

Nakhodka, RUSSIA

Dry dock for offshore gravity base structures

The city of Nakhodka is situated in the far east of mainland Russia. The company Sakhalin Energy Investment Company Ltd. was established in 1994 to develop the Sakhalin II project, one of the largest integrated oil and gas projects in the world, including the Piltun-Asokhskoye oil field and the Lunskoye gas field. The venture called for the construction of two new production platforms founded on huge concrete gravity base structures installed in the fields in summer 2005. The beginning of year-round oil production for both platforms is scheduled for 2007; gas production is expected to get under way by 2008.

Since land transport of these enormous base structures weighing more than 100,000 metric tons was close to impossible, the investment company opted to build them in a dry dock. By later flooding this dock, the floatable offshore structures could easily be towed out to their destination in the open sea.

The dry docks were constructed with a 750-m sheet pile wall around all four sides of the rectangular excavation. 550 m of the surrounding sheet pile wall was built using AU 25 sheet piles; the remaining 200 m required the stronger PU 32 sections with a section modulus of 3,200 cm³/m. A slope



Huge construction projects were launched to exploit Sakhalin's natural resources



A dry dock for offshore platforms was built using more than 3,000 metric tons of steel sheet piles



The 750-m outer dock wall features AU 25 and PU 32 piles

with wells leads down to the bottom of the excavation. Three stages of wells lower the water level below the bottom of the dock, thus allowing construction to proceed in the dry.

The sheet piles used for the Sakhalin II development project were produced in Luxembourg and brought by train to their destination in Nakhodka. Each wagon was loaded with 40 to 45 t of steel sheet piles. Over 3,000 metric tons of sheet piles were required on the job site, in two different lengths: 24 and 29 m. The piles were cut into

12-m pieces to ease transportation. The contractor then spliced the sheet piles on site.

The following quantities of sheet piles were delivered:

- 1,940 t AU 25 in steel grade S 355 GP. Pile length: 24 m (12 m + 12 m)
- 1,100 t PU 32 in steel grade S 355 GP. Pile length: 29 m (12 m + 12 m + 5 m).

The contractor used a template and two different hammers (vibratory and impact hammer) to install the steel sheet piles. The soil conditions encountered are a relatively soft top layer with SPT values (Standard Penetration Test) ranging between 10 and 30 blows per 30 cm penetration overlying a high-density layer with SPT values from 60 to 90 blows. The U-piles were driven through the soft soil, to a depth of 15 m, with the vibratory hammer. The impact hammer was then used to drive the piles

until refusal through the denser soil layers. All AU and PU piles were driven as double piles to speed up the installation process. Driving caps for the impact hammer were provided by Arcelor free of charge for the duration of the works.

Description of the driving equipment:

- Vibrator hammer: ICE 815, eccentric moment: 46 kgm, nominal centrifugal force: 1,250 kN, maximum frequency: 1,600 rpm.
- Hydrohammer: IHC S70. Maximum energy per blow: 70 kNm, 50 blows per minute, Drop weight: 3.5 t.

The two offshore gravity base platform structures were completed after nearly ten months of uninterrupted concrete casting. The dry dock was then flooded and the two gigantic structures were towed to their respective offshore locations some 1,000 nautical miles from Nakhodka in July 2005. ■

Owner:

Sakhalin Energy Investment Company Limited

Contractor:

Quattrogemini Ltd, Finland

Sheet piles:

AU 25 and PU 32

Pile length:

24 m and 29 m

Steel grade:

S 355 GP

Total quantity of sheet piles:

3,040 metric tons