

Geologic Sequestration Data System

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Purpose

- Provide background information on the Class VI Rule and the Geologic Sequestration Data System (GSDS).
- Describe the GSDS development process.
- Gather feedback from participants.



Outline

1. Background information on geologic sequestration (GS).
2. Overview of the Class VI Rule.
3. Overview of the GSDS.
4. Q&A and discussion session.
5. Next steps.



What is geologic sequestration?

1. BACKGROUND ON GS

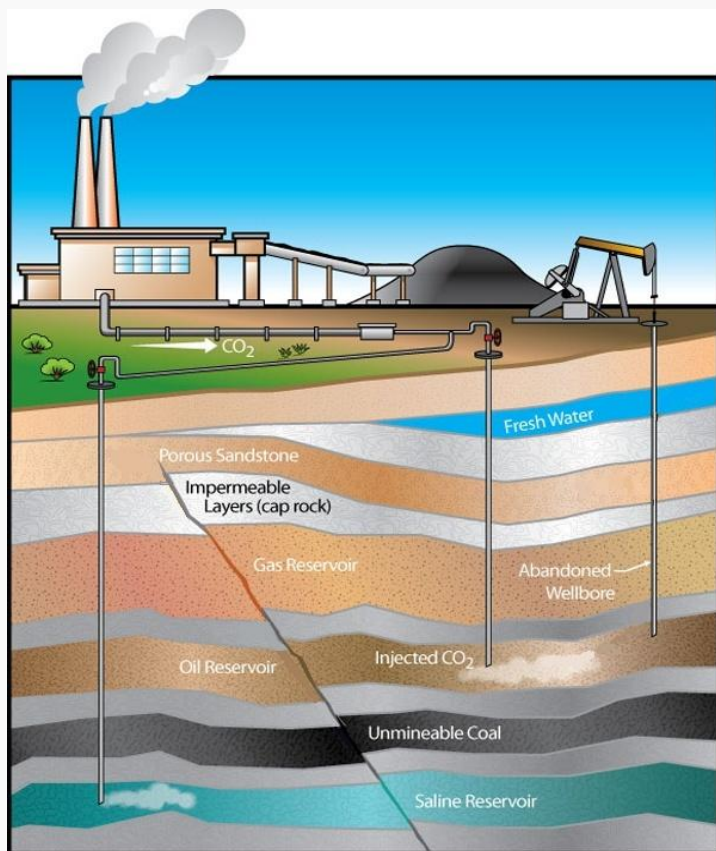


Introduction to GS

- GS is the process of injecting CO₂ into deep subsurface rock formations for long-term storage. It is part of the process known as carbon capture and storage (CCS).
 - Potential tool used to reduce atmospheric carbon dioxide emissions.
 - Potential climate change mitigation technology.



GS Projects



- Underground injection of CO₂ for purposes such as enhanced oil or gas recovery (EOR/EGR) is a long-standing practice.
- However, CO₂ injection specifically for GS involves:
 - Different technical issues,
 - Potentially much larger volumes of CO₂, and
 - Potentially larger-scale projects.

Image: Los Alamos National Laboratory.

<http://www.lanl.gov/news/index.php/fuseaction/1663.article/d/20081/id/12335>



How are GS projects regulated?

2. OVERVIEW OF THE CLASS VI RULE

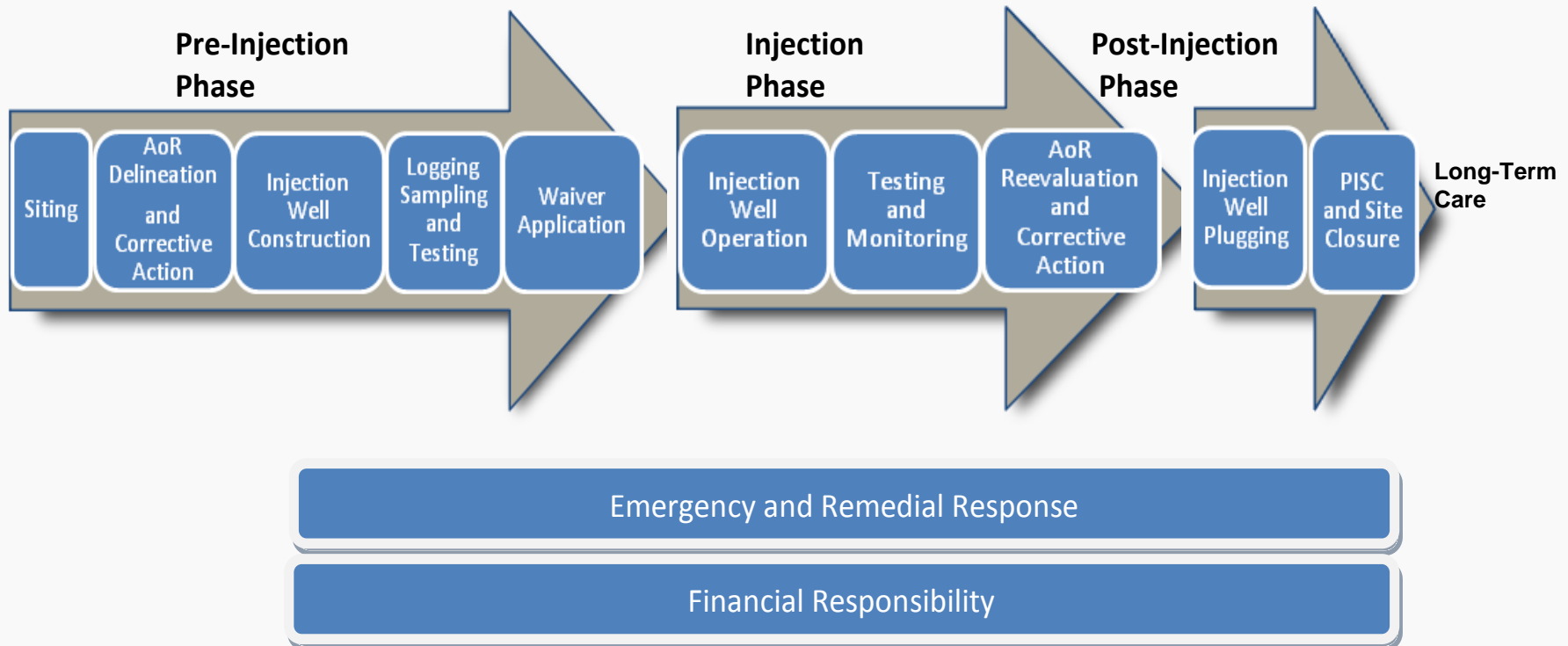


Regulating GS

- On December 10, 2010, EPA published:
 - *The Federal Requirements under the Underground Injection Control (UIC) Program for Carbon Dioxide Geologic Sequestration (GS) Wells* (“the Class VI Rule”).
- These minimum requirements:
 - Focus on USDW protection under the authority of Part C of SDWA.
 - Establish new class of underground injection wells: Class VI.
 - Are codified under 40 CFR 146.81 et seq.
- EPA will take an adaptive approach to the Class VI requirements.



Class VI Rule: Phases





Class VI Rule: Reporting Requirements

Requirements - 40 CFR 146.91(e)

“Owners or operators must submit **all required reports, submittals, and notifications** under subpart H of this part **to EPA in an electronic format** approved by EPA.”

Authority - SDWA 1445(a)(1)



Class VI Rule: UIC Program Director's Roles

- Access data submitted by owners or operators.
 - Evaluate and verify proposed and ongoing injection operations.
- Submit Class VI compliance/oversight information to EPA.

SDWA 1445(a)(1) and 40 CFR 146.91(e)



How will the GSDS be structured and what will it include?

3. OVERVIEW OF THE GSDS



Outline of GSDS Section

- A. Types of GS Data
- B. GSDS Development Process
- C. Joint Requirements Planning Process
- D. Alternatives Analysis Process



Overview of the GSDS:

3A. TYPES OF GS DATA



GS Data

- Data that are generated and/or collected, by owners or operators and permitting authorities, during GS operations that need to be reported, stored, and managed.
- This includes both:
 - Data reported by owners/operators of Class VI wells.
 - Data generated by permitting authorities for compliance and oversight purposes.



Two Types of GS Data

Compliance/Oversight

Reporting Data

Data

Example:

- Data on depth, areal extent, thickness, mineralogy, porosity, permeability, and capillary pressure of the injection and confining zone(s)

Examples:

- Last MIT date
- A notice of adverse financial conditions

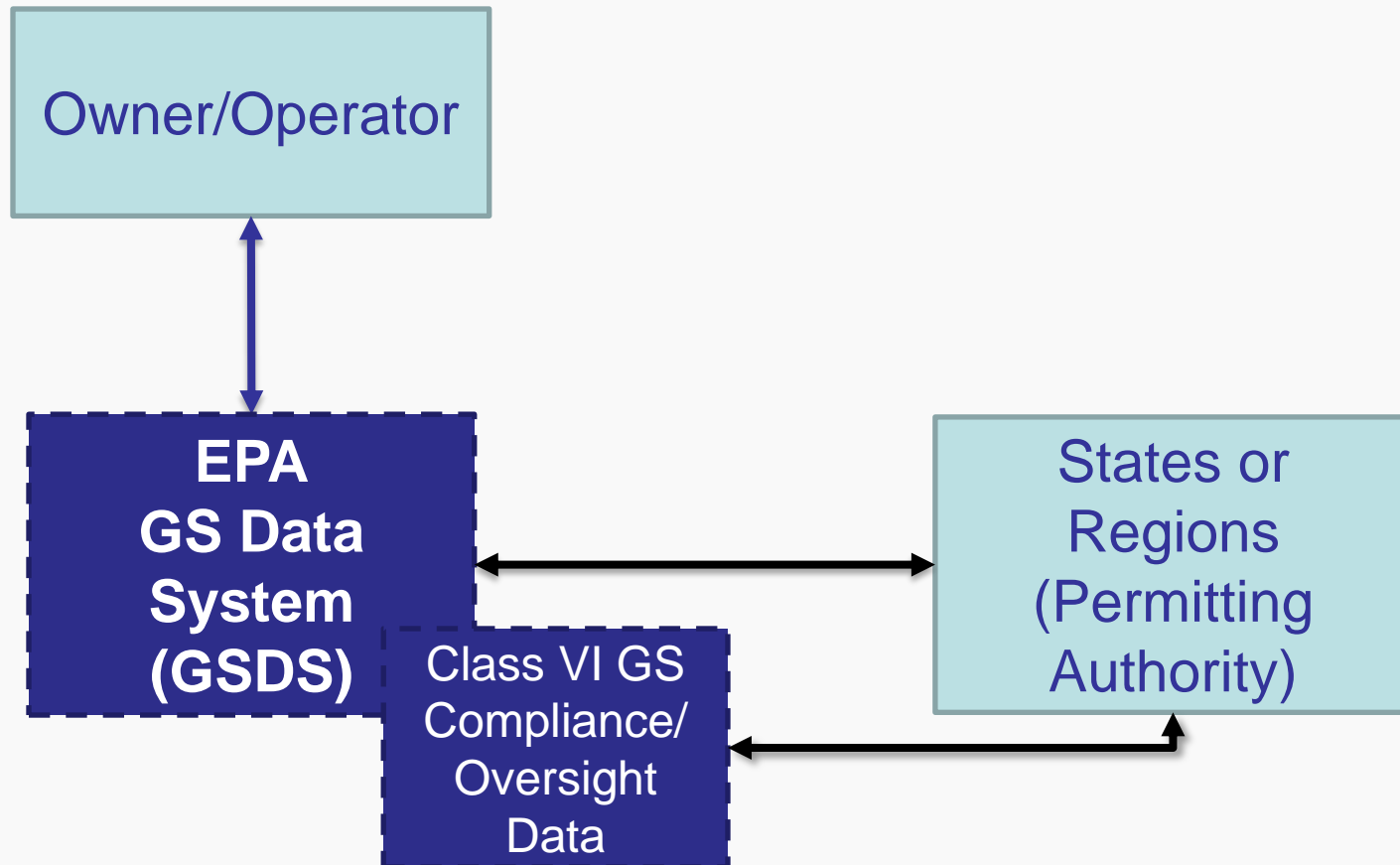
Examples:

- Inspection: Date; Pass or Fail
- Proof of Financial Responsibility: Date; Approved or Not Approved

3. Overview of the GSDS - Types of GS Data



GS Data Flow





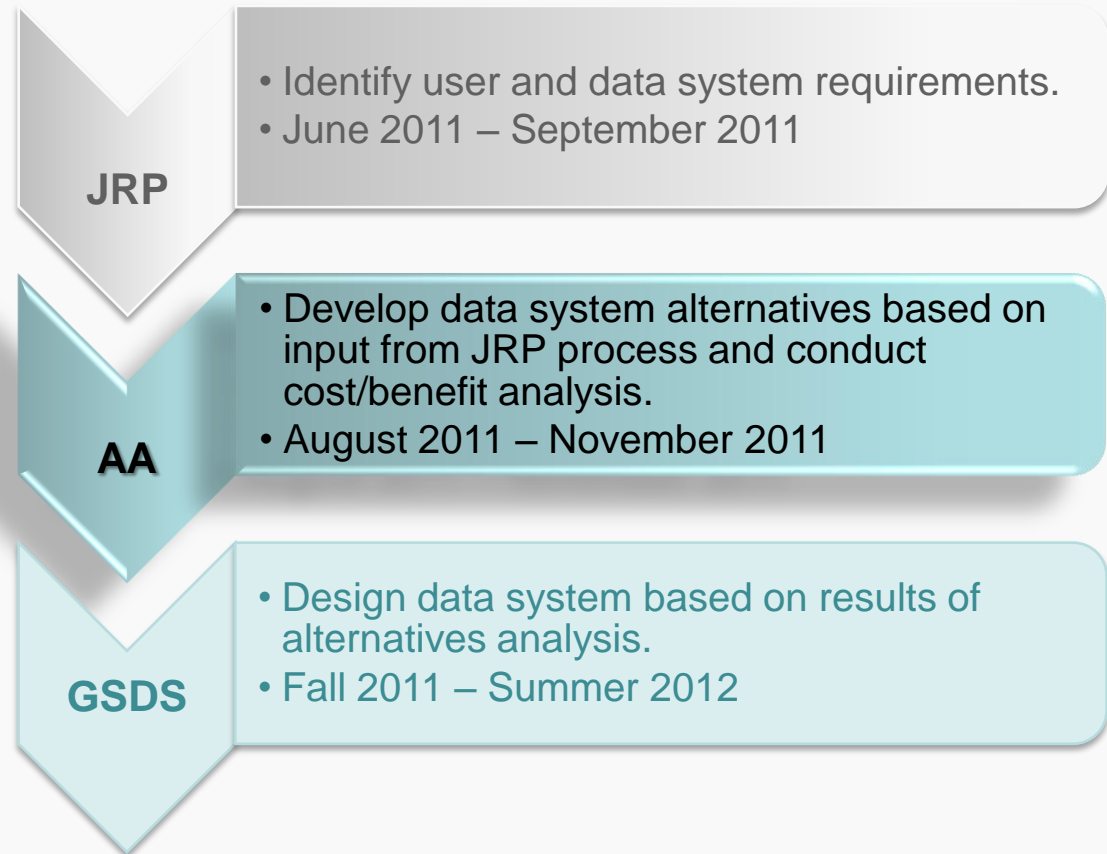
Overview of the GSDS:

3B. GSDS DEVELOPMENT PROCESS



GSDS Development Process and Status

- JRP meetings completed and outcomes are summarized.
- AA begun:
 - JRP outcomes are used to inform development of data system alternatives





Overview of the GSDS:

3C. JOINT REQUIREMENTS PLANNING (JRP) PROCESS



Definition of JRP Process

- Structured meetings in which a carefully selected group of stakeholders and content experts work together to identify, define, create, and refine user requirements.
- EPA held two JRP meetings:
 - JRP1: August 2–3, 2011 - Focused on needs of EPA users, especially Regions.
 - JRP2: August 15–16, 2011 - Focused on needs of state and owner/operator users.



Benefits of JRP

- Encourages partnership.
- Enables stakeholders.
- Adds efficiency.
- Improves quality.
- Increases knowledge.



Purpose of JRP Process for GSDS Development

- To inform the development of alternatives for the Alternatives Analysis.
- To identify/collect input (e.g., formats) on data elements reported/generated to comply with the requirements of the Class VI Rule.
- To identify users of the system and potential use cases.
- To identify data system functionalities and functional areas.



JRP Outcome: Primary Use of GSDS

EPA Regions	States	Owners/Operators	EPA HQ
<ul style="list-style-type: none"> • Review permit applications (DI) • Validate AoR modeling (for permit application & during injection phase) • Track compliance (DI) • Track financial responsibility (DI) • Monitor program activities • Make information available to public • Oversee activities of primacy states in Region 	<ul style="list-style-type: none"> • Review permit applications • Validate owner/operator modeling (for permit application & during injection phase) • Track compliance • Track financial responsibility • Monitor program activities • Make information available to public 	<ul style="list-style-type: none"> • Submit permit applications • Submit semi-annual reports • Submit data to support AoR reevaluation as needed • Fulfill emergency & remedial response requirements • Fulfill annual review of financial responsibility demonstration requirements 	<ul style="list-style-type: none"> • Collect information for adaptive rulemaking activities • Compile inventory information and data for PAMs • Monitor program activities • Track compliance & enforcement activities • Coordinate with e-GGRT requirements • Make information available to public



JRP Outcome: Preferred Data Format

EPA Regions	States	Owners/Operators	EPA HQ
<ul style="list-style-type: none">• Interoperable data formats for greater capabilities for editing, extracting, and management (e.g., GIS-compatible formats for spatial data)	<ul style="list-style-type: none">• PDF	<ul style="list-style-type: none">• PDF	<ul style="list-style-type: none">• Interoperable data formats for greater capabilities for editing, extracting, and management (e.g., GIS-compatible formats for spatial data)



JRP Outcome: Primary Concerns

EPA Regions	States	Owners/Operators	EPA HQ
<ul style="list-style-type: none"> • Compatibility with existing and planned data systems • Receiving data necessary to validate modeling • Receiving data necessary to conduct basin-scale assessments as needed 	<ul style="list-style-type: none"> • Compatibility with existing and planned data systems • Receiving data from EPA instead of receiving data directly from owners/operators 	<ul style="list-style-type: none"> • Potentially reporting to multiple authorities (GSDS & state) • Confidentiality and security (including version control) • Reporting data above-and-beyond rule requirements 	<ul style="list-style-type: none"> • Compatibility with existing data systems • Model validation • Data quality • Larger-scale evaluations • CROMERR compliance



Overview of the GSDS:

3D. ALTERNATIVES ANALYSIS (AA) PROCESS



AA – Definition

- A structured process for evaluating and comparing Project Management options.
- An Alternatives Analysis:
 - Requires review of different options and analyzes the costs and benefits;
 - Distinguishes the option that generates the most benefits to the organization as a whole; and
 - Facilitates and documents a better decision making process.



AA – Requirements

- Established by Section 300 of the Office of Management and Budget's (OMB) Circular Number A-11.
- Must be submitted for all major IT investments.
- Section 300 is online at:
http://www.whitehouse.gov/sites/default/files/omb/circulars/a11/current_year/s300.pdf.



AA – Process

- A Cost-Benefit Analysis should include:
 - An analysis of costs.
 - An analysis of benefits, including:
 - Quantitative, such as financial benefits (if possible); and
 - Qualitative, such as non-financial benefits (e.g., mandated standards, cooperation across organizations).
 - An analysis of technical feasibility.



GSDS Alternatives: Identification

- Four alternatives will be identified for the analysis.
- These alternatives will:
 - Be developed consistent with a conceptual model.
 - Be based on the information received during the JRP process.
 - Use some selected systems to include in the alternatives, such as:
 - UIC National Database: an oversight, compliance database that collects UIC data submitted by primacy/direct implementation (DI) programs.
 - GS³: A Geologic Sequestration Software Suite which is a data storage, management, and analysis platform developed specifically for GS by the Pacific Northwest National Laboratory (PNNL).

3. Overview of the GSDS - AA Process



GSDS Alternatives: Conceptual Model

Class VI GS Data System				
Functional Areas	Reporting/Communication Environment		Collaboration, Transparency, and Oversight Environment	Data Analysis Environment
Users	Owners/ Operators	Permitting Authority (UIC Program Director)	All other users (HQ, Permitting Authorities, States, Public, ICIS, etc.)	Permitting Authorities/EPA HQ
Operations	Submitting: <ul style="list-style-type: none"> Permit Applications Periodic Reports 	Providing: <ul style="list-style-type: none"> Responses 	<ul style="list-style-type: none"> Collaborations per well/AoR – limitations can be placed on different users for different levels of access A subset of information could be made public 	<ul style="list-style-type: none"> GS Project Data Quality Evaluation/Confirmation Regulatory Evaluation
	“Official Communication”			
Technical Requirements /Notes	Requires: <ul style="list-style-type: none"> Use of CDX CROMERR compliance 		<ul style="list-style-type: none"> No need for CROMERR compliance 	
Areas for Data	Records Management Environment		Data Storage	



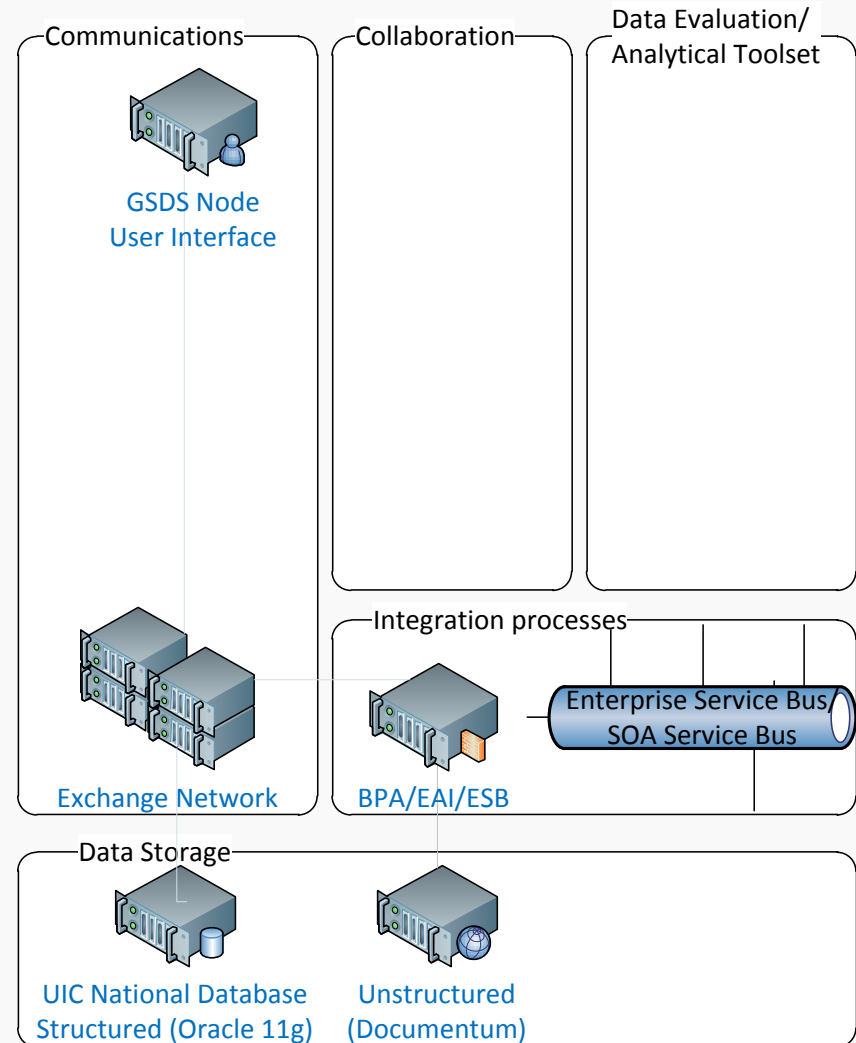
GSDS Preliminary DRAFT Alternatives

Alternatives	GSDS Conceptual Model Environments			
	Reporting/ Communication	Collaboration	Data Evaluation	Data Storage
Alternative 1	Status Quo			Documentum/ UIC National DB
Alternative 2	Modified UIC National Database (New Collaboration Platform and Data Evaluation Environment)			Documentum/ UIC National DB
Alternative 3	GS ³ (Customized for Class VI Support)			GS ³ /Class VI Relational DB/ UIC National DB
Alternative 4	New Class VI Collaboration Platform		GS ³	GS ³ /Class VI Relational DB/ UIC National DB



Alternative #1 (Status Quo)

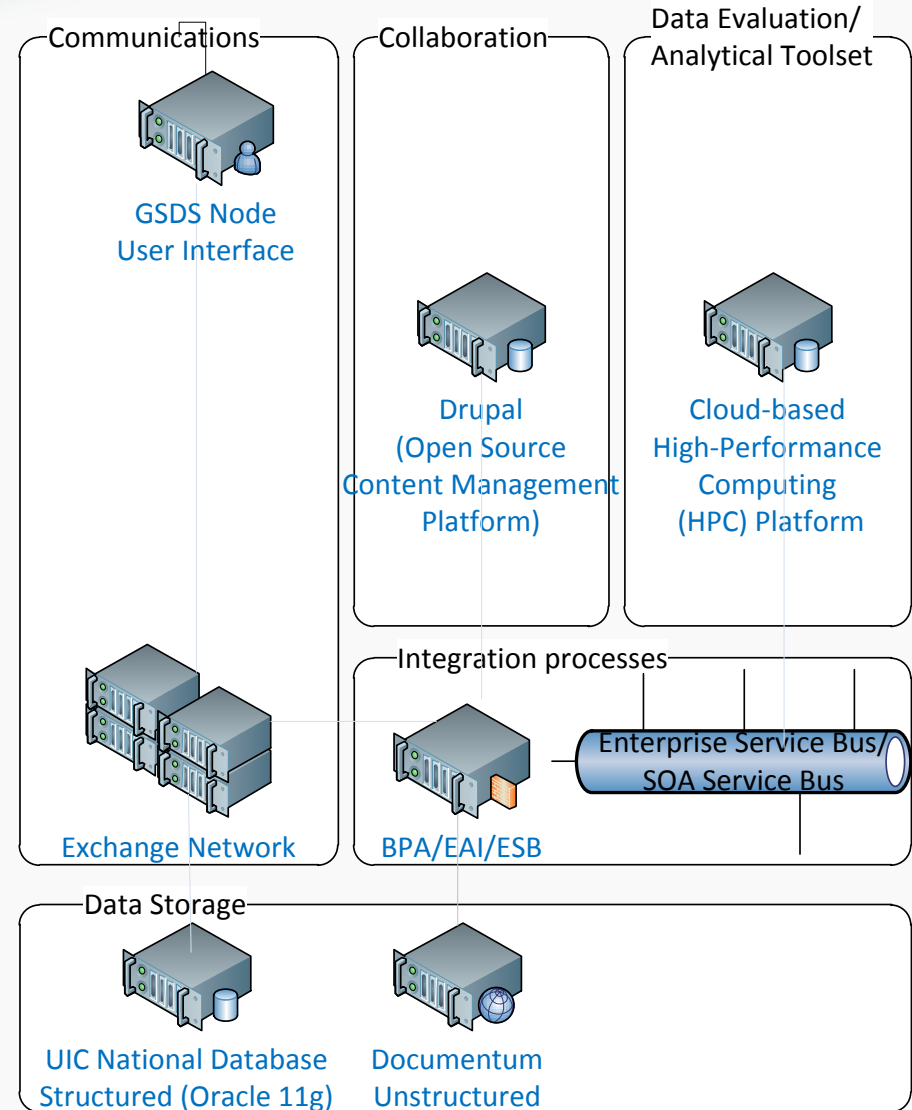
- Data will directly be sent to permitting authorities.
- No collaboration or data evaluation solutions.
- Data Storage:
 - Existing UIC National Database for structured data.
 - Documentum for unstructured data.





Alternative #2

- The UIC National Database will be modified to include:
 - A content management system for the collaboration environment.
 - An HPC platform for the data evaluation environment.
- Data Storage:
 - Modified UIC National Database for structured data.
 - Documentum for unstructured data.

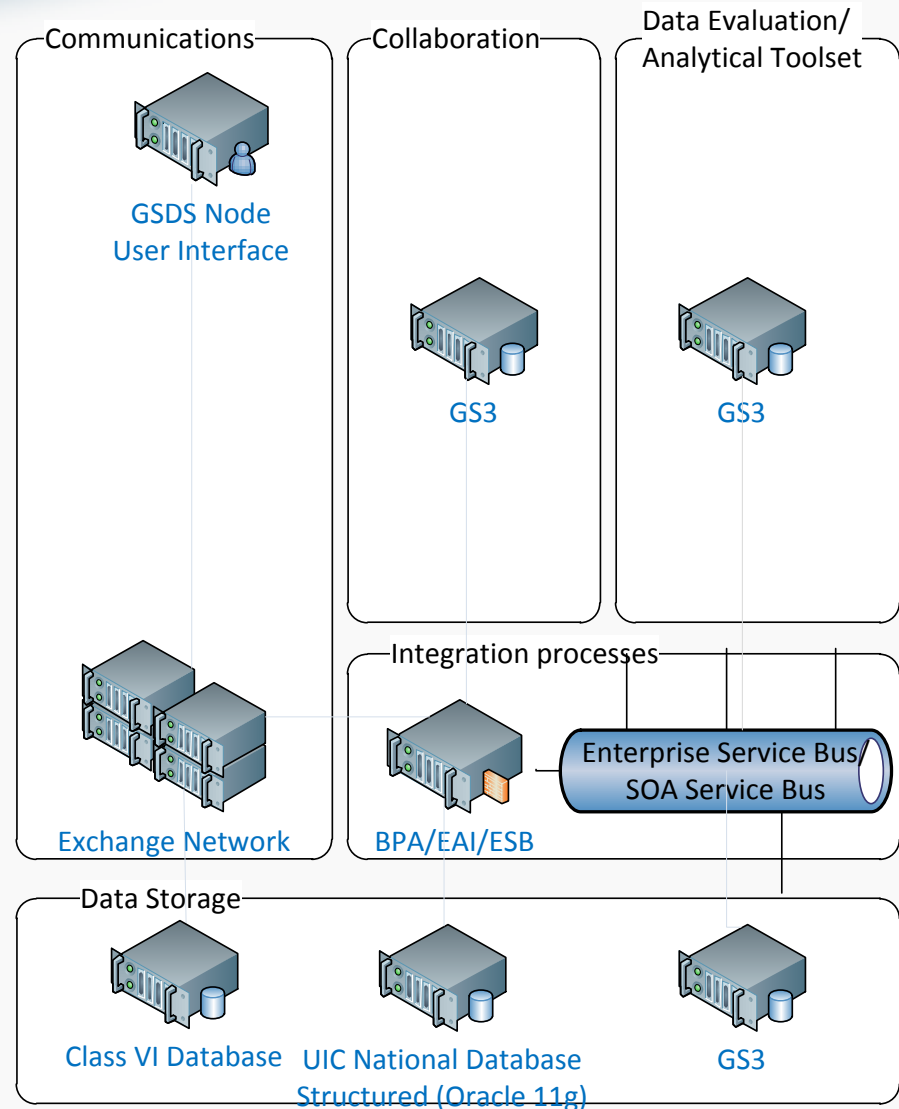


3. Overview of the GSDS - AA Process



Alternative #3

- Comprehensive use of GS³ configured and customized for Class VI support in:
 - Collaboration environment.
 - Data evaluation environment.
- Data Storage:
 - UIC National Database for structured data.
 - GS³ and a relational database (Class VI Database) for the remainder of GS data.

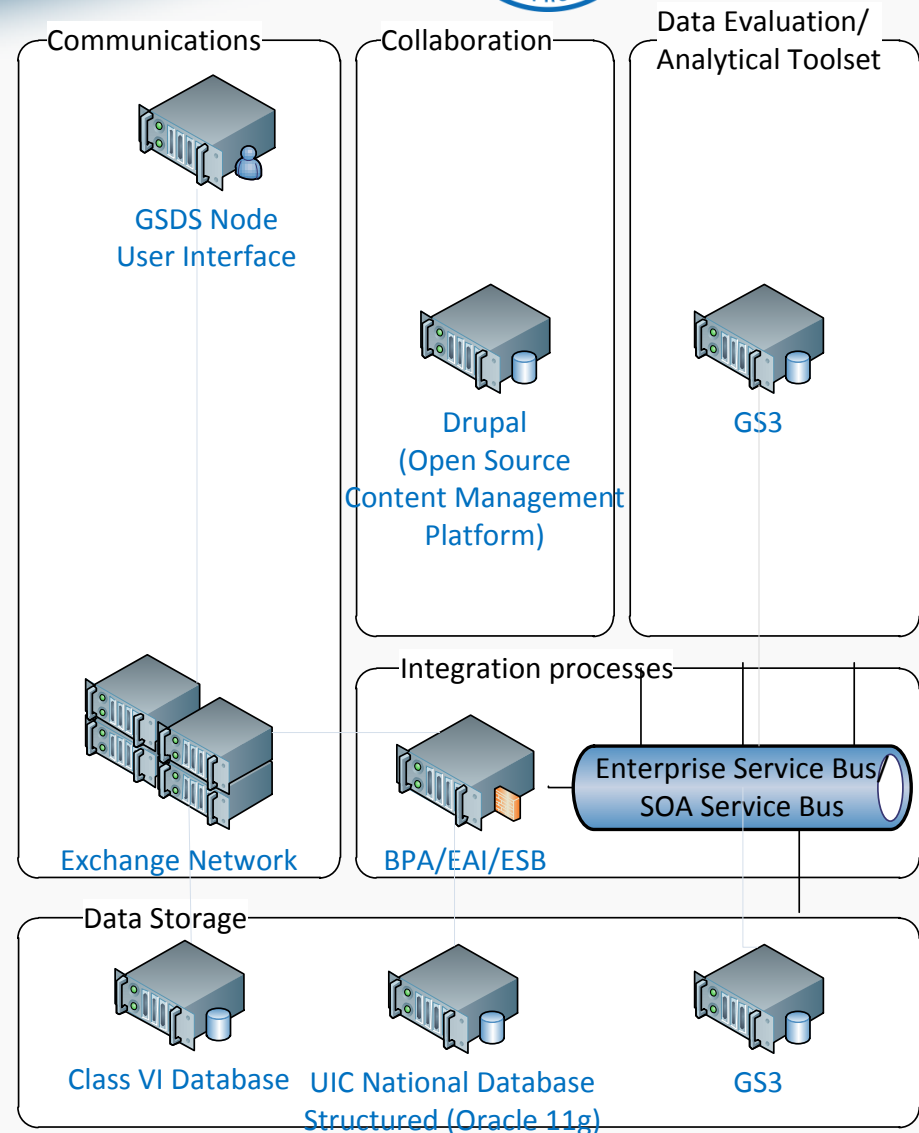


3. Overview of the GSDS - AA Process



Alternative #4

- A new collaboration platform supported by a relational database (Class VI Database).
- GS³ platform for data evaluation environment.
- Data Storage:
 - UIC National Database for structured data.
 - GS³ and Class VI database for the remainder of GS data.





Session for participants' questions, feedback,
and discussion!

4. Q&A



Outline of Q&A Session

- A. General Q&A with participants
- B. Q&A on GS data
- C. Q&A on GSDS
- D. Q&A on AA



Q&A Session:

4A. GENERAL QUESTIONS



Questions?

- Any general questions or comments?



Q&A Session:
4B. GS DATA



Data Formats

- What data formats should EPA expect for the following types of submissions: Geologic data? CO2 stream characteristics and tracking? Models of CO2 plume?
 - Is the interoperability of the GS data important?
- Potential data formats:
 - PDF,
 - Tabular raw data, and/or
 - GIS-compatible formats.



Example: AoR Modeling Data

The Rule Required Data Element	Potential Submittal	Anticipated Format
<p>40 CFR 146.84(c)(1) Predicted lateral and vertical migration of CO₂ plume and formation fluids by using computational modeling. The model must:</p> <ul style="list-style-type: none"> (i) Be based on geologic data collected to characterize the injection zone, confining zone and any additional zones; and anticipated operating data including injection pressures, rates, and total volumes. (ii) Take into account any geologic heterogeneities, other discontinuities, and data quality. (iii) Consider potential migration through faults, fractures, and artificial penetrations. 	<ul style="list-style-type: none"> • The conceptual site model and all supporting data on which the model is based; • Attributes of the code used to create the computational model (e.g., code name, name of the developing organization, governing equations employed, simplifying assumptions); • A description of model's initial and boundary (vertical and lateral) conditions and layers as presented on maps and cross sections; • A description of numerical space discretization, solution methods/options employed, computational parameters, and time-stepping information; • An accounting of all equations of state used to describe thermophysical properties of all fluids modeled (e.g., ground water, carbon dioxide); • Constitutive relationships of the permeable medium (e.g., relative permeability-saturation relationship) and a description of how they were determined; • Values of all model parameters and a description of how model parameters were determined based on site characterization; • If requested by the UIC Program Director, raw model input and output files; • Model results depicting the extent of carbon dioxide plume and pressure-front migration over the lifetime of the project as a function of time, and results of simulations of maximum-risk scenario and the outcome of parameter sensitivity analyses; and • If required by the UIC Director, the relevant qualifications and professional experience of any individuals and/or consulting firms responsible for model development, AoR delineation, and reevaluation, including examples of previous multiphase modeling studies conducted. 	<ul style="list-style-type: none"> • A combination of PDF, tabular data and/or GIS-compatible format



Compliance/Oversight Data

- What information is needed for the determination of compliance/oversight under the Class VI Rule?
- What types of compliance/oversight data elements should be generated throughout the lifecycle of a Class VI well?
For example:
 - Permit values to compare against during the injection and post-injection phases?
 - Frequency data from plans?
 - AoR modeling-related compliance information?



Q&A Session

4C. THE GSDS



GSDS

- What are some ideal characteristics of a data system that involves interaction between owners or operators, state agencies, and EPA Headquarters and Regions?
- Does the system need to have tools to conduct modeling for larger/basin scale evaluations (with multiple operations/plumes) at the permitting agency/EPA level?



GSDS (Continued)

- Are there any additional Regional, state, or cross-program requirements for GS that should be considered when developing the GSDS?
- Are there any functions that the GSDS can be designed to accomplish to assist future users (e.g., automatic forwarding of 24-hour emergency notice reporting to key, pre-determined users via email)?



Q&A Session

4D. GSDS ALTERNATIVES ANALYSIS



Alternatives Analysis

- Are the preliminary alternatives appropriate?
- What are some potential benefits to the alternatives?

Preliminary DRAFT Alternatives for the GSDS

Alternative 1	Alternative 2	Alternative 3	Alternative 4
Status quo	Modification of UIC National Database	GS3 Collaboration/Data Evaluation	GSDS Collaboration/ GS3 Data Evaluation



What are the next steps for GSDS development?

5. NEXT STEPS



Next Steps

- Continue AA process (fall 2011):
 - Finalize alternatives.
 - Conduct cost/benefit analysis.
- Design data system based on results of alternatives analysis (fall 2011 – summer 2012).