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Quarterly Research Performance Progress Report

(Period Ending 03/31/25)

Deepwater Methane Hydrate Characterization & Scientific Assessment

Project Period 6: 11/15/23 - 09/30/25

Submitted by:

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Signature

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Office of Fossil Energy

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DISCLAIMER

1 ACCOMPLISHMENTS

This report outlines the progress of the second quarter of the eleventh fiscal year of the project, from Jan. 1, – Mar. 31, 2025 (Budget Period 6, Year 2).

1.1 Major Project Goals

The primary objective of this project is to gain insight into the nature, formation, occurrence and physical properties of methane hydrate-bearing sediments for the purpose of methane hydrate resource appraisal. This was accomplished through the planning and execution of a state-of-the-art drilling, coring, logging, testing and analytical program that assess the geologic occurrence, regional context, and characteristics of marine methane hydrate deposits in the Gulf of Mexico Continental Shelf. Project Milestones are listed in Table 1-1 and Table 1-2.

Table 1-1. Previous Milestones

Budget Period	Milestone	Milestone Description	Estimated Completion	Actual Completion	Verification Method
1	M1A	Project Management Plan	Mar-15	Mar-15	Project Management Plan
	M1B	Project Kick-off Meeting	Jan-15	Dec-14	Presentation
	M1C	Site Location and Ranking Report	Sep-15	Sep-15	Phase 1 Report
	M1D	Preliminary Field Program Operational Plan Report	Sep-15	Sep-15	Phase 1 Report
	M1E	Updated CPP Proposal Submitted	May-15	Oct-15	Phase 1 Report
	M1F	Demonstration of a Viable Pressure Coring Tool: Lab Test	Sep-15	Sep-15	Phase 1 Report
2	M2A	Document Results of BP1/Phase 1 Activities	Dec-15	Jan-16	Phase 1 Report
	M2B	Complete Updated CPP Proposal Submitted	Nov-15	Nov-15	QRPPR
	M2C	Scheduling of Hydrate Drilling Leg by IODP	May-16	May-17	Report directly to DOE PM
	M2D	Demonstration of a Viable Pressure Coring Tool: Land Test	Dec-15	Dec-15	PCTB Land Test Report, in QRPPR
	M2E	Demonstration of a Viable Pressure Coring Tool: Marine Test	Jan-17	May-17	QRPPR
	M2F	Update UT-GOM2-2 Operational Plan	Feb-18	Apr-18	Phase 2 Report
3	M3A	Document results of BP2 Activities	Apr-18	Apr-18	Phase 2 Report
	M3B	Update UT-GOM2-2 Operational Plan	Sep-19	Jan-19	Phase 3 Report

4	M4A	Document results of BP3 Activities	Jan-20	Apr-20	Phase 3 Report
	M4B	Demonstration of a Viable Pressure Coring Tool: Lab Test	Feb-20	Jan-20	PCTB Lab Test Report, in QRPPR
	M4C	Demonstration of a Viable Pressure Coring Tool: Land Test	Mar-20	Mar-20	PCTB Land Test Report, in QRPPR
5	M5A	Document Results of BP4 Activities	Dec-20	Mar-21	Phase 4 Report
	M5B	Complete Contracting of UT-GOM2-2 with Drilling Vessel	May-21	Feb-22	QRPPR
	M5C	Complete Project Sample and Data Distribution Plan	Jul-22	Oct-21	Report directly to DOE PM
	M5D	Complete Pre-Expedition Permitting Requirements for UT-GOM2-2	Mar-23	Jul-23	QRPPR
	M5E	Complete UT-GOM2-2 Operational Plan Report	May-21	Sep-21	QRPPR
	M5F	Complete UT-GOM2-2 Field Operations	Jul-23	Sep-23	QRPPR

Table 1-2. Current Milestones

Budget Period	Milestone	Milestone Description	Estimated Completion	Actual Completion	Verification Method
6	M6A	Document Results of BP5 Activities	Mar-23	Nov-24	Phase 5 Report
	M6B	Complete Preliminary Expedition Summary	Mar-23	Sep-24	Report directly to DOE PM
	M6C	Initiate comprehensive Scientific Results Volume	Jun-24	Oct-24	Report directly to DOE PM
	M6D	Submit set of manuscripts for comprehensive Scientific Results Volume	Sep-25	-	Report directly to DOE PM

1.2 What Was Accomplishments Under These Goals

1.2.1 Previous Project Periods

Tasks accomplished in previous project periods (Phases 1, 2, 3, 4, and 5) are summarized in Table 1-3, Table 1-4, Table 1-5, Table 1-6, and Table 1-7.

Table 1-3. Tasks Accomplished in Phase 1

PHASE 1/BUDGET PERIOD 1	
Task 1.0	**Project Management and Planning**
Task 2.0	**Site Analysis and Selection**
Subtask 2.1	*Site Analysis*
Subtask 2.2	*Site Ranking / Recommendation*
Task 3.0	**Develop Operational Plan for UT-GOM2-2 Scientific Drilling Program**
Task 4.0	**Complete IODP Complimentary Project Proposal**
Task 5.0	**Pressure Coring and Core Analysis System Modifications and Testing**
Subtask 5.1	*PCTB Scientific Planning Workshop*
Subtask 5.2	*PCTB Lab Test*
Subtask 5.3	*PCTB Land Test Prep*

Table 1-4. Tasks Accomplished in Phase 2

PHASE 2/BUDGET PERIOD 2	
Task 1.0	**Project Management and Planning**
Task 6.0	**Technical and Operational Support of Complimentary Project Proposal**
Task 7.0	**Continued Pressure Coring and Core Analysis System Modifications and Testing**
Subtask 7.1	*Review and Complete NEPA Requirements for PCTB Land Test*
Subtask 7.2	*PCTB Land Test*
Subtask 7.3	*PCTB Land Test Report*
Subtask 7.4	*PCTB Modification*
Task 8.0	**UT-GOM2-1 Marine Field Test**
Subtask 8.1	*Review and Complete NEPA Requirements for UT-GOM2-1*
Subtask 8.2	*UT-GOM2-1 Operational Plan*
Subtask 8.3	*UT-GOM2-1 Documentation and Permitting*
Subtask 8.4	*UT-GOM2-1 Marine Field Test of Pressure Coring System*
Subtask 8.5	*UT-GOM2-1 Marine Field Test Report*
Task 9.0	**Develop Pressure Core Transport, Storage, and Manipulation Capability**
Subtask 9.1	*Review and Complete NEPA Requirements for Core Storage and Manipulation*
Subtask 9.2	*Hydrate Core Transport*
Subtask 9.3	*Storage of Hydrate Pressure Cores*
Subtask 9.4	*Refrigerated Container for Storage of Hydrate Pressure Cores*

Subtask 9.5	*Hydrate Core Manipulator and Cutter Tool*
Subtask 9.6	*Hydrate Core Effective Stress Chamber*
Subtask 9.7	*Hydrate Core Depressurization Chamber*
Task 10.0	**UT-GOM2-1 Core Analysis**
Subtask 10.1	*Routine Core Analysis (UT-GOM2-1)*
Subtask 10.2	*Pressure Core Analysis (UT-GOM2-1)*
Subtask 10.3	*Hydrate Core-Log-Seismic Synthesis (UT-GOM2-1)*
Task 11.0	**Update Science and Operational Plans for UT-GOM2-2 Scientific Drilling Program**
Task 12.0	**UT-GOM2-2 Scientific Drilling Program Vessel Access**

Table 1-5. Tasks Accomplished in Phase 3

PHASE 3/BUDGET PERIOD 3	
Task 1.0	**Project Management and Planning**
Task 6.0	**Technical and Operational Support of CPP Proposal**
Task 9.0	**Develop Pressure Core Transport, Storage, and Manipulation Capability**
Subtask 9.8	*X-ray Computed Tomography*
Subtask 9.9	*Pre-Consolidation System*
Task 10.0	**UT-GOM2-1 Core Analysis**
Subtask 10.4	*Continued Pressure Core Analysis (UT-GOM2-1)*
Subtask 10.5	*Continued Hydrate Core-Log-Seismic Synthesis (UT-GOM2-1)*
Subtask 10.6	*Additional Core Analysis Capabilities*
Task 11.0	**Update Science and Operational Plans for UT-GOM2-2 Scientific Drilling Program**
Task 12.0	**UT-GOM2-2 Scientific Drilling Program Vessel Access**
Task 13.0	**Maintenance and Refinement of Pressure Core Transport, Storage, and Manipulation Capability**
Subtask 13.1	*Hydrate Core Manipulator and Cutter Tool*
Subtask 13.2	*Hydrate Core Effective Stress Chamber*
Subtask 13.3	*Hydrate Core Depressurization Chamber*
Subtask 13.4	*Develop Hydrate Core Transport Capability for UT-GOM2-2 Scientific Drilling Program*
Subtask 13.5	*Expansion of Pressure Core Storage Capability for UT-GOM2-2 Scientific Drilling Program*
Subtask 13.6	*Continued Storage of Hydrate Cores from UT-GOM2-1*
Task 14.0	**Performance Assessment, Modifications, and Testing of PCTB**
Subtask 14.1	*PCTB Lab Test*
Subtask 14.2	*PCTB Modifications/Upgrades*
Task 15.0	**UT-GOM2-2 Scientific Drilling Program Preparations**
Subtask 15.1	*Assemble and Contract Pressure Coring Team Leads for UT-GOM2-2 Scientific Drilling Program*
Subtask 15.2	*Contract Project Scientists and Establish Project Science Team for UT-GOM2-2 Scientific Drilling Program*

Table 1-6. Tasks Accomplished in Phase 4

PHASE 4/BUDGET PERIOD 4	
Task 1.0	**Project Management and Planning**
Task 10.0	**UT-GOM2-1 Core Analysis**
Subtask 10.4	*Continued Pressure Core Analysis (GOM2-1)*
Subtask 10.5	*Continued Hydrate Core-Log-Seismic Synthesis (UT-GOM2-1)*
Subtask 10.6	*Additional Core Analysis Capabilities*
Subtask 10.7	*Hydrate Modeling*
Task 11.0	**Update Science and Operational Plans for UT-GOM2-2 Scientific Drilling Program**
Task 12.0	**UT-GOM2-2 Scientific Drilling Program Vessel Access**
Task 13.0	**Maintenance and Refinement of Pressure Core Transport, Storage, and Manipulation Capability**
Subtask 13.1	*Hydrate Core Manipulator and Cutter Tool*
Subtask 13.2	*Hydrate Core Effective Stress Chamber*
Subtask 13.3	*Hydrate Core Depressurization Chamber*
Subtask 13.4	*Develop Hydrate Core Transport Capability for UT-GOM2-2 Scientific Drilling Program*
Subtask 13.5	*Expansion of Pressure Core Storage Capability for UT-GOM2-2 Scientific Drilling Program*
Subtask 13.6	*Continued Storage of Hydrate Cores from UT-GOM2-1*
Subtask 13.7	*X-ray Computed Tomography*
Subtask 13.8	*Pre-Consolidation System*
Task 14.0	**Performance Assessment, Modifications, and Testing of PCTB**
Subtask 14.1	*PCTB Lab Test*
Subtask 14.2	*PCTB Modifications/Upgrades*
Subtask 14.3	*PCTB Land Test*
Task 15.0	**UT-GOM2-2 Scientific Drilling Program Preparations**
Subtask 15.3	*Permitting for UT-GOM2-2 Scientific Drilling Program*

Table 1-7. Tasks Accomplished in Phase 5

PHASE 5/BUDGET PERIOD 5	
Task 1.0	**Project Management and Planning**
Task 10.0	**UT-GOM2-1 Core Analysis**
Subtask 10.4	*Continued Pressure Core Analysis (UT-GOM2-1)*
Subtask 10.5	*Continued Hydrate Core-Log-Seismic Synthesis (UT-GOM2-1)*
Subtask 10.6	*Additional Core Analysis Capabilities*
Subtask 10.7	*Hydrate Modeling*
Task 11.0	**Update Science and Operational Plans for UT-GOM2-2 Scientific Drilling Program**
Task 12.0	**UT-GOM2-2 Scientific Drilling Program Vessel Access**
Task 13.0	**Maintenance and Refinement of Pressure Core Transport, Storage, and Manipulation Capability**
Subtask 13.1	*Hydrate Core Manipulator and Cutter tool*
Subtask 13.2	*Hydrate Core Effective Stress Chamber*
Subtask 13.3	*Hydrate Core Depressurization Chamber*
Subtask 13.4	*Develop Hydrate Core Transport Capability for UT-GOM2-2 Scientific Drilling Program*
Subtask 13.5	*Expansion of Pressure Core Storage Capability for UT-GOM2-2 Scientific Drilling Program*
Subtask 13.6	*Continued Maintenance and Storage of Hydrate Pressure Cores from UT-GOM2-1*
Subtask 13.7	*Maintain X-ray CT*
Subtask 13.8	*Maintain Preconsolidation System*
Subtask 13.9	*Transportation of Hydrate Core from UT-GOM2-2 Scientific Drilling Program*
Subtask 13.10	*Storage of Hydrate Cores from UT-GOM2-2 Scientific Drilling Program*
Subtask 13.11	*Hydrate Core Distribution*
Task 14.0	**Performance Assessment, Modifications, and Testing of PCTB**
Subtask 14.4	*PCTB Modifications/Upgrades*
Subtask 14.5	*PCTB Land Test III*
Task 15.0	**UT-GOM2-2 Scientific Drilling Program Preparations**
Subtask 15.3	*Permitting for UT-GOM2-2 Scientific Drilling Program*
Subtask 15.4	*Review and Complete NEPA Requirements*
Subtask 15.5	*Finalize Operational Plan for UT-GOM2-2 Scientific Drilling Program*
Task 16.0	**UT-GOM2-2 Scientific Drilling Program Field Operations**
Subtask 16.1	*Execute UT-GOM2-2 Field Program*
Optional Subtask 16.2	*Add Conventional Coring*
Optional Subtask 16.3	*Add Spot Pressure Coring*
Optional Subtask 16.4	*Add Second Hole at H-Location*
Optional Subtask 16.5	*Add Additional Cores and Measurements*
Task 17.0	**UT-GOM2-2 Core Analysis**
Subtask 17.1	*Routine UT-GOM2-2 Core Analysis*
Optional Subtask 17.2	*UT-GOM2-2 Expanded Core Analysis*

1.2.2 *Current Project Period*

Current project period tasks are shown in Table 1-8.

Table 1-8. Current Project Tasks

PHASE 6/BUDGET PERIOD 6	
Task 1.0	**Project Management and Planning**
Task 13.0	**Maintenance and Refinement of Pressure Core Transport, Storage, and Manipulation Capability**
Subtask 13.1	*Hydrate Core Manipulator and Cutter tool*
Subtask 13.2	*Hydrate Core Effective Stress Chamber*
Subtask 13.3	*Hydrate Core Depressurization Chamber*
Subtask 13.6	*Continued Storage of Hydrate Cores from UT-GOM2-1*
Subtask 13.7	*Maintain X-ray CT*
Subtask 13.8	*Maintain Preconsolidation System*
Subtask 13.10	*Storage of Hydrate Cores from UT-GOM2-2 Scientific Drilling Program*
Subtask 13.11	*Hydrate Core Distribution*
Task 16.0	**UT-GOM2-2 Scientific Drilling Program Field Operations**
Subtask 16.6	*Post-Expedition Permitting*
Task 17.0	**UT-GOM2-2 Core Analysis**
Task 18.0	**Project Data Analysis and Reporting**
Subtask 18.1	*Sample and Data Distribution and Archiving*
Subtask 18.2	*Collaborative Post-Field Project Analysis of Geologic Data and Samples*
Subtask 18.3	*Scientific Results Volume and Technical Project Presentations*

1.2.2.1 Task 1.0 – Project Management & Planning

1.2.2.1.1 *Coordinate the overall scientific progress, administration and finances of the project:*

- UT monitored and controlled the project budget, scope, and schedule.
- UT submitted a formal no-cost-extension proposal to extend Budget Period 6 (BP6) for 18-month, from September 30, 2025 through March 30, 2027. (See Section 3.2)

1.2.2.1.2 *Communicate with project team and sponsors:*

- UT organized UT-GOM2-2 science meetings to advance UT-GOM2-2 post-cruise science, and communicate/coordinate analytical and reporting efforts.
- UT organized sponsor and stakeholder meetings.
- UT managed SharePoint sites, email lists, the project website, and the UT-GOM2-2 expedition website.

1.2.2.1.3 *Coordinate and supervise service agreements:*

- UT monitored and validated subcontractor workplans and deliverables.

1.2.2.1.4 *Coordinate subcontractors:*

- UT continued to monitor and control subaward and subcontractor efforts.
- UT formalized a new agreement with Geotek for continued rental of SC120 pressure core storage chambers.

1.2.2.2 Task 13.0 – Maintenance & Refinement of Pressure Core Transport, Storage, & Manipulation Capability

1.2.2.2.1 *Subtask 13.1 – Hydrate Core Manipulator and Cutter Tool*

In this quarter, UT used mini-PCATS to log, image, and cut the following samples:

- UT-GOM2-1
  - Core H005-07FB-5: this core was tested in the K0 Permeameter for a Gas Production Test. This test aims to replicate gas production at in-situ conditions, where the total vertical stress is constant, and the pore pressure is reduced below hydrate stability (see Subtask 13.2 – Hydrate Core Effective Stress Chamber for details)
- UT-GOM2-2
  - Core H002-08CS-1 (Figure 1-1): this core is the first pressure core from the UT-GOM2-2 to be analyzed in mini-PCATS. In total, UT cut 5 consecutive subsamples for geomechanical and petrophysical testing in the K0 permeameter (3 samples), quantitative degassing in the SC35 depressurization chamber (1 sample), core visual analysis in the sapphire window cell (1 sample). The remaining sample was placed back in the storage chamber for additional sampling next quarter.

The Mini-PCATS saw was serviced and reset between core samplings. The system was pressure tested successfully after service. The X-ray system underwent quarterly calibration.

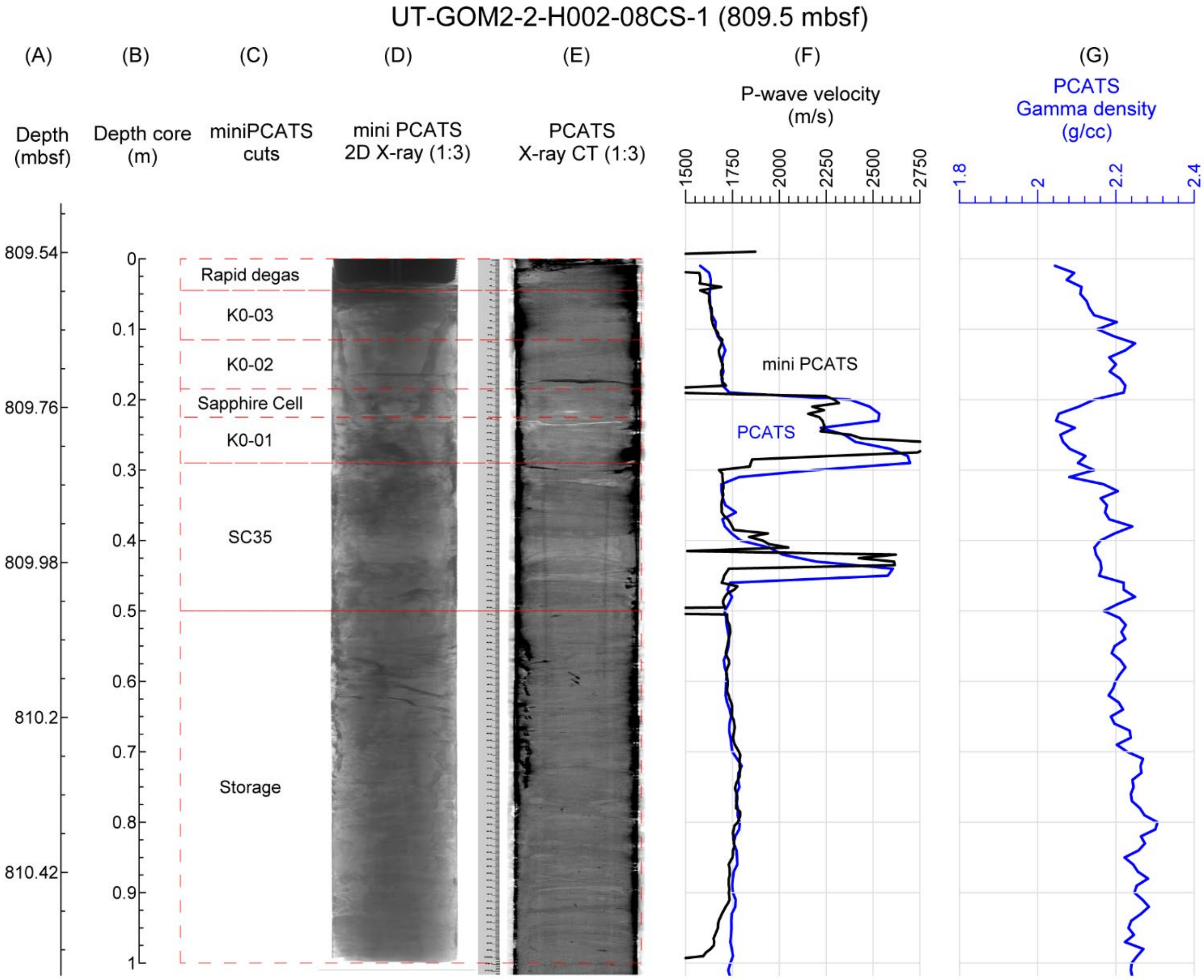

Figure 1-1. Core H002-08CS-1 is the first pressure *core* collected in the UT-GOM2-2 *to be analyzed using the UT* Pressure Core Center. *(A) Depth in meters below the seafloor (mbsf); (B) depth in core; (C)* subsamples obtained using mini-PCATS*; (D)PCATS X-ray CT image (slab view of a 3D computer tomography) with* 3x *horizontal stretching* (aspect ratio 1:3); *(E)* mini-PCATS 2D radiography *with* 3x *horizontal stretching* (aspect ratio 1:3)*; (G) P-wave velocity* obtained in PCATS (blue) and mini-PCATS (black) *and (H) PCATS Gamma density measured under pressure.*

1.2.2.2.2 *Subtask 13.2 – Hydrate Core Effective Stress Chamber*

During this quarter, a sample from UT-GOM2-1 Core H005-7FB-5 was placed in the Effective Stress Chamber for testing (Figure 1-2). The testing of sample 7FB-5 was conducted as a “hydrate production technology test” to ensure all components are operational for a production condition, where the pore pressure is decreased while the total vertical stress is maintained constant. The temperature monitoring testing chamber was used to conduct this test and assess its operation.

The in-situ conditions for sample H005-7B-5 are ~25 MPa and ~18.5 °C, and a pressure drop of 5 MPa is sufficient to cause hydrate dissociation (Bhandari et al., 2024). To replicate this isothermal depressurization and the associated 5 MPa increase in vertical effective stress under experimental conditions of 6 °C, the initial pressure must be set to 10 MPa. Therefore, the initial pore pressure condition for our hydrate production test is *u* = 10 MPa (Figure 1-2, black)., This is followed by an initial depressurization where the hydrate remains stable (Figure 1-2, blue 10 MPa< *u* <5 MPa), and then a further depressurization that induces hydrate dissociation (Figure 1-2, red, *u* <5 MPa).

Figure 1-2 shows the geomechanical and petrophysical results of the “hydrate production test”. We first load the sample uniaxially to its in-situ vertical effective stress of σ'_v = 3.8 MPa and hold the axial effective stress constant for one day. During this process, the sample deforms to ~4% axial strain (Figure 1-2a) and the ratio of horizontal to vertical effective stress decreases to K_0 ~0.6 and rises to 0.75 during the creep phase (Figure 1-2b). The permeability measured at this point is 1 mD (Figure 1-2c). Thereafter, the pore pressure is decreased from *u* = 10 MPa to *u* = 5 MPa while the total axial stress is kept constant. As a result, the effective stress –difference between total stress and pore pressure– increases, and the sample deforms further and the K_0 remains close to 0.7 (Figure 1-2a&b, blue lines).

To cause hydrate dissociation, we decrease the pressure to values lower than 5 MPa, where the hydrate dissociation is expected to occur at 4.9 MPa at 6°C and 0% salinity. The sample deforms significantly (Figure 1-2a, red line), approaching the hydrate-free compression behavior (Figure 1-2a, gray line). During the hydrate dissociation phase, the K_0 drops slightly to 0.67 and remains larger than the hydrate-free K_0 = 0.51. Once all the hydrate is removed, we re-saturate the sample and measure an intrinsic permeability of 3 mD.

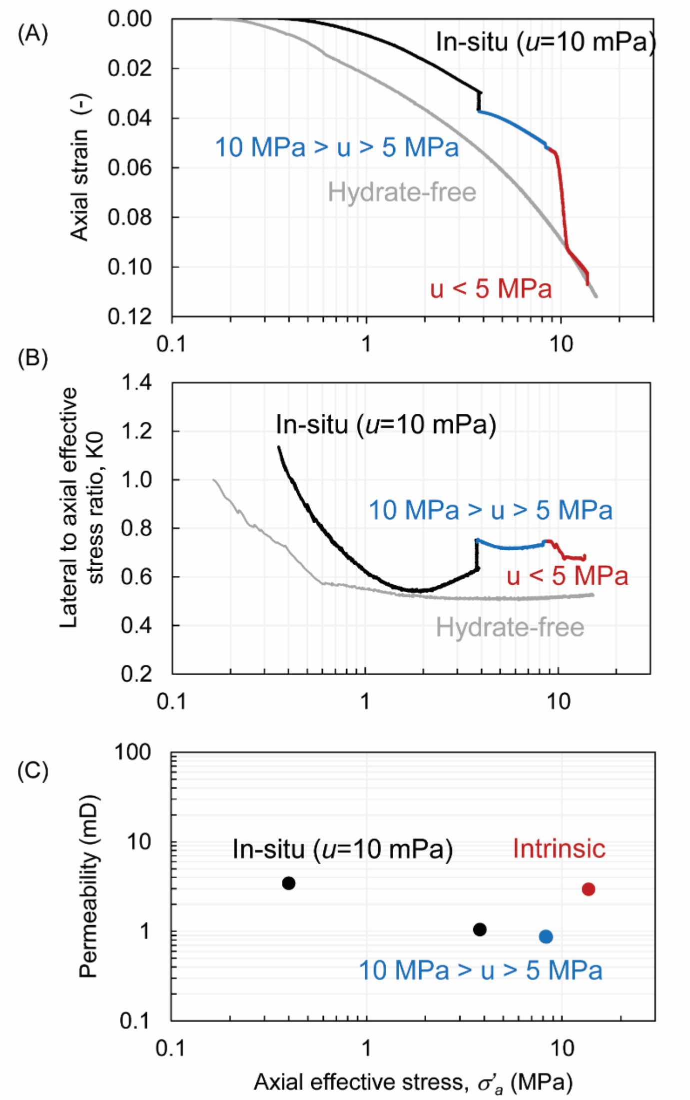

Figure 1-2. Hydrate production test for UT-GOM2-1 sample 07FB-5. Results for (A) uniaxial compression, (B) ratio of lateral to vertical effective stress ratio under uniaxial conditions K0 and (C) permeability are shown for each phase of the test. Loading to in-situ conditions is shown as black, depressurization from 10 to 5 MPa is shown as blue, and further depressurization from 5 to 0 MPa is shown as red. The phase boundary at 6°C and 0% salinity is expected at 4.9 MPa

1.2.2.2.3 *Subtask 13.3 – Hydrate Core Depressurization Chamber*

The system was upgraded to include a 4 liter bubbling chamber to double the methane gas quantification capability. The system was used to quantify methane gas from the core samples tested in the Effective Stress Chamber. The system is in standby mode and ready for use in the next quarter to depressurize core samples from H002-08CS-1.

1.2.2.2.4 *Subtask 13.6 – Continued Storage of Hydrate Cores from UT-GOM2-1*

The UT Pressure Core Center continues to accommodate the remaining pressure cores from UT-GOM2-1 as well as the 13 pressure cores collected during UT-GOM2-2.

1.2.2.2.5 *Subtask 13.7 – Maintain X-ray Computed Tomography*

The X-ray CT underwent a quarterly calibration . The X-ray was used to generate 2D scans of cores H005-07FB-5 and H002-08CS-1. The X-Ray CT continues to operate as designed.

1.2.2.2.6 *Subtask 13.8 – Maintain Pre-Consolidation System*

The system will continue to be evaluated to ensure proper pressure maintenance to generate effective stresses in pressure cores.

1.2.2.2.7 *Subtask 13.10 – Storage of Hydrate Cores from UT-GOM2-2 Scientific Drilling Program*

The UT PCC continues to maintain hydrate-bearing pressure cores at 6°C and connected to the pressure maintenance system, which supplies one-way high-pressure water into the pressure storage chambers. The pressure cores continue to maintain stable storage pressures.

1.2.2.2.8 *Subtask 13.11 – Hydrate Core Distribution*

Future task.

1.2.2.3 Task 16.0 – UT-GOM2-2 Scientific Drilling Program Field Operations

1.2.2.3.1 *Subtask 16.6 – Post-Expedition Permitting*

Task complete.

1.2.2.4 Task 17.0 – UT-GOM2-2 Core Analysis

Work continued on maximizing the amount of science resulting from the UT-GOM2-2 expedition. Efforts are reported by discipline and cover two main areas of research: characteristics of the shallow sand, mud, and ooze intervals; and characteristics of the deep hydrate-bearing sands. Both inform our understanding of hydrate formation and carbon cycling locally, in the basin, and more generally in the Gulf of Mexico.

1.2.2.4.1 *Pressure Coring Tool Assessment*

- UT finished the assessment of the pressure coring tool performance during the expedition comparing pressure and temperature data from various sensors inside the Pressure Coring Tool with Ball Valve (PCTB) and outside on the wireline to rig and wireline data collected as part of the mud logging program. Results have been incorporated into the UT-GOM2-2 Proceedings Volume.

1.2.2.4.2 *Lithostratigraphy*

- Work was completed on a more expansive review of the Lithostratigraphy, including defined lithofacies and lithologic units for the Proceedings Volume.
- UNH is using thin sand petrography and other techniques to investigate what drives sand/silt/coarse sediment fluxes to the Terrebonne basin and the GOM more generally through time. The known processes so far are low stand sand delivery and meltwater sand delivery. UNH will investigate the consistency of these processes throughout the last ~4 glacial cycles represented by the recovered H003 sediment.
- UNH found a few instances of authigenic carbonate in the H003 sediment. These samples are being prepared for isotope analysis and should reveal any additional indicators of authigenic over growths and/or paleo-methane seepage.

1.2.2.4.3 *Biostratigraphy and Age Models*

- UT continued working on an age model based on calcareous nannofossils. One age marker was updated. The evolution of *E. huxleyi* with an age of 290,000 years was moved to 35.63 mbsf.
- USGS continued working on planktic foraminifer radiocarbon age model of UT-GOM2-2 sediments and sediment deposition rates. Deposition rates can impact methanogenesis. The shallow sand (named Lithofacies Unit I) appears to be no older than 1276 to 1387 AD.
- USGS and UNH continued working on sieving and picking foraminifera for age modeling. This work will be ongoing until the end of the project.

1.2.2.4.4 *Physical Properties*

1.2.2.4.4.1 Core Logging and Imaging

- UT completed updating pressure, conventional and conventionalized core logs created with the software package Strater. Logs were updated based on corrections to the core log including missing samples, corrected sample depths, etc. Logs will be published in the expedition proceedings volume.

1.2.2.4.4.2 Strength and Compression Behavior

- Tufts University continued conducting Constant Rate of Strain consolidation tests on UT-GOM2-2 intact samples from whole round cores.
- Tufts started triaxial testing of resedimented samples from whole round blended material.
- Tufts has completed the first draft of a manuscript on compression behavior.

1.2.2.4.4.3 Index Properties

- Tufts started Atterberg Limit testing of the blended whole round samples

- Tufts completed gas pycnometer density measurements on the split core and MAD plugs
- Laser and Hydrometer particle size distribution results were updated to include two grain size classifications, the geoscience classification, and the geotechnical classification. The first is used primarily by sedimentologists and assumes that sands are > 62.5 μm, silts are 3.9 to 62.5 μm, and clays are less than 3.9 μm. The second is primarily used in geoengineering and assumes that sands are > 75 μm, silts are 2 to 75 μm, and clays are less than 2 μm. A comparison of the results will be included in the Proceedings Volume.
- Tufts distributed results from James Hutton for X-ray powdered diffraction to identify minerals and clays.

1.2.2.4.5 *Dissolved Methane Concentration and Hydrate Saturation*

- UT and USGS worked on refining the calculations of methane saturation of the pore water and hydrate saturation of the pore space.

1.2.2.4.6 *Microbiology*

- Kochi Institute for Core Sample Research, part of JAMTEC, completed cell counts of samples received from H002 and H003. Counts will be compared to microbial diversity determinations from Oregon State.

1.2.2.4.7 *Geochemistry*

- UW completed the correction of mineral concentrations for drilling fluid contamination. Contamination was higher than normal for APC coring. Corrections did not impact the general shape of the depth profiles.
- UNH continued developing a method for isolating and measuring the amount of charcoal (wt. %) in the marine sediments using soil standard samples. Ultimately the goal of this method refinement is to quantify the % C in the GOM2-2 sediments that is charcoal (the most non-reactive C phase in marine sediments, thus unavailable for methanogenesis).

1.2.2.5 Task 18.0 – Project Data Analysis and Reporting

1.2.2.5.1 *Subtask 18.1 – Sample and Data Distribution and Archiving*

- No additional sample or data requests were received. All data is available to the science team via password protected websites. When the full expedition report is published the data will be archived and made public.

1.2.2.5.2 *Subtask 18.2 – Collaborative Post-Field Project Analysis of Geologic Data and Samples*

UT-GOM2-2 Proceedings Volume

- UT and the project science team completed most of the work on the UT-GOM2-2 Proceedings Volume preparing for submission to USGS for a formal review. This volume includes the following:
    - Cover pages:
        - To be published on OTSI.gov, Zenodo (DOI: 10.5281/zenodo.13970849, DOI links will work once published)
        - 4 pages
        - Science Party: To also be published here UT-GOM2-2: Science Party
        - Acknowledgements: To also be added to UT-GOM2-2: Deepwater Hydrate Coring Expedition
    - Chapter 1 Summary:
        - To be published as pdf on OTSI.gov, Zenodo (DOI: 10.5281/zenodo.13971076), and Proceedings of the UT-GOM2-2 Deepwater Hydrate Coring Expedition
        - 62 pages
        - 28 figures
        - 2 tables
    - Chapter 2 Methods:
        - To be published as pdf on OTSI.gov, Zenodo (DOI: 10.5281/zenodo.13971228), and Proceedings of the UT-GOM2-2 Deepwater Hydrate Coring Expedition
        - 161 pages
        - 66 figures
        - 14 tables + table of acronyms
    - Chapter 3 Site H:
        - To be published as pdf on OTSI.gov, Zenodo (DOI: 10.5281/zenodo.13971276), and Proceedings of the UT-GOM2-2 Deepwater Hydrate Coring Expedition
        - 178 pages, plus appendices
        - 76 figures
        - 25 tables
        - 9 appendices
            - Appendix A – 1 table of 52 pages
            - Appendix B – 150 pages, images of 38 daily reports
            - Appendix C – 30 pages, 29 figures
            - Appendix D – 47 pages of Strater figures
            - Appendix E – 27 pages of Strater figures
            - Appendix F – 21 pages of Strater figures
            - Appendix G – 10 pages of 2 tables
            - Appendix H – 20 pages of 7 tables

        - Appendix I – 24 page, 22 figures
- The estimated publication date is Summer 2025.

UT-GOM2-2 Data Archive / Data Directory

- UT continued to review core reports, coring data, curation data, logs and images to confirm the final integrated recovery data for each core.
- UT finished building the structure to house 22 datasets on Zenodo under the Zenodo community for GOM, Terrebonne Basin Deepwater Hydrate Coring.

1.2.2.5.3 *Subtask 18.3 – Scientific Results Volume and Technical Project Presentations*

UT-GOM2-2 Scientific Results Volume

- The special collection application submitted to AGU on Nov. 4, 2024, was rejected by AGU. No specific reason was cited, but they did express interest in individual submissions of two of their journals.
- A special collection was also rejected informally by *Journal of Marine and Petroleum Geology (JMPG).*

1.3 What Will Be Done In The Next Reporting Period To Accomplish These Goals

1.3.1 Task 1.0 – Project Management & Planning

- UT will continue to execute the project in accordance with the approved Project Management Plan (PMP) and Statement of Project Objectives (SOPO).
- UT will continue to manage and control project activities in accordance with their established processes and procedures to ensure subtasks and tasks are completed within schedule and budget constraints defined by the PMP.

1.3.2 Task 13.0 – Maintenance And Refinement Of Pressure Core Transport, Storage, & Manipulation Capability

- UT will continue to sample H002-08CS-1 in the next quarter.
- UT will continue to analyze the samples cut for the Hydrate Effective Stress Chamber.
- UT will prepare for a dedicated effort to conduct quantitative degassing of several H002-08CS-1 samples in the next quarter.
- The Mini-PCATS, PMRS, analytical equipment, and storage chambers will undergo continued observation and maintenance at regularly scheduled intervals and on an as-needed basis. Installation of new or replacement parts will continue to ensure operational readiness.

1.3.3 Task 16.0 – UT-GOM2-2 Scientific Drilling Program Field Operations

- Task complete.

1.3.4 Task 17.0 – UT-GOM2-2 Core Analysis

1.3.4.1.1 *Biostratigraphy*

- UT will continue to assess calcareous nannofossils as markers for the age of UT-GOM2-2 sediments and sediment deposition rates.
- USGS will finish their planktic foraminifer radiocarbon age model for the upper 15 m (50,000 years) and send out the first round of samples for benthic foraminifer oxygen-isotope analysis.

1.3.4.1.2 *Physical Properties*

1.3.4.1.2.1 Strength and Compression Behavior

- UT will begin experiments to measure the compressibility and permeability of pressure cores from the UT-GOM2-2 expedition. We will start analyzing core H002-08CS-01, where we interpret there is a section of hydrate-bearing sediment from the Orange Sand.
- Tufts University will continue work on triaxial tests of resedimented samples from whole round blended material.
- Tufts will continue working on a manuscript of the compression behavior.

1.3.4.1.2.2 Index Properties

- Tufts will continue working on Atterberg Limits.

1.3.4.1.2.3 Rock Magnetism

- USGS will being working on a paper summarizing the magnetics of WR313.

1.3.4.1.3 *Microbiology*

- Oregon State will make further determinations of potential microbial activities at different sediment depths, assessments of the key abiological parameters that constrain these cells.
- Oregon State will continue to work with other microbiologists who received samples from 2023 expedition at Walker Ridge 313 Site H.

1.3.4.1.4 *Geochemistry*

- UW will focus on the analysis of all pore water, seawater, drilling mud, and PCATS fluid samples for calcium, magnesium, sodium, and potassium concentrations as well as stable oxygen and hydrogen isotope ratios. In addition, all of the pore water chemical data produced so far will be corrected for PCATS fluid contamination.
- UNH will prep a subset of the ~450 Total S and Total C and Total N samples for del 34S isotope measurements.
- UNH will continue developing a method for isolating and measuring the amount of charcoal (wt. %) in the marine sediments using soil standard samples.

1.3.5 Task 18.0 – Project Data Analysis and Reporting

- UT will submit the proceedings volume to USGS for formal review. UT will address the suggested changes proposed during the USGS review of the Expedition Proceedings once the review is complete.
- UT will hire a publication editor to finalize the Proceedings text, figures, and layout.
- The project science team will continue checking data and creating datasets on Zenodo.

- UT will formulate a plan for a special volume looking at the trade-offs between a virtual collection of papers on our UT-GOM2-2 website (this would follow IODP's approach) and a special collection with ACS Energy and Fuels (similar to the Alaska project). Both have merit.

2 PRODUCTS

Project publications webpage:

https://ig.utexas.edu/energy/gom2-methane-hydrates-at-the-university-of-texas/gom2-publications/

2.1 Publications

Bhandari, A.R., Cardona, A., Flemings, P.B., Germaine, J. T., 2024, The geomechanical response of the Gulf of Mexico Green Canyon 955 reservoir to gas hydrate dissociation: A model based on sediment properties with and without gas hyrdate, Marine and Petroleum Geology, Volume 167. https://doi.org/10.1016/j.marpetgeo.2024.107000

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Darnell, K. N., Flemings, P. B., and DiCarlo, D., 2019, Nitrogen-Driven Chromatographic Separation During Gas Injection Into Hydrate-Bearing Sediments: Water Resources Research. https://doi.org/10.1029/2018wr023414

Ewton, E., 2019, The effects of X-ray CT scanning on microbial communities in sediment cores, Oregon State University.

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2.2 Conference Presentations/Abstracts

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2.3 Proceeding of the UT-GOM2-1 Hydrate Pressure Coring Expedition

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2.4 Proceeding of the UT-GOM2-2 Hydrate Coring Expedition

Volume contents will be published on the UT-GOM2-2 Expedition Proceedings website and on OSTI.gov.

2.4.1 Prospectus

Peter Flemings, Carla Thomas, Tim Collett, Fredrick Colwell, Ann Cook, John Germaine, Melanie Holland, Jesse Houghton, Joel Johnson, Alberto Malinverno, Kevin Meazell, Tom Pettigrew, Steve Phillips, Alexey Portnov, Aaron Price, Manasij Santra, Peter Schultheiss, Evan Solomon, Kehua You, UT-GOM2-2 Prospectus: Science and Sample Distribution Plan, Austin, TX (University of Texas Institute for Geophysics, TX). http://dx.doi.org/10.2172/1827729, 141 p.

2.4.2 Preliminary Report

Peter B. Flemings, Carla Thomas, Stephen C. Phillips, Timothy S. Collett, Ann E. Cook, Evan Solomon, Frederick S. Colwell, Joel E. Johnson, David Awwiller, Irita Aylward, Athma R. Bhandari, Donald Brooks, Alejandro Cardona, Michael Casso, Rachel Coyte, Tom Darrah, Marcy Davis, Brandon Dugan, Dan Duncan, John T. Germaine, Melanie Holland, Jesse Houghton, N. Tanner Mills, Michael Mimitz, Daniel Minarich, Yuki Morono, Zachary Murphy, Joshua O'Connell, Ethan Petrou, Tom Pettigrew, John W. Pohlman, Alexey Portnov, Marcie Purkey Phillips, Thomas Redd, Derek E. Sawyer, Peter Schultheiss, Kelly Shannon, Camille Sullivan, Cathal Small, Kayla Tozier, Man-Yin Tsang, Camila Van Der Maal, William F. Waite, Taylor Walton, 2024, UT-GOM2-2 Preliminary Report Terrebonne Basin Northern Gulf of Mexico, The University of Texas Institute for Geophysics, https://doi.org/10.5281/zenodo.13648253

2.5 Websites

- Project Website:

https://ig.utexas.edu/energy/genesis-of-methane-hydrate-in-coarse-grained-systems/

- UT-GOM2-2 Expedition Website

https://ig.utexas.edu/energy/gom2-methane-hydrates-at-the-university-of-texas/gom2-2-expedition/

- UT-GOM2-1 Expedition Website:

https://ig.utexas.edu/energy/genesis-of-methane-hydrate-in-coarse-grained-systems/expedition-ut-gom2-1/

- Project SharePoint:

https://sps.austin.utexas.edu/sites/GEOMech/doehd/teams/

- Methane Hydrate: Fire, Ice, and Huge Quantities of Potential Energy:

https://www.youtube.com/watch?v=f1G302BBX9w

- Fueling the Future: The Search for Methane Hydrate:

https://www.youtube.com/watch?v=z1dFc-fdah4

- Pressure Coring Tool Development Video:

https://www.youtube.com/watch?v=DXseEbKp5Ak&t=154s

2.6 Technologies Or Techniques

Nothing to report.

2.7 Inventions, Patent Applications, and/or Licenses

Nothing to report.

3 CHANGES/PROBLEMS

3.1 Changes In Approach And Reasons For Change

None.

3.2 Actual Or Anticipated Problems Or Delays And Actions Or Plans To Resolve Them

Budget Period 6 (BP6) is scheduled to end on September 30, 2025. Project leadership has determined that *UT-GOM2-2 Core Analysis* (Task 17.0) and *Project Data Analysis and Reporting* (Task 18.0) cannot be completed within this timeframe due to delays resulting from the 2023 UT-GOM2-2 Hydrate Coring Program. To ensure the successful completion of these critical tasks, we will request a no-cost extension of BP6.

The UT-GOM2-2 Hydrate Coring Program (Task 16.0) was scheduled to occur in early spring 2023. However, the preparation and certification of the Helix *Q4000* multi-service vessel experienced multiple compounding delays. As a result, UT-GOM2-2 field operations did not commence until August 2023 and conclude until September 2023. The resulting schedule shifts have caused cascading impacts affecting the timeline for post-expedition scientific analysis of core samples and data, collaborations, and publications.

Together, Task 17.0 and Task 18.0 represent the final culmination of the of the DE-FE0023919 project, capping 10 years of technology development and scientific research. A no-cost extension of BP6 will help to ensure that Task 17.0 and Task 18.0 are completed to their full measure.

3.3 Changes That Have A Significant Impact On Expenditures

None.

3.4 Change Of Primary Performance Site Location From That Originally Proposed

None.

4 SPECIAL REPORTING REQUIREMENTS

4.1 Current Project Period

Task 1.0 – Revised Project Management Plan

Subtask 18.1 – Project Sample and Data Distribution Plan

Subtask 18.3 – UT-GOM2-2 Scientific Drilling Program Scientific Results Volume

4.2 Future Project Periods

None.

5 BUDGETARY INFORMATION

The Budget Period 6 cost summary is provided in Table 5-1.

Table 5-1. Phase 6 / Budget Period 6 Cost Profile

Baseline Reporting Quarter	Budget Period 6							
	Y1Q1		Y1Q2		Y1Q3		Y1Q4	
	11/16/23-12/31/23		01/01/24-03/31/24		04/01/24-06/30/24		07/01/24-09/30/24	
	Y1Q1	Cumulative Total	Y1Q2	Cumulative Total	Y1Q3	Cumulative Total	Y1Q4	Cumulative Total
Baseline Cost Plan								
Federal Share	$ 555,325	$ 71,091,055	$ 471,086	$ 71,562,141	$ 456,085	$ 72,018,226	$ 456,085	$ 72,474,312
Non-Federal Share	$ 282,554	$ 32,363,632	$ 271,503	$ 32,635,135	$ 269,534	$ 32,904,669	$ 269,535	$ 33,174,204
Total Planned	$ 837,880	$ 103,454,687	$ 742,590	$ 104,197,276	$ 725,619	$ 104,922,895	$ 725,620	$ 105,648,516
Actual Incurred Cost								
Federal Share	$ 2,871,720	$ 70,588,076	$ 391,191	$ 70,979,267	$ 407,450	$ 71,386,716	$ 370,446	$ 71,757,162
Non-Federal Share	$ 745,317	$ 34,398,513	$ 152,951	$ 34,551,464	$ 160,980	$ 34,712,444	$ 130,874	$ 34,843,318
Total Incurred Cost	$ 3,617,037	$ 104,986,589	$ 544,142	$ 105,530,731	$ 568,429	$ 106,099,160	$ 501,320	$ 106,600,480
Variance								
Federal Share	$ 2,316,395	$ (502,979)	$ (79,895)	$ (582,875)	$ (48,636)	$ (631,510)	$ (85,639)	$ (717,150)
Non-Federal Share	$ 462,762	$ 2,034,882	$ (118,552)	$ 1,916,330	$ (108,554)	$ 1,807,775	$ (138,662)	$ 1,669,114
Total Variance	$ 2,779,157	$ 1,531,902	$ (198,448)	$ 1,333,455	$ (157,190)	$ 1,176,265	$ (224,301)	$ 951,964

Baseline Reporting Quarter	Budget Period 6							
	Y2Q1		Y2Q2		Y2Q3		Y2Q4	
	10/01/24-12/31/24		01/01/25-03/31/25		04/01/25-06/30/25		07/01/25-09/30/25	
	Y2Q1	Cumulative Total	Y2Q2	Cumulative Total	Y2Q3	Cumulative Total	Y2Q4	Cumulative Total
Baseline Cost Plan								
Federal Share	$ 401,106	$ 72,875,417	$ 401,106	$ 73,276,523	$ 385,250	$ 73,661,774	$ 385,250	$ 74,047,024
Non-Federal Share	$ 218,494	$ 33,392,698	$ 218,494	$ 33,611,191	$ 216,156	$ 33,827,347	$ 216,156	$ 34,043,503
Total Planned	$ 619,599	$ 106,268,115	$ 619,599	$ 106,887,715	$ 601,406	$ 107,489,121	$ 601,406	$ 108,090,527
Actual Incurred Cost								
Federal Share	$ 512,470	$ 72,269,632	$ 644,774	$ 72,914,406		$ 72,914,406		$ 72,914,406
Non-Federal Share	$ 153,103	$ 34,996,421	$ 116,351	$ 35,112,772		$ 35,112,772		$ 35,112,772
Total Incurred Cost	$ 665,573	$ 107,266,053	$ 761,125	$ 108,027,178	$ -	$ 108,027,178	$ -	$ 108,027,178
Variance								
Federal Share	$ 111,364	$ (605,786)	$ 243,668	$ (362,118)				
Non-Federal Share	$ (65,390)	$ 1,603,723	$ (102,142)	$ 1,501,581				
Total Variance	$ 45,973	$ 997,937	$ 141,526	$ 1,139,463				

6 ACRONYMS

Table 6-1. List of Acronyms

ACRONYM	DEFINITION
AAPG	American Association of Petroleum Geologists
AGU	American Geophysical Union
AOM	Anaerobic Oxidation of Methane
BOEM	Bureau of Ocean Energy Management
BSR	Bottom-Simulating Reflector
BSEE	Bureau of Safety and Environmental Enforcement
CPP	Complimentary Project Proposal
CT	Computed Tomography
DNA	Deoxyribonucleic Acid
DOE	U.S. Department of Energy
GC	Green Canyon
ICP-MS	Inductively Coupled Plasma Mass Spectrometry
IODP	International Ocean Discovery Program
LWD	Logging While Drilling
NEPA	National Environmental Policy Act
NETL	National Energy Technology Laboratory
NMT	New Mexico Tech
OSR	Organoclastic Sulfate Reduction
OSTI	Office of Scientific and Technical Information
OSU	The Ohio State University
PCATS	Pressure Core Analysis and Transfer System
PCC	Pressure Core Center
PCTB	Pressure Core Tool with Ball Valve
PI	Principle Investigator
PM	Project Manager
PMP	Project Management Plan
PMRS	Pressure Maintenance and Relief System
QRPPR	Quarterly Research Performance and Progress Report
RPPR	Research Performance and Progress Report
SEM	Scanning Electron Microscope
SOPO	Statement of Project Objectives
UNH	University of New Hampshire
USGS	United States Geological Survey
UT	University of Texas at Austin
UW	University of Washington
WR	Walker Ridge
XCT	X-ray Computed Tomography

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