Attachment 1

Response to Inspector General Recommendation to Create a Formal Lessons Learned Process

Background

Beginning in 2007, DOE began collecting observations and lessons learned in an Integrated Biorefinery (IBR) database; however, they were not categorized as such or retrievable by keyword search criteria. At this time, BETO had a portfolio of approximately 11 commercial-, and demonstration-scale biorefinery projects. With the advent of the American Recovery and Reinvestment Act (ARRA) in 2009, BETO added 18 more pilot- and demonstration-scale integrated biorefinery projects, raising the total to 29. This triggered the need to expand the database to monitor several more project and funding parameters. Along with these additional monitoring parameters, observations and lessons learned continued to be recorded in what was now called the "IBR database". In 2012, lessons learned were specifically categorized in the IBR database. However, keyword search capability was limited.

Observations vs Lessons Learned: It is important to recognize that the process of learning requires recognizing something that was not understood before it was first observed or evaluated. Observations, by themselves, are not lessons learned. In order for a lesson to be "learned", research shows that reflection and evaluation are needed to formulate what the lesson(s) is/are, and an action(s) must result. In the bioenergy industry, this frequently takes the form of identifying the root cause before a lesson can be "learned" and taking action to mitigate a risk or to recognize an opportunity and leveraging it for the benefit of the project and/or process. DOE has collected far more observations than lessons learned. The process of evaluating these observations and translating the information into viable lessons learned is a key objective for the BETO Program and is one which will continue throughout the lifecycle of the remaining IBR projects.

Current repositories of observations/lessons learned: Observations and lessons learned are documented in four major locations:

1) The IBR database is updated with observations and lessons learned generated by DOE Project Managers and contractor Project Engineers on a routine basis, as necessary. A weekly meeting of DOE Demonstration and Deployment management, DOE Project Managers, contractor Project Monitors, representatives from the Independent Engineer (as needed), and NREL's Project Managers for the IBR data mining activities serves as an ongoing source of observations, reflection and evaluation to determine and document any lessons learned.
2) BETO utilizes three contracts to provide independent engineering expertise to guide its Critical Decisions (CDs, which are key project management decision points adapted from DOE Order 413.3B – *Project Management for the Acquisition of Capital Assets*). Key deliverables under these contracts include providing observations and lessons learned as part of the contractor's monthly reporting, as well as the requirement to deliver a comprehensive lessons learned report at the end of each contract's performance period.
3) Observations and lessons learned are generated from the annual Comprehensive Project Reviews (CPRs) for every IBR project in the active portfolio. Annual Comprehensive Project Reviews (CPRs),

which were instituted as a best practice in 2011, are perhaps the most valuable source for observations and lessons learned at the project-specific level. The annual CPRs provide BETO the opportunity to examine, in detail, how each IBR project is progressing, how they are being managed, what barriers and risks are being encountered, what are the cost and schedule variances, how are risks being mitigated, what lessons are being learned, what is the financial soundness of the project, what are the economic prospects for replicating the technologies, and whether the organizations are capable of successfully executing the projects to completion.

4) The Bi-annual Peer Review provides observations and lessons learned to the BETO Program, which is documented in a report. While oftentimes these are not at the level of specificity and sensitivity (due to the public nature of the Peer Review process), there are insights to be gained from this independent review body.

Protection of business sensitive/trade secret information: Many of the observations and lessons learned are at the project and/or technology level and contain business proprietary and/or trade secret-type information. Consequently, any observations or lessons learned that can be published or shared with those who do not have a need to know this protected information must be of a higher level, cross-cutting nature and must be "sanitized" to assure there is no attribution to any specific project in BETO's IBR portfolio.

Public Communication of Lessons Learned by BETO, to Date

Lessons learned have been communicated recently to the public at these venues:

- 2012 AIChE Annual Meeting, Pittsburgh, PA, October 31, 2012
- 2014 IEA Task 42 Meeting, Berlin, Germany, January 22, 2014

Relevant Benchmark Lessons Learned Systems

BETO researched best practices of lessons learned systems utilized by DOE and other agencies. DOE's Health, Safety and Security (HSS) lessons learned system was reviewed, as well as the formal lessons learned systems operated by the National Aeronautics and Space Administration (NASA), the North Atlantic Treaty Organization (NATO) and the U.S. Army. Additionally, BETO reviewed NASA's IG review of its lessons learned system to ascertain its weaknesses. Importantly, that IG's review revealed that the major weakness of NASA's lessons learned system was that it was not being incorporated into NASA strategy and risk mitigation in an effective manner. BETO envisions examining the opportunities to leverage the lessons learned to better inform its management of the Program portfolio.

BETO Formal Lessons Learned System

While BETO has been documenting observations and lessons learned from the beginning of the IBR program, the systems used are not integrated, information is not captured in a consistent manner, and the different locations that have contained the information are not easily searchable. In response to the Peer Review's request for a formal lessons learned system (and recommended by the IG), BETO has modified its current IBR database to remedy these deficiencies and establish a formal method for documenting observations and lessons learned in a single location that can be searched using keywords and has safeguards to protect release of business proprietary/trade secret information.

Attributes of BETO Formal Lessons Learned System

Based on benchmarking with other lessons learned system mentioned above, BETO's lessons learned database incorporates the following to improve the quality of the lessons learned that are documented:

- Observations and lessons learned are documented in a single location in the IBR database
- Data entry is guided by structured logic to distinguish between observations and lessons learned
- Observations and lessons learned are categorized by project management and bioenergy industry-recognized categories
- Observations and lesson learned can be searched using keyword search capabilities linked to the project management and bioenergy industry-recognized categories
- Observations and lessons learned can be subdivided between internal DOE processes (i.e., solicitation and award management processes) vs. external (industry/project management/technical/financial, etc.)
- Safeguards are in place to affirmatively protect business proprietary/trade secret information
- A group within BETO is envisioned that would periodically meet to consider recent observations and determine whether they are to be categorized as lessons learned

Compilation of Lessons Learned, to date

Attached to this response is a compilation of lessons learned that have been entered into BETO's IBR database utilizing keyword search criteria to categorize them (Attachment 2). This compilation represents a subset of what DOE has compiled, so far (Due to business sensitive information, project-specific lessons learned are not included). Several IBR projects are not yet completed and more observations and lessons learned will be added to the database as these projects progress. This compilation reflects BETO's single, formal lessons learned system that will continue to be the repository for future observations and lessons learned and a clearinghouse of information that could be of value to both the bioenergy industry and the BETO Program.