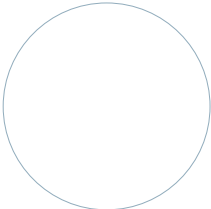
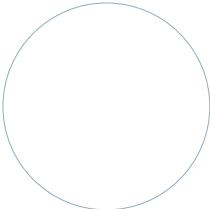
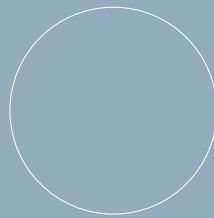
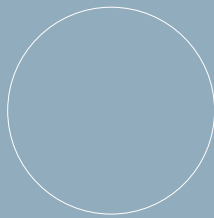


bluewater

# Arctic Tower Loading Unit

Sakhalin I, Dekastri Oil Export Terminal





# Arctic Tower Loading Unit

In 2005 Bluewater completed the Arctic Tower Loading Unit (TLU) for the Sakhalin I, DeKastri Oil Export Terminal.

The Tower Loading Unit is designed to moor a dedicated 110,000 DWT, Aframax class tanker all year round in ice conditions with temperatures as low as -35 degrees Celsius. The unit is provided with an off-loading arm to prevent hose contact with water or ice at all times. In addition to a bow loading system, the unit is capable of offloading via a floating hose system for midship loading during the summer months.

The terminal consists of a fixed vertical tower structure, piled into the seabed with a rotating head on top of the substructure. The tanker connects to the rotating head via a hawser arrangement. A slew bearing allows the rotating head to turn relative to the substructure, ensuring that the tanker can weathervane freely and take up the position of least resistance to the prevailing weather at all times.

The rotating head position, control of the winches for the hawser and loading hose, and the operation of valves etc can be controlled remotely from the tanker as well as from the shore base.

In order to withstand the harsh 1/100 year ice conditions, the tower is equipped with an ice breaking cone. The cone and structure are able to resist ice thicknesses of 2.0 metres (consolidated layer thickness in ridged ice) or 1.5 metres level ice. During operations, with the tanker attached, the system can withstand drifting ice floes of approximately 60 metres in size with thicknesses of up to 0.55 metres.

The structure has also designed to resist fatigue during its design life caused by waves and the alternating ice loads of drifting ice-floes. The structure is also designed to withstand earthquakes.

The challenging seabed conditions consisted of very soft soil in the top 5 metres, and weathered rock between 12 and 16 metres below the seabed. Therefore a special foundation was designed for the 'in-place condition' as well for the 'un-piled condition'.

## Arctic Tower Loading Details

Designed and built by	Bluewater Energy Services BV	1/100 year ice thickness	2.0 m (consolidated layer in ridged ice)
Client	Exxon Neftegas Ltd., Russia	1/100 year ice thickness	1.5 m (level ice)
Project	Sakhalin I, DeKastri Oil Export Terminal	1/100 year wave height	10.9 metres
Completed in	2005	Operational ice thickness	Floe size 60 m, level ice thickness 0.55 metres
Location	Offshore DeKastri on the Siberian side of the Tatar Strait	Peak ground acceleration	2.0 m/s
Water depth	21.5 metres	Number of piles	2 x 8 (pile in pile system)
Off loading capacity	8,000 m <sup>3</sup> /hr	Pile diameter	72" sleeve pile, 56" insert pile
Tanker size	110,000 DWT	Overall length rotating head	74 metres
Design temperature	-35 degrees C	Elevation off-loading arm	61 metres above waterline
		Riser diameter	48"

Angola    Brazil    China    Malaysia    Nigeria    Russia    The Netherlands    United Kingdom    United States