

WELLBASE – An Interactive Platform for Wellbore Material Assessment

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OVERVIEW

Abstract: This project seeks to build an open-source wellbore material data repository with adequate material performance and contextual data to support geologic carbon storage (GCS). By appropriately evaluating the data types made available by the WELLBASE tool, stakeholders can make more informed decisions regarding well selections, risk assessment, and economic analysis for GCS projects. Advanced Natural Language Processing (NLP) models and other custom Python scripts will be deployed in an automated process to extract unstructured data from documents, reports, and web applications and subsequently parse to more usable formats. The processed data will then be integrated into a robust and comprehensive database architecture, optimizing data accessibility, and usability for analytical purposes. The final data products will be accessible through a user-friendly visualization platform that will allow users to query and visualize the data, as well as download data in usable formats.

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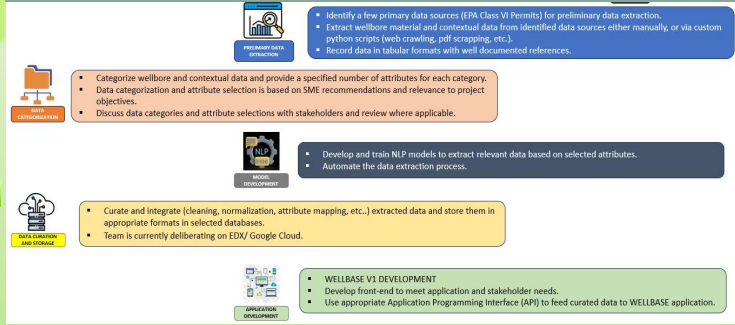
DELIVERABLES

- Provide a tool development plan and schedule for WELLBASE, including descriptions of key modules, functionality, and version release timeline.
- Release WELLBASE tool V1 to the public via EDX discO2ver platform.
- Release WELLBASE tool V2 (with significant edits) to the public via EDX discO2ver.

PROBLEM STATEMENT

To ensure the safe and efficient long-term storage of carbon dioxide in underground structures, it is crucial to thoroughly understand the behavior of existing wellbore materials and predict their performance under various conditions. Currently, the wellbore material data available in the public domain are scattered and not easily accessible. This creates a significant challenge for stakeholders in the decision-making process regarding carbon capture and storage (CCS), as they must manually aggregate data from different sources to meet their needs. There is a clear need for a robust and standardized database on wellbore materials to facilitate wellbore integrity analysis, risk assessment, economic evaluation, and other relevant decision-making processes in CCS. This project aims to address this challenge by developing a comprehensive database platform to collect and host all relevant wellbore material and related data for CCS.

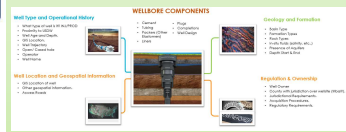
WORKFLOW AND APPROACH



OBJECTIVES

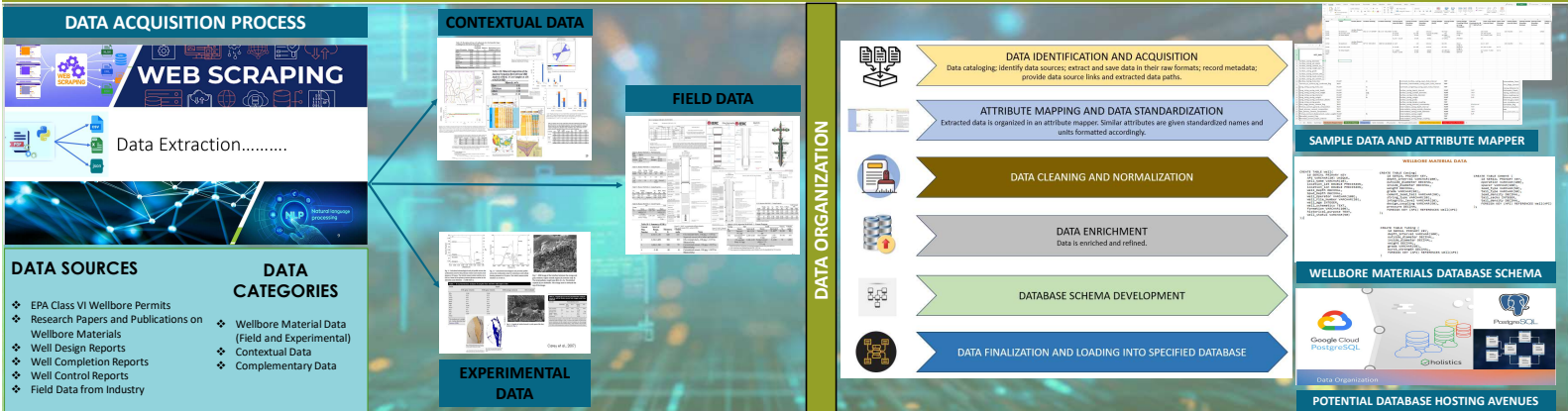
- Leverage custom Python scripts and machine learning (ML) algorithms to acquire data from various sources (e.g., permits, drilling reports, well construction reports, web applications, public and industrial databases, among others).
- Process data into standardized and usable formats.
- Develop a holistic database and an interface platform (WELLBASE V1) to easily access processed data and information on materials used in GCS.

WELLBASE CONCEPT



- An interactive, cross-cutting platform for all stakeholders.
- Allows curation of disparate data (field and experimental) for assessing well integrity for CCS.
- Allow comparison of different well data.
- Facilitates actionable decision-making in geological storage of CO₂.

DATA ACQUISITION, CURATION, AND IMPLEMENTATION



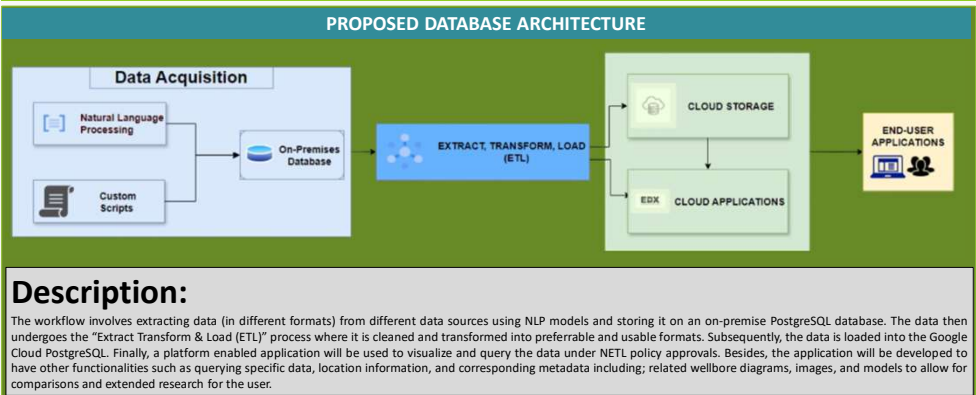
CURRENT DATA SUMMARIES & STATISTICS

Data Source Summaries		
Categories	Sources	Types & Formats
Wellbore Material Data	<ul style="list-style-type: none"> EPA Class VI permit Published annual and semi-annual reports Scientific publications Data from oil and gas industry (obtained directly from source or from providers) 	<ul style="list-style-type: none"> Well logs, charts, tabulations, Scanning Electron Microscopy (SEM) images, graphs, site maps, material images before and after experiments, etc. (.txt, .jpeg, .csv, .xlsx, .gdb, etc.)
Contextual Data	<ul style="list-style-type: none"> EPA Class VI permit Published reports Public Databases from Seismic Data Providers and Open Platforms 	

Wellbore Data Source Summary		
Data Sources	No.	COMMENTS
EPA CLASS VI PERMITS	~ 70	This includes Class VI permits under review available to the public in redacted formats
SCIENTIFIC PUBLICATIONS	~ 55	

Identified Wells Summary		
Well Type	No.	Comments
Monitoring Wells	4	
CCS Injection Wells (Class VI)	4	
Class II Wells	N/A	
Other Well Types	4	This includes wells converted from Class I & II to Class VI.

APPLICATION DEVELOPMENT



KEY CHALLENGES

- DEVELOPMENT CHALLENGES**
- Establishing a comprehensive NLP/ML model is progressing slowly due to the challenge of accessing sufficient and desirable data sources necessary for creating a robust wellbore material database.
 - Significant challenges were also faced in determining the key data categories and attributes that will be most relevant for potential stakeholders and users of WELLBASE.
- PRODUCTION CHALLENGES**
- There are policy lags on cloud deployment of database and WELLBASE application.
- NB:** Stakeholders are welcome to present ideas, views, perspectives and concerns on the most relevant data categories and attributes they would look out for as USERS of WELLBASE.

RECOMMENDATIONS FOR FUTURE WORK

- Explore and leverage on more advanced ML models, libraries, and packages to make the data extraction and acquisition process more efficient.
- Refine data quality for model improvement as data availability improves.
- Offer a "Find Similar" feature to find similar tables based on different attributes from the initial search criteria.
- Develop features to allow users to do their own joins of different column/attributes across different tables from the UI itself which will provide a more unique output based on the use case.
- Provide as much information as deemed necessary within a map marker when the said marker is selected.
- Provide a more robust metadata from the databases to the user when a query is done.