Oil & Natural Gas Technology

DOE Award No.: DE-FE0010175

Quarterly Research Performance Progress Report (Period ending 03/31/2015)

PLANNING OF A MARINE METHANE HYDRATE PRESSURE CORING PROGRAM FOR THE WALKER RIDGE AND GREEN CANYON AREAS OF THE GULF OF MEXICO

Project Period (10/1/2012 – 09/30/2015 (based on granted extension))

Submitted by:
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Signature

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National Energy Technology Laboratory

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Office of Fossil Energy

DISCLAIMER

Executive Summary

This research effort will focus on developing a site characterization program for naturally occurring gas hydrate deposits. It is based on experience gained from a number of previous expeditions that Fugro has conducted for industry and for various National Hydrate Programs. We will draw upon our experience from previous work and combine the objectives and site specific aspects of the planning into a comprehensive document that summarizes the best practices and best approaches. We have solicited organizations and academia outside of Fugro for participation in a Workshop to encourage open sharing of experiences and required R&D improvements to help guarantee success in the next field expedition.

Key issues identified for future research include:

- Develop a better understanding of the structure and properties of methane hydrate reservoirs
- Develop improved methodologies to select exploration targets (Topic 3 work)
- Develop improved ability to sample and test the hydrates in their natural state
- Develop improved technology and methodologies to extract and deliver the gas from hydrates to downstream facilities.
- To take the experience and knowledge gained from previous expeditions to help others be better prepared for future expeditions.

We have proposed the following approach; 1) Desktop Study to Prepare Detailed Plans and Recommendations for all Aspects of the Proposed Offshore Campaign (proposed advances in knowledge/technology), and 2) Prepare detailed plans of execution and make budgetary estimates for a future fieldwork program to collect the pressure cores including a recommended Scope of Work.

There are significant changes with the schedule for completion of the project as originally proposed. We do appreciate the granting of a “No-Cost Extension” for the project of nine (9) months which extended the completion date until end of December 2014. Late last year, we recognized that not all the project objectives could be accomplished even within this timeframe. Various personal reasons primarily with the PI’s health and other personal reasons together with other professional distractions have left a gap in the required effort to complete the project within the existing extension period. We have resolved this problem as described in further detail in this report. We have also recently obtained another no-cost time extension until the end of September 2015. We don’t expect any further extensions to be needed or granted.

Accomplishments

- Continued to review related scientific/industry research efforts in the Sea of Japan and the South China Sea.
- Continued updates to the PMP according to the new tasks identified (e.g. Workshop).
- Completed the development of a project execution plan (PEP) for the planning phase through the field work execution and reporting that will assist in identifying critical discussion points and critical cooperation items.
- PEP incorporates the lessons learned from our most recent hydrate expedition in the South China Sea for GMGS, as well as previous hydrate expeditions that Fugro have been involved with.
- Conducted additional planning sessions with Geotek (Peter Schultheiss) and J.A. Aumann & Associates, (Jim Aumann) and Tim Collett, (USGS) in person and by phone.
- Attended planning meetings with Geotek and other Fugro Data Acquisition Groups.
- Made plans for a peer review to follow the Workshop findings and make final recommendations.
- Have made good progress on sections 2.0 through 6.0 from the Table of Contents (Exhibit 6).

Progress, Results, and Discussion Summary of technical progress

During this quarter, good progress was made. Our main accomplishment was to catch up on past due reporting and to prepare a detailed plan for getting the project schedule on a path to completion now that the additional "no-cost extension" has been granted.

We have advanced the plan for testing of the improvements to the tool based on issues identified during the GMGS program as well as the tests on a similar tool developed directly for DOE that were conducted in Catoosa, OK at the drilling research center facility. We have developed a testing plan in preparation of the Award from GMGS for their third expedition to be held in 2015 in the South China Sea starting in June.

Review previous research projects

We continue to review the most recent marine hydrate expedition, GMGS China and to apply that experience and its learning opportunities to this project. We are also monitoring India's NGHP2 program that is in progress and we have personnel on board *Chikyu* assisting.

Identify technical research concepts

The various research topics include:

- Development of safe drilling procedures for riserless drilling in known hydrate formations based on previous expeditions conducted by Fugro, ODP and IODP.
- Development of core quality measures for rotary pressure coring systems.
- Development of pressure core handling procedures and protocols to ensure best quality results.
- Development of prototype designs on a seabed template to allow control of the rate of penetration and weight on bit from the seafloor instead of the on the deck at the top drive level. This was done completely under Fugro R&D funding, yet we believe it will benefit the next field operation for rotary coring and pressurized coring.

Future work in next reporting period

- We will finalize and report on the updated PMP.
- We plan to conduct a Peer Review of Project Workshop and liaise with our key collaborators.
- We will continue our work on the pressure core acquisition and quality issues based on the PMP and analysis of the upcoming work in the South China Sea for GMGS.
- We will continue our work on the pressure core analysis handling, timing and quality issues
- We will continue to work on safe drilling practices for hydrate bearing sediments using open-hole techniques.
- We plan to report the findings and recommendations from the Project Workshop.
- Progress the research into permitting issues associated with drilling riserless for relatively shallow gas hydrate targets in the Gulf of Mexico.

Key References

Collett, T.S, et. al., USDOE/NETL Report Prepared by Consortium for Ocean Leadership, Project No. DE-FE0010195, Development of a Scientific Plan for a Hydrate-Focused Marine Drilling, Logging and Coring Program – **Historical Methane Hydrate Project Review**, June 2013

Campbell, K.J., Humphrey, G.D. and Little, R.L., "Modern Deepwater Site Investigation: Getting It Right the First Time" for the 2008 **Offshore Technology Conference** 06-May-08 in Houston, Texas. Paper No. 19535.

Humphrey, G.D., Schultheiss, P.J., Holland, M., "Borehole Pressure Coring and Laboratory Pressure Core Analysis for Gas Hydrate Investigations" for the 2008 **Offshore Technology Conference** held May 2008 in Houston, Texas. Paper No. 19601.

Scientific Drilling Magazine, "Wireline Coring and Analysis Under Pressure: Recent Use and Future Developments of the HYACINTH System", Article by Peter Schultheiss, Melanie Holland and Gary Humphrey, published in March 2009.

P.J. Schultheiss, Geotek Ltd.; J.T. Aumann, Aumann & Associates, Inc.; and G.D. Humphrey, Fugro GeoConsulting, Inc., " Pressure Coring and Pressure Core Analysis for the Upcoming Gulf of Mexico Joint Industry Project Coring Expedition " for the 2010 **Offshore Technology Conference** held May 2010 in Houston, Texas. Paper No. 20827.

E. Tervoort, J. Peuchen & G. Humphrey, Gas Hydrate Quantification By Combining Pressure Coring And In-Situ Pore Water Sampling Tools**, Proceedings of the 7th International Conference on Gas Hydrates (ICGH 2011)**, Edinburgh, Scotland, United Kingdom, July 17-21, 2011.

Changes or Problems

We recognized the need to incorporate additional collaborators outside of those listed in our original proposal back in 2012. The primary reason for this was a realization that additional expertise and experience outside of Fugro would prove to benefit the effectiveness of the study. The shift in the timeline has been communicated to the NETL project manager.

We have identified key individuals to assist in putting the necessary efforts and time into the project to complete it by end of September 2015. We plan to have the draft report completed by end of July 2015 and have allowed one month for DOE/NETL review and one month to finalize after the review process is completed. Please see Exhibit 4 for our revised schedule in tabular form. Exhibit 5 in Gantt Chart form. We are nearly on schedule, perhaps 1 to 2 weeks behind.

Participants and Other Collaborating Organizations

	Gary D. Humphrey, Principal Investigator / Project Director, Fugro Employee Houston, Texas	Jim Aumann Salt Lake City, Utah	Dr. Peter Schultheiss, Technical Advisor, Geotek, Ltd. Employee United Kingdom
Nearest month worked	1	0	0
Collaboration outside USA	Discussion with offices in UK and The Netherlands	Worked with Fugro entities in UK and Holland to review performance on GMGS to establish baseline PEP. Upgraded PCTB.	Discussion with offices in USA and The Netherlands
Travel outside USA	None this reporting period	None this reporting period	None this reporting period

Other Collaborating Organizations:

Oklahoma State University and Fugro GeoConsulting have agreed to share progress and results from their respective DOE research projects (DE-FE0009904 and Fugro project DE-FE0010160).

Fugro, Jim Aumann & Associates and Geotek all collaborated on the GMGS China Gas Hydrate field expedition for LWD, coring and pressure coring and in situ testing at several locations in the South China Sea. This work was completed on 08 September 2013. They are both also collaborating with us for the upcoming work (starting 01 June 2015) for GMGS' new expedition, GMGS3 on board the Fugro Voyager.

Impact

The research findings from this project may potentially contribute to the US gas hydrate resource assessment but also international science and governmental organizations that are measuring gas hydrate exploration and production potential in Japan, Korea, China, India, Colombia, Brazil, Vietnam and New Zealand.

Additionally the findings from this project can also have the potential to aid imaging of sequestered C02 gas hydrate for greenhouse gas reduction if that technology advances.

Special Reporting Requirements

None identified this quarter and we appreciate the granting of the no-cost extension. We have seen better progress in this first quarter of 2015 due to the addition of expert staff to assist in our reporting efforts. We expect to have an interim reporting requirement based on the findings and recommendations post workshop. However, these will be covered in subsequent quarterly reports. We asked for another extension to complete the work outlined in this research program. The project completion date is now the end of September, 2015. At the time of this writing, the extension has been granted.

Budgetary Information

A cumulative total of $171,226 has been spent of an allocation of $578,850. The federal share of the costs incurred to date is $136,635 and the cost sharing is $34,591. We do attend several meetings, speak with hydrate project contacts, and other efforts as being consistent with advancing the research project but these are not reflected in the budget spent to date. We have also included the man-hour estimates and projected costs for 2015 through September.

Exhibit I - Milestone Status

- Milestone 1, Task 1 was completed November 14, 2012.
- Milestone 2 has been completed prior to December 2013.
- Completion Milestone was adjusted to 31 December 2014 based on the DOE approval of our no-cost extension, approved in Q1 2014. We request an additional extension in 2015 due to lack of progress during the last half of 2014. This has been tentatively granted through end September 2015 at the time of this writing.
- We will continue to check the milestone status versus what has been updated in the PMP.

Exhibit 2 - Cost Plan (see next two pages)

We have included the projected costs for man-hours in 2015 to complete the work.

Baseline Reporting Quarter	Budget Period 1																			
	Q4 2012		Q1 2013		Q2 2013		Q3 2013		Q4 2013		Q1 2014		Q2 2014		Q3 2014		Q4 2014		Q1 2015	
	Q1	Comulative Total	Q2	Comulative Total	Q3	Comulative Total	Q4	Comulative Total	Q5	Comulative Total	Q6	Comulative Total	Q7	Comulative Total	Q8	Comulative Total	Q9	Comulative Total	Q10	Comulative Total
Baseline Cost Plan																				
Federal Share	115000	115000	115000	230000	115000	345000	118080	463080	0	463080	0	463080	0	463080	0	463080	0	463080	0	463080
Non-Federal Share	28750	28750	28750	57500	28750	86250	29520	115770	0	115770	0	115770	0	115770	0	115770	0	115770	0	115770
Total Planned	143750	143750	143750	287500	143750	431250	147600	578850	0	578850	0	578850	0	578850	0	578850	0	578850	0	578850
Actual Income Cost																				
Federal Share	2456	2456	3715	6171	6064	12235	7380	19615	44979	64594	8876	73470	12977	86447	6552	92999	1724	94723	41912	136635
Non-Federal Share	614	614	929	1543	1516	3059	1845	4904	11245	16149	2219	18368	3244	21612	1638	23250	431	23681	10478	34159
Total Incurred Costs	3070	3070	4644	7714	7580	15294	9225	24519	56224	80743	11095	91838	16221	108059	8190	116249	2155	118404	52390	170794
Variance																				
Federal Share	(112544)	(112544)	(111285)	(223829)	(108936)	(332765)	(110700)	(443465)	44979	(398486)	8876	(389610)	12977	(376633)	6552	(370081)	1724	(368357)	41912	(326445)
Non-Federal Share	(28136)	(28136)	(27821)	(55957)	(27234)	(83191)	(27675)	(110866)	11245	(99621)	2219	(97402)	3244	(94158)	1638	(92520)	431	(92089)	10478	(81611)
Total Variance	(140680)	(140680)	(139106)	(279786)	(136170)	(415956)	(138375)	(554331)	56224	(498107)	11095	(487012)	16221	(470791)	8190	(462601)	2155	(460446)	52390	(408056)

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Exhibit 3 – Actual Project Planning Workshop Participants

In order to capture the experience and knowledge from several hydrate expeditions previously conducted, we propose that a Workshop was conducted at the beginning of May 2014 to pull all of this experience together and establish a "Best Practices" outline or pathway to success. Below is a list of personnel that were included in the Workshop:

Professional's Name	Affiliation	Comments
Brian Ferri	Fugro	35 years+ drilling experience
Steve Brittain	Fugro	30 years+ experience with tool development and implementation on DW projects
Jeff Scott	Fugro	10 years+ drilling and vessel design experience
Jens Breinbjerg	Fugro	10 years+ project management experience on hydrate and DW projects
Michael Benting	Fugro	10 years+ project management and hydrate experience on DW projects
Pedro Regino	Fugro	15+ years of project management and 10+ years of hydrate experience on DW projects
Frank Gozeling	Fugro Holland	Senior Project manager with 30 years+ experience in offshore geotechnical operations and 10 years+ on hydrate project experience
Floris Tuynder	Fugro Holland	Equipment Designer and special consultant for Pressure Coring Systems since 2002.
Dan McConnell	Fugro	Geoscientist with 25 years+ experience also involved in JIP II and responsible for prospecting efforts to find massive sand deposits with hydrates indicated based on LWD work.
Luke Hamilton	Fugro UK	Drilling Manager for Fugro Seacore and offshore driller on two previous hydrate expeditions. 10+ years of offshore drilling experience.

Potential Peer Review Candidates for our Workshop:

Professional's Name	Affiliation	Comments
Tim Collett	USGS	World-wide expert on hydrates
Ray Boswell	US DOE / NETL	World-wide expert on hydrates
Richard Baker	US DOE / NETL	World-wide expert on hydrates
Michael Riedel	Canadian Geologic Survey	World-wide expert on hydrates
Brian Anderson	Univ. West Virginia	Expert Modeler for hydrates
Brad Clements	IODP	possibly Michael Storms
Koji Yamamoto	JOGMEC	Koji Yamamoto or others
Beong-jae Ryu	KIGAM	World-wide expert on hydrates
Scott Dallimore	Geologic Survey of Canada	World-wide expert on hydrates
Pushpendra Kumar	ONGC/DGH	World-wide expert on hydrates
Craig Shipp	Shell	Industry expert on hydrates

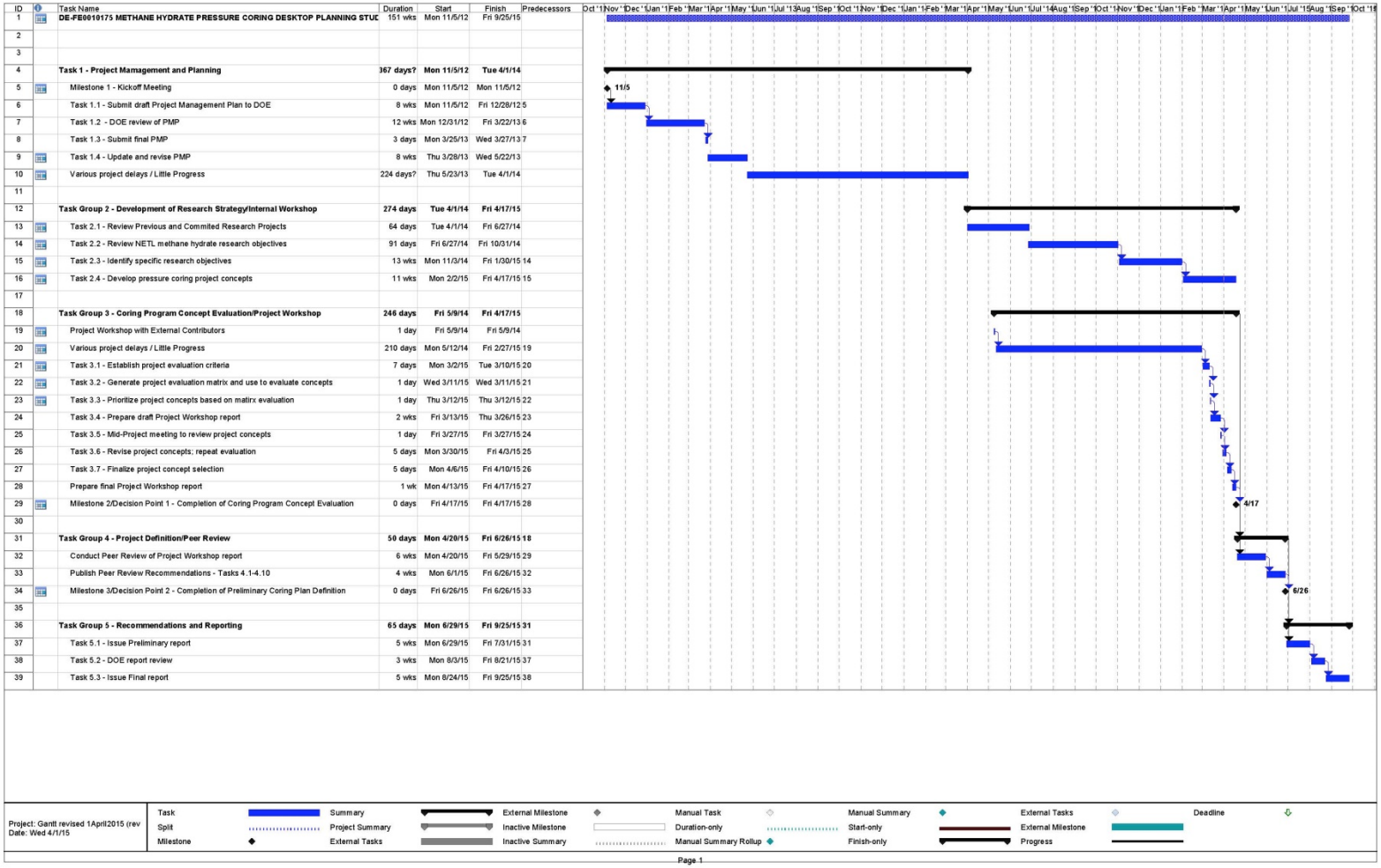
Exhibit 4 – Milestones Table

Schedule to Complete the Hydrate Planning Study
05 April 2015

Item No.	Task Description(s)	SOPO Task No.	Schedule
1	Finalize Project Management Plan related to this Desktop Study (DTS) –	1	Early April 14
2	• Conduct Internal Workshop • Selection of workshop participant • Send out invitations • Organize venue • Meet with NETL/DOE advisors	2, 2.1, 2.2, 2.3 2.4	Early May 14 Early April 14 Mid April 14 Early May 14
3	Complete job specific PMP/PEP (with details as we currently know them)	2	April 14– end April 15
4	Conduct Internal Workshop with participation of "key partners"	3	Early May 14
5	Summarize Workshop Findings and Recommendations	3	Mid April 15
6	Select Peer Review Team and send invitations • Selection of Peer Review Team • Send out invitations • Organize venue	4	Early May 15
7	Conduct Peer Review	4	End May 15
8	Summarize Peer Review Findings and Recommendations	4	Mid June 15
9	Publish Peer Review Recommendations	4	End June 15
10	Plan and Conduct Review - Technical Meeting with DOE	5	Mid June 15
11	Draft Final Report	5	End July 15
12	Allowance for Review, Editing, Additions, and Finalization	5	End August 15
13	Submit Final Report	5	End Sept 15

Exhibit 5 – Gantt Chart – Schedule

See attachment on following page.



ID	Task Name	Duration	Start	Finish	Predecessors
1	**DE-FE0010175 METHANE HYDRATE PRESSURE CORING DESKTOP PLANNING STUD**	151 wks	Mon 11/5/12	Fri 9/25/15	
2					
3					
4	**Task 1 - Project Mamagement and Planning**	**367 days?**	**Mon 11/5/12**	**Tue 4/1/14**	
5	Milestone 1 - Kickoff Meeting	0 days	Mon 11/5/12	Mon 11/5/12	
6	Task 1.1 - Submit draft Project Management Plan to DOE	8 wks	Mon 11/5/12	Fri 12/28/12	5
7	Task 1.2 - DOE review of PMP	12 wks	Mon 12/31/12	Fri 3/22/13	6
8	Task 1.3 - Submit final PMP	3 days	Mon 3/25/13	Wed 3/27/13	7
9	Task 1.4 - Update and revise PMP	8 wks	Thu 3/28/13	Wed 5/22/13	
10	Various project delays / Little Progress	224 days?	Thu 5/23/13	Tue 4/1/14	
11					
12	**Task Group 2 - Development of Research Strategy/Internal Workshop**	**274 days**	**Tue 4/1/14**	**Fri 4/17/15**	
13	Task 2.1 - Review Previous and Commited Research Projects	64 days	Tue 4/1/14	Fri 6/27/14	
14	Task 2.2 - Review NETL methane hydrate research objectives	91 days	Fri 6/27/14	Fri 10/31/14	
15	Task 2.3 - Identify specific research objectives	13 wks	Mon 11/3/14	Fri 1/30/15	14
16	Task 2.4 - Develop pressure coring project concepts	11 wks	Mon 2/2/15	Fri 4/17/15	15
17					
18	**Task Group 3 - Coring Program Concept Evaluation/Project Workshop**	**246 days**	**Fri 5/9/14**	**Fri 4/17/15**	
19	Project Workshop with External Contributors	1 day	Fri 5/9/14	Fri 5/9/14	
20	Various project delays / Little Progress	210 days	Mon 5/12/14	Fri 2/27/15	19
21	Task 3.1 - Establish project evaluation criteria	7 days	Mon 3/2/15	Tue 3/10/15	20
22	Task 3.2 - Generate project evaluation matrix and use to evaluate concepts	1 day	Wed 3/11/15	Wed 3/11/15	21
23	Task 3.3 - Prioritize project concepts based on matirx evaluation	1 day	Thu 3/12/15	Thu 3/12/15	22
24	Task 3.4 - Prepare draft Project Workshop report	2 wks	Fri 3/13/15	Thu 3/26/15	23
25	Task 3.5 - Mid-Project meeting to review project concepts	1 day	Fri 3/27/15	Fri 3/27/15	24
26	Task 3.6 - Revise project concepts; repeat evaluation	5 days	Mon 3/30/15	Fri 4/3/15	25
27	Task 3.7 - Finalize project concept selection	5 days	Mon 4/6/15	Fri 4/10/15	26
28	Prepare final Project Workshop report	1 wk	Mon 4/13/15	Fri 4/17/15	27
29	Milestone 2/Decision Point 1 - Completion of Coring Program Concept Evaluation	0 days	Fri 4/17/15	Fri 4/17/15	28
30					
31	**Task Group 4 - Project Definition/Peer Review**	**50 days**	**Mon 4/20/15**	**Fri 6/26/15**	18
32	Conduct Peer Review of Project Workshop report	6 wks	Mon 4/20/15	Fri 5/29/15	29
33	Publish Peer Review Recommendations - Tasks 4.1-4.10	4 wks	Mon 6/1/15	Fri 6/26/15	32
34	Milestone 3/Decision Point 2 - Completion of Preliminary Coring Plan Definition	0 days	Fri 6/26/15	Fri 6/26/15	33
35					
36	**Task Group 5 - Recommendations and Reporting**	**65 days**	**Mon 6/29/15**	**Fri 9/25/15**	31
37	Task 5.1 - Issue Preliminary report	5 wks	Mon 6/29/15	Fri 7/31/15	31
38	Task 5.2 - DOE report review	3 wks	Mon 8/3/15	Fri 8/21/15	37
39	Task 5.3 - Issue Final report	5 wks	Mon 8/24/15	Fri 9/25/15	38

Project: Gantt revised 1April2015 (rev
Date: Wed 4/1/15

Task | Summary | External Milestone | Manual Task | Manual Summary | External Tasks | Deadline
Split | Project Summary | Inactive Milestone | Duration-only | Start-only | External Milestone
Milestone | External Tasks | Inactive Summary | Manual Summary Rollup | Finish-only | Progress

Exhibit 6 – Revised Table of Contents (TOC) for Final Report (with Assignments)

CONTENTS

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