

Development of Advanced CFD Tools for the Enhanced Prediction of Explosion Pressure Development and Deflagration Risk on Drilling and Production Facilities

PROJECT FACT SHEET

Program

2012 Ultra-Deepwater

Project Number

12121-6403-01

Start Date

August 2014

Duration

25 Months

RPSEA Share

\$3,633,336

Cost Share

\$937,500

Prime Contractor

GexCon US, Inc.

Participants

Chevron; Shell; Total

Contact Information

Principal Investigator

Scott Davis
GexCon US, Inc.
sgdavis@gexcon.com
301-915-9940

Project Manager

Gary Covatch
NETL
gary.covatch@netl.doe.gov
304-285-4589

Bill Head

RPSEA
bhead@rpsea.org
281-690-5519

Reports and Publications

www.rpsea.org/projects/12121-6403-01

RPSEA

www.rpsea.org

NETL

www.netl.doe.gov

Research Objectives

The project objective is to provide oil and gas companies operating in the Gulf of Mexico (GOM) with tools necessary to design “inherently safer” offshore facilities that can survive gas explosion incidents and prevent escalation. This project will enhance and validate the capabilities of the industry-standard explosion modeling computational fluid dynamics (CFD) software, Flame Acceleration Simulator (FLACS), to aid in reducing the Health, Safety and Environment (HS&E)-related incidents in the GOM. The project will improve and adapt the capabilities of FLACS to predict maximum credible event (MCE) early in the design phase of GOM Ultra-Deepwater (UDW) drilling and production facilities and provide the information necessary to design facilities to minimize the consequences of explosion incidents.

Approach

The project has been divided into two parallel tracks. The first track is “Administrative and Experimental Tasks.” In this track, the FLACS Deflagration-to-Detonation Transition (DDT) onset prediction capability will be validated for scales and geometries relevant to GOM UDW structures through a series of large-scale experiments to provide data for model validation of FLACS. The second track, is the “Anticipated Congestion Methodology (ACM) Tasks.” This track will focus on the development anticipated congestion guidance for early design phase GOM offshore drilling and production facilities.

Accomplishments

Preliminary design and validation of CFD (FLACS) tools to predict explosion consequences has been completed. Analysis of congestion GOM topsides facilities has been conducted. An interactive database tool has been constructed to catalog provided platforms and other offshore installations. This database has the capability to count congestion parameters and provide comparisons between as-built installations.

An initial test rig was designed, and analyses of pipe layout, rig brackets and strength were conducted. Modifications to the large-scale test facilities were made, and a final rig 180-ft long and with a gross volume of over 50,000 ft³ has been built in California facility. Large-scale DDT tests to evaluate methane, ethylene and propane, and evaluate mitigation measures are being conducted.

Future Plans

Large scale DDT testing will continue through the end of the project. The congestion database will continue to be populated and optimized. CFD evaluations of provided as-built installations will be conducted.