

# **Determining the Applicability of Carbon Capture and Storage under Best Available Control Technologies (BACT) for Any New or Modified Prevention of Significant Deterioration (PSD)\***

**Steven M. Carpenter<sup>1</sup>**

Search and Discovery Article #80265 (2012)\*\*  
Posted October 29, 2012

\*Adapted from oral presentation given at AAPG Eastern Section meeting, Cleveland, Ohio, 22-26 September 2012

\*\*AAPG©2012 Serial rights given by author. For all other rights contact author directly.

<sup>1</sup>Advanced Resources International, Arlington, VA ([scarpenter@adv-res.com](mailto:scarpenter@adv-res.com))

## **Abstract**

The Environmental Protection Agency is anticipated to issue the first limits on greenhouse gas emissions from new power plants. This regulatory act may end the construction of conventional coal-fired facilities in the United States. The proposed rule will require any new power plant to emit no more than 1,000 pounds of carbon dioxide per megawatt hour of electricity produced. The average U.S. natural gas plant, which emits 800 to 850 pounds of CO<sub>2</sub> per megawatt hour, meets that standard; coal plants emit an average of 1,768 pounds of carbon dioxide per megawatt hour.

A mechanism to evaluate the potential applicability of Carbon Capture and Storage (CCS) for coal fired power production in the US is needed. The ever changing, ever increasing, ever tightening regulatory climate that requires consideration of Best Available Control Technologies (BACT) for any new or modified Prevention of Significant Deterioration (PSD) and Title V requirements is a key mechanism to accomplish both the “letter and spirit of the law”.

In principle, Carbon Capture and Storage (CCS) would provide reduction of greenhouse gases and therefore should be considered. However, since CCS is neither a proven commercial technology nor is it mandated (as of yet), it seems that requiring consideration now is confusing at best.

EPA guidance states that permit applicants and permitting authorities should consider all “available” GHG control options that have the potential for practical application to the source under consideration. The guidance further suggests that once permitting authorities gain experience with GHG BACT determinations, useful information on GHG permitting decisions will be presented.

The expression of regulatory decisions and permitting based on “future tense” terms makes planning, operational, and strategic decisions very difficult for the electric generation market. This presentation will endeavor to discuss and navigate specific details in the PSD requirements for power generation as they apply to carbon capture and storage, and more specifically, how coal fired plants can comply with both the spirit and intent of the rule.



# ***Determining the Applicability of Carbon Capture and Storage under Best Available Control Technologies (BACT) for Any New or Modified Prevention of Significant Deterioration (PSD)***

***Eastern Section – AAPG***

***Session X - Carbon Capture & Sequestration II***

*Prepared By:*

**Steven M. Carpenter, Vice, President  
ADVANCED RESOURCES INTERNATIONAL, INC.  
Arlington, VA**

***Unconventional Resources • Enhanced Recovery • Carbon Sequestration***



**Advanced Resources  
International, Inc.**

# Points of Discussion

2

1. EPA Mandatory GHG Reporting Rule (MRR) - CCS
2. Best Available Control Technology (BACT) – CCS
3. Example application of BACT – GHG emissions



# Mandatory GHG Reporting Rule

3

## ➤ Statutory authority

- ✓ Sections 114 and 208 of the CAA
- ✓ FY 2008 Consolidated Appropriations Act

## ➤ CAA enforcement applies

- ✓ Penalties up to \$32,500/day/violation
- ✓ Each day of non-compliance is a new violation
- ✓ Each section of rule's non-compliance is a violation



# Industries affected by MRR

4

- **Electricity generation**
- *Adipic acid production*
- *Aluminum production*
- *Ammonia manufacturing*
- **CCS Projects**
- *Cement production*
- *HCFC-22 production*
- *HFC-23 destruction processes*
- *Industrial Waste Landfills*
- *Industrial WWTP*
- *Lime manufacturing*
- *Magnesium production*
- *Manure systems*
- **Natural Gas Production**
- *Nitric acid production*
- *Petrochemical production*
- **Petroleum refineries**
- *Phosphoric acid production*
- *Silicon carbide production*
- *Soda ash production*
- *Titanium dioxide production*
- **Underground Coal Mines**



# Electric Signature and Authorization

5



1. ~ 1 week to process
2. Snail Mail
3. Maintain email

## Electronic Signature and Use Agreement

The electronic submittal of information to the United States Environmental Protection Agency (EPA) requires the creation and maintenance of a CDX user account. I have reviewed and agree to the following conditions for the access and use of my account.

(1) I understand and agree that I will be held as legally bound, obligated, or responsible for any electronically signed submission I make as I would be by making such submission in hardcopy form with my handwritten signature;

(2) I agree to maintain an email account. If any email sent to me by EPA is returned as undeliverable, I will explain why this occurred when requested by EPA;

(3) I agree to protect my user name and password from use by anyone except me. I will not divulge or delegate my user name or password to any other individual. I will not store my password in an unprotected location and I will not allow my password to be written into computer scripts to achieve automated login;

(4) I agree to contact the EPA as soon as possible after suspecting or determining that my user name and password have become lost, stolen, or otherwise compromised, or of any other security incidents; and

(5) I agree not to attempt to view, change, or delete data unless I have the authorization to do so. I agree to behave in an ethical and trustworthy manner and to be alert to threats to applications and data.

**Name:** Steven M Carpenter  
**User name:** SMJCARPENTER  
**Organization:** Advanced Resources International  
**Email Address:** carpenter.sm@gmail.com  
**Signature:** \_\_\_\_\_  
**Date:** \_\_\_\_\_

Please submit signed and dated agreement

e-GGRT Help Desk

SAIC

8301 Greensboro Drive, Mail Stop E-11-2

McLean, VA 22102



558254



Advanced Resources  
International, Inc.

# Register facility (one per address)

6

The screenshot shows the EPA e-GGRT (Electronic Greenhouse Gas Reporting Tool) interface. The browser address bar displays <https://ghgreporting.epa.gov/ghg/facilitymanagement/summary.do>. The page header includes the EPA logo and navigation tabs: HOME, FACILITY REGISTRATION, FACILITY MANAGEMENT, and DATA REPORTING. The user is logged in as Steven Carpenter.

**MY FACILITIES** > FACILITY SUMMARY

**SECARB Phase III Anthropogenic Test**  
**Facility Summary**

**E-GGRT FACILITY SUMMARY**  
From this summary page, depending upon your role, you can make changes to the "Facility Profile" information, the facility's representatives Designated Representative (DR) and Alternate Designated Representative (ADR), and to your Agents if you are a DR or ADR.

**Facility Representatives**

Designated Representative	Steven Carpenter	<a href="#">CHANGE</a>
Alternate Designated Representative	none	<a href="#">CHANGE</a>

**Facility Profile**

Facility Information	SECARB Phase III Anthropogenic Test 31.06486 N, 88.18201 W Mobile County AL 00000	<a href="#">EDIT</a>
Owners and Operators	Denbury Onshore, LLC	
Is a CAMD Business System Facility?	No	

**Certificate of Representation Signed and Complete:** No further action is required by the facility representatives.

[Certificate of Representation](#)

Agent (for this facility) for  
none appointed

[Add Agent](#) [Remove selected](#)

**Subpart RR: Geologic Sequestration of Carbon Dioxide**  
Click the Subpart RR link above to submit an R&D Project Exemption Request, a



# Certificate of Representation

7

Certificate of Representation	
<b>FACILITY INFORMATION</b>	
<b>Facility Name</b>	SECARB Phase III Anthropogenic Test
<b>Address</b>	31.06486 N, 88.18201 W Mobile County AL, 00000
<b>Owners and Operators</b>	Denbury Onshore, LLC
<b>REPRESENTATIVE INFORMATION</b>	
<b>Designated Representative</b>	Steven Carpenter Advanced Resources International 1282 Secretariat Court Batavia OH, 45103 513-460-0360 703-528-0439 scarpenter@adv-res.com
<b>Signature Date</b>	Thu, Jun 02, 2011 11:53:34 AM
<b>Alternate Designated Representative</b>	
<b>Signature Date</b>	
<b>CERTIFICATION STATEMENTS</b>	
I certify that I was selected as the designated representative or alternate designated representative, as applicable, by an agreement binding on the owners and operators of the facility or supplier, as applicable.	
I certify that I have all the necessary authority to carry out my duties and responsibilities under 40 CFR part 98 on behalf of the owners and operators of the facility or supplier, as applicable, and that each such owner and operator shall be fully bound by my representations, actions, inactions, or submissions.	
I certify that the owners and operators of the facility or supplier, as applicable, shall be bound by any order issued to me by the Administrator or a court regarding the facility or supplier.	
If there are multiple owners and operators of the facility or supplier, as applicable, I certify that I have given a written notice of my selection as the 'designated representative' or 'alternate designated representative', as applicable, and of the agreement by which I was selected to each owner and operator of the facility or supplier.	

*As the Designated Representative (DR) or Alternate DR,  
“I certify that...”*

# MRR – “Designated Representative”

8

- ☑ **“I certify that I was selected as the designated representative or alternate designated representative, as applicable, by an agreement binding on the owners and operators of the facility or supplier, as applicable.”**
- ☑ **“I certify that I have all the necessary authority to carry out my duties and responsibilities under 40 CFR Part 98 on behalf of the owners and operators of the facility or supplier, as applicable, and that each such owner and operator should be fully bound by my representations, actions, inactions, or submissions.”**
- ☑ **“I certify that the owners and operators of the facility or supplier, as applicable, should be bound by any order issued to me by the USEPA Administrator or a court regarding the facility or supplier.”**
- ☑ **“If there are multiple owners and operators of the facility or supplier, as applicable, I certify that I have given a written notice of my selection as the ‘designated representative’ or ‘alternate designated representative’, as applicable, and of the agreement by which I was selected to each owner and operator of the facility or supplier.”**



# MRR – Reporting Requirements

9

## Data & Recording keeping, **by Facility Address:**

- A list of all units, operations, processes, and activities
- The data used to calculate the GHG emissions
- The GHG emissions calculations and methods used (Tier 1-4)
- Analytical results of site-specific emissions factors
- Analyses for high heat value (HHV), carbon content, and other parameters
- Any facility operating data or process information used
- The annual GHG reports
- Retained record for any missing data
- Certification & QA/QC data of instrumentation
- Maintenance & Calibration records of instrumentation



# MRR – Reporting Requirements

10

## **April 1: GHG Monitoring or “QA/QC” Plan (per fac):**

- Identification of responsibilities (i.e., job titles) for data collection
- Explanation of processes and methods used for data collection
- Describes QA/QC procedures, maintenance, and repair of all CEMS
- Existing corporate documents (e.g., standard operating procedures)
- Yearly revision to the Plan to reflect changes in processes, etc
- Upon request make available for audit

**January 1: Register facilit(ies)**

**March 31: Data reporting previous year**



# Data Reporting

11

*Submit  
data*

https://ghgreporting.epa.gov/ghg/datareporting/facility\_overview.do?selection=yes&combustionSourceCategory=Category1&combust

e-GGRT

Sakai Anti... Gmail ODU MapQ... FoxN... Dict... TWC Weat... MRPC...

Page Safety Tools

EPA United States Environmental Protection Agency

HOME FACILITY REGISTRATION FACILITY MANAGEMENT DATA REPORTING

Hello, Steven Carpenter | My Profile | Logout

e-GGRT Electronic Greenhouse Gas Reporting Tool

SECARB Phase III Anthropogenic Test (2010)  
**e-GGRT Greenhouse Gas Data Reporting**  
[Select Facility](#) • [Facility or Supplier Overview](#)

**FACILITY OR SUPPLIER OVERVIEW**  
This page allows you to add the source and/or supplier categories for which your facility or supplier will be reporting, then to access those data reporting screens using the OPEN buttons.  
After data reporting is complete, you can initiate the annual report review and submission process from this page by using the SUBMIT button (or RESUBMIT for subsequent submissions if needed).  
Facility's GHG Reporting Method: Data entry via e-GGRT web-forms ([Change](#))

REPORT DATA  
2010 Reporting Source or Supplier Category Validation Messages? Subpart Reporting  
Subpart A—General Information [View Messages](#) [OPEN](#)  
[ADD OR REMOVE Subparts](#)

CO<sub>2</sub> equivalent emissions (excluding biogenic) from subparts O - HH (metric tons)  
Biogenic CO<sub>2</sub> emissions from subparts O - HH (metric tons)  
CO<sub>2</sub> equivalent quantity from supplier categories (metric tons)  
[VIEW GHG DETAILS](#)

If all subparts are completed and Validation Messages addressed to your satisfaction, you are ready to prepare and submit an Annual Report.  
**SUBMIT ANNUAL REPORT**

Report	Uploaded File Name	Status	Submitted Date	Certification Date
<a href="#">GENERATE / RE SUBMIT</a>				

**FACILITIES NOT SUBMITTING AN ANNUAL REPORT**  
If this facility is not submitting an annual report this reporting year, please check the box below. For more information regarding legitimate reasons for not submitting a report to EPA, please use the e-GGRT Help links to the left.  
This facility is NOT required to submit a report ☐  
[SAVE](#)

# MRR – Subpart A, C, W, FF, RR & UU

12

A: General

C: Stationary Sources

W: Petroleum and Natural Gas Systems

FF: Underground Coal Mines

RR: Geologic Sequestration of CO<sub>2</sub>

UU: Injection of CO<sub>2</sub>



# MRR Applicability

13

- Subpart RR applies to facilities that conduct geologic sequestration (CCS)
- Subpart UU applies to all other facilities that inject carbon dioxide (EOR)
- Complementary to & expands Underground Injection Control (UIC) permit requirements



Advanced Resources  
International, Inc.

# New Source Review, Prevention of Significant Deterioration & Title V

14

## Best Available Control Technology (BACT)

- EPA has a 5 step process
  - Step 1: ID all available technologies
  - Step 2: Eliminate technically infeasible options
  - Step 3: Rank remaining technologies
  - Step 4: Evaluate most effective controls
  - Step 5: Select BACT's



# New Source Review, Prevention of Significant Deterioration & Title V

15

## Best Available Control Technology (BACT)

- After January 2, 2011, must address GHGs
- WHIJTCCS defines, and EPA considers CCS as an “AVAILABLE” “add-on” technology
- Must include in Step 1 Analysis: Identify
- May exclude in Step 4 Analysis: Evaluate
- In either case, CCS “clearly warrants a comprehensive consideration” and a “detailed case-specific analysis needed to dismiss”



# New Source Review, Prevention of Significant Deterioration & Title V

16

What is hoped is that...CCS under BACT

- Won't be immediately dismissed due to “economic” considerations
- Won't be immediately dismissed due to “technological” considerations
- Won't be immediately dismissed due to “deployment” issues
- Won't be immediately dismissed due to “uncertain regulatory issues”



# New Source Review, Prevention of Significant Deterioration & Title V

17

What is hoped is that at least...CCS under BACT

- Will be preliminarily evaluated for source-CO<sub>2</sub> removal technology application at the plant
- Will be preliminarily evaluated sink capacity near the plant
- Will evaluate the regulatory status in the jurisdiction
- Only then, make a decision as to applicability



# Proposed Natural Gas Plant May Set Tighter GHG BACT Permit Precedent

18

- AES Corp. Huntington Beach Energy Project in southern California
- Natural gas-fired, combined-cycle, air-cooled, 939-megawatt (MW) electrical generating facility
- EPA has proposed to delegate authority for issuing the plant's Clean Air Act prevention of significance deterioration (PSD) permit to California's South Coast Air Quality Management District
- EPA will have final jurisdiction over 2010 guidance for how to perform BACT reviews for GHG permits

# Proposed Natural Gas Plant May Set Tighter GHG BACT Permit Precedent

19

- The BACT for GHG emissions for the AES project is a rate of 1,082 pounds of carbon dioxide per megawatt hour (CO<sub>2</sub>/MWhr) of gross energy output, and a total annual CO<sub>2</sub> emissions limit of 3,161,785 metric tons per year.
- By comparison the average emission rate for NG fired power is 1135 lbs/MWh of carbon dioxide (5% reduction)
- By comparison the average emission rates for coal fired power 2,249 lbs/MWh of carbon dioxide



# Proposed Natural Gas Plant May Set Tighter GHG BACT Permit Precedent

20

- EPA officials can cite AES' advanced technologies or plant designs that are employed to meet GHG BACT when considering subsequent permit applications across the United States
- Project developers must then examine the AES system components and permit conditions when applying for any new permits elsewhere
- This creates a nuanced issue of simple-cycle vs. combined-cycle for Peaker plants that are required to fast-ramp, fast-start, and ramp-down



# Proposed Natural Gas Plant May Set Tighter GHG BACT Permit Precedent

21

- A simple-cycle plant, which does not include the heat-recovery steam generators, would result in more GHG emissions
- Simple-cycle vs. combined-cycle turbine systems has emerged as a key issue in GHG permits
- In June, Wisconsin officials rejected a request by EPA Region V to consider mandating more efficient combined-cycle gas turbines in a final GHG permit due to space (air cooled) issues



# Proposed Natural Gas Plant May Set Tighter GHG BACT Permit Precedent

22

- Also in June, EPA Region IX approved a simple-cycle system for the Pio Pico Energy Center "peaking" power plant in San Diego
- AES Huntington Beach project, planned at two more AES facilities in the coming months, could set a new GHG emissions or energy efficiency threshold EPA or local regulators must follow for future proposals
- AES' PSD permit application with the South Coast air district ALSO must renewable power at a significantly higher energy efficiency rate, helping utilities achieve California's stringent renewable portfolio standard (RPS) with fewer GHG emissions



# Proposed Natural Gas Plant May Set Tighter GHG BACT Permit Precedent

23

- This may mean that, ALL future BACT considerations may:
  - Be required to meet enlarged size (footprint) restrictions of air cooled turbines
  - Be required to meet non-Peaker GHG emission rate for Peaker designed plants (fast-ramp, fast-start, and ramp-down)
  - Be required to meet California's Renewable Portfolio Standards (RPS)



# Thank you!



**Advanced  
Resources  
International**  
[www.adv-res.com](http://www.adv-res.com)

## **Office Locations**

**Washington, DC**  
4501 Fairfax Drive  
Suite 910  
Arlington, VA 22203  
Phone: (703) 528-8420  
Fax: (703) 528-0439

**Houston, TX**  
11490 Westheimer  
Suite 520  
Houston, TX 77042  
Phone: (281) 558-6569  
Fax: (281) 558-9202

**Knoxville, TN**  
603 W. Main Street  
Suite 906  
Knoxville, TN 37902  
Phone: (865) 541-4690  
Fax: (865) 541-4688

**Cincinnati, OH**  
1282 Secretariat Court  
Batavia, OH 45103  
Phone: (513) 460-0360  
[scarpenter@adv-res.com](mailto:scarpenter@adv-res.com)

