# Oil & Natural Gas Technology

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# Quarterly Progress Report

July 1, 2009- September 30, 2009

## Characterization of Methane Degradation and Methane-Degrading Microbes in Alaska Coastal Water

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## EXECUTIVE SUMMARY

This National Energy Technology Laboratory (NETL) project, "Characterization of Methane Degradation and Methane-Degrading Microbes in Alaska Coastal Water", began on October 1, 2008. Part of the fourth quarter was spent finalizing plans for the Beaufort Sea expedition and shipping all supplies to the USCGC *Polar Sea*, the vessel for the expedition. But the main activity of this quarter was the expedition itself, September 15-25, 2009.

As is the case with virtually all field programs, this one had a few problems, but none prevented us from collecting enough samples and data for meeting the objectives of the project. We collected about as many samples as planned for some analysis but more samples (272 in total) were collected than planned for molecular analyses of genes and mRNA for methane degradation and other microbial processes. All samples were successfully shipped back to Delaware without incident.

It was always clear that the success of this project depended on achieving two general goals. The first was obtaining a sufficient number of samples from the Beaufort Sea, and the second was the analyses of those samples back in the lab. The first task has now been completed.

### Progress Report

### Task 1: Project Management Plan

This task was completed.

### Task 2: Cruise Logistics and Planning

This task was completed in August 2009. The remaining supplies were purchased, shipped to Seattle and loaded on the *USCGC Polar Sea* in early August.

### Task 3: Oceanic Cruise

The cruise or expedition was carried out on September 15-25, 2009, thus completing this task. A complete account of the expedition will be given separately in a Cruise Report. In brief, we encountered several problems, but none will prevent us from achieving the goals of this project.

One of the first problems was a delay in the departure date for the expedition, due to the late arrival of the *Polar Sea* in Barrow. The ship was late because she had to turn back in Seattle to fix a mechanical problem. This delay meant that we lost a couple days from the expedition. We discovered another problem with the scintillation counter when we arrived on the ship in Barrow. The counter and its dedicated computer were in the radioactive work van provided by the Oregon State University UNOLS facilities. This instrument is used to radioassay samples for examining microbial activity in

sediments and the water column. The scintillation counter computer would not boot up, and we could not install the software on another computer. In spite of many phone calls and emails to the scintillation counter company and others, we were unsuccessful to fix the problem and lost time in the process. Consequently, fewer samples than planned were taken for rate measurements, but we were able to preserve some samples for analyses back in the lab. A small, single sample counter, which we arranged to be shipped from Delaware to Barrow, was used to survey the rad van after the cruise in compliance with NRC regulations.

As discussed in more detail in the Cruise Report, we collected about as many samples as planned for some of the microscopic analysis but more samples (272 in total) for molecular analyses of genes and mRNA for methane degradation and other microbial processes. All samples were successfully shipped back to Delaware and Germany (see below) without incident.

The remaining supplies and equipment from the expedition remain on the Polar Sea as she continues on other expeditions in the Chukchi and Beaufort Seas. Matt Cottrell will supervise shipping our material back to Delaware after the ship arrives in Seattle in early December.

**Task 4 - Methane Degradation Analysis**

Parts of this task are completed, but much remains to do. The incubations for methane degradation were done on the ship as soon as possible after the sediment cores were available. The incubations were then killed and subsampled on the ship. As planned, these subsamples will be analyzed in Germany by our collaborator, Dr. Tina Treude. The analysis now being done consists of radioassaying the 14C-labeled byproducts (mainly $CO_2$) from the degradation of 14C-methane.

**Other Tasks**

The remaining parts of Task 4 and Tasks 5-7 are scheduled to be completed during the next year of the project.

**Delays and other problems**

The delays and problems associated with expedition were described above. However, these will not interfere with analyses of samples now underway.

**Conclusions**

The fourth quarter of this project was devoted to finalizing preparation for the fall expedition and to actually participating on it. Problems were encountered, but this is common with field programs. In the end, the important point is that we have more than enough samples for analyses and for meeting the objectives of the project.

## Cost Status

The table below gives the project expenses for the second quarter as originally budgeted ("Original") and actual expenditures ("Actual"), as of October 7, 2009.

### Fourth Quarter Budget

| | Original | Actual |
|---|---|---|
| Personnel | $ 12,434 | $ 14,317 |
| Benefits | 3,486 | 4,256 |
| Permanent Equipment | 0 | 0 |
| Expendable Supplies | 3,000 | 8,207 |
| Travel | 0 | 1,607 |
| Subtotal | 18,919 | 27,765 |
| Indirect costs (53%) | 10,027 | 14,716 |
| Total | $ 28,946 | $ 42,481 |

The actual expenditures were higher than originally budgeted, but overall money is being spent as anticipated. In previous quarterly reports, this cost status showed that actual expenditures were less than the original budget and even out the deficits shown here. The biggest difference in this quarter's budget is in the expendable supplies category. The large expenditure in this category was due to all of the supplies bought right before the expedition in September. In addition, there were unanticipated travel expenses because the delay in the start of the cruise meant that we had to re-schedule our airline reservations.

## Products

• Revised Web site

A Web site outlining work in the Arctic by Kirchman lab, including the NETL project (http://www.ocean.udel.edu/cms/dkirchman/Arctic/), has been revised.

• Contacts and lectures with the general public

Kirchman's seminars on climate change in polar environments are available on his Arctic web site.

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