bag Sampling
 - Flow Rate Bag Sampling
 - Methane Concentration and Flow Rate Methods



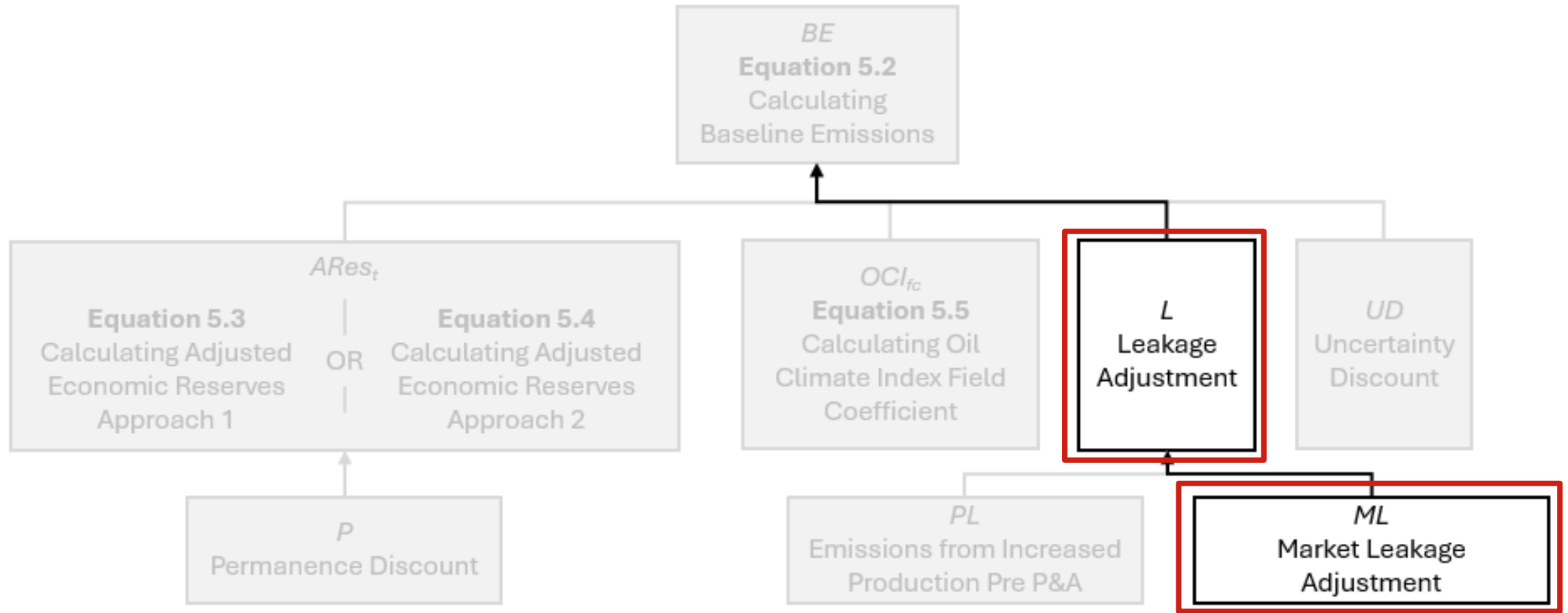
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LEAKAGE ADJUSTMENT

Quantifying GHG Emission Reductions



Market Leakage Adjustment



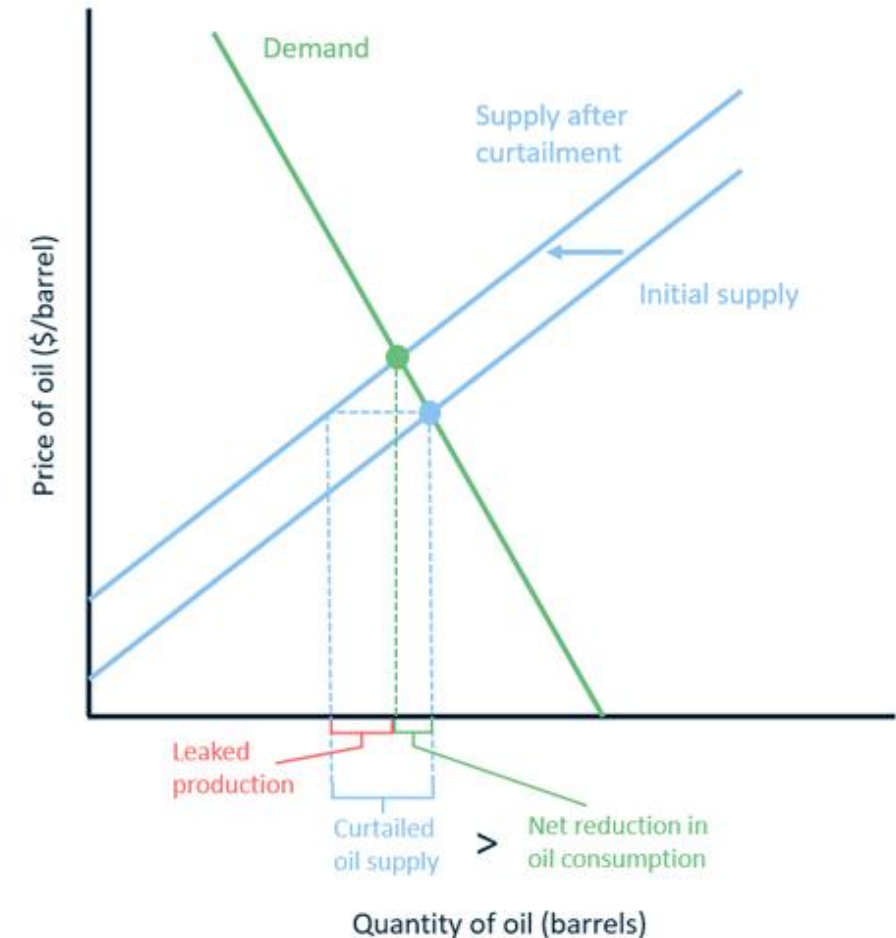
Market Leakage Adjustment

- Market Leakage: when reduced supply from one source is partially offset by increased production from other sources
 - Based on the price elasticity of supply and price elasticity of demand
- Key components for supply-side intervention:
 1. Demand – how do changes in price impact consumer behavior?
 2. GHG Intensity – supply may be partially substituted by cleaner or dirtier sources
- In the next few slides, will consider the market leakage adjustment in terms of:
 1. Existing market leakage study
 2. Oil vs natural gas leakage considerations
 3. National, regional, vs state leakage consideration

Market Leakage Adjustment

- Demand is not perfectly (in)elastic, so leakage is not 100%
- Resources for the Future (2024) study on oil found:
 - ✓ Demand elasticity ranging from -0.12 to -0.53 (average -0.33) based on past studies
 - ✓ Supply elasticity ranging from +0.25 to +0.55 (average +0.42) based on past studies
 - ✓ **Market leakage of 56%, using average elasticities**
 - ✓ North American oil is slightly more (4%) emissions intensive than average
 - ✓ Net decrease in emissions in 98% of scenarios, based on 1.53M Monte Carlo simulations

Figure 1. Stylized Illustration of the Leakage Mechanism



Oil vs Natural Gas

- Price elasticity of demand: measures responsiveness of the quantity demanded in response to price changes
 - Demand for oil and natural gas is inelastic (lower responsiveness to price changes) but becomes more elastic in the long run
- What influences price?
 - Oil – more influenced by world market conditions
 - ✓ Financial markets, supply from (non-)OPEC countries
 - ✓ Economic growth, public transportation availability, fuel alternatives (long run)
 - Natural gas – more influenced by regional market conditions
 - ✓ Volume produced (including imports/domestic) and exports
 - ✓ Weather conditions, economic growth, substitutes
- Demand for oil and gas is inelastic; however, prices are influenced by different factors. Should the protocol have separate leakage adjustments based on oil or natural gas production?

National, Regional, vs State Leakage Adjustment

- The factors that influence price elasticity of supply and demand vary at a regional and state level. **Should leakage be assessed on a more granular level (i.e., regional or state rather than national)?**
- Existing studies have found there is large variability of demand elasticity for natural gas on a regional and state level; however, not every region/state was statistically significant
 - National Renewable Energy Lab (2006) [study](#) on residential demand
 - R. Charles (2016) [study](#) on residential, commercial, and industrial demand

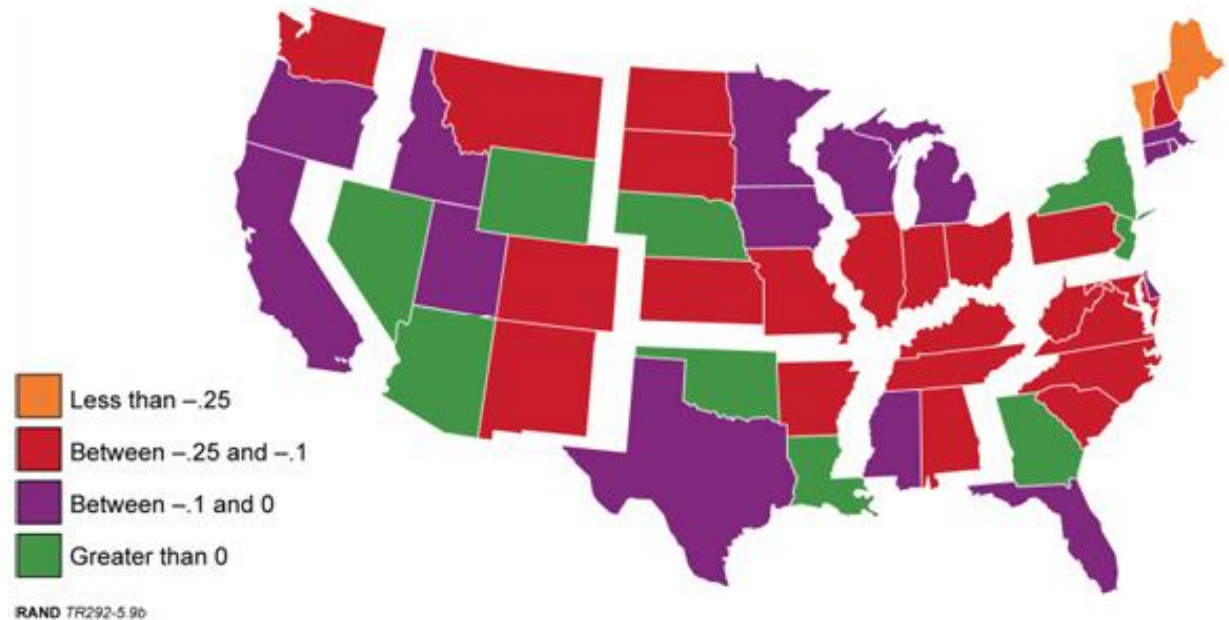


Figure 5.9b: Short-run Price Elasticities for Natural Gas

(NREL, 2006)

Next Steps



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Next Steps



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Follow-Up

- Reserve will post recording and slides online
- Workgroup to submit written comment

Potential Meetings

- Reserve will send Doodle Poll for potential meetings in April
- Workgroup to provide availability ASAP

Draft Protocol

- Reserve will share the draft protocol
- Workgroup to review and provide written comment

Contact Information

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THANK YOU!