DOE/EA-1828

Final Environmental Assessment

Industrial Carbon Capture and Sequestration (ICCS) Area 1 Project

"CO_2 Capture from Biofuels Production and Sequestration into the Mt. Simon Sandstone"

Archer Daniels Midland Company
Decatur, Illinois

For
U.S. Department of Energy
National Energy Technology Laboratory
DE-FE0001547

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COVER SHEET

Responsible Agency: U.S. Department of Energy (DOE)

Title: *CO_2 Capture from Biofuels Production and Sequestration into the Mt. Simon Sandstone* (DOE/EA-1828D)

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Abstract: DOE prepared this EA to evaluate the potential environmental consequences of providing a financial assistance grant under the American Recovery and Reinvestment Act of 2009 (ARRA) in a cooperative agreement with Archer Daniels Midland Company (ADM). If ADM received the funding, the company would demonstrate an integrated system of carbon dioxide (CO_2) capture in an industrial setting and geologic sequestration in a sandstone reservoir. The CO_2 that would be sequestered is currently a by-product of ADM's Decatur fuel-grade ethanol production facility. ADM would capture approximately one million short tons of CO_2 per year using dehydration and compression. The compressed CO_2 would be piped approximately one mile to an injection well and sequestered in the Mount (Mt.) Simon Sandstone Formation, a saline reservoir. The project team members include ADM, the Illinois State Geological Survey, Schlumberger Carbon Services, and Richland Community College.

DOE's proposed action would provide approximately $141.4 million in financial assistance in a cost-sharing arrangement to ADM. The cost of the proposed project would be approximately $207.9 million.

This EA evaluates the environmental resource areas DOE commonly addresses in its EAs and identifies no significant adverse environmental impacts for the proposed project. The proposed project could result in beneficial impacts to the nation's energy efficiency and the local economy, and could contribute to a minor reduction of greenhouse gases.

Availability: The draft EA is available on DOE's National Energy Technology Laboratory website at http://www.netl.doe.gov/publications/others/nepa/ea.html and at:
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ACRONYMS AND ABBREVIATIONS

$\mu g/m^3$	Micrograms per Cubic Meter
µS/cm	Microsiemens per Centimeter
°C	Degrees Celsius
°F	Degrees Fahrenheit
2D	Two Dimensional
3D	Three Dimensional
A.M.	*ante meridiem* (i.e. before noon)
ADM	Archer Daniels Midland Company
ARRA	American Recovery and Reinvestment Act of 2009
AQCR	Air Quality Control Region
AQCR 075	West Central Illinois Intrastate AQCR
BMP	Best Management Practice
CAA	Clean Air Act
CCAR	California Climate Action Registry
CCS	Carbon Capture and Sequestration
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act (Superfund)
CF	Center Frequency
CFR	Code of Federal Regulations
CH_4	Methane
cm	Centimeters
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CWA	Clean Water Act
dB	Decibel
dBA	A-weighted Decibel
DNL	Day-night Average Sound Level
DOE	U.S. Department of Energy
DST	Drill Stem Test
e.g.	*Exempli gratia*, for example
EA	Environmental Assessment
EIA	Energy Information Administration
EIS	Environmental Impact Statement
EOR	Enhanced Oil Recovery
EPCRA	Emergency Planning and Community Right-to-Know Act
ESA	Endangered Species Act
et seq.	*et sequens,* and the following one or ones
etc.	*et cetera*, and so on
FAA	Federal Aviation Administration
FONSI	Finding of No Significant Impact
ft	Feet
ft^2	Square Feet

ft^3	Cubic Feet
GHG	Greenhouse Gas
H_2S	Hydrogen Sulfide
HAPs	Hazardous Air Pollutants
HFCs	Hydrofluorocarbons
hp	Horsepower
Hz	Hertz
i.e.	*id est*, that is
IAC	Illinois Administrative Code
ICCS	Industrial Carbon Capture and Sequestration
IEPA	Illinois Environmental Protection Agency
IHPA	Illinois Historic Preservation Agency
IL	Illinois
ILCS	Illinois Compiled Statutes
IPCC	Intergovernmental Panel on Climate Change
ISGS	Illinois State Geological Survey
kg	Kilograms
km	Kilometer
kPa	Kilopascals
kW	Kilowatt
kWh	Kilowatt Hour
lbs	Pounds
Ldn	Equivalent Day Night Level
Leq	Equivalent Sound Level
Lw	Sound Power Levels
m	Meter
m^2	Square Meter
m^3	Cubic Meter
MACT	Maximum Achievable Control Technology
mD	Millidarcies
MDT	Modular Formation Dynamics Tester
MEA	Mono Ethanol Amine
MGSC	Midwest Geological Sequestration Consortium
Mt.	Mount
MVA	Monitoring, Verification, and Accounting
MW	Megawatt
N_2O	Nitrous Oxide
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NESHAP	National Emission Standards for Hazardous Air Pollutants
NETL	National Energy Technology Laboratory
NHPA	National Historic Preservation Act
NO_2	Nitrogen Dioxide
NO_x	Nitrogen Oxides
NPDES	National Pollutant Discharge Elimination System
NRHP	National Register of Historic Places

NSA	Noise Sensitive Area
NSPS	New Source Performance Standards
NSR	New Source Review
O_3	Ozone
OSHA	Occupational Safety and Health Administration
P.M.	*post meridiem* (i.e. after noon)
Pb	Lead
PEMAf	Palustrine emergent temporarily or semi-permanently flooded wetland
PFCs	Perfluorocarbons
PM_{10}	Particulate Matter of 10 Micrometers or Less in Aerodynamic Diameter
$PM_{2.5}$	Particulate Matter Less than 2.5 Micrometers in Aerodynamic Diameter
ppb	Parts per Billion
ppm	Parts per Million
ppmv	Parts per Million by Volume
PSD	Prevention of Significant Deterioration
psi	Pounds per Square Inch
psig	Pounds per Square Inch Gauge
PWL	Power Level
RCC	Richland Community College
RCRA	Resource Conservation and Recovery Act
Rd.	Road
Recovery Act	American Recovery and Reinvestment Act of 2009, Public Law 111-5
RRA	Resource Rich Areas
SDWA	Safe Drinking Water Act
sec	Seconds
SF_6	Sulfur Hexafluoride
SHPO	State Historic Preservation Office or Officer
SIP	State Implementation Plan
SO_2	Sulfur Dioxide
SO_x	Sulfur Oxides
TEG	Triethylene Glycol
TL	Transmission Loss
TMDL	Total Maximum Daily Load
tpy	Tons per Year
U.S.	United States
UIC	Underground Injection Control
USC	United States Code
USDA	U.S. Department of Agriculture
USDW	Underground Source of Drinking Water
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VOC	Volatile Organic Compounds
VSP	Vertical Seismic Profile

USE OF SCIENTIFIC NOTATION

Very small and very large numbers are sometimes written using scientific notation rather than as decimals or fractions. This notation uses exponents to indicate the power of 10 as a multiplier (i.e., 10^n, or the number 10 multiplied by itself n times; 10^{-n}, or the reciprocal of the number 10 multiplied by itself n times).

For example: $10^3 = 10 \times 10 \times 10 = 1{,}000$

$$10^{-3} = \frac{1}{10 \times 10 \times 10} = 0.001$$

In scientific notation, large numbers are written as a decimal between 1 and 10 multiplied by the appropriate power of 10:

4,900 is written $4.9 \times 10^3 = 4.9 \times 10 \times 10 \times 10 = 4.9 \times 1{,}000 = 4{,}900$.
0.049 is written 4.9×10^{-2}.
1,490,000 or 1.49 million is written 1.49×10^6.

A positive exponent indicates a number larger than or equal to one; a negative exponent indicates a number less than one.

1.0 INTRODUCTION

1.1 Summary

High concentrations of carbon dioxide (CO_2) in the atmosphere can exert a "greenhouse" effect that traps heat within the Earth's atmosphere. Global emissions of CO_2 from human activity have increased from an insignificant level two centuries ago to over twenty-one billion metric tons per year in 2003 (DOE, 2007a). The most notable human activity associated with the generation of CO_2 emissions is the combustion of carbon-based fuels (including oil, natural gas, and coal). Many scientists, including the Intergovernmental Panel on Climate Change (IPCC), believe there a danger from even a modest increase in the Earth's temperature (called "global warming") as it could alter the global climate and cause significant adverse consequences for human health and welfare (DOE, 2007a).

In one of many governmental efforts to address the concerns outlined above, the Department of Energy (DOE) funds projects that would demonstrate the capture of CO_2 from industrial sources and subsequent geologic sequestration of the captured gas. Geologic sequestration involves the permanent storage of CO_2 in deep unmineable coal seams, depleted oil and gas reservoirs, or saline (saltwater-filled) formations. Impermeable caprocks and/or geologic structural or stratigraphic traps retain the CO_2 in the formation similar to natural gas storage trapping mechanisms.

Congress appropriated significant funding for Industrial Carbon Capture and Sequestration (ICCS) in the American Recovery and Reinvestment Act of 2009, Public Law 111-5 (Recovery Act) in order to stimulate the economy and reduce unemployment in addition to furthering DOE's ICCS program. DOE solicited applications for this funding by issuing a competitive Funding Opportunity Announcement (DE-FOA-0000015), *Carbon Capture and Sequestration from Industrial Sources and Innovative Concepts for Beneficial CO_2 Use* on June 8, 2009. The announcement invited applications in two areas of interest: (1) large-scale industrial carbon capture and sequestration (CCS) projects from industrial sources, and (2) Innovative concepts for beneficial CO_2 use. The application period closed on August 7, 2009, and DOE received 92 proposals across the two areas of interest. DOE selected 24 projects based on the evaluation criteria set forth in the funding opportunity announcement. Only 23 projects received awards.

This project, *CO_2 Capture from Biofuels Production and Sequestration into the Mount (Mt.) Simon Sandstone*, was one of the projects DOE selected for Phase I funding in Area of Intent 1. In Phase I, awardees received funding to perform administrative work to complete a Phase II proposal. Phase II projects were then competitively selected from the pool of Phase I awardees. This project was one of nine selected for a Phase II award. One part of the Phase II selection process considered potential environmental impacts of all responsive applications pursuant to 10 Code of Federal Regulations (CFR) § 1021.216.

DOE's Proposed Action is to provide $141.4 million in financial assistance in a cost sharing arrangement with the project proponent, Archer Daniels Midland Company (ADM). The total cost of the project is estimated at $207.9 million.

1.2 Purpose and Need

The DOE's National Energy Technology Laboratory (NETL) has a mission to implement a research, development, and demonstration program to resolve the environmental, supply, and reliability constraints of producing and using fossil energy sources. One aspect of that mission, the resolution of environmental constraints to producing and using fossil fuels, requires NETL to review and, where possible, mitigate projected impacts to global climate change caused by the use of fossil fuels. One possible mitigation technique under review is the capture and long-term removal of CO_2 from the atmosphere through a process called carbon sequestration. The focus of NETL's "Carbon Capture and Sequestration from Industrial Sources and Innovative Concepts for Beneficial CO_2 Use" initiative involves capturing and storing CO_2 emissions prior to release into the atmosphere, as well as enhancing natural carbon uptake and storage processes. The principal goal of the NETL program is to gain a scientific understanding of carbon sequestration options and to provide cost-effective, environmentally sound technology options that ultimately may lead to a reduction in greenhouse gas intensity and stabilization of atmospheric concentrations of CO_2 (DOE, 2007a). One of those options, geologic sequestration, involves the placement of CO_2 or other greenhouse gases into porous and permeable subsurface rock formations in such a way that they remain permanently stored.

The purpose of the proposed ADM project would be to demonstrate the ability of the Mt. Simon Sandstone to accept and retain one million short tons per year or approximately 2.5 million short tons (2.26 million metric tons) of CO_2 injected over a period of 2.5 years (ADM, 2009a); thus testing large-scale sequestration sooner than might otherwise be possible.

Although the processes of geologic sequestration are relatively well known, there is a need for additional research and demonstration to fill gaps in our scientific understanding of carbon sequestration; ensure the protection of human health and the environment; reduce costs; and facilitate the full-scale deployment of this technology. Extensive laboratory investigations, modeling studies, and limited small-scale field studies assessed how CO_2 geologic sequestration would work in the subsurface. Comparing predictions from bench scale tests and numerical models with field results from large-scale injections is necessary to validate the models and demonstrate that scientific understanding is correct (DOE, 2003).

Two-thirds of the United States has deep saline formations beneath it. These formations have an estimated CO_2 storage capacity of up to 3.5 trillion short tons. Many of these formations are located in close proximity to major sources of CO_2 emissions, such as fossil-fuel power plants, which offer the benefit of reducing costs for transportation of CO_2 to the injection site. This proposed large-scale field project would help to resolve uncertainties associated with the reactions that may occur between CO_2, brine, and minerals in the surrounding strata (DOE, 2007a).

The project, under carefully controlled and monitored conditions, would determine whether, and to what extent, large-scale pressurization would affect caprock integrity, cause land surface deformation, and induce seismic hazards. Successful large-scale application of this technology demands that these potential effects, regardless of the probability of their occurrence, must be better understood to design safe and effective sequestration in saline formations. Another possible issue pertains to the acceptable leakage rate from the formation into overlying strata (DOE, 2007a).

If funded, the proposed project would:

- Reduce greenhouse gas emissions on a local scale and contribute significantly to broader knowledge that will reduce global warming on a larger scale,
- Ensure that health and safety and environmental risks are minimized,
- Obtain results quickly so that experience can be used in development of large scale projects in other parts of the world, and
- Optimize costs preceding full-scale deployment.

The test location would provide an opportunity for matching numerical model results with field observations under conditions of multiple high volume injection at a scale similar to what would be done if CO_2 from power plants were captured and sequestered.

1.3 Related Project

ADM's Decatur ethanol plant is the host site for another DOE project, Midwest Geological Sequestration Consortium (MGSC) Phase III Large-Scale Field Test (DE-FC26-05NT42588). That project was the subject of a separate environmental assessment (EA) (DOE/EA-1626) that resulted in a finding of no significant impact (FONSI) dated November 28, 2008.

The proximity of the two projects requires the analysis of any cumulative impacts on the environment from the current MGSC project and proposed ICCS project. Cumulative impacts are addressed under each resource area in Chapter 4 of this document.

1.4 Scope of DOE Decision

The decision for DOE is to either fund or not fund the proposed project including the associated drilling and injection activities. The No-Action Alternative would be no DOE funds provided to ADM for its proposed project, and ADM would not pursue the drilling and injection activities if DOE's decision was to not fund the project. Thus, the No-Action Alternative would involve no drilling and injection activities. Table 1.4 below is based on that premise.

Table 1.4. Comparison of Impacts		
Resource	**No-Action Alternative**	**ADM's Proposed Project**
Air Quality	No impacts, except the loss of beneficial impacts from reducing greenhouse gas, are expected.	Short-term, minor impacts would be limited to temporary diesel emissions and limited air emissions from a dehydration reboiler. The project would not produce emissions that would impede the area's conformity with the State Implementation Plan under the Clean Air Act. In contrast, there would be some beneficial impacts due to the reduction of greenhouse gas emissions.
Geology and Soils	No impacts	Some long-term increase in subsurface pressures due to CO_2 injection would be expected; however, the proposed project would not be expected to cause any measurable leakage of CO_2 from the storage formation to the surface or into another area in the subsurface. There is no more than an imperceptible risk of inducing seismic events due to increased reservoir pressure (see Section 4.2.2).
Water Resources	No impacts	The proposed project may cause some modest increase in water usage due to the drilling of injection and monitoring wells; however, any changes to water quality and quantity would likely be at the lowest detectable levels and full recovery of the resource would likely occur in a reasonable time.
Wetlands/Floodplains	No impacts	No substantial impacts to local wetlands would be expected. Any unexpected impacts to wetlands would be confined to the immediate project area and would not cause any regional impacts.
Terrestrial Vegetation	No impacts	The injection site is fallow. No critical habitats are present. Changes would be limited to a small area and would not be expected to affect the viability of the resources.
Wildlife	No impacts	Some local disturbance and displacement of wildlife may occur; however, any changes to wildlife would be limited to a small portion of the population and would not be expected to affect the viability of the resource. Full recovery would occur in a reasonable time, considering the size of the project and the affected species' natural state.
Land Use	No impacts	Impacts to land use, if any, would be localized and limited to the immediate project area.
Population	No impacts	The effect on size and demographic characteristics of the local population, if any, would be minimal.
Employment and Income	No impacts	The effect on the local economy, labor conditions, and availability of production or consumer resources, if any, would be primarily beneficial, temporary, and of short duration.

Table 1.4. Comparison of Impacts

Resource	No-Action Alternative	ADM's Proposed Project
Infrastructure	No impacts	Some minor impacts to the existing traffic patterns and level of congestion could be expected during drilling and construction activities; however, no long-term impacts in the immediate or surrounding area are expected.
Parks and Recreation	No impacts	Minimal impact to recreational activities in the immediately surrounding area but any disturbance would be minor, temporary in duration, and in character with existing uses of the project area including a nearby park.
Visual Resources	No impacts	The proposed project site is a previously disturbed industrial site. The project is unlikely to change visual landscape in a way that would be objectionable to local residents or frequent visitors.
Noise	No impacts	Temporary minor noise impacts are expected during construction and drilling. During operation, there may be minor increases in operational noise; however, noise levels in the project area are not expected to exceed ambient noise level standards as determined by the Federal, state, and/or local government.
Environmental Justice	No impacts	No disproportionately high or adverse impacts to minority or low- income communities are expected.
Human Health and Safety	No impacts, except the loss of an opportunity to reduce greenhouse gas emissions, are expected.	The project, operated in accordance with state and Federal regulations, would pose no more than a minimal risk to the health and safety of on-site workers and the local population.
Cultural Resources	No impacts	The project area is previously disturbed, and no cultural resources have been found. No substantial impacts are expected.
Waste Management	No impacts	The action is not expected to cause air, water, or soil to be contaminated with any hazardous material that poses a threat to human or ecological health and safety.

* Recovery in a reasonable time: Constant, sustainable improvement is apparent and measurable when the site is routinely observed, and full recovery is achieved over a period of no more than several years.

1.5 Legal Framework

DOE has prepared this EA in accordance with the Council on Environmental Quality (CEQ) "Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act," codified in Title 40 of the *Code of Federal Regulations* in Parts 1500 through 1508 (40 CFR 1500-1508). These implement the procedural requirements of the National Environmental Policy Act (NEPA), found in Title 40 of the *United States Code* in Section 4321 and following sections (42 USC § 4321 *et seq*.).

NEPA requires Federal agencies to consider the potential environmental consequences of a Proposed Action in their decision-making processes. NEPA encourages Federal agencies to protect, restore, or enhance the environment through well-informed Federal decisions. The CEQ NEPA regulations specify that an EA be prepared to:

- Provide sufficient analysis and evidence for determining whether to prepare an Environmental Impact Statement (EIS) or a FONSI.
- Aid in an agency's compliance with NEPA when no EIS is deemed necessary.
- Facilitate EIS preparation when one is necessary.

Further, the CEQ NEPA regulations encourage agencies to integrate NEPA requirements with other environmental review and consultation requirements. Relevant environmental requirements are contained in other Federal statutes, such as the Clean Air Act and the Clean Water Act, and their state counterparts. The following Federal and state statutes and regulations are relevant to this EA. Federal and state permits that may be required are also listed.

Clean Air Act

The Clean Air Act (CAA), 42 USC § 7401 *et seq.*, establishes the National Ambient Air Quality Standards (NAAQS) developed by the U.S. Environmental Protection Agency (USEPA) for the pervasive pollutants: sulfur dioxide (SO_2), carbon monoxide (CO), ozone (O_3), nitrogen dioxide (NO_2), lead (Pb), and particulate matter (both PM_{10} and $PM_{2.5}$). The NAAQS are expressed as concentrations of the criteria pollutants in the ambient air, the outdoor air to which the public is exposed. The CAA also contains emission control permit programs to protect the nation's air quality and establishes New Source Performance Standards that establish design standards, equipment standards, work practices, and operational standards for new or modified sources of air emissions. Where the NAAQS emphasize air quality in general, the New Source Performance Standards focus on particular industrial categories or sub-categories (e.g., fossil fuel fired generators, grain elevators, and steam generating units). Regulations implementing the CAA are found in 40 CFR Parts 50-95. Illinois has been delegated CAA authority under Chapter 415 of *Illinois Compiled Statutes* (ILCS) Section 5/3 and following sections (415 ILCS § 5/3 *et seq*.) (Note: Provisions dealing with Regulations (415 ILCS §5/26 *et seq*.), Enforcement (415 ILCS § 5/30 *et seq*.), Variances (451 ILCS § 5/35 *et seq*.), and Permits (415 ILCS § 5/39 *et seq*.) apply to all of the authority within Chapter 415 of ILCS that follow).

Clean Water Act

The Clean Water Act (CWA), 33 USC § 1251 *et seq.*, establishes a comprehensive framework of standards, technical tools, and financial assistance to address "point source" pollution from municipal and industrial wastewater discharges and "nonpoint source" pollution from urban and rural areas. Applicants for federal licenses or permits to conduct any activity that may result in a discharge to navigable waters must provide the Federal agency with a state CWA Section 401 certification that the discharge would comply with applicable provisions of the CWA. CWA Section 404 establishes a permit program to regulate the discharge of dredged and fill material into waters of the United States, including wetlands. CWA Section 402 establishes the National Pollutant Discharge Elimination System (NPDES), which requires point sources of pollutants to obtain permits to discharge effluents and storm water to surface waters. Regulations for implementing relevant CWA programs are found in 33 CFR Parts 320-331 and 40 CFR Parts

400-503. Illinois has been delegated CWA authority under 415 ILCS §§ 5/11 and 5/19.1 *et seq*., and 20 ILCS § 830.

Safe Drinking Water Act

The Safe Drinking Water Act (SDWA), 42 USC 300 *et seq.*, gives USEPA the responsibility and authority to regulate public drinking water supplies by establishing drinking water standards, delegating authority for enforcement of drinking water standards to the states, and protecting aquifers from hazards such as injection of wastes and other materials into wells. Important for this EA are the SDWA provisions relating to injection wells. Congress passed the Safe Drinking Water Act in 1974. In part, the SDWA requires USEPA to develop minimum federal requirements for Underground Injection Control (UIC) programs and other safeguards to protect public health by preventing injection wells from contaminating underground sources of drinking water. Illinois has been delegated SDWA authority under 415 ILCS §§ 5/19.1 *et seq*. and 55/1 *et seq*.

Resource Conservation and Recovery Act

The Resource Conservation and Recovery Act (RCRA), 42 USC § 6901 *et seq.*, regulates the treatment, storage, and disposal of solid and hazardous wastes. RCRA sets "cradle to grave" standards for both solid waste and hazardous waste management. Certain wastes are specifically excluded because they are regulated under other statutes. Some examples are domestic sewage and septic tank waste; agricultural wastes; industrial discharges; some nuclear wastes; and mining overburden. RCRA regulations are found in 40 CFR Parts 239-282. Illinois has been delegated RCRA authority under 415 ILCS § 5/20 *et seq*.

Comprehensive Environmental Response, Compensation, and Liability Act/Emergency Planning and Community Right-to-Know Act

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 USC § 9601 *et seq*., also known as "Superfund," established a tax on the chemical and petroleum industries and provided broad federal authority to respond directly to releases or threatened releases of hazardous substances that may endanger public health or the environment. CERCLA also establishes requirements for closed and abandoned hazardous waste sites, provides for the liability of persons responsible for the release of hazardous substances, and established a trust fund to pay for orphan facility cleanup and closure. Regulations for implementing CERCLA are found in 40 CFR Parts 300-312.

The Emergency Planning and Community Right-to-Know Act (EPCRA), 42 USC § 1001 *et seq.*, requires Federal agencies to provide information on hazardous and toxic chemicals to state emergency response commissions, local emergency planning committees, and USEPA. EPCRA's goal is to provide this information to ensure that local emergency plans are sufficient to respond to unplanned releases of hazardous substances. Regulations implementing EPCRA are found in 40 CFR Parts 350-374. Illinois EPCRA authority is found in 415 ILCS § 5/20 *et seq*. and § 5/25b-1 *et seq*.

National Historic Preservation Act

The National Historic Preservation Act (NHPA), 16 USC § 470 *et seq.*, requires DOE to consult with the State Historic Preservation Officer (SHPO) prior to any construction to ensure that no historical properties would be adversely affected by a proposed project. DOE must also afford the Advisory Council on Historic Preservation a reasonable opportunity to comment on the proposed project. Regulations for implementing NHPA are found in 36 CFR 800-812. Illinois historic preservation authority is found in 20 ILCS § 3420/1 *et seq*.

Archaeological Resources Protection Act

The Archaeological Resources Protection Act, 16 USC § 470aa *et seq.*, requires a permit for excavation or removal of archaeological resources from publicly held or Native American lands. The Act requires that excavations further archaeological knowledge in the public interest and that the resources removed remain the property of the United States. Regulations for implementing the Act are found in 43 CFR 7 and 36 CFR 296. Illinois archaeological protection authority is found in 20 ILCS § 3420/1 *et seq*.

American Indian Religious Freedom Act

The American Indian Religious Freedom Act, 42 USC § 1996, establishes policy to protect and preserve the inherent and Constitutional right of Native Americans to believe, express, and exercise their traditional religions. The law ensures the protection of sacred locations; access of Native Americans to those sacred locations and traditional resources that are integral to the practice of their religions; and establishes requirements that would apply to Native American sacred locations, traditional resources, or traditional religious practices potentially affected by construction and operation of proposed facilities. Regulations for implementing the Act are also found in 43 CFR 7. Illinois Native American protection authority is found in 20 ILCS § 3420/1 *et seq*.

Native American Graves Protection and Repatriation Act

The Native American Graves Protection and Repatriation Act, 25 USC § 3001, directs the Secretary of the Interior to guide the repatriation of federal archaeological collections and collections that are culturally affiliated with Native American tribes and held by museums that receive federal funding. DOE would follow the provisions of this Act if any excavations associated with the proposed construction led to unexpected discoveries of Native American graves or grave artifacts. Regulations for implementing the Act are found in 43 CFR 10. Illinois Native American protection authority is found in 20 ILCS § 3420/1 *et seq*.

Endangered Species Act

The Endangered Species Act (ESA), 16 USC 1531 *et seq.*, establishes a national program for the conservation of threatened and endangered species of fish, wildlife, and plants, as well as the preservation of the ecosystems on which they depend. ESA Section 7 requires any federal agency authorizing, funding, or carrying out any action to ensure that the action is not likely to jeopardize the continued existence of any endangered species or threatened species, or result in the destruction or adverse modification of critical habitat of such species. Regulations implementing the ESA interagency consultation process are found in 50 CFR Part 402. Illinois endangered species protection authority is found in 520 ILCS § 10/1 *et seq*.

Fish and Wildlife Conservation Act/Fish and Wildlife Coordination Act

The Fish and Wildlife Conservation Act, 16 USC § 2901 *et seq.*, encourages Federal agencies to conserve and promote conservation of non-game fish and wildlife species and their habitats. In addition, the Fish and Wildlife Coordination Act, 16 USC § 661 *et seq.*, requires Federal agencies undertaking projects affecting water resources to consult with the United States Fish and Wildlife Service (USFWS) and the state agency responsible for fish and wildlife resources. Compliance with these statutes is internalized in the DOE NEPA process. Illinois fish and wildlife authority is found in 515 ILCS § 5/5-5 *et seq*. and 520 ILCS §§ 20 and 25.

Noise Control Act

The Noise Control Act of 1972, 42 USC § 4901 *et seq.*, directs federal agencies to carry out programs in their jurisdictions to the fullest extent within their authority and in a manner that furthers a national policy of promoting an environment free from noise that jeopardizes health and welfare. This would involve complying with applicable municipal noise ordinances to the maximum extent practicable. Illinois regulates noise at the state level with authority found in 415 ILCS 5/23 *et seq*.

Farmland Protection Policy Act

The Farmland Protection Policy Act, 7 USC § 4201 *et seq.*, directs federal agencies to identify and quantify adverse impacts of Federal programs on farmlands in order to minimize the unnecessary and irreversible conversion of agricultural land to non-agricultural uses. Regulations implementing the Act are found in 7 CFR 658. Illinois farmland protection authority is contained in 505 ILCS §§ 5 and 75.

Occupational Safety and Health Act

The Occupational Safety and Health Act, 29 USC § 651 *et seq.*, requires employers to furnish employees employment and a place of employment that are free from recognized hazards that are causing or are likely to cause death or serious physical harm to the employees, and to comply with occupational safety and health standards promulgated by the Occupational Safety and Health Administration (OSHA). OSHA standards are implemented under regulations found in 29 CFR Parts 1900-2400. Illinois regulates OSHA requirements through authority found in 820 ILCS § 225 *et seq*.

Pollution Prevention Act

The Pollution Prevention Act, 42 USC § 13101 *et seq.*, establishes a national policy for waste management and pollution control that focuses first on source reduction, and then on environmentally safe waste recycling, treatment, and disposal. Three executive orders provide guidance to agencies to implement the Pollution Prevention Act: Executive Order 12873, “Federal Acquisition, Recycling, and Waste Prevention,” Executive Order 13101, “Greening the Government through Waste Prevention, Recycling, and Federal Acquisition,” and Executive Order 13148, “Greening the Government through Leadership in Environmental Management.”

Federal Aviation Administration Act

49 USC §§ 106(f) and (g) give the Administrator of the Federal Aviation Administration (FAA) a number of powers, including the authority to regulate objects affecting navigable airspace. Regulations requiring FAA notification if any structure of more than 200 feet (60.96 meters (m)) high would be constructed are found in 14 CFR Part 77. The FAA then determines if the structures would or would not be an obstruction to air navigation. Illinois regulates navigable airspace under authority found in 620 ILCS §25 *et seq*.

Executive Orders

A number of presidential executive orders in addition to those noted above provide additional guidance to Federal agencies in developing EAs, including this EA. The most relevant of them include:

- Executive Order 11514, “Protection and Enhancement of Environmental Quality”
- Executive Order 11988, “Floodplain Management”
- Executive Order 12856, “Right to Know Laws and Pollution Prevention Requirements” Executive Order 12898, “Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations”
- Executive Order 13112, “Invasive Species”
- Executive Order 13186, “Responsibilities of Federal Agencies to Protect Migratory Birds”
- Executive Order 13423, “Strengthening Federal Environmental, Energy, and Transportation Management”

Federal executive orders can be accessed at: http://www.archives.gov/federal-register/codification/.

Federal and State Permitting

The following are potentially applicable federal and state permitting requirements to construct and operate the proposed facilities.

- Acid Rain Permit, 40 CFR Part 72
- Airspace Obstruction Control Permit, 14 CFR Part 77
- Clean Air Act Prevention of Significant Deterioration Permit, Acid Deposition Control Permit, and Operating Permit, 40 CFR Parts 50-96
- Clean Water Act, Section 401 Certification, Section 402 NPDES Permit, Section 404 Wetlands Permit, and Pretreatment Authorization for Discharge of Wastewater to Municipal Collection System, 40 CFR Parts 104-140, 403
- Safe Drinking Water Act Underground Injection Control Permit, 40 CFR Part 144

- Rivers and Harbor Act Permit, 33 CFR Part 322
- Notice to the Federal Aviation Administration, 14 CFR Part 77
- RCRA, 40 CFR Parts 239 through 299
- Sales Tap Approval, 18 CFR 157.211, approval would be required to tap into or modify existing interstate gas pipelines.

Illinois Permits

- Accommodation of Utilities on Right-of-Way, 92 Illinois Administrative Code (IAC) Part 530
- Air Construction Permit, 35 IAC Parts 201 and 203
- Air Operating Permit, 35 IAC Part 201, 203 and 205
- Certificate of Public Convenience and Necessity, Section 3-105 and 8-406 of the Illinois Public Utilities Act
- Interconnection Agreement from the Illinois Commerce Commission may be required.
- NPDES Permit, 35 IAC Part 309, 35 IAC, Subtitle C, Chapter 1
- Permit for Groundwater Monitoring Wells, 77 IAC 920
- Permit for Nonhazardous Onsite Waste Disposal Facility, 35 IAC Parts 812 and 813
- Potable Water Supply Connection Permits, ILCS, Chapter 415
- Prevention of Significant Deterioration (PSD) Permit, 40 CFR 52.21
- RCRA Permit Program, 35 IAC 702 and 703
- UIC Permit, 35 IAC Parts 704 and 730
- Wastewater Facility Construction Approval, ILCS, Chapter 415

2.0 PROPOSED ACTION AND ALTERNATIVES

DOE's Proposed Action is to provide ADM with $141.4 million in financial assistance in a cost-sharing arrangement to demonstrate the ability of the Mt. Simon Sandstone, a major regional saline reservoir in the Illinois Basin, to accept and retain approximately 2.5 million short tons of CO_2 injected over a period of 2.5 years (ADM, 2009a). This Proposed Action would also meaningfully assist in the nation's economic recovery by creating jobs in the United States in accordance with the objectives of the Recovery Act.

2.1 ADM's Proposed Project

The objective of the proposed project evaluated in this EA is to demonstrate an integrated system of CO_2 capture in an industrial setting and geologic sequestration in a sandstone reservoir. The CO_2 that would be sequestered is currently a by-product in ADM's Decatur fuel-grade ethanol production facility. ADM would capture approximately one million tons of CO_2 per year using dehydration and compression. The compressed CO_2 would be piped approximately one mile to an injection well and sequestered in the Mt. Simon Sandstone Formation, a saline reservoir.

The proposed project would include the construction of a compression/dehydration facility, approximately 5,290-feet (1,611 m) of 8-inch pipeline, 1,224 feet (373 m) of 24-inch pipeline, one electrical substation, up to 4.67 miles (7.52 kilometer (km)) of electrical power line, one injection well with associated equipment, and one verification well for monitoring of the sequestered CO_2 (ADM, 2010a; ADM, 2010b). The project would also include construction of a 12,000 ft^2 (1,115 m^2) building on the Richland Community College Campus – the National Sequestration Education Center (NSEC), a center for outreach and education that will be operated by and eventually owned by the College. The compression facility has a design capacity to capture and condition 2,183 short tons (1,980 metric tons) per day of biogenically produced CO_2 from the ADM biofuels production plant. An additional 1,091 short tons (990 metric tons) per day of CO_2 from the MGSC project will be included when that project completes its injection period in the first quarter of 2014. The project would not operate continuously at its design capacity and overall project production levels would be targeted at a carbon capture and storage goal of up to one million short tons (0.9 million metric tons) per year by 2014. The captured CO_2 would be compressed, transported via pipeline to the injection well, and injected into the Mount Simon Sandstone reservoir for permanent geologic sequestration.

The proposed project would continue to refine previously developed Monitoring, Verification, and Accounting (MVA) techniques and incorporate new technologies to understand potential leakage pathways of the larger scale test, provide post-injection monitoring, and provide assurance that health and safety requirements are fully accounted for (DOE, 2008).

2.1.1 Project Location

The project site would be on the east side of the city of Decatur, Illinois, in Macon County (Figure 2.1.1-1). This site would be located in Section 5 of Township 16 North Range 3 East, surveyed from the 3rd Principal Meridian, and on flat terrain within the Decatur ADM Complex. The compression/dehydration facility would be located within the industrial complex to the south of the proposed injection well site (Figure 2.1.1-2). A pipeline would transport CO_2 as a supercritical fluid from the compression/dehydration facility to the injection well following, as much as possible, an existing pipeline corridor that transfers steam to the Richland Community College campus.

The ADM ICCS Site infrastructure would be integrated into the current footprint of the Decatur ADM Complex and would be constructed north of the railroad tracks and south of the MGSC injection well (ADM, 2009b). No space outside the existing Decatur ADM Complex footprint would be required for the compression/dehydration facility, except for a 200-foot (61 m) pipeline easement on the Richland Community College property. A field drainage ditch is located on the northeast corner of the field. Buildings, tanks, roads, etc., associated with manufacturing operations are also on the Decatur ADM Complex (DOE, 2008).

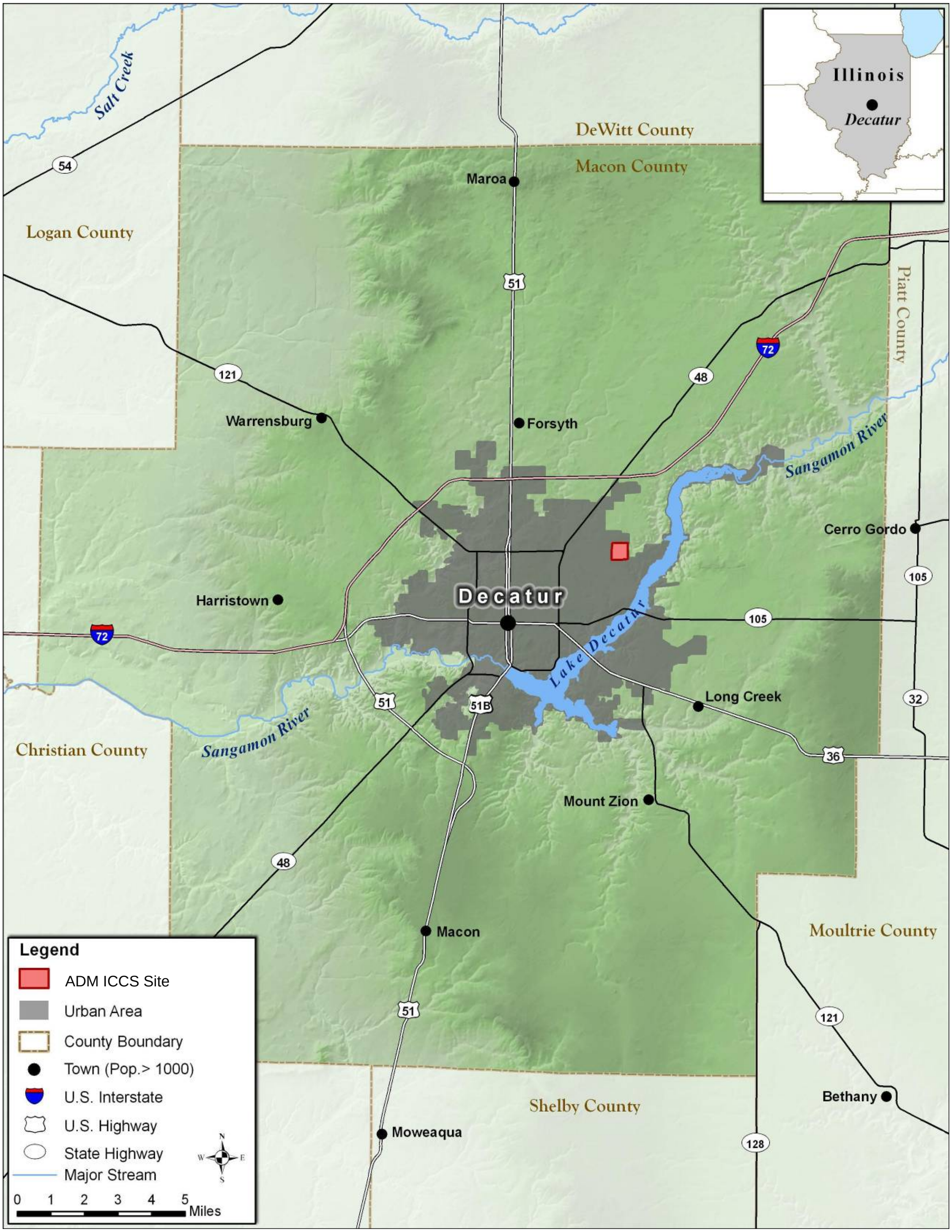

Figure 2.1.1-1. Regional Vicinity Map

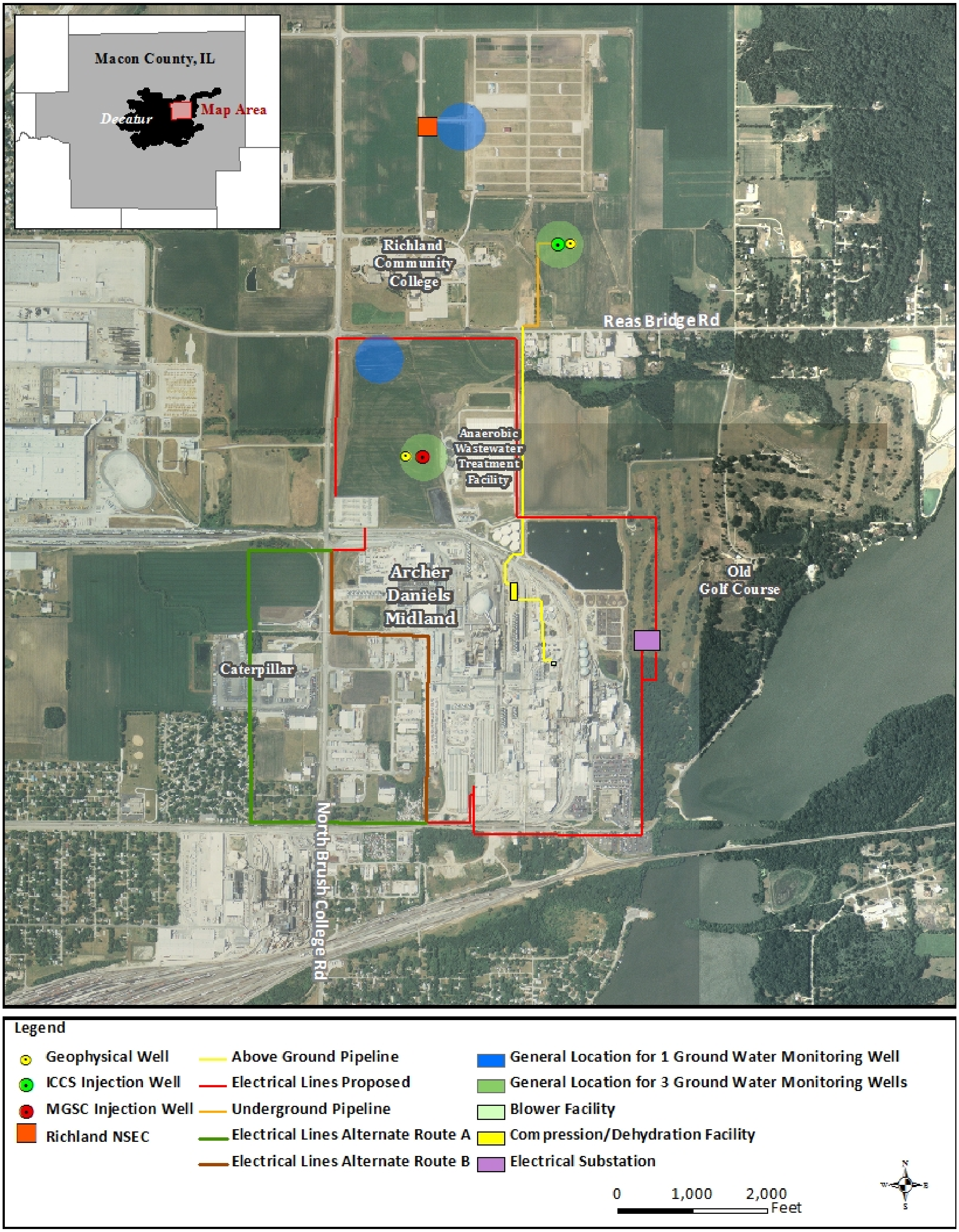

Figure 2.1.1-2. Project Area Map

2.1.2 Construction

Proposed new construction would include the construction of a compression/dehydration facility, approximately 5,290-feet (1,611 m) of 8-inch pressurized pipeline, 1,224 feet (373 m) of 24-inch pipe carrying CO_2 at approximately 10 pounds per square inch gauge (psig), one electrical substation, up to 4.67 miles (7.52 km) of electrical power line, and one injection well with associated equipment. The facility would include the CO_2 treatment, compression, and dehydration equipment necessary to condition the CO_2 from the ADM ethanol production plants. The facility would be capable of delivering approximately 1.0 million short tons per year. The pipeline would deliver the CO_2 from the compression/dehydration facility to the injection well (ADM, 2009a; ADM, 2010b).

2.1.2.1 CO_2 Supply

The proposed sequestration site at the ADM facility will be supplied with 99 percent pure CO_2 from the ethanol production part of ADM's operations. The CO_2 will be moisture laden and at atmospheric pressure from the fermentation vessels, so it will need to be dehydrated and compressed to approximately 2500 pounds per square inch (psi) and delivered to the wellhead as supercritical CO_2.

A 24-inch (61 centimeter (cm)) 1,224-ft pipe will carry the CO_2 at approximately 10 psig from the outlet of the booster gas blower to the dehydration/compression facility. The dehydration/compression facility is proposed near the northern boundary of the ADM facility. The CO_2 will be dehydrated, compressed to approximately 2500 psig and 95 degrees Fahrenheit (F) , and then moved about 5,290-feet through an 8-inch (15.24 cm) pipe to the injection well location. That well location will be on a tract of approximately 207 acres, also owned by ADM and located adjacent to their plant (ADM, 2010b).

Outlet CO_2 streams from ethanol fermentor vents are typically 99% + pure CO_2, saturated with water vapor at 80 degrees Fahrenheit (°F) and atmospheric pressure. Common impurities are ethanol and nitrogen in the range of 600 to 1000 parts per million by volume (ppmv) each. Other impurities in lesser amounts often include oxygen, methanol, acetaldehyde, and hydrogen sulfide. Early compositional analysis of the source stream has aided in the equipment selection and materials specification.

2.1.2.2 Pressurized Pipeline

The pipeline that would transfer the CO_2 from the compression/dehydration facility to the CO_2 injection site would be an 8-inch diameter schedule 40 or 80 steel pipe designed to meet standards for the temperature and pressure of the CO_2 stream. The pressurized pipeline length would be approximately 5,290-foot (ADM, 2010b). The first 4,000 feet of the pipeline would be installed aboveground using existing pipe bridges and racks, and following the current pipeline alleys at the Decatur ADM Complex (Figure 2.1.1-2). The pipeline would be located on Decatur ADM Complex property, until it reaches Reas Bridge Road just south of Richland Community College (RCC). At this point, the pipeline will be routed underground and will use RCC's property easement for about 200 feet (ft) until the pipeline reaches the ADM property line. The pipeline would continue underground until it reaches the injection well (1,100 ft). The pipeline alignment would follow as much as possible the current pipeline alleys or easements that deliver steam to the Richland Community College campus (ADM, 2010b).

2.1.2.3 Electrical Substation and Power Lines

A 100MW Electrical Substation with an area of 250,000 square feet (ft^2) (23,225 square meters (m^2)) would be constructed and located on the former golf course (ADM land) east of the ADM plant. The substation construction will include electrical power lines that connect the substation with the existing power grid. The power lines will follow one of two possible corridors to make this connection as shown on Figure 2.1.1-2. The power line routing shown as Alternative A would be 4.67 miles (7.52 km) in length. Alternative B routing would be 4.25 miles (6.8 km) in length. The substation would be constructed within the ADM property. Power lines would be constructed either on ADM property or using utility easements that would be obtained from property owners.

2.1.2.4 Injection Well

The injection well and verification well would be located in a field north of the primary industrial complex and east of the Richland Community College campus (Figure 2.1.1-2). Previously, this field was used for agriculture and agricultural expositions that have left simple unoccupied structures on the injection site. The proposed injection rate is approximately one million short tons per year of supercritical CO_2 (ADM, 2010a, ADM, 2010b).

Based on regional geology, the specific injection interval within the Mt. Simon is planned to be near the base of the Mt. Simon Sandstone and the granite basement rock. The injection interval would be determined based on well logs, core samples, and drill stem tests from the initial well drilled on the site prior to injection (DOE, 2008).

For the anticipated Mt. Simon net thickness and permeability, reservoir modeling and nodal analyses suggest that an injection well with $9^5/_8$ inch (24.45 cm) diameter injection casing and 4.5-inch (11.43 cm) diameter injection tubing would be adequate to meet the up to one million short tons a year injection rate into the injection tubing. Although subsurface information will be available from the MGSC project, pre-drilling modeling may be revised once well logs and core samples are recovered from the injection and reservoir monitoring well installation. Perforating the well casing would occur in the Mt. Simon formation before CO_2 injection begins, assuming identification of a high permeability zone. If the potential injectivity of this interval is not large enough or the interval is not found, the well could be perforated at different depths and permeability tests conducted so that an appropriate injection interval could be determined (DOE, 2008).

The installation, operation, and eventual closure of the injection well is carefully governed by a regulatory program—the UIC permit program administered by USEPA, and delegated to qualified states such as the state of Illinois. ADM currently has a Class I – Non-Hazardous area permit for CO_2 injection.

ADM is in discussion with US EPA Region 5 and Illinois EPA regarding a permitting path forward and will comply with all Class VI injection well regulations.

USEPA's UIC regulations prohibit injection wells from causing "the movement of fluid containing any contaminant into an underground source of drinking water, if the presence of that contaminant may cause a violation of any primary drinking water regulation...or may otherwise adversely affect the health of persons" (40 CFR 144.12(a)). The federal UIC Program has been implemented since 1980 and has responsibility for managing over 800,000 injection wells. The programmatic components of the UIC Program are designed to prevent fluid movement into Underground Source of Drinking Water (USDWs) by addressing the potential pathways through which injected fluids can migrate into USDWs. These programmatic components are most recently described in a proposed rule for Class VI injection wells, published in the Federal Register, Volume 74, Number 167 on Monday, August 31, 2009.

2.1.2.5 Quantifying the Fate of Injected CO_2

Pressure and gas composition in the well annulus can be continuously monitored to determine the integrity of the injection string and the packer inside the casing used to isolate the injection zone from the remainder of the well. Changes in pressure or composition can be rapidly detected using pressure sensors or analyzers and the well shut-in to determine the cause of the change.

The verification well drilled near the injection well will allow sampling of reservoir fluids as well as track the downhole temperature and pressure. This will allow for monitoring of the interaction of the CO_2 with the formation. While it will probably be too early to identify mineralization of the CO_2 (via cores) in these wells, ADM should be able to get information on the fate of the CO_2 as it interacts with the formation water. In addition, time-lapse fluid sampling from these wells will allow detailed geochemical analysis of the CO_2/saline water interaction.

The impact of NaCl concentrations on CO_2 solubility is well known and is shown in Duan and Sun (2003) and Duan, Sun, Zhu, and Chou (2006). Injected supercritical CO_2 will be partitioned between the injected free phase, CO_2 trapped by capillary forces to develop a residual saturation of CO_2, and CO_2 that will dissolve in the brine. The effects can be readily modeled both in advance and, more accurately, once the injection well is drilled and site-specific data are collected.

Cement integrity measurements would be run periodically to determine the status of the bond between the rock and the well casing. Advanced ultrasonic devices can be used for more detailed analysis: characterization of formation/cement and cement/casing interfaces, hydraulic communication maps, and monitoring of the cement degradation. Casing and tubing corrosion can be estimated using a variety of measurements.

2.1.2.6 Monitoring, Verification, and Accounting of CO_2 Containment

Reservoir modeling would incorporate: data developed during the pre-injection site assessment period, data developed from the MGSC injection and reservoir monitoring wells drilled approximately 1 mile from the proposed injection site, data developed from the ICCS projects injection and reservoir monitoring wells, data collected when the MGSC project begins injection and from data collected when the ICCS project begins injection. During Phase 1 of this project, the project team has characterized the project site using orthogonal two-dimensional (2D) seismic lines to confirm the geological structure at the site and to test for any seismically resolvable faults that may exist. During Phase 2 of this project, the project team will conduct a full three-dimensional (3D) seismic survey to provide additional detail of the geological structure at the site and better predict the CO_2 plume shape and development. Next, the injection well would then be drilled through the entire Mt. Simon Sandstone to the underlying granitic basement, followed by extensive logging, core sampling, and fluid sampling to build a comprehensive site reservoir model. The model, when combined with information produced for the MGSC project, would enable better understanding of injected CO_2 distribution and potential reactivity of the CO_2 and CO_2-laden brine with the reservoir and the seals.

The extent of the plume movement would be calculated through the dynamic model after the input of every new data point. Continuous monitoring of downhole pressure will provide valuable input to the model on a frequent scale. Periodic monitoring with a visual sampling program will allow frequent updating with relevant plume migration imaging. Time-lapse logging in all wells, along with the full complement of monitoring and verification technologies, will be input to the dynamic model as acquired, and the model tuned to fit the data. The Monitoring, Verification and Accounting (MVA) program proposed for this project would allow the extent of the plume aerial to be assessed periodically (ADM, 2009a).

Microseismicity is commonly used for hydrofrac monitoring in the oil and gas industry. In low permeability formations, real-time microseismicity events detection allows imaging the fracture extension to help controlling injection parameters (pressure and rate) to avoid fracturing the cap-rock. Fracture propagation and geomechanical models can be calibrated by comparing observations and predictions. Temperature contrast between the injected CO_2 and the formation may favor the failure of completion components, which may also lead to microseismic events (ADM, 2009a).

The monitoring of the environment is essentially focused on the detection of leaks, either directly by monitoring CO_2 concentration and fluxes (together with other fracture-pathfinder geogas), or indirectly by measuring their consequences on the environment. This involves measurements in shallower formations (aquifers, vadose zone, surface, or atmosphere).

The project will also employ a combination of direct air sampling and electronic monitors to measure near surface CO_2 concentrations and along with simple air safety detectors based on OSHA standards.

2.1.2.7 Injection Well Surface Facilities

Temporary facilities and improvements would be constructed or placed at the ground surface within a 300 feet (91.44 m) by 300 feet area in the immediate vicinity of the injection well (see Figure 2.1.1-2). These facilities, many of which are temporary to the drilling activity, would support well construction. At the conclusion of the well construction the temporary facilities would be removed leaving only an access road and pad around the injection wellhead. The site would be fenced off and monitored daily. During well construction the temporary facilities would include:

- Pipe tubs (to hold drill pipe and casing),
- Tubs, Catwalk (ramp at the side of the drill rig where pipe is laid out be lifted to the derrick floor),
- Catwalk water tank,
- Fuel trailer,
- Frac tanks (tanks to hold fluid for stimulating the well),
- Pumps (used to pump drilling mud during drilling operations),
- Drill rig, pumps,
- Trip tank (a small mud tank used to ascertain the amount of mud necessary to keep the wellbore full with the exact amount of mud that is displaced by drill pipe),
- Steel pits (a temporary steel containment for holding wellbore fluids),
- Mudlogger (a person who records information derived from examination and analysis of formation cuttings made by the bit and of mud circulated out of the hole to determine the presence of natural gas or oil),
- Pits, Mudlogger, 50,000 gallon (189.27 kiloliter) reserve pit (an earthen, plastic-lined pit to clean out the mud pump and store excess drilling mud),
- 150,000 gallon (567.81 kiloliter) reserve pit (settling or shaker an earthen, plastic-lined pit adjacent to the shale shaker where the drill cuttings are separated from the mud),
- Manifold rack (a pipe fitting with several side outlets to connect it with other pipes),
- Flare pit (usually a water-filled, plastic-lined, earthen pit over which, a flare is lit to burn off an produced natural gas during drilling operations),
- 20 parking stalls,
- Three operations trailers,
- An office/conference room facility, and
- A communications shack.

2.1.2.8 Community College Outreach Facility

The ICCS project will also include construction of a building on the Richland Community College Campus – the National Sequestration Education Center (NSEC), a center for outreach and education that will be operated by and eventually owned by the College. This 12,000 ft^2 (1,115 m^2) building will be located at the entrance to the developed (Farm Progress Site) area north of the Richland Community College Campus.

2.1.3 Operations and Maintenance

2.1.3.1 General

The proposed total project period injection of approximately 2.5 million short tons of supercritical CO_2, at the rate of up to one million short tons per year would use the Mt. Simon formation as a target storage zone. Injection would be by one well at the Decatur ADM Complex. There is one operating 88-foot deep hydrocarbon well site near the Decatur ADM

Complex, and the closest known penetration of the Mt. Simon formation is the MGSC injection and reservoir monitoring well located north of the compression/dehydration facility. These wells are beyond the radius of influence (1,250 feet (381 m)) of the proposed injection well.

Prior to injection, the CO_2 stream would need to be dewatered and compressed. The minimum compression is to the critical point of CO_2, which is 88 $^{\circ}$F (31.1 degrees Celsius (°C)) and 73 atmospheres pressure (7,395 kilopascals (kPa)).

Compression of the gas stream and cooling would cause the water vapor in the CO_2 to condense, but a condensate of almost pure water and CO_2 is a highly corrosive mixture, and it will be carefully controlled in view of the high pressure of the system proposed.

All well construction materials will be acid-resistant and are duplicates of those used in the MGSC well, which uses CO_2-resistant cement across the reservoir and primary seal, and 13-chrome steel casing in the lower 2,000 ft of the injection and seal zone and in the entire length of the injection tubing. The packer utilized will also be constructed of CO_2-resistant metals and special elastomers rated for CO_2 service.

Non-potable saline water is produced during drill stem testing and on-going sampling from the verification well (DOE, 2008). In addition, water byproduct of the CO_2 conditioning process prior to injection would be condensation water from the dehydration, which would consist of essentially distilled water with a small mole fraction of triethylene glycol (TEG) and perhaps traces of ethanol. This fluid would be handled through the existing ADM wastewater system for treatment, testing, and disposal.

Noise control would be maintained by housing compressors and noise-generating equipment in a dedicated process building.

2.1.3.2 Target Zone and Operational Integrity

ADM (2008a) has recognized that the successful operation of the proposed project would primarily be an issue of the integrity of the test site and would require a number of monitoring processes. In principle, compression and dehydration are straightforward matters in petroleum engineering. They would be complicated in this instance by issues of corrosion control that are addressed by design considerations of the compression-dehydration system. Corrosion monitoring would be an integral part of the operations of the aboveground facilities. Once operational without significant corrosion, the compression-dehydration system would be a simple operation with little environmental impact.

Target Zone

The chosen target zone is the Mt. Simon formation. The estimated top of the Mt. Simon formation is between 5,000 and 6,000 feet (1.52 – 1.83 km) at the Decatur ADM Complex (DOE, 2008). It is very thick sandstone, overlain by the impermeable Eau Claire shale formation. The estimated Eau Claire thickness is 300-500 feet (91.44 – 152.40 m) in the injection area. Further, impermeable confining formations are the Maquoketa shale (about 2,500 feet (762 m) below grade) and at lesser depth still the New Albany shale (1,800 feet (548.64 m) below land surface).

Unlike the MGSC carbon sequestration project, there is no need to set aside a long leading time period for the evaluation of the target zone, selection of the injection zone within the Mt. Simon formation, and construction of infrastructure and facilities prior to commencing project operations. A significant amount of data has been acquired to characterize the target zone during the MGSC project as well as the ICCS project Phase 1 and planned activity during the Phase 2 design and construction periods.

The ICCS well has a close enough proximity (less than 1 mile from the MGSC Phase 3 injection and monitoring wells) that the information developed from the MGSC project (well cores and logs) should be similar and applicable to the ICCS well. The ADM project will confirm parameters of porosity and permeability, but the time required for this evaluation is significantly reduced from what was required for the MGSC project.

The distance between the two project's injection wells is approximately 1 mile; therefore, no significant differences between the two sites have been observed or are expected. Additionally, the MGSC project should be in the operation period (injecting) for approximately one year before operations commence for the ICCS project. Because of these factors, the ICCS project has no requirement for additional data acquisition or monitoring to occur between the construction (drilling) and operational (injection) period.

Since CO_2 would likely rise within the sandstone, it could do the following (ADM, 2008).

- First, the CO_2 could dissolve in the saline formation water; this would be expected to be an important process at the high pressures involved, and should acidify the water;
- Second, the acidic water could attack the carbonaceous cements that are sometimes present in sandstone, but are limited at this site; this could be a favorable effect in that it would improve the permeability to fluid flow. However, initial computer simulations of geochemistry suggest that this effect would not be a major one.
- The Eau Claire formation, being dolomitic, is subject to attack by any residual CO_2 that had not been consumed by reactions in the target zone. Models of one million metric tonnes of injected CO_2 after a one hundred year post-injection period show that injected CO_2 will not reach the base of the Eau Claire shale making the long-term potential for dissolution of the shale highly unlikely. If that were to happen, the CO_2 could not penetrate the overlying shale layers, as these would be mostly inert to CO_2.

Cement Integrity

The well would be cemented according to Illinois regulations. Prior to injection well operation, ADM would run casing logs (cement bond logs) to check cement integrity prior to deployment. The initial cementing of well casing strings would be performed according to requirements of the Illinois EPA Underground Injection Control Regulations and defined in the UIC permit modification.

Tests of the Mt. Simon Formation

Site-specific geologic information has been developed for the MGSC carbon sequestration project. The evaluation of data collected during drilling, evaluation, and initial operation of the MGSC injection well would be used to determine final depths of injection and operational conditions for the ICCS project. Geologic, geomechanical, and operational information collected during well installation, evaluation, and operation includes:

- The formation pressure,
- The formation fracture pressure,
- The fracture gradient of the confining Eau Claire formation,
- Porosity,
- Permeabilities, horizontal and vertical (if possible), to CO_2 and water,
- Radius of influence,
- Injectivity, and
- Drill stem tests.

The results of the above would determine the injection pressure, which would not exceed the fracture pressure plus some built-in margin of safety. This in turn would determine the pipe size required for the planned injection rate and the duty of the compression system.

2.1.3.3 Integrity of the Pipeline

System pressure would be monitored closely, as a loss of pressure is indicative of loss of the CO_2 supercritical fluid (DOE, 2008).

Since CO_2 is neither toxic nor explosive, the worst case would be a sudden complete failure of pipe. This would release all the CO_2 in the pipe. The result would be dry ice formation at the break due to the sudden expansion, and release of a large gas cloud as the supercritical fluid is converted to CO_2 gas. The gas is nontoxic, but a sudden, large release from the pipeline might displace air for the workers at the Decatur ADM Complex, or perhaps at the outskirts of Decatur if the release was into a confined area (DOE, 2008).

This scenario, though highly unlikely, would be modeled, taking into account the sudden release and its atmospheric dispersion. If, after the final design is chosen, the modeling suggests a possibility of health effects or even fatalities due to air displacement, it would be necessary to install automatic low-pressure shut-downs at intervals along the pipe. The effect of this would be to limit the amount of CO_2 that could escape in a sudden, complete failure of the pipe (See Section 4.9).

ADM has significant past experience compressing, treating, and handling CO_2 liquids. ADM has a well established emergency response plan that coordinates with the appropriate external agencies and is aligned with the needs of an integrated manufacturing complex. These established procedures will be applied and, if needed, modified to suit the needs of this specific process, therefore ADM will have contingency and maintenance plans to avoid and to respond to leaks, explosions, and overpressure events.

The process control system for the CO_2 compression facility is designed to prevent and to alert operations personnel in the event of a significant deviation of the normal operating process parameters (e.g., CO_2 temperature, pressure, and flow). For example, in the event of an overpressure event, the process control system will automatically spillback CO_2 to the first stage of compression reducing the flow to the injection well. If the over pressure situation persists, the control system will open the atmospheric vent to bring the pressure down. During this period, the operations personnel will receive numerous alarms alerting them of the process deviation allowing them the opportunity to take corrective actions.

In the event of a failure, the compression facility will be equipped with emergency stops and automated isolation valves that will allow operations personnel to quickly shutdown, isolate, and depressurize the unit. These and other systems along with personnel trained on the unit specific operating and maintenance procedures will promote safe operation of the plant. Additionally, all unit operations and maintenance personnel will be given safety and emergency response training prior to commissioning the unit.

This facility will be designed and constructed to meet appropriate ASME standards, e.g., the process piping will be designed in conformance with the ASME B31.3 standard. Existing standards that govern mechanical integrity (e.g. API 510) were developed for facilities processing flammable and reactive materials. This facility will be processing CO_2 which is non flammable and non reactive, therefore these standards are not appropriate for this process service. Because ADM understands the hazards that compressed CO_2 presents and to insure the mechanical integrity of the facility, maintenance and inspection procedures will be developed that will cover the future operation of the CO_2 compression and transmission infrastructure.

Emergency response and mechanical integrity testing specific to the sub surface facility (injection well bore), has been developed and is detailed in the UIC permit’s Appendices.

2.1.4 Decommissioning

ADM would have two choices available to them:

First, they may decide to continue the sequestration project as part of their ongoing operations. In that case, regulatory approval would be obtained as necessary.

Second, if they do not choose to continue or if the demonstration project has not shown unequivocally favorable results, the plant site does not require decommissioning immediately. However, the well would have to be abandoned, and the pipeline could be abandoned in place or the aboveground sections removed. Well abandonment would be according to Illinois Environmental Protection Agency (IEPA) UIC regulations. All decommissioning would be done in compliance with applicable laws and regulations.

2.2 Alternatives

DOE's alternatives to this project consist of the 83 technically acceptable applications received in response to the Funding Opportunity Announcement, *Carbon Capture and Sequestration from Industrial Sources and Innovative Concepts for Beneficial CO_2 Use.* Prior to selection, DOE made preliminary determinations regarding the level of review required by NEPA based on potentially significant impacts identified in reviews of acceptable applications. DOE conducted these preliminary environmental reviews pursuant to 10 C.F.R. § 1021.216. These preliminary NEPA determinations and reviews were provided to the selecting official, who considered them during the selection process. A synopsis of the potential environmental consequences of the proposed projects is attached as Appendix G, in accordance with 10 C.F.R. § 1021.216 (h).

Because DOE's Proposed Action is limited to providing financial assistance in cost-sharing arrangements to projects submitted by applicants in response to a competitive funding opportunity, DOE's decision is limited to either accepting or rejecting the project as proposed by the proponent, including its proposed technology and selected sites. DOE's consideration of reasonable alternatives is therefore limited to the technically acceptable applications and a no-action alternative for each selected project.

2.2.1 No-Action

DOE's provision of cost sharing in ADM's proposed project is the Federal action that brings the proposed project under NEPA. Under the No-Action alternative, DOE would not provide partial funding for the proposed project. In the absence of DOE funding, project proponents (ADM) would not proceed with the proposed project tasks. Thus, the components of the proposed project (including building of a compression/dehydration and injection of CO_2 facility) would not occur under the No-Action alternative.

2.3 Issues Considered and Dismissed

The Purpose and Need section above highlighted the importance of the overall program of evaluating ICCS as one tool among many to address global climate change while providing this nation with a secure energy future. Many potential impact issues associated with EAs were reviewed to compile this EA. Because of the lack of potential impact to certain issues due to the specific characteristics of the proposed project, the following issues were considered but dismissed from detailed analysis:

Right-of-Way Acquisition	There was no need for additional right-of-way.
Wild & Scenic Rivers	There are no designated Wild & Scenic Rivers within a 75-mile (120 km) distance from the project site.
Increase Local Government Expenditures	The expected population dynamics of the temporary workforce are not expected to impose additional local government expenditures through need for new roads, schools, etc.

Impact Property Values	This is a minor expansion within an existing industrial facility.
Alter Local Hydrology Patterns	None of the proposed construction would impact drainage in the local watershed.
Harm Tribal Lands	No lands affiliated with Native American tribes would be impacted by ADM's Proposed Project.

3.0 THE ENVIRONMENTAL ANALYSIS APPROACH

This chapter describes how the environmental review team analyzed the potential impacts of this ADM's Proposed Project (i.e., injection and analysis of potential for geologic storage of CO_2). Chapter 4 provides a description of the affected environment and the potential environmental effects of ADM's proposed project along with an analysis of environmental effects if the proposed project was not implemented.

3.1 Approach to the Analysis

An EA is intended to be a clear, focused analysis of impacts. It is not intended to be merely a compilation of encyclopedic information about the project or about the environment. Accordingly, the environmental review team used a systematic approach to identifying, and then answering the relevant impact questions.

The initial step was to develop a detailed description of the components of the CO_2 storage process to be used at this project site to study the potential of geologic sequestration of CO_2. This description was presented in Chapter 2.

For each project component (e.g., underground injection of CO_2), the team sought to identify all the types of direct effects which that activity could cause on any environmental resource. For example, clearing a site of vegetation could cause soil erosion. In doing this preliminary identification of the types of impacts that potentially could occur, the team drew upon their experience with previous projects.

For each potential direct effect, the team then sought to identify the potential indirect effects on other environmental resources. For example, soil erosion could cause sedimentation in nearby streams, which could in turn harm the fish and other species in the stream.

$\boxed{\text{Site clearing}} \xrightarrow[\textit{cause}]{\textit{could}} \boxed{\text{Soil erosion?}} \xrightarrow[\textit{cause}]{\textit{which could}} \boxed{\text{Damage to stream species?}}$

In some cases, the team identified multiple effects on the same resource, which are shown in diagrams. This served as the framework of the analysis of impacts. That is, the team focused their efforts on answering these questions as to whether these effects would in fact occur, and if so, how extensive, how severe, and how long-lasting they would be.

3.2 Analysis of Significance

The review team used a systematic process to evaluate the importance, or significance, of the predicted impacts. This process involved comparing the predictions to the significance criteria established by the team and set out below in Table 3.2. These significance criteria were based on legal and regulatory constraints and on team members' professional technical judgment.

Table 3.2. Impact Significance Thresholds	
Resource Area	**Impact Significance Thresholds** **An impact would be significant if it EXCEEDS the following conditions.**
Air Quality	The project would not produce emissions that would impede the area's conformity with the State Implementation Plan under the Clean Air Act.
Geologic Formations	The proposed project would cause no measurable leakage of CO_2 from the storage formation to the surface or into another area in the subsurface, and there is no more than an imperceptible risk of inducing seismic events due to increased reservoir pressure.
Soils	Any changes in soil stability, permeability, or productivity would be limited in extent. Full recovery would occur in a reasonable time*, considering the size of the project. Mitigation, if needed, would be simple to implement and proven to be effective in previous applications.
Surface Water	Any changes to surface water quality or hydrology would be confined to the immediate project area. Full recovery would occur in a reasonable time, considering the size of the project and the affected area's natural state.
Groundwater	Any changes to groundwater quality and quantity would be at the lowest detectable levels. Full recovery would occur in a reasonable time. Mitigation, if needed, would be proven to be effective in previous applications.
Wetlands and Floodplains	Any impacts to wetlands/floodplains would be confined to the immediate project area and would not cause any regional impacts. Planned mitigation measures would fully compensate for lost wetland values in a reasonable time.
Terrestrial Vegetation	Any changes to native vegetation would be limited to a small area and would not affect the viability of the resources. Full recovery would occur in a reasonable time, considering the size of the project and the affected resource's natural state. Mitigation, if needed, would be proven to be effective in previous applications.
Wildlife	Any changes to wildlife would be limited to a small portion of the population and would not affect the viability of the resource. Full recovery would occur in a reasonable time, considering the size of the project and the affected species' natural state.
Threatened or Endangered Species	Any effect to a federally listed species or its critical habitat would be so small that it would not be of any measurable or perceptible consequence to the protected individual or its population. This negligible effect would equate to a "no effect" determination in U.S. Fish and Wildlife Service terms.
Land Use	Any change in land use would be limited to a small area and would not noticeably alter any particular land use at the ADM ICCS Site or in adjacent areas. The affected areas would fully recover in a reasonable time once the project is completed.
Population and Employment	Changes to the normal or routine functions of the affected community are short-term or do not alter existing social or economic conditions in a way that is disruptive or costly to the community.
Infrastructure	The project would not noticeably affect or disrupt the normal or routine functions of public institutions, roads, electricity, and other public utilities and services in the project area.

Table 3.2. Impact Significance Thresholds	
Resource Area	**Impact Significance Thresholds** **An impact would be significant if it EXCEEDS the following conditions.**
Parks and Recreation	Any disturbance would be minor, temporary in duration, and in character with existing uses of the project area.
Visual Resources	The action, along with planned mitigation, would not permanently change the visual landscape in a way that is objectionable to a number of local residents or frequent visitors. (or) The action, along with planned mitigation, would not change the visual resource classification of the affected area.
Noise	Noise levels in the project area would not exceed ambient noise level standards as determined by the Federal, state, and/or local government.
Environmental Justice	Neither minority nor low-income groups within the affected community would experience proportionately greater adverse effects than other members of the community would.
Human Health and Safety	The project, with current and planned mitigation measures, would pose no more than a minimal risk to the health and safety of on-site workers and the local population.
Cultural Resources	The action would not affect the context or integrity features (including visual features) of a site listed or eligible for listing on the National Register of Historic Places or of other cultural significance. The consultations with the SHPO and any other potentially affected groups would result in the determination of effect under Section 106 of the NHPA of *no adverse effect*.
Waste Management	The action, along with planned mitigation measures, would not cause air, water, or soil to be contaminated with hazardous material that poses a threat to human or ecological health and safety.

* Recovery in a reasonable time: Constant, sustainable improvement is apparent and measurable when the site is routinely observed, and full recovery is achieved over a period of no more than several years.

4.0 DESCRIPTION OF THE AFFECTED ENVIRONMENT AND ENVIRONMENTAL EFFECTS

4.1 Air Quality

4.1.1 Description

This is a description of regional climate, ambient air quality with respect to attainment of NAAQS, and identification of applicable air quality regulations.

4.1.1.1 Climate and Weather

Decatur, Illinois, average winter temperature is 25.7°F. The average summer temperature is 74.6°F. The total annual precipitation is 39 inches (99.06 cm) with 58% of this falling in April through September. The growing season for most crops also falls within the April through September period. The average seasonal snowfall is 21.5 inches (54.6 cm) (DOE, 2008).

4.1.1.2 National Ambient Air Quality Standards and Attainment Status

USEPA Region 5 and the IEPA regulate air quality in Illinois. The CAA (42 USC 7401-7671q), as amended, gives the USEPA the responsibility to establish the primary and secondary NAAQS (40 CFR Part 50) that set acceptable concentration levels for seven criteria pollutants: PM_{10}, $PM_{2.5}$, SO_2, CO, nitrogen oxides (NO_x), O_3, and lead. Short-term standards (1-, 8-, and 24-hour periods) have been established for pollutants contributing to acute health effects, while long-term standards (annual averages) have been established for pollutants contributing to chronic health effects. Based on the severity of the pollution problem, nonattainment areas are categorized as marginal, moderate, serious, severe, or extreme. Each state has the authority to adopt standards stricter than those established under the federal program. However, the State of Illinois accepts the federal standards.

Federal regulations designate Air-Quality Control Regions (AQCRs) in violation of the NAAQS as "nonattainment" areas. Federal regulations designate AQCRs with levels below the NAAQS as "attainment" areas. "Maintenance" AQCRs are areas that have previously been designated "nonattainment" and have been redesignated to "attainment" for a probationary period through implementation of maintenance plans. The project area is completely within the West Central Illinois Intrastate AQCR (AQCR 075) (40 CFR 81.264). Federal regulations designate AQCR 075 as an attainment area for all criteria pollutants (40 CFR 81.314). Because the project area is in an attainment region, the air conformity regulations do not apply. However, the project's emissions of criteria pollutants and the applicability thresholds under the general conformity rules were carried forward for more detailed analysis to determine the level of impact under NEPA.

4.1.1.3 Local Ambient Air Quality

Existing ambient air quality conditions can be estimated from measurements conducted at air quality monitoring stations close to the project area (Table 4.1.1.3). With the exception of the eight-hour O_3 and $PM_{2.5}$ standards, air-quality measurements are below the NAAQS (USEPA, 2008). The reported maximum of 0.091 parts per million (ppm) for the eight-hour level exceeds the standard of 0.08 ppm within the region. However, the 3-year average of the fourth highest daily maximum 8-hour average O_3 concentrations over each year has not exceeded 0.08 ppm; hence, the area is in attainment. The reported maximum of 37 micrograms per cubic meter (µg/m^3) for the 24-hour $PM_{2.5}$ level exceed the standards of 35 µg/m^3. However, it was only exceeded once and was granted attainment status.

Table 4.1.1.3. NAAQS and Monitored Air Quality Concentrations

Pollutant and Averaging Time	Primary NAAQS[1]	Secondary NAAQS[1]	Monitored Data[2]	Location of Station
CO				
8-Hour Maximum[3] (ppm)	9	(None)	2	Sangamon County
1-Hour Maximum[3] (ppm)	35	(None)	3	
NO_2				
Annual Arithmetic Mean (ppm) 1-Hour Maximum[8] (ppm)	0.053 0.100	0.053 0.100	*(no data available)*	-
Ozone				
8-Hour Maximum[4] (ppm)	0.08	0.12	0.069	Macon County
$PM_{2.5}$				
Annual Arithmetic Mean[5] (µg/m^3)	15	15	12	Macon County
24-Hour Maximum[6] (µg/m^3)	35	35	29	
PM_{10}				
Annual Arithmetic Mean[7] (µg/m^3)	50	50	24	Macoupin County
24-Hour Maximum[3] (µg/m^3)	150	150	54	
SO_2				
Annual Arithmetic Mean (ppm)	0.03	(None)	0.003	
24-Hour Maximum[3] (ppm)	0.14	(None)	0.025	Macon County
3-Hour Maximum[3] (ppm) 1-Hour maximum[9] (ppm)	- 0.075	0.5 (None)	0.042 0.050	

1 - Source: 40 CFR 50.1-50.12.
2 - Source: (USEPA, 2008).
3 - Not to be exceeded more than once per year
4 - The 3-year average of the fourth highest daily maximum 8-hour average O_3 concentrations over each year must not exceed 0.08 ppm.
5 - The 3-year average of the weighted annual mean $PM_{2.5}$ concentrations from must not exceed 15.0 µg/m^3.
6 - The 3-year average of the 98th percentile of 24-hour concentrations at each population-oriented monitor must not exceed 65 µg/m^3.
7 - The 3-year average of the weighted annual mean PM_{10} concentration at each monitor within an area must not exceed 50 µg/m^3.
8 - To attain this standard, the 3-year average of the 98th percentile of the daily maximum 1-hour average at each monitor within an area must not exceed 100 parts per billion (ppb) (effective January 22, 2010).
9 - Final rule signed June 2, 2010. To attain this standard, the 3-year average of the 99th percentile of the daily maximum 1-hour average at each monitor within an area must not exceed 75 ppb.

4.1.1.4 Existing Facility Emissions

The Decatur ADM Complex operates a variety of grain processing activities, including milling, oil refining, alcohol, and ethanol production. It has many stationary sources of air emissions. Significant sources of emissions include storage tanks, dryers, boilers, evaporators, and conveyers. Insignificant sources include small boilers, storage tanks, and internal combustion engines. Based on the facility's potential to emit, Decatur ADM Complex is a major source of volatile organic compounds (VOC), PM, CO, hazardous air pollutants (HAPs), NO_x, and SO_2. A facility-wide Title V permit (permit number 115015AAE) was issued on August 18, 2004 (IEPA, 2004). As part of the permit requirements, the facility must comply with emission limits and operational hours for individual pieces of equipment, and submit an annual facility-wide emission statement. Table 4.1.1.4 lists the overall annual emissions for the Decatur ADM Complex. CO_2 emissions are not reported by the facility since the first annual reporting of CO_2 emissions under the USEPA Reporting Rule is for calendar year 2010.

Table 4.1.1.4. Existing (2009) Air Emissions for Decatur ADM Complex

Criteria Pollutants	Decatur ADM Complex Annual Emissions (Short Tons per Year)
CO	2993.5
NO_x	1685.34
PM_{10}	1,478.5
$PM_{2.5}$	415.36
SO_2	7087.5
VOC	3543.29

Source: (ADM, 2010c).

4.1.1.5 Greenhouse Gases and Global Warming

Greenhouse gases (GHG) are components of the atmosphere that contribute to the greenhouse effect and global warming. Some greenhouse gases occur naturally in the atmosphere, while others result from human activities such as the burning of fossil fuels. Federal agencies, states, and local communities address global warming by preparing GHG inventories and adopting policies that will result in a decrease of GHG emissions. According to the Kyoto Protocol and California Climate Action Registry (CCAR), there are six GHGs: CO_2, nitrous oxide (N_2O), methane (CH_4), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6) (UNFCCC, 2008; CARB, 2007a). Although the direct GHG (CO_2, CH_4, and N_2O) occur naturally in the atmosphere, human activities have increased their atmospheric concentrations. From the pre-industrial era (i.e., ending about 1750) to 2004, concentrations of CO_2 have increased globally by 35 percent. Within the United States, fossil fuel combustion accounted for 94 percent of all CO_2 emissions released in 2005. On a global scale, fossil fuel combustion added approximately 30 $x10^9$ short tons (27 $x10^9$ metric tons) of CO_2 to the atmosphere in 2004, of which the United States accounted for about 22 percent (DOE, 2008). DOE's Energy Information Administration (EIA) report indicates that United States' CO_2 emissions have grown by an average of 1.2 percent annually since 1990 and energy-related CO_2 emissions constitute as much as 83 percent of the total annual CO_2 emissions (DOE, 2007b).

Since 1900, the Earth's average surface air temperature has increased by about 1.2 to 1.4ºF. The eight warmest global average temperatures on record have all occurred within the past 10 years, with the warmest year being 2005 (USEPA, 2009a). With this in mind, DOE, while preserving their core operations, is poised to support climate-changing initiatives to reduce GHG emissions.

4.1.2 Effects of ADM's Proposed Project

Short-term minor impacts to air quality would be expected with the implementation of the proposed project. Direct and indirect air emission would not exceed applicability thresholds, be "regionally significant," or contribute to a violation of any federal, state, or local air regulation. Air emissions would be limited to temporary diesel emissions from drilling equipment during well development. Dehydration reboilers, which could generate limited air emissions, would be the only expected sources of air emissions during injection or monitoring operations. In summary, the project would not produce emissions that would impede the area's conformity with the State Implementation Plan under the Clean Air Act.

4.1.2.1 Estimated Emissions and General Conformity

The general conformity rules require Federal agencies to determine whether action(s) they engage in or permit would increase emissions of criteria pollutants above preset threshold levels (40 CFR 93.153(b)). These *de minimis* (of minimal importance) rates vary depending on the severity of the nonattainment and geographic location. Because AQCR 075 is in attainment, the air conformity regulations do not apply. However, all direct and indirect emissions of criteria pollutants were estimated and compared to applicability threshold levels of 100 short tons per year (tpy) to determine whether implementation of the proposed project would cause significant environmental impacts. The total direct and indirect emissions associated with the following activities were accounted for (Table 4.1.2.1).

- Site preparation, construction, and drilling,
- Construction and operation of transport pipeline,
- Operation and maintenance of injection facilities, and
- Subsurface injections of CO_2.

Construction and drilling emissions would primarily be due to the use of diesel drilling rigs, mud pumps, diesel generators and motors, heavy construction equipment, deliveries to the site, the application of architectural coatings, and fugitive dust. Drill rig operations during well construction are anticipated to occur 24 hours per day and 7 days per week for no more than three months for the well. The operational emissions would primarily be due to vehicle operation and the proposed natural gas-fired dehydration reboiler in the regenerator column. There are no planned operational activities along the proposed pipeline or at the well sites that would generate emissions of criteria pollutants.

The total direct and indirect emissions associated with the proposed project would not exceed applicability threshold levels. Because AQCR 075 is an attainment area, there is no existing emission budget. However, due to the limited size and scope of the proposed project, it is not anticipated that the estimated emissions would make up 10 percent or more of regional emissions for any criteria pollutant and not be regionally significant. A detailed breakdown of drilling, construction, and operation emissions is located in Appendix A.

Table 4.1.2.1. Proposed Project Emissions Compared to Applicability Thresholds								
	Annual emissions (Short Tons Per Year)						*De minimis* threshold (Short Tons Per Year)	Would emissions exceed applicability thresholds? [Yes/No]
Activity (Annual)	CO	NO_x	VOC	SO_x	PM_{10}	$PM_{2.5}$		
Drilling and Construction	4.8	8.7	1.17	<0.01	0.4	0.4	100	No
Facility Operations	0.0	0.2	0.0	0.0	0.0	0.0		

Note: SO_x is sulfur oxides.

4.1.2.2 Regulatory Review

New stationary sources of emissions may be subject to both federal and state permitting requirements. These requirements include, but are not limited to, New Source Review (NSR), PSD, and New Source Performance Standards (NSPS) for selected categories of industrial sources. In addition, under the National Emission Standards for Hazardous Air Pollutants (NESHAP), new and modified stationary sources of air emissions may be subject to Maximum Achievable Control Technology (MACT) requirements if their potential to emit HAPs exceeds either 10 short tons per year of a single HAP, or 25 short tons per year of all regulated HAPs. These regulations are outlined in Title 35 of the Illinois Administrative Code Subpart B, Air Emission Regulations (IPCB, 2002).

The Decatur ADM Complex is in an attainment area and would introduce a limited new insignificant stationary source of air emissions; the dehydration reboiler. However, since it would be located at an existing major source, it is possible that the reboiler would need a permit to construct, and be added to the list of insignificant sources outlined in the facility's Title V permit. At the final design stages, the reboiler would be chosen and permitting requirements correspondingly determined.

The construction and drilling activities would be accomplished in full compliance with Illinois regulatory requirements through the use of compliant practices and/or products. Some applicable sections may include:

- Subchapter C: Part 212: Visible and Particulate Matter Emissions,
- Subchapter C: Part 215: Organic Material Emissions Standards and Limitations, and
- Subchapter I: Part 237: Open Burning.

Construction and drilling activities would be expected to cause some localized dust. Standard mitigation techniques such as watering, erecting wind breaks, and using covers where practicable would be employed to minimize its effects.

4.1.2.3 Greenhouse Gas Emissions

Direct and Indirect CO_2 Emissions. Carbon emissions from the Decatur ADM Complex would be captured and sequestered in the Mt. Simon deep saline reservoir. It is anticipated that approximately 2.5 million short tons of CO_2 would be sequestered during the initial 2.5-year injection period. However, the overall amount of CO_2 generated would increase due to the burning of diesel fuel during drilling, the additional electrical demand (10-12 megawatt (MW)), and worker commutes. The net CO_2 emissions for the project were estimated (Table 4.1.2.3). A net decrease of approximately 2.3 million short tons of CO_2 emission would be realized over the life of the project. These 2.5 million short tons of CO_2 are currently vented to the atmosphere and would not be if the proposed project were implemented. This is less than 0.0001% of the global CO_2 emissions. The additional 190,177 short tons of CO_2 from the drilling, construction, and electricity usage would not be generated at all without the implementation of the proposed project.

Table 4.1.2.3. Net CO_2 Emissions for ADM's Proposed Project

Activity/Source	Emissions (Short Tons)
Drilling and Construction	494
Electricity Usage	188,587
Worker Commutes	602
Sequestration	**(2,500,000)**
Total Emissions Reduction	**(2,309,823)**

Fugitive CO_2 Emissions and Compressor Blowdown. Because sequestration of CO_2 is an integral part of research and development activities for the proposed project, fugitive air emissions of CO_2 would occur during routine operations. Sources of emissions during sequestration operations include aboveground valves, piping, and wellheads that comprise the transmission pipeline. In addition, compressors are often equipped with automatic blowdown valves that depressurize compressors, bottles, separators, and interconnecting lines in the event of a shutdown.

It is expected that emissions from these sources would be very small. The majority of the CO_2 stream that would feed the system would otherwise be vented to the atmosphere without the proposed project. Therefore, CO_2 that is vented from the unit during this project are emissions that would otherwise have occurred if the compression unit, pipeline, and wells were not in place. Therefore, these sources of fugitive emissions would not increase overall CO_2 emissions.

4.1.3 Effects of No-Action

Selecting the No-Action alternative would result in no direct impact to ambient air-quality conditions. No drilling or construction would be undertaken and no changes in facility operations would be expected. Ambient air-quality conditions would remain as described in Section 4.1.1.3.

Selecting the No-Action alternative could have minor indirect impacts to air quality. No-Action, meaning that this project is not carried out in any setting, would allow for 2.5 million short tons of CO_2 not to be sequestered, and therefore vented into the atmosphere. This would incrementally increase the amount of GHG in the atmosphere and continue to contribute to global warming.

4.1.4 Cumulative Effects

The State of Illinois takes into account the effects of all past, present, and reasonably foreseeable emissions during the development of the State Implementation Plan (SIP). The State of Illinois accounts for all significant stationary, area, and mobile emission sources in the development of this plan. Estimated emissions generated by the proposed project, when considered in addition to comparable emissions from the related MGSC project, would be *de minimis* and would not be regionally significant. Therefore, it is not anticipated that the proposed project would contribute substantially to adverse cumulative effects to air quality.

4.2 Geology and Soils

4.2.1 Description

The ADM ICCS Facility is located on the east side of the city of Decatur, Illinois, which lies in Macon County (Section 5 of Township 16 North Range 3 East). The sites are located on the existing Decatur ADM Complex. Project activities are planned northeast of the main ADM plant in an open field owned by ADM. The land use of the Decatur ADM Complex is characterized as industrial, although the area has been previously leased for agricultural uses (DOE, 2008). Water bodies in the vicinity include Lake Decatur, which was formed in 1920s by the damming of the Sangamon River, a principal tributary of the Illinois River (Decatur, 2008a; IDNR, 2003). This river and reservoir provide surface drainage for the surrounding land and water supply for the city of Decatur (Decatur, 2008a). The sites are located on essentially flat topography with slopes less than 5% as determined from topographic maps covering the area. There is no evidence of karst topography (such as sinkholes) in the area (DOE, 2008).

Subsurface. The subsurface geology of the Illinois Basin (Figure 4.2.1-1) in the project area consists of a thick sedimentary sequence of Cambrian to Pennsylvanian geologic formations overlain by unconsolidated moraine deposits of the Quaternary-age Wedron Group (ISGS, 1996). The thickest and most widespread brine reservoir in the Illinois Basin is the basal Cambrian-age Mt. Simon Sandstone. It is overlain by the Cambrian Eau Claire Formation, a regionally extensive very low-permeability shale, and underlain by Precambrian granitic basement. The deposition of the Mt. Simon Sandstone is commonly interpreted to be a shallow, subtidal marine environment. In general, the paleogeography of Illinois at the time of uppermost Mt. Simon deposition was one of a low-relief coastal setting in a subsiding basin that was open to the ocean to the south. In the northern half of Illinois, the Mt. Simon is used extensively for natural gas storage. Detailed reservoir data are available from these projects. Data from ten Mt. Simon gas storage projects shows that the upper 200 feet (60.96 m) has porosity and permeability high enough to be a good sequestration target. The closest Mt. Simon penetration to the sites is the MGSC Phase III injection and reservoir monitoring wells. They are about 3,900 feet (1,200 meters) to the south of the proposed injection well location.

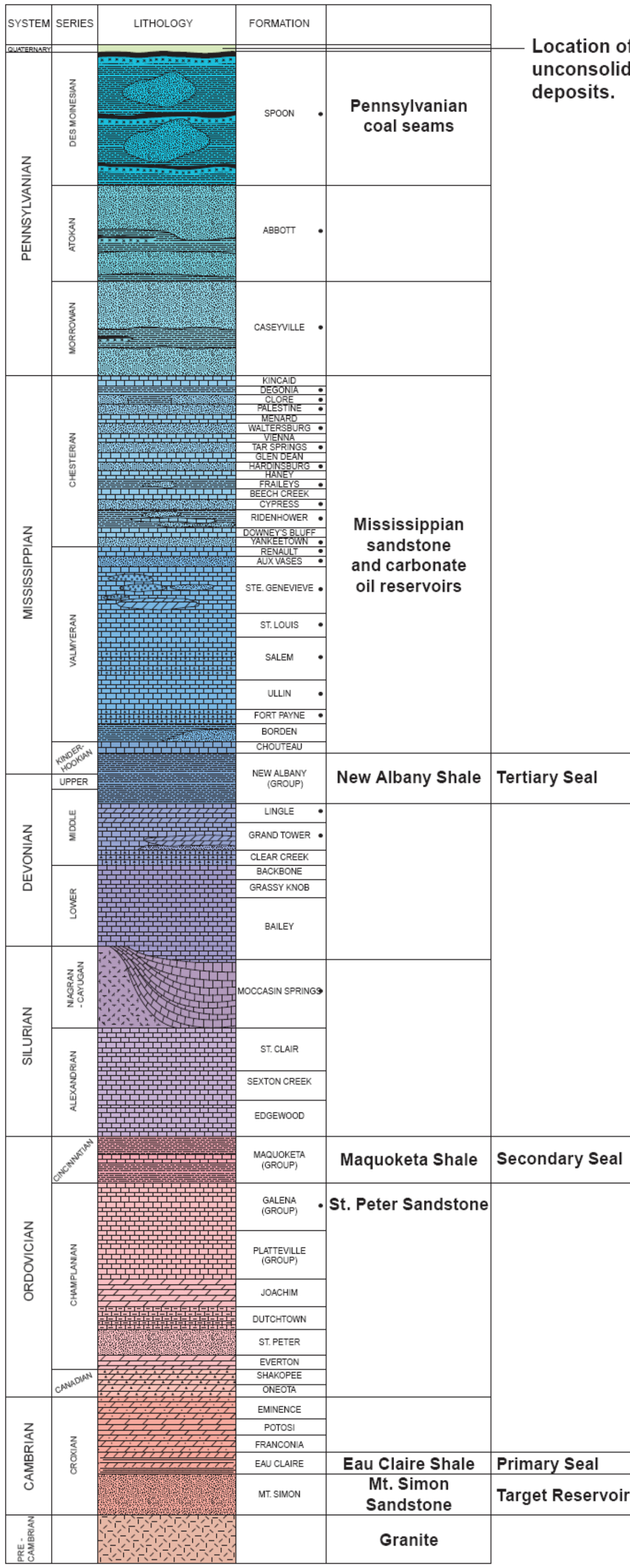

Figure 4.2.1-1. Illinois Basin's Stratigraphic Column of Key Formations for CO_2 Injections
Source: (DOE, 2008).

Core and well data from the existing well, drilled for the Midwest Geologic Sequestration Consortium project[1], located less than one mile from the proposed site, demonstrate that 497 feet of the Eau Claire Formation are present. The upper 300 feet of the Eau Claire Formation at this location are comprised of tight dolomitic siltstone, dolomite, and limestone, in descending order. The bottom 197 feet of the Eau Claire is shale with little or no carbonate stingers present. Geochemical and geophysical analyses confirm the presence of this thick shale. X-ray diffraction and other geochemical analysis are currently underway on the Eau Claire samples and information from these analyses will be included in subsequent UIC Class VI permit applications. Mapping from regional data suggests that the gross thickness of the Mt. Simon is 1,000 to 1,600 feet (304.8 – 487.68 m) at the two sites. The nearest well with a porosity log for the entire thickness of the Mt. Simon, the MGSC Phase III site, was drilled on ADM property 3,900 feet from the proposed project. The MGSC III well drilled through 7164.7 feet of Mt. Simon before drilling into the Precambrian granite (Weibel, 2010).

The gross thickness of the MGSC III well had an average porosity, calculated from wireline logs, of 13.4 percent and a permeability of 26 milidarcys. The MGSC III well log porosity data are similar to those found in the Hinton #7, the deepest well at the Manlove Field in Champaign County, approximately 37 miles (59.55 km) northeast of the project area. The Manlove Field is the deepest Mt. Simon natural gas storage field in the Illinois Basin (DOE, 2008).

A regional Mt. Simon structure map suggests that the top of the Mt. Simon is between 5,000 and 6,000 feet (1.52 and 1.83 km) measured depth at the sites. For the CO_2 injection portion of this research project, the injection interval would not be the entire thickness of the Mt. Simon; rather it would be a subinterval within the gross thickness of this massive sandstone geologic unit that has acceptable permeability properties (DOE, 2008).

Analysis of Mt. Simon Sandstone thin sections from 90 feet (27 m) of core demonstrate that the sandstone is cemented by silicate cements with little to no evidence of carbonate cements.

Within the Illinois Basin, three thick shale units function as major regional seals. These are, from shallowest to deepest, the Devonian-age New Albany Shale, Ordovician-age Maquoketa Formation, and the Cambrian-age Eau Claire Formation. There are also many minor, thinner Mississippian- and Pennsylvanian-age shale beds that form seals for known hydrocarbon traps within the Basin. The lowermost seal, the Eau Claire, has only two known penetrations. The MGSC III project's injection and reservoir monitoring wells are located about 3,900 feet from the proposed injection well. The next nearest penetration of the Eau Claire seal is over 17-miles (27.36 km) from the site. The MGSC well is being continually monitored for integrity and other parameters. Thus, there are no existing wellbores whose integrity would be of concern. All three major seals are laterally extensive and appear, from subsurface wireline correlations, to be continuous within a 100-mile (160.93 km) radius of the site locations (DOE, 2008).

The primary confining zone (seal) at the sites is the Cambrian age Eau Claire Formation. An isopach map based on regional well control suggests that the Eau Claire should be 300–500 feet (91.44 – 152.40 m) thick at the proposed sites. The estimated top of the Eau Claire Formation

[1] The legal name of this well is ADM CCS #1. For the purpose of distinguishing existing wells from proposed ICCS project wells, this well is identified as an "MGSC well" in this document.

would occur between 4,500 to 5,500 feet. The Eau Claire Formation is composed primarily of a silty, argillaceous dolomitic sandstone or sandy dolomite in northern Illinois and becomes a siltstone or shale in the central part of the Illinois Basin. Regionally, the Eau Claire is a persistent shale interval above the Mt. Simon that is expected to provide a good seal.

The database of UIC and gas storage wells with cores from the Eau Claire was also used to derive seal qualities. Data show that the Eau Claire's median permeability is 0.000026 millidarcies (mD) and median porosity is 4.7%. At the Ancona Gas Storage Field, located 80 miles (128.75 km) to the north of the proposed sites, cores were obtained through 414 feet (126.19 m) of the Eau Claire, and 110 analyses were performed on a foot-by-foot basis on the recovered core. Most vertical permeability analyses showed values of less than 0.001 mD up to 0.001 mD. Only five analyses were in the range of 0.100–0.871 mD, the latter being the maximum value in the data set. Thus, even the more permeable beds in the Eau Claire Formation are expected to be relatively tight and would tend to act as sealing lithologies (DOE, 2008).

There are two secondary seals expected at the sites. The Ordovician-age Maquoketa Shale is laterally continuous across the sites and is estimated to be over 200 feet (60.96 m) thick at the sites at an estimated depth of between 2,500 to 2,600 feet (762 to 792.48 m) measured depth. This shale is a regional seal for oil reservoirs from the Ordovician Galena (Trenton) Limestone. The Devonian-Mississippian-age New Albany Shale at a depth of approximately 1,800 feet (548.64 m) is about 140 feet (42.67 m) thick in the project area. Extensive well control from oilfields shows that this shale is a good seal for oil accumulations. Thus, it should also be a good secondary seal against the vertical migration of CO_2 (DOE, 2008).

There are no mapped regional faults and fractures within a 25-mile (40.23 km) radius of the proposed sites. A preliminary 2-D seismic survey has been completed during Phase I of the ICCS as well as a 3-D and vertical seismic profile (VSP) as part of the MGSC project. Additional 3-D and VSP data are planned as part of this project to further characterize the site geology and monitor the fate of the CO_2.

Soils. Soils in the area were mapped by the U.S. Department of Agriculture (USDA) (Figure 4.2.1-2). Nine loam units have been mapped within the project site with Drummer silty clay loam (152), and Flanagan silt loam (154A) as most prevalent of the loam types. The most common soil type is the Flanagan silt loam. This is a nearly level, somewhat poorly drained soil located on broad ridges on till plains and moraines. The soil is not highly susceptible to erosion due to the flat topography. Drummer, which is characterized by a nearly level poorly drained soil that occurs in broad, flat areas on outwash or till plains, is not highly susceptible to erosion due to the flat topography. The land capability classification, or the suitability of a soil type for a particular field crop, for the Flanagan and Drummer soil types are moderately limited in the selection of species and require moderate conservation measures (NRCS, 2008). Specifically for these soil types, the land capability class of IIw denote that excess water (ponding/flooding) can interfere with crop productivity.

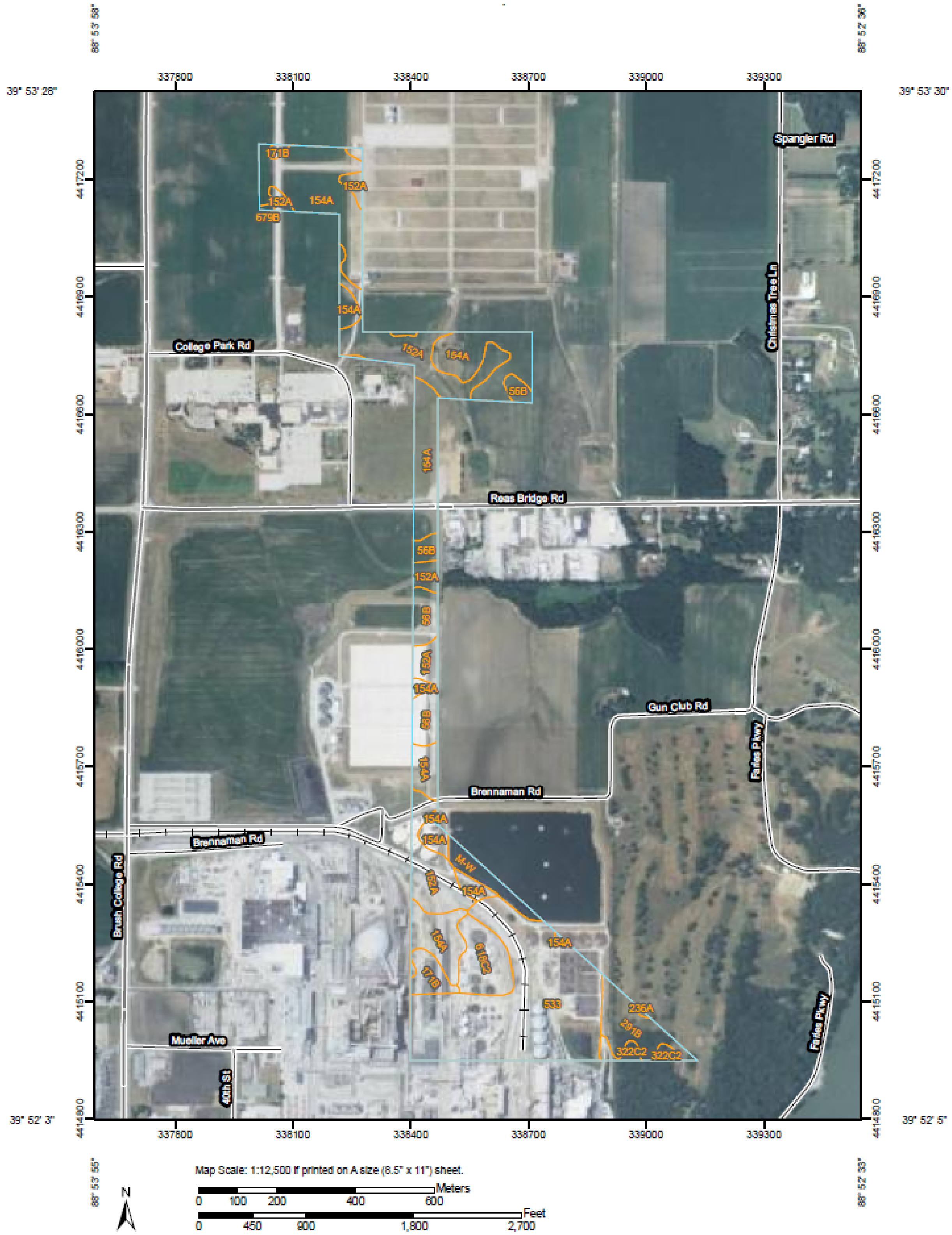

Figure 4.2.1-2. Map of Soil Types over the ADM ICCS Facility Site
Source: (NRCS, 2007).

Macon County, Illinois (IL115)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
56B	Dana silt loam, 2 to 5 percent slopes	6.1	5.6%
152A	Drummer silty clay loam, 0 to 2 percent slopes	18.6	17.1%
154A	Flanagan silt loam, 0 to 2 percent slopes	35.7	32.8%
171B	Catlin silt loam, 2 to 5 percent slopes	2.6	2.4%
236A	Sabina silt loam, 0 to 2 percent slopes	0.1	0.1%
291B	Xenia silt loam, 2 to 5 percent slopes	5.3	4.9%
322C2	Russell silt loam, 5 to 10 percent slopes, eroded	1.4	1.2%
533	Urban land	30.8	28.3%
618C2	Senachwine silt loam, 5 to 10 percent slopes, eroded	5.4	5.0%
679B	Blackberry silt loam, 2 to 5 percent slopes	0.1	0.1%
M-W	Miscellaneous Water	2.7	2.5%
Totals for Area of Interest		**108.8**	**100.0%**

Source: (NRCS, 2009).

At the sites, the low topographic relief suggests that there is essentially no potential for landslides, and negligible risk of subsidence (DOE, 2008).

4.2.2 Effects of ADM's Proposed Project

The main potential negative effects of the proposed project (injection of approximately 2.5 million short tons of CO_2 over 2.5 years) are identified in the following paragraphs with accompanying notations regarding their likelihood of occurrence.

A sudden release of CO_2 to the surface would be considered unlikely because of the well technology to be used and the expertise of the technology providers. If it was to occur, such an event is unlikely to have a large impact on the soil resources surrounding the well. Effects would be very localized and readily remediated. The main risk to the soils would be if a sudden release occurred late in the project after substantial injection had occurred (in Year 3 for example). Under these circumstances, the injected CO_2 would have had time to interact with organic and mineral matter in the reservoir and potentially contain dissolved organic compounds and other contaminants. In related CO_2-Enhanced Oil Recovery (EOR) experience when sudden releases have occurred, the main adverse outcome to soils around the wellhead has been well blowout of dry ice contaminated with crude oil. There is no expectation of any crude oil in the reservoir at the ADM sites.

Relatively slow leakage from the well bores due to casing and/or cement problems are likely to be detected ahead of time by the Mechanical Integrity Testing likely to be proposed in the UIC Permit application (DOE, 2008).

MGSC models of one million metric tons of injected CO_2 after a one hundred year post-injection period show that injected CO_2 will not reach the base of the Eau Claire shale making the long-term potential for dissolution of the shale and subsequent leakage of the CO_2 highly unlikely.

The Mt. Simon Sandstone is a clean, second-cycle sediment dominated by silicate minerals cemented by quartz. The availability of cations such as calcium is limited; therefore, the ability of precipitates to form and alter injectability is limited. The reaction rate for carbonate cement to form is very slow. Since the expected time period for carbonate cement formation is hundreds to thousands of years post-injection, the increase of availability of CO_2 in the Mt. Simon brine is highly unlikely to decrease permeability.

The USGS National Earthquake Information Center website (http://earthquake.usgs.gov/regional/neic/) indicates no record of significant seismic activity (M3 or greater) in Macon County.

The nearest earthquakes, all in the M3 to M3.99 range are

1. in southeastern Christian County, about 28 miles from the injection site
2. in northern Piatt County, about 32 miles from the injection site
3. just south of Bloomington, in central McLean County, about 38 miles from the injection site

The proposed injection site in Decatur Illinois is well away from the New Madrid and Wabash Valley seismic zones and there is no site-specific manifestation of these zones at the Decatur site. In fact, there are no mapped regional faults or fracture zones with a 25-mile radius of the proposed site. Thus, there are no evident planes of failure that could potentially allow bedrock movement that would impact the integrity of the site and with any possible relationship to fluid injection pressures that could activate these surfaces.

Seismicity in the southern Illinois region of the Wabash Valley seismic zone is related to deep-seated northeast trending normal and strike-slip faulting in the Precambrian basement. Decatur is not on this trend and in fact this structural trend angles away from Decatur as you proceed north from southern Illinois.

The nine largest events in this zone from 1958 to 1987 occurred at depths of 16,100 to 76,800 ft, much too deep to be affected by any fluid injection in the Mt. Simon Sandstone at Decatur, and not at the distances involved. Additionally, the earthquakes of record do not correlate with any known structures in the Paleozoic sedimentary section, which includes the Mt. Simon, thus any impact from daily injection pressures at Decatur is highly unlikely. Any microseismic activity detectable by instruments (not an earthquake) is likely to be related to fluid flow through tortuous pathways in the injection zone.

Timothy H. Larson, Ph. D., Geophysicist with Illinois State Geological Survey states that a deep well injection for disposing of waste has not caused seismic activity. He also believes that the injection pressures of the CO_2 at the Decatur site are not high enough to cause fracturing of the rock. High injection pressures have resulted in seismic activities in other areas of the U.S.

Due to the highly unlikely nature of the above-described effects, the conclusion is that there would be no measurable leakage of CO_2 from the storage formation to the surface or into another area in the subsurface.

4.2.3 Effects of No-Action

If the No-Action alternative is implemented, the construction and injection activities of the proposed project do not take place. Thus, no impacts to soils and geology would occur.

4.2.4 Cumulative Effects

ADM has no other projects planned for the area (ADM, 2010d). Since there are no substantial impacts to geological and soil resources from the proposed project or the related MGSC project with its comparable effects, the proposed project and the No-Action alternative do not substantially contribute to the cumulative impacts to these resources in the project area or its vicinity.

4.3 Water Resources

4.3.1 Description

The only significant source of surface water in the immediate vicinity is Lake Decatur, which is located approximately 1 mile (1.61 km) to the east of the proposed project site. Lake Decatur is a 3,090 acre reservoir formed by the damming of the Sangamon River, a major tributary to the Illinois River. Lake Decatur is the source of drinking water for the City of Decatur (Decatur, 2008a).

Water flows in the Sangamon River are monitored by the United States Geological Survey (USGS) downstream of the project site (05573540: Sangamon River at Route 48) and the Sangamon Dam. Hydrometric records from 1983-2007 indicate an annual mean flow of 693 cubic feet (ft^3)/second (sec) (211.23 cubic meter (m^3)/sec) and recorded a maximum peak flow of 31,800 ft^3/sec (9692.64 m^3/sec) in May of 2002 (USGS, 2007).

Surface water quality was assessed on the Sangamon River in Decatur, Illinois, between the years 1978-1997. Specific conductance was measured between 300-1010 microsiemens per centimeter (µS/cm) with a mean value of 586.6 µS/cm. The pH of surface water samples had a field test range between 6.4 and 8.8 over the 1978-1997 sampling period (DOE, 2008).

Lake Decatur and the upstream reaches of the Sangamon River were identified on the IEPA’s 2006 Section 303(d) (of the Clean Water Act) list of impaired waters (waters in which at least one applicable use is not fully supported). Uses not supported for Lake Decatur on the 2006 list were aquatic life, fish consumption, public and food processing water supplies, and aesthetic quality. The use not supported by upstream segments of the Sangamon River on the 2006 list was primary contact. Although still impaired, these waters have been removed from the 2008 list because a Total Maximum Daily Load (TMDL) has been established by IEPA. The exception is that Lake Decatur is on the 2008 303(d) list for not supporting aquatic life and fish consumption (IEPA, 2008; IEPA, 2006).

The City of Decatur also relies on ten groundwater wells to supplement its water supply in times of drought. The source of groundwater is the Mahomet Aquifer, located 6 miles to the north of the ADM ICCS project site, where water is pumped into the Sangamon River to supplement water levels in Lake Decatur (Roadcap and Wilson, 2001). The Mahomet aquifer is a major aquifer at 150 – 300 foot depth capable of yielding significant amounts of water (usually greater than 1,000 gallons per minute or approximately greater than 3,800 liters per minute). Other shallower aquifers are found in the Banner Formation, the Glasford Formation, and more recent sediments (DOE, 2008).

Sand and gravel aquifers are likely to be thin or absent in the Banner Formation, the lower portion of the Glasford Formation, and the more recent sediments. Sand and gravel aquifers are likely to be 5 to 20 feet thick in the upper portion of the Glasford Formation and are likely found within 100 feet of the ground surface (DOE, 2008).

4.3.2 Effects of ADM's Proposed Project

The current regulatory framework for USEPA's UIC permitting program includes multiple provisions for safeguarding and preventing injected fluid movement into USDWs (See Section 2.1.2.4). The permitted Class I injection wells on the ADM site would employ accepted industry standards in meeting the specified permit provisions and conditions.

The sequestration of CO_2 in deep brine reservoirs involves possible drilling through USDWs and a slow upward migration of sequestered CO_2 that has the potential to impact groundwater quality if not adequately trapped by confining layers. CO_2 interacts with the host brine to generate a low pH solution (approximately 2.8 to 3.0). This acid water is known to mobilize metals adsorbed to mineral grains. Injection of CO_2 could also cause pressure gradients that can result in displacement of brine into overlying aquifers. These outcomes are of relatively low risk for the ADM ICCS Site because of the:

- Depth of the proposed injection zone,
- Multiple sequences of shale seals between the injection zone and USDW, and
- Absence of seismic activity in the local area.

The main potential negative effects of the proposed project are identified in the following paragraphs with accompanying notations regarding their likelihood of occurrence.

A sudden release of CO_2 to the surface involves extreme volume expansion of CO_2 from supercritical liquid state to gas and the large adiabatic decompression that occurs in such events are explosive in nature and result in high velocity ejection of dry ice and frozen formation water. Some of this material would be injected into the shallow aquifers around the wellhead. This type of event is considered unlikely for the proposed project because of the well technology to be used and the expertise of the technology providers. If it does occur, such an event is unlikely to have a large impact on the water resources surrounding the well. Effects would be very localized and readily remediated (Skinner, 2003).

The main risk to water resources would be if a blowout occurred late in the project after substantial injection had occurred (in Year 3 for example). Under these circumstances, the injected CO_2 would have had time to interact with organic and mineral matter in the reservoir and potentially have dissolved organic compounds and other contaminants. In CO_2-EOR experiences when blowouts have occurred, the main adverse outcome to shallow groundwater, immediately around the wellhead, has been well blowout of dry ice contaminated with crude oil (Skinner, 2003). There is no expectation of any crude oil in the reservoir at the ADM sites.

Relatively slow leakage from the well bore due to casing and/or cement problems are easily detected ahead of time by the Mechanical Integrity Testing likely to be proposed in the UIC Permit application.

With regard to relatively slow or extremely slow leakage from the injection zone through the seal into USDW, data in the specific test location is not yet available, but proxy information from other similar wells in the region may be used to infer such values by analogy. Potential impacts to groundwater will also be anticipated and minimized by implementation of a monitoring and mitigation plan that focuses on potential leakage pathways. For this test, there are four geological factors to consider when assessing the possibility that upward migration of the injected and sequestered CO_2 into USDWs. These include the number of intervening confining layers that occur between the injection zone and USDWs, thickness of those confining layers, the permeability and porosity of the confining layers, and the potential for fracture to occur in the confining layers.

Section 4.2.1 indicated that there are three thick shale units that function as major regional seals. There are also many minor, thinner Mississippian- and Pennsylvanian-age shale beds that form seals for known hydrocarbon traps within the basin (DOE, 2008). The lowermost seal, the Eau Claire, has only two known penetrations. The MGSC III project's injection and reservoir monitoring wells are located about 3,900 feet from the proposed injection well. The next nearest penetration of the Eau Claire seal is over 17-miles from the site. However, the MGSC well is being continually monitored for integrity and other parameters. Thus, there are no existing wellbores whose integrity would be of concern. All three major seals are laterally extensive and appear, from subsurface wireline correlations, to be continuous within a 100-mile radius of the project site (DOE, 2008).

Section 4.2.1 also states that the expected thicknesses of the confining layers at the project site are substantial, likely measuring 300-500 feet for the primary Eau Claire formation, over 200 feet for the Maquoketa formation, and 140 feet for the New Albany Shale formation. The shallower secondary formations have already demonstrated their effectiveness as regional seals for oilfields (DOE, 2008).

Section 4.2.1 summarizes porosity and permeability values from nearby gas storage wells, concluding that even the more permeable beds in the Eau Claire formation, with permeability values as high as 0.871 mD are expected to be relatively tight and tend to act as sealing lithologies (DOE, 2008).

The main faults and or fracture zones of concern are ones that may penetrate through the seals into the reservoir (that is ones that penetrate the containment zone). Based on information presented in the UIC permit (DOE, 2008) application, no faults have been documented within 25 miles (40.23 km) of the project site. Section 4.2.1 indicates a preliminary 2-D seismic survey has been completed during Phase I of the ICCS as well as a 3-D and VSP as part of the MGSC project. Additional 2-D, 3-D, and VSP data are planned to further characterize the site geology and monitor the fate of the CO_2. There is no specific data available on the fracture pressure of the Eau Claire Formation, but there are indications of successful storage of gas in the Mt. Simon without fracturing the overlying Eau Claire for 10 underground natural gas storage reservoirs in Illinois operating in the Mt. Simon at depths ranging from 1,420 to 3,950 feet (432.82 to 1,203 m) (DOE, 2008).

The injection process does not require substantial volumes of water. Therefore, there should not be a direct impact on the supply of water resources of the area.

The surface water resources primarily represented by Lake Decatur are subject to the same subsurface effects described above for USDWs. The difference is the potential effects are reduced by the greater vertical separation from the saline reservoir as well as horizontal separation from the lake, which is approximately 1 mile to the east of the ADM ICCS site. As described earlier, a sudden CO_2 release to the surface causes formation of dry ice and frozen formation water, and the effects are very localized.

The soils are not highly erodible (See Section 4.2), so water contamination from increased run-off is not a major issue. Further, ADM will obtain all necessary permits for construction storm water discharges (ADM, 2010d).

For reasons presented above, the project has limited potential to have negative effects on the availability and current uses of water resources and the potential to cause impairment of water resources through construction and operation of the sequestration project.

4.3.3 Effects of No-Action

If the No-Action alternative is implemented, the construction and injection activities of the proposed project do not take place. Thus, no impacts to water resources are expected to occur.

4.3.4 Cumulative Effects

ADM has no other projects planned for the area (ADM, 2010d). Since there are no substantial impacts to water resources from the proposed project or the related MGSC project with its comparable effects, the proposed project and the No-Action alternative do not substantially contribute to the cumulative impacts to these resources in the project area or its vicinity.

4.4 Wetlands and Floodplains

This section identifies and describes wetlands and floodplains potentially impacted by the proposed project. In addition, this section provides the required floodplain and wetland assessment and public review for compliance with 10 CFR Part 1022, “Compliance with Floodplain and Wetland Environmental Review Requirements.”

4.4.1 Description

There are no wetlands designated within the project area boundaries according to the National Wetlands Inventory (USFWS, 1987)(See Appendix H). The facility would be built within the existing industrial setting of the Decatur ADM Complex, and the project facilities would not be located near any wetland area. The nearest wetland is located adjacent to the western boundary of the ADM complex with a road separating it from the project site (DOE, 2008).

The National Wetlands Inventory map unit outside of the northwest site boundary is classified as PEMAf (USFWS, 1987). The PEMAf unit is an emergent wetland classified as palustrine emergent temporarily or semi-permanently flooded (USFWS, 2009a). Palustrine system designations include all non-tidal wetlands dominated by trees, shrubs, persistent emergent vegetation, emergent mosses, or lichens.

Project construction that would be nearest to the wetland unit is the proposed electrical lines. These lines would be located along ADM’s western property boundary along the east side of North Brush College Road, with the road passing between the wetland unit and the proposed electrical lines.

There are no floodplains in the ADM complex area. The nearest floodplain is associated with an unnamed tributary off the Sangamon River and Lake Decatur to the east of the project site approximately 0.36 miles (0.58 km) (Illinois State Water Survey, 1996). Figure 4.4.1 shows the location of the floodplains to the test site.

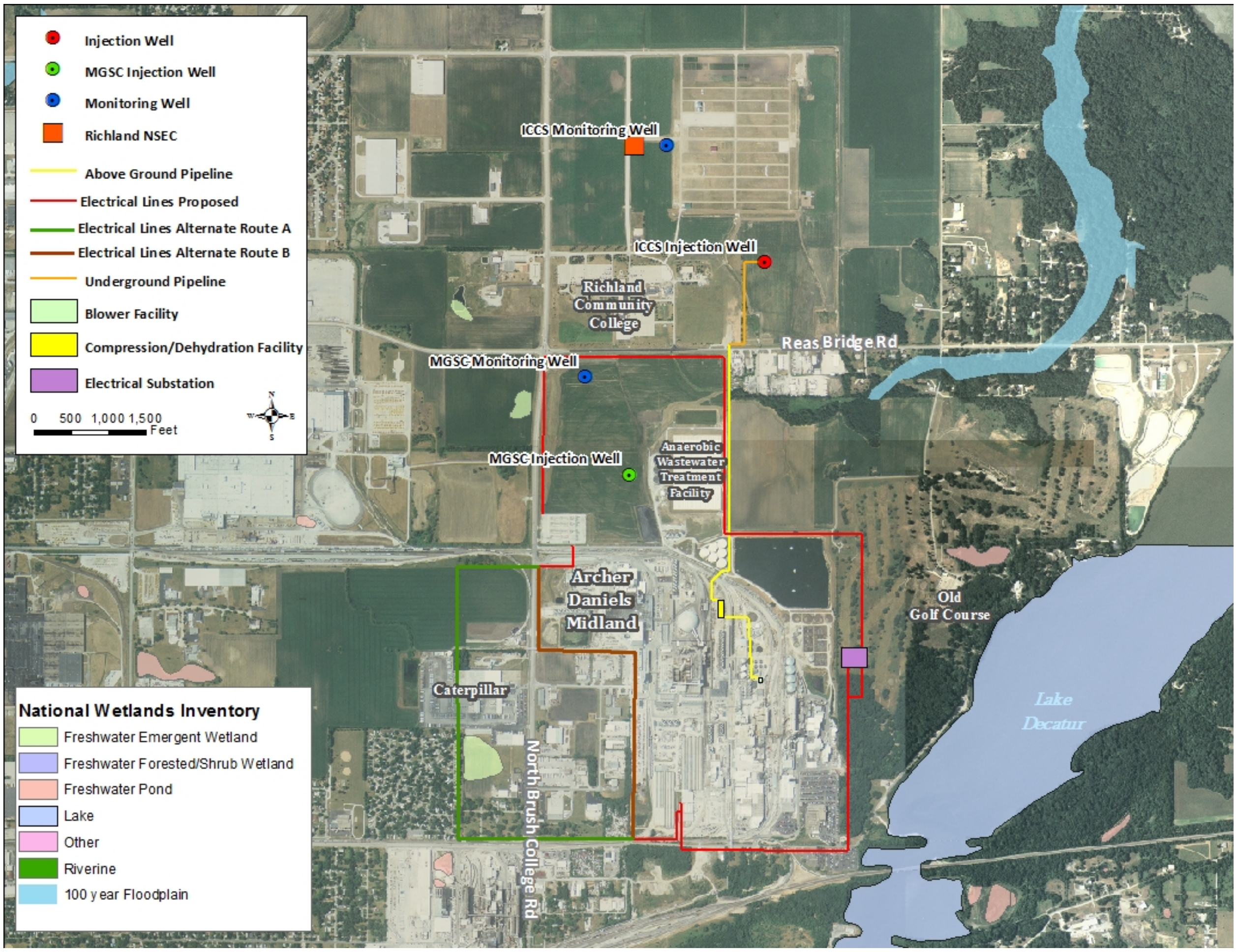

Figure 4.4.1. Floodplains near the ADM ICCS Site

4.4.2 Effects of ADM's Proposed Project

As there are no wetlands or floodplains in the project site, wetland resources and floodplains would not be impacted by construction of the proposed project. The injection well and verification well would be drilled far enough away so that there would be no impacts to the wetland located outside the study area. Furthermore, it is not likely that wetlands would be impacted by the discharge of wastewater from project activities. Similarly, the well would be far enough away so that there would be no impacts to floodplains.

Only the proposed electrical lines are near the identified wetland unit on the west side of North Brush College Road. At this location, the electrical lines would be placed on new wooden poles constructed on the east side of North Brush College Road. The ground disturbance associated with the electrical line construction is minimal and will have only a negligible effect on the wetlands unit at this location.

The unlikely event of leakage of injected CO_2 to the surface could pose detrimental effects on wetlands and floodplains near or at some distance from the project site. Wetland vegetation and water quality could be impacted by increased concentrations of CO_2, possibly resulting in changes in species composition, plant death, changes in pH, and water quality (International Energy Agency, 2007).

Although leakage of CO_2 to the surface affecting wetlands and floodplains in a widespread area is possible, it is more likely that any impacts to wetlands and floodplains would be confined to the immediate project area and would not cause any regional impacts. Thus, impacts on wetlands and floodplains by the proposed project would not be expected to exceed the significance threshold.

4.4.3 Effects of No-Action

Under the No-Action alternative, the proposed project would not be implemented. No impacts to wetlands or floodplains would occur as a result of this alternative.

4.4.4 Cumulative Effects

Previous industrial development of the project area by ADM and recent agricultural practices may have resulted in impacts to any wetlands that may have occurred onsite at one time. Wetlands in the project area vicinity are subject to adverse effects from ongoing agricultural, residential, and industrial activities; these activities are likely to continue in the future.

When considering the effects of these ongoing projects, along with minimally adverse effects generated by the related MGSC project, the proposed project would not pose any additional threats to wetlands or floodplains in the project area, aside from the unlikely leakage of CO_2 to the surface from either this project or the related project, which would have widespread consequences on wetlands and floodplains. However, given the larger impacts to wetlands and floodplains from other past, present, and future activities, cumulative impacts contributed by the proposed project would be minimally adverse and are not expected to exceed the threshold of significance.

4.5 Terrestrial Vegetation

4.5.1 Description

The proposed new project facilities would be located in an area characterized by the Bailey Ecoregion classification as the Prairie Parkland (Temperate) Province of the Prairie Division (National Atlas, 2008). This ecoregion covers an extensive area from Canada to Oklahoma, with alternating prairie and deciduous forest. Vegetation in this province is forest-steppe, characterized by intermingled prairie, groves, and strips of deciduous trees (Bailey, 1995). Trees often cover the highest hills. Grasses are the dominant prairie vegetation. The most prevalent type of grassland is bluestem prairie, dominated by such plants as big bluestem, little bluestem, switchgrass, and Indian grass, along with many species of wildflowers and legumes. In many places where grazing and fire are controlled, deciduous forest is encroaching on the prairies. Due to generally favorable conditions of climate and soil, most of the area is cultivated, and little of the original vegetation remains. The upland forest in this province is dominated by oak and hickory.

The proposed project site consists of land within the Decatur ADM Complex that has been disturbed from its natural state. Surrounding land is industrial, residential, or agricultural. A fallow agricultural field north of the primary industrial complex and north and east of the Richland Community College campus comprises most of the project site. Low growing grasses occur on the project site, which has been previously disturbed.

The Illinois Department of Natural Resources has compiled an inventory of resource rich areas (RRA) in Illinois (DOE, 2008). The proposed project site does not lie within a designated natural area. The Sangamon River RRA, approximately seven miles (11.27 km) to the northeast of the proposed project site, is the closest RRA.

No critical habitats or federally listed plant species exist in the vicinity of the project site. One federally listed plant species, the Eastern prairie fringed orchid (*Platanthera leucophaea*) - threatened, and one Illinois state listed endangered plant species, wild hyacinth (*Camassia angusta*), occur in Macon County (USFWS, 2009b; IDNR, 2008), but are not likely to be found in the project area. A review of the USFWS technical assistance website (USFWS, 2009c) on January 26, 2010 for federally listed threatened and endangered species resulted in a conclusion that the proposed project would have “no effect” on listed species, their habitats, or proposed or designated critical habitat.

4.5.2 Effects of ADM’s Proposed Project

Construction activities associated with the proposed project would occur within currently developed and fallow field areas in the interior and at the perimeter of the primary industrial complex where there is mostly non-native vegetation growing. The new proposed well and pipeline would be placed in the areas of low growing grasses, which may be disturbed or removed for well and pipeline installation. The majority of disturbance would occur in previously disturbed areas, minimizing adverse impacts on vegetation. Part of the pipeline would be underground and co-located with steam lines in a 200-foot easement on the property of Richland Community College, which mainly consists of paved surfaces.

Approximately a 300 foot by 300 foot area around the injection well would be disturbed by installation of facilities and improvements as described in Section 2.1.2.7. For the injection well, the well pad and the surrounding operations area would disturb approximately 2 acres (8,094 m^2), on which there would be very little vegetation. Installation of a verification well would disturb a very small area around each well, probably less than 0.5 acre (2,023 m^2) total, on which there would be very little vegetation. Installation of the 5,290-foot pressurized pipeline would be aboveground for most of its length, following the current pipeline alleys at the Decatur ADM Complex as much as possible; a small portion would be co-located with steam lines in an easement on the property of Richland Community College. Thus, pipeline construction would not likely disturb more than 1 acre (4,050 m^2) on which there would be very little, if any, vegetation. Installation of 1,224 feet of ductwork carrying uncompressed CO_2 would also disturb vegetation along its length. There could also be localized vegetation disturbance from foot traffic during installation, injection, and monitoring; however, this area would likely be minimal and limited to the areas immediately surrounding the equipment.

A new ICCS facility would be constructed near the north boundary of the ADM complex. The footprint for this facility would be 30,000 ft^2 (2,787 m^2). Vegetation on this site would be cleared; however, most plants are non-native and the area has been previously disturbed. Heavy equipment may cause temporary disturbance in adjacent areas beyond the footprint of construction. Repeated disturbance of vegetation (i.e., due to vehicle passes) during these activities would cause damage to plants and destruction of the vegetation mat. There would also be localized vegetation disturbance from foot traffic during construction. The overall impact on vegetation would be reduced by concentrating the area of disturbance to the smallest area necessary to complete the project.

A new 500 ft (152 m) by 500 ft electrical substation is proposed on the former golf course land owned by ADM that is east of the primary industrial complex. The footprint for this facility would be 250,000 ft^2 (23,225 m^2). Vegetation on this site would be cleared; however, most plants are non-native and the area has been previously developed as a golf course. Heavy equipment may cause temporary disturbance in adjacent areas beyond the footprint of construction. Repeated disturbance of vegetation (i.e., due to vehicle passes) during these activities would cause damage to plants and destruction of the vegetation mat. There would also be localized vegetation disturbance from foot traffic during construction. The overall impact on vegetation would be reduced by concentrating the area of disturbance to the smallest area necessary to complete the project.

Total vegetation disturbance/clearing from construction and installation of all project components would occur on approximately 10 acres (40,470 m^2).

Exotic plants or seeds could be brought to the site with fill material or on equipment. New introductions could allow for exotic plants to become established and spread, especially in areas where the ground is newly disturbed by construction activities. Exotic plants currently growing in the area can also become established and spread on newly disturbed substrates. However, Best Management Practices (BMPs) would be employed to ensure that imported material does not contain exotic plant material.

- Obtaining gravel and fill for construction or maintenance from certified noxious weed-free sources. Gravel pits and fill sources would be inspected to identify weed-free sources.
- Limiting the area of disturbance. For example, heavy construction equipment would be kept on road surfaces to the extent possible.
- Monitoring and removing any invasive species observed subsequent to project completion.

As no critical habitats or federally listed plant species exist in the vicinity of the project area, there would be no impacts on threatened or endangered species.

The unlikely event of leakage of injected CO_2 to the surface could pose detrimental effects on vegetation near or at some distance from the project area. Although atmospheric CO_2 promotes plant growth, increased concentrations in the soil could lead to root asphyxiation and plant death

(International Energy Agency, 2007). Impacts of seepage on on-shore ecosystems could also include altered biological diversity and changes to the composition and numbers of species in the local environment. The range of effects on terrestrial ecosystems could extend to entire ecosystems and could be chronic, acute, or lethal depending on species affected and concentrations of CO_2. However, aerial imaging of the injection site would monitor vegetative conditions to validate integrity of seal formation, injection well, and other potential migration pathways to the biosphere. Any irregularities, such as dieback, that are detected would trigger remediation measures.

Any changes to native vegetation would be limited to a small area and would not affect the viability of the resources. Full recovery would occur in a reasonable time, considering the size of the project and the affected resource's natural state. Therefore, impacts on terrestrial vegetation would not be expected to exceed the significance threshold.

4.5.3 Effects of No-Action

Under the No-Action alternative, the proposed project would not be implemented. No impacts to terrestrial vegetation would occur as a result of this alternative.

4.5.4 Cumulative Effects

Vegetation in the ADM complex has been previously cleared for ADM industrial development and agricultural practices, including the related MGSC project. These activities have involved removal, trampling, or destruction of vegetation and disturbance of ground cover. Any vegetation disturbance associated with the proposed project would occur in previously disturbed areas or areas devoid of any vegetation. It is also possible that an unlikely leakage of CO_2 to the surface would have wider spread consequences on vegetation. Overall, cumulative impacts from the proposed project when added to other past, present, and reasonably foreseeable future actions, including less than one acre of disturbance for the injection well and less than 0.5 acres disturbance for each of four monitoring wells for the related MGSC project, would be minimally adverse and are not expected to exceed the threshold of significance.

4.6 Wildlife

4.6.1 Description

Common mammals that occur in rural areas near Decatur, Illinois, include white-tail deer, groundhog, skunk, mink, red and gray fox, and river otter. Common birds include Canada goose, owls, hawks, turkey vulture, and mourning dove. Reptiles include snapping turtle, spotted turtle, timber rattlesnake, western fox snake, eastern milk snake, and bull snake.

No critical habitat exists in the vicinity of the project site or in Macon County. One federally listed wildlife species, the Indiana bat (*Myotis sodalis*) - endangered, and two Illinois state listed endangered species, upland sandpiper (*Bartramia longicauda*) and Bewick's wren (*Thryomanes bewickii*), occur in Macon County (USFWS, 2009b; IDNR, 2008). Of these species, only the Bewick's wren has been documented as occurring approximately one mile south of the project site. A review of the USFWS technical assistance website (USFWS, 2009c) on January 26, 2010 for federally listed threatened and endangered species resulted in a conclusion that the proposed project would have “no effect” on listed species, their habitats, or proposed or designated critical habitat.

4.6.2 Effects of ADM’s Proposed Project

Activities for construction of the CO_2 compression-dehydration facility, installation of an injection well and pipeline, vehicle traffic, lighting during night work, and human presence would cause temporary displacement and disturbance of resident wildlife for the 2.5-year duration of the project. Species are expected to return to the area after construction and injection is completed, although there may still be some minimal disturbance during the duration of post injection monitoring. These impacts would be localized and limited to the immediate area of the project area.

It is estimated that approximately 10 acres of wildlife habitat would be disturbed by installation of an injection well and pipeline. A 300 foot by 300 foot area around the injection well would be disturbed by installation of facilities and improvements as described in Section 2.1.2.7. The injection well pad and the surrounding operations area would disturb a total of approximately four acres (16,187 m^2), on which there would be very little, if any, wildlife habitat. Installation of the verification well would disturb a very small area around each well, probably less than 0.5 acre total, on which there would be very little, if any, wildlife habitat. Construction of the 5,290-foot pressurized pipeline would be aboveground for most of its length, following the current pipeline alleys at the Decatur ADM Complex as much as possible; a small portion would be co-located with steam lines in an easement on the property of Richland Community College. Thus, pipeline construction would not likely disturb more than 1 acre on which there would be very little, if any, wildlife habitat. Installation of 1,224 feet of 24-inch pipe carrying uncompressed CO_2 would also disturb wildlife habitat along its length. A new 30,000 square feet compression/dehydration facility would be constructed near the north boundary of the ADM complex. A new 500 ft by 500 ft electrical substation is proposed on the former golf course land owned by ADM that is east of the primary industrial complex. The footprint for this facility would be 250,000 ft^2. All wildlife habitat on these two building sites would be disturbed and/or destroyed.

As no critical habitats or federally listed animal species exist in the vicinity of the project area, there would be no impacts on threatened or endangered species.

The unlikely event of leakage of injected CO_2 to the surface could pose detrimental effects on wildlife near or at some distance from the project area. Effects of a leak would decrease in severity in a series of concentric rings, with those organisms closest to the leak suffering from acute or even lethal concentrations of CO_2 (International Energy Agency, 2007). Changes in subsurface biogeochemical processes could lead to changes in soil pH with associated negative effects on microbial populations, leading to a change in nutrients present, which would progress up the food chain. Changes in the quality of groundwater would have serious consequences on water resources. Both food chain and water resource impacts would likely have detrimental effects on animal health. Additionally, prolonged exposure to high CO_2 concentrations may result in increased risk of asphyxiation for some wildlife (International Energy Agency, 2007).

Any impacts on wildlife from the proposed project would be limited to a small portion of the population and would not affect the viability of the resource. Full recovery would occur in a reasonable time, considering the size of the project and the affected species' natural state. Therefore, impacts on wildlife would not be expected to exceed the significance threshold.

4.6.3 Effects of No-Action

Under the No-Action alternative, the proposed project would not be implemented. No impacts to wildlife would occur as a result of this alternative.

4.6.4 Cumulative Effects

Wildlife and habitat in the project area have been, and continue to be, subject to disturbance and damage by ADM industrial development and activities, and agricultural practices, including the recent development of the related MGSC project. Habitat disturbance associated with new infrastructure as part of the proposed project would be limited, and wildlife displacement and disturbance would be temporary, lasting only for the duration of the construction, injection, and monitoring period. It is also possible that an unlikely leakage of CO_2 to the surface would have more widespread consequences on wildlife and habitat. Cumulative impacts from the proposed project when added to other past, present, and reasonably foreseeable future actions, including the related MGSC project, would be minimally adverse and are not expected to exceed the threshold of significance.

4.7 Land Use

4.7.1 Description

The ADM ICCS Site would be located near Decatur, Illinois, within Macon County. The injection site and most of the project improvements are located entirely within the large Decatur ADM Complex that is owned and managed by ADM. A 200-foot portion of the pressurized 8-inch pipeline is located within an easement on Richland Community College property. A proposed education center is located on Richland Community College property and will ultimately be owned and managed by the college. ADM is one of the world's largest processors of soybeans, corn, wheat, and cocoa. ADM is a leading manufacturer of biodiesel, ethanol, soybean oil and meal, corn sweeteners, flour, and other value-added food and feed ingredients (DOE, 2008).

The Decatur ADM complex consists of various processing facilities including cogeneration and a corn wet milling plant with ethanol production, which would be the sources of CO_2 for this project. Additional primary facilities include bio-products, oilseed processing, and vegetable oil refining.

Nearby properties and/or land uses include Richland Community College; Caterpillar, Inc.; industry-related commercial businesses; and a private farm (Figure 2.1.1-2). Macon County and the City of Decatur have developed and implemented a comprehensive plan in July 2009 that establishes existing and compatible future land uses. The proposed project area with its industrial land use is consistent with the recently adopted City/County comprehensive plan (Decatur, 2009).

Land utilized for the proposed ADM compression/dehydration facility and much of the pipeline construction are either visibly industrial in nature or are planned for industrial development, which is in concert with their industrial designation as part of the Decatur ADM Complex. The injection well area and the pipeline are also within the Decatur ADM Complex, except for a 200-foot segment of the pipeline that passes through an easement on the property of the Richland Community College. The land utilized for the electrical substation is a former golf course. The land was previously purchased by ADM to accommodate expansion, as represented here by the electrical substation. The Decatur ADM Complex is a secured and fenced area that would also include the compression/dehydration facility and the injection well sites once this project commences.

The Drummer silty clay loam (152), Flanagan silt loam (154A), Proctor silt loam (148B), Catlin silt loam (171B) and Dana silt loam (56B) have all been identified at the project site based on the Soil Survey of Macon County (Figure 4.2.1-2)(DOE, 2008). All of these soils are considered characteristic of prime farmland.

Project design parameters indicate that if the injected CO_2 plume would migrate off site, it would take several years. ADM is aware of the legal and mineral rights issues should the plume move off site and when work begins on Phase 2, ADM would take necessary steps to secure mineral rights and additional permitting and requirements specified by law.

An agricultural ground cover is planned surrounding the areas where the injection well would be located.

4.7.2 Effects of ADM's Proposed Project

The proposed project would slightly expand the visual and physical industrial character of the very large Decatur ADM Complex while remaining almost entirely within existing ADM property. The current Decatur ADM Complex developed property size is 300 acres (1,214,057 m^2) while the proposed facility and injection well site would be almost 5 acres. Current industrial land use designations would be unaffected by this project. Though the proposed injection well site is industrial property, there have been past uses there that were agricultural, including an annual agricultural exhibition that has resulted in some simple structures that remain on the site. With the exception of a 300 foot by 300 foot area for injection well surface improvements, the injection well area that is disturbed would be replanted in agricultural ground cover, retaining much of the agricultural appearance of this area of the project and minimizing any effects on identified prime farmland resources.

New elevated pipelines required by the project are planned to follow existing elevated pipe corridors on Decatur ADM Complex property, except for the portion beyond the entry into the easement on the Community College property, which would be placed underground.

The ADM compression/dehydration facility would be set adjacent to other heavy industrial uses featuring cooling towers and other plant facilities and equipment that are typical of this type of industrial facility. The appearance and operation of this part of the project would be compatible with its immediately surrounding land uses.

The ADM compression/dehydration facility and pipeline will be built almost entirely within the Decatur ADM Complex (excluding the pipeline easement on the Community College property) and will be integrated with the control of ADM's processing facilities. ADM may choose to continue operation of the compression/dehydration facility, pipeline, and injection well after the proposed DOE project is complete. That decision will be based on value of that operation with respect to greenhouse gas mitigation laws that may come into effect between now and 2014 at the conclusion of the project. Should requirements for emissions reductions applicable to companies like ADM be adopted, then ADM may continue operations consistent with permitting requirements for geological sequestration that may be in effect at that time and considering the relative value of the facility with respect to other options available to the company.

Should ADM choose not to operate the facility, the disposition of the equipment will be made in accordance with regulatory requirements and project closeout options available to ADM and to DOE in view of DOE's role in supporting the ADM ICCS Site. Equipment that is readily moved may be salvaged and other installed components, such a concrete foundation slabs and buried pipeline segments, may be put to other uses within the Decatur ADM Complex. The injection well would be plugged in accordance with the UIC permit issued at the time of its initial operation.

Pore space rights may be necessary if the injected plume migrates offsite. ADM is aware of this need and would take required steps when that becomes necessary.

The effects of the proposed project are that land use impacts would be limited to a small area and would not noticeably alter any particular land use at the ICCS site or in adjacent areas. The affected areas would fully recover in a reasonable time once the project is completed. Therefore, the impacts to land use from implementing the proposed project are not expected to exceed the significance threshold.

4.7.3 Effects of No-Action

Under the No-Action alternative, the ADM ICCS Site work would not be implemented. No impacts to land use would occur because of this alternative.

4.7.4 Cumulative Effects

No additional land use development is currently planned near the project outside of Decatur ADM Complex property (DOE, 2008). ADM has no major development planned beyond routine expansion of current plant facilities (ADM, 2010d) and the recently completed MGSC project. This project would expand industrial development in a predominately industrial land use area, so cumulative impacts would be negligible with regard to most unplanned development that may occur in this area and should be considered compatible with the current industrial character of the project area, and especially the related and similar MGSC project.

4.8 Socioeconomic Resources

This section describes the socioeconomic conditions that may be affected by implementation of the proposed project and addresses any potential impact that may result.

4.8.1 Population

4.8.1.1 Description

The project site would be located on the east side of the metropolitan area of Decatur, Illinois, and is primarily contained by the existing ADM industrial complex. Within the corporate limits of the City of Decatur, the project area would be surrounded by a mixture of industrial and agricultural land with some residential and commercial properties located in the area, but substantially removed from the site proper. With a 2009 estimated population of 73,799 residents (Census, 2009a), Decatur is the county seat and also the largest city in Macon County.

The city is part of the larger Decatur Metropolitan Statistical Area, which had an estimated population of 108,204 in 2009 (Census, 2009b). Incorporated communities within a 15 mile (24.14 km) radius of Decatur include: Argenta – population 825; Forsyth – population 3,007; Harristown - population 1,236; Long Creek - population 1,342; Macon - population 1,128; Mount Zion - population 5,232; Oreana - population 814; and Warrensburg - population 1,160 (Census, 2009c). Block data (Census, 2000a) for the area immediately surrounding the project site indicate a total of 51 residents living in 19 housing units, with an occupancy rate of 100 percent. Despite the predominately urban character of the Decatur region, 46.3 percent, or nine of the residential units in the areas neighboring the project site are classified by the U.S. Census as rural.

The 2009 estimated population for the city of Decatur, 73,799 shows a 9.8 percent decline from the 2000 population of 81,860, continuing a trend from the previous decade in which the city declined from its 1990 population of 83,885 (Census, 2008a). In 2009, Decatur supported a total of 37,657 housing units with a median value of $77,000 (Census, 2009b). The occupancy rate for all units in the city was 84.2 percent. The average population density for the metropolitan area of Decatur is 1,799 persons per square mile (2,589,988 m^2), with a housing density of 918.5 units per square mile (2,589,988 m^2) (Census, 2000b). The median age of Decatur residents, 37.2 years, is slightly lower than that for the surrounding county, 39.7 years. Approximately 25.3 percent of the population is 19 years old or younger, with 6.8 percent under the age of five and 16 percent aged 65 and over (Census, 2009a).

The estimated population of Macon County in 2009 was 108,204 residents; a slight decrease of 5.7 percent from the 2000 total of 114,706 (Census, 2009d). In 2009, there were a total of

52,509 housing units in the county, with an occupancy rate of 86.9 percent and an estimated average density of 90.4units per square mile (2,589,988 m^2). Population density for this year was estimated to be 186.4 persons per square mile (2,589,988 m^2) (Census, 2000b). Residents aged 19 years and younger represented 25.4 percent of the total population. Children under five years of age account for 6 percent of the county's population and persons 65 years of age and older make up 16.3 percent of the population (Census, 2009e).

4.8.1.2 Effects of ADM's Proposed Project

Implementation of the proposed project would have only a minor, if not negligible, effect on the size and demographic characteristics of the local population. Any additional, permanent full-time employment generated as a result of this alternative would be minimal. Labor requirements would be temporary and limited to the construction of the well, pipeline, education center, substation, and compressor facilities. Estimates for the additional workforce required at the site range from 200-220 personnel during peak construction, estimates indicate that approximately 800 jobs will be created during the projects 5-year period. This temporary increase would be easily accommodated by existing local resources.

ADM's proposed project would be in keeping with the industrial character existing in the project area and would not introduce any new or incompatible uses. The proposed ICCS site would be located primarily within the existing Decatur ADM Complex boundaries with the exception of a 200-foot length of pipeline that lies within an easement on the Richland Community College property and an education center that is operated by and will eventually be owned by Richland Community College. No additional land outside the existing footprint would be needed. As a result, no substantial impact would be associated with the potential to change the community character and setting, demographic composition, or housing availability beyond that already existing under ADM's current operation. Therefore, the impacts from implementing the proposed project are expected to be below the significance threshold.

4.8.1.3 Effects of No-Action

The No-Action alternative would mean that DOE funds would not be used to support the proposed drilling, construction, and monitoring and data collection activities on the project site. In the absence of DOE funding, the proposed alternative would not proceed. Correspondingly, no change would occur in the existing condition, and the current management of the site would continue. No changes to local demographic composition or community setting and character would be anticipated under this alternative. Any future changes in the use or infrastructure of the site would be dependent on ADM short and longer-term corporate planning and any specific future use determinations for the project site that may derive from that process. Therefore, the impacts from implementing the No-Action alternative are expected to be below the significance threshold.

4.8.1.4 Cumulative Impacts

The introduction of the proposed ICCS site operation would not be expected to account for any noticeable changes in the size or demographic characteristics of the local population and would not contribute to any substantial changes in local community character and setting. As in this project, the small population increases as a result of the related MGSC project were temporary and are not considered additive to the small temporary increases from this project. When considered in combination with ADM's current and proposed management of the existing site and the future site condition, including the related MGSC project, the cumulative effects would be expected to be minor and are not expected to exceed the threshold of significance.

4.8.2 Employment and Income

4.8.2.1 Description

The local economy of the City of Decatur is characterized by a combination of heavy and light industries along with large-scale agricultural production and services. Farming and farm-related occupations continue to be a major source of employment in the Macon County area. Per capita personal income for the city of Decatur in 2008 was $23,290. Employment statistics for the year indicate that the city supported a total civilian labor force of 36,121 workers, with an unemployment rate of 6.9 percent or 2,492 workers. The largest occupational categories included: management, professional, and related occupations, with 9,719 workers, or 28.9 percent of the workforce; sales and office occupations, with 9,624 workers or 28.6 percent of the workforce; and service occupations with 6,040 workers, or 18.0 percent of the total. Median household income in 2006 was $39,394 (Census, 2008b).

The leading employment sectors for Macon County in 2008 were manufacturing, with 19.1 percent of total employment; health care and social assistance, with 24.4 percent; and retail trade, with 11.7 percent of the total (Census, 2008c). Employment statistics for November 2009 indicate that the county supported a total labor force of 54,472 workers, with an unemployment rate of 12.6.percent, or 6,872 workers. This represents an increase of 5.4 percent from the 2008 annual average unemployment (BLS, 2010). The per capita personal income in 2008 was $25,912 (Census, 2008c). Median household income for 2008 was $45,649 (Census, 2008c). A summary of income distribution by household is presented in Table 4.8.2.1.

Table 4.8.2.1. Household Income for 2008

	Number	Percent
Less than $10,000	2,712	5.9%
$10,000 to $14,999	2,803	6.1%
$15,000 to $24,999	5,497	12.0%
$25,000 to $34,999	6,520	14.2%
$35,000 to $49,999	7,936	17.3%
$50,000 to $74,999	8,639	18.8%
$75,000 to $99,999	6,106	13.3%
$100,000 to $149,999	3,336	7.3%
$150,000 to $199,999	981	2.1%
$200,000 or more	1,429	3.1%
Total Households	**45,959**	**100%**

Source: (Census, 2008c).

4.8.2.2 Effects of ADM's Proposed Project

Implementation of the proposed project would be expected to have only minimal effect on the local economy, labor conditions, and the availability of production or consumer resources in the surrounding community. Permanent, longer term labor requirements for operation, monitoring, and maintenance of the proposed facility would not be expected to be substantial and could easily be accommodated by ADM's existing labor force or from the available local labor force.

Labor requirements for the construction of an injection well, pipeline, education center, substation, and capture facilities would be temporary and of short duration. These requirements represent skill areas that could be accommodated by ADM's existing workforce or from the larger Decatur and Macon County workforce without major impact or stress to existing labor availability in the area. As a result, no substantial change in regional employment would be anticipated. However, the local labor market has experienced a sharp increase in unemployment during the past 18 months. Temporary employment associated with the proposed alternative would result in a minor beneficial impact to the creation of new employment in the local area.

Funding for this project is estimated at approximately $208 million. The local economy of the City of Decatur and surrounding Macon County is sufficient to capture much of this additional spending. This represents a potential beneficial impact to the local economy in the form of wages and salaries paid to local workers and income to local commercial entities providing goods and services. However, it is likely that at least a portion of project expenditures might be spent outside the local economy for labor, goods or services not locally available, so that the actual benefit would probably be somewhat less.

Resource requirements for the project would not be expected to result in substantial changes in the provision of infrastructure and other services to local residents. Since the ADM plant produces its own electricity, additional demand created by the proposed alternative would not impact industrial or residential users in the local area. Similarly, water requirements would be within existing capacity and wastewater would be directed to the wastewater treatment facility or the water-reuse system that currently exists for the Decatur ADM Complex. No additional impact on supply or rate structure would be anticipated for local users in the surrounding community. Therefore, the impacts from implementing the proposed project are expected to be below the significance threshold.

4.8.2.3 Effects of No-Action

In the absence of federal funding, the proposed project would likely not proceed. ADM's current management and operations at the project site would be expected to continue unchanged. As a result, no change would be expected to occur in the existing condition or uses of the project site. Current trends in employment, production, and commercial activity would be expected to continue in their present pattern with no additional direct or indirect impact to the local economy. Therefore, the impacts from implementing the No-Action alternative are expected to be below the significance threshold.

4.8.2.4 Cumulative Impacts

The introduction of the proposed project to other planned or reasonably foreseeable actions at the study site or in the surrounding area, including the recently completed and related MGSC project, would be expected to have only a minor effect on the local economy. As described in Chapter 2, ADM's proposed project would have minimal or no adverse impact on local employment or the availability and cost of local resources and services in the Decatur or larger Macon County economy. The use of these resources for the related MGSC project has already occurred and so are not cumulative when considered relative to the current ADM project.

Therefore, it would not be expected to contribute to any cumulative effect. Some potential benefit would be derived from the small additional labor requirement and from additional expenditures in the local economy associated with the proposed project. These benefits could be experienced without adverse consequences and would not alter the existing condition or contribute substantially to the cumulative effect.

4.8.3 Infrastructure

4.8.3.1 Description

The ICCS Project Site would be located in an industrial area adjacent to the urbanized area of Decatur. The road system in the surrounding region is a combination of intra-urban and rural roads. To the north, the carbon capture site is bounded by Reas Bridge Road (Rd.) (Illinois (IL)-24). North Brush College Rd. (IL-1) forms the western boundary of the project site. To the east and somewhat removed from the project site boundary, Gun Club Road joins Christmas Tree Road to intersect with Reas Bridge road approximately one-half mile from the northeastern corner of the project site. To the south, the Decatur ADM Complex supports a network of service roads of varying capacity.

Traffic volume studies for the segment of North Brush College Road running north from the intersection at Faries Parkway indicate an average daily volume of 11,300 vehicles, increasing to 20,700 vehicles by 2025. The current daily truck traffic into and out of the Decatur ADM Complex is estimated at approximately 1,750 trips (DOE, 2008).

There are no utility transmission lines within the boundaries of the project area, apart from those servicing ADM facilities. A pipeline right-of way crosses the southeastern corner of the project site and continues south along the site border to the Decatur ADM Complex. A freight rail line of the Illinois Central Railroad crosses east to west in the area between the compression-dehydration facility and the injection well. A spur connects this line to the Decatur ADM Complex.

The project will draw electrical power from an onsite electrical power plant that would be supplemented by power from the local grid. The electrical substation and power line construction is proposed in this project to enable provision of power from the local grid. The substation will be located on ADM property and the power lines will be located either on ADM property or in utility easements acquired from property owners.

4.8.3.2 Effects of ADM's Proposed Project

ADM's proposed project would not substantially alter existing traffic patterns, level of congestion, or road conditions in the immediate and surrounding area of the project site. Typical increases in traffic that might result from the proposed project are presented in Tables 4.8.3.2-1, 4.8.3.2-2, and 4.8.3.2-3 below.

Table 4.8.3.2-1. Well Construction Transport Estimate for the Injection Well

Description of Transport	Number*	Type of vehicle
Movement of rig & components to site	39-56 loads	flatbeds
Normal delivery of mud chemicals, bits,	4	flatbed
Visits by ADM, Illinois State Geological Survey (ISGS), etc.	10	cars/trucks
Cementing trucks	4	pump trucks & cement bins
Logging trucks & tools	2	logging trucks w/tools
Drill pipe, jars, drill collars, etc.	3	flat beds
20 inch casing	3	flat beds
13 3/8 inch casing	7-9	flat beds
9 5/8 inch casing	11-13	flat beds
Crew changes, daily for rig personnel	3	cars or vans
Vacuum trucks, waste disposal trucks, etc.	2	vacuum trucks
Casing running, lay down machines	5	2 Short Ton + 4 flatbeds
Other miscellaneous trucks, vehicles	4	F150's, cars, vans
* Number of vehicles per week or number of loads		
Note: Traffic will peak during set-up, mobilization & demobilization, cementing & logging runs as well as when running pipe		

Adapted from: (Schlumberger, 2008).

Table 4.8.3.2-2. Transport Estimate for the Substation Construction

Description of Transport	Number*	Type of Vehicle
Movement of grading equipment & equipment trailers	10 loads	flatbeds
Delivery of ground cover	20 loads	Dump Trucks
Visits by ADM, etc.	10	cars/trucks
Cementing trucks	10 loads	pump trucks
Building	2	flat bed
Fencing Materials	2 loads	flat beds
Fencing Crews	2	cars/trucks
Materials-Poles, wire, equipment, etc..	20 loads	flat beds
Crane	2 loads	flat bed & crane
Crew changes, daily for personnel	4	cars/trucks
Vacuum trucks, waste disposal trucks, etc.	2	vacuum trucks
Ameren Personnel daily	3	trucks/utility trailer
Other miscellaneous trucks, vehicles	4	F150's, cars, vans

Table 4.8.3.2-2. Transport Estimate for the Substation Construction		
Description of Transport	**Number***	**Type of Vehicle**
* Number of vehicles per week or number of loads		
Note: Traffic will peak during set-up, mobilization & demobilization, cementing & gravel runs as well as when compaction of yard is complete.		

Source: (ADM, 2010e)

Table 4.8.3.2-3. Transport Estimate for the National Sequestration Education Center Building Construction		
Description of Transport	**Number***	**Type of vehicle**
Movement of grading equipment & equipment trailers	5 loads	flatbeds
Visits by ADM, etc.	10	cars/trucks
Cementing trucks	17 loads	pump trucks
Building-steel & misc. materials	6 loads	flat bed
Cranes, forklifts, aerial lift equipment, & etc.	4	flat bed & crane
Crew changes, daily for personnel	4	cars/trucks
Vacuum trucks, waste disposal trucks, etc.	2	vacuum trucks
Other miscellaneous trucks, vehicles	4	F150's, cars, vans
* Number of vehicles per week or number of loads		
Note: Traffic will peak during set-up, mobilization & demobilization also after building foundation completion.		

Source: (ADM, 2010e)

Any temporary increases in traffic during the construction phase would not be sufficient to cause a substantial change in conditions during these periods. No activities occurring at the project site would be likely to disturb power or other utility transmission lines in the area. Therefore, the impacts from implementing the proposed project are expected to be below the significance threshold.

4.8.3.3 Effects of No-Action

Operations at the existing Decatur ADM Complex are ongoing. In the event that the proposed project is not implemented, any subsequent effect on traffic flow and patterns would be considered part of the current traffic conditions in the area. No additional impact would be anticipated. There are no public utilities at the site which might be disturbed either under current conditions. Therefore, the impacts from implementing the No-Action alternative are expected to be below the significance threshold.

4.8.3.4 Cumulative Impacts

Cumulative impacts would not be anticipated in association with the proposed project. There are no planned or reasonably foreseeable actions for the project area which when added to the effect of the proposed project would substantially change local road use or traffic patterns. This is true also of the related MGSC project, the majority of whose potentially cumulative infrastructure demands have already occurred. There would be limited potential to alter or disturb power or other infrastructure services to the area as a result of the proposed project, but these potential impacts are not expected to exceed the threshold of significance.

4.8.4 Parks and Recreation

4.8.4.1 Description

Major facilities in the surrounding area include:

- Faries Park – a 7-acre (28,328 m^2) picnic and recreational area located approximately 1.8 miles (2.9 km) from the project site to the southeast.
- Nelson Golf Course and Park – a 45-acre (182,109 m^2) facility with picnic playground and sports facilities, located approximately three miles (4.83 km) to the southeast of the project site;
- Lions Park – a 2.5-acre (10,117 m^2) site that serves as a neighborhood park with picnic and court facilities, located approximately two miles (3.22 km) to the northwest of the project site; and
- Chandler Park – a 17.5-acre (70,820 m^2) lakefront park with picnic facilities, located approximately 2 miles (3 km) to the southwest of the project site (DOE, 2008).

4.8.4.2 Effects of ADM's Proposed Project

The addition of the injection well, pipeline, education center, substation, and compression/dehydration facility to the existing Decatur ADM Complex would generate negligible impact to recreational activities in the immediately surrounding area. No facilities exist in the immediate vicinity of the project site that might be disturbed by site activities. The proposed project would be in keeping with the existing industrial character of the project site and does not alter the existing setting or interfere with the user experience of more remotely located facilities. Therefore, the impacts from implementing the proposed project are expected to be below the significance threshold.

4.8.4.3 Effects of No-Action

Parks and recreational opportunities both nearby and in the larger Decatur area have historically existed along with ADM operations at the Decatur ADM Complex. No additional impact would be anticipated from continuing management practices or site activities. Therefore, the impacts from implementing the No-Action alternative are expected to be below the significance threshold.

4.8.4.4 Cumulative Impacts

The addition of the proposed project to ongoing activities at the Decatur ADM Complex, including the recently completed and related MGSC project, would have no substantial impact to the character, setting, or visitor experience associated with parks or other recreational opportunities in the immediately surrounding and larger Decatur communities.

4.8.5 Visual Resources

4.8.5.1 Description

There are no scenic vistas or aesthetic landscapes in the vicinity of the proposed project. The project site would be on the east side of Decatur, Illinois, and primarily within the Decatur ADM Complex. The ADM compression/dehydration facility would be located within the industrial complex to the south of the proposed injection well site. An electrical substation would be constructed on a former golf course adjacent to the industrial complex that is currently owned by ADM. An education center would be located on property belonging to the Richland Community College. The pipeline would travel from the compression/dehydration facility to the injection well following, as much as possible, an existing pipeline corridor that transports steam to Richland Community College.

4.8.5.2 Effects of ADM's Proposed Project

Under the proposed project, construction of a compression/dehydration facility (which is located immediately south of the MGSC injection well site on ADM property), an electrical substation, and education center, one injection well, various deep and shallow monitoring wells, and pipeline would minimally alter the visual elements of the project area, much of which are agricultural fields. In the area of the injection well, simple structures remain on the site from previous agricultural exhibitions that will continue to be conducted after the injection well is in place. However, facilities constructed under the proposed project would not contrast with the present landscape as industrial features are common in the immediate vicinity of the ICCS site.

The unlikely event of leakage of injected CO_2 to the surface could pose detrimental effects on terrestrial ecosystems, having impacts on visual resources if areas of vegetation are altered. Changes in species composition, frequency and density of plants, or vegetation dieback could alter visual elements in the landscape and viewsheds.

Overall, it is not likely that the proposed project would change the visual landscape in a way that would be objectionable to local residents or frequent visitors. Thus, impacts on visual resources would not be expected to exceed the significance threshold.

4.8.5.3 Effects of No-Action

Under the No-Action alternative, the ICCS Site work by ADM would not be implemented. No impacts to visual resources would occur because of this alternative.

4.8.5.4 Cumulative Impacts

Visual quality at the project site has been predominantly altered by the past ADM industrial development, including the MGSC carbon sequestration project. Agriculture, residential, and other ongoing industrial activities have also affected the visual quality of the surrounding area. Given the larger impacts to visual resources from past, present, and future activities, and the similar character of the nearby MGSC project, cumulative impacts added from the proposed project would be minimally adverse and are not expected to exceed the threshold of significance.

4.8.6 Noise

Noise is defined as any sound that is undesirable because it interferes with communication, is intense enough to damage hearing, or is otherwise intrusive. Human response to noise varies depending on the type and characteristics of the noise, distance between the noise source and the receptor, receptor sensitivity, and time of day. Noise is often generated by activities that are part of everyday life, such as construction or vehicular traffic.

Sound varies by both intensity and frequency. Sound pressure level, measured in decibels (dB), is used to quantify sound intensity. The dB is a logarithmic unit that expresses the ratio of a sound pressure level to a standard reference level. Hertz (Hz) are used to quantify sound frequency. The human ear responds differently to different frequencies. A-weighting, described in a-weighted decibels (dBA), approximates this frequency response to express accurately the perception of sound by humans. Sounds encountered in daily life and their approximate level in dBA are provided in Table 4.8.6-1.

Table 4.8.6-1. Common Sounds and Their Levels

Outdoor	Sound level (dBA)	Indoor
Snowmobile	100	Subway train
Tractor	90	Garbage disposal
Noisy restaurant	85	Blender
Downtown (large city)	80	Ringing telephone
Freeway traffic	70	TV audio
Normal conversation	60	Sewing machine
Rainfall	50	Refrigerator
Quiet residential area	40	Library

Source: (Harris, 1998).

The dBA noise metric describes steady noise levels. However, very few noises are, in fact, constant; therefore, a noise metric, Day-night Sound Level (DNL) has been developed. DNL is defined as the average sound energy in a 24-hour period with a 10-dB penalty added to the nighttime levels (10 P.M. to 7 A.M.). DNL is a useful descriptor for noise because it averages ongoing yet intermittent noise, and it measures total sound energy over a 24-hour period. In addition, Equivalent Sound Level (Leq) is often used to describe the overall noise environment. Leq is the average sound level in dB.

The Noise Control Act of 1972 (Public Law 92-574) directs Federal agencies to comply with applicable federal, state, interstate, and local noise control regulations. In 1974, the USEPA provided information suggesting that continuous and long-term noise levels in excess of DNL 65 dBA are normally unacceptable for noise-sensitive land uses such as residences, schools, churches, and hospitals.

The State of Illinois's Environmental Protection Act of 1985 limits noise to levels that protect the health, general welfare, and property. The State of Illinois limits the noises in individual frequency ranges at noise sensitive land uses (Table 4.8.6-2) (35 IAC H.901.101) (IL, 2008). There are no maximum overall levels outlined in the regulation. In addition, Decatur has a local noise regulation as part of the zoning code that states it is unlawful to generate sound louder than 80 dBA at the property line (Decatur Zoning Code Section XVII Subpart D) (Decatur, 2008b). Sounds generated from construction activities are exempt from both the state and local regulations.

Table 4.8.6-2. State of Illinois Environmental Noise Standards

Octave Band Center Frequency (Hz)	Allowable Octave Band Sound Pressure Levels (dB) of Sound Emitted to Noise Sensitive Land Uses		
	Industrial Source	Commercial Source	Residential Source
31.5	75	72	72
63	74	71	71
125	69	65	65
250	64	57	57
500	58	51	51
1000	52	45	45
2000	47	39	39
4000	43	34	34
8000	40	32	32

Sources: (IL, 2008; Decatur, 2008b).

4.8.6.1 Description

The Decatur ADM Complex and adjacent areas are primarily mixed use industrial and recreational with Faries Park recreational complex to the east, and a community college to the north, and a rail station to the south of the project area. The nearest noise sensitive area (NSA) is a community college north of the Decatur ADM Complex. Existing sources of noise at NSAs near the Decatur ADM Complex, compressor location, and drilling site include rail traffic traveling east of the Wabash Rail Station, local road traffic, high-altitude aircraft overflights, and natural noises such as leaves rustling, and bird vocalizations. It is also possible that industrial noise contributes to overall noise environment outside of the facilities property boundary. For analysis purposes, the NSAs surrounding the facility have been categorized as quiet suburban residential areas. This would constitute the worst case existing noise conditions. The noise environment consists of light traffic conditions where no mass transportation vehicles and relatively few automobiles and trucks pass. The background sound either is distant traffic or is difficult to identify by residents.

Table 4.8.6.1. Estimated Existing Noise Levels at Nearby Noise Sensitive Areas							
	Closest Noise Sensitive Area (NSA)				Estimated Existing Sound Levels (dBA)		
Site	Distance	Direction	Type	Land Use Category	DNL	Leq (Daytime)	Leq (Nighttime)
Drilling Site	860 ft 261 m	West	School	Quiet Suburban Residential	55	53	47
Compressor Site	2,500 ft 790 m	North					

Source: (ANSI, 2003).

4.8.6.2 Effects of ADM's Proposed Project

Short-term and long-term minor adverse effects to the noise environment would be expected with the implementation of the proposed project. The effects would be primarily due to heavy equipment noise during construction and drilling, and the operation of the proposed compressor. This evaluation considers significant sound sources that could affect NSAs.

Construction Noise. There would be some form of moderate to heavy construction at the Decatur ADM Complex and the well locations. Individual pieces of construction equipment typically generate noise levels of 80 to 90 dBA at a distance of 50 feet (15.2 m). Table 4.8.6.2-1 presents typical noise levels (dBA at 50 feet (15.2 m)) that USEPA has estimated for the main phases of outdoor construction.

Table 4.8.6.2-1. Noise Levels Associated with Outdoor Construction	
Construction Phase	Leq (dBA) at 50 feet (15.2 m) from Source
Ground Clearing	84
Excavation, Grading	89
Foundations	78
Structural	85
Finishing	89

Source: (USEPA, 1974).

With multiple items of equipment operating concurrently, noise levels can be relatively high during daytime periods at locations within several hundred feet of an active construction sites. The zone of relatively high construction noise levels typically extends to distances of 400 to 800 feet (122 to 244 m) from the site of major equipment operations. Locations within 1,000 feet (305 m) would experience substantial levels (greater than 62 dBA) of construction noise. There are no NSAs within 1,000 feet of the construction sites except for the proposed education center. Although the existing college is within 1,000 feet of the proposed education center, building of the education center would be temporary and end with the construction phase. These effects would be minor. Construction activities are exempt from both the state and local regulations.

These effects would be temporary and would be considered minor. The following BMPs would be used to reduce these already limited effects:

- Construction would predominately occur during normal weekday business hours in areas adjacent to noise-sensitive land uses such as residential areas; and

- Construction equipment mufflers would be properly maintained and in good working order.

Drilling Noise. ADM's Proposed Project would involve drilling operations for the injection well. Components of the drilling equipment include the drill rig, mud pumps, and diesel generators. The generator and combined diesel driven systems would have the standard exhaust muffles. Noise from heavy equipment would be temporary and end with the drilling phase. Drilling equipment is expected to operate twenty-four hours per day, seven days per week, for up to six months. The noise would be clearly audible at the nearest NSA 860 feet (261 m) west of the injection well location. At this distance, the DNL would be approximately 62 dB. These levels would be below the threshold for land use incompatibility for long-term noise sources. Noise levels within the buildings would be significantly less, and unlikely to interfere with classroom operation. Although unlikely, if the drilling noise became loud enough to interfere with normal levels of verbal communication inside the buildings, sound barriers would be effective in reducing noise levels. Due to the short-term nature of the drilling activities, and given the primary function of the college is indoors, these effects would be minor under NEPA.

Drilling noise would be expected to dominate the soundscape for all on-site personnel. Personnel, and particularly equipment operators, would utilize adequate personal hearing protection to limit exposure and ensure compliance with federal health and safety regulations.

Operational Noise. The compressor facility is in the preliminary design stages. Therefore, a complete equipment list and associated manufacturers specifications is not finalized. The only major noise-producing equipment would be four 3,250 horsepower (hp) reciprocating compressors, two 2,000 hp blowers, and two 500 hp multistage pumps. Only one pump and one blower would be operated at a time. The compressors would be an order of magnitude louder than the proposed pumps or blowers and would mask them completely. The compressors would operate 24 hours per day, 7 days per week. Noise levels that would be generated by operation of the compressors at the nearest NSA have been compared to the levels outlined in the state and local noise regulation (Table 4.8.6.2-2).

Table 4.8.6.2-2. Compressor Noise Levels at Nearest NSA Compared to Noise Standards

Octave Band Center Frequency (Hz)	Allowable Sound Pressure Levels (dB)	Predicted Compressor Noise Levels	Exceeds Standard (Yes/No)
31.5	75	47	No
63	74	43	No
125	69	48	No
250	64	46	No
500	58	43	No
1000	52	44	No
2000	47	46	No
4000	43	33	No
8000	40	11	No
Leq (dBA)	80	50	No

Sources: (IL, 2008; Decatur, 2008b).

Because of the limited amount of noise and the distance to the nearest NSA, violations of neither the state nor the local noise regulations are expected. Special variances to the state or local noise ordinance, mitigation measures, or both would not likely be required. Overall, these effects would be considered minor. Therefore, the impacts from implementing the proposed project are expected to be below the significance threshold.

4.8.6.3 Effects of No-Action

The No-Action alternative would have no impacts to noise because no drilling would occur, and no additional equipment would be installed. Noise levels would remain at their existing levels.

4.8.6.4 Cumulative Impacts

ADM's Proposed Project would introduce long-term incremental increases in the noise environment. However, these increases would be relatively small when compared to the existing conditions, including the similar long-term compressor noise contribution of the related MGSC project, and would be considered minor.

4.8.7 Environmental Justice

Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations" (The White House, February 11, 1994), requires that Federal agencies consider as a part of their action any disproportionately high and adverse human health or environmental effects to minority and low income populations. Agencies are required to ensure that these potential effects are identified and addressed.

The USEPA defines environmental justice as "the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies." For purposes of assessing environmental justice under NEPA, the CEQ defines a minority population as one in which the percentage of minorities exceeds 50 percent or is substantially higher than the percentage of minorities in the general population or other appropriate unit of geographic analysis (CEQ, 1997).

Consideration of the potential consequences of the proposed project for environmental justice requires three main components:

- A demographic assessment of the affected community to identify the presence of minority or low income populations that may be potentially affected;
- An assessment of all potential impacts identified to determine if any result in significant adverse impact to the affected environment; and
- An integrated assessment to determine whether any disproportionately high and adverse impacts exist for minority and low-income groups present in the study area.

4.8.7.1 Description

For the environmental justice analysis, the immediate site vicinity is defined as those census blocks that contain a portion of the project area or immediately adjacent to the project area. In 2000, minority populations accounted for 17.5 percent of the total population of immediate site vicinity or a total of 9 residents (Census, 2000a). This is substantially lower than the minority percentage for the population of the City of Decatur as a whole. In 2000, minority population accounted for 22.3 percent of the city's total population or 18,331 individuals. Hispanic or Latino populations (of any race) represented 1.2 percent of the total, or 978 individuals. Socioeconomically disadvantaged individuals, those living at or below the poverty line, constituted 16.5 percent of the population or 12,999 individuals in 2000 (Census, 2006).

Minority populations made up approximately 15.2 percent of the total population of Macon County. Hispanic or Latino residents (of any race) constitute approximately one percent of the total population or 1,120 individuals. In 2000, there were 14,316 individuals living at or below the poverty level, or 12.9 percent of the population (Census, 2006).

4.8.7.2 Effects of ADM's Proposed Project

Minority and lower income groups are generally not present in the study area in significantly greater proportions than for the Decatur community as a whole and the larger Macon County area. Additionally, both direct and indirect effects to local populations, resources, and the character and setting of the local community would be anticipated to be minimal for all populations in the immediate study area and for the surrounding communities. Therefore, no disproportionately high or adverse impacts to minority or low-income communities would be expected.

4.8.7.3 Effects of No-Action

The present management of the project site by ADM would be expected to continue with no appreciable change to the existing activities at the Decatur ADM Complex. No disproportionate impact to minorities or low-income populations would be anticipated under the No-Action alternative.

4.8.7.4 Cumulative Impacts

The proposed project considered by this EA would add only minimally to existing conditions for environmental justice in the project area, which includes the related MGSC project, and surrounding communities. As a result, any incremental impact would not be expected to be sufficient to exceed the significance threshold and would most likely be experienced evenly across all populations.

4.9 Human Health and Safety

4.9.1 Description

Air pollution causes human health problems. Air pollution can cause breathing problems; throat and eye irritation; cancer; birth defects; and damage to immune, neurological, reproductive, and respiratory systems (USEPA, 2009b). National and state ambient air quality standards represent the maximum allowable atmospheric concentrations that may occur and still protect public health and welfare with a reasonable margin of safety (See Section 4.1). In addition, OSHA regulations specify appropriate protective measures for all employees.

Spills from the construction of the proposed project and its operation could also a source of possible impacts to human health and safety. Spills can introduce soil contamination and allow exposure pathways to workers and the public. The risks and effects of a spill depend on its composition and extent of pollution. A common material used in construction and operation that can be spilled is gasoline. Gasoline irritates the lungs and is a skin irritant. Enough gasoline exposure can cause death or nervous system damage (ATSDR, 2008). Similarly, waste management also is a source of possible human health and safety risks from exposure to contaminants (See Section 4.11).

CO_2 leaks are a concern to human health and safety within the project area. CO_2 is heavier than ambient air, colorless, and odorless, which makes it an invisible hazard (DOE, 2007a). Since it is denser than ambient air, leaked CO_2 will typically pool in hollows and confined spaces until dispersed by wind or other ventilation methods (DOE, 2007a; IPCC, 2005). CO_2 under pressure or at high concentration levels can cause suffocation and permanent brain injury from lack of air (DOE, 2007a). Headache, impaired vision, labored breathing, and mental confusion also can occur from CO_2 exposure. The pressure drop from CO_2 leaks from vessels (pipes) creates a cold hazard, and even the vapor can cause frostbite (IPCC, 2005). Generally, the pooling and large, rapid releases of the CO_2 are the situations of concern for human health and safety instead of small gradual leaks due to concentration level differences (IPCC, 2005; DOE, 2007a).

No general CO_2 exposure standards exist yet for the public (DOE, 2007a). The immediately dangerous level of exposure for CO_2 to life and health is 5% or 40,000 ppm. For up to several hours, exposure to 0.5 to 1.5% CO_2 in the air typically is not harmful for people with normal health. However, people with impaired health (such as cerebral disease), children, and people involved in complex tasks are more susceptible to the effects of CO_2 exposure. CO_2 exposure impedes people's performance of complex tasks by causing labored breathing, headache, and mental confusion. The occupational standard of maximum allowable concentration of CO_2 in air for eight hours of continuous exposure is 0.5%, and for a short period, it is 3.0% (IPCC, 2005).

Leaked CO_2 can cause human health issues in the water and in air. CO_2 underground injection can contaminate groundwater if the CO_2 migrates to underground aquifers (See Section 4.3). This contamination can occur when CO_2 causes mobilization of chemicals such as metals in the soil into the aquifers. Despite monitoring and permitting requirements (USEPA's UIC program), the risk to human health from potable water contamination still exists from underground injection. Similar to air emissions of CO_2, gradual releases of CO_2 into water sources typically do not cause substantial harm to human health, but rapid releases could (DOE, 2007a).

Between 1994 and 2006, there were 31 CO_2 pipeline accidents reported in the United States, but no injuries or fatalities (DOE, 2007c). Some historical causes of CO_2 pipeline incidences are relief valve failure (4 failures), weld/gasket/valve packing failure (3 failures), corrosion (2 failures), and outside force (1 failure). The incident rate from 1990 to 2002 for CO_2 pipelines in the U.S. was 0.0002 $mile^{-1}$ $year^{-1}$ (0.00032 km^{-1} $year^{-1}$) (IPCC, 2005). This rate of failure is comparatively small. For comparison with natural gas pipelines, see Table 4.9.1.

Table 4.9.1. Comparison of Natural Gas Pipelines to CO_2 Pipelines from 1995 to 2005

Category	Natural Gas	CO_2
Miles (km) of Pipeline	304,001 (489,242) (in 2003)	3,300 (5,311)
Number of Incidents	960	12
Property Damage per Incident	$484,000	$42,000
Injuries from Incidents	82	0
Fatalities	29	0

Source: (DOE, 2007a).

The workers on the project would be subject to the same types of health risks that are generally associated with their professions (DOE, 2007a). The most fatalities of any industry in the private sector in 2008 occurred in the construction industry with 404 deaths in 2008 (BLS, 2009a). The construction incident rate of total recordable cases of non-fatal occupational injuries and illnesses in 2008 was 4.7 per 100 full-time workers (BLS, 2009b).

4.9.2 Effects of ADM's Proposed Project

ADM's proposed project would include pipe installation; construction and operation of a compression-dehydration facility; construction and operation of an education center; construction and operation of an electrical substation; collection and transportation of CO_2; drilling of injection and observation wells; and injection of supercritical CO_2 (See Section 2.1). These could all present risks to human health and safety. The materials and equipment used for construction and operation would meet prescribed standards (DOE, 2008).

The equipment that would be used for the implementation of the proposed project represents only minimal risks to human health and safety under normal operating conditions (DOE, 2007a). Thus, if BMPs, maintenance, and regulations are followed, the equipment should pose little impact to human health and safety. Drilling into pressurized formations could release flammable gases like methane. Preventative measures to minimize well blowouts or venting of dangerous gases should be implemented. Measures to avoid the equipment failure caused by high pressure would be executed (DOE, 2007a). ADM's safety procedures will be updated as necessary for the new project components (ADM, 2010d).

Since almost all of the construction and operation of the proposed project is on ADM property, the increase in traffic from workers and delivery of equipment and materials should be partially limited to onsite, which reduces risk to pedestrians and the public. However, the proposed project would still represent an increase in traffic, which increases the potential for accidents. The current truck traffic in and out of the Decatur ADM Complex is approximately 1,750 trucks per day (DOE, 2008). The expected increase in the number of trips due to the proposed project from the current level of vehicle activity is minor. Thus, the impact to human health and safety from the increase in transportation is not expected to exceed the level of significance threshold (See Sections 4.8.1 and 4.8.3).

Air emissions from the proposed project are not anticipated to be regionally significant (See Section 4.1). Thus, the impacts to human health from air emissions would not be expected to exceed the significance threshold. Following mitigation measures and BMPs would reduce any impacts to human health from air quality. Further, workers would follow OSHA procedures, which would further reduce the impact to human health. The natural gas burning from the dehydration reboiler would produce limited air pollutants (ADM, 2010d). However, the proposed project only produces a very small amount of these air pollutants, and these are the same types and quantities as with any burning of natural gas. Thus, there would be a minimal risk to human health and safety. All necessary risk assessments would be conducted as part of the planning process and would be built on existing MGSC documentation as appropriate.

The soils are not highly erodible (See Section 4.2); therefore, water contamination from increased runoff, which could lead to human health and safety risks, is not a major issue (See Section 4.3). Further, the facility will soon begin the construction permit process for the construction storm water discharges (ADM, 2010d). Water collected during the dehydration of the CO_2 will be used for cooling tower make up water or send to the process water pretreatment plant. The pretreated water is subsequently sent to the City of Decatur Publicly Owned Treatment Works (DOE, 2008). Therefore, the overall effect of the proposed project to surface water quality is expected to not exceed the significance threshold.

The only hazardous or toxic material used in the proposed project is CO_2 (ADM, 2009a). Thus, if safety procedures and BMPs were followed, spills and leaks from equipment and processes (other than CO_2) would be of low concentrations as well as nonhazardous and not toxic. This would represent a low risk to human health and safety (DOE, 2007c). Under normal conditions, hazardous and toxic materials can be used safely when appropriate safety precautions are followed (DOE, 2007a). Thus, the minimal concentrations of VOCs in the collected CO_2 should be a minimal risk to human health and safety. All necessary risk assessments would be conducted as part of the planning process and would be built on existing MGSC documentation as appropriate. All personnel would wear safety gear appropriate to the materials handled (ADM, 2010d).

The design of the proposed project's MVA plan would be to avoid, detect, and correct any unintended CO_2 emissions (ADM, 2009a). The Eau Claire Formation, the Mt. Simon Sandstone, and the thick shale units present at the proposed injection site make groundwater contamination highly unlikely (DOE, 2008). However, groundwater monitoring would still occur to detect problems and initiate corrective action, if necessary. The groundwater monitoring would include testing for metals, ammonia, CO_2, pH, dissolved oxygen, and other possible contaminants (ADM, 2010d) (See Section 4.3). This would allow for early detection and appropriate measures to be initiated if there were any problems. This would reduce the risk to human health and safety. The final injection pressure would be below any fracture pressure for the formation, which will be estimated once the reservoir monitoring study and other information is completed (ADM, 2010d). Remaining below the fracture pressure reduces the possibility of air and water contamination by CO_2 from fractures (See Section 4.2). The probability of hazardous leaks from the storage is small (NETL, 2008; Heinrich et al., 2004). With proper monitoring and mitigation, the risk from induced seismicity and fractures would be expected to be below the significance threshold.

Public education/outreach about potential threats and processes could reduce the risks and consequences of health and safety issues like accidents. A local emergency response plan would help reduce the risk of impact to the workers and the public (DOE, 2007a). The primary human health risk from the proposed project to the public would be pipeline leaks releasing CO_2 (DOE, 2007a). A rapid release of CO_2 has a very low probability due to monitoring, proper siting, and BMPs (DOE, 2007a). The risks could be minimized by having appropriate safety and operating procedures currently in place for gas processing facilities and pipelines including monitoring and inspections (DOE, 2007a). In general, CO_2 injection has occurred safely for over twenty years with oil and gas activities (NETL, 2008). Moreover, CO_2 comprises the dominant (sometimes more than 90%) of many acid gas injections (hydrogen sulfide (H_2S), CO_2, and other constituents). Acid gas injections have occurred for years without causing any substantial harm from known incidents. Operational error rather than mechanical error has been the cause of most acid gas incidents (Heinrich et al., 2004). Thus, adherence to BMPs and following industry standards will be important to prevent incidents. Finally, there have been no fatalities or injuries among the public from an acid gas incident in the last 50 years (AERCB, 2008). Therefore, with proper safety procedures and plans, the risk to the public should not exceed the significance threshold.

The wet, uncompressed CO_2 would be transported in a 24-inch pipeline. Leaks from this wet, uncompressed CO_2 would not be a substantial concern for human health and safety as it is currently discharged to the atmosphere (DOE, 2008).

Other than having a smaller diameter, the CO_2 pipeline from the compression-dehydration facility to the injection site would be similar to most CO_2 pipeline systems. The carbon steel pipe segments are nominally 40 feet (12.19 m) long with welded seams. Stainless steel is not necessary for this section of the CO_2 piping as the CO_2 is dehydrated. Wall thickness would be determined based on final operating outlet pressure of the compression system plus appropriate safety allowances.

The CO_2 pipeline would be mostly aboveground, but will be installed underground as it enters a perpetual easement on approximately 200 feet on the Richland Community College property. Line markers would be used to locate the pipeline, and the location would be entered into the ADM database of plant facilities and information (ADM, 2010d). Having the pipeline location information known in the database should help reduce the risk of accidents from construction and operation of other onsite activities. All the monitoring for CO_2 would reduce the risk for CO_2 leaks, and the mitigation measures would reduce the consequences of any incidents. Current monitoring systems will be used (ambient CO_2 monitoring and alarm system). Any additional necessary monitoring identified in the planning and design process would be initiated (ADM, 2010d).

Too much pressure would cause automatic venting of the compressor and injection system to reduce the safety risks from equipment malfunction. Pipeline inspection and monitoring would reduce the risks of failures and thus to human health. A common mitigation measure for a leaking casing is venting the CO_2 under appropriate controlled conditions (DOE, 2008). One of the major concerns regarding pipeline safety is water and other contaminants causing corrosion leading to pipe failure (DOE, 2007a). However, the CO_2 would be dried and removed of contaminants, which reduces the risk from pipeline failure (ADM, 2009a).

In the event that atmospheric CO_2 concentrations increase to a prescribed concentration, alarms would be sounded to alert workers of a potential CO_2 release. In the event of a substantial CO_2 release, employees would have been informed and trained regarding appropriate evacuation procedures following ADM safety plans. Further, modeling of atmospheric dispersion and CO_2 concentration distribution around the project site and vicinity from worst case scenario(s) of atmospheric CO_2 releases would be conducted in order to develop and implement additional emergency response plans that are essential to reduce impacts to human health and the environment.

The workers on the project would be subject to the same types of health risks that are generally associated with their professions (DOE, 2007a). Protective equipment such as hard hats, safety shoes, hearing protection (earplugs), and safety glasses would be worn (ADM, 2010d). Any further safety equipment needed for the possible hazards should be used such as a respirator or dust mask for someone working with equipment that generates dust. Following safety hazards would minimize occupational hazards (DOE, 2007a).

The risks to human health and safety from a rapid release of CO_2 as a result of activities associated with the proposed project would depend on the amount released and conditions (such as wind direction and strength) at the time of the release (DOE, 2007c). A sudden and rapid release of CO_2 from equipment, such as a wellhead being removed, would likely be detected quickly. The processes for containing well blow-outs would be employed to stop such a release. Workers on-site would be the primary group affected. If concentrations of CO_2 greater than 7 to 10% in the air were created, it would cause immediate danger to humans. Depending on the amount released and the pressure, the leak could take hours to days to contain, but it could take as little as minutes (IPCC, 2005; Heinrich et al., 2004). However, the leaked CO_2 amount is likely to be minimal compared to the amount injected due to dispersion of CO_2 in the ground away from injection site (Heinrich et al., 2004; IPCC, 2005). Once the release is over, no lingering effects would occur (Heinrich et al., 2004). In addition, the oil and gas industry employs engineering and administrative controls to manage these types of hazards regularly (IPCC, 2005). Therefore, while the risk of accidents exists, the risks to human health and safety, with the proper response plans and monitoring, should be below the significance threshold.

Currently, ADM staff handles and transports CO_2 and has experience with high-pressure pipelines and has experience with CO_2 at supercritical conditions through the MGSC project (DOE, 2008). ADM’s safety procedures will be updated as necessary for the new project components (ADM, 2010d). Workers would also be updated on safety procedures, especially ones related to handling of high pressure CO_2 (DOE, 2008). Additionally, the proposed project should be implemented in accordance with applicable guidance from the OHSA (Occupational Safety and Health Standards: 29 CFR 1910) as well as other applicable industry standards and regulations (DOE, 2007a). Decommissioning of the facility would represent the same types of risks as the operation. Thus, with proper safety procedures, the impact to human health and safety should be minimal. While a risk assessment for MSGS has been completed, further risk assessments are likely to occur as part of the planning and designed phases as needed. With the low failure rate of CO_2 pipelines, proper siting, and the monitoring involved, the overall risk to human health and safety is not expected to exceed the significance threshold.

4.9.3 Effects of No-Action

Under the No-Action alternative, there would be no construction, operation, or decommissioning of the sequestration project site. Thus, none of the risks listed in the previous section would occur, which would mean no impacts to human health and safety. The exception would be the fact that the proposed project's purpose is to further the research for options in preventing global climate change. Possible deaths from sea levels rising, deaths from increased severity of storms, increase respiratory diseases, and increased deaths from heat are some of the wide variety of potential human health and safety impacts from global climate change (Miller, 2003). However, as many other projects are in operation or being proposed to assist in the reduction of risk from global climate change, not all of the global climate change risks are attributable to the No-Action alternative. Nevertheless, the No-Action alternative does represent some risk to human health and safety, but not a substantial one.

4.9.4 Cumulative Effects

Since CO_2 is not flammable, there is less of a risk to human health and safety from the proposed project in combination with any existing projects in the area (IPCC, 2005). There are no planned projects in or near the project area (ADM, 2010d). The cumulative impacts of existing activities in and around the project area, including the related MGSC project, does not represent a substantial risk to human health and safety with existing and upcoming mitigation and safety procedures in place, which means the cumulative impacts with implementing the proposed project are not expected to exceed the significance criteria.

Since the current projects in the area do not pose a substantial risk to human health and safety, the No-Action alternative does not represent any additional risks to human health and safety. As described in the previous section, the exception is that not implementing the proposed project (thus, implementing the No-Action alternative) would have an adverse impact on the progress toward solutions for global climate change. However, since this is a single project of many, the cumulative impacts to human health and safety for the No-Action alternative are not expected to exceed the threshold of significance.

4.10 Cultural Resources

Cultural and historic resources are protected by a variety of laws and regulations, including the

NHPA, as amended, and the Archaeological Resources Protection Act. Section 106 of the National Historic Preservation Act and implementing regulations (36 CFR 800) outline the procedures to be followed in the documentation, evaluation, and mitigation of impacts cultural resources. The Section 106 process applies to any federal undertaking that has the potential to affect cultural resources. The Illinois Historic Preservation Agency (IHPA) is the SHPO for Illinois (IHPA, 2007).

4.10.1 Description

No historical sites, federal or state historical areas, or Native American Indian reservations occur in the proposed project area (DOE, 2008). The closest National Register of Historic Places (NRHP) property is approximately 3 miles (5 km) away to the northeast from the project site boundary (HAARGIS, 2002; NPS, 2008a). Within the project area, the majority of the land is already disturbed (Figure 2.1.1-2). No archeological or historical resources have been found so far at the project site. Further, the project area is outside the "high archaeological resource potential area." This is defined as the presence of certain soil types, such as Parkland Sand and Mackinaw Member, and within a buffer of stream floodplains (ISM, 1994).

Two federally recognized Native American tribes have land claims in Macon County, the Kickapoo Tribe of Indians of the Kickapoo Reservation in Kansas and the Kickapoo Tribe of Oklahoma (NPS, 2008b). As part of the EA process, DOE will send consultation letters to the nearby Native American Tribes and appropriate Bureau of Indian Affairs Regional Offices to inform them of the project, invite input, and request information of any known sites or issues in the project area. The closest cemetery to the project area is St. John cemetery, which is approximately 1.5 miles (2.4 km) south from the project site boundary.

ADM has not performed a cultural resources survey in the project area (ADM, 2010b).

Fossils need to be at or near the surface to allow access to them. Fossils are formed in sedimentary rock. There are no outcropping surface sedimentary rocks in the project area, so there should be no readily accessible fossils (See Section 4.2).

4.10.2 Effects of ADM's Proposed Project

The potential for impacts to cultural resources is the greatest during the construction phase. Discovery of previously unknown cultural resources can occur during construction activities in historically undisturbed areas. The construction noise and earthmoving activities can also deteriorate the use of the area for Native American activities (DOE, 2007a).

Some construction activities occurring under the proposed project with the potential to disturb cultural resources are land clearing, transporting equipment, leveling, drilling, and laying pipelines. These earthmoving activities can cause an adverse impact to cultural resources by altering drainage patterns, creating fugitive dust, and crushing the resources. Altered drainage patterns and runoff can deteriorate the artifacts or move them. Fugitive dust can cover and remove, in the case of paintings, artifacts. Spills from refueling equipment also damages cultural resources, which reduces the information potentially gained by the items. Further, construction activities can alter or destroy the context of the cultural resources. Operational impacts include use of heavy equipment, which is described above, and improved access to the area, which increases the possibility of illegal collection of properties (DOE, 2007a). Decommissioning would require similar heavy equipment but would be a relatively short time frame relative to the operation and construction phases. Thus, decommissioning would be the same type of possible impacts as described above.

During the EA process, the SHPO would make a determination on what level, if any, the project would have on cultural resources. However, the project area is previously disturbed. Consequently, since no cultural resources have been found yet, there would be less of a possibility for discovering cultural resources during the proposed project.

As there is no surface sedimentary rock, the risk to fossils (paleontological resources) that could be used for scientific/educational purposes is negligible (See Section 4.2). Due to distance to the nearest NRHP site (3 miles or 5 km), there should be no substantial impacts to visual resources to any known eligible or existing NRHP sites. During the EA process, DOE would send consultation letters to the nearby Native American Tribes and appropriate Bureau of Indian Affairs Regional Offices to inform them of the project, invite input, and request information of any known sites or issues in the project area. All issues these groups raise would be resolved.

The cemetery is not in the location of the construction and operation. Thus, the proposed project should not have any direct impacts to the cemetery. The cemetery is in an industrial site, so the impacts from the proposed project should be no greater than what the cemetery has experienced in the past (See Sections 4.8.5 and 4.8.6).

If cultural resources were discovered during the construction, the construction would be stopped, and the SHPO, any relevant Tribes, or other agencies consulted. If the cultural resources were found to be historic properties or human remains, then the construction component would need to be relocated elsewhere or other acceptable mitigation performed as per consultation with the SHPO and any relevant Tribes or agencies.

Based on the information above, the impacts from implementing the proposed project are not expected to exceed the impact significance threshold.

4.10.3 Effects of No-Action

Under the No-Action alternative, ADM would not construct and operate the ICCS project. Thus, there would be no construction, operation, or decommissioning activities. Therefore, there would be no impacts to cultural resources. However, the No-Action alternative would not fulfill the need of the project.

4.10.4 Cumulative Effects

ADM has no other projects planned for the area (ADM, 2010d). Since there are no substantial impacts to cultural resources, the proposed project and the No-Action alternative do not substantially contribute to the cumulative impacts to cultural resources in the vicinity of the project area or in the project area, considering also the finding of no substantial impacts to cultural resources for the related MGSC project. As impacts to cultural resources are generally local (heavy machinery crushing resources, etc.), the proposed project and the No-Action alternative both are unlikely to contribute to impacts to cultural resources outside the vicinity of the project area, and those local impacts would not be expected to exceed the threshold of significance.

4.11 Waste Management

4.11.1 Description

During the drilling stage of the proposed project, which would include the drilling of an injection well and verification well, different types of wastes would be generated. These wastes could potentially include:

- Lubricating oils and greases,
- Used solvents,
- Used hydraulic fluid,
- Metal parts, wire and cable,
- Oily rags,
- Domestic sewage,
- Domestic solid waste,
- Contaminated soil from spills,
- Discarded cement,
- Containers (metal, wood, plastic, etc.),
- Produced water (oily and/or saline), and
- Drilling mud and cuttings.

All drilling waste disposal methods will be in accordance with existing ADM conditions for the Decatur ADM Complex as well as any and all applicable local/federal or state regulations as indicated from any permit requirements for the project. An earthen pit would be constructed and properly lined to contain and prevent ground water migration of drill cuttings, water-based drilling fluids, rig wash water and to a certain degree, rain water.

As cuttings are produced by the drilling operation, they will be diverted to a lined earthen pit. After drilling operations are completed, the pit will be returned to as close to its original state as possible, keeping in mind future operations for each of the wells to be drilled in the area. All used engine oils and any other chemical-related items that need to be changed/rolled out as part of the drilling process, will be placed in sealed barrels, properly labeled and transported to an appropriate disposal location.

The underground injection control permit application indicated that upon decommissioning, tubing would be sold as scrap metal, and the site would not treat, store or dispose of hazardous waste (DOE, 2008). The permit application also indicated shallow groundwater monitoring wells would be drilled using appropriate coring tools, which would require the use of bentonite based drilling mud, or the use of hollow stem augers.

All wastewater would be directed to the wastewater treatment facility or the water re-use system that exists for the Decatur ADM Complex. Wastewater from the drilling would be evaluated, then treated, and discharged into the City system. If that cannot be the case, then ADM will dispose of it with its wastewater contract; it will be disposed of properly. Additionally, the operation of a compressor would generate waste products that could include:

- Used lube oil,
- Spent glycols,
- Used metal parts,
- Used gaskets,
- Oily rags,
- Filters,
- Containers,
- Contaminated soils from spills and leaks, and
- Domestic solid wastes.

The final compressor selections have not been made but would likely include an electric driven multi-stage reciprocating compressor. The exact nature and volumes of waste generated would be dependent on the final compressor selection. It is assumed that frame lubrication oil (which is typically lower weight mineral or synthetic oil) would typically be changed twice per year and cylinder oil (which is typically an animal fat for this application) would be continuously metered into the compressor cylinders at low rates and would remain in the CO_2 stream. Each type of oil has a filter, and it is projected that approximately 8 to 16 filters would be used per year. The lubrication oil and oil filters would be sent either to a waste oil recycler or disposed in accordance with applicable regulations.

If a TEG glycol dehydration unit were selected for use, approximately 48 waste glycol particulate filters (half rich, half lean) would be generated per year. Glycol carbon filters are changed as needed. The glycol particulate filters and the spent carbon would be disposed of offsite in accordance applicable regulations. The exact disposal protocol would follow that established by ADM to dispose of their other wastes.

There should be little to no saline water brought to the surface that is not controlled through well control or direct sampling via drill stem test (DST) or modular formation dynamics tester (MDT). The drilling fluids would have weight enough to be in excess of formation pressure, thus no flow back is expected. Only during times when sampling is occurring would fluids be brought to surface in contained jugs and/or sample chambers, likely using MDT. If large amounts of fluids are required, a DST would be used and there may be some fluid spillage on the rig floor, which will be washed to the reserve pit (DOE, 2008).

4.11.2 Effects of ADM's Proposed Project

Based on the volumes of drill waste generated, it is not anticipated that there will be any drilling wastes that exceed the significance threshold (DOE, 2008). All drilling waste disposal methods would be in accordance with existing local, state, or regulations.

Waste lube oil, filters, and spent carbon generated from dehydration/compression/cooling and transportation processes would be handled according to applicable regulations and should not exceed any significance thresholds. Other waste streams generated should not pose significant waste management problem as they would not be unique to the carbon sequestration process.

Based on the anticipated volumes of domestic wastes to be generated and the approved disposal options available, the impacts from these waste streams should not exceed significance thresholds. No hazardous waste is to be generated; therefore, no hazardous waste management issues should arise.

Any waste formation brine resulting from geochemical sampling would be in sufficiently low volumes that a suitable disposal option would be available. Therefore, impacts from waste management are not expected to exceed the significance threshold.

4.11.3 Effects of No-Action

Under the No-Action alternative, no drilling waste would be generated. No wastes from the capture, conditioning, and transportation of the CO_2 would be generated and no waste formation brine from sampling would be realized.

4.11.4 Cumulative Impacts

Potential cumulative impacts related to the drilling of the wells would include disposal of drilling mud and a minor quantity of produced water. Provided all regulatory requirements were met and wastes were disposed of through an approved waste receiver, the cumulative waste impacts, related to the drilling requirements of the proposed project, would not be expected to exceed the threshold of significance. Since drilling of the MGSC well has already occurred, the impact from that drilling activity is not considered cumulative to the proposed ADM project.

Potential cumulative impacts related to the waste products from the compression and transportation of CO_2 for the proposed project are not expected to be substantial assuming suitable collection and handling of solid wastes, lubricating oils and coolants, and the treatment and/or re-use of the wastewater stream at the Decatur ADM Complex. The effects of the related MGSC project are additive to those of the proposed projects, but the combined total is still not expected to be substantial.

There would likely be negligible cumulative impacts regarding wastes related to sampling and monitoring of the wells from both the MGC project and this proposed project due to the relatively small volumes of waste that would be generated from these activities.

Overall, the proposed project would not cause air, water, or soil to be contaminated with waste (assuming appropriate drilling waste management and compressor waste containment strategies are in place) to a degree that would pose a threat to human or ecological health and safety.

5.0 CONSULTATION AND COORDINATION

5.1 Preparation for Development of this Environmental Assessment

A kick-off teleconference occurred on August 23, 2010 by members of the team charged with the development of this EA. Subsequent to that meeting, a review was made of available information necessary for the completion of the EA and data gaps were submitted to NETL.

5.2 Agency Coordination

The Council on Environmental Quality's regulations for implementing NEPA allows federal agencies to invite comment from tribal, state, and local agencies, as well as other federal agencies in the preparation of EAs. The purpose of this coordination is to obtain special expertise with respect to environmental and cultural issues in order to enhance interdisciplinary capabilities, and otherwise ensure successful, effective consultation in decision-making.

5.2.1 U.S. Fish and Wildlife Service

The mission of the USFWS is to conserve, protect, and enhance fish, wildlife, and plants and their habitats for the continuing benefit of American people.

See Appendix C for letter sent to agency.

5.2.2 State Historic Preservation Office (SHPO)

The National Historic Preservation Act (NHPA) requires DOE to consult with the SHPO prior to any construction to ensure that no historical properties would be adversely affected by a proposed project. DOE must also afford the Advisory Council on Historic Preservation a reasonable opportunity to comment on the proposed project.

See Appendix D for letter sent to and received from the SHPO.

5.2.3 Bureau of Indian Affairs

The American Indian Religious Freedom Act, 42 USC § 1996, establishes policy to protect and preserve the inherent and Constitutional right of Native Americans to believe, express, and exercise their traditional religions. The law ensures the protection of sacred locations, access of Native Americans to those sacred locations and traditional resources that are integral to the practice of their religions, and establishes requirements that would apply to Native American sacred locations, traditional resources, or traditional religious practices potentially affected by construction and operation of proposed facilities.

See Appendix E for letters sent to the Bureau of Indian Affairs and Tribal Councils.

5.2.4 State Agencies

Illinois Department of Natural Resources and Illinois Environmental Protection Agency were consulted, and correspondences with these agencies are in Appendix F.

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8.0 GLOSSARY

Adiabatic Decompression – Thermodynamic process in which no heat is transferred to or from the working fluid.

Adsorbed – Condensed and forming a thin film on a surface.

Ambient – The natural surroundings of a location.

Argillaceous Dolomitic Sandstone – Sandstone containing substantial amounts of clay-like components and sedimentary carbonate rock.

Asphyxiation – A condition of severely deficient supply of oxygen to the body that arises from being unable to breathe normally.

A-weighted Decibels – An expression of the relative loudness of sounds in air as perceived by the human ear.

Best Management Practices – Innovative, dynamic, and improved environmental protection practices applied to oil and natural gas drilling and production to help ensure that energy development is conducted in an environmentally responsible manner.

Blowdown – Minimum discharge of recalculating water to discharged materials contained in the water, the further buildup of which would cause concentration in amounts exceeding limits established by best engineering practice.

Brine – Water saturated or nearly saturated with salt.

Caprock – A non permeable rock formation that prevents fluids from migrating upward from a porous formation.

Carbon Dioxide – Greenhouse gas created by combustion and emitted primarily from human activity such as the burning of fossil fuels to generate electricity and operate vehicles, abbreviated CO_2.

Carbon Sequestration – The capture and storage of carbon long-term in an effort to avoid release of that carbon as carbon dioxide in the atmosphere.

Criteria Pollutants – The Clean Air Act requires USEPA to set standards for six common air pollutants. These commonly found air pollutants (also known as "criteria pollutants") are found all over the United States. They are particle pollution (often referred to as particulate matter), ground-level ozone, carbon monoxide, sulfur oxides, nitrogen oxides, and lead.

Cultural Resources – Archaeological sites, historical sites (e.g. standing structures), Native-American resources, and paleontological resources.

Cumulative Effects – Those effects on the environment that result from the incremental effect of the action when added to past, present and reasonably foreseeable future actions regardless of what agency (federal or nonfederal) or person undertakes such other actions.

Day-night Sound Level – The A-weighted equivalent sound level for a 24 hour period with an additional 10 dB imposed on the equivalent sound levels for night time hours of 10 P.M. to 7 A.M.

Decibel – A unit of measurement that expresses the magnitude of a physical quantity (usually intensity) relative to a specified or implied *reference level*. The decibel is useful for a wide variety of measurements in science (for this application, it is sound).

Downhole – A location in the geologic strata that is lower/below a designated location.

Endangered Species – A species whose numbers are so small that the species is at risk for extinction. A federal list of endangered species can be found in 50 CFR 17.11 (wildlife), 50 CFR 17.12 (plants), and 50 CFR 222.23(a) (marine organisms). Illinois maintains its list of endangered species with the Illinois Endangered Species Protection Board.

Effluent – Waste stream flowing into the atmosphere, surface water, groundwater, or soil.

Emergent – Amphibious plants or ecosystems that are partially or temporarily in the water or but not continuously or entirely.

EA – (Environmental Assessment), A concise public document, prepared in compliance with the National Environmental Policy Act, that briefly discusses the purpose and need for an action, alternatives to such action, and provides sufficient evidence and analysis of impacts to determine whether to prepare an environmental impact statement or finding of no significant impact (40 CFR 1508.9).

EIS – (Environmental Impact Statement), A detailed written statement required by Section 102(2) (C) of the National Environmental Policy Act, analyzing the environmental impacts of a Proposed Action, adverse effects of the project that cannot be avoided, alternative courses of action, short-term uses of the environment versus the maintenance and enhancement of long-term productivity, and any irreversible and irretrievable commitment of resources (40 CFR 1508.11).

Environmental Justice – The confluence of social and environmental movements, which deals with the inequitable environmental burden born by groups such as racial minorities, women, or residents of developing nations.

Equivalent Sound Level – The level of a steady-state noise without impulses or tone components which is equivalent to the actual noise emitted over a period of time.

Erodible – The erodibility of soils can be described as their sensitivity to the effects of wind and water on the soil structure. This property is expressed as an erodibility index, where low values indicate high susceptibility to erosion, and high values correspondingly indicate a low susceptibility to erosion. The erodibility index is determined by combining the effects of slope and soil type, rainfall intensity and land use. These aspects are represented by terrain morphology (soil and slope), mean annual rainfall, and broad land use patterns.

FONSI – (Finding of No Significant Impact), A document prepared in compliance with the National Environmental Policy Act, supported by an environmental assessment, that briefly presents why a Federal action will have no significant effect on the human environment and for which an environmental impact statement, therefore, will not be prepared (40 CFR 1508.13).

Greenhouse Gas – Greenhouse gases are the gases present in the earth's atmosphere which reduce the loss of heat into space and therefore contribute to global temperatures.

Hazardous Waste – Waste substances which can pose a substantial or potential hazard to human health or the environment when improperly managed.

Hertz – The frequency of sound waves.

Hydrocarbon Traps – A subsurface pool of hydrocarbons contained in porous rock formations that are trapped by overlying rock formations with lower permeability.

Isopach Map – A map with contours that display the stratigraphic thickness of a subsurface rock unit.

Kilowatt – A measurement of electric power.

Median Household Income – The median household income is commonly used to provide data about geographic areas and divides households into two equal segments with the first half of households earning less than the average household income and the other half earning more.

Minority – Individual(s) who are members of the following population groups: American Indian or Alaskan Native; Asian or Pacific Islander; Black, not of Hispanic origin; or Hispanic.

Minority Population – Identified where either the affected area’s minority population exceeds 50 percent or the affected area’s minority population percentage is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographic analysis.

Moraine – Glacially formed accumulation of unconsolidated glacial debris (soil and rock) which can occur in currently glaciated and formerly glaciated regions, such as those areas acted upon by a past ice age.

NAAQS – (National Ambient Air Quality Standards), Standards established by the USEPA that apply for outdoor air throughout the country. Primary standards are designed to protect human health, with an adequate margin of safety, including sensitive populations such as children, the elderly, and individuals suffering from respiratory disease.

NEPA – (National Environmental Policy Act), Requires all agencies, including Department of Energy, to examine the environmental impacts of their actions, incorporate environmental information, and use public participation in the planning and implementation of all actions. Federal agencies must integrate NEPA with other planning requirements, and prepare appropriate NEPA documents to facilitate better environmental decision making (40 CFR 1500).

New Source Performance Standards – Are pollution control standards issued by the USEPA. The term is used in the Clean Air Act Extension of 1070 to refer to air pollution emission standards, and in the Clean Water Act referring to standards for discharges of industrial wastewater to surface waters.

Nonattainment Areas – The Clean Air Act and Amendments of 1990 define a "nonattainment area" as a locality where air pollution levels persistently exceed national standards or that contributes to ambient air quality in a nearby area that fails to meet standards. Designating an area as nonattainment is a formal rulemaking process, and USEPA normally takes this action only after air quality standards have been exceeded for several consecutive years.

Paleogeography – The study of what the geography was in times past. It is most often used in connection with the physical landscape.

Palustrine – Non-tidal wetlands.

Particulate Matter – Small solid particles and liquid droplets in the sir.

Perfluorocarbons – (PFCs), Compounds derived from hydrocarbons by replacement of hydrogen atoms by fluorine atoms. PFCs are made up of carbon and fluorine atoms only.

Permeability – Formations that transmit fluids readily, such as sandstones, are described as permeable and tend to have many large, well-connected pores.

pH – The measure of the acidity or alkalinity of a solution.

Porosity – A measure of the void spaces in a material.

Quaternary – The period after the Neogene Period roughly 1.8 million years ago to the present.

Saline Formation – Layers of porous rock that are saturated with bring water.

Sequestration – Development and demonstration of technologies for the placement of CO_2 into a repository such that it will remain stored for very long periods of time (hundreds to thousands of years); the three potential pathways for storage are geologic sequestration, terrestrial sequestration, and ocean sequestration.

Supercritical CO_2 – Carbon dioxide that is in a fluid state while also being at or above both its critical temperature and pressure.

Vertical Seismic Profile – (VSP), A technique of seismic measurements used for correlation with surface seismic data.

Wetland – Area inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.

APPENDICES

Appendix A Air Emission Calculations

Table A-1. Drilling Emissions

Heavy Equipment Use

Equipment Type	Number of Units	Days on Site	Hours Per Day	Operating Hours
Bore/Drill Rigs	1	90	24	2160
Generator Sets	4	90	24	8640
Other Construction Equipment	3	90	24	6480

Drilling Equipment Emission Factors (pounds (lbs)/hour)

Equipment	CO	NO_x	VOC	SO_x	PM_{10}	$PM_{2.5}$
Bore/Drill Rigs	0.5281	1.3416	0.1295	0.0017	0.0591	0.0591
Generator Sets	0.3461	0.6980	0.1075	0.0007	0.0430	0.0430
Other Construction Equipment	0.4504	1.1575	0.1215	0.0013	0.0503	0.0503

Source: (CARB, 2007b)

Drilling Equipment Emissions (tons)

Equipment	CO	NO_x	VOC	SO_x	PM_{10}	$PM_{2.5}$
Bore/Drill Rigs	0.5704	1.4489	0.1399	0.0019	0.0638	0.0638
Generator Sets	1.4952	3.0154	0.4642	0.0030	0.1858	0.1858
Other Construction Equipment	1.4592	3.7504	0.3937	0.0041	0.1631	0.1631
Total Equipment Emissions	**3.5247**	**8.2147**	**0.9978**	**0.0090**	**0.4127**	**0.4127**

Drilling Worker Commutes

Number of Workers	30
Number of Trips	2
Miles Per Trip	30
Days of Drilling	90
Total Miles	162000

Pollutant	CO	NO_x	VOC	SO_x	PM_{10}	$PM_{2.5}$
Emission Factor (lbs/mile)	0.0105	0.0011	0.0011	0.0000	0.0001	0.0001
Total Emissions (lbs)	1708.85	178.67	174.83	1.74	13.78	8.57
Total Emissions (tons)	**0.8544**	**0.0893**	**0.0874**	**0.0009**	**0.0069**	**0.0043**

Source: (CARB, 2007b)

Total Drilling Emissions (tons)

Activity/Source	CO	NO_x	VOC	SO_x	PM_{10}	$PM_{2.5}$
Heavy Equipment	3.5247	8.2147	0.9978	0.0090	0.4127	0.4127
Worker Commutes	0.8544	0.0893	0.0874	0.0009	0.0069	0.0043
Total Drilling Emissions per well	4.3791	8.3040	1.0852	0.0099	0.4195	0.4169

Table A-2. Construction Emissions

Construction Equipment Use						
Equipment Type	**Number of Units**	**Days on Site**	**Hours Per Day**	**Operating Hours**		
Air Compressors	1	30	4	120		
Cement & Mortar Mixers	1	30	7	210		
Cranes	1	30	7	210		
Generator Sets	1	30	7	210		
Tractors/Loaders/Backhoes	1	30	7	210		
Construction Equipment Emission Factors (lbs/hour)						
Equipment	**CO**	**NO_x**	**VOC**	**SO_x**	**PM_{10}**	**$PM_{2.5}$**
Air Compressors	0.3782	0.7980	0.1232	0.0007	0.0563	0.0563
Cement and Mortar Mixers	0.0447	0.0658	0.0113	0.0001	0.0044	0.0044
Cranes	0.6011	1.6100	0.1778	0.0014	0.0715	0.0715
Generator Sets	0.3461	0.6980	0.1075	0.0007	0.0430	0.0430
Tractors/Loaders/Backhoes	0.4063	0.7746	0.1204	0.0008	0.0599	**0.0599**
Source: (CARB, 2007b)						
Construction Equipment Emissions (tons)						
Equipment	**CO**	**NO_x**	**VOC**	**SO_x**	**PM_{10}**	**$PM_{2.5}$**
Air Compressors	0.0227	0.0479	0.0074	0.0000	0.0034	0.0034
Cranes	0.0631	0.1691	0.0187	0.0001	0.0075	0.0075
Generator Sets	0.0363	0.0733	0.0113	0.0001	0.0045	0.0045
Tractors/Loaders/Backhoes	0.0427	0.0813	0.0126	0.0001	0.0063	0.0063
Total Equipment Emissions	**0.1648**	**0.3716**	**0.0500**	**0.0003**	**0.0217**	**0.0217**
Painting						
VOC Content	1.25	lbs/gallon				
Coverage	400	ft^2/gallon				
Emission Factor	0.003125	lbs/ft^2				
Building/Facility	Wall Surface	VOC [lbs]	VOC [tons]			
Compressor Housing	1000	3.125	0.0015625			
Support Facilities	5000	15.625	0.0078125			
Total	**6000**	**18.75**	**0.009375**			

Table A-2. Construction Emissions (Continued)

Delivery of Equipment and Supplies						
Number of Deliveries	2					
Number of Trips	2					
Miles Per Trip	30					
Days of Construction	30					
Total Miles	3600					
Pollutant (pounds/mile)	**CO**	**NO_x**	**VOC**	**SO_x**	**PM_{10}**	**$PM_{2.5}$**
Emission Factor (lbs/mile)	0.0219	0.0237	0.0030	0.0000	0.0009	0.0007
Total Emissions (lbs)	79.02	85.37	10.77	0.09	3.08	2.66
Total Emissions (tons)	**0.0395**	**0.0427**	**0.0054**	**0.0000**	**0.0015**	**0.0013**
Source: (CARB, 2007b)						
Worker Commutes						
Number of Workers	20					
Number of Trips	2					
Miles Per Trip	30					
Days of Construction	30					
Total Miles	36000					
Pollutant (pounds/mile)	**CO**	**NO_x**	**VOC**	**SO_x**	**PM_{10}**	**$PM_{2.5}$**
Emission Factor (lbs/mile)	0.0105	0.0011	0.0011	0.0000	0.0001	0.0001
Total Emissions (lbs)	379.74	39.70	38.85	0.39	3.06	1.91
Total Emissions (tons)	**0.1899**	**0.0199**	**0.0194**	**0.0002**	**0.0015**	**0.0010**
Source: (CARB, 2007b)						
Total Construction Emissions (tons)						
Activity/Source	**CO**	**NO_x**	**VOC**	**SO_x**	**PM_{10}**	**$PM_{2.5}$**
Construction Equipment	0.1648	0.3716	0.0500	0.0003	0.0217	0.0217
Painting	0.0000	0.0000	0.0094	0.0000	0.0000	0.0000
Delivery of Equipment and Supplies	0.0395	0.0427	0.0054	0.0000	0.0015	0.0013
Worker Commutes	0.1899	0.0199	0.0194	0.0002	0.0015	0.0010
Total Construction Emissions	**0.3942**	**0.4341**	**0.0842**	**0.0006**	**0.0248**	**0.0240**

Table A-3. CO_2 Emission Calculations

Drilling and Construction		
Diesel Fuel Usage	500	Gallons Per Day
Drilling Period	90	Days
Total Fuel	45000	Gallons
Total Fuel	170343	Liters
Emission Factor	2.6304	kg CO_2 per liter
Total Emissions	448070.2	kg
Total Emissions	494	Tons
Electricity Usage		
Electricity Usage	12000	kW
Hours	21900	Hours
Power	262800000	
Emission Factor	0.6510	kg CO_2/Kwh
Total Emissions	171082800	kg
Total Emissions	188587	Tons
Worker Commutes		
Number of Workers	20	Workers
Number of Trips	2	Trips
Miles Per Trip	30	Miles
Days of Operation	913	Days
Total Miles	1095000	Miles
Emission Factor	1.1	lbs/mile
Total Emissions	1204500	lbs
Total Emissions (tons)	602.0	tons

Source: (CARB, 2007b)

Total CO_2 Emissions (tons)	
Activity/Source	Emissions (tons)
Drilling and Construction	988
Electricity Usage	188587
Worker Commutes	602
Sequestration	**(2500000)**
Total Emissions Reduction	**(2309823)**

Note: kWh is kilowatt hour, kW is kilowatt, and kg is kilogram.

Appendix B Noise Calculations

Table B-1. Drilling Noise

	Feet	**Meters**											
NSA 1 - Community College	**860**	**262**											
	Octave Band Center Frequency, Hz												
Source				**31.5**	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	**dB**
Drill Rig (at 25 Feet)				93	97	94	91	92	91	88	81	76	
Power Level (PWL)				121	125	123	120	121	120	116	109	105	
Transmission Loss (TL) Enclosure (1/2 inch wood)				0.5	-5.5	-11.5	-17.5	-23.5	-29.5	-35.6	-41.6	-47.6	
PWL with enclosure				122	23	17	11	5	-1	-7	-13	-19	
Mud Handling (Shaker and Pump) (at 25 Feet)				89	90	88	81	79	78	75	74	68	
PWL				118	119	117	110	108	107	104	103	97	
Generators (Light Plant)	**325**	**435.5**	CF	**5**	**9**	**3**	**7**	**15**	**19**	**25**	**35**	**43**	
Exhaust Noise	Lw	145.1		140.1	136.1	142.1	138.1	130.1	126.1	120.1	110.1	102.1	134
			Muffler Correction	25	25	29	29	27	25	24	23	23	
			PWL	115.1	111.1	113.1	109.1	103.1	101.1	96.1	87.1	79.1	107
			CF	**4**	**11**	**13**	**13**	**12**	**9**	**8**	**9**	**17**	
Inlet Noise	Lw	107.6	PWL	103.6	96.6	94.6	94.6	95.6	98.6	99.6	98.6	90.6	105
			CF	**22**	**14**	**7**	**7**	**8**	**6**	**7**	**13**	**20**	
Casing Noise	Lw	118.1	**PWL**	96	104	111	111	110	112	111	105	98	117
Excavator (at 25 Feet)					84	85	81	81	81	78	73		
PWL				29	113	114	110	110	110	107	102	29	
Total Sound Intensity				2.4907	1.0575	1.0167	0.3944	0.2741	0.3185	0.2104	0.0725	0.0122	
Total PWL				**124**	**120**	**120**	**116**	**114**	**115**	**113**	**109**	**101**	**128**
Hemispherical Spreading				-62	-62	-62	-62	-62	-62	-62	-62	-62	
Atmospheric Absorption				0	0	0	0	-1	-1	-2	-6	-11	
Flat Sound Level				62	58	58	53	51	51	49	40	28	
Octave Band A-Weighted Correction				-39	-26	-16	-9	-3	0	1	1	-1	
A-Weighted Sound Level				23	32	42	44	48	51	50	41	27	**56**
												Ldn	**62**

Notes:
Calculations based on available data from typical equipment set-ups, actual equipment would vary dependent on results of geotechnical evaluation and site-specific design.
Calculations do not account for effect of topographic features, reflection, and natural barriers
Lw is sound power levels, and Ldn is Equivalent Day Night Level. CF is center frequency

Table B-2. Compressor Noise

NSA 1 - Community College	**Feet 2500**	**Meters 762**											
				Octave Band Center Frequency, Hz									
Source				**31.5**	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	**dB**
Reciprocating Compressor		**12000.0**	CF	**11**	**15**	**10**	**11**	**13**	**10**	**5**	**8**	**15**	
	Lw	129.5	**PWL**	119	115	120	119	117	120	125	122	115	128
Total Sound Intensity				0.7108	0.2830	0.8949	0.7108	0.4485	0.8949	2.8298	1.4182	0.2830	
Total PWL				**119**	**115**	**120**	**119**	**117**	**120**	**125**	**122**	**115**	**129**
Hemispherical Spreading				-72	-72	-72	-72	-72	-72	-72	-72	-72	
Atmospheric Absorption				0	0	0	-1	-2	-4	-7	-18	-32	
Octave Band A-Weighted Correction				-39	-26	-16	-9	-3	0	1	1	-1	
A-Weighted Sound Level (without barrier)				8	17	32	37	40	44	47	33	10	**50**
												Ldn	**56**
Critical Distance Calculation	**Feet 1300**	**Meters 396**											
				Octave Band Center Frequency, Hz									
Source				**31.5**	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	**dB**
Reciprocating Compressor		**12000.0**	CF	**11**	**15**	**10**	**11**	**13**	**10**	**5**	**8**	**15**	
	Lw	129.5	**PWL**	119	115	120	119	117	120	125	122	115	128
Total Sound Intensity				0.7108	0.2830	0.8949	0.7108	0.4485	0.8949	2.8298	1.4182	0.2830	
Total PWL				**119**	**115**	**120**	**119**	**117**	**120**	**125**	**122**	**115**	**129**
Hemispherical Spreading				-66	-66	-66	-66	-66	-66	-66	-66	-66	
Atmospheric Absorption				0	0	0	0	-1	-2	-4	-9	-17	
Octave Band A-Weighted Correction				-39	-26	-16	-9	-3	0	1	1	-1	
A-Weighted Sound Level (without barrier)				14	23	38	43	47	52	56	48	31	**58**
												Ldn	**65**

Appendix C USFWS Consultation

THE MANGI ENVIRONMENTAL GROUP, INC.
7927 Jones Branch Dr. McLean VA 22102
703 760 4801 Fax 703 760 4899
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Viet Nam Veteran Owned

MEMO

TO: Department of Energy and Archer Daniels Midland Company

FROM: Eveline Martin, Environmental Scientist

DATE: November 18, 2010

RE: Section 7 Endangered Species Act Consultation – Industrial Carbon Capture and Sequestration (ICCS) Area 1 Project

The Department of Energy is in the process of completing NEPA documentation to evaluate the potential environmental consequences of providing a financial assistance grant under the American Recovery and Reinvestment Act of 2009 (ARRA) in a cooperative agreement with Archer Daniels Midland Company (ADM). If ADM received the funding, the company would demonstrate an integrated system of carbon dioxide (CO_2) capture in an industrial setting and geologic sequestration in a sandstone reservoir. The CO_2 that would be sequestered is currently a by-product at ADM's Decatur, Illinois fuel-grade ethanol production facility. ADM would capture approximately one million short tons of CO_2 per year, or approximately 2.5 million short tons (2.26 million metric tons) of CO_2 injected over a period of 2.5 years, using dehydration and compression. The compressed CO_2 would be piped approximately one mile to an injection well and sequestered in the Mt. Simon Sandstone Formation, a saline reservoir. The project is located on property of ADM, immediately adjacent to Decatur, Illinois, Macon County, Sec 5 T16N R3E.

The proposed project would include the construction of a compression/dehydration facility, approximately 5,290-feet (1,611 meters (m)) of 8-inch pipeline, 1,224 feet (373 m) of 24-inch pipeline, one electrical substation, up to 4.67 miles (7.52 kilometer (km)) of electrical power line, one injection well with associated equipment, and one verification well for monitoring of the sequestered CO_2.

The Mangi Environmental Group carefully reviewed the U.S. Fish and Wildlife technical assistance website (http://www.fws.gov/midwest/endangered/index.html) on November 18, 2010 for federally listed threatened and endangered species. According to the website, two species are listed and may be present in Macon County: the Indiana bat (endangered) and the eastern prairie fringed orchid (threatened).

The action area for the proposed project is made up almost entirely of fallow agricultural field north of the primary industrial complex on ADM property. This property does not contain habitat for either of the listed T&E species in Macon County. Indiana bats hibernate during winter in caves or, occasionally, in abandoned mines; heir summer habitat is in wooded areas

SBA Prime Contractor Of The Year Region 3 where they usually roost under loose tree bark on dead or dying trees. The eastern prairie fringed orchid occurs in habitats such as mesic prairie and wetlands such as sedge meadows, marsh edges, and bogs.

As suitable habitat is not present in the project area, our finding is "species and critical habitat not present". For this reason, we conclude that the Industrial Carbon Capture and Sequestration (ICCS) Area 1 Project will have "no effect" on listed species, their habitats, or proposed or designated critical habitat.

Appendix D SHPO Consultation

NATIONAL ENERGY TECHNOLOGY LABORATORY
Albany, OR • Morgantown, WV • Pittsburgh, PA

U.S. DEPARTMENT OF ENERGY

November 23, 2010

Anne Haaker, Deputy State Historic Preservation Officer
Preservation Services
#1 Old State Capitol Plaza
Springfield, IL 62701-1507

RE: Industrial Carbon Capture and Sequestration (ICCS) Area 1 Project, Decatur, Illinois

Dear Ms. Haaker:

With the support of the U.S. Department of Energy's (DOE) National Energy Technology Laboratory (NETL), Archer Daniels Midland Company (ADM) proposes to demonstrate an integrated system of carbon dioxide (CO_2) capture in an industrial setting and geologic sequestration in a sandstone reservoir (Mount Simon) referred to as ICCS Area 1 Project (ADM's Proposed Project). Federal funding may be committed by NETL for the fieldwork contemplated, and the federal action (i.e. DOE's Proposed Action) is to provide approximately $141.4 million of American Recovery and Reinvestment Act of 2009 (ARRA) funds to implement the ADM's Proposed Project in Decatur, Macon County, Illinois (IL).

ADM's Proposed Project would inject and closely monitor the flow of one million short tons of CO_2 per year for 2.5 years using dehydration and compression (see Figure 1). The CO_2 is a by-product of ADM's Decatur, IL fuel-grade ethanol production facility. The project team members include ADM, Illinois State Geological Survey, Schlumberger Carbon Services, and Richland Community College. Along with NETL, the partners represent the funding sources. The permitting and licensing agencies include Macon County and City of Decatur as well as IEPA.

The proposed project would involve the construction of a compression/dehydration facility of 30,000 square feet (ft^2), approximately 5,290-feet of 8-inch pipeline, 1,224 feet of 24-inch pipeline, one electrical substation of 500 by 500 feet, up to 4.67 miles of electrical power lines, one injection well with associated equipment, a geophysical well, shallow monitoring wells, and one verification well for monitoring of the sequestered CO_2. In addition, ADM's Proposed Project would include building the National Sequestration Education Center in 12,000 ft^2 at the Richland Community College Campus. Most of the activities would be in either the fallow field or the current ADM complex. The total disturbance size would be 10 acres.

The project site is near the MGSC project with IHPA Log #018070708 and #005012308 from 2008 (see Figure 1). Based on the 2008 communication, no historical properties were affected. The project would be located in Section 5 of Township 16 North Range 3 East, surveyed from the 3rd Principal Meridian, and on flat terrain within the Decatur ADM Complex (see Figure 2). The Decatur ADM Complex's address is 4666 E Faries Pkwy # 1, Decatur, IL 62526-5632. No structures exist at the locations of the new buildings or injection wells, which is visible from Figure 1. The pipelines would be in existing pipeline corridors as much as possible. The only existing

626 Cochrans Mill Road, P.O. Box 10940, Pittsburgh, PA 15236

building impacted would be the blower building. Figure 3 below depicts the site plan while Figures 4-8 present the current photos of the blower building. This building was built in 1986.

DOE is requesting information or concerns you may have on properties of traditional, religious, or cultural significance in the vicinity of the proposed ADM's project site. Any information you provide will assist the Department in the preparation of an environmental assessment (EA) and fulfillment of its responsibilities under Section 106 of the National Historic Preservation Act.

As designed, the proposed project would avoid any disturbance to known cultural or archeological sites. If any cultural materials were to be discovered during the construction phase of the project, all work would cease until the Illinois Historic Preservation Agency is contacted and corrective measures implemented.

DOE will provide you a copy of the Draft EA, once completed, where you may again respond to any specific concerns you may have. All correspondence(s) with your office will be included in an appendix to the EA.

Should you require additional information, please contact me by telephone at (412) 386-5428 or by email at pierina.fayish@netl.doe.gov.

Thank you in advance for your consideration.

Sincerely,

Pierina N. Fayish

Pierina Fayish
NEPA Document Manager

Enclosures

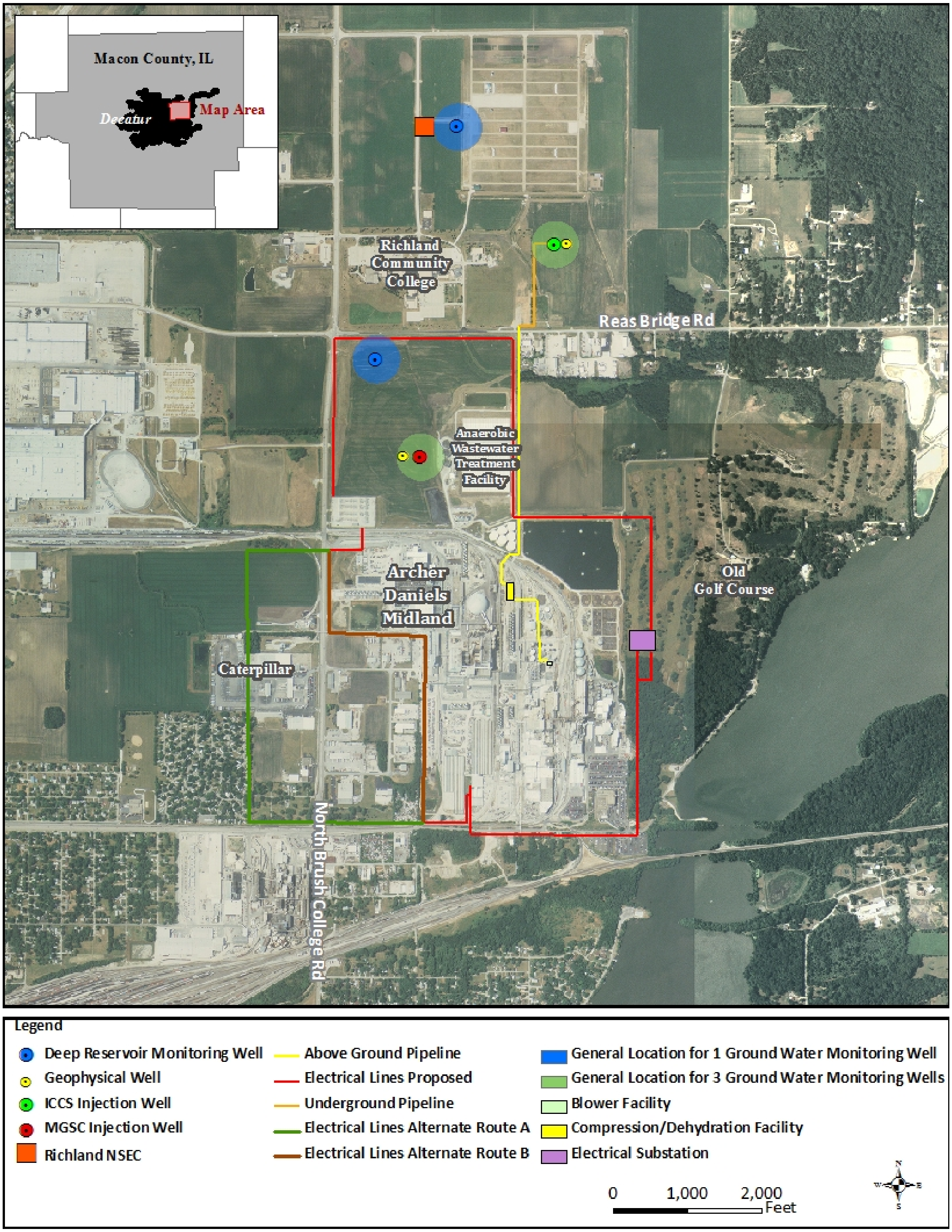

Figure 1. ADM Project Map

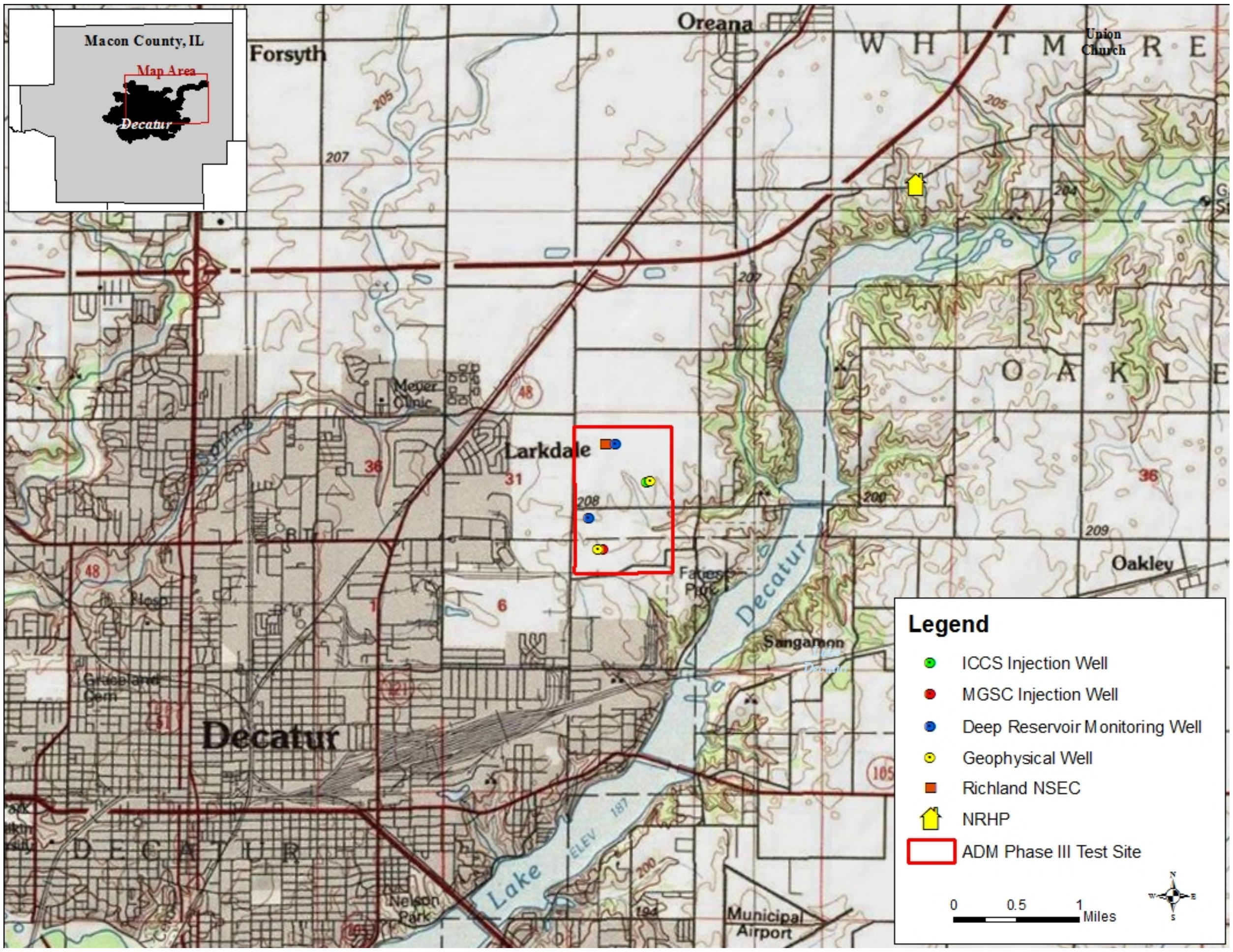

Figure 2. ADM Topographic Map with NRHP site

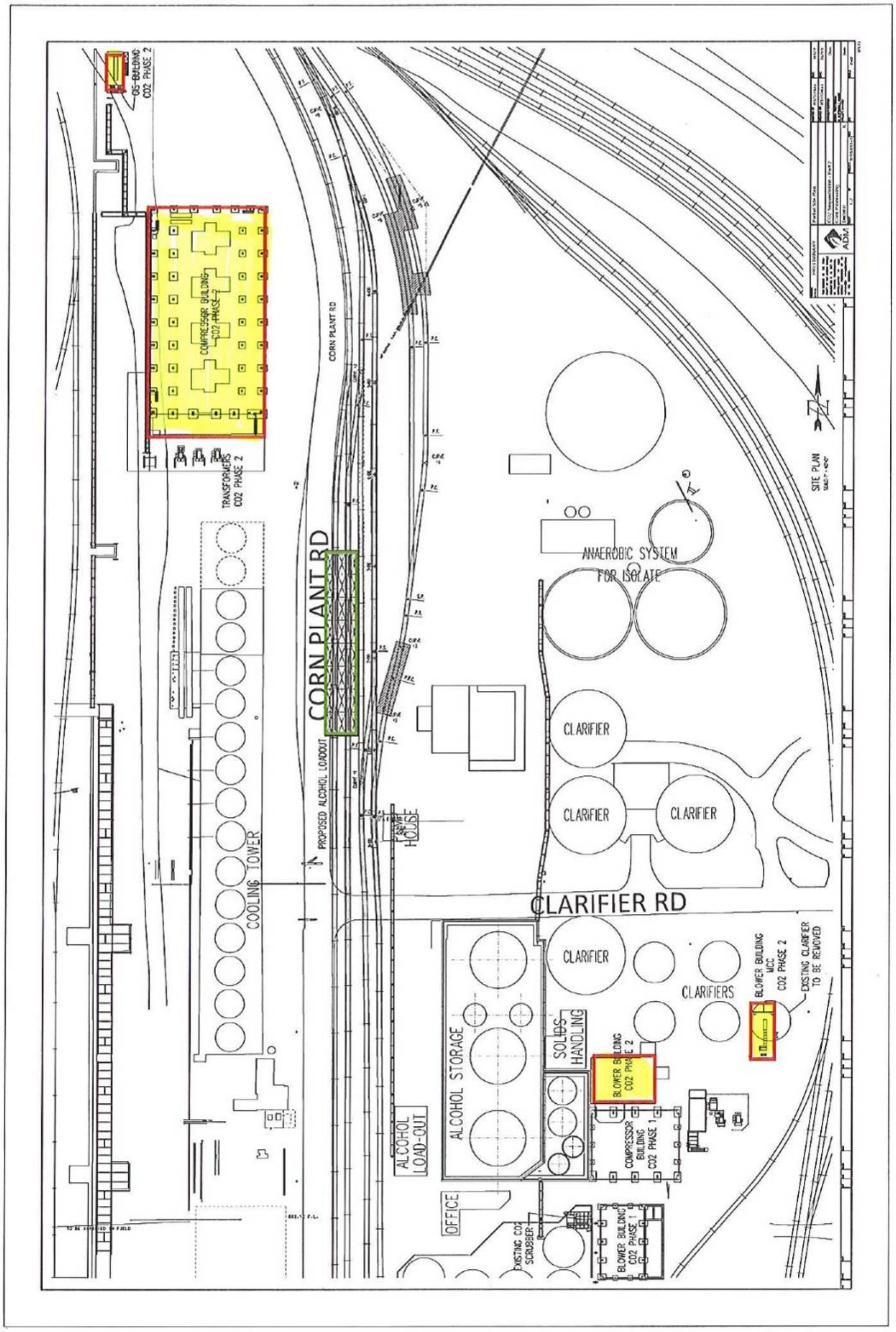

Figure 3. ADM Site Plan

Figure 4. Side Exterior View of Blower Building

Figure 5. Rear Exterior View of Blower Building

Figure 6. First Interior View of Blower Building

Figure 7. Second Interior View of Blower Building

Figure 8. Third Interior View of Blower Building

SHPO Response

Illinois Historic
Preservation Agency

FAX (217) 782-8161

1 Old State Capitol Plaza • Springfield, Illinois 62701-1512 • www.illinois-history.gov

Macon County
Decatur
New Construction of Compression/Dehydration Facility and Rehabilitation of Blower Building
4666 E. Faries Parkway
IHPA Log #012121010

December 22, 2010

Pierina Fayish
U.S. Department of Energy
National Energy Technology Laboratory
P.O. Box 10940
Mailstop B922/ M217
Pittsburgh, PA 15236

Dear Ms. Fayish:

We have reviewed the documentation submitted for the referenced project(s) in accordance with 36 CFR Part 800.4. Based upon the information provided, no historic properties are affected. We, therefore, have no objection to the undertaking proceeding as planned.

Please retain this letter in your files as evidence of compliance with section 106 of the National Historic Preservation Act of 1966, as amended. This clearance remains in effect for two years from date of issuance. It does not pertain to any discovery during construction, nor is it a clearance for purposes of the Illinois Human Skeletal Remains Protection Act (20 ILCS 3440).

If you have any further questions, please contact me at 217/785-5027.

Sincerely,

Anne E. Haaker

Anne E. Haaker
Deputy State Historic
Preservation Officer

A teletypewriter for the speech/hearing impaired is available at 217-524-7128. It is not a voice or fax line.

Appendix E Consultation with Tribes

The enclosures are at the section's end.

NATIONAL ENERGY TECHNOLOGY LABORATORY
Albany, OR • Morgantown, WV • Pittsburgh, PA

U.S. DEPARTMENT OF ENERGY

November 19, 2010

Arlan Whitebird, Chairperson
Kickapoo Tribe of Indians of the Kickapoo Reservation in Kansas
1107 Goldfinch Road
Horton, KS 66439

RE: Industrial Carbon Capture and Sequestration (ICCS) Area 1 Project, Decatur, Illinois

Dear Chairperson Whitebird:

With the support of the U.S. Department of Energy's (DOE) National Energy Technology Laboratory (NETL), Archer Daniels Midland Company (ADM) proposes to demonstrate an integrated system of carbon dioxide (CO_2) capture in an industrial setting and geologic sequestration in a sandstone reservoir (Mount Simon) referred to as ICCS Area 1 Project (ADM's Proposed Project). Federal funding may be committed by NETL for the fieldwork contemplated, and the federal action (i.e. DOE's Proposed Action) is to provide approximately $141.4 million of American Recovery and Reinvestment Act of 2009 (ARRA) funds to implement the ADM's Proposed Project in Decatur, Macon County, Illinois (IL).

ADM's Proposed Project would inject and closely monitor the flow of one million short tons of CO_2 per year for 2.5 years using dehydration and compression (see figure below). The CO_2 is a by-product of ADM's Decatur, IL fuel-grade ethanol production facility. The project team members include ADM, Illinois State Geological Survey, Schlumberger Carbon Services, and Richland Community College. The proposed project would involve the construction of a compression/dehydration facility, approximately 5,290-feet of 8-inch pipeline, 1,224 feet of 24-inch pipeline, one electrical substation, up to 4.67 miles of electrical power lines, one injection well with associated equipment, geophysical well, shallow monitoring wells, and one verification well for monitoring of the sequestered CO_2. In addition, the project would include building the National Sequestration Education Center at the Richland Community College Campus.

DOE is requesting information or concerns you may have on properties of traditional, religious, or cultural significance in the vicinity of the proposed ADM's project site. Any information you provide will assist the Department in the preparation of an environmental assessment (EA) and fulfillment of its responsibilities under Section 106 of the National Historic Preservation Act.

As designed, the proposed project would avoid any disturbance to known cultural or archeological sites. If any cultural materials were to be discovered during the construction phase of the project, all work would cease until the Illinois Historic Preservation Agency is contacted and corrective measures implemented.

DOE will provide you a copy of the Draft EA, once completed, where you may again respond to any specific concerns you may have. All correspondence(s) with your office will be included in an appendix to the EA.

626 Cochrans Mill Road, P.O. Box 10940, Pittsburgh, PA 15236

Should you require additional information, please contact me by telephone at (412) 386-5428 or by email at pierina.fayish@netl.doe.gov.

Thank you in advance for your consideration.

Sincerely,

Pierina N. Fayish

Pierina Fayish
NEPA Document Manager

Enclosures

NATIONAL ENERGY TECHNOLOGY LABORATORY
Albany, OR • Morgantown, WV • Pittsburgh, PA

U.S. DEPARTMENT OF ENERGY

November 19, 2010

Diane Rosen, Regional Director
Midwest Region Office
Bureau of Indian Affairs
One Federal Drive, Room 550
Ft. Snelling, MN 55111-4007

RE: Industrial Carbon Capture and Sequestration (ICCS) Area 1 Project, Decatur, Illinois

Dear Ms. Rosen:

With the support of the U.S. Department of Energy's (DOE) National Energy Technology Laboratory (NETL), Archer Daniels Midland Company (ADM) proposes to demonstrate an integrated system of carbon dioxide (CO_2) capture in an industrial setting and geologic sequestration in a sandstone reservoir (Mount Simon) referred to as ICCS Area 1 Project (ADM's Proposed Project). Federal funding may be committed by NETL for the fieldwork contemplated, and the federal action (i.e. DOE's Proposed Action) is to provide approximately $141.4 million of American Recovery and Reinvestment Act of 2009 (ARRA) funds to implement the ADM's Proposed Project in Decatur, Macon County, Illinois (IL).

ADM's Proposed Project would inject and closely monitor the flow of one million short tons of CO_2 per year for 2.5 years using dehydration and compression (see figure below). The CO_2 is a by-product of ADM's Decatur, IL fuel-grade ethanol production facility. The project team members include ADM, Illinois State Geological Survey, Schlumberger Carbon Services, and Richland Community College. The proposed project would involve the construction of a compression/dehydration facility, approximately 5,290-feet of 8-inch pipeline, 1,224 feet of 24-inch pipeline, one electrical substation, up to 4.67 miles of electrical power lines, one injection well with associated equipment, geophysical well, shallow monitoring wells, and one verification well for monitoring of the sequestered CO_2. In addition, the project would include building the National Sequestration Education Center at the Richland Community College Campus.

DOE is requesting information or concerns you may have on properties of traditional, religious, or cultural significance in the vicinity of the proposed ADM's project site. Any information you provide will assist the Department in the preparation of an environmental assessment (EA) and fulfillment of its responsibilities under Section 106 of the National Historic Preservation Act.

As designed, the proposed project would avoid any disturbance to known cultural or archeological sites. If any cultural materials were to be discovered during the construction phase of the project, all work would cease until the Illinois Historic Preservation Agency is contacted and corrective measures implemented.

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DOE will provide you a copy of the Draft EA, once completed, where you may again respond to any specific concerns you may have. All correspondence(s) with your office will be included in an appendix to the EA.

Should you require additional information, please contact me by telephone at (412) 386-5428 or by email at pierina.fayish@netl.doe.gov.

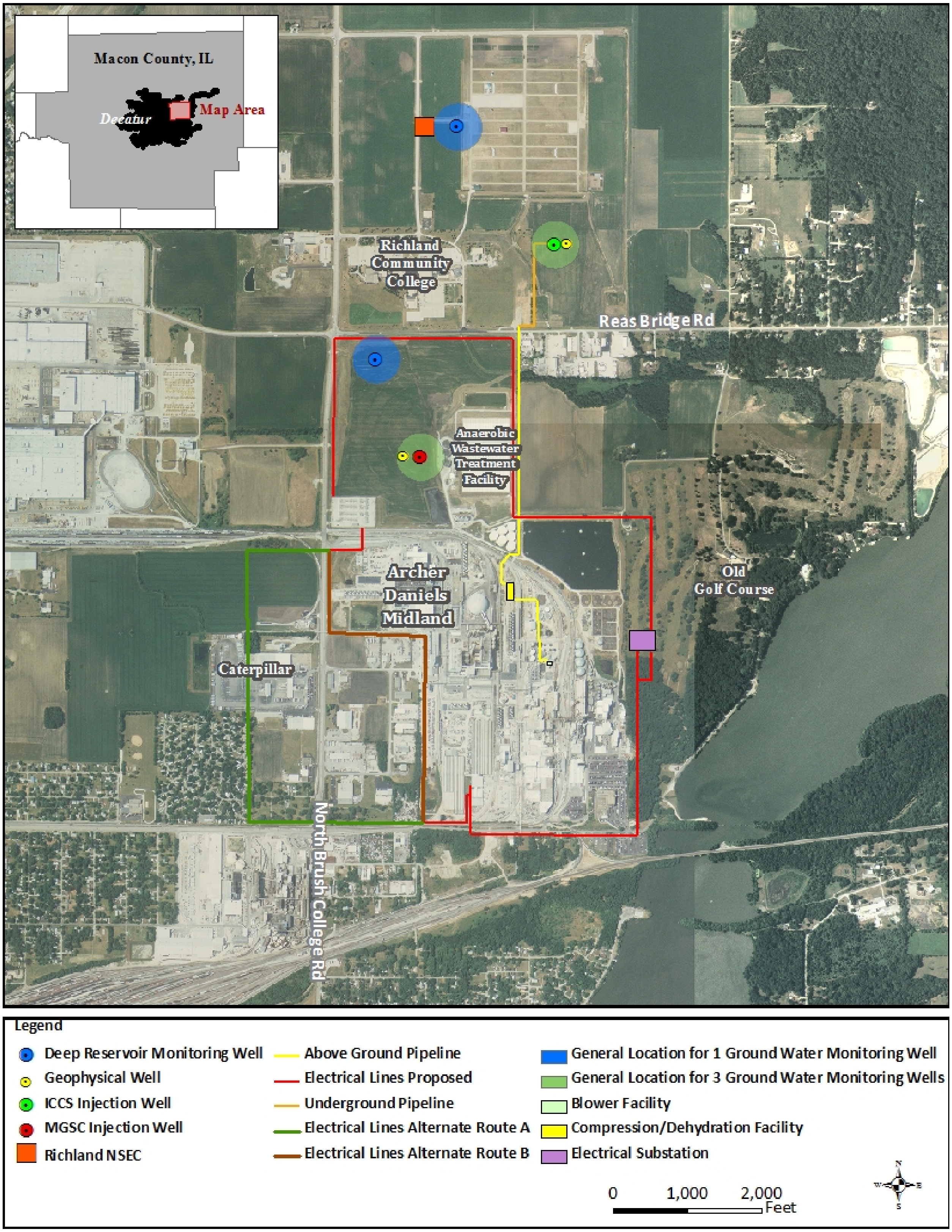
Thank you in advance for your consideration.

Sincerely,

Pierina N Fayish

Pierina Fayish
NEPA Document Manager

Enclosures



ADM Project Map

No responses received

Appendix F State Agencies

The enclosure is at the section's end.

NETL NATIONAL ENERGY TECHNOLOGY LABORATORY
Albany, OR • Morgantown, WV • Pittsburgh, PA

U.S. DEPARTMENT OF ENERGY

November 19, 2010

Karen Miller, Section Manager
Impact Assessment Section
Illinois DNR
1 Natural Resources Way
Springfield, IL 62702

RE: Industrial Carbon Capture and Sequestration (ICCS) Area 1 Project, Decatur, Illinois

Dear Ms. Miller:

With the support of the U.S. Department of Energy's (DOE) National Energy Technology Laboratory (NETL), Archer Daniels Midland Company (ADM) proposes to demonstrate an integrated system of carbon dioxide (CO_2) capture in an industrial setting and geologic sequestration in a sandstone reservoir (Mount Simon) referred to as ICCS Area 1 Project (ADM's Proposed Project). Federal funding may be committed by NETL for the fieldwork contemplated, and the federal action (i.e. DOE's Proposed Action) is to provide approximately $141.4 million of American Recovery and Reinvestment Act of 2009 (ARRA) funds to implement the ADM's Proposed Project in Decatur, Macon County, Illinois (IL).

ADM's Proposed Project would inject and closely monitor the flow of one million short tons of CO_2 per year for 2.5 years using dehydration and compression (see figure below). The CO_2 is a by-product of ADM's Decatur, IL fuel-grade ethanol production facility. The project team members include ADM, Illinois State Geological Survey, Schlumberger Carbon Services, and Richland Community College. The proposed project would involve the construction of a compression/dehydration facility, approximately 5,290-feet of 8-inch pipeline, 1,224 feet of 24-inch pipeline, one electrical substation, up to 4.67 miles of electrical power lines, one injection well with associated equipment, geophysical well, shallow monitoring wells, and one verification well for monitoring of the sequestered CO_2. In addition, the project would include building the National Sequestration Education Center at the Richland Community College Campus.

As part of our obligation when providing funding for a proposed project, DOE is required under Section 7 of the *Endangered Species Act* to use its authority to ensure actions are approved, funded, or carried out that will avoid impacts to both flora and fauna that are considered threatened or endangered species, or proposed for listing as threatened or endangered species, on the proposed project site. DOE has already determined that the closest resource rich area is approximately seven miles to the northeast of the proposed site. The one state listed endangered plant species, wild hyacinth (*Camassia angusta*), is unlikely to exist on the fallow field or the industrial site of the project area. The two Illinois state listed endangered species, upland sandpiper (*Bartramia longicauda*) and Bewick's wren (*Thryomanes bewickii*), occur in Macon County. Of these species, only the Bewick's wren has been documented as occurring approximately one mile south of the project site. DOE is requesting information or concerns you may have on natural resources

626 Cochrans Mill Road, P.O. Box 10940, Pittsburgh, PA 15236

including threatened and endangered species in the vicinity of the proposed ADM's project site. Any information you provide will assist the Department in the preparation of an environmental assessment (EA) and fulfillment of its responsibilities under Endangered Species Act.

DOE will provide you a copy of the Draft EA, once completed, where you may again respond to any specific concerns you may have. All correspondence(s) with your office will be included in an appendix to the EA.

Should you require additional information, please contact me by telephone at (412) 386-5428 or by email at pierina.fayish@netl.doe.gov.

Thank you in advance for your consideration.

Sincerely,

Pierina N. Fayish

Pierina Fayish
NEPA Document Manager

Enclosures

NATIONAL ENERGY TECHNOLOGY LABORATORY
Albany, OR • Morgantown, WV • Pittsburgh, PA

U.S. DEPARTMENT OF ENERGY

November 19, 2010

DiAnne Schuerman
Environmental Review
Illinois Environmental Protection Agency
1021 North Grand Avenue East
Post Office Box 19276
Springfield, Illinois 62794-9276

RE: Industrial Carbon Capture and Sequestration (ICCS) Area 1 Project, Decatur, Illinois

Dear Ms. Schuerman:

With the support of the U.S. Department of Energy's (DOE) National Energy Technology Laboratory (NETL), Archer Daniels Midland Company (ADM) proposes to demonstrate an integrated system of carbon dioxide (CO_2) capture in an industrial setting and geologic sequestration in a sandstone reservoir (Mount Simon) referred to as ICCS Area 1 Project (ADM's Proposed Project). Federal funding may be committed by NETL for the fieldwork contemplated, and the federal action (i.e. DOE's Proposed Action) is to provide approximately $141.4 million of American Recovery and Reinvestment Act of 2009 (ARRA) funds to implement the ADM's Proposed Project in Decatur, Macon County, Illinois (IL).

ADM's Proposed Project would inject and closely monitor the flow of one million short tons of CO_2 per year for 2.5 years using dehydration and compression (see figure below). The CO_2 is a by-product of ADM's Decatur, IL fuel-grade ethanol production facility. The project team members are ADM, Illinois State Geological Survey, Schlumberger Carbon Services, and Richland Community College. The proposed project would involve the construction of a compression/dehydration facility, approximately 5,290-feet of 8-inch pipeline, 1,224 feet of 24-inch pipeline, one electrical substation, up to 4.67 miles of electrical power lines, one injection well with associated equipment, geophysical well, shallow monitoring wells, and one verification well for monitoring of the sequestered CO_2. In addition, the project would include building the National Sequestration Education Center at the Richland Community College Campus.

DOE is requesting information or concerns you may have on environmental quality in the vicinity of the proposed ADM's project site. Any information you provide will assist the Department in the preparation of an environmental assessment (EA).

DOE will provide you a copy of the Draft EA, once completed, where you may again respond to any specific concerns you may have. All correspondence(s) with your office will be included in an appendix to the EA.

Should you require additional information, please contact me by telephone at (412) 386-5428 or by email at pierina.fayish@netl.doe.gov.

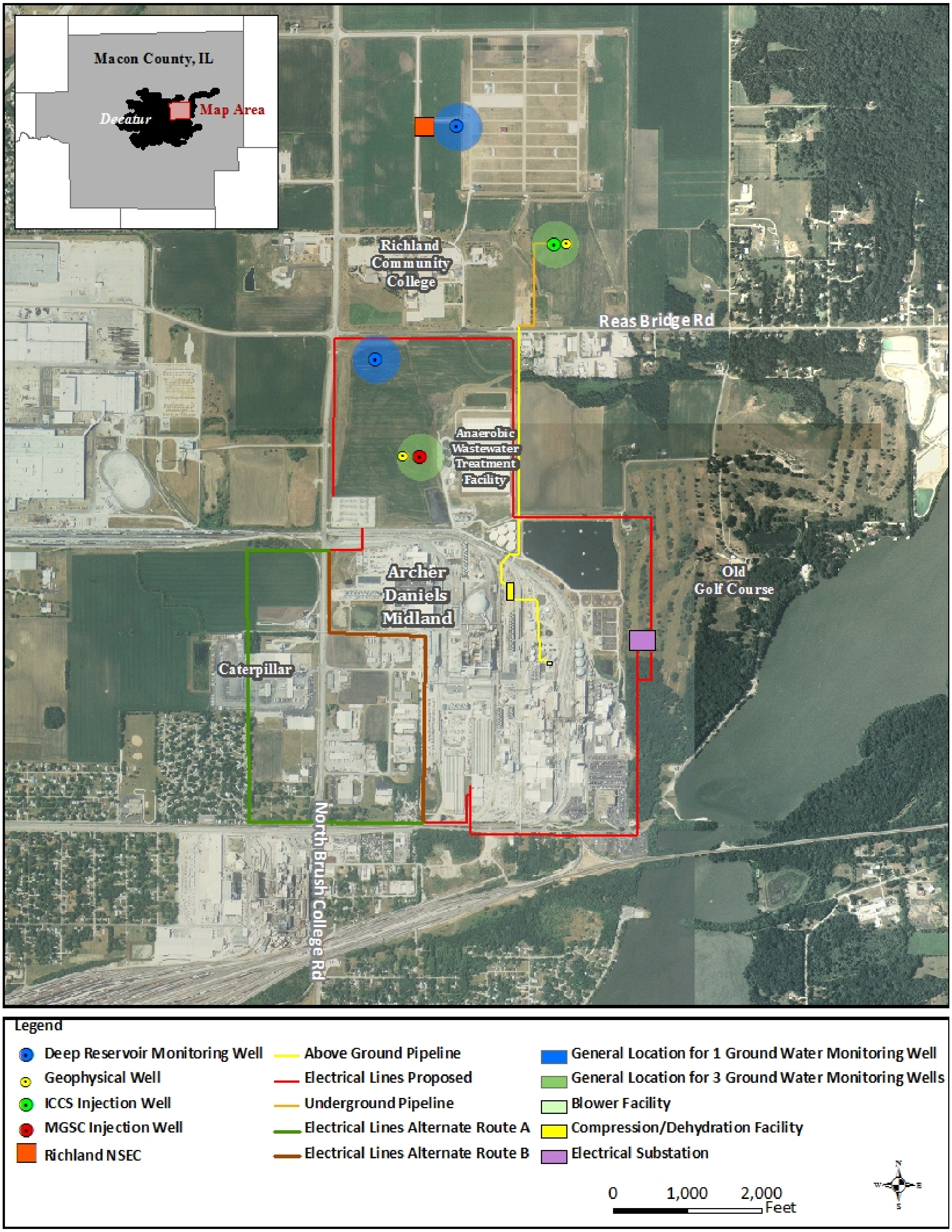
Thank you in advance for your consideration.

Sincerely,

Pierina N. Fayish

Pierina Fayish
NEPA Document Manager

Enclosures



ADM Project Map

Illinois DNR Response

Illinois Department of Natural Resources

One Natural Resources Way Springfield, Illinois 62702-1271
http://dnr.state.il.us

Pat Quinn, Governor
Marc Miller, Director

December 14, 2010

Pierina Fayish
National Energy Technology Laboratory
626 Cochrans Mill Road
P.O. Box 10940
Pittsburgh, PA 15236

Re: Industrial Carbon Capture and Sequestration Project-Decatur
Project Number(s): 1106009
County: Macon

Dear Applicant:

This letter is in reference to the project you recently submitted for consultation. The natural resource review provided by EcoCAT identified protected resources that may be in the vicinity of the proposed action. The Department has evaluated this information and concluded that adverse effects are unlikely. Therefore, consultation under 17 Ill. Adm. Code Part 1075 is terminated.

This consultation is valid for two years unless new information becomes available that was not previously considered; the proposed action is modified; or additional species, essential habitat, or Natural Areas are identified in the vicinity. If the project has not been implemented within two years of the date of this letter, or any of the above listed conditions develop, a new consultation is necessary.

The natural resource review reflects the information existing in the Illinois Natural Heritage Database at the time of the project submittal, and should not be regarded as a final statement on the site being considered, nor should it be a substitute for detailed site surveys or field surveys required for environmental assessments. If additional protected resources are encountered during the project's implementation, you must comply with the applicable statutes and regulations. Also, note that termination does not imply IDNR's authorization or endorsement of the proposed action.

Please contact me if you have questions regarding this review.

Karen Miller
Division of Ecosystems and Environment
217-785-5500

Illinois EPA Response

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY
1021 North Grand Avenue East, P.O. Box 19276, Springfield, Illinois 62794-9276 • (217) 782-2829
James R. Thompson Center, 100 West Randolph, Suite 11-300, Chicago, IL 60601 • (312) 814-6026
PAT QUINN, GOVERNOR DOUGLAS P. SCOTT, DIRECTOR

217-782-0547

November 30, 2010

Pierina Fayish
NEPA Document Manager
National Energy Technology Lab
626 Cochrans Mill Road
P O Box 10940
Pittsburg, PA 15236

Dear Pierina Fayish:

Thank you for the opportunity to review the proposed project for the Industrial Carbon Capture and Sequestration at ADM in Decatur, IL.

The Agency has no objections to the project; however a permit is required from the Bureau of Land for the underground injection of CO2. You may contact, 217-524-3300 BOL Permits, request Steve Nightingale for questions.

A construction site activity stormwater NPDES permit will be required from the Division of Water Pollution Control for more than one acre being disturbed during construction. You may contact Al Keller, 217-782-0610, with NPDES permit questions.

A permit may also be required from the Bureau of Air, please contact Ed Bakowski, 217-782-2113, with questions.

Sincerely,

Lisa Bonnett

Lisa Bonnett
Acting Deputy Director

Rockford • 4302 N. Main St., Rockford, IL 61103 • (815) 987-7760
Elgin • 595 S. State, Elgin, IL 60123 • (847) 608-3131
Bureau of Land – Peoria • 7620 N. University St., Peoria, IL 61614 • (309) 693-5462
Collinsville • 2009 Mall Street, Collinsville, IL 62234 • (618) 346-5120
Des Plaines • 9511 W. Harrison St., Des Plaines, IL 60016 • (847) 294-4000
Peoria • 5415 N. University St., Peoria, IL 61614 • (309) 693-5463
Champaign • 2125 S. First St., Champaign, IL 61820 • (217) 278-5800
Marion • 2309 W. Main St., Suite 116, Marion, IL 62959 • (618) 993-7200

Appendix G Environmental Synopsis

ENVIRONMENTAL SYNOPSIS
Industrial Carbon Capture & Sequestration (ICCS)
Technology Area I
DE-FOA-0000015

January 2011

National Energy Technology Laboratory
U.S. Department of Energy
Morgantown, West Virginia

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CONTENTS

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INTRODUCTION

The U.S. Department of Energy (DOE or the Department) prepared this Environmental Synopsis pursuant to the Department's responsibilities under section 216 of DOE's National Environmental Policy Act (NEPA) Implementing Procedures set forth in 10 CFR Part 1021. This synopsis summarizes the consideration given to environmental factors and records that the relevant environmental consequences of reasonable alternatives were evaluated in the process of selecting awardees seeking financial assistance under Technology Area 1 of the Industrial Carbon Capture and Sequestration (ICCS) program In addition to financial and technical elements, DOE considered relevant environmental factors and consequences of the projects proposed to DOE in response to the funding opportunity announcement (FOA). DOE initially selected 12 applicants seeking financial assistance under Technology Area 1 and provided cost-shared funding for project definition activities; DOE then selected three of the initial twelve awardees for continued funding beyond project definition, pending completion of project-specific NEPA reviews. As required by section 216, this synopsis does not contain business, confidential, trade secret or other information that statutes or regulations would prohibit DOE from disclosing. It also does not contain data or other information that may in any way reveal the identity of the offerors.[2]

BACKGROUND

The ICCS program is a cost-shared collaboration between the government and industry to increase investment in clean industrial technologies and carbon capture and sequestration (CCS) projects. In contrast to other federally funded activities, these projects are not federal projects; instead, they are private projects seeking federal financial assistance. Under the ICCS funding opportunity, industry proposes projects that meet their needs and those of their customers while furthering the national goals and objectives of DOE. The successful development of advanced technologies and innovative concepts that reduce emissions of carbon dioxide into the atmosphere is a key objective of the nation's effort to help mitigate the effects of climate change.

Awardees under this FOA would receive assistance using funds appropriated by the American Recovery and Reinvestment Act of 2009, Public Law 111-5, (Recovery Act). The Recovery Act's purposes are to stimulate the economy and to create and retain jobs. Accordingly, special consideration was given to projects that promote and enhance job creation, preservation and economic recovery, in an expeditious manner. In accordance with the Recovery Act, and Section 703 of Public Law 110-140, DOE's two specific objectives were identified in the FOA as (1) Technology Area 1 – *Large-Scale Industrial CCS Projects from Industrial Sources*; and (2) Technology Area 2 – *Innovative Concepts for Beneficial* CO_2 *Use*. This synopsis specifically deals with the review process conducted for applications under Technology Area 1.

The applications reviewed under this FOA were initially selected for a first phase funding in October 2009 as the first of a two phase process for final awards of financial assistance. Under Phase I of the review process for Technology Area 1, DOE selected 12 projects related to the capture of CO_2 from industrial sources for geological storage or enhanced oil recovery (EOR). During Phase I, DOE provided cost shared funding for applicants to conduct project definition activities (e.g. preliminary design and permitting) and to prepare information that would assist the Department in performing its obligations pursuant to NEPA. Near the end of Phase I, awardees were given an opportunity to submit renewal applications for Phase II awards that would provide financial assistance for detailed design, construction and demonstration of the proposed technologies. DOE received eight renewal applications from the 12 projects selected under Phase I.

[2] The three awardees selected for continued financial assistance are identified in this synopsis and information on these proposed projects will be available on the DOE National Energy Technology Laboratory web site at http://www.netl.doe.gov/technologies/iccs/index.html.

Applications under the ICCS program were evaluated against specific programmatic criteria:

• Technology merit, technical plan, and site suitability;

• Project organization and project management plan;

• Commercial potential;

• Funding plan;

• Financial condition and capacity of proposed funding sources;

• Financial commitment to meet cost-sharing requirements.

These criteria represented the total evaluation scoring. However, the selection official also considered the results of the environmental evaluation and the applicant's budget information and financial management system, as well as program policy factors, in making selections.

As a federal agency, DOE must comply with NEPA (42 U.S.C. §§ 4321 *et seq*.) by considering potential environmental issues associated with its actions prior to deciding whether to undertake these actions. The environmental review of applications received in response to the ICCS FOA was conducted pursuant to Council on Environmental Quality Regulations (40 Code of Federal Regulations (CFR) Parts 1500 - 1508) and DOE's NEPA Implementing Procedures (10 CFR Part 1021), which provide directions specific to NEPA in the context of procurement and financial assistance actions.

PURPOSE AND NEED

The purpose and need for DOE's selections of awardees under the ICCS Program are to satisfy the responsibility Congress imposed on the Department to carry out a program to demonstrate technologies for the large-scale capture of CO_2 from industrial sources. Technology Area 1 under the FOA focused on the demonstration of advanced technologies that capture and sequester carbon dioxide emissions from industrial sources into underground formations or put the CO_2 to beneficial use in a manner that permanently prevents the CO_2 from entering the atmosphere, including the expansion of CO_2 use in EOR, while providing information on the cost and feasibility of deployment of sequestration technologies. Therefore, under the FOA, DOE sought projects with technologies that have progressed beyond the research and development stage to a point of readiness for operation at a scale that, if successful, could be readily replicated and deployed into commercial practice within the industry.

The industrial technologies proposed could produce heat, fuels, chemicals, hydrogen or other useful products with or without production of electricity. Thus, industrial sources could include cement plants, chemical plants, refineries, steel and aluminum plants, manufacturing facilities, and power plants using opportunity fuels (petroleum coke, municipal waste, etc.). DOE sought projects at a sufficient scale to show the potential for market penetration upon successful demonstration of the technology, and be integrated with commercial plant operation. DOE also allowed for leading-edge technologies not currently deployed in the utility marketplace or CO_2 injection industry, as opposed to new applications of commercial technologies or incremental improvements of commercial technologies or previously demonstrated technologies. DOE's specific technical objectives included demonstrating:

- Projects that capture and sequester amounts of CO_2 approaching or exceeding a target of one million tons per plant per year;
- Projects with large-scale CCS that include integration of CO_2 capture, transportation and sequestration with comprehensive MVA;
- Geological sequestration in multiple geological settings as a means to evaluate costs, operational processes, and technical performance;
- CO_2 capture technologies that are integrated within existing or new industrial facilities;

- Projects capable of operating technologies that make progress toward the capture and sequestration of seventy-five percent of CO_2 from the treated stream, comprising at least ten percent of CO_2 by volume that would otherwise be emitted to the atmosphere; and
- Projects at a sufficient scale to show the potential for market penetration;

ALTERNATIVES

DOE received eight Phase II renewal applications out of the twelve projects selected for Phase I in ICCS Technology Area 1, all of which were determined to have met the mandatory eligibility requirements listed in the FOA. The applications proposed projects located in eight states: California, Illinois, Kansas, Louisiana, Michigan, Mississippi, Texas, and Washington. The criteria for evaluating Phase II applications under ICCS Technology Area 1 were published in the FOA. Technical and financial evaluations represented the total evaluation scoring; however, the environmental evaluation, which was not point-scored, entered into the evaluation and selection process. Each applicant was required to complete and submit a standard environmental information volume for each site or alternative site included in its application.

The evaluations of the applications focused on the technical description of the proposed project, financial plans and budgets, potential environmental impacts, and other information that the applicants submitted. Following reviews by technical, environmental, and financial panels and a comprehensive assessment by a merit review board, a DOE official selected those applications that best met DOE's purpose and need. By broadly soliciting proposals to meet the programmatic purpose and need for DOE action and by evaluating the potential environmental impacts associated with each proposal before selecting applicants, DOE considered a reasonable range of alternatives for meeting its purpose and need.

Applications were divided into two broad categories:

- Group 1: Addition of Carbon Capture Equipment at an Existing and Operating Facility; and
- Group 2: Addition of Carbon Capture Equipment at a Planned or Yet-to-Be Constructed Facility.

DOE received five applications for existing and operating facilities (Group 1) and three applications for planned or yet-to-be constructed facilities (Group 2).

ENVIRONMENTAL REVIEW

DOE assembled environmental review teams to assess all applications that met the mandatory requirements. The review teams considered 20 resource areas that could potentially be impacted by the technologies and sites proposed under ICCS Technology Area 1. These resource areas consisted of:

- Aesthetics
- Air Quality
- Biological Resources
- Climate
- Community Services
- Cultural Resources
- Environmental Justice
- Floodplains
- Geology
- Ground Water
- Human Health and Safety
- Land Use
- Noise
- Socioeconomics
- Soils
- Surface Water
- Transportation and Traffic
- Utilities
- Wastes and Materials
- Wetlands

The review teams were composed of environmental professionals with experience evaluating the impacts of industrial facilities, power plants, and energy-related projects in the resource areas considered by DOE.

The review teams considered the information provided as part of each application, which included narrative text, worksheets, and the environmental information volumes for the sites proposed by the applicant. In addition, reviewers independently verified the information provided to the extent practicable using available sources commonly consulted in the preparation of NEPA documents, and conducted preliminary analyses to identify the potential range of impacts that would be associated with each application. Reviewers identified both direct and indirect potential impacts to the resource areas mentioned above, as well as short-term impacts that might occur during construction and start-up, and long-term impacts that might occur over the expected operational life of the proposed project and beyond. The reviewers also considered any mitigation measures proposed by the applicant and any reasonably available mitigation measures that may not have been proposed.

Reviewers assessed the potential for environmental issues and impacts using the following characterizations:

- **Beneficial** – Expected to have a net beneficial effect on the resource in comparison to baseline conditions.
- **None (negligible)** – Immeasurable or negligible in consequence (not expected to change baseline conditions).
- **Low** – Measurable or noticeable but of minimal consequence (barely discernable change in baseline conditions).
- **Moderate** – Adverse and considerable in consequence but moderate and not expected to reach a level of significance (discernable, but not drastic, alteration of baseline conditions).
- **High** – Adverse and potentially significant in severity (anticipated substantial changes or effects on baseline conditions that might not be mitigable).

  For cases in which an application failed to provide sufficient information to support a determination among the above characterizations, the reviewers assigned one of the following characterizations:

- **Limited Concern** – The potential for substantial adverse impacts would be negligible to low based on background information about the resource area with respect to the geographic location of the project.
- **Elevated Concern** – The potential for substantial adverse impacts would be moderate to high based on background information about the resource area with respect to the geographic location of the project.

Applications in Response to the FOA

Based on the technologies and sites proposed, none of the applications were deemed to have a high potential for adverse impacts in eighteen of the twenty resource areas. However, one application was considered to have potential for high adverse impacts to floodplains, with another having high potential for health and safety concerns. The following impacts by resource area were considered in the selection of candidates for award:

Aesthetics –Low to moderate impacts would be expected for one facility. This site would be located within view of a residential area; however, it would be located where a previous facility stood that posed similar aesthetic issues, leading to little relative change. Low impacts were projected for all remaining sites. Temporary impacts could result at one site due to construction of a CO_2 pipeline near a National Historic Trail.

Air Quality – Moderate impacts would be expected for five projects, with three of them having elevated concerns due to new sources of criteria pollutants from planned or yet-to-be constructed plants. The other two facilities with expected moderate impacts would add new energy-generating systems to their plants as part of the project. Low impacts were anticipated for the remaining three projects. Concerns included increases in emissions of volatile organic compounds from four sites, increases in NO_x emissions from two sites, and increase in $PM_{2.5}$ and SO_2 emissions at one site. Temporary impacts from fugitive dust and combustion equipment were expected from all sites as a result of construction activities.

Biological Resources – Moderate impacts would be expected for four projects due to plant construction and land clearing activities. Impacts to aquatic species and habitat would be a concern for two projects as a result of process water intake, water discharge, and potential for accidental chemical release. Low impacts would be expected for the remaining sites.

Climate – Beneficial impacts would be expected for all projects as a result of greenhouse gas emissions reductions.

Community Services – Low impacts would be expected for all but one project, which would involve a new power plant. Generally, projects anticipating a larger temporary workforce during construction would be expected to place a higher demand on community services – particularly in smaller, more rural communities where currently existing community services are more limited.

Cultural Resources – Moderate impacts would be expected for two projects due to their proximity to multiple sites eligible for the National Register of Historic Places and other cultural resources. Low impacts would be expected for the remaining six projects. Potential impacts would include tribal concerns over pipeline routes. Impacts would vary with the extent of known tribal claims and their proximity to the proposed project or pipeline route.

Environmental Justice – Moderate impacts would be expected for one project due to the potential for disproportionate effects on minorities if an accidental release of hazardous chemical were to occur. Low impacts would be expected for the remaining projects, typically a function of lesser concentrations of low income and minority populations in surrounding areas.

Floodplains – Moderate to high impacts would be expected for three projects due to siting of the CO_2 capture facilities partially or totally within floodplains, and there would be limited concern for one site for which the floodplains are not delineated. Low to no impacts would be expected for the remaining proposed facilities. Low to moderate potential impacts during pipeline construction or pipeline routing would be expected for all but one project for which there are no floodplains within the proposed route. Floodplains would be impacted by any activity that modifies the available flood storage within the designated area; however, long-term potential impacts on the corridors would be minimal provided the surface contours are returned to preconstruction conditions.

Geology –Moderate impacts would be expected at one project due to sequestration within a rock formation largely untested for storage effectiveness. One project alternative presents elevated concern as it has potential for caprock fracture combined with abnormally high levels of hydrogen sulfide (H_2S) in the formation water. The potential for low to moderate impacts exists for all applications, either from CO_2 injection into saline aquifers or use for enhanced oil recovery.

Ground Water – Low impacts would be expected for all projects. Impacts could include displacement of saline waters in reservoirs targeted for CO_2 injection or loss of CO_2 containment should injection pressures exceed appropriate thresholds.

Human Health and Safety – Low to moderate impacts would be expected for all projects due to hazards associated with construction. The level of risk is generally related to the size and complexity of the planned construction. There could also be a risk to human health and safety from loss of containment of CO_2 during transport and injection. This risk is present for all applications and generally varies from low to moderate with distance and is influenced by population density along the CO_2 transport route. Shorter routes through sparsely populated areas were considered to have a lower risk than longer routes through regions of higher population. Low to moderate potential impacts could also be expected resulting from hazards associated with use, storage, and transport of ammonia for the CO_2 capture process. One project has a high potential impact due to the proximity of CO_2 pipelines to seismic faults and potential fracturing.

Land Use – Low impacts would be expected for all projects.

Noise – Moderate temporary impacts would be expected during construction of the pipeline routes for two projects that would pass near sensitive receptors. Long-term impacts during operations would be expected to be low for all projects.

Socioeconomics – Beneficial impacts would be expected for all projects. All projects would provide some additional employment as a result of construction, operations, and multiplier effects. Most employment opportunities would be in the local area.

Soils – Low impacts would be expected for projects located on previously disturbed land or within proximity to other industrial facilities. Moderate impacts would be expected for those projects with disturbances to prime farmland soils. One project would be located on a brownfield site, requiring additional remediation.

Surface Water – Moderate impacts would be expected for four projects due to proposed pipeline crossings of numerous streams and other water bodies, including one project where the pipeline crosses a major river. Moderate impacts would also be expected for two of the projects due to increased water demand. Low impacts would be expected for the remaining four projects. Increased sediment and nutrient loadings associated with increased stormwater runoff would be a concern for all projects.

Transportation and Traffic – Low impacts would be expected for all projects. Temporary impacts from construction are likely; however, operations would not be expected to result in any long-term traffic problems.

Utilities – Moderate impacts would be expected for five projects, associated with the supply of electricity for the CO_2 capture and compression systems. Low impacts would be expected for the remaining three projects.

Wastes and Materials – Low to moderate impacts would be expected for all projects due to required materials used and waste generated during operations of the CO_2 capture facilities, and wastes generated during construction, typically proportional to the size of the project.

Wetlands –Low impacts would be expected for all projects but one, which would have moderate impacts from more extensive wetland clearing as a result of CO_2 pipeline construction and ROW clearing.

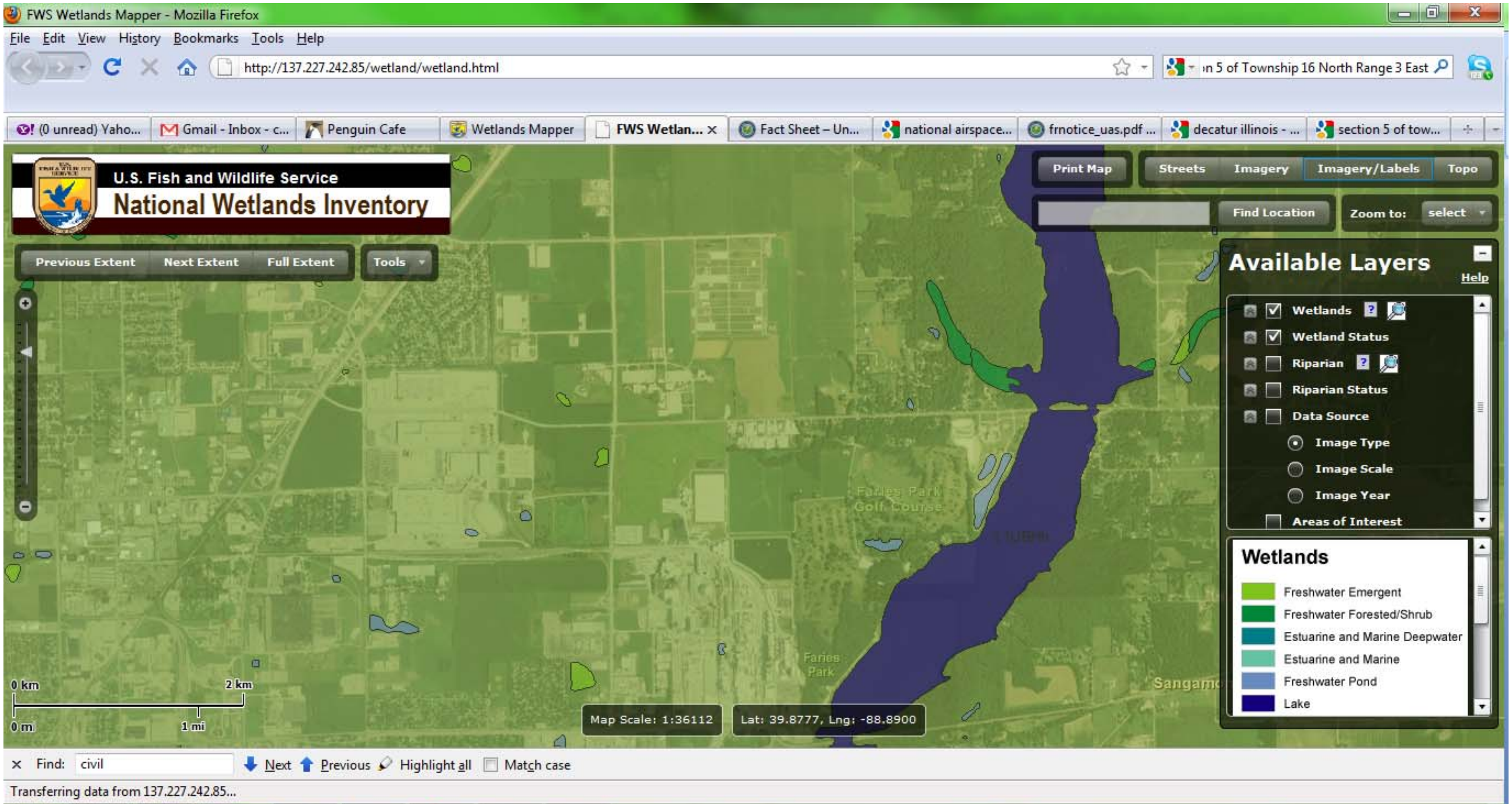
CONCLUSION

The alternatives available to DOE from applications received in response to the FOA for ICCS Technology Area I provided reasonable alternatives for accomplishing the Department's purpose and need to satisfy the responsibility Congress imposed on the Department to carry out a program to demonstrate technologies for the large-scale capture of CO_2 from industrial sources. The alternatives available to DOE would also meet the Department's goal of demonstrating advanced technologies that capture CO_2 emissions from industrial sources and either sequester the CO_2 in underground formations or put the CO_2 to beneficial use that permanently prevents it from entering the atmosphere. An environmental review was part of the evaluation process of these applications. DOE prepared a critique containing information from this environmental review. That critique, summarized here, contained summary as well as project-specific environmental information. The critique was made available to, and considered by, the selection official before selections for financial assistance were made.

DOE determined that selecting three applications in response to the FOA Technology Area 1 would meet the Department's purpose and need. DOE selected three projects for awards of financial assistance:

- Archer Daniels Midland Company (Decatur, IL) – project location in Decatur, IL. CO_2 capture from biofuels production and sequestration in the Mt. Simon sandstone formation; DOE determined that an environmental assessment is the appropriate level of environmental review for the proposed project.
- Air Products & Chemicals, Inc. (Allentown, PA) – project location in Port Arthur, TX. CO_2 capture from steam methane reforming process and transport to the Denbury Green Pipeline for use in EOR; DOE determined that an environmental assessment is the appropriate level of environmental review for the proposed project.
- Leucadia Energy, LLC (New York, NY) – project location in Lake Charles, LA. CO_2 capture from flue gas from yet-to-be constructed petroleum coke gasification plant and transport to the Denbury Green Pipeline for use in EOR; DOE determined that an environmental impact statement is the appropriate level of environmental review for the proposed project.

Appendix H NWI Online Wetlands Mapper



Screen shot taken 14 April 2011 from http://137.227.242.85/wetland/wetland.html

Appendix I Correspondence with USEPA Region 5

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

FEB 25 2011

REPLY TO THE ATTENTION OF:

E-19J

Pierina Fayish, Project Manager
U.S. Department of Energy
National Energy Technology Laboratory
P.O. Box 10940, MS: 922-M217
Pittsburgh, Pennsylvania 15236

Re: CO_2 Capture from Biofuels Production and Sequestration into the Mt. Simon Sandstone Environmental Assessment, Decatur, Illinois

Dear Ms. Fayish:

The U.S. Environmental Protection Agency (EPA) has reviewed the referenced draft Environmental Assessment (EA) prepared by the Department of Energy pursuant to our authorities under the National Environmental Policy Act (NEPA), Council on Environmental Quality regulations (40 CFR Parts 1500-1508), Section 309 of the Clean Air Act, and Section 404 of the Clean Water Act.

The proposed project involves building a Class VI injection well at the Decatur, Illinois Archer Daniels Midland Company (ADM) plant site as part of a trial run to determine the feasibility of injecting carbon dioxide (CO_2) into higher-porosity sedimentary strata, such as the Mt. Simon Sandstone, in a safe, environmentally conscious, and economically beneficial manner. The project proposes to capture, dehydrate, compress, transport, and inject approximately 2.5 million short tons of CO_2 byproduct produced at the Decatur, Illinois ADM facility, during the 2.5 year trial run. The project entails the construction of a dehydration/compression facility, building approximately 6,514 linear feet of pipeline between the existing ADM CO_2 discharge vent to the dehydration/compression facility and the Class VI injection well, construction of an electrical substation and 4.67 miles of electrical line, and also the construction of a 1,200 ft^2 carbon sequestration education center at nearby Richland Community College.

Based on our review, we have identified issues relating to shale stability, acidification, groundwater modeling, microseismicity, contingency plans, wetland impacts, and UIC permitting, as stated below:

Shale Stability & Water Acidification

The EA indicates that the Eau Claire Shale is dolomitic in composition. Groundwater pH readings of 2.8-3.0 are expected to occur as a result of water acidification by CO_2 and dissolutions of heavy metals, thus allowing mobilization within the injected strata. Since dolomite is characterized as a weakly effervescing mineral under acidic conditions, EPA believes long-term, possibly localized, dissolution of the Eau Clarie Shale could allow acidic groundwater and dissolved heavy metals to migrate out of the Mt. Simon Sandstone. EPA recommends conducting a geochemical analysis of the Eau Claire Shale and the Mt. Simon Sandstone.

Groundwater Modeling

Concerns regarding the projected size, volume, and path of the CO_2 groundwater plume are vague in the EA, and do not discuss specific predictions regarding the aforementioned variables. The projected time required for a given amount of CO_2 to chemically bond and solidify into a calcium carbonate cement was not discussed. Will this potentially alter permeability of the Mt. Simon Sandstone—more so closer to the injection well?

Micoseismicity

The effects of microseismicity (small-scale earthquakes) on the integrity of the injection well and the structural security of the local sedimentary strata are not fully explained. Earthquakes have occurred in tectonically active regions are a result of liquid injection into the subsurface. Similarly, EPA believes the proposed test injection well will be in close proximity to the Wabash Valley seismic zone and the New Madrid fault's zone of influence. In light of these concerns, EPA recommends identifying any cumulative impacts that would occur as a result of both proposed daily injection pressure and bedrock movement that could occur as a result of seismic events.

Contingency Plan

Whether or not ADM will have a contingency plan in place for leaks and explosions is not well understood. Does ADM have standard maintenance measures that will be taken to avoid leaks and explosions? Similarly, does ADM have a plan that will be initiated during an overpressurization event at the well?

Wetlands

NEPAssist, an environmental assessment tool used by USEPA, showed the presence of wetlands directly across North Brush Road from the injection well site. Please describe the sources used to make a jurisdictional determination for the non-presence of wetland features at the project site.

UIC Permitting

In addition to investigating potential flow pathways, EPA is concerned about the effects of injection pressure when combined with existing brine in the Mt. Simon Sandstone. ADM believes that the well may be permitted either as a new permit, or as a modification for an existing area permit. However, area permits for Class I, non-hazardous, injection wells are most often permitted individually. Additionally, Class VI regulations do not permit area permitting. What path of permitting does ADM intend to pursue both before, and after, Class VI injection well regulations become binding on September 6, 2011?

CO_2 solubility in the formation brine water is less than fresh water. This process should be thoroughly explored and modeled to better define how much CO_2 will remain in supercritical fluid state versus dissolved state into formation water. The EA also does not mention construction materials as being acid resistant. Technical analyses regarding geochemical changes, groundwater modeling, and acidification will be required as part of a future Class VI well permit, provided ADM intends to apply for one after September 6, 2011.

EPA is available to discuss these comments to the draft EA at your convenience. Please feel free to contact me at 312-886-2910 or Mike Sedlacek of my staff at 312-886-1765 to discuss these comments.

Sincerely,

Kathleen Kowal

for Kenneth A. Westlake, Chief
NEPA Implementation Section
Office of Enforcement and Compliance Assurance

cc: Becky Harvey, Underground Injection Control Branch
Lisa Perenchio, Underground Injection Control Branch
Jeff McDonald, Underground Injection Control Branch
Leslie Patterson, Underground Injection Control Branch
Andrew Greenhagen, Underground Injection Control Branch

NATIONAL ENERGY TECHNOLOGY LABORATORY
Albany, OR • Morgantown, WV • Pittsburgh, PA

U.S. DEPARTMENT OF ENERGY

April 25, 2011

Kenneth A. Westlake E-19J
Chief, NEPA Implementation Section
United States Environmental Protection Agency
Region 5
77 West Jackson Blvd
Chicago, IL 60604

Dear Mr. Westlake:

The National Energy Technology Laboratory (NETL) received your comments in response to the Draft Environmental Assessment (EA) for "CO_2 Capture from Biofuels Production and Sequestration into the Mt. Simon Sandstone," DOE/EA-1828D. NETL has reviewed your comments and provided clarifications below. Please see the attached Final EA with the clarifying information highlighted in blue and identified by section and page number below each comment and response.

EPA Comment 1:
The EA indicates that the Eau Claire Shale is dolomitic in composition. Groundwater pH readings of 2.8-3.0 are expected to occur as a result of water acidification by CO2, and dissolutions of heavy metals, thus allowing mobilization within the injected strata. Since dolomite is characterized as a weakly effervescing mineral under acidic conditions, EPA believes long-term, possibly localized, dissolution of the Eau Claire Shale could allow acidic groundwater and dissolved heavy metals to migrate out of the Mt. Simon Sandstone. EPA recommends conducting a geochemical analysis of the Eau Claire Shale and the Mt. Simon Sandstone.

Response 1:
Core and well data from the existing well drilled for the Midwest Geologic Sequestration Consortium (MGSC) project[1], located less than one mile from the proposed site, demonstrate that 497 feet of the Eau Claire Formation are present. The upper 300 feet of the Eau Claire Formation at this location are comprised of tight dolomitic siltstone, dolomite, and limestone, in descending order. The bottom 197 feet of the Eau Claire is shale with little or no carbonate stringers present. Geochemical and geophysical analyses confirm the presence of this thick shale. X-ray diffraction and other geochemical analysis are currently underway on the Eau Claire samples and information from these analyses will be included in subsequent UIC Class VI permit applications. MGSC models of the one

[1] The legal name of this well is ADM CCS #1. For the purpose of distinguishing existing wells from the proposed project wells, this well was identified as an "MGSC well" in the EA document.

626 Cochrans Mill Road, P.O. Box 10940, Pittsburgh, PA 15236

million metric tonnes of injected CO_2 after a one hundred year post-injection period show that injected CO_2 will not reach the base of the Eau Claire shale making the long-term potential for dissolution of the shale highly unlikely. Analysis of Mt. Simon Sandstone thin sections from 90 feet of core demonstrate that the sandstone is cemented by silicate cements with little to no evidence of carbonate cements.

Document changes: Text was added to Section 2.1.3.2 on page 22, Section 4.2.1 on page 38, and Section 4.2.2 on pages 41-42.

EPA Comment 2:
Concerns regarding the projected size, volume, and path of the CO_2 groundwater plume are vague in the EA, and do not discuss specific predictions regarding the aforementioned variables. The projected time required for a given amount of CO_2 to chemically bond and solidify into a calcium carbonate cement was not discussed. Will this potentially alter permeability of the Mt. Simon Sandstone-more so closer to the injection well?

Response 2:
The Mt. Simon Sandstone is a clean, second-cycle sediment dominated by silicate minerals cemented by quartz. The availability of cations such as calcium is limited; therefore, the ability of precipitates to form and alter injectability is limited. The reaction rate for carbonate cement formation is very slow. Since the expected time period for carbonate cement formation is hundreds to thousands of years post-injection, the increase of availability of CO_2 in the Mt. Simon brine is highly unlikely to decrease permeability.

Document changes: Text was added to Section 4.4.2 on page 42.

EPA Comment 3:
The effects of micro seismicity (small-scale earthquakes) on the integrity of the injection well and the structural security of the local sedimentary strata are not fully explained. Earthquakes have occurred in tectonically active regions are a result of liquid injection into the subsurface. Similarly, EPA believes the proposed test injection well will be in close proximity to the Wabash Valley seismic zone and the New Madrid fault's zone of influence. In light of these concerns, EPA recommends identifying any cumulative impacts that would occur as a result of both proposed daily injection pressure and bedrock movement that could occur as a result of seismic events.

Response 3:
The proposed injection site in Decatur Illinois is well away from the New Madrid and Wabash Valley seismic zones and there is no site-specific manifestation of these zones at the Decatur site. In fact, there are no mapped regional faults or fracture zones with a 25-mile radius of the proposed site. Thus, there are no evident planes of failure that could potentially allow bedrock movement that would impact the integrity of the site and with any possible relationship to fluid injection pressures that could activate these surfaces. Seismicity in the southern Illinois region of the Wabash Valley seismic zone is related to deep-seated northeast trending normal and strike-slip faulting in the Precambrian basement. Decatur is not on this trend and in fact this structural trend angles away from Decatur as you proceed north from southern Illinois. The nine largest events in this zone from 1958 to 1987 occurred at depths of 16,100 to 76,800 ft, much too deep to be affected by any fluid injection in the Mt. Simon Sandstone at Decatur, and not at the distances involved. Additionally, the earthquakes of record do not correlate with any known structures in the Paleozoic sedimentary section, which includes the Mt. Simon, thus any impact from daily injection pressures at Decatur is highly unlikely. Any instrumentally-detectable

microseismic activity (not an earthquake) is likely to be related to fluid flow through tortuous pathways in the injection zone.

Document changes: Text was added to Section 4.2.2 on page 42.

EPA Comment 4:
In addition to investigating potential flow pathways, EPA is concerned about the effects of injection pressure when combined with existing brine in the Mt. Simon Sandstone. ADM believes that the well may be permitted either as a new permit, or as a modification for an existing area permit. However, area permits for Class I, non-hazardous, injection wells are most often permitted individually. Additionally, Class VI regulations do not permit area permitting. What path of permitting does ADM intend to pursue both before, and after, Class VI injection well regulations become binding on September 6, 2011?

CO_2 solubility in the formation brine water is less than fresh water. This process should be thoroughly explored and modeled to better define how much CO_2 will remain in supercritical fluid state versus dissolved state into formation water. The EA also does not mention construction materials as being acid resistant. Technical analyses regarding geochemical changes, groundwater modeling, and acidification will be required as part of a future Class VI well permit, provided ADM intends to apply for one after September 6, 2011.

Response 4:
ADM is in discussion with US EPA Region 5 and Illinois EPA regarding a permitting path forward and will comply with all Class VI injection well regulations.

The impact of NaCl concentrations on CO_2 solubility is well known and is shown in Duan and Sun (2003) and Duan, Sun, Zhu, and Chou (2006). Injected supercritical CO_2 will be partitioned between the injected free phase, CO_2 trapped by capillary forces to develop a residual saturation of CO_2, and CO_2 that will dissolve in the brine. The effects can be readily modeled both in advance and, more accurately, once the injection well is drilled and site-specific data are collected.

All well construction materials will be acid-resistant and are duplicates of those used in the MGSC well, which uses CO_2-resistant cement across the reservoir and primary seal, and 13-chrome steel casing in the lower 2,000 ft of the injection and seal zone and in the entire length of the injection tubing. The packer utilized will also be constructed of CO_2-resistant metals and special elastomers rated for CO_2 service.

Document changes: Text was added to Section 2.1.2.4 on page 18, Section 2.1.2.5 on page 18, and Section 2.1.3.1 on page 21.

EPA Comment 5:
NEPAssist, an environmental assessment tool used by NEPAssist, showed the presence of wetlands directly across North Brush Rd from the injection well site. Please describe the sources used to make a jurisdictional determination for the non-presence of wetland features at the project site.

Response 5:

There is a wetland to the west of North Brush College Road, as was previously described in Section 4.4.1 of the EA. The National Wetlands Inventory[2] (NWI) was the source used to identify the presence of wetlands. Please refer to Figure 4.4.1 of the EA for a visual representation of the wetland you described, as well as other wetlands in the area. The unit you identified is outside the northwestern boundary of the project site. Additionally, the well that you are describing (directly across North Brush College Rd) is a monitoring well that already exists at the site. That well is for the separate MGSC project and was analyzed in a previous EA. The existing well locations are shown on project maps (such as Figure 4.4.1) because DOE analyzed effects from the on-going MGSC project at the ADM site cumulatively with the proposed project. Only the proposed electrical lines are near the identified wetland unit on the west side of North Brush College Road. These lines would be placed on new wooden poles along ADM's western property boundary along the east side of North Brush College Road, with the road passing between the wetland unit and the proposed electrical lines. The ground disturbance associated with the electrical line construction is minimal and is not expected to affect this or any of the other wetlands outside the project area. Other potential impacts to wetlands from the proposed project activities were discussed in Section 4.4.2 of the EA.

Document changes: Text was added to section 4.4.1 and 4.4.2 on pages 47 and 48, respectively.

EPA comment 6: Whether or not ADM will have a contingency plan in place for leaks and explosions is not well understood. Does ADM have standard maintenance measures that will be taken to avoid leaks and explosions? Similarly, does ADM have a plan that will be initiated during an overpressure event at the well?

Response 6:
ADM has significant past experience compressing, treating, and handling CO_2 liquids. ADM has a well established emergency response plan that coordinates with the appropriate external agencies and is aligned with the needs of an integrated manufacturing complex. These established procedures will be applied and if needed modified to suit the needs of this specific process, therefore ADM will have contingency and maintenance plans to avoid and to respond to leaks, explosions, and overpressure events.

The process control system for the CO_2 compression facility is designed to prevent and to alert operations personnel in the event of a significant deviation of the normal operating process parameters (e.g., CO_2 temperature, pressure, and flow). For example, in the event of an overpressure event, the process control system will automatically spillback CO_2 to the first stage of compression reducing the flow to the injection well. If the over pressure situation persists, the control system will open the atmospheric vent to bring the pressure down. During this period, the operations personnel will receive numerous alarms alerting them of the process deviation allowing them the opportunity to take corrective actions.

In the event of a failure, the compression facility will be equipped with emergency stops and automated isolation valves that will allow operations personnel to quickly shutdown, isolate, and depressurize the unit. These and other systems along with personnel trained on the unit specific operating and maintenance procedures will promote safe operation of the plant. Additionally, all unit operations and maintenance personnel will be given safety and emergency response training prior to commissioning the unit.

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[2] (USFWS, 1987). United States Fish and Wildlife Service. *National Wetlands Inventory. 1987. Wetlands and Deepwater Habitats of the Conterminous United States - Illinois.* Accessed February 2010 at http://www.fws.gov/wetlands/Data/DataDownload.html.

This facility will be designed and constructed to meet appropriate ASME standards, e.g., the process piping will be designed in conformance with the ASME B31.3 standard. Existing standards that govern mechanical integrity (e.g. API 510) were developed for facilities processing flammable and reactive materials. This facility will be processing CO_2 which is non flammable and non reactive, therefore these standards are not appropriate for this process service. Because ADM understands the hazards that compressed CO_2 presents and to insure the mechanical integrity of the facility, maintenance and inspection procedures will be developed that will cover the future operation of the CO_2 compression and transmission infrastructure.

Emergency response and mechanical integrity testing specific to the sub surface facility (injection well bore), has been developed and is detailed in the UIC permit's Appendices H and I respectively.

Document changes: Text was added in Section 2.1.3.3 on pages 23-24.

Please contact me at (412) 386-5428 with any further questions.

Sincerely.

Pierina N. Fayish

Pierina N. Fayish
NEPA Document Manager