Memorandum of Understanding

Between

Cooperative Research Centre for Greenhouse Gas Technologies (CO2CRC)

and

United States Department of Energy
National Energy Technology Laboratory

I. Purpose

The purpose of this Memorandum of Understanding (MOU) between the United States Department of Energy (DOE), National Energy Technology Laboratory (NETL) (hereinafter "DOE/NETL") and Cooperative Research Centre for Greenhouse Gas Technologies (hereinafter "CO2CRC") of Australia, is to establish a cooperative working arrangement between NETL and CO2CRC in the areas of the Otway carbon sequestration project.

II. Funding

All work performed by DOE/NETL and CO2CRC under this MOU will be done with each organization funding its own activities.

III. Specific Research and Development Projects

CO2CRC and NETL and its contractors shall share data regarding the Otway carbon sequestration project. CO2CRC has overseen a project storing carbon in a gas field in Australia and has production and injection data, as well as geologic models of the site. CO2CRC will provide this data to NETL. NETL will use this data to run simulations of prior and potential CO2 injection into the field for the purposes of developing tools for risk assessment. NETL will be performing simulations of injection at the site and collaborating with Los Alamos National Lab to develop the systems model for the sequestration system.

Scope of work. The overall objective of the project is to demonstrate how the results of Otway CO2 injection project can be utilized in a systems model. We will apply an approach integrating NETL's Surrogate Reservoir Modeling techniques and LANL's CO2-PENS to the Otway test data. The goal is to demonstrate how the field observations can be used to predict scenarios with higher injection rates or longer injection duration. We will use the geologic model for the Otway field to develop a numerical reservoir simulation model and match field injection data with it. To comprehensively analyze the entire solution space a Surrogate Reservoir

Model (SRM) will be developed based on the history matched model. This SRM will be able to predict saturations and pressures as a function of location in the reservoir and injection rates. The SRM will be used in a systems model for the field that will be developed using LANL's CO2-PENS model. The systems model will include the important components in the field such as the target injection zone, monitoring well and faults. The systems model will be subsequently used to understand the impact of injecting CO2 over longer time period (as well as at higher injection rates) while taking into account variability in multiple reservoir parameters on CO2 interactions with reservoir and other system components.

Methodology:
Completion of this project will require accomplishment of the following tasks:
Task #1. Flow Model Development.
Task #2. Model History Matching.
Task #3. Development of Surrogate Reservoir Model (SRM).
Task #4. Comprehensive analysis of the Flow Model using the Developed SRM taking into account distributions of parameter values.
Task #5. Preparation of a version of SRM that can be used in the CO2 – PENS.
Task #6 Development of a systems model in CO2-PENS
Task #7 Incorporation of SRM model abstractions in CO2-PENS
Task #8 Monte-Carlo analysis with CO2-PENS

Expected Outcomes:
The expected outcomes of the above tasks are as follows:
1.A base reservoir flow model based on the geological information that is provided using a commercial reservoir simulator.
2.A history matched reservoir flow model based on the production/injection history of the Otway field. The model will be history matched based on modification and tuning of the geological information that is provided.
3.A Surrogate Reservoir Model (SRM) based on the history matched flow model that will be used as a forward looking model that can be run in real-time and allow us to comprehensively examine the entire solution space.
4.A comprehensive Uncertainty Analysis of the Flow Model using the Developed SRM.
5.Preparation of the SRM in a way that would be able to be used in the CO2 – PENS.
6.A CO2-PENS model for the site.
7.Results of the Monte-Carlo analysis with CO2-PENS focused on understanding the implications of varying CO2 injection rates and durations.

IV. Technical Coordination

The technical Point of Contact for NETL is Grant Bromhal.

The technical Point of Contact for CO2CRC is Charles Jenkins.

V. Intellectual Property Rights of the Parties

Any intellectual property right which is owned or controlled by either party hereto prior to the date of this MOU, or which is acquired or developed by a party independently of its performance under this MOU, shall at all times continue to be owned or controlled by said party. Any intellectual property developed solely by the employees of either party in the performance of work under this MOU shall be owned by that party. In the event an activity conducted under this MOU results in intellectual property developed jointly by one or more employees of CO2CRC and one or more employees of DOE, CO2CRC and DOE shall jointly own such intellectual property. As to all such jointly owned intellectual property, each party shall be free to use, practice and license non-exclusively such jointly owned intellectual property, without in any way accounting to the other party. Notification of any such use, practice, and license shall be made between the parties within 30 days of such events. Procedures for seeking, obtaining and maintaining protection (such as patents or copyrights) for jointly owned intellectual property shall be mutually agreed in good faith by the owning parties.

VI. Publication Rights

Each party reserves the right to publish written works related to work conducted hereunder either separately or by co-authorship with the other party. In the event the party publishes separately, both parties agree to submit a draft of any such publication to the other party for a 30-day review period prior to release.

VII. Third Party Claims

Each party shall be responsible for claims, losses, damages, and expenses which are proximately caused by the negligence or wrongful acts or omissions of that party or its employees, agents or representatives acting within the scope of their employment.

VIII. Communications

To provide for consistent and effective communications, the parties have designated points of contact listed below:

DOE/NETL

Grant Bromhal
USDOE/NETL
3610 Collins Ferry Road
P.O. Box 880

CO2CRC

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CSIRO
GPO BOX 3023
CANBERRA ACT 2601
AUSTRALIA

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+61 2 6246 5629

Morgantown, WV 26507-0880
304.285.4688
Grant.Bromhal@netl.doe.gov

The points of contact shall coordinate all requests for assistance under this MOU and shall serve as the communication link between CO2CRC and DOE/NETL on matters relating to work performed or to be performed under this MOU.

X. Entire Agreement

This MOU embodies the entire agreement between CO2CRC and DOE/NETL with regard to the work described in this MOU and supersedes all other communications, either oral or written. The parties shall not be bound by, or be liable for any statement, representation, promise, inducement or understanding not set forth herein. No amendments or modifications shall be valid unless incorporated into this MOU.

XI. Authorities

Work performed under this MOU is authorized by the Department of Energy Organization Act As Amended (Public Law 95-91).

XII. Effective Date, Modification, And Termination

This MOU is effective upon acceptance of the two parties and shall remain in effect until July 1, 2012 unless terminated in accordance with the terms set forth herein. This MOU may be modified by mutual consent of the parties. Any modifications must be signed by the point of contact designated for each party in Article IX above. This MOU may be terminated at any time by mutual consent of the parties. Either party may terminate this MOU unilaterally by providing 30 calendar days written notice.

ACCEPTANCE for CO2CRC:

By: _____ Date: 25 June 2010
Signature

PETER J COOK
Printed Name

ACCEPTANCE for the United States Department of Energy:

By: _____ Date: 8/16/12

Anthony V. Cugini
Director
NETL