National Seismic Data Repository: An investigation into a proposal

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GSA –Connects 09/22/2024

Form Task Force to Prepare Business Plan for National Seismic Data Archives – CCS and Class I, II IV injectors, to identify risks.
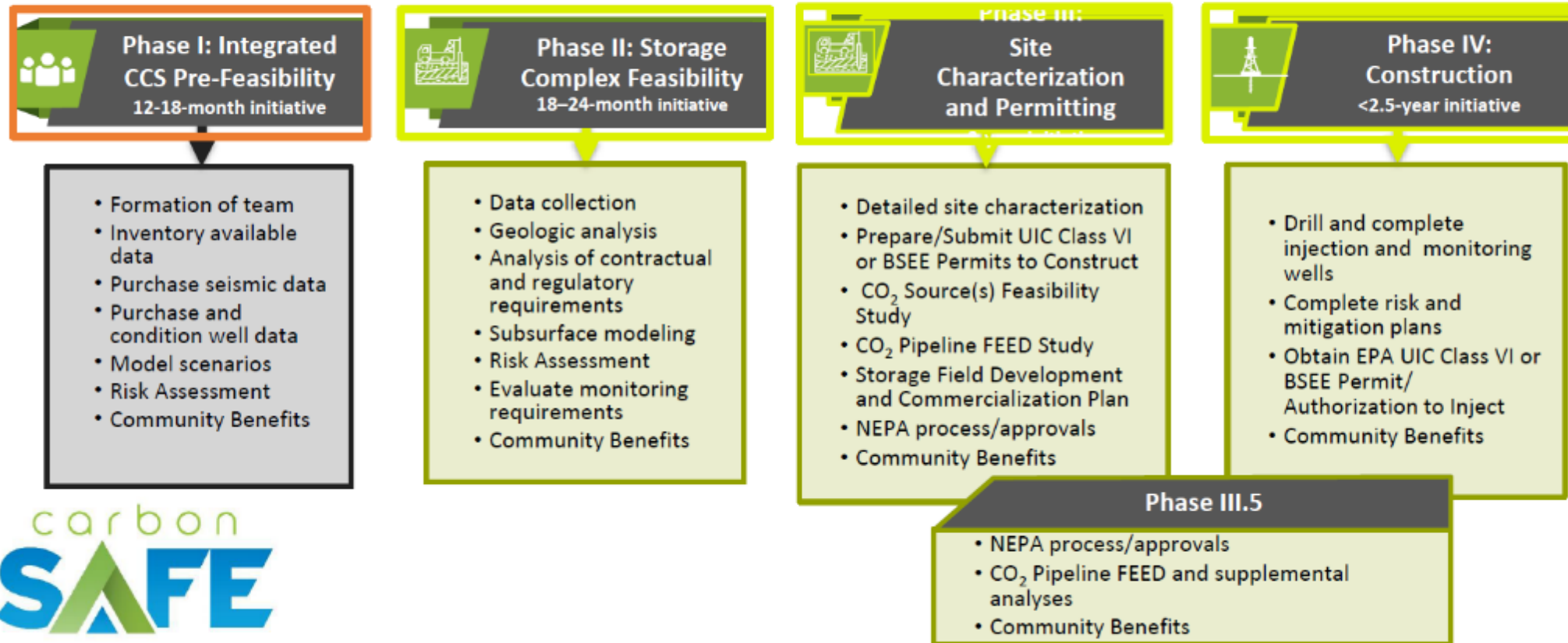
- Central Accurate index of(most) of the seismic data recorded over the past 100 years Location, - *Biggest Challenge* Acquisition parameters, processing sequence, and versions
  (Framework by 2nd Quarter 2025)
  - Raw data
  - Title and version history
  - Original cost, processing history, and current value
  - REFORMAT old media before data disappears

- Accessible to all: academia, industry, regulators
  - Include academic research, and private, sources

- Establish a financial model that fairly compensates contributors
  - Pays for the upkeep of the archive and retrieval
  - Makes affordable for academics, small operators, regulators, and researchers.

- Implement a permanent archive retrieval system
  - Coordinate with vendors currently providing these services
  - Create standards across industry, research, academia

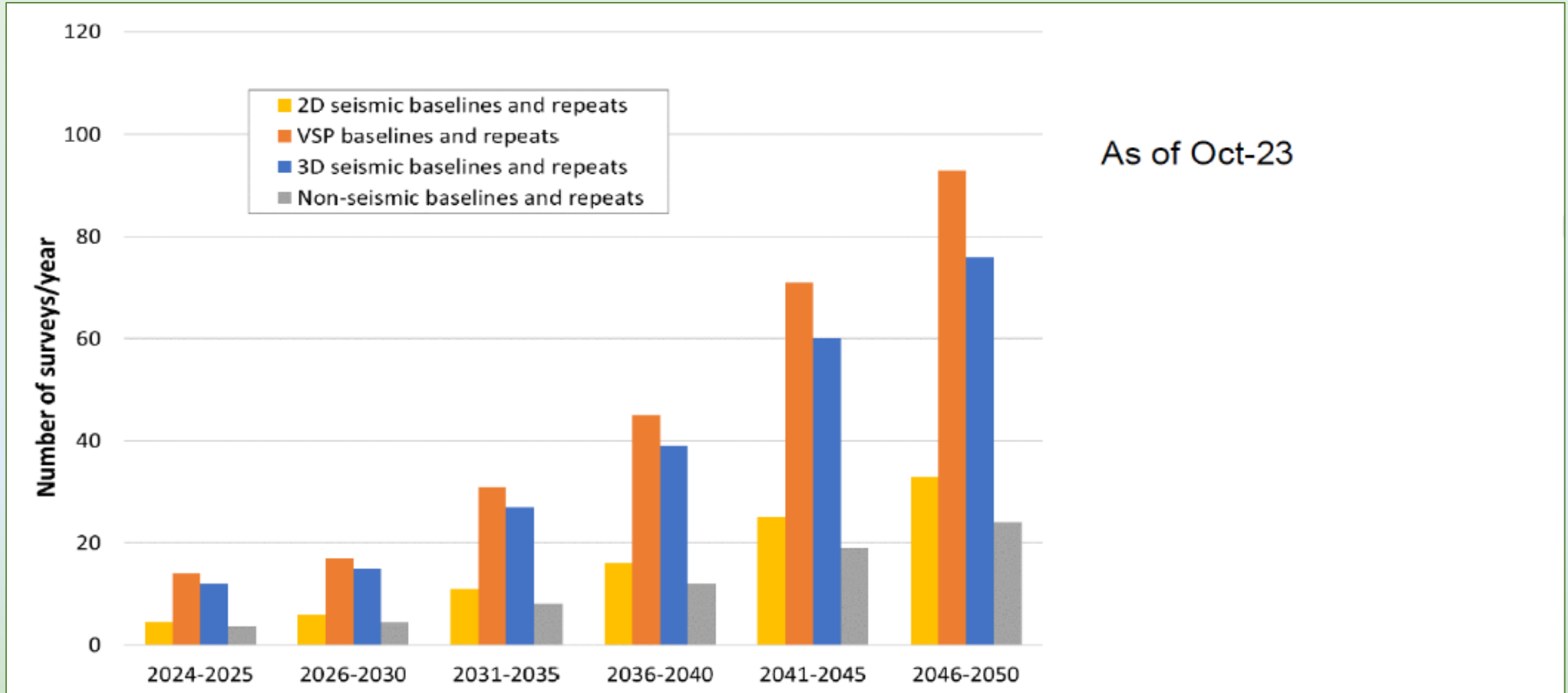# Need for access to legacy data for CCS Planning

Field Demonstration Projects

Carbon Storage Assurance Facility Enterprise (CarbonSAFE)

NETL — NATIONAL ENERGY TECHNOLOGY LABORATORY

Phase I: Integrated CCS Pre-Feasibility
12-18-month initiative
- Formation of team
- Inventory available data
- Purchase seismic data
- Purchase and condition well data
- Model scenarios
- Risk Assessment
- Community Benefits

Phase II: Storage Complex Feasibility
18–24-month initiative
- Data collection
- Geologic analysis
- Analysis of contractual and regulatory requirements
- Subsurface modeling
- Risk Assessment
- Evaluate monitoring requirements
- Community Benefits

Phase III: Site Characterization and Permitting
- Detailed site characterization
- Prepare/Submit UIC Class VI or BSEE Permits to Construct
- CO_2 Source(s) Feasibility Study
- CO_2 Pipeline FEED Study
- Storage Field Development and Commercialization Plan
- NEPA process/approvals
- Community Benefits

Phase IV: Construction
<2.5-year initiative
- Drill and complete injection and monitoring wells
- Complete risk and mitigation plans
- Obtain EPA UIC Class VI or BSEE Permit/ Authorization to Inject
- Community Benefits

Phase III.5
- NEPA process/approvals
- CO_2 Pipeline FEED and supplemental analyses
- Community Benefits

carbon SAFE

U.S. DEPARTMENT OF ENERGY

Bipartisan Infrastructure Law (BIL): Storage, Validation and Testing (Section 40305): Carbon Storage Assurance Facility Enterprise (CarbonSAFE): Phases II, III, III.5, and IV

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A Class VI Application-Based Assessment of the Future of Geophysics in US CCUS Projects, and DOE's Investments to Influence This; (Presented at "Towards Gigatons CO2 Storage, Golden CO, July 14-19, 2024) David Alumbaugh, LBNL, Mark McCoy, NETL, P Jordan, J Corea, LBNL and B Petras Battelle
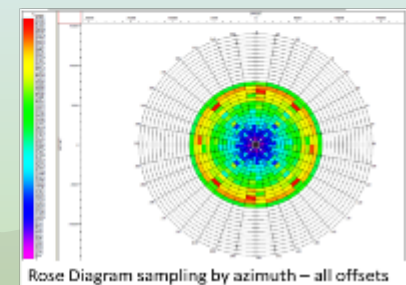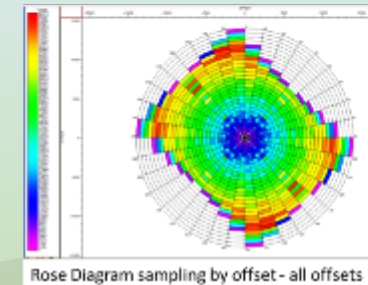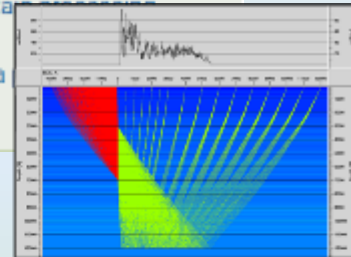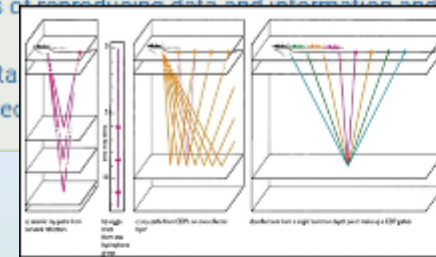
Future Geophysics Use for CCS Monitoring

How to locate and 'acquire ' Seismic data for use in CCS or injector permitting

- Is there any data available?
  - Public domain? – DOE, National Archives, USGS?
  - Brokers - catalog and sell licenses to proprietary data that has been released.
  - Operators my release information about available data that they have acquired
  - Spec companies provide information of data they won that is available.
  - Check for public domain data through USGS reports?????
- Design and acquire new data. Need to tie in information outside of specific objectives. *NO seismic is an island.*
  - Qualified seismic acquisition professionals: Objective targets, budget, restrictions
  - Underwrite a speculative survey
  - Join a group to share costs and benefits.

ENHANCED CONTENT - TABLE OF CONTENTS

Rose Diagram sampling by offset - all offsets

Rose Diagram sampling by azimuth – all offsets

# How is seismic data acquired, located, reprocessed, and used by industry?

- Plan and execute a *seismic acquisition project*
  - Objective-based parameters, processing, and interpretation
- 'Buy' existing data
  - Rights to trade, sell, give, etc.
- License existing
  - Parameters determined by
  - Fine tune amount,
  - NO Selling, Trading, or giving to partners.
- Bootleg – STEAL
  - Don't !!!!

Large volumes of data have been collected but not accessible

- Legacy Industry data – salt mines, copies, old media
  - Bankruptcy
  - Mergers
  - Acquisitions
  - Copies of Spec or group data

- Public domain not cataloged- how is the public supposed to access
  - Data requests
    - Offshore MMS – BOEM data required
    - AK, Louisiana

- DOE-sponsored data
  - SEAM Models,
  - Teapot Dome -3D 1999
  - Carbon Safe – IBDP, Etc.

One Company (SEI) Data Library
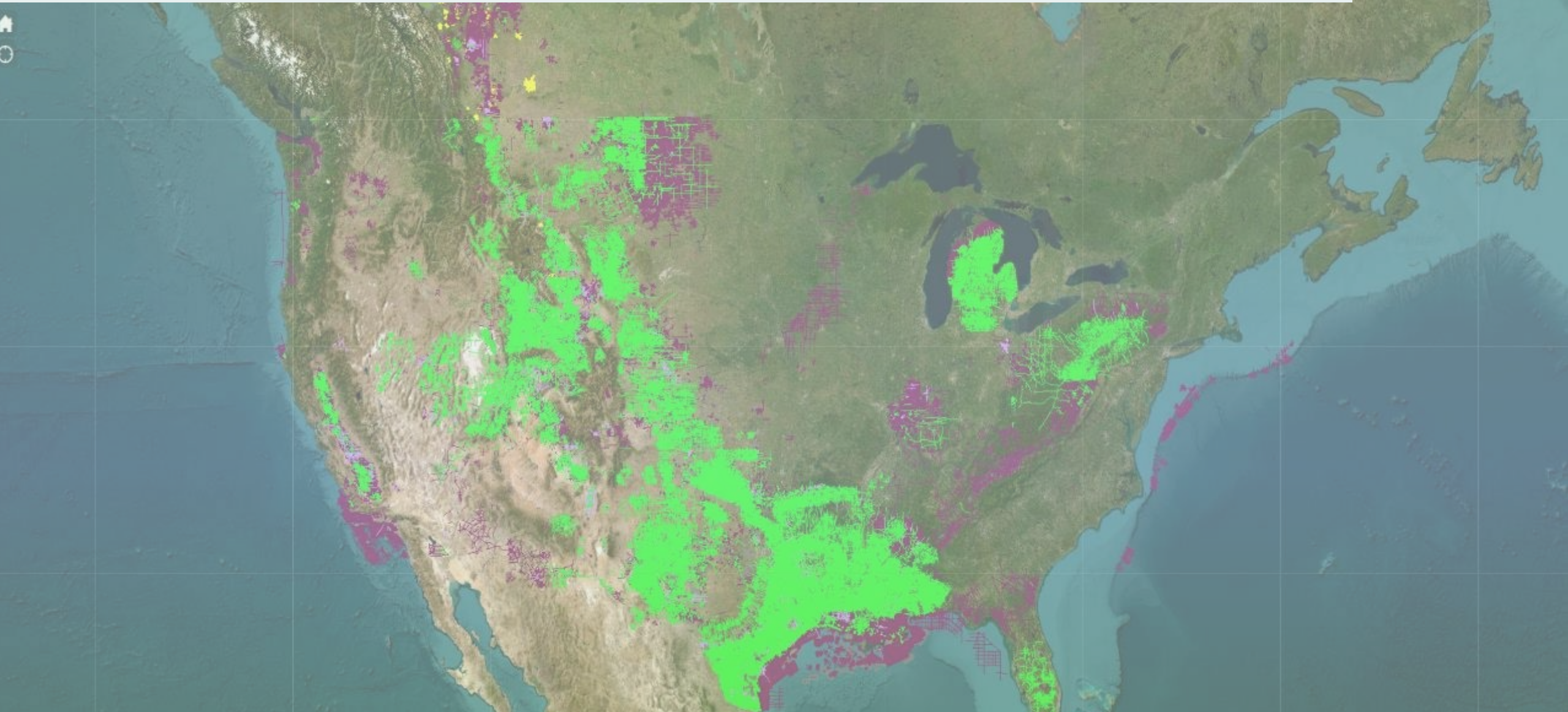
Over 1,650,000 2D miles and 108,000 sq. miles of 3D proprietary seismic data at your fingertips

American Geophysical Corporation –Data Library

2D Seismic Data   3D Seismic Data   https://www.americangeophysical.com/maps.htm#

Please contact your American Geophysical representative.
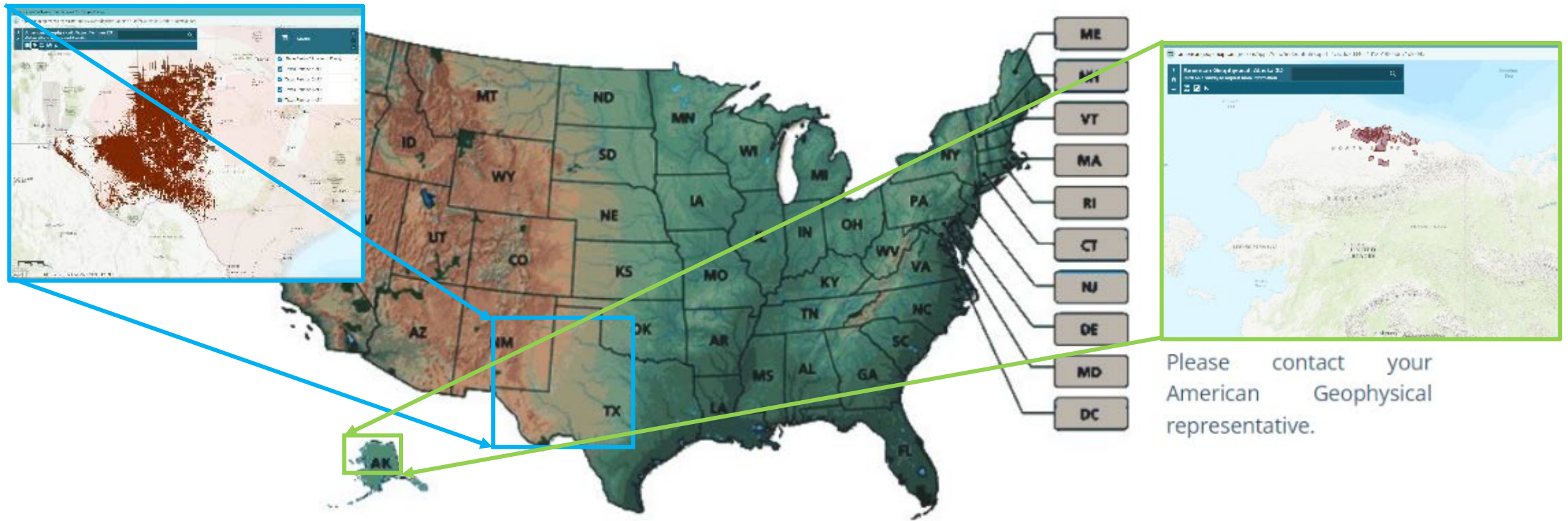
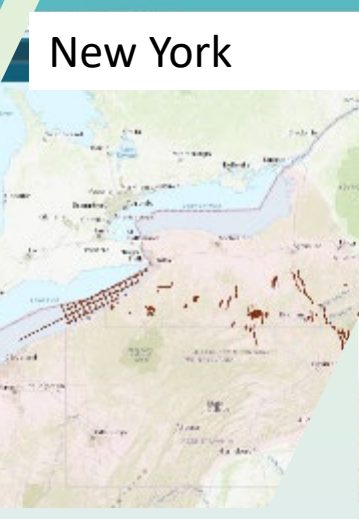American Geophysical Corporation is a primary source for 3D and 2D seismic data locations throughout the U.S. onshore.
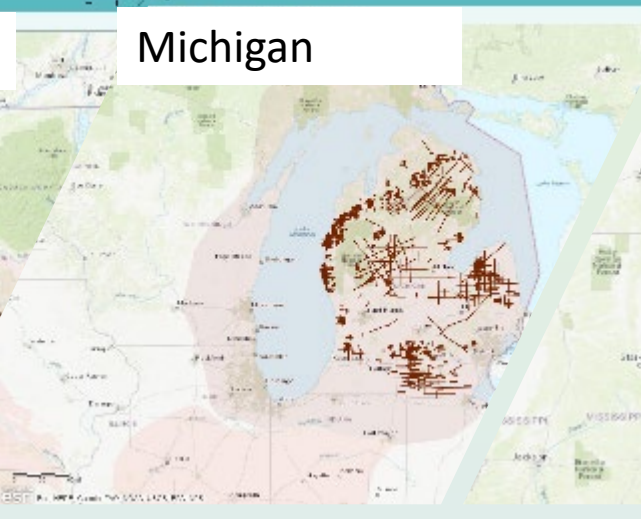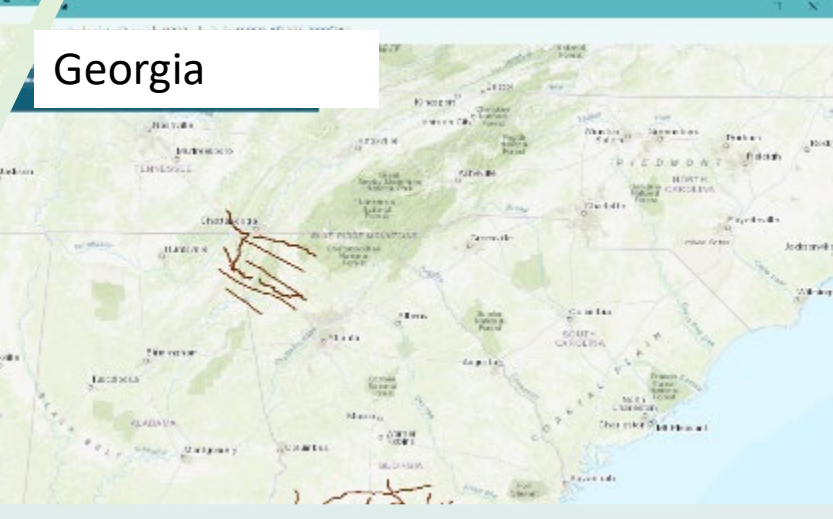
Xxx miles 2D data 34   states

XXX miles of 3D data in 22 states

Arkansas
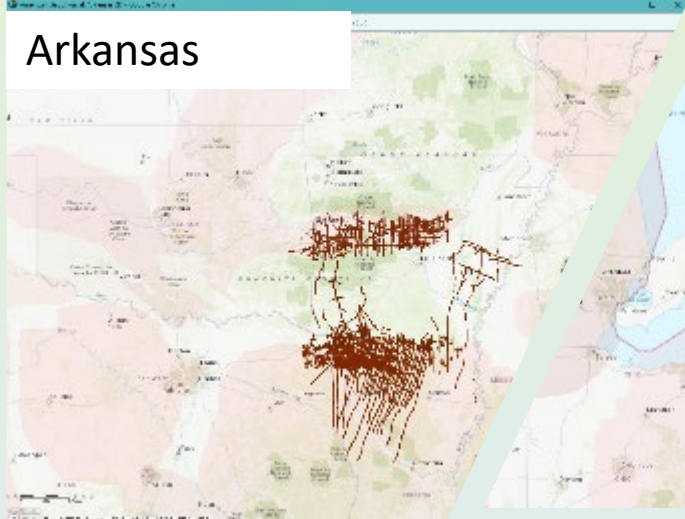
New York

Michigan

Georgia

Virginia
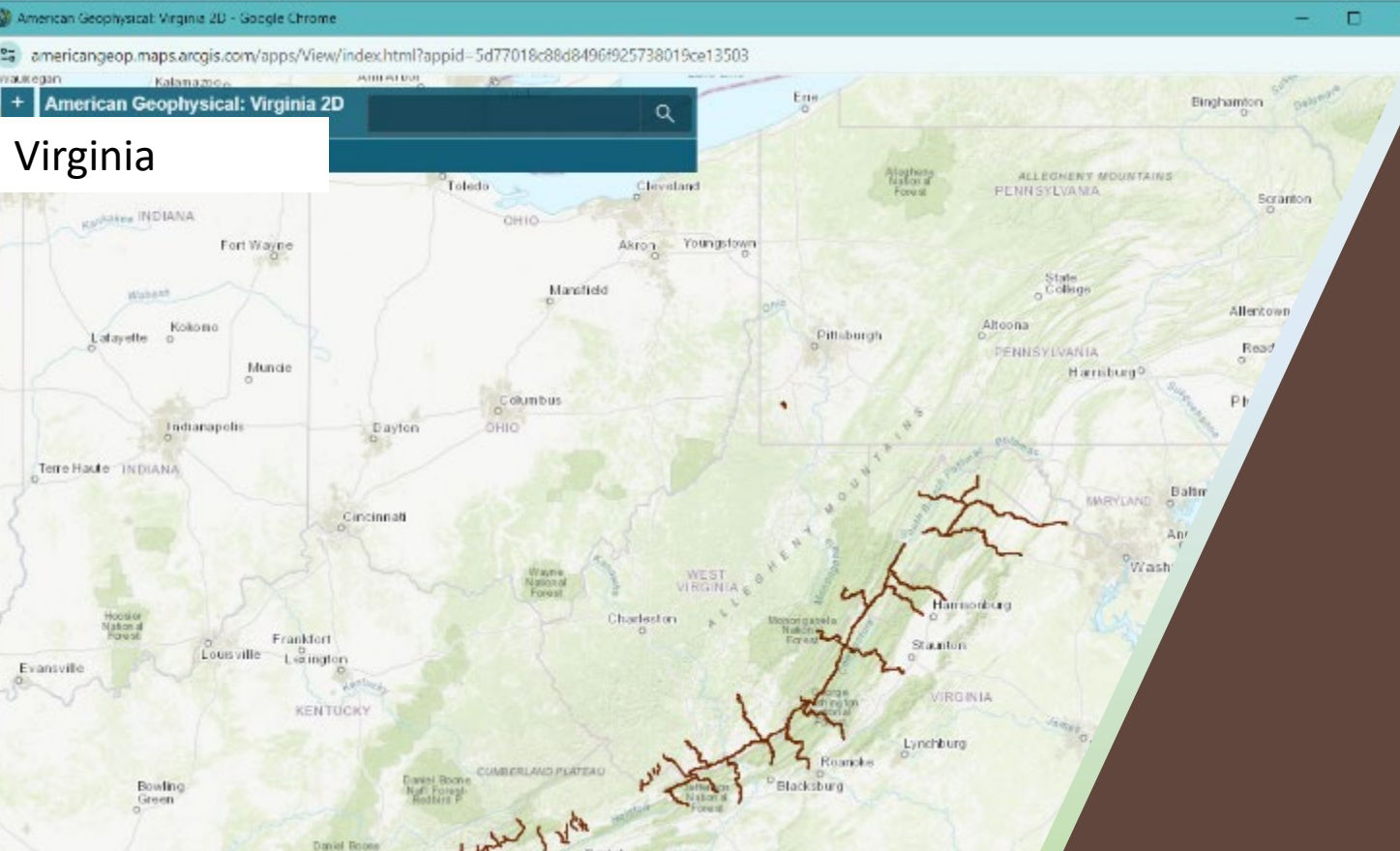
American Geophysical Corporation Random state maps of 2D Seismic data
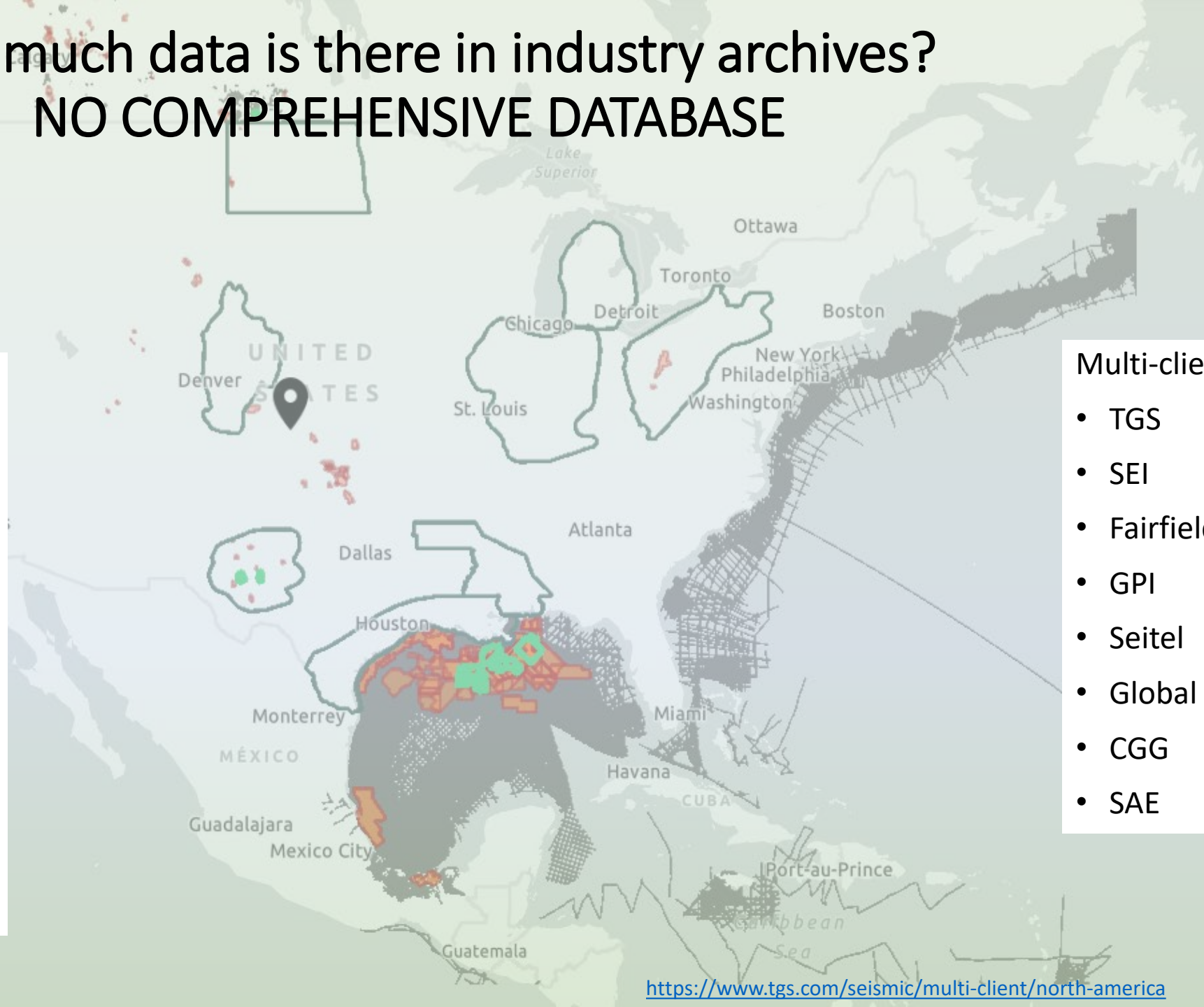
How much data is there in industry archives?
NO COMPREHENSIVE DATABASE

Proprietary – Individual companies fully owned(released data marketed by seismic Data Brokers like AGC)

- Chevron
- XOM
- Conoco Phillips
- Chesapeake
- EGI
- EOG
- Pioneer
- Marathon
- Small Independent Oil and gas companies.

Multi-client

- TGS
- SEI
- Fairfield
- GPI
- Seitel
- Global
- CGG
- SAE

Updated estimate 3D offshore

The National Archive of Marine Seismic Surveys (NAMSS) holds the following :

700 3D seismic surveys covering 689,883 square kilometers.
594 2D seismic surveys with 34,102 tracklines covering 1,671,789 kilometers.
https://walrus.wr.usgs.gov/NAMSS/

North America - Lower 48	
All Companies proprietary	?????
Multi-Client Company 1	18427
Multi-Client Company 2	5515
Multi-Client Company 3	8502
Multi-Client Company 4	11408
Multi-Client Company 5	10159
Multi-Client Company 6	1478
Multi-Client Company 7	1146
Multi-Client Company 8	29546
Multi-Client Company 9	48630
Multi-Client Company 10	39882
Multi-Client Company 11	3273
Multi-Client Company 12	7025
Total Multi-Client	184, 991

*There has been consolidation in multi-client data libraries. This list is not intended to represent the number of multi-client companies currently in operation. (S Sutherland research)

Historical Data amounts – NGDRS
National Research Council – 1995 Report Value of data preservation.

NATIONAL GEOSCIENCE DATA REPOSITORY SYSTEM(NGDRS) PHASE III:11/202-3/2003 IMPLEMENTATION AND OPERATION OF THE REPOSITORY. 6.5:1 ROI

- Large Scale Transfers of Seismic data; delayed due to the vast scale of seismic data relative to funding availability.

- GeoTrek – Linux and MySQL open-source database.

- Update MapServer & Map Script Language

- Evaluating the viability of transferring seismic from the western shelf of Florida.

- 85 % Cores, 12 million linear feet. Available for public use.

National Geosciences Data Repository System Phase III: Implementation and Operation of the Repository Final Report: 10/2003

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Code of Federal Regulations – National Archives

- eCFR :: 30 CFR Part 551 -- Geological and Geophysical (G&G) Explorations of the Outer Continental Shelf
  - Section 551.1 Definitions: **Geophysical data** :tools means "measurements that have not been processed or interpreted."

- Section 555.12 – describes submission of data to the BOEM https://www.ecfr.gov/current/title-30/section-551.12
  - § 551.12 Submission, inspection, and selection of geophysical data and information collected under a permit and processed by permittees or third parties.

- Section 555.14 – protection and disclosure of data – https://www.ecfr.gov/current/title-30/section-551.14
  - § 551.14 Protecting and disclosing data and information submitted to BOEM under a permit.
    - (b) Timetable for release of G&G data and information related to oil, gas, and sulphur that BOEM acquires. Except for high-resolution data and information released under 30 CFR 550.197(b)(2), BOEM will release or disclose acquired data and information in accordance with paragraphs (b)(1) through (7) of this section.
    - (d) Sharing data and information with coastal States.

https://www.ecfr.gov/current/title-30/chapter-V/subchapter-B/part-551

DOE-sponsored data in Public Domain

Most (all?) DOE sponsored projects require placing data in public domain.

- **Teapot Dome 3D 1999** – 3D Land data set to be used to refine processing and interpretation projects   Included most seismic interpretation software packages
- **Illinois Basing Decatur Project (IBDP):** CCUS Pilot project with ADM to study CCS in the Illinois basin.
- **SEG SEAM Life of Field** –**SE**G **A**dvanced **M**odeling Corporation
  - Dynamic model of Gas oil Water field with 4D Seismic simulation
- **Other DOE-sponsored projects**?

How easy is it to locate and get that data? Is there a central updated database?

Past efforts to establish database

- State/ entities that collect data after periods of exclusivity
  - Alaska
  - Louisiana
  - ?????

- OEM (formerly MMS) – Offshore Seismic

Where is this data? Can it be easily located and "acquired"?

Economic Model for data owners to put data into the public domain

- What, Where When – Data catalogue accessible to all
  - PPDM standards in maintaining data integrity and support functions.
  - DOE funded research,
  - Academic research data
  - SEG research files, program data GWB, etc.
- Receive credits proportional to data value input - equivalent to Fair market value
  - Cash
  - Credits for other data in the pool
  - Proof of ownership
- Agency, industry ?– Validates Ownership
  - Maintains database for credits or compensation
  - Coordinate's location and reproduction with various data owners or vendors.
  - Follow up on data deliveries.
- Training and employment in validating data integrity

Current Proposal: Form Task Force to prepare a Business plan by 2nd quarter of 2025

Incentives to contribute data to the public domain
- Reflects value, but is accessible to academia,
- Coop for CCUS areas of review with multiple injectors

Proper complete archive of raw data and processing history
- Trained workforce required
- Cost to maintain and retrieve

Affordability and accessibility for CCUS, Geothermal, Induced Seismicity
- Compensation needed to support storage, retrieval, and reproduction
- Cost reduced by Co-oping the expense.
- Subsidies – for training and maintenance

Acknowledgements

Many thanks to all who supported my quest for seismic data for the past 40 years in industry. Additionally, the following have provided additional information

- Linda Bragg – PPDM " What is seismic" project to standardize data model for archiving

- Jim Howell: Ovation Data services BOEM

- Lynne Griffin and Cathy Wittrock American Geophysical Corporation