

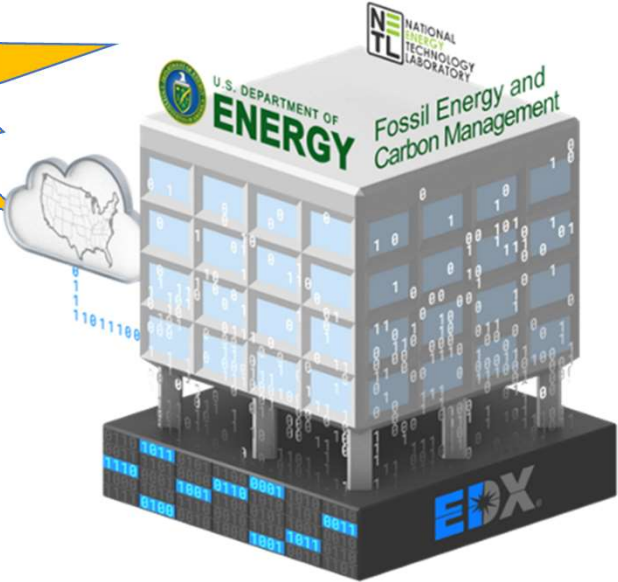
Carbon Storage Program Data Curation, Transformation, and Reuse



Paige Morkner
Geo-data Scientist

EDX SPATIAL

Coming
Fall 2023!!!



Supporting



2023 Carbon Management Research
Project Review Meeting

Aug. 28, 2023

Disclaimer



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Authors and Contact Information



Paige Morkner^{1,2}; Jennifer Bauer¹; Abigail Choisser^{1,2}; Michael Sabbatino^{1,2}; Stephen Leveckis^{1,2}; Kelly Rose¹

¹National Energy Technology Laboratory, 1450 Queen Avenue SW, Albany, OR 97321, USA

²NETL Support Contractor, 1450 Queen Avenue SW, Albany, OR 97321, USA

Carbon Storage Data and The Energy Data eXchange (EDX)

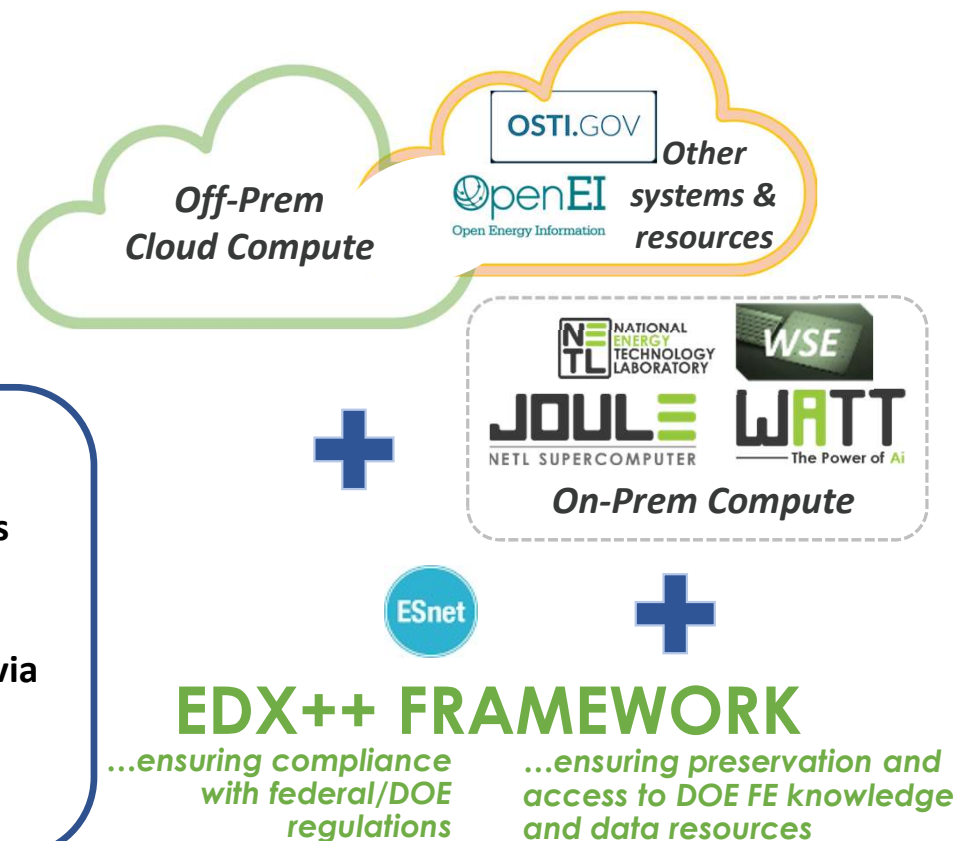


Using AI/ML, millions of data features and attributes have been integrated and preserved across the USA in support of advanced carbon storage projects

This effort has already aided SMART, NRAP and outside entities (e.g., major industry operator) to drive subsurface modeling, machine learning, and insights for a range of end user needs

EDX supports:

- RCSP, CarbonSafe, NRAP data ingestion
- Data mining to aggregate authoritative, open-source resources relevant to CS researchers
- Integration of other FE resources
- Access, visualization, and interaction with CS data collections via NETL EDX mapping platforms Natcarb Viewer and EDX Spatial
- Reuse of data by new FE projects via EDX Collaborative Workspaces and more...



Carbon Storage Data Lifecycle

Data Collection

- Expert-driven research
- EDX submissions
- AI/ML methods for data collection, SmartSearch



Metadata Development and Capture

- Cataloging
- ReadMe file development
- Natural language processing for keywords, topic modeling, geographic association
- Assignment of symbology

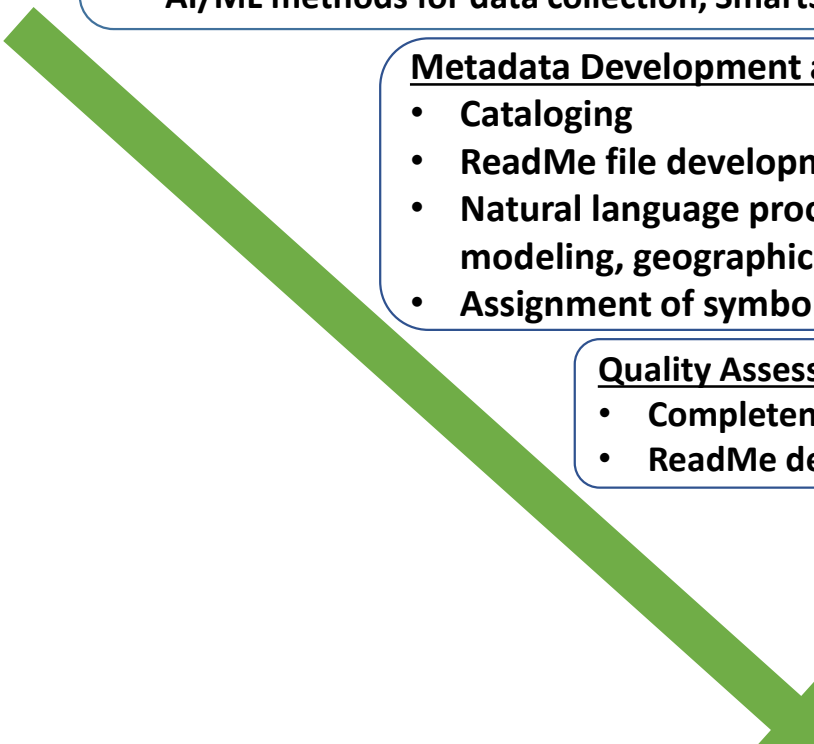


Quality Assessment, Quality Control

- Completeness, accuracy, usability, authority of source analysis
- ReadMe development, removal of redundant files

Data Preparation and Publishing

- Submission packaging
- ArcGIS Enterprise with EDX
 - EDX Spatial
 - Collaborative Map Applications



EDX Groups – Increase in Data Volume in Last Year



EY22 Carbon Storage Review Meeting

Carbon Storage Open Database
This is a group to bring together data resources related to all open carbon storage data on EDX [read more](#)

Followers	Submissions
8	311

[+ Follow](#)

- Data Usage: 1.569 TB**
- Resources: 1222**



EY23 Carbon Storage Review Meeting

Carbon Storage Open Database
This is a group to bring together data resources related to all open carbon storage data on EDX [read more](#)

Followers	Submissions
12	394

[+ Follow](#)

- Data Usage: 14.074 TB**
- Downloads: 63630**
- Resources: 2102**

Some EDX Topical Groups:

- Carbon Transport and Storage
- CarbonSAFE
- Core Characterization
- DisCO2ver Datasets and DisCO2ver Tools
- FutureGen Data
- Illinois Basin Decatur Project
- NRAP and NRAP Applications Catalog
- NRAP Phase II & III Tools
- Offshore Carbon Capture and Storage
- Regional Carbon Sequestration Partnership groups
- Spatial Data Resources
- Water Data Group

- *EDX Spatial* is a multi-cloud (EDX-Esri-AWS) curated mapping platform for the display of R&D spatial data resources published on EDX
- Supports the visual display of data in mapping applications making them accessible to explore by users prior to download
- Guides users back to the original EDX submission for data download
- Enables organization of data into research themes
 - Carbon Storage Open Database
 - NATCARB
 - Offshore
 - Other subsurface and surface
- Supports hosting of dashboards and other applications supporting carbon storage data, EDX4CCS, NRAP and other research portfolios

**Public Release
Fall 2023!!!**

Search, Visualize, Download, Create

This platform is for exploring and downloading GIS data, visualizing geospatial data, and building apps. You can analyze and combine datasets using maps, as well as develop new web map and mobile applications.

Explore Data Collections

Click the icons to browse through specific data collections in NETL Portal.



Carbon Storage Open Database



Global Oil and Gas Infrastructure



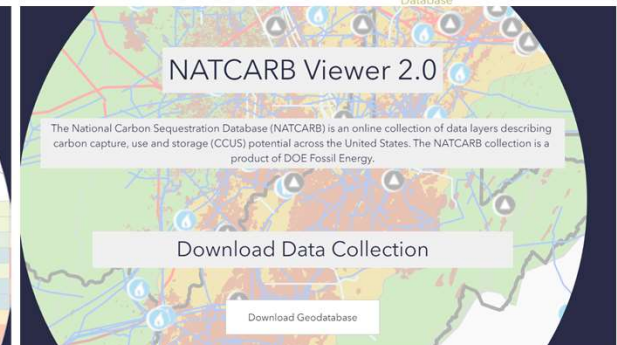
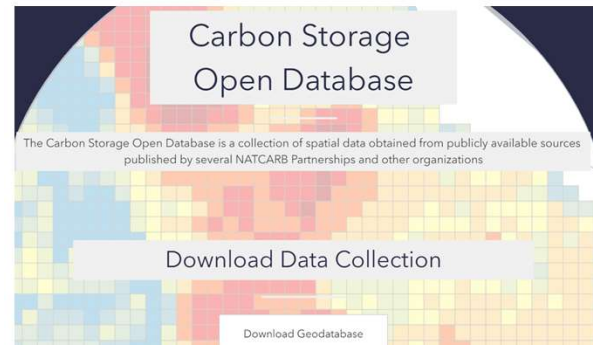
NATCARB Viewer



Offshore Gulf of Mexico



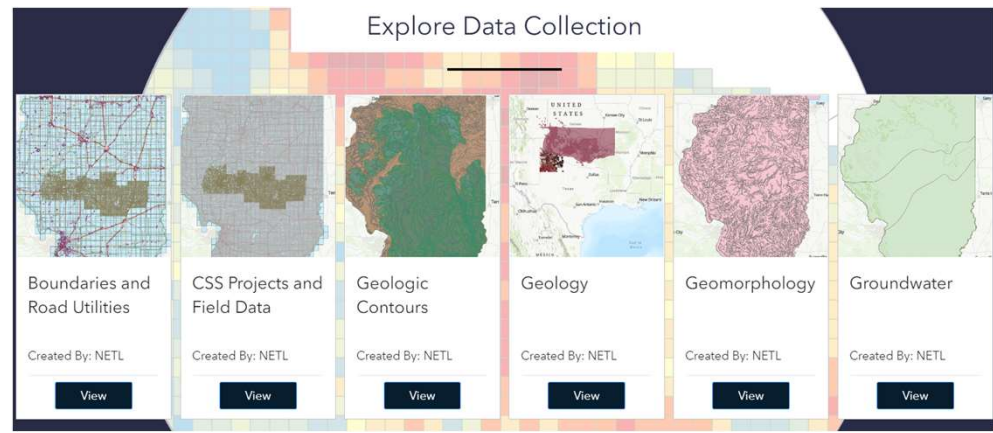
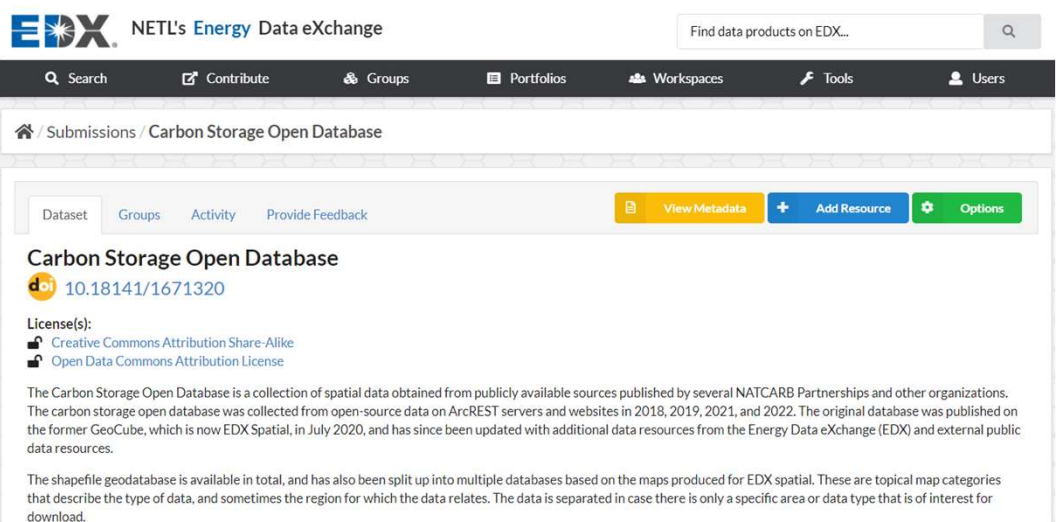
Rare Earth Elements & Coal Open Database



EY23 Carbon Storage Open Database Progress



- Publishing of updated geodatabase on EDX
 - Full and topical geodatabases available
 - Total of 16 topical geodatabases
 - One Raster-specific geodatabase
 - Available data catalog and ReadMe file
- Development of regional and topical maps for display in EDX Spatial



<https://edx.netl.doe.gov/dataset/carbon-storage-open-database>

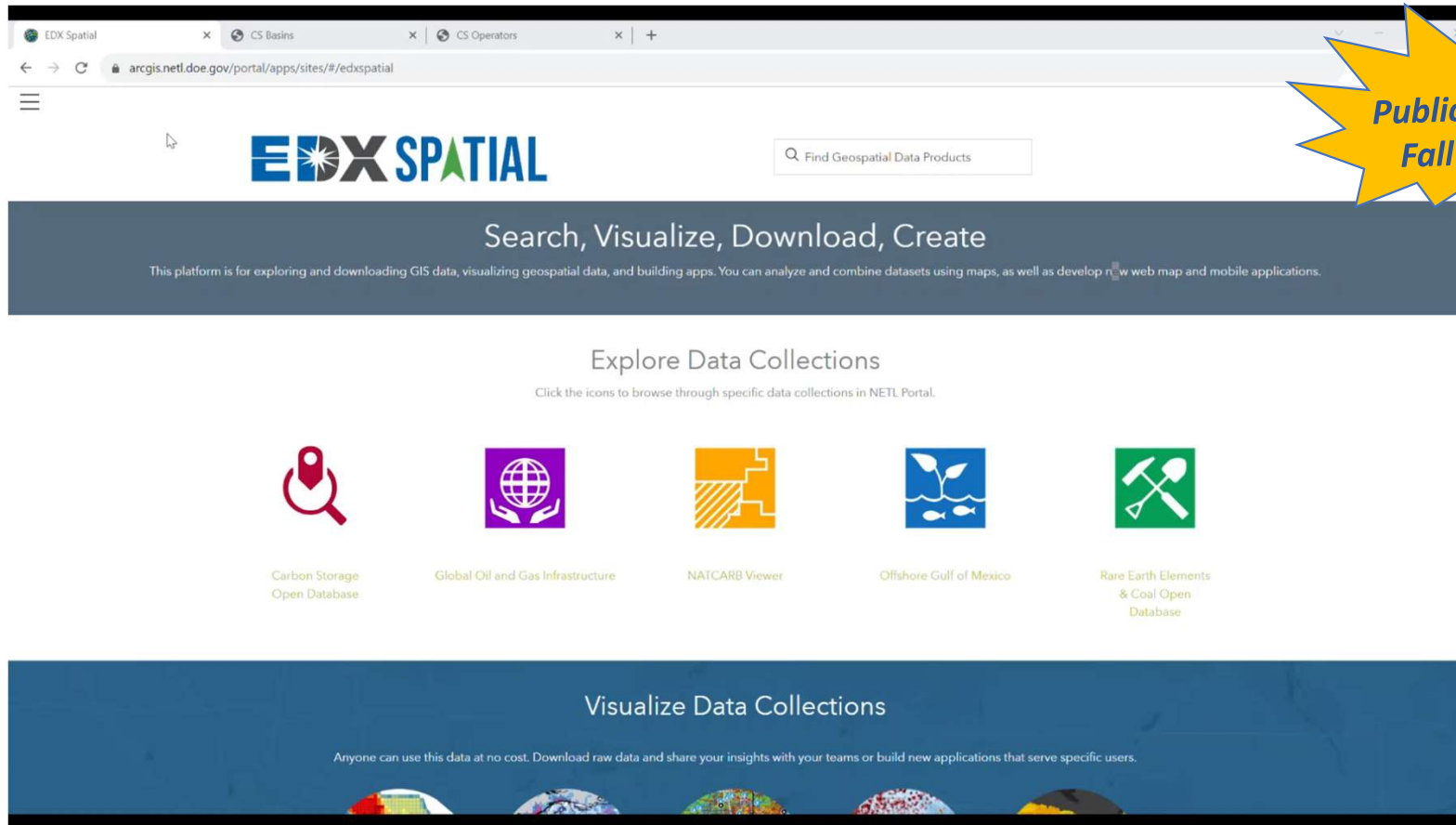


Symbology Standards for EDX Spatial



- Developed symbology standards for carbon storage based on the symbology standards guidance released for online mapping
 - Federal Geographic Data Committee (FGDC) Digital Cartographic Standards for Geologic Mapping
 - U.S. Geologic Survey digital cartographic standards
- **Results: A guide for assigning symbology across online mapping applications within EDX Spatial tailored to CCS-specific data types**

EDX Spatial Symbology Reference Guide													
Catalog Format Syntax: [Geometry, 'ArcGIS 2D Symbol Name', 'Point Size', 'Outline/Line Weight', 'Rotation']													
Feature	Geometry	Catalog Format	Fill RGBO	Line RGBO	Fill Hex	Fill T%	Line Hex	Line T%	ArcGIS 2D Symbol	Point Size	Outline/Line Wt	Rotation	FGDC Ref.
O&G, MINING, AND CCUS FACILITIES													
Proposed CCS Well	Point	[point, 'Square Diamond	[0, 0, 0, 50]	[0, 0, 0, 50]	#000000	50%	#000000	50%	Square Diamond	7	1	None/Default	*19.5.92
Drilled CCS Well	Point	[point, 'Square Diamond	[0, 0, 0, 100]	[0, 0, 0, 100]	#000000	0%	#000000	0%	Square Diamond	7	1	None/Default	*19.5.92
CCS Storage Capacity; CO2 Storage Reservoir	Point	[point, 'Square Diamond	[216, 255, 0, 50]	[0, 0, 0, 0]	#D8FF00	50%	N/A	100%	Square Diamond				
	Polyline	[polyline, '0.5 Point	[0, 0, 0, 0]	[216, 255, 0, 100]	N/A	100%	#D8FF00	0%	0.5 Point				
	Polygon	[polygon, 'Extent Tr	[216, 255, 0, 25]	[216, 255, 0, 100]	#D8FF00	75%	#D8FF00	0%	Extent Transparent				
General CO2 Point Sources	Point	[point, 'Diamond 3'	[255, 0, 0, 100]	[0, 0, 0, 100]	#FF0000	0%	#000000	0%	Diamond 3				



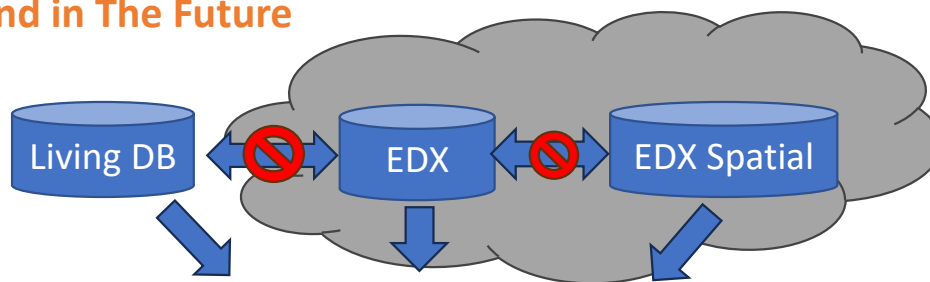
The screenshot shows a web browser window with the URL `arcgis.netl.doe.gov/portal/apps/sites/#/edxspatial`. The page features the EDX SPATIAL logo and a search bar labeled "Find Geospatial Data Products". Below the search bar is a dark blue banner with the text "Search, Visualize, Download, Create" and a subtext: "This platform is for exploring and downloading GIS data, visualizing geospatial data, and building apps. You can analyze and combine datasets using maps, as well as develop new web map and mobile applications." The main content area is titled "Explore Data Collections" with the instruction "Click the icons to browse through specific data collections in NETL Portal." It displays five icons representing different data collections: Carbon Storage Open Database (red location pin), Global Oil and Gas Infrastructure (purple globe), NATCARB Viewer (orange puzzle pieces), Offshore Gulf of Mexico (blue waves and fish), and Rare Earth Elements & Coal Open Database (green pickaxe). At the bottom, a blue banner titled "Visualize Data Collections" states: "Anyone can use this data at no cost. Download raw data and share your insights with your teams or build new applications that serve specific users." Below this banner are several small globe icons.

**Public Release
Fall 2023!!!**

Living Database

Supporting CS Data Curation Now and in The Future

- Store and share data in a structured, secure database environment
 - Reduce redundant acquisition
 - Direct data access (not file based storage)
 - Consistent data with staff turnover
 - Enhanced collaboration
- Curation of data and knowledge
- Allows direct analysis from database



Living Database

NATIONAL ENERGY TECHNOLOGY LABORATORY

Living Database Databases

Living Database Tables

gom
livingdb
news
offshore_data
offshore_data_updates
offshore_mil
postgres
ree
smartsearch_amo
spatial_data
template1
template_postgis
xmat
xmat_nlp

test_xmat
xmat_documents
xmat_top_docs

Connect to and Search EDX

Connect to and Search ArcGIS

Wells

Create Custom Query For Current Table

Database Currently Connected To: ArcGIS

id	title	name	type	owner	tags	description	categories	licenseinfo	hyperlink	
40	FutureGen_Cha...	FutureGen_Cha...	Vector Tile ...	NETL_Admin	['Carbon Stora...	<div style='text...	[]	None	Go to Webpage	c18r
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45	FutureGen_roa...	FutureGen_roa...	Vector Tile ...	NETL_Admin	['Carbon Stora...	<div style='text...	[]	None	Go to Webpage	b47
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47	Horizontal_Well...	Horizontal_Well...	Vector Tile ...	NETL_Admin	['Carbon Stora...	<div style='text...	[]	None	Go to Webpage	66e

Current Capabilities:

- Data View, Search, and Query Builder
- Link to External Tools (EDX, EDX Spatial)
- Query Builder



Visit Michael Sabbatino's Poster "Managing Carbon Storage Data with a Living Database" Tuesday evening!

Summary



- **Continuing to improve and support data access and management for carbon storage data published to EDX**
 - Supporting publishing of datasets
 - Supporting integration of spatial data into EDX Spatial (Coming Fall 2023)
 - Supporting workflows of integrating spatial data into platforms such as the disCO₂ver platform
 - Supporting the build of tools to support long-term data curation and access, such as Living Database

Tuesday Evening - Live Tool Demos!

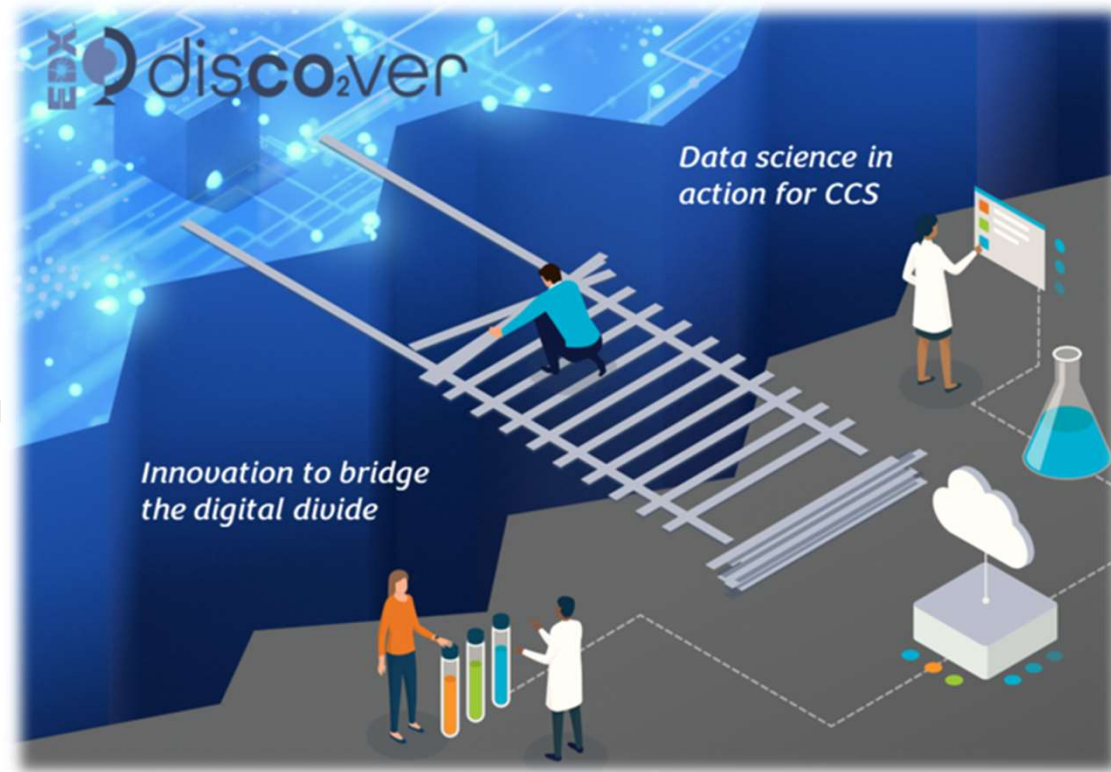




When: 5:45 - 7:45 p.m.

Where: The Ballroom Foyer and East/West Atriums

What:

- **Environmental Justice and Social Justice** for CS Systems
- The **international offshore CS** and web-database and tool
- RokBase, Virtualizing **CS Rock Property Data** platform
- **Class VI Data Support Tool** for regulatory requirements
- **CO2 Pipeline Routing Smart Tool**
- Co2Locate - **Class II Well Reuse and Regional Evaluation Tool**
- **Carbon Storage Planning Framework Dashboard**
- **3D Data Viewer** and Preview Capability
- AIIM Model, **Assessing Infrastructure Reuse Potential** for CS
- **EDX disCO₂ver**, a one-stop tool for CO₂ digital resources



 In demo "theater room"  support team will offer in person demos & Q&A

Additional Information



Contact:

Paige Morkner, Paige.Morkner@netl.doe.gov

Data resources and important URLs:

Morkner, P., Sabbatino, M., Choisser, A., Creason, C., Wingo, P., DiGiulio, J., Jones, K., Greenburg, R., Bauer, J., and Rose, K. Carbon Storage Open Database, 7/14/2023, <https://edx.netl.doe.gov/dataset/carbon-storage-open-database>, DOI:

10.18141/1671320

<https://edx.netl.doe.gov/>

Citations:

Morkner, P., Bauer, J., Creason, C., Sabbatino, M., Wingo, P., Greenburg, R., Walker, S., Yeates, D., Rose, K. 2022. Distilling Data to Drive Carbon Storage Insights. *Computers & Geosciences*. <https://doi.org/10.1016/j.cageo.2021.104945>

Morkner, P., Bauer, J., Shay, J., Sabbatino, M., and Rose, K. An Updated Carbon Storage Open Database - Geospatial Data Aggregation to Support Scaling -Up Carbon Capture and Storage. United States: N. p., 2022.

Web. <https://www.osti.gov/biblio/1890730>

Morkner, P., Rose, K., Bauer, J., Rowan, C., Barkhurst, A., Baker, D.V., Sabbatino, M., Bean, A., Creason, C.G., Wingo, P., and Greenburg, R. Tools for Data Collection, Curation, and Discovery to Support Carbon Sequestration Insights. United States: N. p., 2020. Web. <https://www.osti.gov/biblio/1777195>

Acknowledgments



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