

DEP SPECIFICATION

METOCEAN DATA ACQUISITION DATA REQUIREMENTS FOR PROJECTS AND REAL-TIME SYSTEMS

DEP 37.00.10.11-Gen.

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DESIGN AND ENGINEERING PRACTICE

DEM1



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1. INTRODUCTION

1.1 SCOPE

This DEP specifies requirements and gives recommendations for the acquisition of meteorological, oceanographic, ice and hydrological data for use in the design, construction and operation of offshore and onshore structures of all types used in the petroleum and natural gas industries.

National legislation can also determine local requirements for meteorological, oceanographic, ice and hydrological measurements.

This DEP includes onshore, coastal and offshore data acquisition in upstream, midstream and downstream projects. However, metocean and ice data are often required for other activities within the oil and gas lifecycle outside of the DCAF process, such as acquisition of acreage and exploration drilling, and the same principles and recommendations apply to these activities.

Section (2) of this DEP provides general requirements for data acquisition.

Section (3) of this DEP specifies requirements and gives recommendations for meteorological, oceanographic, ice and hydrological data acquisition for projects covering data definition, implementation and assimilation and analysis. It highlights the key issues that need to be addressed.

Section (4) of this DEP replaces DEP 37.00.10.12-Gen., which is now withdrawn. It specifies requirements and gives recommendations for facility-based real-time metocean systems aimed at the support of onshore and offshore operations for the following types of facility: Onshore, Coastal, Offshore fixed structures in shallow water, Offshore floating structures in shallow water and Offshore floating structures in deep water.

This DEP contains mandatory requirements to mitigate process safety risks in accordance with Design Engineering Manual (DEM) 1 - Application of Technical Standards.

This is an update of the DEP of the same number dated February 2012 that was made inactive in 2017. It is now reactivated, see (1.5) regarding the changes.

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This DEP is intended for use in project development and operations of various facilities both offshore and onshore, including oil refineries, chemical plants, gas plants, loading terminal, exploration and production facilities and supply/distribution installations. This DEP may also be applied in other similar facilities.

When DEPs are applied, a Management of Change (MOC) process shall be implemented; this is of particular importance when existing facilities are to be modified.

If national and/or local regulations exist in which some of the requirements could be more stringent than in this DEP, the Contractor shall determine by careful scrutiny which of the requirements are the more stringent and which combination of requirements will be acceptable with regards to the safety, environmental, economic and legal aspects. In all cases, the Contractor shall inform the Principal of any deviation from the requirements of this DEP which is considered to be necessary in order to comply with national and/or local regulations. The Principal may then negotiate with the Authorities concerned, the objective being to obtain agreement to follow this DEP as closely as possible.

1.3 DEFINITIONS

1.3.1 General definitions

The **Contractor** is the party which carries out all or part of the design, engineering, procurement, construction, commissioning or management of a project, or operation of a facility. The Principal may undertake all or part of the duties of the Contractor.

The **Manufacturer/Supplier** is the party that manufactures or supplies equipment and services to perform the duties specified by the Contractor.

The **Principal** is the party which initiates the project and ultimately pays for it. The Principal may also include an agent or consultant authorised to act for, and on behalf of, the Principal.

The word **shall** indicates a requirement.

The capitalised term **SHALL [PS]** indicates a process safety requirement.

The word **should** indicates a recommendation.

The word **may** indicates a permitted option.

1.3.2 Specific definitions

Term	Definition
Aviation Operations	Fixed wing or helicopter operations for manning or supply of facilities
Climate Change	Change in the state of the climate that can be identified by changes in the mean, extremes and/or the variability of its properties and that persists for an extended period, typically decades or longer. Climate change can be due to natural internal processes or external forcing and persistent anthropogenic changes in the composition of the atmosphere or in land use and may impact the representativeness of data used in design.
Cloud Cover	The fraction of the sky obscured by clouds when observed from a particular location and is usually measured in Oktas.
Cloud Height	The distance between the Mean Sea Level and the cloud base and is used to represent the elevation of the cloud. Several cloud heights can be measured for one condition.
Coastal conditions	Where conditions are influenced by coastal processes including extreme events. Specifically, where coastlines, islands, shoals and the seabed can interact with the Metocean, ice and hydrological related conditions to cause more severe and/or different conditions at a location than would have been expected without this influence.
Coastal facility	A facility in a coastal location such that the meteorological, oceanographic, ice and hydrological risks are influenced by the presence of oceanographic processes as well as terrestrial processes (e.g., an LNG plant with associated jetty or port facility).
Conductivity	The electrical conductivity of seawater and used in conjunction with seawater temperature and density to determine the seawater salinity.
Construction Operations	Onshore or offshore construction, heavy lifts and float-over installation for facilities installation.

Term	Definition
Design Criteria	Metoccean extreme storm event values with return periods ranging from 1 year to 10,000 years.
Dew point	The temperature of a given air/water-vapour mixture at which, under atmospheric pressure, condensation starts.
Drilling operations	Onshore or offshore drilling operations
Dry Bulb Air Temperature	The dry bulb air temperature, commonly referred to as air temperature, is basically the ambient air temperature indicated by a thermometer not affected by the moisture of the air.
Forecasting	Technique using numerical models to predict the state of the atmosphere and the oceans for a future time and given location(s).
Gust	A sudden, brief increase in the wind speed over a specified duration of time, e.g., 3-s gust which is the wind speed averaged over a 3-s duration. Different sensor types might record different gust speed values depending upon the individual sensor response characteristics.
Hindcasting	Technique using numerical models to compute the state of the atmosphere and the oceans for times in the past at given locations.
Ice	Ice used in this DEP refers to any cold climate/ice related parameters, including those directly related to sea ice and icebergs but also could include frost penetration and icing where relevant.
Infragravity Waves	Infragravity waves are low frequency waves (nominally 0.003 to 0.05 Hz), generated through: - nonlinear wave-wave interactions within incident sea waves and swell waves; - wave refraction and breaking on a sloping beach, as well as wave reflection at the shoreline; - oscillations in the longshore current. Infragravity waves are important to harbour oscillations, sediment transport, and other nearshore hydrodynamic processes and therefore have a high impact on the response of moored large vessels in coastal waters.
Infrequent conditions	Conditions sufficiently infrequent that they might not be captured by a typical measurement campaign (1-2 years) such as tropical storms or Infragravity waves but would significantly impact design or operational conditions where included
Internal Waves (solitons)	Internal waves are gravity waves which oscillate within the body of a fluid, typically propagating on the interface between two fluids of different density. Hence in the ocean they typically propagate along the thermocline. Nonlinear solitary internal waves are called soliton.
Long Term Data Set	A hindcast or measured data set spanning at least 20 years

Term	Definition
Long-term oscillations and inter-annual variability	Long term oscillation impact metocean parameters such as directionality, sea level pressure and temperature which in turn impact storm severity and frequency. Most installations will have to survive the full cycle of these oscillations typically 5 to 30-years and data acquisition often will not cover the full oscillation cycle. These oscillations include: • The North Atlantic Oscillation (NAO): • The Arctic Oscillation (AO): • The Pacific Decadal Oscillation (PDO): • The El Niño/La Niña-Southern Oscillation (ENSO): • The Indian Ocean Dipole (IOD): • The Atlantic Multi-decadal Oscillation (AMO):
Marine Operations	Marine based logistics for manning and/or supply of facilities
Metocean	In this DEP, the term "Metocean" represents all Meteorological, Oceanographic, Ice, and Hydrological conditions relevant to a location.
Metocean TA Review Process	Shell's internal process for metocean document review
Nonlinear Wave-Wave Interaction	Nonlinear wave-wave interactions often occur when waves are steep enough so that wave components (e.g., with different wave frequencies) affect each other. This process can result in both low and high frequency waves beyond the incident wave frequency range.
Nowcasting	The forecasting of the weather in the next 6 hours, aimed at identifying smaller features such as thunderstorms or showers.
Offshore Fixed	Fixed platform typical in water depth <250 m (<820 ft)
Offshore Floating Deepwater	Floating platform in water depth >250 m (<820 ft) such as TLP, Semi sub, FLNG, FPSO
Offshore Floating Shallow	Floating platform, typically in water depth <250 m (<820 ft) such as FPSO
Onshore facility	Onshore location for a plant or logistics base such as airport
Operating Conditions	The metocean conditions experienced during normal operations.
Production / plant operations	Production, LNG processing, refining, chemical plant

Term	Definition
Rapidly varying conditions	Conditions that vary rapidly when compared to typical data collection recording intervals and as such continuous 'high time-resolution' data needs to be measured and recorded to enable extreme conditions to be derived.
Real-time Global Portal	Shell's system for collation of global real-time data as specified in SR.16.10128
Relative Humidity	Humidity is the quantity of water vapour present in air. Relative humidity can be expressed as the ratio of the vapour partial pressure of the air to the saturation vapour partial pressure of the air at the actual dry bulb temperature. Relative humidity can also be expressed as the ratio of the vapour density of the air to the saturation vapour density at the actual dry bulb temperature
Return period	This is an estimate of the likelihood of extreme events (storms, wave heights, wind speeds, etc.) of a certain intensity or size. Also known as recurrence interval.
Sea State	A description of the properties of sea surface waves at a given time and place. In engineering applications, this is usually expressed in terms of the significant wave height and wave period.
Sea Waves and Swell Waves	Sea waves are waves that are generated locally by wind, whereas swell waves are produced by distant storms and progress to the considered location. Swell waves have longer periods than sea waves and are not correlated to local wind conditions in terms of wave direction and wave height.
Seiche	Seiches are standing waves or sloshing/oscillations of the free surface of a body of water in a closed or semi-closed basin. These oscillations are of relatively long period, extending from minutes in harbours and bays to over 10 h in large lakes. Any external perturbation to the lake or embayment can induce an oscillation.
Short term data set	A measured or modelled data set spanning less than 5 years although should be more than 1 year and seasonally balanced.
Significant Wave Height	This is 4 times the standard deviation of the sea surface and is approximately equal to the average of the 1/3 highest waves.
Storm Surges	Storm surges represent the water surface response to wind-induced surface shear stress and pressure fields. Storm-induced surges can produce short-term water surface rise to an elevation considerably above mean water levels.
Storms	Storms are the result of atmospheric disturbances and result in strong winds, heavy rainfall, and in high waves offshore.
Tanker Operations	Loading/unloading of Oil, LNG or condensate at Jetty, SBM or platform.
Tsunami	A tsunami is a large destructive sea wave generated by earthquakes, volcanic eruptions, or large sub-sea landslides.

Term	Definition
Unknown/ frontier area	Offshore areas in which Shell does not have operating experience and measured data is sparse making a detailed understanding of the conditions impossible before data is measured
Visibility	A measure of the distance at which an object or light can be clearly discerned. Visibility sensors measure the meteorological optical range which is defined as the length of atmosphere over which a beam of light travels before its luminous flux is reduced to 5% of its original value. (This is calculated by measuring the amount of infra-red scatter in a small volume of air at the sensor location and assuming this sample has similar properties to the surrounding air mass.)
Water Level	The actual mean water level over an averaging period of minutes or hours (i.e. excluding the effects of waves) relative to an agreed datum.
Wave Diffraction	Wave diffraction is the bending, spreading and interference of waves when they pass by an obstruction or through a gap.
Wave Reflection	Wave reflection occurs when waves reach an obstacle, e.g., a sea wall or a breakwater; waves also reflect off beaches and at locations with sharp depth changes.
Wave Refraction	Refraction is the bending of the wave propagation direction due to variations in the water depth under the waves. The part of a wave in shallow water moves slower than the part of a wave in deeper water. So, when the depth under a wave crest varies along the crest, the wave bends.
Wave Shoaling	Shoaling occurs as waves enter shallower water. The wave speed and wave length decrease in shallow water, therefore the energy per unit area of the wave has to increase, resulting in an increase in the wave height. The wave period remains the same in shoaling.

1.3.3 Abbreviations

Term	Definition
ABC	Air Borne Contaminants
ADCP	Acoustic Doppler Current Profiler
AMO	Atlantic Multi-decadal Oscillation
AO	Arctic Oscillation
BDP	Basic Design Package
BFD/BOD	Basis for/of Design
BTEX	Benzene, Toluene, Ethylbenzene and Xylene
DAP	Data Acquisition Plan
DCAF	Discipline Controls and Assurance Framework

Term	Definition
DGPS	Differential Global Positioning System
DLP	Data Load Plus
ENSO	El Niño-Southern Oscillation
FAT	Factory Acceptance Test
FEED	Front End Engineering and Design
FLNG	Floating Liquefied Natural Gas
FPSO	Floating Production Storage and Offloading facility
FSR	Facilities Status Reporting
HPR	Heave, Pitch and Roll
Hs	Significant wave height
HSSE	Health, Safety, Security and Environment
IER	Ice Environment Report
IOD	Indian Ocean Dipole
IOOS	Integrated Ocean Observing System
IPS	Ice Profiling Sonar
ITP	Inspection and Test Plan
JHA	Job Hazard Analysis
LNG	Liquefied Natural Gas
MDAP	Metoccean Data Acquisition Plan
MRD	Metoccean Reference Document
MSL	Mean Sea Level
NAO	North Atlantic Oscillation
OGP	Oil and Gas Producers
ORS	Opportunity Realisation Standard
PCD	Process Control Domain
PDO	Pacific Decadal Oscillation
PS	Protection Systems