NewFields

amec

NewFields

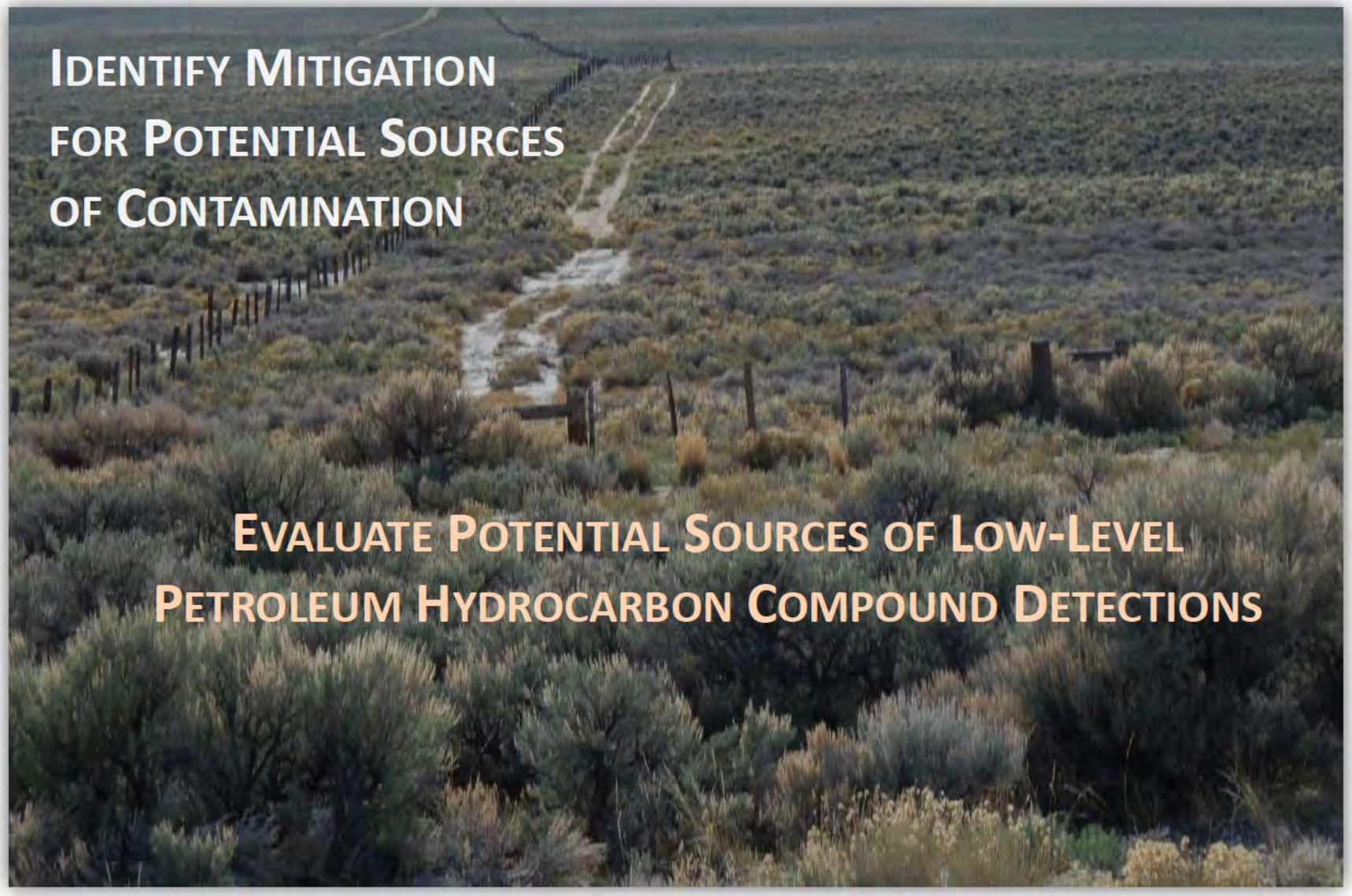
Interim Plan

LLPHC – Study Design and Execution

Pinedale Anticline Project Area ROD, Sublette County, Wyoming

NewFields

Task 3, Interim Plan



Study Protocols

Planning Documents:

- ✓ Plan of Study
- ✓ Sampling and Analysis Plan

Prescribed Approach

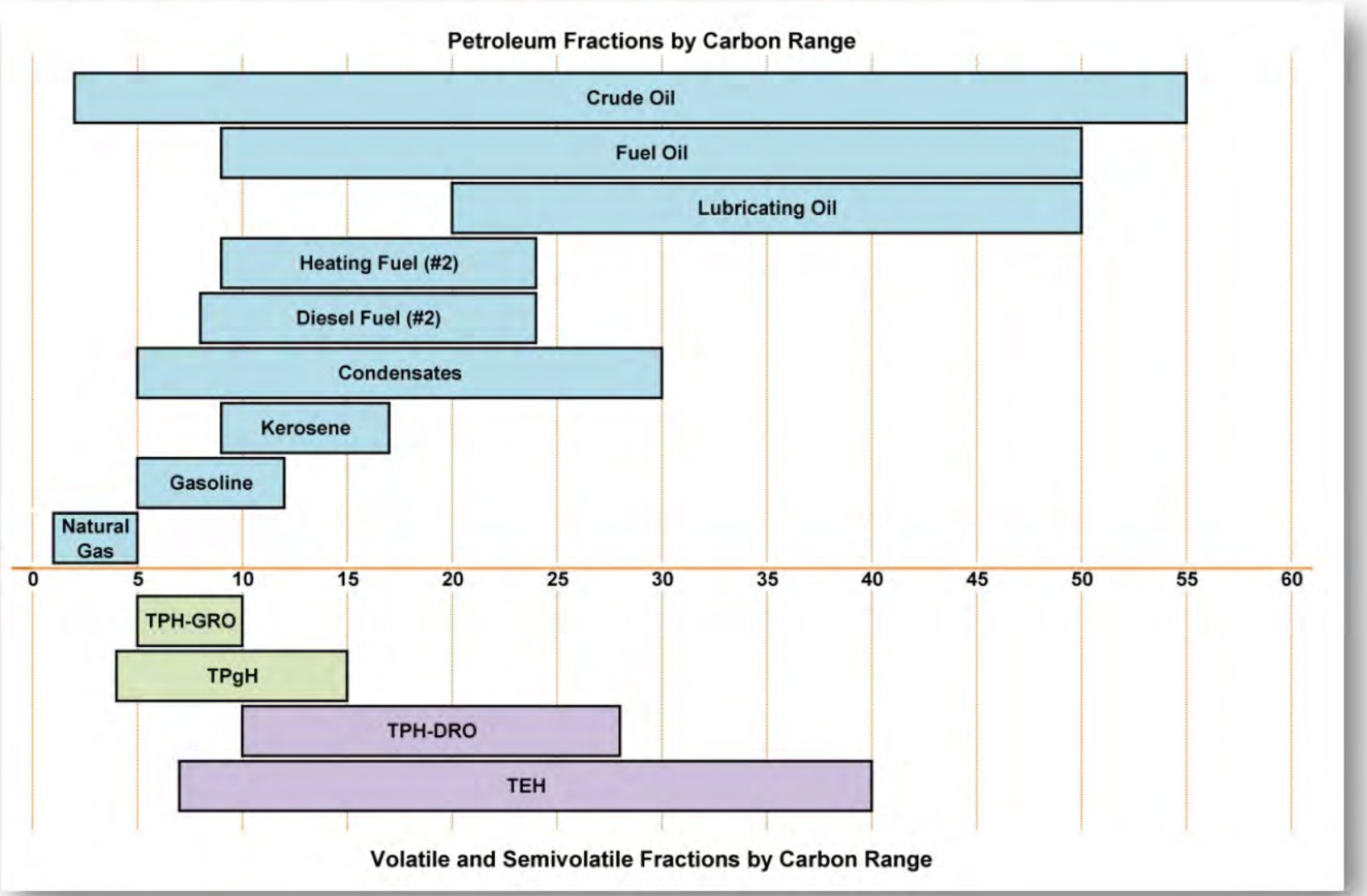
Reviewed & Accepted by:

TECHNICAL TEAM

BLM
DEQ
EPA
Operators

NewFields

Hydrocarbons – Basic Terms



Volatiles vs. Semivolatiles

Volatile detections are:

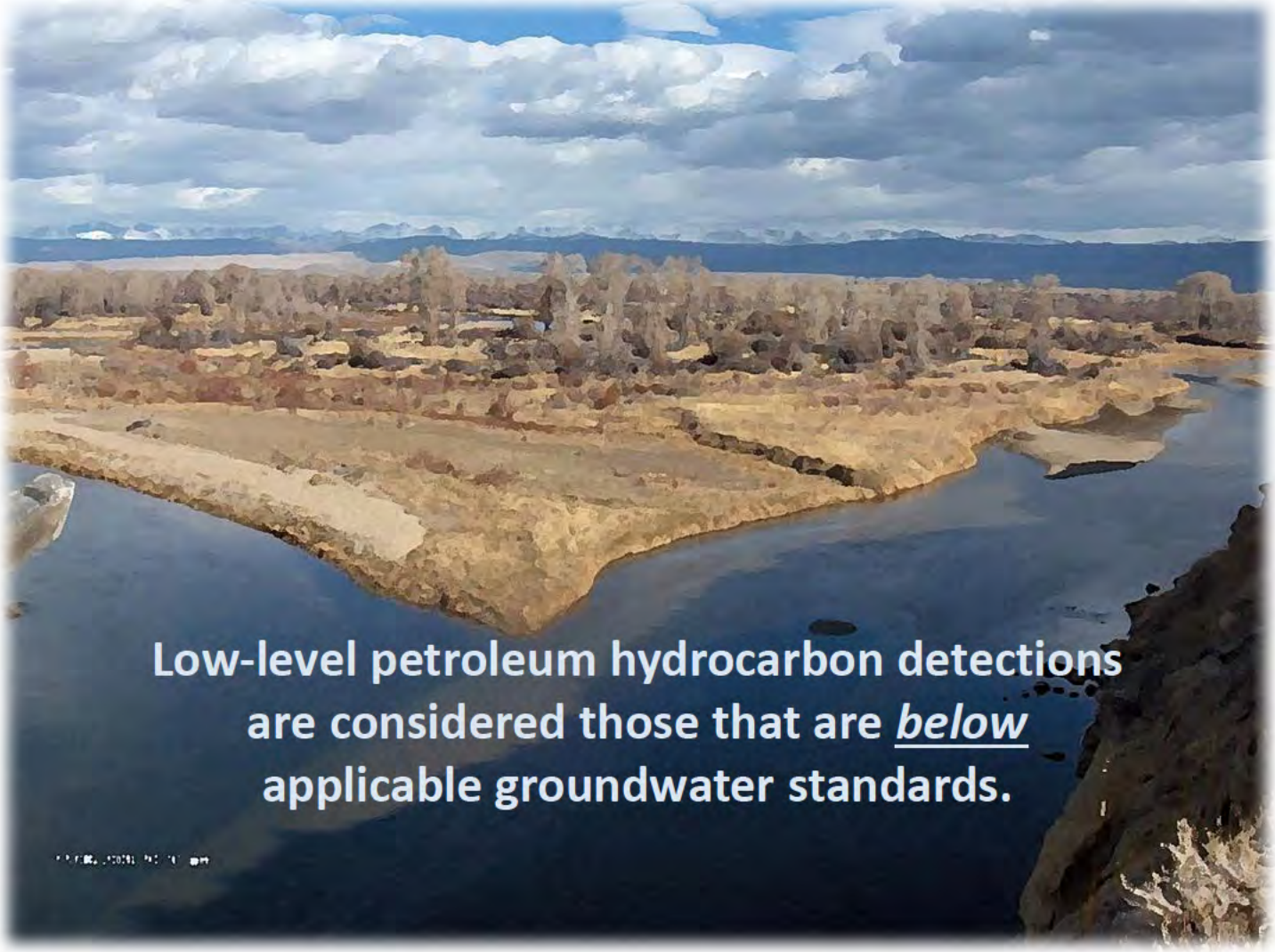
- Total purgeable hydrocarbons (TPgH) and/or TPH-GRO,
- Hydrocarbon gas detected by dissolved gas analysis, or
- Volatile Organic Compounds (individual VOCs).

Semivolatile detections are:

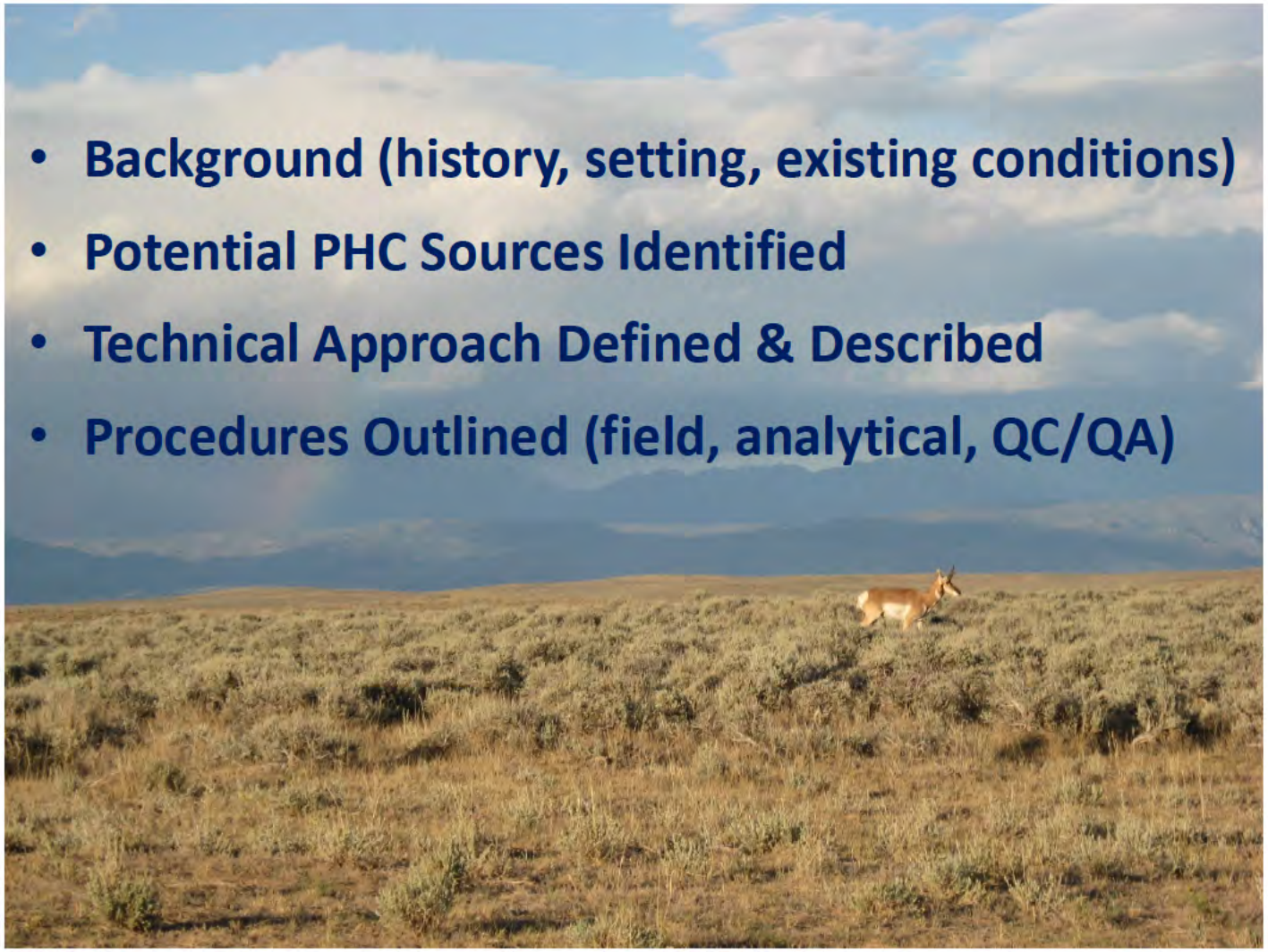
- Total extractable hydrocarbons (TEH) and/or TPH-DRO, or
- Semivolatile Organic Compounds (individual SVOCs).

NewFields

Low-Level . . . defined



Sampling and Analysis Plan (Nov 2010)



Technical Approach

SAMPLE TYPES

- Potential PHC Source Materials
- Gas Samples
- Groundwater Samples

Potential Source Material Samples

1. Drilling Mud
2. Condensate
3. Produced Water
4. Flowback Fluid
5. Pump Installation Mts.
6. LNAPL
7. Carbonaceous Shale

NewFields

Gas Samples

1. Casing Gas
(Water Wells)

2. Natural Gas
(Production Wells)

Groundwater Samples

Four Groups:

1. Control wells
2. LEL wells
3. PHC wells
4. Study wells

(see poster board)

Sample Analysis

- Inorganics
- Metals
- Fractions – Volatile and Semivolatile
- VOCs and SVOCs
- Stable Isotopes
- Hydrocarbon Gas Composition
- Thermal Maturity (carbonaceous shale)

Energy Laboratories, Inc., Isotech Laboratories, Precision Analysis, Questar Applied Technologies, Intertek Westport Technology Center

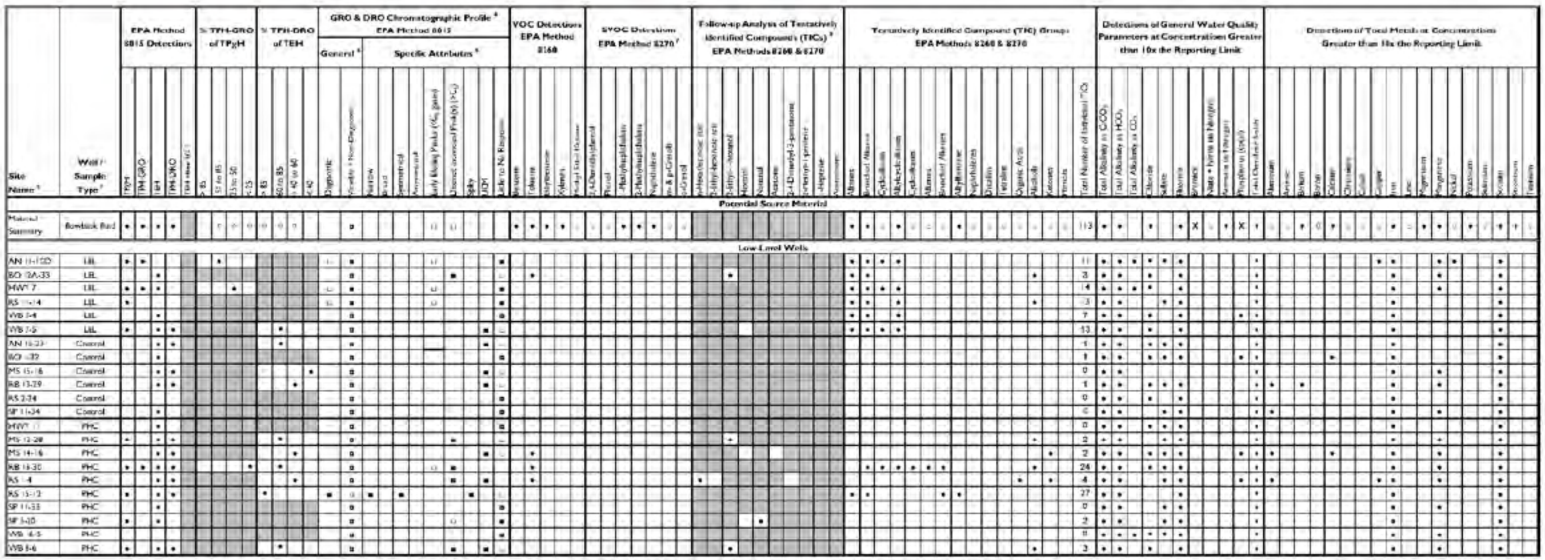
NewFields

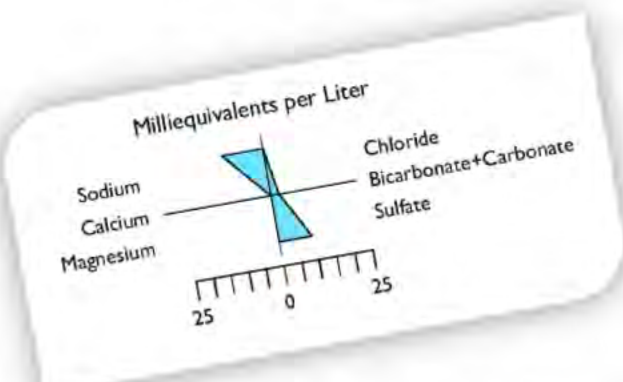
Five Sampling Events

1. Sep 2010 (pump installation materials [dope])
2. Nov-Dec 2010
    - Groundwater – Industrial water supply wells
    - Potential Source Materials – LNAPL, condensate, produced water, drill mud
    - Gas – water well casing gas, NG production wells
3. Feb-Mar 2011(flowback fluid)
4. Jun 2011 (groundwater from study wells)
5. Feb 2012 (follow-up groundwater and gas)

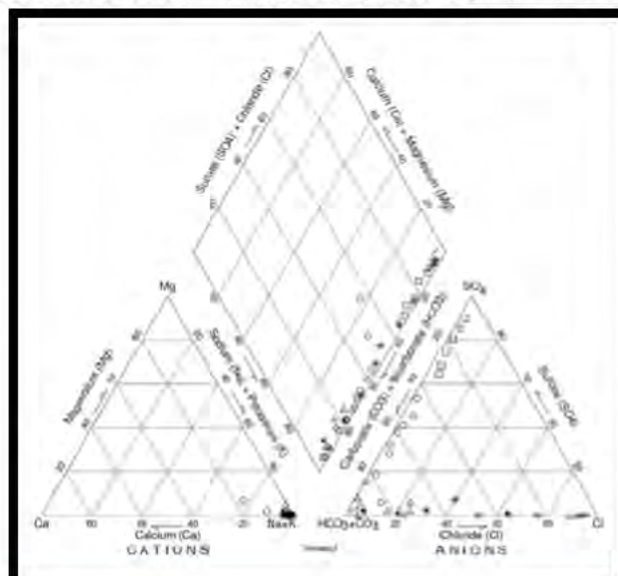
Data Evaluation Approach

Compiled data

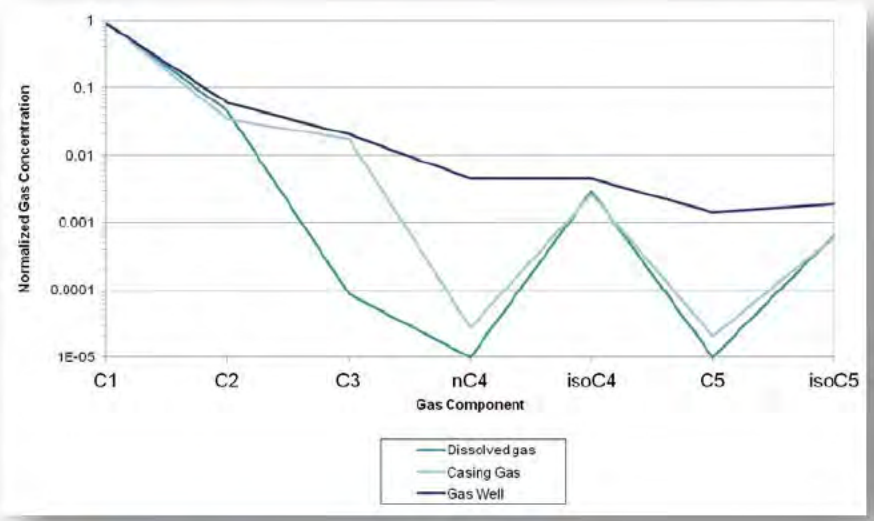




Characterized water types



Data Evaluation (more)

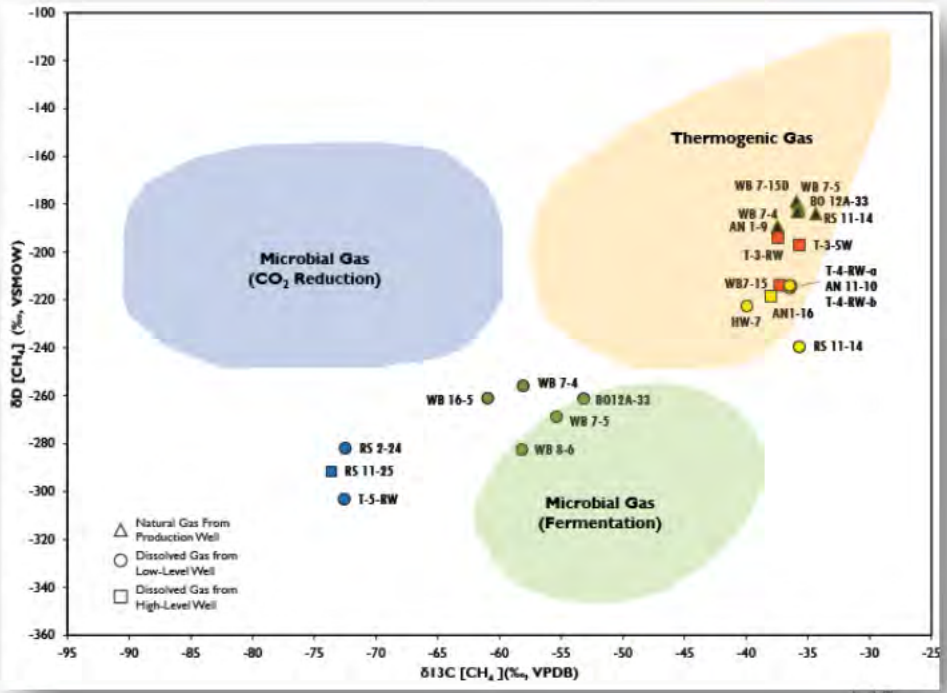


Gas Component Ratios

Stable Isotope Geochemistry

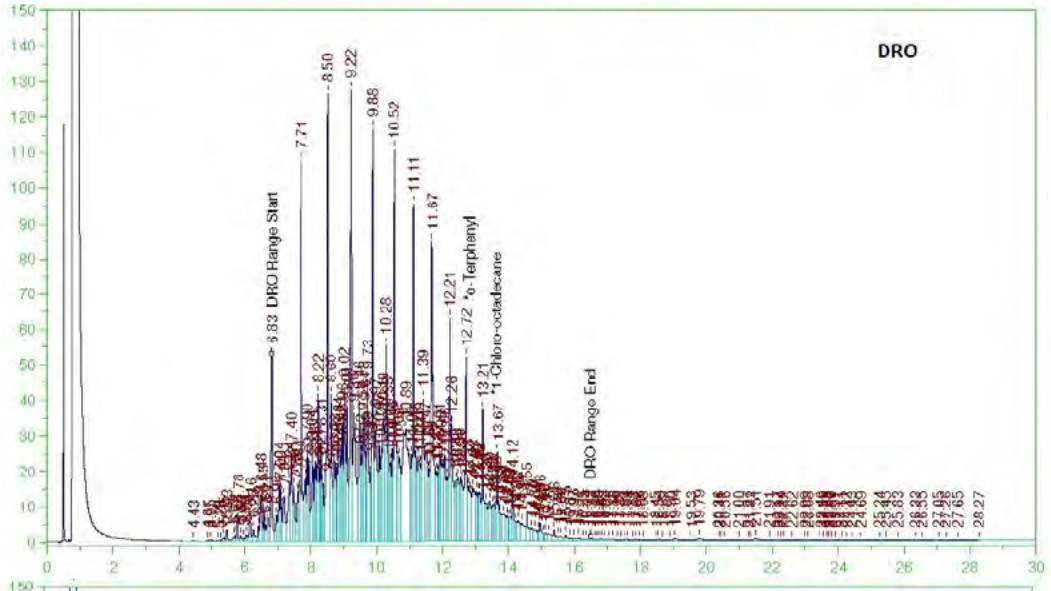
Isotopes of water and dissolved organic carbon

Carbon and hydrogen isotopes of methane

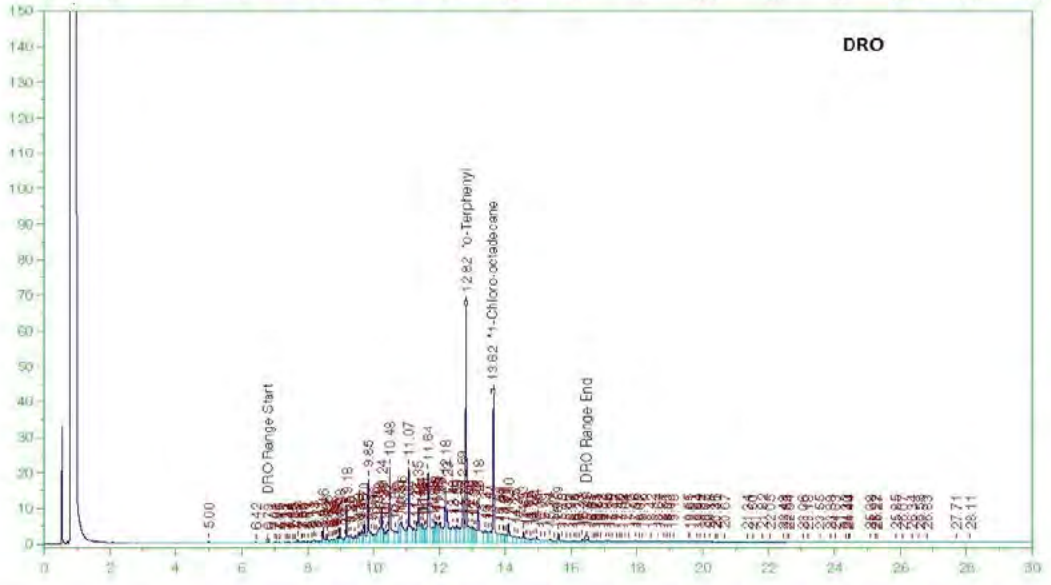


NewFields

Chromatogram Pattern Matching



Potential Source Material, Drill Mud



Industrial Water Well Sample

NewFields

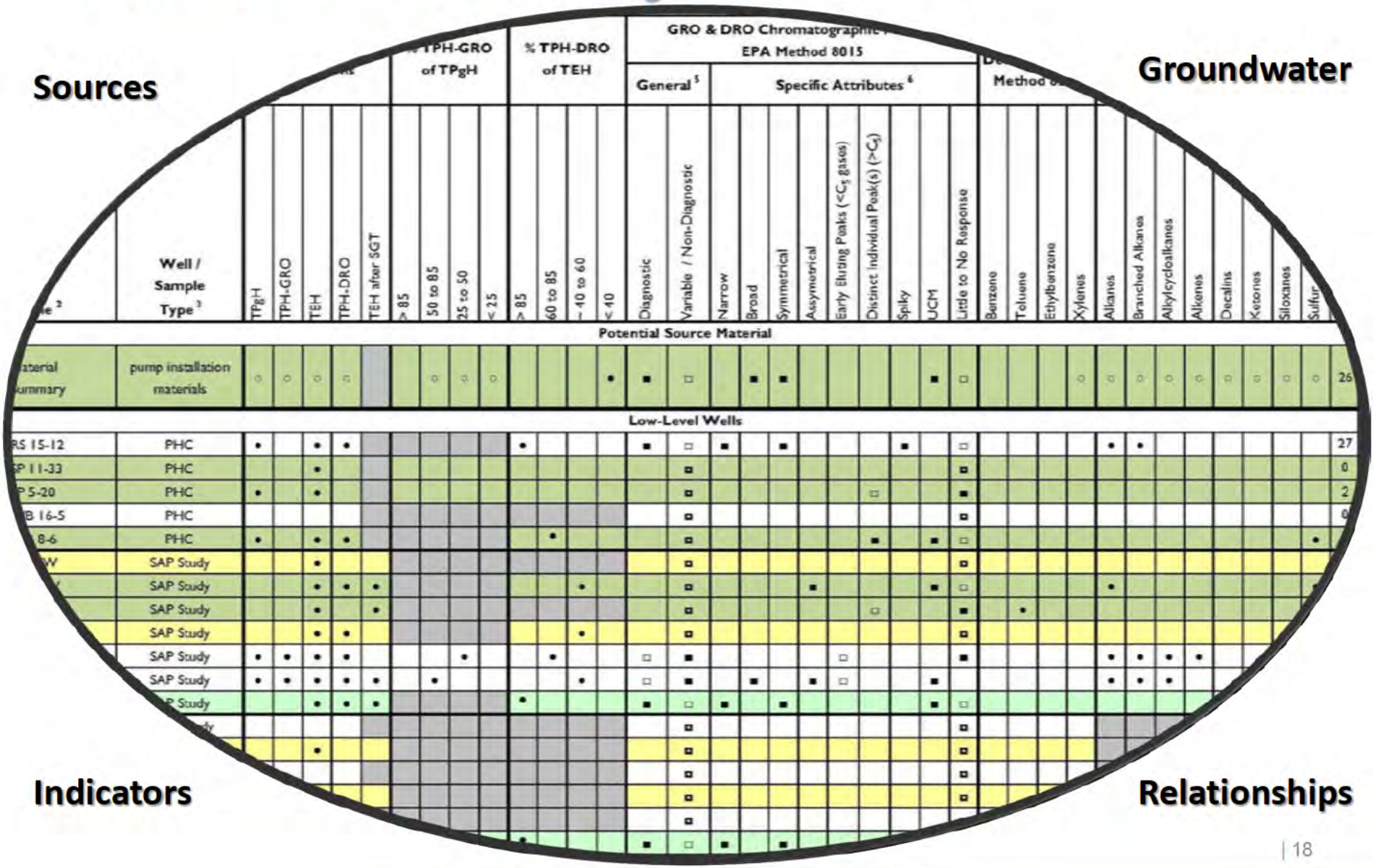
Point and Non-Point Sources Considered

- ✓ Construction, Completion, Abandonment of Natural Gas Wells
- ✓ Facilities Associated with NG Production
- ✓ Water Supply Well Construction, Use, Operation
- ✓ Underground Injection of Produced Water
- ✓ On-Pad Spills
- ✓ Off-Pad Sites
- ✓ Sampling Methods and Analytical Laboratory Issues
- ✓ Natural Sources

Chemical Data Analysis

Sources

Groundwater



Indicators

Relationships

NewFields

Data Analysis, more

Operational

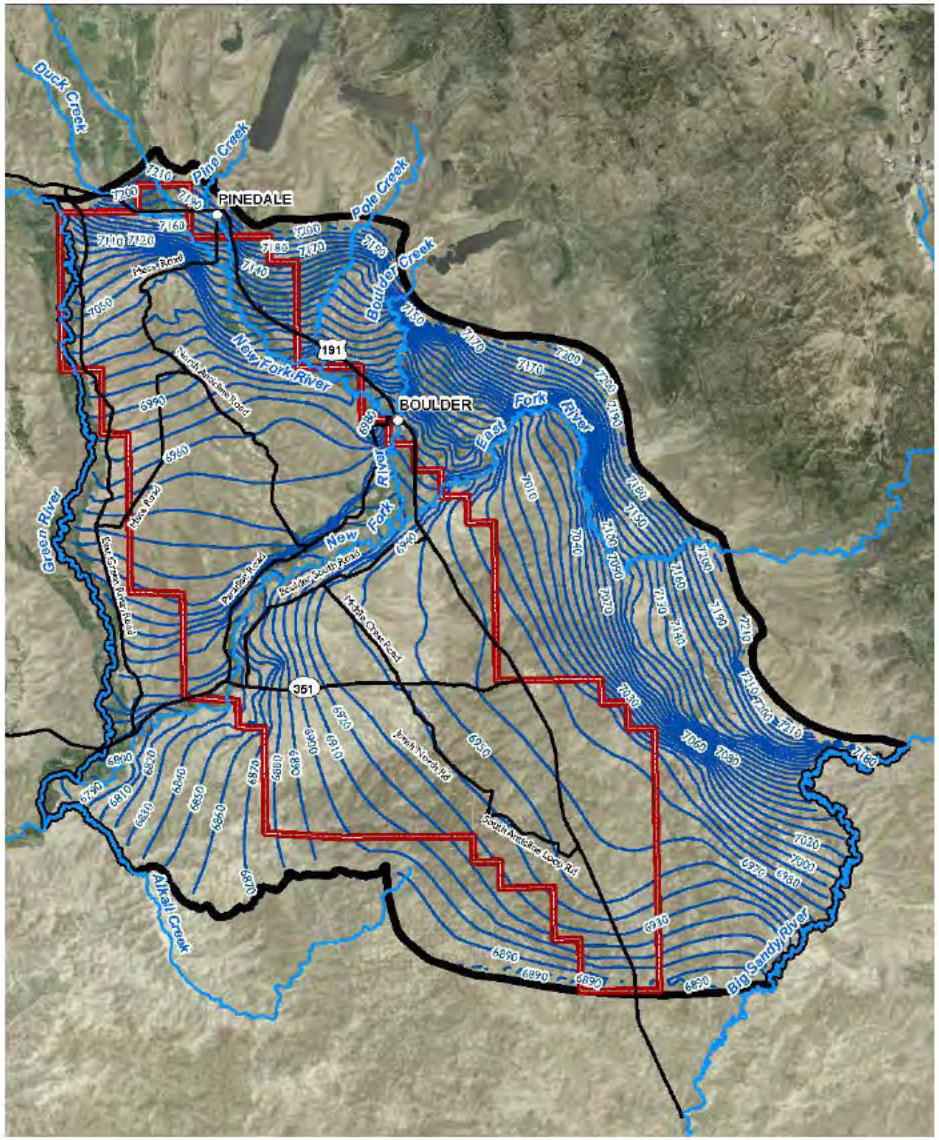
Temporal

Spatial

NewFields

Data Analysis, more

Physical System



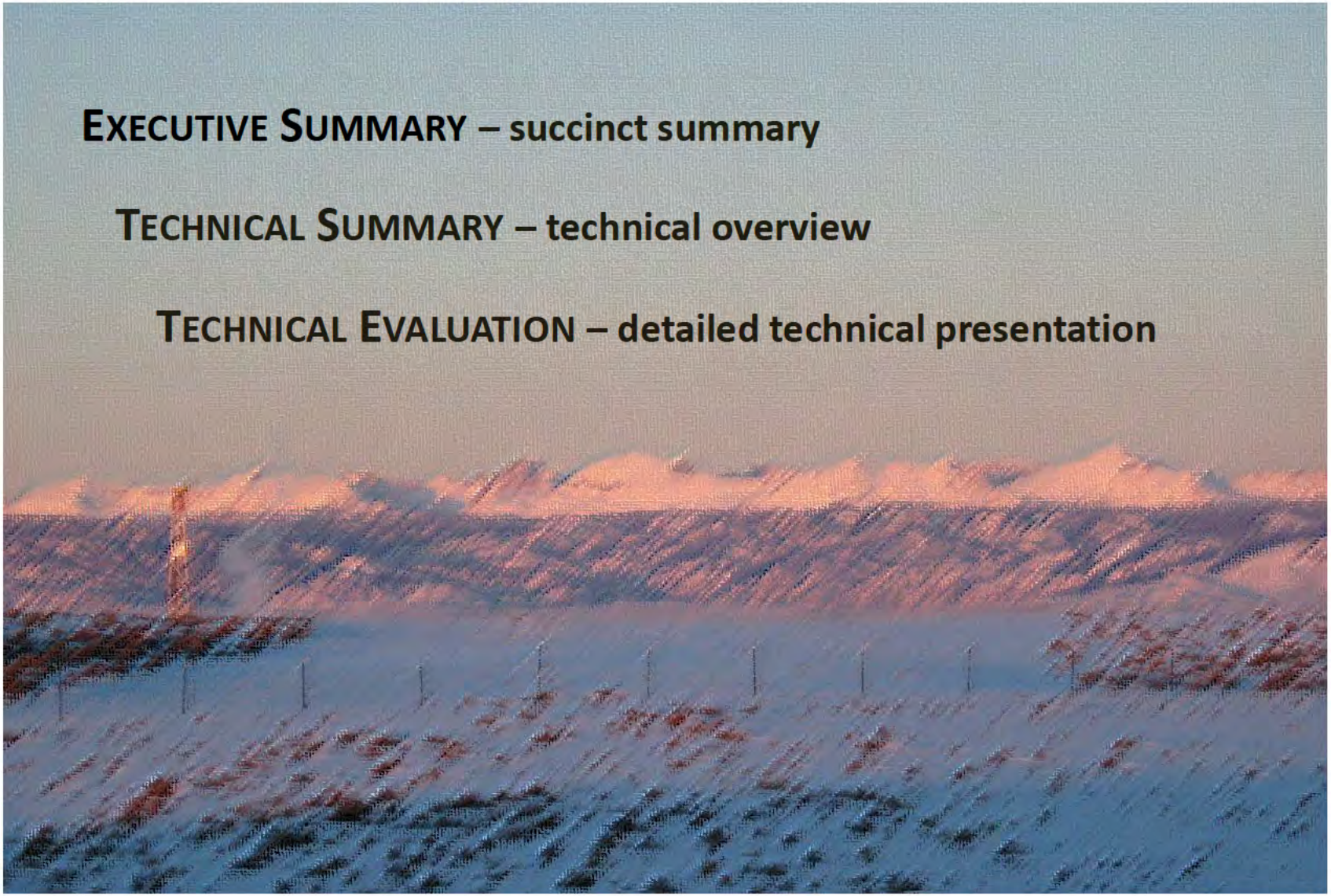
Reporting, a Deliberate Process

- Data/Chemical Intensive
- Low-levels
- Technical Reviewers
- 4 versions, then Final
- Technical Team – Key
  - Review/Comment
  - Meet/Discuss
  - Respond
  - (Repeat)

NewFields

Report Organization

EXECUTIVE SUMMARY – succinct summary

TECHNICAL SUMMARY – technical overview

TECHNICAL EVALUATION – detailed technical presentation