

# ARB's Carbon Capture and Sequestration (CCS) Program

## CCS Technical Discussion Series: Monitoring

### Background on ARB's CCS Technical Discussions

ARB is currently developing a program to allow for the use of carbon capture and sequestration (CCS) in its climate change programs, and to advance the use of CCS as a greenhouse gas (GHG) reduction strategy generally. As part of this effort, ARB's CCS program staff seeks to better understand the ability of CCS to contribute to California's climate goals, the limitations or advantages of the technology, and the innovation and incentives necessary for adoption. To support this work, ARB is developing a quantification methodology (QM) for CCS projects. As with other QMs, the CCS QM may be adopted for use in the Cap-and-Trade and Low Carbon Fuel Standard programs as determined appropriate in rulemaking(s) specific to these programs. For more information on ARB's CCS program and development of the QM please visit our website at <http://www.arb.ca.gov/cc/ccs/ccs.htm>.

In order to ensure staff is using the best available information and understands stakeholder concerns, we are hosting a series of technical discussions. The CCS technical discussions are topic focused stakeholder-led discussions. The intent is to allow interested parties to provide input that will inform development of the CCS QM, as well as the CCS program generally. ARB will identify subject areas and specific questions, with the expectation that stakeholders will provide presentations, or other materials, and participate in an open discussion.

The CCS technical discussions will be accessible via webinar, conference call, and in-person at ARB headquarters in Sacramento, California. At the discussion, ARB will provide a short overview of the identified subject area, as well as other information pertinent to the discussion if applicable, but the primary focus will be on stakeholder presentations and discussion. ARB generally will not provide a presentation or formal meeting notes, but will post all stakeholder presentations or other submitted materials to ARB's CCS website at <http://www.arb.ca.gov/cc/ccs/meetings/meetings.htm>.

### Monitoring Technical Discussion

The monitoring technical discussion is meant to achieve a better understanding of the merits and shortcomings of existing CCS monitoring plan schemes, as well as issues and uncertainties related to CCS monitoring. This technical discussion will also offer a platform for the open exchange of information related to the development and implementation of CCS monitoring plans. Monitoring plans are one of several components of the comprehensive CCS QM being developed by ARB that will ensure that emissions reductions are real, permanent, quantifiable, and verifiable.

The main goal of this technical discussion is to determine what monitoring requirements are needed in a CCS project. CCS monitoring plans are used to ensure that carbon dioxide (CO<sub>2</sub>) injected into underground storage reservoirs is permanently contained within the geologic formations, behaving as expected in the subsurface, and that any unexpected CO<sub>2</sub> plume migration or potential leaks to the atmosphere are detected

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early so that appropriate responses can be taken. Monitoring is done with the use of various technologies that are used to detect and quantify leaks. A typical monitoring plan will measure the amount of CO<sub>2</sub> stored at a sequestration site, monitor the site for plume migration or leaks or a deterioration of storage integrity over time, and verify that the CO<sub>2</sub> is permanently stored and does not harm the environment. Well-designed monitoring plans are reactive to any changes detected during injection, and a verification component measuring the amount and location of stored CO<sub>2</sub> is usually included.

### Participating in the Monitoring Technical Discussion

DATE: Friday August 5, 2016  
TIME: 9:30 a.m. to 4:00 p.m.

To attend in person:

LOCATION: Room 550  
ADDRESS: Cal/EPA Headquarters Building  
1001 "I" Street  
Sacramento, California 95814

To participate by webinar:

<https://attendee.gotowebinar.com/register/4952393161540958979>

To participate by teleconference:

United States: +1 (631) 992-3221  
Access Code: 797-177-549  
Please note that this is a toll call.

### Presenting at the Monitoring Technical Discussion

If you would like to present at the Monitoring Technical Discussion, please contact Ms. Sara King at (916) 323-1009 or [Sara.King@arb.ca.gov](mailto:Sara.King@arb.ca.gov) by July 28, 2016. ARB is requesting that presentations be limited to 20 minutes. Depending on interest, ARB may adjust presentation length and will communicate this to presenters ahead of time.

If you require special accommodation for the scheduled meeting or need this document in an alternate format (e.g., Braille, large print) or another language, please contact Ms. Regina Cornish at (916) 327-1493, as soon as possible. TTY/TDD/Speech to Speech users may dial 711 for the California Relay Service.

If you have questions about the Monitoring Technical Discussion, please contact Ms. Sarah Penfield, Air Pollution Specialist, at (916) 324-8182 or [Sarah.Penfield@arb.ca.gov](mailto:Sarah.Penfield@arb.ca.gov).

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### Questions to Guide the CCS Monitoring Technical Discussion

The following sections provide a list of questions that is intended to guide stakeholder presentations and the discussion generally. Please note that this list is not exhaustive either in topics or questions, and that when developing monitoring requirements ARB must adhere to the requirements of AB32, the California Administrative Procedures Act, and its current regulations, such as MRR, which has specific accuracy requirements.

#### **Monitoring Plan Development**

Monitoring plans are used for multiple purposes including understanding plume stability, pressure management, and leak detection and quantification.

1. What process should be used to develop a CCS monitoring plan?
2. What specific elements should or should not be included in a monitoring plan?
3. How should CCS monitoring plans be implemented?
4. What criteria should we use to evaluate monitoring plans?
5. Are there specific technologies that should always be required in a CCS monitoring plan?
6. Are there specific performance metrics that should be required as components of a CCS monitoring plan?
7. How should a monitoring plan differ between sequestration in oil & gas reservoirs and sequestration in saline formations?
8. How should monitoring schedules be determined?
9. What specific or general triggers should require monitoring plans to be updated?
10. What monitoring should be required at different stages of a CCS project, and for how long (e.g. construction, operation, post-injection)?
11. What contingencies should be included in a monitoring plan?
12. What role should monitoring play in determining CO<sub>2</sub> plume stability?
13. What degree of plume stability should be required in order to cease monitoring activities?
14. What role does verification play in a monitoring plan?

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### **Monitoring Tools and Techniques**

1. Which monitoring tools and techniques are the most useful or beneficial and which are the least useful and beneficial?
2. What are the costs associated with different monitoring tools and techniques?
3. Which technologies are thoroughly tested and widely deployed and thus ready for application in CCS projects, and which are still being tested and not widely available?
4. Which technologies are best suited to use in monitoring injection rates and pressures, as well as injection well integrity?
5. Which monitoring tools and techniques are better suited to monitoring geological seals?
6. Which technologies are best suited to be used to monitor subsurface distribution of CO<sub>2</sub>?
7. How should pressure front development and plume stability be monitored?
8. Are there other areas or regimes not listed above that should be monitored, and if so which monitoring technologies would be best suited to the task?

### **Leak Detection and Quantification**

1. What strategies and technologies should be used to detect and quantify leaks?
2. What are the technical challenges associated with leak detection and quantification?
3. What technologies and methods should be used to establish background CO<sub>2</sub> concentration for monitoring CO<sub>2</sub> surface leaks?
4. What strategies and technologies should be used for surface and subsurface leak detection and quantification?
5. How accurately can surface and subsurface leaks be detected and quantified?
6. What considerations need to be made regarding contingency planning for when a leak is detected?
7. What additional monitoring should be required after a leak is detected?