# Final Scientific/Technical Report

National Research Council Research Associateships Program with Methane Hydrates Fellowships Program/National Energy Technology Laboratory

Issued March 20, 2014
For the Period July 5, 2005 – January 31, 2014

**WORK PERFORMED UNDER AGREEMENT**
DE-FC26-05NT42248

**SUBMITTED BY**
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## DISCLAIMER



## ABSTRACT

This report summarizes work carried out over the period from July 5, 2005 – January 31, 2014. The work was carried out by the National Research Council Research Associateships Program of the National Academies, under the US Department of Energy's National Energy Technology Laboratory (NETL) program.

This Technical Report consists of a description of activity from 2005 through 2014, broken out within yearly timeframes, for NRC/NETL Associateships researchers at NETL laboratories which includes individual tenure reports from Associates over this time period. The report also includes descriptions of program promotion efforts, a breakdown of the review competitions, awards offered, and Associate's activities during their tenure.

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**Annual Contract Technical Report**

**July 05, 2005 – July 04, 2006**

**DE-FC26-05NT42248**

## Publicity

The National Academies Research Associateship Programs for the reporting period were announced to the scientific community, beginning in the fall of the preceding year, 2004. Publicity materials describing the National Research Council-National Energy Technology Laboratory (NETL) Programs were distributed in November to presidents, graduate deans, and heads of appropriate science and engineering departments and minority-affairs offices of all academic degree-granting institutions in the United States. An e-mail announcement of the programs was sent to these same contact points prior to each review deadline. Promotional materials were sent to Laboratory Program Representatives, Associateship Advisers, and other interested persons. General advertisements of programs were placed in leading scientific and engineering publications. Publicity materials and other related information were made available on the internet. Research Associateship Programs staff attended numerous professional scientific and engineering meetings and minority recruitment events to promote the various programs and to meet with prospective applicants throughout the year.

## Requests

Application materials were distributed in response to specific requests for information about the NETL Research Associateship Program or as a result of general requests by persons whose fields of specialization appeared to be appropriate for the research opportunities available in the NETL laboratories.

## Competition

Panel reviews of applicants for the Research Associateship Programs, including those with the National Energy Technology Laboratory, are conducted four times each year. The following is a breakdown of the action taken with the applications to the National Energy Technology Laboratory during the reporting period.

| | AUG 05 | NOV 05 | FEB 06 | MAY 06 | TOTAL |
|---|---|---|---|---|---|
| **TOTAL APPLICATIONS** | 0 | 1 | 1 | 1 | **3** |
| **Number of Applications Reviewed** | 0 | 0 | 0 | 1 | **1** |
| Applications not recommended (did not pass Review) | 0 | 0 | 0 | 0 | **0** |
| **Applications Recommended** (passed Review) | 0 | 0 | 0 | 1 | **1** |
| Awards offered | 0 | 0 | 0 | 1 | **1** |
| Awards accepted | 0 | 0 | 0 | 1 | **1** |
| Awards declined | 0 | 0 | 0 | 0 | **0** |
| Awards withdrawn by RAP (NRC officially withdrew award *after* it had been accepted.) | 0 | 0 | 0 | 0 | **0** |

## Associates' Citizenship

The one Associate on tenure between July 05, 2005 and July 04, 2006 was a citizen of the United States.

## Associates' Activities

No Associates ended tenure during this report period.

No final reports were submitted during this report period.

Additional information about the Associates' activities can be found in the attachments described below and the Appendix.

*Attachment 1:* Associates who were on tenure between July 05, 2005 and July 04, 2006. Included are the Associate's laboratory center/division location, the starting and termination dates, and the names of their advisers. For those Associates who ended tenure during the report period, it is noted if the final and adviser evaluation reports have been received. Associates are required to submit final reports upon termination of tenure, and advisers are asked to submit a final evaluation of each Associate. Associates who have not submitted a final report have received follow-up correspondence.

*Attachment 2:* All recommended candidates by category (e.g., Recommended, Accepted, No Funding, Declined, etc.). This report includes information about citizenship, the PhD institution, the title of proposed research, proposed or actual starting date, and adviser.

*Attachment 3:* Summaries of Associate patent activity, if any, and Associate research during tenure as reported on the Associates' termination reports. The summary of patent activity includes the patent application title, inventor(s), and date of application.

*Appendix:* Final reports received from the Associates who ended tenure during the report period.

## Associates On Tenure 7/5/2005 - 7/4/2006 Attachment 1

### NETL - National Energy Technology Laboratory



| Associate Name+ / Adviser | Center | Tenure Dates Start/End | Termination Report | Adviser Report |
|---|---|---|---|---|
| Schwartz, Michael<br>*Dr. Bradley Bockrath* | (S) National Energy Technology Laboratory | 11/1/2005 - 10/31/2006 | | |

1 Associates Listed

*** End of Center ***

+ (S) indicates the associate was a Senior.

Highlighted entries indicate no intry on the Award Init Screen but data on the Post Tenure Screen.

## May 2006

**A- Accepted Award**

HALJASMAA, IGOR
Citizenship: United States
Adviser: Dr. Yee Soong
Research Field: 5820
Research Title: Investigation of Important Issues related to CO2 Sequestration in Coal Seams and Saline Aquifer Formations

Ph.D. Date: 2006
University of Pittsburgh/PA
Actual Starting Date: 8/04/06
Termination Date: 8/03/07

* * *

THE NATIONAL ACADEMIES
*Advisers to the Nation on Science, Engineering, and Medicine*

Policy and Global Affairs
Associateship Programs

500 Fifth Street, NW, GR 322A
Washington, DC 20001
Phone: 202 334 2760
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THE NATIONAL ACADEMIES
*Advisers to the Nation on Science, Engineering, and Medicine*

# National Research Council
**RESEARCH ASSOCIATESHIP PROGRAM**

**with the**

**National Energy Technology Laboratory**

**Annual Contract Technical Report**

**July 05, 2006 – July 04, 2007**

**DE-FC26-05NT42248**

## Publicity

The National Academies Research Associateship Programs for the reporting period were announced to the scientific community, beginning in the fall of the preceding year. Publicity materials describing the National Research Council-National Energy Technology Laboratory (NETL) Programs were distributed in November to presidents, graduate deans, and heads of appropriate science and engineering departments and minority-affairs offices of all academic degree-granting institutions in the United States. An e-mail announcement of the programs was sent to these same contact points prior to each review deadline. Promotional materials were sent to Laboratory Program Representatives, Associateship Advisers, and other interested persons. General advertisements of programs were placed in leading scientific and engineering publications. Publicity materials and other related information were made available on the internet. Research Associateship Programs staff attended numerous professional scientific and engineering meetings and minority recruitment events to promote the various programs and to meet with prospective applicants throughout the year.

## Requests

Application materials were distributed in response to specific requests for information about the NETL Research Associateship Program or as a result of general requests by persons whose fields of specialization appeared to be appropriate for the research opportunities available in the NETL laboratories.

## Competition

Panel reviews of applicants for the Research Associateship Programs, including those with the National Energy Technology Laboratory, are conducted four times each year. The following is a breakdown of the action taken with the applications to the National Energy Technology Laboratory during the reporting period.

| | AUG 06 | NOV 06 | FEB 07 | MAY 07 | TOTAL |
|---|---|---|---|---|---|
| **TOTAL APPLICATIONS** | 1 | 1 | 2 | 1 | **5** |
| **Number of Applications Reviewed** | 1 | 1 | 2 | 0 | **4** |
| Applications not recommended (did not pass Review) | 0 | 0 | 0 | 0 | **0** |
| **Applications Recommended** (passed Review) | 1 | 1 | 2 | 0 | **4** |
| Awards offered | 0 | 1 | 1 | 0 | **2** |
| Awards accepted | 0 | 1 | 1 | 0 | **2** |
| Awards declined | 0 | 0 | 0 | 0 | **0** |
| Awards withdrawn by RAP (NRC officially withdrew award *after* it had been accepted.) | 0 | 0 | 0 | 0 | **0** |

## Associates' Citizenship

The three Associates on tenure between July 05, 2006 and July 04, 2007 were all citizens of the United States.

## Associates' Activities

No Associates ended tenure during this report period.

No final reports were submitted during this report period.

THE NATIONAL ACADEMIES
*Advisers to the Nation on Science, Engineering, and Medicine*

# National Research Council
**RESEARCH ASSOCIATESHIP PROGRAM**

**with the**

**National Energy Technology Laboratory**
**Methane Hydrates Fellowship Program**

**Annual Contract Technical Report**

**July 05, 2007– July 04, 2008**

**DE-FC26-05NT42248**

## Publicity

The National Academies Research Associateship Programs for the reporting period were announced to the scientific community, beginning in the fall of the preceding year. Publicity materials describing the National Research Council-National Energy Technology Laboratory (NETL) Programs were distributed in November to presidents, graduate deans, and heads of appropriate science and engineering departments and minority-affairs offices of all academic degree-granting institutions in the United States. An e-mail announcement of the programs was sent to these same contact points prior to each review deadline. Promotional materials were sent to Laboratory Program Representatives, Associateship Advisers, and other interested persons. General advertisements of programs were placed in leading scientific and engineering publications. Publicity materials and other related information were made available on the internet. Research Associateship Programs staff attended numerous professional scientific and engineering meetings and minority recruitment events to promote the various programs and to meet with prospective applicants throughout the year.

## Requests

Application materials were distributed in response to specific requests for information about the NETL Research Associateship Program or as a result of general requests by persons whose fields of specialization appeared to be appropriate for the research opportunities available in the NETL laboratories.

## Competition

Panel reviews of applicants for the Research Associateship Programs, including those with the National Energy Technology Laboratory, are conducted four times each year. The following is a breakdown of the action taken with the applications to the National Energy Technology Laboratory during the reporting period.

| | AUG 07 | NOV 07 | FEB 08 | MAY 08 | TOTAL |
|---|---|---|---|---|---|
| **TOTAL APPLICATIONS** | 0 | 1 | 0 | 3 | 4 |
| **Number of Applications Reviewed** | 0 | 0 | 0 | 1 | 1 |
| Applications not recommended (did not pass Review) | 0 | 0 | 0 | 1 | 1 |
| **Applications Recommended** (passed Review) | 0 | 0 | 0 | 0 | 0 |
| Awards offered | 0 | 0 | 0 | 0 | 0 |
| Awards accepted | 0 | 0 | 0 | 0 | 0 |
| Awards declined | 0 | 0 | 0 | 0 | 0 |
| Awards withdrawn by RAP (NRC officially withdrew award *after* it had been accepted.) | 0 | 0 | 0 | 0 | 0 |

## Associates' Citizenship

The four Associates on tenure between July 05, 2007 and July 04, 2008 were all citizens of the United States.

Additional information about the Associates' activities can be found in the attachments described below and the Appendix.

*Attachment 1:* Associates who were on tenure between July 05, 2007 and July 04, 2008. Included are the Associate's laboratory center/division location, the starting and termination dates, and the names of their advisers. For those Associates who ended tenure during the report period, it is noted if the final and adviser evaluation reports have been received. Associates are required to submit final reports upon termination of tenure, and advisers are asked to submit a final evaluation of each Associate. Associates who have not submitted a final report have received follow-up correspondence.

*Attachment 2:* All recommended candidates by category (e.g., Recommended, Accepted, No Funding, Declined, etc.). This report includes information about citizenship, the PhD institution, the title of proposed research, proposed or actual starting date, and adviser.

*Attachment 3:* Summaries of Associate patent activity, if any, and Associate research during tenure as reported on the Associates' termination reports. The summary of patent activity includes the patent application title, inventor(s), and date of application.

*Appendix:* Final reports received from the Associates who ended tenure during the report period.

## Associates On Tenure 7/5/2007 - 7/4/2008 Attachment 1

### National Energy Technology Laboratory



| Associate Name+ Adviser | Center | Tenure Dates Start/End | Termination Report | Adviser Report |
|---|---|---|---|---|
| Crandall, Dustin Micheal<br>*Dr. Duane H. Smith* | National Energy Technology Laboratory, Morgantown | 8/31/2007 - 8/30/2009 | | |
| Frame, Dustin Michael<br>*Dr. Cynthia Powell* | National Energy Technology Laboratory | 2/20/2007 - 2/19/2008 | Not Recd | Not Recd |
| Haljasmaa, Igor<br>*Dr. Yee Soong, III* | National Energy Technology Laboratory | 8/4/2006 - 8/3/2009 | | |
| Schwartz, Michael<br>*Dr. Bradley Bockrath* | (S) National Energy Technology Laboratory | 11/1/2005 - 10/31/2008 | | |

4 Associates Listed

+ (S) indicates the associate was a Senior.

Highlighted entries indicate no intry on the Award Init Screen but data on the Post Tenure Screen.

## Competition

Panel reviews of applicants for the Research Associateship Programs, including those with the National Energy Technology Laboratory/Methane Hydrates Fellowship Program, are conducted two times each year. The following is a breakdown of the action taken with the applications to the National Energy Technology Laboratory during the reporting period.

| | AUG 07 | NOV 07 | FEB 08 | MAY 08 | TOTAL |
|---|---|---|---|---|---|
| **TOTAL APPLICATIONS** | 1 | 0 | 3 | 0 | 4 |
| **Number of Applications Reviewed** | 1 | 0 | 3 | 0 | 4 |
| Applications not recommended (did not pass Review) | 0 | 0 | 0 | 0 | 0 |
| **Applications Recommended** (passed Review) | 1 | 0 | 3 | 0 | 4 |
| Awards offered | 1 | 0 | 0 | 0 | 1 |
| Awards accepted | 1 | 0 | 0 | 0 | 1 |
| Awards declined | 0 | 0 | 0 | 0 | 0 |
| Awards withdrawn by RAP (NRC officially withdrew award *after* it had been accepted.) | 0 | 0 | 0 | 0 | 0 |

## Associates' Citizenship

The three Associates on tenure between July 05, 2007 and July 04, 2008 were all citizens of the United States.

## Associates' Activities

No Associates ended tenure during this report period.

No Final Reports were submitted during this report period.

Additional information about the Associates' activities can be found in the attachments described below and the Appendix.

*Attachment 1:* Associates who were on tenure between July 05, 2007 and July 04, 2008. Included are the Associate's laboratory center/division location, the starting and termination dates, and the names of their advisers. For those Associates who ended tenure during the report period, it is noted if the final and adviser evaluation reports have been received. Associates are required to submit final reports upon termination of tenure, and advisers are asked to submit a final evaluation of each Associate. Associates who have not submitted a final report have received follow-up correspondence.

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*Appendix:* Final reports received from the Associates who ended tenure during the report period.

## Associates On Tenure 7/5/2007 - 7/4/2008 Attachment 1

### Methane Hydrates Fellowship Program



| Associate Name<br>Adviser | Center | Tenure Dates<br>Start/End | Termination Report | Adviser Report |
|---|---|---|---|---|
| Heintz, Monica Beryl<br>*Dr. David Valentine* | (P) Methane Hydrates Fellowship Program | 7/2/2007 - 7/1/2009 | | |
| Lapham, Laura Lee<br>*Dr. Jeffrey Chanton* | Methane Hydrates Fellowship Program | 2/4/2008 - 2/3/2009 | | |
| Solomon, Evan Alan<br>*Dr. Miriam Kastner* | Methane Hydrates Fellowship Program | 2/19/2008 - 2/18/2009 | | |

3 Associates Listed

# Recommended Candidates 7/5/2007 - 7/4/2008
# Methane Hydrates Fellowship Program



## August 2007

**A- Accepted Award**

LAPHAM, LAURA L
Citizenship: United States
Adviser: Dr. Jeffrey Chanton
Research Field: A135
Ph.D. Date: 2007
U of North Carolina-Chapel Hill
Actual Starting Date: 2/04/08
Termination Date: 2/03/09
Research Title: Controls on Hydrate Stability in Methane Depleted Sediments: Laboratory and Field Measurements

## February 2008

**1- Recommended** ( 3 Applicants listed)

INGRAM, WESLEY C
Citizenship: United States
Adviser: Dr. Stephen R. Meyers
Research Field: 5780
Ph.D. Date: 2009
U of North Carolina-Chapel Hill
Research Title: Centennial-Millennial Scale Stability of a Large Gas-Hydrate Field in the Gulf of Mexico

RADICH, JAMES G
Citizenship: United States
Adviser: Dr. Rudy Rogers
Research Field: 6330
Ph.D. Date: 2010
Mississippi State University
Research Title: Microorganisms' Role in Surrounding Sediment and Interstitial Waters of Massive Gas Hydrates

THURBER, ANDREW R
Citizenship: United States
Adviser: Dr. Lisa A. Levin
Research Field: 5850
Ph.D. Date: 2011
Scripps Research Institute/CA
Research Title: Metazoan Impacts on Methane Release from the Seafloor

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# National Research Council
**RESEARCH ASSOCIATESHIP PROGRAM**

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**National Energy Technology Laboratory**
**Methane Hydrates Fellowship Program**

**Annual Contract Technical Report**

**July 05, 2008– July 04, 2009**

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## Publicity

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## Requests

Application materials were distributed in response to specific requests for information about the NETL esearch Associateship Program or as a result of general requests by persons whose fields of specialization appeared to be appropriate for the research opportunities available in the NETL laboratories.

## Competition

Panel reviews of applicants for the Research Associateship Programs, including those with the National Energy Technology Laboratory are conducted four times per year. The following is a breakdown of the action taken with the applications during the report period.

| | AUG'08 | NOV'08 | FEB'09 | MAY'09 | TOTAL |
|---|---|---|---|---|---|
| **TOTAL APPLICATIONS** | 0 | 1 | 0 | 1 | 2 |
| **Number of Applications Reviewed** | 0 | 0 | 0 | 1 | 1 |
| Applications not recommended (did not pass Review) | 0 | 0 | 0 | 0 | 0 |
| **Applications Recommended** (passed Review) | 0 | 0 | 0 | 1 | 1 |
| Awards offered | 0 | 0 | 0 | 0 | 0 |
| Awards accepted | 0 | 0 | 0 | 0 | 0 |
| Awards declined | 0 | 0 | 0 | 0 | 0 |
| Awards withdrawn by RAP (NRC officially withdrew award *after* it had been accepted.) | 0 | 0 | 0 | 0 | 0 |

## Associates' Citizenship

Associates on tenure between July 5, 2008 and July 4, 2009, were all citizens of the United States.

## Associates' Activities

The one Associate who ended tenure during the report period was on tenure for 36 months.

The one Associate who ended tenure during the report period, did not submit a final report.

No Adviser evaluations were received during the report period.

Additional information about the Associates' activities can be found in the attachments described below and the Appendix.

***Attachment 1:*** Associates who were on tenure between July 5, 2008, and July 4, 2009. Included are the Associate's laboratory center/division location, the starting and termination dates, and the names of their advisers. For those Associates who ended tenure during the report period, it is noted if the final and adviser evaluation reports have been received. Associates are required to submit final reports upon termination of tenure, and advisers are asked to submit a final evaluation of each Associate. Associates who have not submitted a final report have received follow-up correspondence.

***Attachment 2:*** All recommended candidates by category (e.g., Recommended, Accepted, No Funding, Declined, etc.). This report includes information about citizenship, the PhD institution, the title of proposed research, proposed or actual starting date, and adviser.

***Attachment 3:*** Summaries of Associate patent activity, if any, and Associate research during tenure as reported on the Associates' termination reports. The summary of patent activity includes the patent application title, inventor(s), and date of application.

***Appendix:*** Final reports received from the Associates who ended tenure during the report period.

## Competition

Panel reviews of applicants for the Research Associateship Programs, including those with the Methane Hydrates Fellowship Program are conducted two times per year. The following is a breakdown of the action taken with the applications during the report period.

| | AUG'08 | NOV'08 | FEB'09 | MAY'09 | TOTAL |
|---|---|---|---|---|---|
| **TOTAL APPLICATIONS** | 1 | 0 | 8 | 0 | 9 |
| **Number of Applications Reviewed** | 1 | 0 | 8 | 0 | 9 |
| Applications not recommended (did not pass Review) | 0 | 0 | 1 | 0 | 1 |
| **Applications Recommended** (passed Review) | 1 | 0 | 7 | 0 | 8 |
| Awards offered | 0 | 0 | 2 | 0 | 2 |
| Awards accepted | 0 | 0 | 2 | 0 | 2 |
| Awards declined | 0 | 0 | 0 | 0 | 0 |
| Recommended no funds | 1 | 0 | 5 | 0 | 6 |
| Awards withdrawn by RAP (NRC officially withdrew award *after* it had been accepted.) | 0 | 0 | 0 | 0 | 0 |

## Associates' Citizenship

Associates on tenure between July 5, 2008 and July 4, 2009, were all citizens of the United States.

## Associates' Activities

No Associates ended tenure during the report period.

No Adviser evaluations were received during the report period.

Additional information about the Associates' activities can be found in the attachments described below and the Appendix.

***Attachment 1:*** Associates who were on tenure between July 5, 2008, and July 4, 2009. Included are the Associate's laboratory center/division location, the starting and termination dates, and the names of their advisers. For those Associates who ended tenure during the report period, it is noted if the final and adviser evaluation reports have been received. Associates are required to submit final reports upon termination of tenure, and advisers are asked to submit a final evaluation of each Associate. Associates who have not submitted a final report have received follow-up correspondence.

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***Attachment 3:*** Summaries of Associate patent activity, if any, and Associate research during tenure as reported on the Associates' termination reports. The summary of patent activity includes the patent application title, inventor(s), and date of application.

***Appendix:*** Final reports received from the Associates who ended tenure during the report period.

## February 2009

**A- Accepted Award** ( 2 Applicants listed)

COOK YOCKEY, ANN E
Citizenship: United States
Adviser: Dr. David Goldberg
Research Field: 5800
Research Title: Investigating Gulf of Mexico Gas Hydrate Reservoirs Using LWD Images and Logs

Ph.D. Date: 2009
Columbia University/NY
Expected Starting Date: 10/15/09
Termination Date: 10/14/10

DAIGLE, HUGH C
Citizenship: United States
Adviser: Dr. Brandon Dugan
Research Field: 5889
Research Title: Heterogeneous Hydate Accumulations: Influence of Pore- and Fracture-Scale Processes

Ph.D. Date: 2011
Rice University/TX
Actual Starting Date: 8/17/09
Termination Date: 8/16/10

# Recommended Candidates 7/5/2008 - 7/4/2009
# Methane Hydrates Fellowship Program

## August 2008

**Z- Recommended/No Funding**

BOWLES, MARSHALL W — Ph.D. Date: 2010
Citizenship: United States — University of Georgia
Adviser: Dr. Samantha Joye
Research Field: A067
Research Title: The Kinetics of Methane Oxidation in Hydrate-Rich and Adjacent Sediments: Can the Biological Methane Filter Buffer the Atmosphere Against a Methane Hydrate 'Burp"?

## February 2009

**Z- Recommended/No Funding** ( 5 Applicants listed)

BOWLES, MARSHALL W — Ph.D. Date: 2010
Citizenship: United States — University of Georgia
Adviser: Dr. Samantha Joye
Research Field: 1874
Research Title: The Kinetics of Methane Oxidation in Hydrate-Rich and Adjacent Sediments: Can the Biological Methane Filter Buffer the Atmosphere Against a Methane Hydrate 'Burp"?

BRIGGS, BRANDON R — Ph.D. Date: 2009
Citizenship: United States — Oregon State University
Adviser: Dr. Frederick Colwell
Research Field: 5850
Research Title: Subseafloor Macroscopic Biofilms Involved in Anaerobic Methane Oxidization

HOLTZMAN, RAN — Ph.D. Date: 2008
Citizenship: United States — University of California-Berkeley
Adviser: Dr. Ruben Juanes
Research Field: 6779
Research Title: Coexistence of Gas and Hydrate in Marine Sediments: Implications on the Global Carbon Cycle and Seafloor Stability

LINDBERG, GERRICK E — Ph.D. Date: 2009
Citizenship: United States — Boston University/MA
Adviser: Dr. Feng Wang
Research Field: A134
Research Title: Application of Non-Equilibrium Free Energy Calculations to Effeciently Quantify the Stability of Clathrate Hydrates

STUBBS, CHRISTOPHER C — Ph.D. Date: 2009
Citizenship: United States — Univ of California-Santa Barbara
Adviser: Dr. Ira Leifer
Research Field: A135
Research Title: Sonar-Based Regional Characterization of Gas Bubble Fluxes from Methane Hydrate Destabilization in the Gulf of Mexico and East Siberian Arctic Shelf

# Recommended Candidates 7/5/2008 - 7/4/2009
# Methane Hydrates Fellowship Program

## February 2009

**A- Accepted Award** ( 2 Applicants listed)

COOK YOCKEY, ANN E — Ph.D. Date: 2009
Citizenship: United States — Columbia University/NY
Adviser: Dr. David Goldberg — Expected Starting Date: 10/15/09
Research Field: 5800 — Termination Date: 10/14/10
Research Title: Investigating Gulf of Mexico Gas Hydrate Reservoirs Using LWD Images and Logs

DAIGLE, HUGH C — Ph.D. Date: 2011
Citizenship: United States — Rice University/TX
Adviser: Dr. Brandon Dugan — Actual Starting Date: 8/17/09
Research Field: 5889 — Termination Date: 8/16/10
Research Title: Heterogeneous Hydate Accumulations: Influence of Pore- and Fracture-Scale Processes

# Methane Hydrates Fellowship Program

## August 2008

**Z- Recommended/No Funding**

BOWLES, MARSHALL W — Ph.D. Date: 2010
Citizenship: United States — University of Georgia
Adviser: Dr. Samantha Joye
Research Field: A067
Research Title: The Kinetics of Methane Oxidation in Hydrate-Rich and Adjacent Sediments: Can the Biological Methane Filter Buffer the Atmosphere Against a Methane Hydrate 'Burp"?

## February 2009

**Z- Recommended/No Funding** ( 5 Applicants listed)

BOWLES, MARSHALL W — Ph.D. Date: 2010
Citizenship: United States — University of Georgia
Adviser: Dr. Samantha Joye
Research Field: 1874
Research Title: The Kinetics of Methane Oxidation in Hydrate-Rich and Adjacent Sediments: Can the Biological Methane Filter Buffer the Atmosphere Against a Methane Hydrate 'Burp"?

BRIGGS, BRANDON R — Ph.D. Date: 2009
Citizenship: United States — Oregon State University
Adviser: Dr. Frederick Colwell
Research Field: 5850
Research Title: Subseafloor Macroscopic Biofilms Involved in Anaerobic Methane Oxidization

HOLTZMAN, RAN — Ph.D. Date: 2008
Citizenship: United States — University of California-Berkeley
Adviser: Dr. Ruben Juanes
Research Field: 6779
Research Title: Coexistence of Gas and Hydrate in Marine Sediments: Implications on the Global Carbon Cycle and Seafloor Stability

LINDBERG, GERRICK E — Ph.D. Date: 2009
Citizenship: United States — Boston University/MA
Adviser: Dr. Feng Wang
Research Field: A134
Research Title: Application of Non-Equilibrium Free Energy Calculations to Effeciently Quantify the Stability of Clathrate Hydrates

STUBBS, CHRISTOPHER C — Ph.D. Date: 2009
Citizenship: United States — Univ of California-Santa Barbara
Adviser: Dr. Ira Leifer
Research Field: A135
Research Title: Sonar-Based Regional Characterization of Gas Bubble Fluxes from Methane Hydrate Destabilization in the Gulf of Mexico and East Siberian Arctic Shelf

## Associates On Tenure 7/5/2008 - 7/4/2009 Attachment 1

### Methane Hydrates Fellowship Program



| Associate Name<br>Adviser | Center | Tenure Dates<br>Start/End | Termination Report | Adviser Report |
|---|---|---|---|---|
| Heintz, Monica Beryl<br>*Dr. David Valentine* | (P) Methane Hydrates Fellowship Program | 7/2/2007 - 7/1/2010 | | |
| Lapham, Laura Lee<br>*Dr. Jeffrey Chanton* | Methane Hydrates Fellowship Program | 2/4/2008 - 2/3/2010 | | |
| Solomon, Evan Alan<br>*Dr. Miriam Kastner* | Methane Hydrates Fellowship Program | 2/19/2008 - 7/31/2009 | | |

3 Associates Listed

**National Energy Technology Laboratory**

## May 2009

**1- Recommended**

JARRELL, REBECCA A — Ph.D. Date: 2009
Citizenship: United States — SUNY Environmental Sci & Forestry
Adviser: Dr. Duane H. Smith
Research Field: A006
Research Title: Using Novel Stereolithography Experimental Flow Cells to Characterize Geological Carbon Dioxide Sequestration

## Associates On Tenure 7/5/2008 - 7/4/2009 Attachment 1

### National Energy Technology Laboratory



| Associate Name+ Adviser | Center | Tenure Dates Start/End | Termination Report | Adviser Report |
|---|---|---|---|---|
| Crandall, Dustin Micheal<br>*Dr. Duane H. Smith* | National Energy Technology Laboratory | 8/31/2007 - 8/21/2009 | | |
| Haljasmaa, Igor<br>*Dr. Yee Soong, III* | National Energy Technology Laboratory | 8/4/2006 - 8/3/2009 | | |
| Schwartz, Michael<br>*Dr. Bradley Bockrath* | (S) National Energy Technology Laboratory | 11/1/2005 - 10/31/2008 | Not Recd | Not Recd |

3 Associates Listed

+ (S) indicates the associate was a Senior.

THE NATIONAL ACADEMIES
*Advisers to the Nation on Science, Engineering, and Medicine*

# National Research Council
**RESEARCH ASSOCIATESHIP PROGRAM**

**with the**

**National Energy Technology Laboratory**
**Methane Hydrates Fellowship Program**

**Annual Contract Technical Report**

**July 05, 2009– July 04, 2010**

**DE-FC26-05NT42248**

## Publicity

The National Academies Research Associateship Programs for the reporting period were announced to the scientific community, beginning in the fall of the preceding year. Publicity materials describing the National Research Council-National Energy Technology Laboratory (NETL) Programs were distributed in November to presidents, graduate deans, and heads of appropriate science and engineering departments and minority-affairs offices of all academic degree-granting institutions in the United States. An e-mail announcement of the programs was sent to these same contact points prior to each review deadline. Promotional materials were sent to Laboratory Program Representatives, Associateship Advisers, and other interested persons. General advertisements of programs were placed in leading scientific and engineering publications. Publicity materials and other related information were made available on the Internet. Research Associateship Programs staff attended numerous professional scientific and engineering meetings and minority recruitment events to promote the various programs and to meet with prospective applicants throughout the year.

## Requests

pplication materials were distributed in response to specific requests for information about the NETL esearch Associateship Program or as a result of general requests by persons whose fields of specialization appeared to be appropriate for the research opportunities available in the NETL laboratories.

## Competition

Panel reviews of applicants for the Research Associateship Programs, including those with the National Energy Technology Laboratory are conducted four times per year. The following is a breakdown of the action taken with the applications during the report period.

| | AUG'09 | NOV'09 | FEB'10 | MAY'10 | TOTAL |
|---|---|---|---|---|---|
| **TOTAL APPLICATIONS** | 2 | 1 | 0 | 1 | 4 |
| **Number of Applications Reviewed** | 2 | 0 | 0 | 0 | 2 |
| Applications not recommended (did not pass Review) | 0 | 0 | 0 | 0 | 0 |
| **Applications Recommended** (passed Review) | 2 | 0 | 0 | 0 | 2 |
| Awards offered | 2 | 0 | 0 | 0 | 2 |
| Awards accepted | 2 | 0 | 0 | 0 | 2 |
| Awards declined | 0 | 0 | 0 | 0 | 0 |
| Awards withdrawn by RAP (NRC officially withdrew award *after* it had been accepted.) | 0 | 0 | 0 | 0 | 0 |

## Associates' Citizenship

Associates on tenure between July 5, 2009 and July 4, 2010, were citizens of the following countries:

3 U.S. Citizens
Permanent Resident
1 Republic of Korea

## Associates' Activities

Associate who ended tenure during the report period were on tenure for an average of 30 months, ranging from 24 months to 36 months.

Of the 2 Associates who ended tenure during the report period, 1 submitted a final report.

2 Articles published in refereed journals
0 Patent applications
4 International presentations
9 Domestic presentations
0 Awards

After ending their tenure, Associates indicated their future plans as follows:

0 Remain at host agency as perm. employee
1 Remain at host agency as contract employee
0 Research position at other US gov't. lab
0 Administrative position at US gov't. lab
0 Research position at foreign gov't. lab
0 Research/teaching-US college/university
0 Research/teaching-foreign college/university
0 Research/admin in industry
0 Research/admin in non-profit organization
0 Postdoctoral research
0 Self employed
0 Other (may include unemployed)

their final report the Associates were asked to evaluate certain aspects of their experiences on a scale of 1 (low) to 10 (high). The average rating for each item follows:

| | | |
|---|---|---|
| 10.0 | *Short-term value* | Development of knowledge, skills, and research productivity |
| 10.0 | *Long-term value* | How your Research Associateship affected your career to date |
| 9.0 | *Laboratory Support* | Equipment, funding, orientation, safety and health training, etc. |
| 4.0 | *Adviser Mentoring* | Quality of mentoring from the Research Adviser |
| 9.0 | *LPR* | Quality of administrative support from the LPR |
| 10.0 | *NRC* | Quality of administrative support from the NRC |

Advisers also were asked to complete an evaluation of the Associate. The following summarizes the Adviser evaluations for Associates ending tenure during the report period. Of the 2 Associate who ended tenure, 2 Adviser evaluations were completed. Assessments were made on six criteria using the following rating scale: 1-below average, 2-average, 3-above average, 4-good, and 5-outstanding/exceptional. The average rating for each item follows:

4.5 Knowledge of field
4.0 Innovative thinking
4.5 Research techniques
3.5 Independence
4.5 Motivation
4.5 Overall scientific ability

The Adviser was asked, "Would you like this Associate as a professional colleague?" The Adviser responded in the following manner:

1 0% Yes
0 0% No
0 0% No Comment
1 0% No Answer

## Competition

Panel reviews of applicants for the Research Associateship Programs, including those with the Methane Hydrates Fellowship Program are conducted two times per year. The following is a breakdown of the action taken with the applications during the report period.

| | AUG'09 | NOV'09 | FEB'10 | MAY'10 | TOTAL |
|---|---|---|---|---|---|
| **TOTAL APPLICATIONS** | 1 | 0 | 7 | 0 | 8 |
| **Number of Applications Reviewed** | 1 | 0 | 7 | 0 | 8 |
| Applications not recommended (did not pass Review) | 0 | 0 | 0 | 0 | 0 |
| **Applications Recommended** (passed Review) | 1 | 0 | 7 | 0 | 8 |
| Awards offered | 0 | 0 | 1 | 0 | 1 |
| Awards accepted | 0 | 0 | 1 | 0 | 1 |
| Awards declined | 0 | 0 | 0 | 0 | 0 |
| Recommended no funds | 1 | 0 | 5 | 0 | 6 |
| Awards still pending | 0 | 0 | 1 | 0 | 1 |
| Awards withdrawn by RAP (NRC officially withdrew award *after* it had been accepted.) | 0 | 0 | 0 | 0 | 0 |

## Associates' Citizenship

Associates on tenure between July 5, 2009 and July 4, 2010, were all citizens of the United States.

## Associates' Activities

Associates who ended tenure during the report period were on tenure for an average of 26 months, ranging from 17 months to 36 months.

Of the 3 Associates who ended tenure during the report period, 1 (33%) submitted final reports. In the final reports, Associates indicated the following scholarly activity while on tenure.

1 Articles published in peer-reviewed journals
2 Patent applications
0 International presentations
9 Domestic presentations
0 Awards

After ending their tenure, Associates indicated their future plans as follows:

0 Remain at host agency as perm. employee
0 Remain at host agency as contract employee
0 Research position at other US gov't. lab
0 Administrative position at US gov't. lab
0 Research position at foreign gov't. lab
0 Research/teaching-US college/university
1 Research/teaching-foreign college/university
0 Research/admin in industry
0 Research/admin in non-profit organization
0 Postdoctoral research
0 Self employed
0 Other (may include unemployed)

In their final reports, Associates were asked to evaluate certain aspects of their experiences on a scale of 1 (low) to 10 (high). The average rating for each item follows:

| | | |
|---|---|---|
| 10.0 | *Short-term value* | Development of knowledge, skills, and research productivity |
| 10.0 | *Long-term value* | How your Research Associateship affected your career to date |
| 10.0 | *Laboratory Support* | Equipment, funding, orientation, safety and health training, etc. |
| 10.0 | *Adviser Mentoring* | Quality of mentoring from the Research Adviser |
| 10.0 | *LPR* | Quality of administrative support from the LPR |
| 10.0 | *NRC* | Quality of administrative support from the NRC |

Advisers also were asked to complete an evaluation of the Associate. The following summarizes the Adviser evaluations for Associates ending tenure during the report period. Of the 3 Associates who ended tenure, 1 (33%) Adviser evaluations were completed. Assessments were made on six criteria using the following rating scale: 1-below average, 2-average, 3-above average, 4-good, and 5-outstanding/exceptional. The average rating for each item follows:

5.0 Knowledge of field
5.0 Innovative thinking
5.0 Research techniques
5.0 Independence
5.0 Motivation
5.0 Overall scientific ability

The Adviser was asked, "Would you like this Associate as a professional colleague?" The Advisers responded in the following manner:

1 (100%) Yes
0 (0%) No
0 (0%) No Comment
0 (0%) No Answer

Additional information about the Associates' activities can be found in the attachments described below and the Appendix.

***Attachment 1:*** Associates who were on tenure between July 5, 2009, and July 4, 2010. Included are the Associate's laboratory center/division location, the starting and termination dates, and the names of their advisers. For those Associates who ended tenure during the report period, it is noted if the final and adviser evaluation reports have been received. Associates are required to submit final reports upon termination of tenure, and advisers are asked to submit a final evaluation of each Associate. Associates who have not submitted a final report have received follow-up correspondence.

***Attachment 2:*** All recommended candidates by category (e.g., Recommended, Accepted, No Funding, Declined, etc.). This report includes information about citizenship, the PhD institution, the title of proposed research, proposed or actual starting date, and adviser.

***Attachment 3:*** Summaries of Associate patent activity, if any, and Associate research during tenure as reported on the Associates' termination reports. The summary of patent activity includes the patent application title, inventor(s), and date of application.

***Appendix:*** Final reports received from the Associates who ended tenure during the report period.

## Associates On Tenure 7/5/2009 - 7/4/2010 Attachment 1

### National Energy Technology Laboratory



| Associate Name+ Adviser | Center | Tenure Dates Start/End | Termination Report | Adviser Report |
|---|---|---|---|---|
| Crandall, Dustin Micheal<br>*Dr. Duane H. Smith* | National Energy Technology Laboratory | 8/31/2007 - 8/21/2009 | Received | Received |
| Haljasmaa, Igor<br>*Dr. Yee Soong, III* | National Energy Technology Laboratory | 8/4/2006 - 8/3/2009 | Not Recd | Received |
| Kauffman, Douglas Ralph<br>*Dr. Christopher S. Matranga* | National Energy Technology Laboratory | 5/5/2010 - 5/4/2011 | | |
| Lee, Shiwoo<br>*Dr. Randall S. Gemmen* | (S) National Energy Technology Laboratory | 1/4/2010 - 1/3/2011 | | |

4 Associates Listed

+ (S) indicates the associate was a Senior.

## August 2009

**A- Accepted Award** ( 2 Applicants listed)

KAUFFMAN, DOUGLAS R — Ph.D. Date: 2010
Citizenship: United States — University of Pittsburgh/PA
Adviser: Dr. Christopher S. Matranga — Actual Starting Date: 5/05/10
Research Field: 5399 — Termination Date: 5/04/11
Research Title: Electrochemical Reduction of Carbon Dioxide with Nanoscale Copper Oxide

LEE, SHIWOO — Ph.D. Date: 2003
Citizenship: Republic of Korea — Korea Inst of Science & Tech
Adviser: Dr. Randall S. Gemmen — Actual Starting Date: 1/04/10
Research Field: 8215 — Termination Date: 1/03/11
Research Title: Control of the Catalytic Activity of Solid Oxide Fuel Cell Cathodes through Surface Modification

## National Energy Technology Laboratory

**Crandall, Dustin Micheal** **8/31/2007 8/21/2009**

2 Developed relative permeability (kr) curves for CO2-Brine and air-water multiphase flows in a realistic computational fluid dynamics model of a rock fracture. Results show that stadard kr curves are vastly different than flow in fracuture kr curves.

3 Developed a numerical code to directly identify and measure interfacial area within a anoluge porous media model during multiphase flow. Results show that interfacial are increased linearly when gas is injected into a liquid saturatred porous medium.

4 Performed numerical simulations of fluid in fracture models surrounded by permeable media and developed a correlation function that will enable inclusion of this research in field-scale modeling.

5 Measured and characterized micro-fractures models in coal samples using a confocal microscope as they dried over a period of several months.

6 Performed numerical simulations examining the relationship between wall-roughness and fluid flow in fractures and developed several relationships that llink microscopic roughness parameters to fluid flow resistance.

## Associates On Tenure 7/5/2009 - 7/4/2010 Attachment 1

### National Energy Technology Laboratory Methane Hydrates Fellowship Program



| Associate Name<br>Adviser | Center | Tenure Dates<br>Start/End | Termination Report | Adviser Report |
|---|---|---|---|---|
| Cook Yockey, Ann Elizabeth<br>*Dr. David Goldberg* | Methane Hydrates | 1/4/2010 - 1/3/2011 | | |
| Daigle, Hugh Callahan<br>*Dr. Brandon Dugan* | (D)Methane Hydrates | 8/17/2009 - 8/16/2011 | | |
| Heintz, Monica Beryl<br>*Dr. David Valentine* | (P) National Energy Technology Laboratory Methane Hydrates Fellowship Program | 7/2/2007 - 7/1/2010 | Not Recd | Not Recd |
| Lapham, Laura Lee<br>*Dr. Jeffrey Chanton* | National Energy Technology Laboratory Methane Hydrates Fellowship Program | 2/4/2008 - 2/3/2010 | Received | Received |
| Solomon, Evan Alan<br>*Dr. Miriam Kastner* | National Energy Technology Laboratory Methane Hydrates Fellowship Program | 2/19/2008 - 7/31/2009 | Not Recd | Not Recd |

5 Associates Listed

# Recommended Candidates 7/5/2009 - 7/4/2010
# National Energy Technology Laboratory Methane Hydrates Fellowship Program

## August 2009

**Z- Recommended/No Funding**

MARTIN, RUTH A — Ph.D. Date: 2009
Citizenship: United States — University of Washington
Adviser: Dr. Marta Torres
Research Field: 5780
Research Title: Foraminifera Associated with Methane Venting: New Insights from Flow Through Time Resolved Analyses

## February 2010

**Z- Recommended/No Funding** ( 5 Applicants listed)

BRIGGS, BRANDON R — Ph.D. Date: 2009
Citizenship: United States — Oregon State University
Adviser: Dr. Research Adviser Methane Hydrates
Research Field: 5850
Research Title: Anaerobic Methane Oxidizing Consortia Sustained by Hydrate Methane in Seafloor Fractures

FITZGERALD, GARRETT C — Ph.D. Date: 2013
Citizenship: United States — Columbia University/NY
Adviser: Dr. Research Adviser Methane Hydrates
Research Field: A134
Research Title: Carbon Neutral Methane Production via Gas Hydrates

MARTIN, RUTH A — Ph.D. Date: 2010
Citizenship: United States — University of Washington
Adviser: Dr. Research Adviser Methane Hydrates
Research Field: 5779
Research Title: Foraminiferal Carbonates Associated with Methane Venting: New Insights from Flow-through Time Resolved Analyses

REAMAN, DANIEL M — Ph.D. Date: 2010
Citizenship: United States — Ohio State University
Adviser: Dr. Research Adviser Methane Hydrates
Research Field: A134
Research Title: Stability and Deformation of Methan Clathrates

RYAN, TERRENCE R — Ph.D. Date: 2012
Citizenship: United States — West Virginia University
Adviser: Dr. Research Adviser Methane Hydrates
Research Field: 5800
Research Title: Methane Hydrate Formation in Natural Sediments

## February 2010

### 1- Recommended

AMAN, ZACHARY M — Ph.D. Date: 2011
Citizenship: United States — Colorado School of Mines
Adviser: Dr. Research Adviser Methane Hydrates
Research Field: 6330
Research Title: Micromechanical Normal and Shear Adhesion Force Measurements Between Clathrate Hydrates and Minerals

### A- Accepted Award

BROTHERS, LAURA L — Ph.D. Date: 2010
Citizenship: United States — University of Maine at Orono
Adviser: Dr. Research Adviser Methane Hydrates — Expected Starting Date: 10/01/10
Research Field: 5780 — Termination Date: 9/30/11
Research Title: Artic Continental Shelf Response to Global Climate Change: A Geophysical Study of Permafrost Degradation and Potentia Hydrate dissociation in Nearshore Beaufort Sea

## National Energy Technology Laboratory Methane Hydrates

**Lapham, Laura Lee** **2/04/2008** **2/03/2010**

2 Set up gas hydrate laboratory.

3 Developed, deployed and retrieved seafloor instruments.

4 Measured methane and mixed gas (methane, ethane, propane) hydrate dissolution rate of ~0.12mM/hr in the laboratory.

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National Research Council

AUG 2 4 2009
ASSOCIATESHIP PROGR

**Research Associateship Programs**

# *FINAL REPORT*

**Return this form directly to the NRC as an E-mail attachment, or print out and mail or fax.**

| 1) *Associate Last or Family Name* | *First Name* | *M.I.* |
|---|---|---|
| Crandall | Dustin | M |

| 2) *FORWARDING Address* (to which your tax statement will be mailed) | *FORWARDING Phone(s) and E-Mail* (if known) |
|---|---|
| Res. or Inst.<br>Street 912 Timberline<br>City, State Zip Morgantown, WV 26505 | Home Phone: 304-282-6691<br>Alt. Phone:<br>E-mail: meDustin@gmail.com |
| 3) *Today's Date*<br>July 31, 2009 | *Dates of Tenure*<br>from August 31, 2007 to August 24, 2009 |

| 4) *Agency* | *Laboratory or Center* | *Division / Directorate / Department* |
|---|---|---|
| NETL | Morgantown, WV | Geosciences |

5) *Name of Laboratory NRC Adviser* (and USMA Mentor, if applicable)
Duane H Smith

6) *TITLE OF RESEARCH PROPOSAL*

Multiphase Transport through Natural Fractures - Numerical and Experimental Examinationas with Applications to CO2 Sequestration and Leakage

7) *SUMMARY OF RESEARCH DURING TENURE* Itemize significant findings in concise form, utilizing key concepts/words.

1) Developed relative permeability (kr) curves for CO2-Brine and air-water multiphase flows in a realistic computational fluid dynamics model of a rock fracture. Results show that standard kr curves are vastly different than flow in fracture kr curves.

2) Developed a numerical code to directly identify and measure interfacial area within a anolgue porous media model during multiphase flow. Results show that interfacial are increases linearly when gas is injected into a liquid saturated porous medium.

3) Performed numerical simulations of fluid flow in fracture models surrounded by permeable media and developed a correlation function that will enable inclusion of this research in field-scale modeling.

4) Measured and characterizied of micro-fractures in coal samples using a confocal microscope as they dried over a period of several months.

5) Performed numerical simulations examining the relationship between wall-roughness and fluid flow in fractures and developed several relationships that link macroscopic roughness parameters to fluid flow resistance.

(USMA Davies Fellow: please add summary of teaching, including classes taught.)

8) *RESEARCH IN PROGRESS* Describe in no more than 100 words.

Fluid flow in fractures plays a vital role in many areas of geophysical research, significantly affecting the scaling behavior of some important processes. I am continuing my research on linking micro scale fracture properties to larger scale observable fluid flow phenomena. My primary avenue of research is numerical, with high-resolution/fine-grid single and multi-phase CFD simulations, but linking this directly to experimental studies is attempted whenever practical/possible.

9) *PUBLICATIONS AND PAPERS RESULTING FROM NRC ASSOCIATESHIP RESEARCH*
Provide complete citations: author(s), title, full name of journal, volume number, page number(s), and year of publication.

a) Publications in peer-reviewed journals

Dustin Crandall, Goodarz Ahmadi, Martin Ferer, and Duane H. Smith, (2009) Distribution and occurrence of localized-bursts in two-phase flow through porous media. Physica A 38, 574-584.

Dustin Crandall, Goodarz Ahmadi, Douglas Leonard, Martin Ferer, and Duane H. Smith D. (2008) A new stereolithography experimental porous flow device. Review of Scientific Instruments 79, 044501.

b) Books, book chapters, other publications

None

c) Manuscripts in preparation, manuscripts submitted

**Dustin Crandall, Jennifer Niessner, and S. Majid Hassanizadeh (in preperation) Determination of parameters for a two-phase flow model in porous media including fluid-fluid interfacial area from experiments in a flow cell**

**Dustin Crandall, Grant Bromhal, and Zuliema T. Karpyn, (submitted) Numerical simulations examining the relationship between wall-roughness and fluid flow in fractures. Contaminant Hydrology.**

**Dustin Crandall, and Duane H. Smith, (submitted) Experimentally measured interfacial area during lateral air injection into water-saturated porous media. Vadose Zone Journal.**

**Dustin Crandall, Goodarz Ahmadi, and Duane H. Smith, (submitted) Computational modeling of fluid flow through a fracture in permeable rock. Transport in Porous Media.**

10) *PATENT OR COPYRIGHT APPLICATIONS RESULTING FROM NRC ASSOCIATESHIP RESEARCH*

Provide titles, inventors, and dates of applications.

None

11) *PRESENTATIONS AT SCIENTIFIC MEETINGS OR CONFERENCES*

Provide complete references: author(s), title, abstract/proceeding citation, meeting name and location.

International

**Dustin Crandall and Duane H. Smith (May 2009) Numerical and experimental modeling of multiple fluid flows in a rough-walled sandstone fracture. 2009 Joint Assembly, Toronto ON, Canada.**

**Dustin Crandall, Goodarz Ahmadi, and Duane H. Smith (March 2009) Numerical modeling of immiscible two-phase flow in micro-models using a commercial CFD code. 1st Conference on Challenges of Porous Media, Kaiserslautern, Germany.**

**Dustin Crandall, Jennifer Niessner, S. Majid Hassanizadeh, and Duane H. Smith (July 2008) Experimentally determined interfacial area between immiscible fluids in porous media. Gordon Conference: Flow and Transport in Permeable Media, Oxford UK.**

**Dustin Crandall, Goodarz Ahmadi, and Duane H. Smith (April 2008) Surface roughness effects on fluid transport through a natural rock fracture. 1000 Islands Fluid Mechanics Meeting, Gananoque ON, Canada.**

Domestic

**Dustin Crandall, Grant Bromhal, and Dustin McIntyre (March 2010) Wall-roughness and aperture effects on fracture permeability. To be presented at GeoX 2010, 3rd International Workshop on X-Ray CT for Geomaterials, New Orleans LA.**

**Dustin Crandall, Grant Bromhal, and Duane H. Smith (August 2009) Conversion of a micro-CT scanned rock fracture into a useful model, FEDSM2009 - 78118, ASME Fluids Engioneering Division 2009 Summer Meeting, Vail CO.**

**Dustin Crandall, Goodarz Ahmadi, and Duane H. Smith (August 2009) Modeling of immiscible two-phase flows in a natural rock fracture, FEDSM2009 - 78138, ASME Fluids Engioneering Division 2009 Summer Meeting, Vail CO.**

**Dustin Crandall, Goodarz Ahmadi, and Duane H. Smith (August 2009) Modeling of gas-liquid flows through an interconnected channel matrix, FEDSM2009 - 78092, ASME Fluids Engioneering Division 2009 Summer Meeting, Vail CO.**

**Dustin Crandall, Martin Ferer, and Duane H. Smith (December 2008) Experimental examination of localized-bursts of fluid advancement during immiscible drainage in porous media. American Geophysical Union Annual Fall Meeting, San Francisco CA.**

**Jennifer Niessner, S. Majid Hassanizadeh and Dustin Crandall (November 2008) Modeling two-phase flow in porous media including fluid-fluid interfacial area, IMECE2008-66098, ASME International Mechanical Engineering Congress & Exposition, Boston MA.**

**Goodarz Ahmadi, Dustin Crandall, and Duane H. Smith (August 2008) Gas-liquid flows in flow cells and fracture models. 2008 ASME Fluids Engineering Conference, Jacksonville FL.**

**Dustin Crandall and Duane H. Smith (July 2008) Fracture roughness effects on flow through a fracture. Computational Methods in Water Resources – XVII International Conference, San Francisco CA.**

**Dustin Crandall, Goodarz Ahmadi, Martin Ferer, and Duane H. Smith (December 2007) A stereolithography pore-throat model. American Geophysical Union Annual Fall Meeting, San Francisco CA.**

12) *SEMINARS OR LECTURES DELIVERED AT UNIVERSITIES AND/OR INSTITUTES* **Include dates, names and locations of seminars.**

**None**

13) *PROFESSIONAL AWARDS RECEIVED DURING TENURE*

**None**

14) *POST-TENURE POSITION TITLE*

**'Engineer/Technologist IV'**

15) *POST-TENURE ORGANIZATION* **Provide name and address of organization.**

**Parsons (Head Office)**
**100 West Walnut Street**
**Pasadena CA 91124**

16) *POST-TENURE POSITION STATUS / CATEGORY* **Please indicate only one.**

- ☐ Remain at Host Agency as Permanent Employee
- ☒ Remain at Host Agency as Contract/Temporary Employee
  - Abbreviate Host Laboratory/Center NETL - MGN
- ☐ Research Position at Another US Government Laboratory
- ☐ Administrative Position at US Government Laboratory
- ☐ Research Position at Foreign Government Laboratory
- ☐ Research/Teaching at US College/University
- ☐ Research/Teaching at Foreign College/University
- ☐ Research/Administration in Industry
- ☐ Research/Administration in Non-Profit Organization
- ☐ Postdoctoral Research
- ☐ Self Employed
- ☐ Other: specify _____

17) *APPRAISAL OF RESEARCH ASSOCIATESHIP PROGRAM*

**On a scale of 1 – 10 (poor - excellent), please rate the following:**

SHORT TERM VALUE

10 Development of knowledge, skills, and research productivity

**Comments**

**This has been a wonderful oportunity for me to expand my knowledge**

LONG TERM VALUE

10 How the NRC Associateship award affected your career to date

**Comments**

**The contacts that I have made will be a lasting benefit to my career, regardless of the path I pursue.**

LAB SUPPORT

2 Quality of support--equipment, funding, orientation, safety and health guidelines, etc.

**Comments**

**The quality of the facilities at NETL Morgantown were phenomenal. The only qualm is it took over one year for me to get a working telephone.**

ADVISER/MENTOR SUPPORT

4 Quality of mentoring from the Lab NRC Adviser (USMA Mentor, if applicable)

**Comments**

**He is a difficult man to work with; very smart and knowledgeable, but difficult.**

LPR SUPPORT

5 Quality administrative support from the Agency/Lab NRC Program Representative (LPR)

**Comments**

**Mike Nowak was always prompt in helping me with any issue that arose and I thank him for that.**

NRC SUPPORT

10 Quality of administrative support from the NRC

**Comments**

18) *PLEASE PROVIDE ANY SUGGESTIONS FOR PROGRAM IMPROVEMENT.*

Travel to conferecnes was a very important aspect of my growth during my tenure, for making contacts, gathering ideas and learning what the state of the art in my field is. The multi-tiered method of distributing funds from NETL to NRC and then attempting to get reiembursed through the reverse process was tedious, slow, and aggrivating. I am still waiting for a partial rembursement from Decemeber 2008 travel, and quite truthfully do not think I will receive these funds.

But, that being said, everything else was wonderful. This was a great opportunity to build my career, understand the opportunities available within the Department of Energy, and transition to a long-term carrer after graduation. Thank you very much.

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National Research Council

RECEIVED JAN 19 2010 ASSOCIATESHIP PROGRAMS

**Research Associateship Programs**

**FINAL REPORT**

| 1) *Associate Last or Family Name* | *First Name* | *M.I.* |
|---|---|---|
| Lapham | Laura | L |

| 2) *FORWARDING Address* (to which your tax statement will be mailed) | *FORWARDING Phone(s) and E-Mail* (if known) |
|---|---|
| Res. or Inst. Center for Geomicrobiology, Aarhus University<br>Street Ny Munkegade 114, DK-8000<br>City, State Zip Aarhus C, Denmark | Home Phone: +45 8942 3280<br>Alt. Phone:<br>E-mail: lapham@ocean.fsu.edu |

| 3) *Today's Date* | *Dates of Tenure* |
|---|---|
| January 18, 2010 | from February 4, 2008 to February 3, 2010 |

| 4) *Host Agency* (e.g., AFRL) | *Laboratory or Center* (e.g., Wright Patterson AFB) | *Division / Directorate / Department* (e.g., High-Speed Propulsion) |
|---|---|---|
| NETL | Florida State University | Oceanography Department |

5) *Name of Laboratory NRC Adviser* (and USMA Mentor, if applicable)

Jeff Chanton

6) *TITLE OF RESEARCH PROPOSAL*

Controls on hydrate stability in methane depleted sediments: Laboratory and field measurements

7) *SUMMARY OF RESEARCH DURING TENURE* Itemize significant findings in concise form, utilizing key concepts/words.

1) Set up gas hydrate laboratory

2) Developed, deployed and retrieved seafloor instruments

3) Measured methane and mixed gas (methane, ethane, propane) hydrate dissolution rate of ~0.12mM/hr in the laboratory

4)

5)

(USMA Davies Fellow: please add summary of teaching, including classes taught.)

8) *RESEARCH IN PROGRESS* Describe in no more than 100 words.

The main hypothesis was that oil contaminants in natural hydrates act as a barrier and slow down their dissolution. To date, pure methane and mixed gas hydrate dissolution rate experiments have been carried out. However, due to time limitations, adding the oil contamination will have to wait. These experiments will be underway in the month of Feb and are expected to be completed by summer 2010.

9) *PUBLICATIONS AND PAPERS RESULTING FROM NRC ASSOCIATESHIP RESEARCH*

Provide complete citations: author(s), title, full name of journal, volume number, page number(s), and year of publication.

a) Publications in peer-reviewed journals

Lapham, L. L., Chanton, J. P., Chapman, R. and Martens, C. S., (in review). Methane under-saturated fluids in deep-sea sediments: implications for gas hydrate stability. Earth and Planetary Science Letters.

b) Books, book chapters, other publications

none

c) Manuscripts in preparation, manuscripts submitted

Lapham, Chanton, MacDonald, Martens (in preperation) Controls on hydrate stability in methane depleted sediments: Laboratory and field measurements

10) *PATENT OR COPYRIGHT APPLICATIONS RESULTING FROM NRC ASSOCIATESHIP RESEARCH*

Provide titles, inventors, and dates of applications.

none

11) *PRESENTATIONS AT SCIENTIFIC MEETINGS OR CONFERENCES*

Provide complete references: author(s), title, abstract/proceeding citation, meeting name and location.

International

**Domestic**

**Yulia Luzinova, Lapham, L., Chanton, J. "Towards In situ Characterization of Carbonate Minerals within Hydrocarbon Seep Ecosystems via Infrared-attenuated Total Reflection Spectroscopy" to Pittcon 2010 conference**

**Garcia-Pineda, O., I. MacDonald, W. Pichel, X. Li, B. Zimmer, and L. Lapham. Using SAR to estimate spatial and temporal variability of oil output from natural hydrocarbon seep formations. Submitted for International Geoscience & Remote Sensing Symposium, July 2010.**

**Lutken, C. B., L. Macelloni, L. Lapham, S. Caruso, M. Lodi, R. Camilli, V. Asper, A. Dierks, C. Knapp, and J. Knapp. Monitoring seafloor morpho-geological evolution of the MC 118 hydrate/carbonate mound via multiple AUV missions. Submitted for AAPG meeting, April 2010.**

**Lapham, L.L., C.S. Martens, and J.P. Chanton. Controls on gas hydrate stability in methane depleted sediments: Laboratory and field measurements. Submitted for American Geophysical Union meeting, Dec 2009.**

**Ussler, W., C.P. Paull, L. Lapham, M. Riedel, and D. Caress. Geochemistry of Methane and Gas-hydrate-rich Shallow Sediments Associated with Active Seafloor Mounds. Submitted for American Geophysical Union meeting, Dec 2009.**

**Paull, C.P, W. Ussler, D.W. Caress, H. Thomas, E. Lundsten, M. Riedel, and L. Lapham. Seafloor manifestations of gas venting and near seafloor gas hydrate occurrences. Submitted for American Geophysical Union meeting, Dec 2009.**

**Lapham, L.L., J .P. Chanton, C.S. Martens, P. D. Higley, H. W. Jannasch and J.R. Woolsey. Temporal variability in pore-fluid chemistry at a Gulf of Mexico gas hydrate site. American Geophysical Union meeting, Dec 2008.**

**Haacke, R., M. Riedel, J. Pohlman, K. Rose, L. Lapham, T. Hamilton, R. Enkin, G.D. Spence, and R.D. Hyndman. Investigations on the role of gas hydrate in wide-spread slope failures at frontal ridges of the accretionary wedge of the northern Cascadia margin. American Geophysical Union meeting, Dec 2008.**

**McGee, T., J.R. Woolsey, L.L. Lapham, R. Kleinberg, L. Macelloni, B. Battista, C. Knapp, S. Caruso, V. Goebel, R. Chapman, and P. Gerstoft. Structure of a carbonate/hydrate mound in the northern Gulf of Mexico. Poster presentation at Gas Hydrate meeting Vancouver, BC, Canada, July 6-10, 2008.**

12) *SEMINARS OR LECTURES DELIVERED AT UNIVERSITIES AND/OR INSTITUTES* **Include dates, names and locations of seminars.**

**University of Georgia, Athens, GA (January 2010)**
**University of New Orleans (December 2009)**
**SRI, Inc, St Petersburg, FL (September 2009)**
**National Energy Technology Lab, Morgantown, West Virginia (March 2009)**
**Center for Geomicrobiology, Aarhus, Denmark (January 2009)**

13) *PROFESSIONAL AWARDS RECEIVED DURING TENURE*

**none**

14) *POST-TENURE POSITION / JOB TITLE*

**Researcher**

15) *NAME AND ADDRESS OF POST-TENURE POSITION / JOB ORGANIZATION*

**Center for Geomicrobiology, Aarhus University**
**Ny Munkegade 114, DK-8000 Aarhus C, Denmark**
**Tel: +45 8942 3280, Fax: +45 8942 2722**

16) *POST-TENURE POSITION STATUS / CATEGORY* **Please indicate only one.**

- ☐ Remain at Host Agency as Permanent Employee
- ☐ Remain at Host Agency as Contract/Temporary Employee
  - **Abbreviate Host Laboratory/Center** _____
- ☐ Research Position at Another US Government Laboratory
- ☐ Administrative Position at US Government Laboratory
- ☐ Research Position at Foreign Government Laboratory
- ☐ Research/Teaching at US College/University
- ☒ Research/Teaching at Foreign College/University
- ☐ Research/Administration in Industry
- ☐ Research/Administration in Non-Profit Organization
- ☐ Postdoctoral Research
- ☐ Self Employed
- ☐ Other: **specify** _____

**On a scale of 1 – 10 (poor - excellent), please rate the following:**

SHORT TERM VALUE

10 Development of knowledge, skills, and research productivity
**Comments**

LONG TERM VALUE

10 How the NRC Associateship award affected your career to date
**Comments**

LAB SUPPORT

10 Quality of support from the Laboratory–equipment, funding, orientation, safety and health guidelines, etc.
**Comments**

ADVISER/MENTOR SUPPORT

10 Quality of mentoring from the Laboratory NRC Adviser (USMA Mentor, if applicable)
**Comments**

LPR SUPPORT

10 Quality of administrative support from the Laboratory (e.g., NIST) NRC Program Representative (LPR)
**Comments**

NRC SUPPORT

10 Quality of administrative support (applications, inquiries, post-review, award-related, travel, etc.) from the NRC
**Comments**

18) *PLEASE PROVIDE ANY SUGGESTIONS FOR PROGRAM IMPROVEMENT.*

eturn this form via fax, or as scanned PDF via e-mail, directly to your **NRC Program Coordinator.**

| Fax | E-mail Addresses | | Mail & Delivery Address |
|---|---|---|---|
| | Linda Sligh: | lsligh@nas.edu | *(enter the name of your NRC Program Coordinator here)* |
| | Jason Thornhill: | jthornhill@nas.edu | NRC Research Associateship Programs |
| 202 – 334 – 2759 | Peggy Wilson: | pwilson@nas.edu | 500 Fifth Street NW, Room 568 |
| | Suzanne White: | swhite@nas.edu | Washington, DC 20001 |

THE NATIONAL ACADEMIES
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# National Research Council

**RESEARCH ASSOCIATESHIP PROGRAM**
**with**
**Methane Hydrates Fellowship Program**
**National Energy Technology Laboratory**

**Annual Contract Technical Report**

Contract No. DE-FC26-05NT42248
Contract Period: 07/05/2005-09/30/2012
Report Period: 07/05/2010-07/04/2011

During the reporting period, the NRC conducted the following activities in support of the subject contract:

**Outreach and Promotion**

The promotional schedule to advertise the National Research Council (NRC) Research Associateship Programs included the following: 1) attendance at meetings of major scientific and engineering professional societies; 2) advertising in programs and career centers for these and other professional society meetings; 3) direct mailing and emailing of announcements and program materials to presidents, graduate deans, and heads of appropriate science and engineering departments and minority-affairs offices of all academic degree-granting institutions in the United States; 4) posting announcements on internet job sites, electronic newsletters and professional society websites; 5) print advertising in high profile publications (e.g., Science magazine, the Chronicle of Higher Education); and, 6) maintaining a presence on social media sites such as Facebook.

The NRC attended a number of minority focused events in which we maintained exhibit booths, participated in workshops and advertised in meeting literature, newsletters and websites or submitted materials for distribution. In addition, ads were placed in a variety of minority publications (e.g., Affirmative Action, Black Collegian).

In advertising the Research Opportunities available to prospective applicants, the NRC maintained an up-to-date listing of all active Research Advisers, current Adviser contact information and details of each Research Opportunity.

**Processing and Review of Applications**

Applications to the Research Associateship Program were submitted via a web-based application system. Each the four application cycles opened two months prior to the application deadline. NRC staff provided support to prospective applicants including providing application instructions, technical support and additional information as requested.

A summary of applications for the reporting period is shown in Table 1.

For each applicant, the NRC received and processed an application form, a research proposal, transcripts, a statement of previous and current research, and confidential reference reports. An application file check was made prior to the review and each applicant was notified if required documents were missing.

The NRC convened panels in five broad discipline areas for the competitive review of applications in the Research Associateship Programs. Results of the review were made available to Laboratory Program Representatives immediately following the conclusion of the each review.

A summary of the outcome of the review of applications for the reporting period is shown in Table 1.

**Administration of Awards**

The NRC made awards to applicants based on sponsor authorization. A summary of awards authorized and the acceptance or declination by the applicant during the current reporting period is shown in Table 1.

For Associates beginning or continuing tenure, the NRC provided the administrative functions described in the contract Statement of Work. These functions included stipend payments, management of a major medical nefits insurance program, and reimbursement for relocation and travel to professional meetings.

A summary of NRC Research Associates on tenure during the reporting period is shown in Table 2.

## Outcomes Reporting

All NRC Associates who completed tenure were required to submit a final report that described the outcome of their Associateship award. Final reports received by the NRC during the current reporting period are attached to this technical report.

The activities of Associates submitting final reports during this reporting period, including publications, presentations and patents, as well as an assessment of their experience in the program, are summarized in Table 3. Specific research accomplishments of Associates completing tenure during the reporting period are summarized in Table 4.

**Table 1.** Applications and Awards

**Table 2.** Associates on Tenure

**Table 3.** Associates Activity

**Table 4.** Summary of Associate Research

**Attachments:** Associate Final Reports

# Methane Hydrates Fellowship Program

## ble 1: Applications and Awards

| | Aug 2010 | Nov 2010 | Feb 2011 | May 2011 | TOTAL |
|---|---|---|---|---|---|
| TOTAL APPLICATIONS | 6 | 0 | 1 | 0 | 7 |
| Applications not reviewed | 1 | 0 | 0 | 0 | 1 |
| Applications reviewed | 5 | 0 | 1 | 0 | 6 |
| Not recommended | 0 | 0 | 0 | 0 | 0 |
| Recommended | 5 | 0 | 1 | 0 | 6 |
| Withdrawn | 1 | 0 | 0 | 0 | 1 |
| Lab decision pending | 3 | 0 | 1 | 0 | 4 |
| Awards offered | 1 | 0 | 0 | 0 | 1 |
| Applicant decision pending | 0 | 0 | 0 | 0 | 0 |
| Awards accepted | 1 | 0 | 0 | 0 | 1 |
| Awards declined | 0 | 0 | 0 | 0 | 0 |
| Not funded | 0 | 0 | 0 | 0 | 0 |

## ıble 2: Associates on Tenure

| Associate | Adviser | Tenure Dates | Country of Citizenship | Final Report |
|---|---|---|---|---|
| **NETL/MHFP-Methane Hydrates** | | | | |
| **MHRF-Methane Hydrates, Pittsburgh, PA** | | | | |
| Brothers, Laura L. | Methane Hydrates, Research Adviser | 10/1/2010-9/30/2012 | United States | |
| Cook Yockey, Ann Elizabeth | Goldberg, David | 1/4/2010-1/3/2012 | United States | |
| Daigle, Hugh Callahan | Dugan, Brandon | 8/17/2009-7/15/2011 | United States | |

## ıble 3: Associates' Activities

- **0** Associates ended tenure during the report period
- **0** months was the average tenure length
- **0** months was the longest
- **0** months was the shortest
- **0** submitted final reports

In the final reports, Associates indicated the following scholarly activity while on tenure.

- **0** Articles published in refereed journals
- **0** Patent applications
- **0** International presentations
- **0** Domestic presentations
- **0** Awards

After ending their tenure, Associates indicated their future plans as follows:

- **0** Permanent position at the NRC host agency
- **0** Contract or temporary position at the NRC host agency
- **0** Research/administrative position with another U.S. government agency
- **0** Research/administrative position with foreign government agency
- **0** Research/teaching at US college/university
- **0** Research/teaching position at a foreign college or university
- **0** Research/administrative position in private industry in the U.S.
- **0** Research/administrative position in private industry outside of the U.S.
- **0** Research/administrative position with a non-profit
- **0** Self-employed/consulting
- **0** Postdoctoral Research
- **0** Other
- **0** No information provided

In their final reports, Associates were asked to evaluate certain aspects of their experiences on a scale of 1 (low) to 10 (high). The average rating for each item follows:

- **0.0** Short-term value (lab)-Development of knowledge, skills, and research productivity at lab
- **0.0** Long-term value (career)-How your Research Associateship affected your career to date
- **0.0** Laboratory Support-Equipment, funding, orientation, safety & health training, etc.
- **0.0** Adviser Mentoring-Quality of mentoring from the Research Adviser
- **0.0** LPR Support-Quality of administrative support from the LPR
- **0.0** NRC Support-Quality of administrative support from the NRC

## ıble 4: Summary of Associate Research

| Associate | Tenure Dates | |
|---|---|---|
| No associates terminated tenure during the report period. | | |

# National Energy Technology Laboratory

## ible 1: Applications and Awards

| | Aug 2010 | Nov 2010 | Feb 2011 | May 2011 | TOTAL |
|---|---|---|---|---|---|
| TOTAL APPLICATIONS | 0 | 0 | 1 | 2 | 3 |
| Applications not reviewed | 0 | 0 | 1 | 0 | 1 |
| Applications reviewed | 0 | 0 | 0 | 2 | 2 |
| Not recommended | 0 | 0 | 0 | 0 | 0 |
| Recommended | 0 | 0 | 0 | 2 | 2 |
| Withdrawn | 0 | 0 | 0 | 0 | 0 |
| Lab decision pending | 0 | 0 | 0 | 2 | 2 |
| Awards offered | 0 | 0 | 0 | 0 | 0 |
| Applicant decision pending | 0 | 0 | 0 | 0 | 0 |
| Awards accepted | 0 | 0 | 0 | 0 | 0 |
| Awards declined | 0 | 0 | 0 | 0 | 0 |
| Not funded | 0 | 0 | 0 | 0 | 0 |



GH

## ıble 2: Associates on Tenure

| Associate | Adviser | Tenure Dates | Country of Citizenship | Final Report |
|---|---|---|---|---|
| **NETL-National Energy Technology Laboratory** | | | | |
| **NETL-National Energy Technology Laboratory, Morgantown, WV** | | | | |
| Lee, Shiwoo | Gemmen, Randall S. | 1/4/2010-1/3/2012 | Korea, South | |
| **NETL-National Energy Technology Laboratory** | | | | |
| **NETL-National Energy Technology Laboratory, Pittsburgh, PA** | | | | |
| Kauffman, Douglas Ralph | Matranga, Christopher Shawn | 5/5/2010-9/14/2011 | United States | |

## ble 3: Associates' Activities

- 0 Associates ended tenure during the report period
- 0 months was the average tenure length
- 0 months was the longest
- 0 months was the shortest
- 0 submitted final reports

In the final reports, Associates indicated the following scholarly activity while on tenure.

- 0 Articles published in refereed journals
- 0 Patent applications
- 0 International presentations
- 0 Domestic presentations
- 0 Awards

After ending their tenure, Associates indicated their future plans as follows:

- 0 Permanent position at the NRC host agency
- 0 Contract or temporary position at the NRC host agency
- 0 Research/administrative position with another U.S. government agency
- 0 Research/administrative position with foreign government agency
- 0 Research/teaching at US college/university
- 0 Research/teaching position at a foreign college or university
- 0 Research/administrative position in private industry in the U.S.
- 0 Research/administrative position in private industry outside of the U.S.
- 0 Research/administrative position with a non-profit
- 0 Self-employed/consulting
- 0 Postdoctoral Research
- 0 Other
- 0 No information provided

In their final reports, Associates were asked to evaluate certain aspects of their experiences on a scale of 1 (low) to 10 (high). The average rating for each item follows:

- 0.0 Short-term value (lab)-Development of knowledge, skills, and research productivity at lab
- 0.0 Long-term value (career)-How your Research Associateship affected your career to date
- 0.0 Laboratory Support-Equipment, funding, orientation, safety & health training, etc.
- 0.0 Adviser Mentoring-Quality of mentoring from the Research Adviser
- 0.0 LPR Support-Quality of administrative support from the LPR
- 0.0 NRC Support-Quality of administrative support from the NRC

## ıble 4: Summary of Associate Research

| Associate | Tenure Dates | |
|---|---|---|
| No associates terminated tenure during the report period. | | |

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# National Research Council

**RESEARCH ASSOCIATESHIP PROGRAM**
**with**
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**National Energy Technology Laboratory**

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A summary of applications for the reporting period is shown in Table 1.

For each applicant, the NRC received and processed an application form, a research proposal, transcripts, a statement of previous and current research, and confidential reference reports. An application file check was made prior to the review and each applicant was notified if required documents were missing.

The NRC convened panels in five broad discipline areas for the competitive review of applications in the Research Associateship Programs. Results of the review were made available to Laboratory Program Representatives immediately following the conclusion of the each review.

A summary of the outcome of the review of applications for the reporting period is shown in Table 1.

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The NRC made awards to applicants based on sponsor authorization. A summary of awards authorized and the acceptance or declination by the applicant during the current reporting period is shown in Table 1.

For Associates beginning or continuing tenure, the NRC provided the administrative functions described in the contract Statement of Work. These functions included stipend payments, management of a major medical benefits insurance program, and reimbursement for relocation and travel to professional meetings.

A summary of NRC Research Associates on tenure during the reporting period is shown in Table 2.

## Outcomes Reporting

All NRC Associates who completed tenure were required to submit a final report that described the outcome of their Associateship award. Final reports received by the NRC during the current reporting period are attached to this technical report.

The activities of Associates submitting final reports during this reporting period, including publications, presentations and patents, as well as an assessment of their experience in the program, are summarized in Table 3. Specific research accomplishments of Associates completing tenure during the reporting period are summarized in Table 4.

**Table 1.** Applications and Awards

**Table 2.** Associates on Tenure

**Table 3.** Associates Activity

**Table 4.** Summary of Associate Research

**Attachments:** Associate Final Reports

# Methane Hydrates Fellowship Program

## Table 1: Applications and Awards

| | Aug 2011 | Nov 2011 | Feb 2012 | May 2012 | Total |
|---|---|---|---|---|---|
| TOTAL APPLICATIONS | 1 | 0 | 0 | 0 | 1 |
| Applications not reviewed | 0 | 0 | 0 | 0 | 0 |
| Applications reviewed | 1 | 0 | 0 | 0 | 1 |
| Not recommended | 0 | 0 | 0 | 0 | 0 |
| Recommended | 1 | 0 | 0 | 0 | 1 |
| Withdrawn | 0 | 0 | 0 | 0 | 0 |
| Lab decision pending | 1 | 0 | 0 | 0 | 1 |
| Awards offered | 0 | 0 | 0 | 0 | 0 |
| Applicant decision pending | 0 | 0 | 0 | 0 | 0 |
| Awards accepted | 0 | 0 | 0 | 0 | 0 |
| Awards declined | 0 | 0 | 0 | 0 | 0 |
| Not funded | 0 | 0 | 0 | 0 | 0 |

## Table 2: Associates on Tenure

| Associate | Adviser | Tenure Dates | Country of Citizenship | Final Report |
|---|---|---|---|---|
| **NETL/MHFP-Methane Hydrates** | | | | |
| **MHRF-Methane Hydrates, Pittsburgh, PA** | | | | |
| Brothers, Laura L. | Methane Hydrates, Research Adviser | 10/1/2010-9/30/2012 | United States | |
| Cook Yockey, Ann Elizabeth | Goldberg, David | 1/4/2010-1/3/2012 | United States | Received |
| Daigle, Hugh Callahan | Dugan, Brandon | 8/17/2009-7/15/2011 | United States | Received |
| Wilson, Rachel Marie | | 1/3/2012-1/2/2013 | United States | |

## ıble 3: Associates' Activities

**2** Associates ended tenure during the report period
**23** months was the average tenure length
**24** months was the longest
**23** months was the shortest
**2** submitted final reports

In the final reports, Associates indicated the following scholarly activity while on tenure.

**5** Articles published in refereed journals
**0** Patent applications
**1** International presentations
**2** Domestic presentations
**0** Awards

After ending their tenure, Associates indicated their future plans as follows:

**0** Permanent position at the NRC host agency
**0** Contract or temporary position at the NRC host agency
**0** Research/administrative position with another U.S. government agency
**0** Research/administrative position with foreign government agency
**1** Research/teaching at US college/university
**0** Research/teaching position at a foreign college or university
**0** Research/administrative position in private industry in the U.S.
**0** Research/administrative position in private industry outside of the U.S.
**0** Research/administrative position with a non-profit
**0** Self-employed/consulting
**0** Postdoctoral Research
**0** Other
**0** No information provided

In their final reports, Associates were asked to evaluate certain aspects of their experiences on a scale of 1 (low) to 10 (high). The average rating for each item follows:

**7.0** Short-term value (lab)-Development of knowledge, skills, and research productivity at lab
**10.0** Long-term value (career)-How your Research Associateship affected your career to date
**10.0** Laboratory Support-Equipment, funding, orientation, safety & health training, etc.
**10.0** Adviser Mentoring-Quality of mentoring from the Research Adviser
**10.0** LPR Support-Quality of administrative support from the LPR
**8.0** NRC Support-Quality of administrative support from the NRC

## able 4: Summary of Associate Research

| Associate | Tenure Dates | |
|---|---|---|
| **Cook Yockey, Ann** | **1/4/2010-1/3/2012** | |
| 1 | Determination of gas hydrate saturation in gas hydrate filled fractures (published in Geophysics, 2010). | |
| 2 | Gas hydrate in sand reserviors has highly variable saturations that vary widely over cm depth scales ( published in Marine and Petroleum Geology, 2011). | |
| 3 | Continuing development of #1 (in collaboration with Schlumberger) to include inversion of directional resistivity measurements to determine hydrate saturation in gas hydrate-filled fractures. | |
| 4 | Discovery of gas hydrate fracture artifacts in X-ray images of cores. | |
| 5 | Modeling of diagenesis and methanogenesis in marine sediments. | |

# National Energy Technology Laboratory

## Table 1: Applications and Awards

| | Aug 2011 | Nov 2011 | Feb 2012 | May 2012 | Total |
|---|---|---|---|---|---|
| TOTAL APPLICATIONS | 0 | 0 | 0 | 0 | 0 |
| Applications not reviewed | 0 | 0 | 0 | 0 | 0 |
| Applications reviewed | 0 | 0 | 0 | 0 | 0 |
| Not recommended | 0 | 0 | 0 | 0 | 0 |
| Recommended | 0 | 0 | 0 | 0 | 0 |
| Withdrawn | 0 | 0 | 0 | 0 | 0 |
| Lab decision pending | 0 | 0 | 0 | 0 | 0 |
| Awards offered | 0 | 0 | 0 | 0 | 0 |
| Applicant decision pending | 0 | 0 | 0 | 0 | 0 |
| Awards accepted | 0 | 0 | 0 | 0 | 0 |
| Awards declined | 0 | 0 | 0 | 0 | 0 |
| Not funded | 0 | 0 | 0 | 0 | 0 |

## ıble 2: Associates on Tenure

| Associate | Adviser | Tenure Dates | Country of Citizenship | Final Report |
|---|---|---|---|---|
| **NETL-National Energy Technology Laboratory** | | | | |
| **NETL-National Energy Technology Laboratory, Morgantown, WV** | | | | |
| Lee, Shiwoo | Gemmen, Randall S. | 1/4/2010-1/3/2013 | Korea, South | |
| **NETL-National Energy Technology Laboratory** | | | | |
| **NETL-National Energy Technology Laboratory, Pittsburgh, PA** | | | | |
| Kauffman, Douglas Ralph | Matranga, Christopher Shawn | 5/5/2010-9/14/2011 | United States | Received |

## ıble 3: Associates' Activities

**1** Associates ended tenure during the report period
**16** months was the average tenure length
**16** months was the longest
**16** months was the shortest
**1** submitted final reports

In the final reports, Associates indicated the following scholarly activity while on tenure.

**1** Articles published in refereed journals
**0** Patent applications
**0** International presentations
**1** Domestic presentations
**0** Awards

After ending their tenure, Associates indicated their future plans as follows:

**0** Permanent position at the NRC host agency
**1** Contract or temporary position at the NRC host agency
**0** Research/administrative position with another U.S. government agency
**0** Research/administrative position with foreign government agency
**0** Research/teaching at US college/university
**0** Research/teaching position at a foreign college or university
**0** Research/administrative position in private industry in the U.S.
**0** Research/administrative position in private industry outside of the U.S.
**0** Research/administrative position with a non-profit
**0** Self-employed/consulting
**0** Postdoctoral Research
**0** Other
**0** No information provided

In their final reports, Associates were asked to evaluate certain aspects of their experiences on a scale of 1 (low) to 10 (high). The average rating for each item follows:

**10.0** Short-term value (lab)-Development of knowledge, skills, and research productivity at lab
**10.0** Long-term value (career)-How your Research Associateship affected your career to date
**10.0** Laboratory Support-Equipment, funding, orientation, safety & health training, etc.
**10.0** Adviser Mentoring-Quality of mentoring from the Research Adviser
**10.0** LPR Support-Quality of administrative support from the LPR
**8.0** NRC Support-Quality of administrative support from the NRC

## able 4: Summary of Associate Research

| Associate | Tenure Dates | |
|---|---|---|
| **Kauffman, Douglas** | **5/5/2010-9/14/2011** | |
| 1 | Synthesis of ligand-stabilized Cu2O and CuO nanoparticles with discrete size. | |
| 2 | Electrochemical and electronic and physical characterization of particles. | |
| 3 | Exploration of electrocatalytic activity of various Cu-oxide materials (including nanoparticles) for CO2 reduction and Methanol oxidation. | |

THE NATIONAL ACADEMIES
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**National Research Council**

**Research Associateship Programs**

# *FINAL REPORT*

| 1) *Associate Last or Family Name* | *First Name* | *M.I.* |
|---|---|---|
| **Cook Yockey** | **Ann** | **E** |

| 2) *FORWARDING Address* (to which your tax statement will be mailed) | *FORWARDING Phone(s) and E-Mail* (if known) |
|---|---|
| **Residence or Institution**<br>**Street 159 Tibet Rd.**<br>**City, State Zip Columbus, OH 43202** | **Home Phone: 917-684-1786**<br>**Alt. Phone:**<br>**Preferred E-mail: acook@ldeo.columbia.edu** |

| 3) *Today's Date* | *Dates of Tenure* |
|---|---|
| **Dec 13, 2011** | from **January 4, 2010** to **January 3, 2012** |

| 4) *Host Agency* | *Laboratory or Center* | *Division / Directorate / Department* |
|---|---|---|
| **NETL** | **Lamont-Doherty** | **Borehole Research Group** |
| **(e.g., AFRL)** | **(e.g., Wright Patterson AFB)** | **(e.g., High-Speed Propulsion)** |

5) *Name of Laboratory NRC Adviser* (and USMA Mentor, if applicable)

**Ray Boswell** **Dave Goldberg**

6) *TITLE OF RESEARCH PROPOSAL*

**Investigating Gulf of Mexico gas hydrate reserviors using LWD images and logs**

7) *SUMMARY OF RESEARCH DURING TENURE* **Itemize significant findings in concise form, utilizing key concepts/words.**

**1) Determination of gas hydrate saturation in gas hydrate filled fractures (published in Geophysics, 2010)**

**2) Gas hydrate in sand reserviors has highly variable saturations that vary widely over cm depth scales ( published in Marine and Petroleum Geology, 2011)**

**3) Continuing development of #1 (in collaboration with Schlumberger) to include inversion of directional resistivity measurements to determine hydrate saturation in gas hydrate-filled fractures**

**4) Discovery of gas hydrate fracture artifacts in X-ray images of cores**

**5) Modeling of diagenesis and methanogenesis in marine sediments**

**(USMA Davies Fellow: please add summary of teaching, including classes taught.)**

8) *RESEARCH IN PROGRESS* **Describe in no more than 100 words.**

**I am still working on research projects # 3, 4, and 5.**

9) *PUBLICATIONS AND PAPERS RESULTING FROM NRC ASSOCIATESHIP RESEARCH*

**Provide complete citations: author(s), title, full name of journal, volume number, page number(s), and year of publication.**

**a) Publications in peer-reviewed journals**

**Cook, A.E., Anderson, B.I., Rasmus, J., Sun, K., Li, Q., Collett, T.S., and Goldberg, D.S., (2011) Electrical anisotropy of gas hydrate bearing sand reservoirs in the Gulf of Mexico. Marine and Petroleum Geology (in press), doi:10.1016/j.marpetgeo.2011.09.003**

**Boswell, R., Frye, M., Shelander, D., Shedd, W., McConnell, D., and Cook, A., (2011) Architecture of gas-hydrate-bearing sands from Walker Ridge 313, Green Canyon 955, and Alaminos Canyon 21: Northern deepwater Gulf of Mexico. Marine and Petroleum Geology (in press), doi:10.1016/j.marpetgeo.2011.08.010**

**Collett, T.S., Lee, M.W., Zyrianova, M.V., Mrozewski, S.A., Guerin, G., Cook, A.E., Goldberg, D.S., (2011) Gulf of Mexico Gas Hydrate Joint Industry Project Leg II logging-while-drilling data acquisition and analysis. Marine and Petroleum Geology (in press), doi:10.1016.marpetgeo.2011.08.003**

**Cook, A.E., Anderson, B. I., Malinverno, A., Mrozewski, S., and Goldberg, D.S., (2010) Electrical anisotropy due to gas hydrate-filled fracture planes. Geophysics. Vol. 75, No. 6, F173-F185.**

**Riedel, M., Collett, T.S., Kumar, P., Sathe, A.V., and Cook, A., (2010) Seismic imaging of a fractured gas hydrate system in the Krishna-Godavari Basin offshore India. Marine and Petroleum Geology 27, 1476-1493.**

**b) Books, book chapters, other publications**

**Birchwood, R., Dai, J., Shelander, D., Boswell, R., Collett, T., Cook, A., Dallimore, S., Fujii, K., Imasato, Y., Fukuhara, M., Kusaka, K., Murray, D., and Saeki, T.,(2010) Developments in Gas Hydrates, Oilfield Review, Spring Edition, 18-33.**

**c) Manuscripts in preparation, manuscripts submitted**

10) *PATENT OR COPYRIGHT APPLICATIONS RESULTING FROM NRC ASSOCIATESHIP RESEARCH*
**Provide titles, inventors, and dates of applications.**

11) *PRESENTATIONS AT SCIENTIFIC MEETINGS OR CONFERENCES*
**Provide complete references: author(s), title, abstract/proceeding citation, meeting name and location.**

**International**

**Cook, A., Rasmus, J., Li, Q., Sun, K., Anderson, B., Collett, T., and Goldberg D., (2011) Analyzing electrical anisotropy in gas hydrate reservoirs using logging-while-drilling directional resistivity data from the Gulf of Mexico Gas Hydrate Joint Industry Project. Proceedings of the 7th International Conference on Gas Hydrates, Edinburgh, Scotland, July 17-21, 2011. Oral Presentation.**

**Domestic**

**Cook, A., Invited Lecture at the Gordon Research Conference on Natural Gas Hydrate Systems at Colby College, in Waterville Maine. June 7, 2010. Title: Hydrate-filled fracture reservoirs on continental margins**

**Cook, A. and Malinverno, A., Can in situ methanogeneisis explain a 3 m-thick gas hydrate-filled sand in Walker Ridge Block 313, Gulf of Mexico? AGU 2010 Fall Meeting, San Francisco, CA. Abstract OS53A-1353. December 17, 2010.**

12) *SEMINARS OR LECTURES DELIVERED AT UNIVERSITIES AND/OR INSTITUTES* **Include dates, names and locations of seminars.**

**Gas hydrate filled fractures: Insight into a unique methane reservior. Ohio State University, April 6, 2011.**

13) *PROFESSIONAL AWARDS RECEIVED DURING TENURE*

14) *POST-TENURE POSITION / JOB TITLE*

**Assistant Professor; Ohio State University**

15) *NAME AND ADDRESS OF POST-TENURE POSITION / JOB ORGANIZATION*

**Ann Cook**
**School of Earth Sciences**
**275 Mendenall Lab**
**125 S. Oval Mall**
**Columbus, OH 43210**

16) *POST-TENURE POSITION STATUS / CATEGORY* **Please indicate only one.**

- ☐ Permanent position at the NRC host agency
- ☐ Contract or temporary position at the NRC host Agency
  **Abbreviate Host Laboratory/Center** ____
- ☐ Research/Administrative position with another U.S.-government agency
- ☐ Research/Administrative position with a foreign-government agency
- ☒ Research/teaching position at a U.S. college or university
- ☐ Research/teaching position at a foreign college or university
- ☐ Research/administration position in private industry in the U.S.
- ☐ Research/administration position in private industry outside of the U.S.
- ☐ Research/administration position with a non profit
- ☐ Self-employed/consulting
- ☐ Postdoctoral research
- ☐ Other **(Please specify, possible)** ____
- ☐ No information provided

17) *APPRAISAL OF RESEARCH ASSOCIATESHIP PROGRAM*
**On a scale of 1 – 10 (poor - excellent), please rate the following:**

SHORT TERM VALUE

☒ 7 Development of knowledge, skills, and research productivity

**Comments**

**While I am very happy I have had the time to try new modeling techniques, I have not been able to complete all of the modeling I wanted to. Hopefully I will be able to complete these projects at my future position.**

LONG TERM VALUE

10 How the NRC Associateship award affected your career to date

**Comments**

**I only see positive future outcomes from my postdoctoral research. I have been able to learn new processing and modeling techniques which I anticipate will be a part of future research.**

LAB SUPPORT

10 Quality of support from the Laboratory--equipment, funding, orientation, safety and health guidelines, etc.

**Comments**

ADVISER/MENTOR SUPPORT

10 Quality of mentoring from the Laboratory NRC Adviser (USMA Mentor, if applicable)

**Comments**

LPR SUPPORT

10 Quality of administrative support from the **L**aboratory (e.g., NIST, NRL, IWR, FHWA) NRC **P**rogram **R**epresentative (LPR)

**Comments**

**Ray is an excellent program representative.**

NRC SUPPORT

8 Quality of administrative support. Please assess respective NRC aspects (e.g., moving company, insurance, Omega, payroll, coordinator, travel, etc.)

**Comments**

**In general, these services were adequate. I was very impresed with Nancy Diener, who handled reimbursements for research costs very quickly and efficently. I am also very happy that the travel reimbursement process is now streamlined an online.**

18) *PLEASE PROVIDE ANY SUGGESTIONS FOR PROGRAM IMPROVEMENT.*

**The biggest problems with the program was the allocated research dollars were not available for items I wanted to spend them on. While I occaisionally do things in a laboratory, this does not happen frequently and I do not consider myself a laboratory based scientist. However, the money for this program was allocated to be spent on laboratory items. Further expansion of what the research money could be spent on would be beneficial for field based or computer based scientists. Also, it would also be nice if research money could be spent on publication costs -- something all scientists need to pay for.**

**Please do NOT scan to PDF. Send the Final Report as MSWord document via e-mail to your NRC Program Coordinator**

*No handwritten signature required; but you may upload a scanned signature file below:*

**Asha Davis:** adavis@nas.edu
**Linda Sligh:** lsligh@nas.edu
**Jason Thornhill:** jthornhill@nas.edu
**Peggy Wilson:** pwilson@nas.edu
**Suzanne White:** swhite@nas.edu

**Rev. July 2011**

**Id#** **Proj/Act ID#**

THE NATIONAL ACADEMIES
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**National Research Council**

**Research Associateship Programs**

# *FINAL REPORT*

| 1) *Associate Last or Family Name* | *First Name* | *M.I.* |
|---|---|---|
| **Daigle** | **Hugh** | **C.** |

| 2) *FORWARDING Address* (to which your tax statement will be mailed) | *FORWARDING Phone(s) and E-Mail* (if known) |
|---|---|
| Res. or Inst.<br>Street **2929 Greenbriar St. Apt. 6307**<br>City, State Zip **Houston, TX 77098** | **Home Phone: 713-824-6833**<br>**Alt. Phone:**<br>**E-mail: hugh.daigle@gmail.com** |

| 3) *Today's Date* | *Dates of Tenure* |
|---|---|
| **May 25, 2011** | from **August 17, 2009** to **July 15, 2011** |

| 4) *Host Agency* | *Laboratory or Center* | *Division / Directorate / Department* |
|---|---|---|
| **NETL** | **Rice University** | **Department of Earth Science** |
| (e.g., AFRL) | (e.g., Wright Patterson AFB) | (e.g., High-Speed Propulsion) |

5) *Name of Laboratory NRC Adviser* (and USMA Mentor, if applicable)

**Dr. Brandon Dugan**

6) *TITLE OF RESEARCH PROPOSAL*

**Heterogeneous hydrate accumulations: Influence of pore- and fracture-scale processes**

7) *SUMMARY OF RESEARCH DURING TENURE* **Itemize significant findings in concise form, utilizing key concepts/words.**

**1) Formation of fracture-hosted hydrate deposits by hydraulic fracturing is possible in settings with high methane flux and low sediment permeability**

**2) Frost-heaving by hydrate lenses can form small-scale fractures and veins but is not likely to form larger-scale features**

**3) The relative fluxes of different methane phases (dissolved/gaseous) influences hydrate and fracture distributions**

**4) Pore-scale inhibition of hydrate nucleation due to capillary phenomena controls preferential accumuation of hydrate in coarser-grained sediments**

**5) Marine hydrate provinces are dynamic settings that evolve on time scales from decades to centuries**

**(USMA Davies Fellow: please add summary of teaching, including classes taught.)**

**N/A**

8) *RESEARCH IN PROGRESS* **Describe in no more than 100 words.**

**N/A**

9) *PUBLICATIONS AND PAPERS RESULTING FROM NRC ASSOCIATESHIP RESEARCH*

**Provide complete citations: author(s), title, full name of journal, volume number, page number(s), and year of publication.**

**a) Publications in peer-reviewed journals**

**Daigle, H., Dugan, B., in press. An improved technique for computing permeability from NMR measurements in mudstones. Journal of Geophysical Research B: Solid Earth, doi:10.1029/2011JB008353.**

**Daigle, H., Dugan, B., 2011. Capillary controls on methane hydrate distribution and fracturing in advective systems. Geochemistry, Geophysics, Geosystems, 12, Q01003, doi:10.1029/2010GC003392.**

**Daigle, H., Dugan, B., 2010. Origin and evolution of fracture-hosted methane hydrate deposits. Journal of Geophysical Research B: Solid Earth, 115, B11103, doi:10.1029/2010JB007492.**

**Daigle, H., Dugan, B., 2010. Effects of multiphase methane supply on hydrate accumulation and fracture generation. Geophysical Research Letters, 37, L20301, doi:10.1029/2010GL044970.**

**b) Books, book chapters, other publications**

**Daigle, H., 2011. Pore-scale controls on permeability, fluid flow, and methane hydrate distribution in fine-grained sediments. PhD thesis, Department of Earth Science, Rice University, Houston, Texas.**

**c) Manuscripts in preparation, manuscripts submitted**



**Daigle, H., Dugan, B., in preparation. Permeability anisotropy and fabric development: A mechanistic explanation. Water Resources Research.**

10) *PATENT OR COPYRIGHT APPLICATIONS RESULTING FROM NRC ASSOCIATESHIP RESEARCH*
**Provide titles, inventors, and dates of applications.**

**N/A**

11) *PRESENTATIONS AT SCIENTIFIC MEETINGS OR CONFERENCES*
**Provide complete references: author(s), title, abstract/proceeding citation, meeting name and location.**

**International**

**Daigle, H., Bangs, N., Dugan, B., 2011. "Transient pressures, hydraulic fracturing, and gas migration at southern Hydrate Ridge: Geophysical observations and flow modeling." 7th International Conference on Gas Hydrates, Edinburgh, Scotland.**

**Domestic**

**Daigle, H., Dugan, B., 2010. "Free gas in the regional hydrate stability zone: Implications for hydrate distribution and fracturing behavior." American Geophysical Union Fall Meeting, San Francisco, CA.**

**Daigle, H., Dugan, B., 2010. "Lithologically partitioned hydrates in advective systems." Gordon Research Conference on Natural Gas Hydrates, Waterville, ME.**

**Daigle, H., Dugan, B., 2010. "Fracture genesis and fracture filling in methane hydrate systems." DOE/NETL Methane Hydrate Workshop, Atlanta, GA.**

**Daigle, H., Dugan, B., 2009. "Fracture genesis and fracture filling in methane hydrate systems." American Geophysical Union Fall Meeting, San Francisco, CA.**

12) *SEMINARS OR LECTURES DELIVERED AT UNIVERSITIES AND/OR INSTITUTES* **Include dates, names and locations of seminars.**

**Daigle, H., 2010. "Poromechanical feedbacks in methane hydrate systems: Insights from 1-D models." Massachusetts Institute of Technology, Cambridge, MA (1 October 2010).**

**Daigle, H., Dugan, B., 2010. "Origins of fracture-hosted methane hydrates." Chevron Energy Technology Company, Houston, TX (11 March 2010).**

.3) *PROFESSIONAL AWARDS RECEIVED DURING TENURE*

**Leroy Caleb Gibbon Award (best-conceived and best-written thesis submitted within 6 weeks of the oral defense), Rice University Department of Earth Science, 2011**

**Outstanding Graduate Student Award, Rice University Department of Earth Science, 2010**

14) *POST-TENURE POSITION / JOB TITLE*

**Petrophysicist**

15) *NAME AND ADDRESS OF POST-TENURE POSITION / JOB ORGANIZATION*

**Chevron Energy Technology Company, 1500 Louisiana St., Houston, TX 77002**

16) *POST-TENURE POSITION STATUS / CATEGORY* **Please indicate only one.**

- ☐ Permanent position at the NRC host agency
- ☐ Contract or temporary position at the NRC host Agency
  **Abbreviate Host Laboratory/Center** ____
- ☐ Research/Administrative position with another U.S.-government agency
- ☐ Research/Administrative position with a foreign-government agency
- ☐ Research/teaching position at a U.S. college or university
- ☐ Research/teaching position at a foreign college or university
- ☒ Research/administration position in private industry in the U.S.
- ☐ Research/administration position in private industry outside of the U.S.
- ☐ Research/administration position with a non profit
- ☐ Self-employed/consulting
- ☐ Postdoctoral research
- ☐ Other **(Please specify, possible)** ____
- ☐ No information provided

17) *APPRAISAL OF RESEARCH ASSOCIATESHIP PROGRAM*
**On a scale of 1 – 10 (poor - excellent), please rate the following:**

SHORT TERM VALUE

9 Development of knowledge, skills, and research productivity
**Comments**
**Gave me a good opportunity to develop independent research and collaboration skills**

LONG TERM VALUE

9 How the NRC Associateship award affected your career to date

**Comments**

**Allowed me to pursue high-impact research for my PhD dissertation**

LAB SUPPORT

8 Quality of support from the Laboratory--equipment, funding, orientation, safety and health guidelines, etc.

**Comments**

**Generally good although there were some problems obtaining and using university-licensed software**

ADVISER/MENTOR SUPPORT

10 Quality of mentoring from the Laboratory NRC Adviser (USMA Mentor, if applicable)

**Comments**

**Dr. Dugan was very generous with his time and provided excellent help with programming issues**

LPR SUPPORT

10 Quality of administrative support from the **L**aboratory (e.g., NIST) NRC **P**rogram **R**epresentative (LPR)

**Comments**

NRC SUPPORT

10 Quality of administrative support. Please assess respective NRC aspects (e.g., moving company, insurance, Omega, payroll, coordinator, travel, etc.)

**Comments**

18) *PLEASE PROVIDE ANY SUGGESTIONS FOR PROGRAM IMPROVEMENT.*

**I was pleased with how the program was administered and do not see any areas that are in pressing need of improvement.**

Return this form via e-mail as a WORD document directly to your **NRC Program Coordinator.**

| | E-mail Addresses |
|---|---|
| **Liz Decker:** | edecker@nas.edu |
| **Linda Sligh:** | lsligh@nas.edu |
| **Jason Thornhill:** | jthornhill@nas.edu |
| **Peggy Wilson:** | pwilson@nas.edu |
| **Suzanne White:** | swhite@nas.edu |

THE NATIONAL ACADEMIES
*Advisers to the Nation on Science, Engineering, and Medicine*
National Research Council

**Research Associateship Programs**

# *FINAL REPORT*

| 1) *Associate Last or Family Name* | *First Name* | *M.I.* |
|---|---|---|
| **Kauffman** | **Douglas** | **R** |

| 2) *FORWARDING Address* (to which your tax statement will be mailed) | *FORWARDING Phone(s) and E-Mail* (if known) |
|---|---|
| Res. or Inst.<br>Street **213 Main Street**<br>City, State Zip **Pittsburgh, PA 15201** | **Home Phone: 412-680-8757**<br>**Alt. Phone:**<br>**E-mail: dougk82@hotmail.com** |

| 3) *Today's Date* | *Dates of Tenure* |
|---|---|
| **September 7, 2011** | from **May 5, 2010** to **September 14, 2011** |

| 4) *Host Agency* | *Laboratory or Center* | *Division / Directorate / Department* |
|---|---|---|
| **NETL** | **Pittsburgh** | **Chemistry and Surafce Science** |
| (e.g., AFRL) | (e.g., Wright Patterson AFB) | (e.g., High-Speed Propulsion) |

5) *Name of Laboratory NRC Adviser* (and USMA Mentor, if applicable)
**Christopher Matranga**

6) *TITLE OF RESEARCH PROPOSAL*

**Structure versus electrocatalytic activity of nanoscale copper oxides**

7) *SUMMARY OF RESEARCH DURING TENURE* **Itemize significant findings in concise form, utilizing key concepts/words.**

1) **Synthesis of ligand-stabilized Cu2O and CuO nanoparticles with discrete size**

2) **Electrochemical and electronic and physical characterization of particles**

3) **Exploration of electrocatalytic activity of various Cu-oxide materials (including nanoparticles) for CO2 reduction and Methanol oxidation**

4)

5)

**(USMA Davies Fellow: please add summary of teaching, including classes taught.)**

8) *RESEARCH IN PROGRESS* **Describe in no more than 100 words.**

**I have conducted fundamental research into the influence of organic capping ligands on Cu-oxide electrocatalysts for CO2 reduction and methanol oxidation reactions. During the course of this research we found that the presence of organic ligands, which are chemically attached to the catalyst surface, can direct both the reaction rate and product selectivity, and we found that the ligand-stabilized nanoparticles demonstrated higher catalytic activities and better product selectivities than bulk materials. This finding is significant because it dismisses a long standing belief that organic ligands only serve to passivate the catalyst surface and reduce reactivity, and opens the possibility of tuning catalyst reactivity and product selectivity by careful selection of surface ligands. The techniques that have been developed through the course of this work are of interest to several NETL-based and academic researchers, and several collaborative efforts have been arranged .**

9) *PUBLICATIONS AND PAPERS RESULTING FROM NRC ASSOCIATESHIP RESEARCH*
**Provide complete citations: author(s), title, full name of journal, volume number, page number(s), and year of publication.**

**a) Publications in peer-reviewed journals**

**D. R. Kauffman, P. Ohodnicki, B. Kail, C. Matranga, "Selective Electrocatalytic Activity of Ligand Stablized Copper Oxide Nanoparticles" The Journal of Physical Chemistry Letters, vol. 2, pp. 2038-2043, 2011.**

**b) Books, book chapters, other publications**

**c) Manuscripts in preparation, manuscripts submitted**

0) *PATENT OR COPYRIGHT APPLICATIONS RESULTING FROM NRC ASSOCIATESHIP RESEARCH*
**Provide titles, inventors, and dates of applications.**

11) *PRESENTATIONS AT SCIENTIFIC MEETINGS OR CONFERENCES*

**Provide complete references: author(s), title, abstract/proceeding citation, meeting name and location.**

**International**

**Domestic**

**D. R. Kauffman, B. Kail, P. Ohodnicki, C. Matranga, "Electrocatalytic Activity of Ligand-Stablized Copper Oxide Nanoparticles" ACS National Spring Meeting, March 27-31 2011, Anaheim CA.**

12) *SEMINARS OR LECTURES DELIVERED AT UNIVERSITIES AND/OR INSTITUTES* **Include dates, names and locations of seminars.**

13) *PROFESSIONAL AWARDS RECEIVED DURING TENURE*

14) *POST-TENURE POSITION / JOB TITLE*

**Contracted Researcher at NETL**

15) *NAME AND ADDRESS OF POST-TENURE POSITION / JOB ORGANIZATION*

**NETL**

16) *POST-TENURE POSITION STATUS / CATEGORY* **Please indicate only one.**

- ☐ Remain at Host Agency as Permanent Employee
- ☒ Remain at Host Agency as Contract/Temporary Employee
  - **Abbreviate Host Laboratory/Center** **NETL**
- ☐ Research Position at Another US Government Laboratory
- ☐ Administrative Position at US Government Laboratory
- ☐ Research Position at Foreign Government Laboratory
- ☐ Research/Teaching at US College/University
- ☐ Research/Teaching at Foreign College/University
- ☐ Research/Administration in Industry
- ☐ Research/Administration in Non-Profit Organization
- ☐ Postdoctoral Research
- ☐ Self Employed
- ☐ Other: **specify** _____

17) *APPRAISAL OF RESEARCH ASSOCIATESHIP PROGRAM*

**On a scale of 1 – 10 (poor - excellent), please rate the following:**

SHORT TERM VALUE

10 Development of knowledge, skills, and research productivity

**Comments**

LONG TERM VALUE

10 How the NRC Associateship award affected your career to date

**Comments**

LAB SUPPORT

10 Quality of support from the Laboratory--equipment, funding, orientation, safety and health guidelines, etc.

**Comments**

ADVISER/MENTOR SUPPORT

10 Quality of mentoring from the Laboratory NRC Adviser (USMA Mentor, if applicable)

**Comments**

LPR SUPPORT

10 Quality of administrative support from the **L**aboratory (e.g., NIST) NRC **P**rogram **R**epresentative (LPR)

**Comments**

NRC SUPPORT

8 Quality of administrative support. Please assess respective NRC aspects (e.g., moving company, insurance, Omega, payroll, coordinator, travel, etc.)

**Comments**



18) *PLEASE PROVIDE ANY SUGGESTIONS FOR PROGRAM IMPROVEMENT.*

Return this form via e-mail as a WORD document directly to your **NRC Program Coordinator**.

**E-mail Addresses**


**Liz Decker:** edecker@nas.edu
**Linda Sligh:** lsligh@nas.edu
**Jason Thornhill:** jthornhill@nas.edu
**Peggy Wilson:** pwilson@nas.edu
**Suzanne White:** swhite@nas.edu


**Rev. April 2010**

**ID#** **CC#**

THE NATIONAL ACADEMIES
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# National Research Council

**RESEARCH ASSOCIATESHIP PROGRAM**
**with**
**Methane Hydrates Fellowship Program**
**National Energy Technology Laboratory**

**Annual Contract Technical Report**

Contract No. DE-FC26-05NT42248
Contract Period: 07/05/2005-01/31/2014
Report Period: 07/05/2012-07/04/2013

During the reporting period, the NRC conducted the following activities in support of the subject contract:

**Outreach and Promotion**

The promotional schedule to advertise the National Research Council (NRC) Research Associateship Programs included the following: 1) attendance at meetings of major scientific and engineering professional societies; 2) advertising in programs and career centers for these and other professional society meetings; 3) direct mailing and emailing of announcements and program materials to presidents, graduate deans, and heads of appropriate science and engineering departments and minority-affairs offices of all academic degree-granting institutions in the United States; 4) posting announcements on internet job sites, electronic newsletters and professional society websites; 5) print advertising in high profile publications (e.g., Science magazine, the Chronicle of Higher Education); and, 6) maintaining a presence on social media sites such as Facebook.

The NRC attended a number of minority focused events in which we maintained exhibit booths, participated in workshops and advertised in meeting literature, newsletters and websites or submitted materials for distribution. In addition, ads were placed in a variety of minority publications (e.g., Affirmative Action, Black Collegian).

In advertising the Research Opportunities available to prospective applicants, the NRC maintained an up-to-date listing of all active Research Advisers, current Adviser contact information and details of each Research Opportunity.

**Processing and Review of Applications**

Applications to the Research Associateship Program were submitted via a web-based application system. Each of the four application cycles opened two months prior to the application deadline. NRC staff provided support to prospective applicants including providing application instructions, technical support and additional information as requested.

A summary of applications for the reporting period is shown in Table 1.

For each applicant, the NRC received and processed an application form, a research proposal, transcripts, a statement of previous and current research, and confidential reference reports. An application file check was made prior to the review and each applicant was notified if required documents were missing.

The NRC convened panels in five broad discipline areas for the competitive review of applications in the Research Associateship Programs. Results of the review were made available to Laboratory Program Representatives immediately following the conclusion of the each review.

A summary of the outcome of the review of applications for the reporting period is shown in Table 1.

**Administration of Awards**

The NRC made awards to applicants based on sponsor authorization. A summary of awards authorized and the acceptance or declination by the applicant during the current reporting period is shown in Table 1.

For Associates beginning or continuing tenure, the NRC provided the administrative functions described in the contract Statement of Work. These functions included stipend payments, management of a major medical benefits insurance program, and reimbursement for relocation and travel to professional meetings.

A summary of NRC Research Associates on tenure during the reporting period is shown in Table 2.

## Outcomes Reporting

All NRC Associates who completed tenure were required to submit a final report that described the outcome of their Associateship award. Final reports received by the NRC during the current reporting period are attached to this technical report.

The activities of Associates submitting final reports during this reporting period, including publications, presentations and patents, as well as an assessment of their experience in the program, are summarized in Table 3. Specific research accomplishments of Associates completing tenure during the reporting period are summarized in Table 4.

**Table 1.** Applications and Awards

**Table 2.** Associates on Tenure

**Table 3.** Associates Activity

**Table 4.** Summary of Associate Research

**Attachments:** Associate Final Reports

# Methane Hydrates Fellowship Program

## ıble 1: Applications and Awards

| | Aug 2012 | Nov 2012 | Feb 2013 | May 2013 | Total |
|---|---|---|---|---|---|
| TOTAL APPLICATIONS | 2 | 0 | 1 | 0 | 3 |
| Applications not reviewed | 0 | 0 | 0 | 0 | 0 |
| Applications reviewed | 2 | 0 | 1 | 0 | 3 |
| Not recommended | 0 | 0 | 0 | 0 | 0 |
| Recommended | 2 | 0 | 1 | 0 | 3 |
| Withdrawn | 0 | 0 | 0 | 0 | 0 |
| Lab decision pending | 0 | 0 | 1 | 0 | 1 |
| Awards offered | 1 | 0 | 0 | 0 | 1 |
| Applicant decision pending | 0 | 0 | 0 | 0 | 0 |
| Awards accepted | 1 | 0 | 0 | 0 | 1 |
| Awards declined | 0 | 0 | 0 | 0 | 0 |
| Not funded | 1 | 0 | 0 | 0 | 1 |

## ıble 2: Associates on Tenure

| Associate | Adviser | Tenure Dates | Country of Citizenship | Final Report |
|---|---|---|---|---|
| **NETL/MHFP-Methane Hydrates** | | | | |
| **MHRF-Methane Hydrates, Pittsburgh, PA** | | | | |
| Brothers, Laura L. | Methane Hydrates, Research Adviser | 10/1/2010-9/7/2012 | United States | Received |
| Marlow, Jeffrey James | Methane Hydrates, Research Adviser | 3/1/2013-2/28/2014 | United States | |
| Wilson, Rachel Marie | | 1/3/2012-1/2/2014 | United States | |

## ble 3: Associates' Activities

**1** Associates ended tenure during the report period
**23** months was the average tenure length
**23** months was the longest
**23** months was the shortest
**1** submitted final reports

In the final reports, Associates indicated the following scholarly activity while on tenure.
**2** Articles published in refereed journals
**0** Patent applications
**1** International presentations
**7** Domestic presentations
**0** Awards

After ending their tenure, Associates indicated their future plans as follows:
**1** Permanent position at the NRC host agency
**0** Contract or temporary position at the NRC host agency
**0** Research/administrative position with another U.S. government agency
**0** Research/administrative position with foreign government agency
**0** Research/teaching at US college/university
**0** Research/teaching position at a foreign college or university
**0** Research/administrative position in private industry in the U.S.
**0** Research/administrative position in private industry outside of the U.S.
**0** Research/administrative position with a non-profit
**0** Self-employed/consulting
**0** Postdoctoral Research
**0** Other
**0** No information provided

In their final reports, Associates were asked to evaluate certain aspects of their experiences on a scale of 1 (low) to 10 (high). The average rating for each item follows:

**10.0** Short-term value (lab)-Development of knowledge, skills, and research productivity at lab
**10.0** Long-term value (career)-How your Research Associateship affected your career to date
**10.0** Laboratory Support-Equipment, funding, orientation, safety & health training, etc.
**10.0** Adviser Mentoring-Quality of mentoring from the Research Adviser
**10.0** LPR Support-Quality of administrative support from the LPR
**10.0** NRC Support-Quality of administrative support from the NRC

## ıble 4: Summary of Associate Research

| Associate | Tenure Dates | |
|---|---|---|
| **Brothers, Laura** | **10/1/2010-9/7/2012** | |
| 1 | My collaborators and I identified a velocity anomaly indicative of subsea permafrost along the 700 km of the US Beaufort Sea inner shelf, using prestacked multichannel seismic data. | |
| 2 | This work produced the first regional map of subsea permafrost distribution on US Beaufort Sea continental shelf (Brothers et al., 2012), which has implications for the contemporary distribution of relict methane hydrate. | |
| 3 | The permafrost velocity anomaly ends within 30 km of shore and does not extend beyond the 20 m isobath, implying that older assumptions about the present-day offshore extent of ice-bearing permafrost on this shelf should be revised. | |
| 4 | These results played a central role in the planning and execution of the first-ever survey of real-time methane fluxes across the ocean-water interface in a subsea permafrost/methane hydrate system (Pohlman et al., 2012) | |
| 5 | We are collaborarating with other USGS and BOEM scientists to examine all publicly avaliable seismic and offshore drill log data. This analysis will yield a map of subsea permafrost based on a comprehensive database of offshore observations. | |

# National Energy Technology Laboratory

## Table 1: Applications and Awards

| | Aug 2012 | Nov 2012 | Feb 2013 | May 2013 | Total |
|---|---|---|---|---|---|
| TOTAL APPLICATIONS | 0 | 0 | 0 | 0 | 0 |
| Applications not reviewed | 0 | 0 | 0 | 0 | 0 |
| Applications reviewed | 0 | 0 | 0 | 0 | 0 |
| Not recommended | 0 | 0 | 0 | 0 | 0 |
| Recommended | 0 | 0 | 0 | 0 | 0 |
| Withdrawn | 0 | 0 | 0 | 0 | 0 |
| Lab decision pending | 0 | 0 | 0 | 0 | 0 |
| Awards offered | 0 | 0 | 0 | 0 | 0 |
| Applicant decision pending | 0 | 0 | 0 | 0 | 0 |
| Awards accepted | 0 | 0 | 0 | 0 | 0 |
| Awards declined | 0 | 0 | 0 | 0 | 0 |
| Not funded | 0 | 0 | 0 | 0 | 0 |

## 'able 2: Associates on Tenure

| Associate | Adviser | Tenure Dates | Country of Citizenship | Final Report |
|---|---|---|---|---|
| **NETL-National Energy Technology Laboratory** | | | | |
| **NETL-National Energy Technology Laboratory, Morgantown, WV** | | | | |
| Lee, Shiwoo | Gemmen, Randall S. | 1/4/2010-1/3/2014 | Korea, South | |

## 'able 3: Associates' Activities

- **0** Associates ended tenure during the report period
- **0** months was the average tenure length
- **0** months was the longest
- **0** months was the shortest
- **0** submitted final reports

In the final reports, Associates indicated the following scholarly activity while on tenure.

- **0** Articles published in refereed journals
- **0** Patent applications
- **0** International presentations
- **0** Domestic presentations
- **0** Awards

After ending their tenure, Associates indicated their future plans as follows:

- **0** Permanent position at the NRC host agency
- **0** Contract or temporary position at the NRC host agency
- **0** Research/administrative position with another U.S. government agency
- **0** Research/administrative position with foreign government agency
- **0** Research/teaching at US college/university
- **0** Research/teaching position at a foreign college or university
- **0** Research/administrative position in private industry in the U.S.
- **0** Research/administrative position in private industry outside of the U.S.
- **0** Research/administrative position with a non-profit
- **0** Self-employed/consulting
- **0** Postdoctoral Research
- **0** Other
- **0** No information provided

In their final reports, Associates were asked to evaluate certain aspects of their experiences on a scale of 1 (low) to 10 (high). The average rating for each item follows:

- **0.0** Short-term value (lab)-Development of knowledge, skills, and research productivity at lab
- **0.0** Long-term value (career)-How your Research Associateship affected your career to date
- **0.0** Laboratory Support-Equipment, funding, orientation, safety & health training, etc.
- **0.0** Adviser Mentoring-Quality of mentoring from the Research Adviser
- **0.0** LPR Support-Quality of administrative support from the LPR
- **0.0** NRC Support-Quality of administrative support from the NRC

## ıble 4: Summary of Associate Research

| Associate | Tenure Dates | |
|---|---|---|
| No associates terminated tenure during the report period. | | |

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**National Research Council**

**Research Associateship Programs**

# *FINAL REPORT*

| 1) *Associate Last or Family Name* | *First Name* | *M.I.* |
|---|---|---|
| **Brothers** | **Laura** | **L.** |

| 2) *FORWARDING Address* (to which your tax statement will be mailed) | *FORWARDING Phone(s) and E-Mail* (if known) |
|---|---|
| Res. or Inst. **U.S. Geological Survey**<br>Street **384 Woods Hole Road**<br>City, State Zip **Woods Hole, MA 02543** | **Home Phone: 2079498034**<br>**Alt. Phone: 508457-2312**<br>**E-mail: lbrothers@usgs.gov** |

| 3) *Today's Date* | *Dates of Tenure* |
|---|---|
| **August 31, 2012** | from **October 1, 2010** to **September 7, 2012** |

| 4) *Host Agency* | *Laboratory or Center* | *Division / Directorate / Department* |
|---|---|---|
| **USGS** | **Woods Hole Sci Cntr** | |
| (e.g., AFRL) | (e.g., Wright Patterson AFB) | (e.g., High-Speed Propulsion) |

5) *Name of Laboratory NRC Adviser* (and USMA Mentor, if applicable)

**Carolyn Ruppel**

6) *TITLE OF RESEARCH PROPOSAL*

**A geophysical study of permafrost degradation and potential hydrate dissociation in nearshore US Beaufort Sea.**

7) *SUMMARY OF RESEARCH DURING TENURE* **Itemize significant findings in concise form, utilizing key concepts/words.**

**1) My collaborators and I identified a velocity anomaly indicative of subsea permafrost along the 700 km of the US Beaufort Sea inner shelf, using prestacked multichannel seismic data.**

**2) This work produced the first regional map of subsea permafrost distribution on US Beaufort Sea continental shelf (Brothers et al., 2012), which has implications for the contemporary distribution of relict methane hydrate.**

**3) The permafrost velocity anomaly ends within 30 km of shore and does not extend beyond the 20 m isobath, implying that older assumptions about the present-day offshore extent of ice-bearing permafrost on this shelf should be revised.**

**4) These results played a central role in the planning and execution of the first-ever survey of real-time methane fluxes across the ocean-water interface in a subsea permafrost/methane hydrate system (Pohlman et al., 2012)**

**5) We are collaborarating with other USGS and BOEM scientists to examine all publicly avaliable seismic and offshore drill log data. This analysis will yield a map of subsea permafrost based on a comprehensive database of offshore observations**

**(USMA Davies Fellow: please add summary of teaching, including classes taught.)**

8) *RESEARCH IN PROGRESS* **Describe in no more than 100 words.**

**I am currently integrating results from offshore drill logs, stacked and prestacked multichannel seismic data to produce a map and comprehensive database of U.S. Beaufort Sea continental shelf permafrost observations to be completed as part of my duties as a USGS employee in FY2013. Depending on funding decisions, I may also have the opportunity to advise on and/or participate in future university-led controlled source electromagnetics surveys that my mentor has proposed be conducted across the permafrost/no permafrost transition where the USGS has formerly collected new seismic data.**

9) *PUBLICATIONS AND PAPERS RESULTING FROM NRC ASSOCIATESHIP RESEARCH*

**Provide complete citations: author(s), title, full name of journal, volume number, page number(s), and year of publication.**

**a) Publications in peer-reviewed journals**

**Brothers, L.L., Hart, P.E., Ruppel, C., 2012, Minimum subsea permafrost distribution on the US Beaufort Sea continental shelf, Geophysical Research Letters v. 39 L15501 doi:10.1029/2012GL052222**

**b) Books, book chapters, other publications**

**Ruppel, C., Brothers, L., Hart, P., Maue, C., Pohlman, J., Kessler, J., Sparrow, K.J., Worley, C., 2012, Methane dynamics associated with long-term climate change on the Beaufort Sea Inner Shelf, Fire in the Ice, The National Methane Hydrates R&D Program, Methane Hydrate R&D Program Newsletter, Spring 2012.**

**Pohlman, J., C. Ruppel, C. Maue, L. Brothers, J. Kessler, and C. Worley, 2012, Real-time mapping of seawater and atmospheric methane concentrations offshore of Alaska's North Slope,Sound Waves (USGS newsletter).**

Brothers, L.L., Kelley, J.T., Belknap, D.F., Koons, P.O., Barnhardt, W.A., 2011, Pockmarks: Self-scouring seep features?, Paper Number 326 In Proceedings of the 7th International Conference on Gas Hydrates.http://www.pet.hw.ac.uk/icgh7/

c) Manuscripts in preparation, manuscripts submitted

Brothers, L.L., Herman, B., Hart, P.E., Ruppel, C.D., and Collett, T.S.Multiproxy constraints on the distribution of subsea permafrost on the U.S. Beaufort Sea continental shelf , in preparation for Journal of Geophysical Research

10) *PATENT OR COPYRIGHT APPLICATIONS RESULTING FROM NRC ASSOCIATESHIP RESEARCH*
Provide titles, inventors, and dates of applications.

11) *PRESENTATIONS AT SCIENTIFIC MEETINGS OR CONFERENCES*
Provide complete references: author(s), title, abstract/proceeding citation, meeting name and location.

International

Brothers, L.L., Kelley, J.T., Belknap, D.F., Koons, P.O., Barnhardt, W.A., 2011, Pockmarks: Self-scouring seep features? 7th International Conference on Gas Hydrates, Paper Number 326.

Domestic

Brothers, L.L., Hart, P.E., Ruppel, C.,2012, Minimum distribution of subsea ice-bearing permafrost on the US Beaufort Sea continental shelf, Gordon Research Conference on Natural Gas Hydrates, Ventura, CA.

Pohlman, J.W., Kessler, J.K., Maue, C., Ruppel, C.D., Brothers, L.L., Yvon-Lewis, S.A., Sparrow, K., Bergeron, E., Worley, C., 2012, Methane fluxes to the atmosphere in an area of possibly dissociating gas hydrate in the shallow Alaskan Beaufort Sea, Eos Trans. AGU 87(36), Ocean Sciences Meet. Supplement, Abstract OS35E-02

Ruppel, C., Brothers, L., Hart, P., Pohlman, J., 2012, Warming-driven dissociation of gas hydrates on the continental shelf and upper continental slope of the US Beaufort Sea, for Arctic Frontiers, Tromso, Jan 2012.

Brothers, L.L., Hart, P.E., Ruppel, C., 2011, Subsea permafrost mapped across the US Beaufort Sea using multichannel seismic data, AGU Fall Meeting

Ruppel, C., Brothers, L.L., Hart, P.E., Worley, C., 2011, The distribution of subsea permafrost and shallow methane on the central U.S. Beaufort Inner Shelf from newly acquired geophysical data, AGU Fall Meeting

Brothers, L.L.,Hart, P.E., Ruppel, C., 2011, U.S. Beaufort Shelf Subsea Permafrost/Gas Hydrates(?) Distribution from Legacy Seismic Data, Marine Geosciences Leadership Symposium, Consortium for Ocean Leadership

Brothers, L.L.,Hart, P.E., Ruppel, C., 2011, U.S. Beaufort Shelf Subsea Permafrost/Gas Hydrates(?) Distribution from Legacy Seismic Data,USGS-DOE Climate-Hydrates Workshop, Boston MA, Feb. 2011.

12) *SEMINARS OR LECTURES DELIVERED AT UNIVERSITIES AND/OR INSTITUTES* Include dates, names and locations of seminars.

- February 2, 2012. Earth Sciences Spearker Series, City College of New York, NY, NY.
- October 15, 2011. Allegheny College, Marine Sciences Field Trip, Yarmouth, MA.
- June 13, 2011. Summer Student Fellow Summer Lecture Series, Woods Hole Oceanographic Institute, Woods Hole, MA.
- March 11, 2011 and April 9, 2012. Center for Coastal and Ocean Mapping/Joint Hydrographic Center (CCOM/JHC) Seminar Series, University of New Hampshire, Durham, NH.
- October 2, 2010. Center Meeting, U.S. Geological Survey, Woods Hole Coastal and Marine Science Center, Woods Hole, MA.

13) *PROFESSIONAL AWARDS RECEIVED DURING TENURE*



14) *POST-TENURE POSITION / JOB TITLE*

Research Geologist GS12/1

15) *NAME AND ADDRESS OF POST-TENURE POSITION / JOB ORGANIZATION*

**U.S. Geological Survey**

16) *POST-TENURE POSITION STATUS / CATEGORY* **Please indicate only one.**

- ☐ Permanent position at the NRC host agency
- ☐ Contract or temporary position at the NRC host Agency
  **Abbreviate Host Laboratory/Center** ____
- ☐ Research/Administrative position with another U.S.-government agency
- ☐ Research/Administrative position with a foreign-government agency
- ☐ Research/teaching position at a U.S. college or university
- ☐ Research/teaching position at a foreign college or university
- ☐ Research/administration position in private industry in the U.S.
- ☐ Research/administration position in private industry outside of the U.S.
- ☐ Research/administration position with a non profit
- ☐ Self-employed/consulting
- ☐ Postdoctoral research
- ☐ Other **(Please specify, possible)** ____
- ☐ No information provided

17) *APPRAISAL OF RESEARCH ASSOCIATESHIP PROGRAM*

**On a scale of 1 – 10 (poor - excellent), please rate the following:**

SHORT TERM VALUE

10 Development of knowledge, skills, and research productivity

**Comments**

**Excellent**

LONG TERM VALUE

10 How the NRC Associateship award affected your career to date

**Comments**

**The fellowship allowed me to conduct stimulating research, and led me to a permenent job with the USGS. It has been a life changing opportunity.**

LAB SUPPORT

10 Quality of support from the Laboratory--equipment, funding, orientation, safety and health guidelines, etc.

**Comments**

**Excellent. This form does not specifically mention field-based research, but it is worth mentioning that I had the opportunity to conduct such research with USGS financial support and was able to acquire data to validate some of the conclusions I had drawn based on the analysis of legacy seismic data (the core part of my NRC project).**

ADVISER/MENTOR SUPPORT

10 Quality of mentoring from the Laboratory NRC Adviser (USMA Mentor, if applicable)

**Comments**

**My NRC Adviser was an exceptional mentor. She allowed me to participate in frontier science programs, introduced me to professionals in the gas hydrates field and was extremely supportive of my professional aspirations.**

LPR SUPPORT

10 Quality of administrative support from the **L**aboratory (e.g., NIST) NRC **P**rogram **R**epresentative (LPR)

**Comments**

**My LPR was very supportive and the administration of research needs, etc. was wonderful.**

NRC SUPPORT

10 Quality of administrative support. Please assess respective NRC aspects (e.g., moving company, insurance, Omega, payroll, coordinator, travel, etc.)

**Comments**

**I received excellent administrative support. In particular, Linda Sligh was a great program coordinator. Nancy Denier went above and beyond the call of duty to make sure the my research needs were met. All travel, payroll and insurance administration was great. Despite my status as an "associate," not permanent employee, of the USGS, I also had outstanding administrative support from my local hosting USGS Center and its staff.**

18) *PLEASE PROVIDE ANY SUGGESTIONS FOR PROGRAM IMPROVEMENT.*

**My only suggestion is for increased flexibility with regard to "Research" funds. Specifically, it would be helpful if research funds could be used for research-related travel. In my almost entirely computer-based subdiscipline, it is difficult to use the bulk of the research funding allocated by NRC in the categories required (e.g., "supplies"). Additionally, my federal agency, like most, requires that it must own the computer and much of the software that I use if I am to have access to its network. I could easily have expended research funds to support participation in field-based research that was directly related to the fellowship's topic.**

Return this form via e-mail as a WORD document directly to your **NRC Program Coordinator.**

**E-mail Addresses**
**Liz Decker:** edecker@nas.edu
**Linda Sligh:** lsligh@nas.edu

Jason Thornhill: jthornhill@nas.edu
Peggy Wilson: pwilson@nas.edu
Suzanne White: swhite@nas.edu

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# National Research Council

**RESEARCH ASSOCIATESHIP PROGRAM**
**with**
**Methane Hydrates Fellowship Program**
**National Energy Technology Laboratory**

**Annual Contract Technical Report**

Contract No. DE-FC26-05NT42248
Contract Period: 07/05/2005-01/31/2014
Report Period: 07/05/2013-01/31/2014

During the reporting period, the NRC conducted the following activities in support of the subject contract:

**Outreach and Promotion**

The promotional schedule to advertise the National Research Council (NRC) Research Associateship Programs included the following: 1) attendance at meetings of major scientific and engineering professional societies; 2) advertising in programs and career centers for these and other professional society meetings; 3) direct mailing and emailing of announcements and program materials to presidents, graduate deans, and heads of appropriate science and engineering departments and minority-affairs offices of all academic degree-granting institutions in the United States; 4) posting announcements on internet job sites, electronic newsletters and professional society websites; 5) print advertising in high profile publications (e.g., Science magazine, the Chronicle of Higher Education); and, 6) maintaining a presence on social media sites such as Facebook.

The NRC attended a number of minority focused events in which we maintained exhibit booths, participated in workshops and advertised in meeting literature, newsletters and websites or submitted materials for distribution. In addition, ads were placed in a variety of minority publications (e.g., Affirmative Action, Black Collegian).

In advertising the Research Opportunities available to prospective applicants, the NRC maintained an up-to-date listing of all active Research Advisers, current Adviser contact information and details of each Research Opportunity.

**Processing and Review of Applications**

Applications to the Research Associateship Program were submitted via a web-based application system. Each the four application cycles opened two months prior to the application deadline. NRC staff provided support to prospective applicants including providing application instructions, technical support and additional information as requested.

A summary of applications for the reporting period is shown in Table 1.

For each applicant, the NRC received and processed an application form, a research proposal, transcripts, a statement of previous and current research, and confidential reference reports. An application file check was made prior to the review and each applicant was notified if required documents were missing.

The NRC convened panels in five broad discipline areas for the competitive review of applications in the Research Associateship Programs. Results of the review were made available to Laboratory Program Representatives immediately following the conclusion of the each review.

A summary of the outcome of the review of applications for the reporting period is shown in Table 1.

**Administration of Awards**

The NRC made awards to applicants based on sponsor authorization. A summary of awards authorized and the acceptance or declination by the applicant during the current reporting period is shown in Table 1.

For Associates beginning or continuing tenure, the NRC provided the administrative functions described in the contract Statement of Work. These functions included stipend payments, management of a major medical benefits insurance program, and reimbursement for relocation and travel to professional meetings.

A summary of NRC Research Associates on tenure during the reporting period is shown in Table 2.

## Outcomes Reporting

All NRC Associates who completed tenure were required to submit a final report that described the outcome of their Associateship award. Final reports received by the NRC during the current reporting period are attached to this technical report.

The activities of Associates submitting final reports during this reporting period, including publications, presentations and patents, as well as an assessment of their experience in the program, are summarized in Table 3. Specific research accomplishments of Associates completing tenure during the reporting period are summarized in Table 4.

**Table 1.** Applications and Awards

**Table 2.** Associates on Tenure

**Table 3.** Associates Activity

**Table 4.** Summary of Associate Research

**Attachments:** Associate Final Reports

# Methane Hydrates Fellowship Program

## ıble 1: Applications and Awards

| | Aug 2013 | Nov 2013 | Total |
|---|---|---|---|
| TOTAL APPLICATIONS | 2 | 0 | 2 |
| Applications not reviewed | 0 | 0 | 0 |
| Applications reviewed | 2 | 0 | 2 |
| Not recommended | 0 | 0 | 0 |
| Recommended | 2 | 0 | 2 |
| Withdrawn | 0 | 0 | 0 |
| Lab decision pending | 0 | 0 | 0 |
| Awards offered | 0 | 0 | 0 |
| Applicant decision pending | 0 | 0 | 0 |
| Awards accepted | 0 | 0 | 0 |
| Awards declined | 0 | 0 | 0 |
| Not funded | 2 | 0 | 2 |

## .ble 2: Associates on Tenure

| Associate | Adviser | Tenure Dates | Country of Citizenship | Final Report |
|---|---|---|---|---|
| **NETL/MHFP-Methane Hydrates** | | | | |
| **MHRF-Methane Hydrates, Pittsburgh, PA** | | | | |
| Frederick, Jennifer Mary | Buffett, Bruce | 1/13/2014-1/12/2015 | United States | |
| Marlow, Jeffrey James | Buffett, Bruce | 3/1/2013-2/28/2015 | United States | |
| Wilson, Rachel Marie | | 1/3/2012-1/2/2014 | United States | Received |

## ble 3: Associates' Activities

**1** Associates ended tenure during the report period
**24** months was the average tenure length
**24** months was the longest
**24** months was the shortest
**1** submitted final reports

In the final reports, Associates indicated the following scholarly activity while on tenure.

**3** Articles published in refereed journals
**0** Patent applications
**0** International presentations
**4** Domestic presentations
**0** Awards

After ending their tenure, Associates indicated their future plans as follows:

**0** Permanent position at the NRC host agency
**0** Contract or temporary position at the NRC host agency
**0** Research/administrative position with another U.S. government agency
**0** Research/administrative position with foreign government agency
**0** Research/teaching at US college/university
**0** Research/teaching position at a foreign college or university
**0** Research/administrative position in private industry in the U.S.
**0** Research/administrative position in private industry outside of the U.S.
**0** Research/administrative position with a non-profit
**0** Self-employed/consulting
**1** Postdoctoral Research
**0** Other
**0** No information provided

In their final reports, Associates were asked to evaluate certain aspects of their experiences on a scale of 1 (low) to 10 (high). The average rating for each item follows:

**10.0** Short-term value (lab)-Development of knowledge, skills, and research productivity at lab
**10.0** Long-term value (career)-How your Research Associateship affected your career to date
**10.0** Laboratory Support-Equipment, funding, orientation, safety & health training, etc.
**10.0** Adviser Mentoring-Quality of mentoring from the Research Adviser
**10.0** LPR Support-Quality of administrative support from the LPR
**10.0** NRC Support-Quality of administrative support from the NRC

## ıble 4: Summary of Associate Research

| Associate | Tenure Dates | |
|---|---|---|
| **Wilson, Rachel** | **1/3/2012-1/2/2014** | |
| 1 | Hydrate dissolution rate is not dependant on crystal structure. | |
| 2 | Both outcropping and disseminated hydrates are susceptible to dissolution. | |
| 3 | Sand covering slowed the dissolution rate by approximately 50% and reduced the final methane saturation in the bulk fluid. | |
| 4 | Addition of 10% by weight of oil to the sand increased the dissolution rate approximately offsetting the benefit of the sand. | |

# National Energy Technology Laboratory

## ıble 1: Applications and Awards

| | Aug 2013 | Nov 2013 | Total |
|---|---|---|---|
| TOTAL APPLICATIONS | 0 | 0 | 0 |
| Applications not reviewed | 0 | 0 | 0 |
| Applications reviewed | 0 | 0 | 0 |
| Not recommended | 0 | 0 | 0 |
| Recommended | 0 | 0 | 0 |
| Withdrawn | 0 | 0 | 0 |
| Lab decision pending | 0 | 0 | 0 |
| Awards offered | 0 | 0 | 0 |
| Applicant decision pending | 0 | 0 | 0 |
| Awards accepted | 0 | 0 | 0 |
| Awards declined | 0 | 0 | 0 |
| Not funded | 0 | 0 | 0 |

## ıble 2: Associates on Tenure

| Associate | Adviser | Tenure Dates | Country of Citizenship | Final Report |
|---|---|---|---|---|
| **NETL-National Energy Technology Laboratory** | | | | |
| **NETL-National Energy Technology Laboratory, Morgantown, WV** | | | | |
| Lee, Shiwoo | Gemmen, Randall S. | 1/4/2010-1/3/2015 | Korea, South | |

## ıble 3: Associates' Activities

- 0 Associates ended tenure during the report period
- 0 months was the average tenure length
- 0 months was the longest
- 0 months was the shortest
- 0 submitted final reports

In the final reports, Associates indicated the following scholarly activity while on tenure.

- 0 Articles published in refereed journals
- 0 Patent applications
- 0 International presentations
- 0 Domestic presentations
- 0 Awards

After ending their tenure, Associates indicated their future plans as follows:

- 0 Permanent position at the NRC host agency
- 0 Contract or temporary position at the NRC host agency
- 0 Research/administrative position with another U.S. government agency
- 0 Research/administrative position with foreign government agency
- 0 Research/teaching at US college/university
- 0 Research/teaching position at a foreign college or university
- 0 Research/administrative position in private industry in the U.S.
- 0 Research/administrative position in private industry outside of the U.S.
- 0 Research/administrative position with a non-profit
- 0 Self-employed/consulting
- 0 Postdoctoral Research
- 0 Other
- 0 No information provided

In their final reports, Associates were asked to evaluate certain aspects of their experiences on a scale of 1 (low) to 10 (high). The average rating for each item follows:

- 0.0 Short-term value (lab)-Development of knowledge, skills, and research productivity at lab
- 0.0 Long-term value (career)-How your Research Associateship affected your career to date
- 0.0 Laboratory Support-Equipment, funding, orientation, safety & health training, etc.
- 0.0 Adviser Mentoring-Quality of mentoring from the Research Adviser
- 0.0 LPR Support-Quality of administrative support from the LPR
- 0.0 NRC Support-Quality of administrative support from the NRC

## ıble 4: Summary of Associate Research

| Associate | Tenure Dates | |
|---|---|---|
| No associates terminated tenure during the report period. | | |

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National Research Council

**Research Associateship Programs**

# *FINAL REPORT*

| 1) *Associate Last or Family Name* | *First Name* | *M.I.* |
|---|---|---|
| **Wilson** | **Rachel** | **M** |

| 2) *FORWARDING Address* (to which your tax statement will be mailed) | *FORWARDING Phone(s) and E-Mail* (if known) |
|---|---|
| Residence or Institution **Residence**<br>Street **114 Holy Ghost Ct**<br>City, State Zip **Crawfordville, FL, 32327** | **Home Phone: 828-421-0722**<br>**Alt. Phone: 828-421-3935**<br>**Preferred E-mail: rachelmywilson@gmail.com** |
| 3) *Today's Date*<br>**12/30/13** | *Dates of Tenure*<br>from **01/03/2012** to **01/02/2014** |

| 4) *Host Agency* | *Laboratory or Center* | *Division / Directorate / Department* |
|---|---|---|
| **NETL** | **FSU** | **Methane Hydrates Research Fellowship** |
| (e.g., AFRL) | (e.g., Wright Patterson AFB) | (e.g., High-Speed Propulsion) |

5) *Name of Laboratory NRC Adviser* (and USMA Mentor, if applicable)
**Jeffrey Chanton**

6) *TITLE OF RESEARCH PROPOSAL*

Factors influencing Hydrate Dissolution Rates within the Hydrate Stability Zone: Interactions with Sand Substrates and Surface Armoring

7) *SUMMARY OF RESEARCH DURING TENURE* **Itemize significant findings in concise form, utilizing key concepts/words.**

1) **Hydrate dissolution rate is not dependant on crystal structure**
2) **Both outcropping and disseminated hydrates are susceptible to dissolution**
3) **Sand covering slowed the dissolution rate by approximately 50% and reduced the final methane saturation in the bulk fluid**
4) **Addition of 10% by weight of oil to the sand increased the dissolution rate approximately offsetting the benefit of the sand**
5)

**(USMA Davies Fellow: please add summary of teaching, including classes taught.)**

8) *RESEARCH IN PROGRESS* **Describe in no more than 100 words.**

**I plan to continue to investigate the role of additives in influencing hydrate dissolution rates via surface armoring. I have found that mineral oil did not signficantly affect hydrate dissolution, however, motor oil which is more similar to natural products occuring at hydrocarbon seeps did alter the dissolution rate of the hydrate. Further investigations will probe the causative agent and the exact mechanism of this enhanced dissolution.**

9) *PUBLICATIONS AND PAPERS RESULTING FROM NRC ASSOCIATESHIP RESEARCH*
**Provide complete citations: author(s), title, full name of journal, volume number, page number(s), and year of publication.**

**a) Publications in peer-reviewed journals**


**Wilson, RM,** L Macelloni, A Simonetti, LL Lapham, CB Lutken, K Sleeper, M D'Emidio, M Pizzi, J Knapp, and JP Chanton. Subsurface methane sources and migration pathways within a gas hydrate mound system, Gulf of Mexico. *Geochemistry, Geophysics, Geosystems, Accepted.*

Lapham, LL, **RM Wilson,** IR MacDonald, and JP Chanton. (2014) Gas hydrate dissolution rates quantified with laboratory and seafloor experiments. *Geochimica et Cosmochimica Acta.* **125**: 492-503 (DOI: 10.1016/j.gca.2013.10.030)

Lapham, LL, **R Wilson,** M Riedel, CK Paull, and ME Holmes. (2013) Temporal variability of *in situ* methane concentrations in gas hydrate-bearing sediments near Bullseye Vent, Northern Cascadia Margin. *Geochemistry, Geophysics, Geosystems.* **14**(7): 2445-2459


**b) Books, book chapters, other publications**

**N/A**



**c) Manuscripts in preparation, manuscripts submitted**

**Wilson, RM,** LL Lapham, M. Reidel, ME Holmes, and JP Chanton. Time-series in situ methane concentrations from sediment porewaters overlying hydrate, *in preparation.*

**Wilson, RM**, LL Lapham, and JP Chanton. Surface armoring of gas hydrates by sediment and oil: the role of surface coatings in the control of hydrate dissolution. *In preparation*

Macelloni, L, CB Lutken, S Garg, A Simonetti, M D'Emidio, **RM Wilson,** K Sleeper, LL Lapham, T Lewis, M Pizzi, J Knapp, C Knapp, J Brooks, and TM McGee. Heat-flow regimes and the hydrate stability zone of Woolsey Mound (Northern Gulf of Mexico): A transient, thermogenic, fault-controlled hydrate system. Journal of Geophysical Research, *Under Review.*

10) *PATENT OR COPYRIGHT APPLICATIONS RESULTING FROM NRC ASSOCIATESHIP RESEARCH*
**Provide titles, inventors, and dates of applications.**

**N/A**

11) *PRESENTATIONS AT SCIENTIFIC MEETINGS OR CONFERENCES*
**Provide complete references: author(s), title, abstract/proceeding citation, meeting name and location.**

**International**

**Domestic**

**Wilson*, RM,** L Lapham, and JP Chanton (2013) Integrating seismic data and geochemical profiles to identify methane provenance, cycling, and migration pathways. American Chemical Society National Meeting. New Orleans, LA. April 8th-12th

**Wilson, RM**, LL Lapham, B Anderson, N Garapati, and J Chanton (2012) Laboratory experiments probe hydrate dissolution rates. Poster. The Gordon Research Conference on Natural Gas Hydrate Systems, Ventura, CA. March 18th-23rd

Lapham, LL, **RM Wilson,** M Riedel, and J Chanton (2012) Measuring in-situ methane concentration over time near Bullseye vent, Vancouver Island. Poster. The Gordon Research Conference on Natural Gas Hydrate Systems, Ventura, CA. March 18th-23rd

D'Emidio, M, M Ingrassia, CB Lutken, L Macelloni, A Simonetti, M Pizzi, LL Lapham, **RM Wilson**, P Hsing, and C Fisher. (2012) Biogeophysical classification of seafloor seeps at a carbone-hydrate mound, Northern Gulf of Mexico. Poster. The Gordon Research Conference on Natural Gas Hydrate Systems, Ventura, CA. March 18th-23rd

**Wilson*, RM**, LL Lapham, CS Martens, JP Chanton, H Mendlovitz, K Sleeper, and M Riedel. (2012) Time-series methane monitoring in gassy sediments and the benthic boundary layer. Ocean Sciences Meeting, Salt Lake City, Utah. February 20th-24th

12) *SEMINARS OR LECTURES DELIVERED AT UNIVERSITIES AND/OR INSTITUTES* **Include dates, names and locations of seminars.**

**N/A**

13) *PROFESSIONAL AWARDS RECEIVED DURING TENURE*

**N/A**

14) *POST-TENURE POSITION / JOB TITLE*

**Postdoctoral Associate, Florida State University**

15) *NAME AND ADDRESS OF POST-TENURE POSITION / JOB 0RGANIZATION*

**Florida State University**
**117 N Woodward Ave**
**Tallahassee, FL 32306**

16) *POST-TENURE POSITION STATUS / CATEGORY* **Please indicate only one.**

☐ Permanent position at the NRC host agency
☐ Contract or temporary position at the NRC host Agency
**Abbreviate Host Laboratory/Center** ____
☐ Research/Administrative position with another U.S.-government agency
☐ Research/Administrative position with a foreign-government agency
☐ Research/teaching position at a U.S. college or university
☐ Research/teaching position at a foreign college or university
☐ Research/administration position in private industry in the U.S.
☐ Research/administration position in private industry outside of the U.S.
☐ Research/administration position with a non profit
☐ Self-employed/consulting
X Postdoctoral research
☐ Other **(Please specify, possible)** ____

☐ No information provided

17) *APPRAISAL OF RESEARCH ASSOCIATESHIP PROGRAM*
**On a scale of 1 – 10 (poor - excellent), please rate the following:**

SHORT TERM VALUE
10 Development of knowledge, skills, and research productivity
**Comments**
**This program was invaluable in providing research funds and time without outside distractions to focus on an area of hydrate dynamics that is currently under-studied and underestimated. Through the benefit of this program I have had the opportunity to make great strides in contributing to this emerging field as evidenced by the large number of publications that I have contributed in only two years of study.**

LONG TERM VALUE
10 How the NRC Associateship award affected your career to date
**Comments**
**This award has provided me the opportunity to contribute to a number of manuscripts in highly respected journals within the field and to attend scientific conferences to communicate my results and network with colleagues. Both of these benefits have enhanced my career potential and will continue to do so for the foreseeable future as I plan to continue to publish results and continue collaborations forged while I was a recipient of this fellowship.**

LAB SUPPORT
10 Quality of support from the Laboratory--equipment, funding, orientation, safety and health guidelines, etc.
**Comments**
**Excellent support.**

ADVISER/MENTOR SUPPORT
10 Quality of mentoring from the Laboratory NRC Adviser (USMA Mentor, if applicable)
**Comments**
**Excellent support.**

LPR SUPPORT
10 Quality of administrative support from the **L**aboratory (e.g., NIST, NRL, IWR, FHWA) NRC **P**rogram **R**epresentative (LPR)
**Comments**
**Excellent support.**

NRC SUPPORT
10 Quality of administrative support. Please assess respective NRC aspects (e.g., moving company, insurance, Omega, payroll, coordinator, travel, etc.)
**Comments**
**Excellent support. Everything was taken care of perfectly; I did not once have a second thought about insurance, payroll, or travel matters.**

18) *PLEASE PROVIDE ANY SUGGESTIONS FOR PROGRAM IMPROVEMENT.*

**Please do NOT scan to PDF. Send the Final Report as MSWord document via e-mail to your NRC Program Coordinator**

***No handwritten signature required; but you may upload a scanned signature file below:***

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