UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF
AIR AND RADIATION

October 12, 2011

Mr. William Manley
Archer Daniels Midland Company
4666 Faries Parkway
Decatur, IL 62521

Re: Submission in support of an exemption from 40 CFR Part 98, Subpart RR as a research and development project for ADM's Midwest Geologic Sequestration Consortium Project in Decatur, Illinois

Dear Mr. Manley:

The United States Environmental Protection Agency (EPA) has reviewed the June 23, 2011 submission and the August 22, 2011 Response to Request for Additional Information by Archer Daniels Midland Co. (ADM) in support of an exemption for ADM's Midwest Geologic Sequestration Consortium Project in Decatur, Illinois from 40 CFR Part 98, Subpart RR as a research and development project. EPA approves the exemption of ADM's Midwest Geologic Sequestration Consortium Project in Decatur, Illinois from 40 CFR Part 98, Subpart RR, as discussed below.

EPA has determined that the project meets the definition of "research and development project" at 40 CFR 98.449. In making its determination, EPA considered the submitted information, including the purpose of the project, the planned duration of the project, and the planned amount of CO_2 to be injected. EPA concluded that the duration of the project (September 30, 2011 to September 30, 2014), and estimated injection volume (330,000 tonnes per year for three years) is consistent with the research purpose of the project which is to test various monitoring technologies and reservoir modeling techniques in the heterogeneous Mount Simon Sandstone. EPA believes that the monitoring technologies, including permanently installed 3-D vertical seismic profiling, satellite interferometry, and microseismic monitoring are being implemented in a novel approach that is consistent with the definition of "research and development project." Furthermore, as noted in the preamble to the final Subpart RR rule, "[s]mall and large-scale projects meeting the criteria for an exemption, such as the current Regional Carbon Sequestration Partnership projects supported by the Office of Fossil Energy at the [Department of Energy], would be considered R&D for the purposes of this exemption from reporting for the duration of the R&D activity".

Therefore EPA approves the exemption of the project at ADM's Midwest Geologic Sequestration Consortium Project in Decatur, Illinois from 40 CFR Part 98, Subpart RR. The project is exempted from 40 CFR Part 98, Subpart RR until September 30, 2014, which is the end date of the R&D project that is stated in the submission request.

EPA's determination relies on the accuracy and completeness of the information provided in your June 23, 2011 and August 22, 2011 submissions. If any of the information provided by Archer Daniels Midland Co. in the aforementioned submissions significantly changes, you must re-submit a request for a research and development project exemption from 40 CFR Part 98, Subpart RR for this project. This decision is appealable under 40 CFR Part 78.

If you have any questions regarding this determination, please write to gsreporting@epa.gov and a member of the Greenhouse Gas Reporting Program will respond.

Sincerely,

Anhar Karimjee
Chief, Greenhouse Gas Reporting Branch

Attachment 1- ADM Midwest Geologic Sequestration Consortium Project in Decatur, Illinois Research and Development Exemption Request

Attachment 2 - ADM Midwest Geologic Sequestration Consortium Project in Decatur, Illinois Response to Request for Additional Information

e-GGRT Subpart RR: R&D Project Exemption Request

Facility Information

Facility Name	Archer Daniels Midland Co.
Address	4666 FARIES PARKWAY DECATUR IL 62521
Owners and Operators	Archer Daniels Midland Company
Designated Representative	William Manley Mr.
Alternate Designated Representative	Dean, Frommelt Mr.

Submission Information

Submitted By (Date)	William Manley (June 23, 2011 - 09:45 AM)
Certified By (Date)	William Manley (June 23, 2011 - 09:46 AM)

Request Details

Name of Project	Archer Daniels Midland Co.
CO2 injection (for R&D) Start Date	September 30, 2011
CO2 injection (for R&D) End Date	September 30, 2014
Class of Underground Injection Control permit	Class I
Underground Injection Control permit Start Date	December 23, 2008
Underground Injection Control permit End Date	December 23, 2018
Source and type of funding	** 79% U.S. Department of Energy grant ** 10% Archer Daniels Midland contribution ** 6% Illinois State Geological Survey contribution ** 5% Schlumberger Carbon Services contribution
Research Purpose	** Determine the geologic behavior of sequestered CO2 via seismic mapping ** Determine the viability of CO2 sequestration as a method of carbon storage ** Determine the safety of CO2 sequestration with regard to USDWs via groundwat monitoring around the plume

CLOSE Window

Archer Daniels Midland Company, Decatur, IL
Midwest Geologic Sequestration Consortium Project
40 CFR Part 98 Subpart RR – Research & Development Exemption Request

Response to EPA Request for Additional Information – 08/17/2011 Email

EPA questions in italics followed by ADM response.

Injection volume: What are the planned annual CO2 injection volumes for ADM's Midwest Geologic Sequestration Consortium Project?

The annual injection volume is nominally planned to be 333,000 metric tonnes at a rate of 1,000 tonnes per day, thus allowing for lower rates during startup and downtime for maintenance.

Research purpose: EPA requests that you provide more detail regarding the research purpose for this project. The June 23, 2011 submission stated three research purposes: to determine the geologic behavior of sequestered CO2 via seismic mapping, determine the viability of CO2 sequestration as a method of carbon storage, and determine the safety of CO2 sequestration with regard to USDWs via groundwater monitoring around the plume.

Existing commercial projects have utilized seismic mapping to determine the geologic behavior of injected CO_2. What research is being conducted on the use of seismic mapping at this project? Are there any novel monitoring technologies that are planned to be tested at the project?

The target reservoir-caprock system is the Mount Simon Sandstone-Eau Claire Shale. No carbon dioxide has ever been injected into the Mount Simon in the Illinois Basin. While the Mount Simon is a thick reservoir sandstone, ranging from 500 ft. to 2400 ft. in thickness over mapped areas of the basin (1,600 ft thick at the Decatur site) no reservoir models have ever been developed that incorporate the lateral heterogeneity of the Mount Simon and that respect the compartmentalization inherited from the original depositional system. Uniform radial flow models are only estimates of CO_2 distribution. Because the Mount Simon was deposited as a braided fluvial system, major and minor channel forms and the orientation of the channel axes are expected to have some influence on CO_2 distribution. To address that issue, a separate well has been drilled immediately adjacent to the injection well and a string of 31 multicomponent geophones have been permanently cemented into that well. Repeat offset and 3D Vertical Seismic Profiles (VPS) will be shot into this well to image the CO_2 plume as it develops. The VSPs can be acquired at lower cost than repeat 3D surface reflection seismic and therefore are being investigated in comparison to the resolution of standard 3D seismic. No other CO_2 sequestration demonstration project in the US has installed this technology for plume monitoring. Baseline 3D VSPs and a baseline full 3D seismic volume have been acquired in advance of injection.

Further, work is being done on seismic inversion using acoustic impedances derived from injection well data and the 3D seismic volume to define porosity zones in the Mount Simon. That porosity distribution then can be compared in three dimensions with actual plume images once injection is underway to further understand reservoir heterogeneity. Preliminary seismic inversion results for this project have been reported in various conferences. The high

porosity (20%+) zones in the Mount Simon can clearly be distinguished from the lower reservoir quality parts of the same formation. No other US sequestration demonstration project has shown similar work which has the potential to improve plume monitoring and prediction for any larger scale projects.

Other novel monitoring technologies include the development of mechanical earth models from well and seismic data to compare with any actual uplift detected by satellite interferometry. Such uplift has been monitored at a project in the Algerian desert but has not been done using specially installed surface reflectors over a potential plume in a North American test case. The stability of dense carbonate rocks between the injection zone at around 7,000 ft. and the surface may result in little or no surface signal being seen, but this cannot be predicted in advance, hence the research into this topic.

EPA noted in the preamble to the proposed rule that many of the injection and monitoring technologies that may be applicable for GS are commercially available today. How will your project, in particular, contribute to determining the viability of GS? Are any injection or operational practices planned to be tested, validated and verified? Are there unique conditions in which you are testing the viability of storing CO2 through your project?

Questions have been raised about subsurface injection as a cause of microseismic events (by scientists) or even of earthquakes (by the general public) that are in the range that can be felt without instrumentation. The injection of fluids into the Mount Simon will be regulated to below the fracture gradient pressure and is not expected to cause rock fracture. This is especially true due to the excellent reservoir quality at the injection site. Nevertheless, microseismic events may occur that represent fluid flow between compartments in the reservoir or other types of subsurface noise. The MGSC injection well is fitted with three tubing-conveyed, casing-coupled microseismic sensors to record any such events. Baseline data are being collected pre-injection and will be recorded continuously during injection. This arrangement of such downhole technology and event testing-recording is the first test of this technology on any CO_2 injection well anywhere in the world. Outcomes will validate the technology as well as the inferences drawn from pre-injection step rate tests with respect to fracture gradient assessment. Viability of GS will be enhanced by recording the microseismic events and attempting to determine the origin of any that are observed. Verifying the lack of any induced fracturing is vital to protecting USDWs.

EPA regulates injection and geologic sequestration of CO2 through the Underground Injection Control Program to ensure that underground sources of drinking water are not endangered. What type of groundwater monitoring research will be performed at your project? Is your project testing novel monitoring technologies or approaches?

This project is testing a novel subsurface fluid and pressure monitoring technology that will provide fluid sampling and pressure data for nine subsurface zones in the injection reservoir and two zones above the primary reservoir seal. A monitoring well has been drilled to the same depth as the injection well (~7,200 ft) at a distance of 1,000 ft from the injection well, and fitted with a permanent system of ports isolated between packers for each of these zones. This is a first in the world test of this technology to determine any subsurface failure of the primary

reservoir caprock that would allow the earliest possible detection of containment failure. The distribution of supercritical CO_2 will also be verified in this well by repeat cased hole logging and results compared to models of plume distribution and of seismic indicators (VSPs). The premise is that it is far better to verify containment performance by subsurface sampling than only by sampling just the deepest USDW (~140 ft) in the project area. We will also sample reservoir brine in advance of CO_2 arrival which will help validate our understanding of dissolution rates in the reservoir brine, a process which contributes to the shrinkage of subsurface plumes and thus tends to mitigate risk to USDWs. Further, reservoir models predicting CO_2 distribution that depend on observed ratios of vertical vs. horizontal permeabilities will be validated thus allowing more accurate prediction of how buoyant CO_2 behaves in the subsurface and when it actually impinges on the topseal (caprock) of the reservoir.