

Wind Wave and Current Conditions for the Deepwater Port Neptune LNG Terminal in Massachusetts Bay

Project Characteristics:

- *Met-ocean Conditions Affecting Deepwater Port Construction and Operations*
- *Operational and Extreme Omni-directional and Directional Statistics for Regional Currents, Waves and Winds*
- *Seasonal Variability of the Met-ocean Conditions at the Site of Deepwater Port*

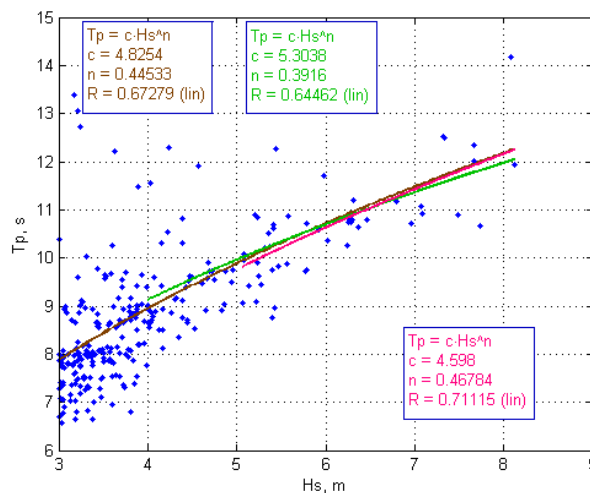
Operational and extreme wind, wave and current statistics were required by Suez LNG N.A. and NEPTUNE LNG LLC for the design of a Deepwater Port for an LNG facility in Massachusetts Bay, approximately 20 miles northeast of Boston, MA. The objective of the Project for Woods Hole Group was to provide met-ocean criteria for the design and construction of the Deepwater Port.

The development of the Deepwater Port met-ocean criteria was based on (i) met-ocean data that have been collected in the region in the past 20 years; (ii) results from regional wave hindcast studies; (iii) output from a 3-D hydrodynamic model of the regional circulation; and (iv) scientific publications. The source data were compiled and analyzed to produce statistics for both operational and extreme conditions. The output information from the analysis is presented in tabular and/or graphical forms.

The description of general environmental conditions for the area comprised regional winds, precipitation, air and water temperature, salinity, water density and resistivity, visibility, atmospheric stability, wave regime, astronomical tides and storm surge, wind-driven circulation, tidal currents, and large-amplitude internal waves.

Wind data from different sources were first converted to 10-meter winds and then used to calculate various statistics. The design criteria for wind were then developed on the basis of the comparative analysis of operational and extremal statistics derived from different data sources.

Hindcast and observational data were used to develop design criteria for waves. Operational statistics for waves included monthly joint frequency distributions



Scatter Plot of Peak Significant Wave Heights (H_s) and of Associated Wave Peak Periods (T_p) Showing Power Law Fits to the Data with 3m, 4m, and 5m Thresholds for H_s

for wave height and direction, wave scatter diagrams, directional and omni-directional significant wave height exceedance, persistence of various wave conditions. Operational and extremal statistics for currents included directional and omni-directional statistics as well as seasonal and extreme current profiles. Estimates of combined loads from waves, wind, and currents were also provided.

Multiple sources of information suggest the area of Deepwater Port is influenced by shoreward propagating large-amplitude internal waves, which may reach amplitudes of about 30m. A regional description of large-amplitude internal wave characteristics was provided based on a literature review.