

Ekofisk oil platform

Structural strengthening of offshore installation in Norway

Ekofisk is one of the main oil fields in the Norwegian sector of the North Sea about 280 km southwest of Stavanger. The black gold was discovered at Ekofisk field in Norwegian sector in 1969 which boosted the search for oil in the

Photos 1 and 2.
Views of the Ekofisk 2/4 oil platform.

area. This turned out to be one of the biggest oil field encompassing 3.3 billion barrel oil and more than 180 billions m³ of natural gas.

In 1971 the first platform was producing oil at that field and it still working today.

Ekofisk oil field is currently managed by Conoco Philips and has a total daily average oil production of 50,000 barrels of oil.

New technology and high oil prices have led to the decision to extend the lifetime of Ekofisk up to 2050. Structural strengthening of the sub-sea concrete structure is a part of this project. During summer of 2008 the Ekofisk 2/4 platform was reinforced. Conoco

Philips required a product with very high compressive strength, high modulus of elasticity, no shrinkage, anti-washout properties and a workability that allowed pumping in 5.08 cm flexible hose for minimum 280 m. At last or perhaps first, the product had to be approved according to the environmental regulations in the North Sea.

Developing and Using a New Mapei Product System

Rescon Mapei AS, the Norwegian subsidiary of the Mapei Group, started developing and testing in laboratory scale in January 2008 a new formulation of MAPEFILL



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N expanding mortar for anchoring, manufactured by Rescon Mapei AS and distributed in the Scandinavian countries. In April 2008 the first medium scale test was performed. The results from these tests were encouraging and next step was the full scale test at Killingøy offshore base near Haugesund. The product system for the operation was named MAPEFILL N/EG which is MAPEFILL N modified with a super-plasticiser (DYNAMON SP-3) and RESCON T, an anti-washout admixture manufactured

Photo 3. MAPEFILL N/EG expanding mortar, especially developed by Rescon Mapei AS for this project, is poured into the mixer. **Photo 4.** MAPEFILL N/EG and RESCON T are poured into the pumping machine after mixing.



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by Rescon Mapei AS. High compressive strength and high modulus of elasticity together with good pumpability characterize this product system. The mortar was pumped through a 250 m long 5.08 cm hose into a 66.04 cm steel pipe filled with water. A model of platform legs was mounted at the quay front. All sub sea operation were handled by ROV (Remotely Operated Vehicle) underwater robots. Drilling holes, handling hoses, connecting valves etc. were performed by the robots. During the offshore operation no divers was in sea. It was very satisfying to observe that the operation worked out as planned. After 3 days the grouted leg was lifted onshore, cut open for a visual inspection. The test identified crucial elements and

IN THE SPOTLIGHT

MAPEFILL

It is the international counterpart of MAPEFILL N/EG, specially developed by Rescon Mapei AS, the Norwegian subsidiary of the Mapei Group, for the Ekofisk strengthening project. MAPEFILL is a pre-blended powdered grout composed of high strength cement, graded

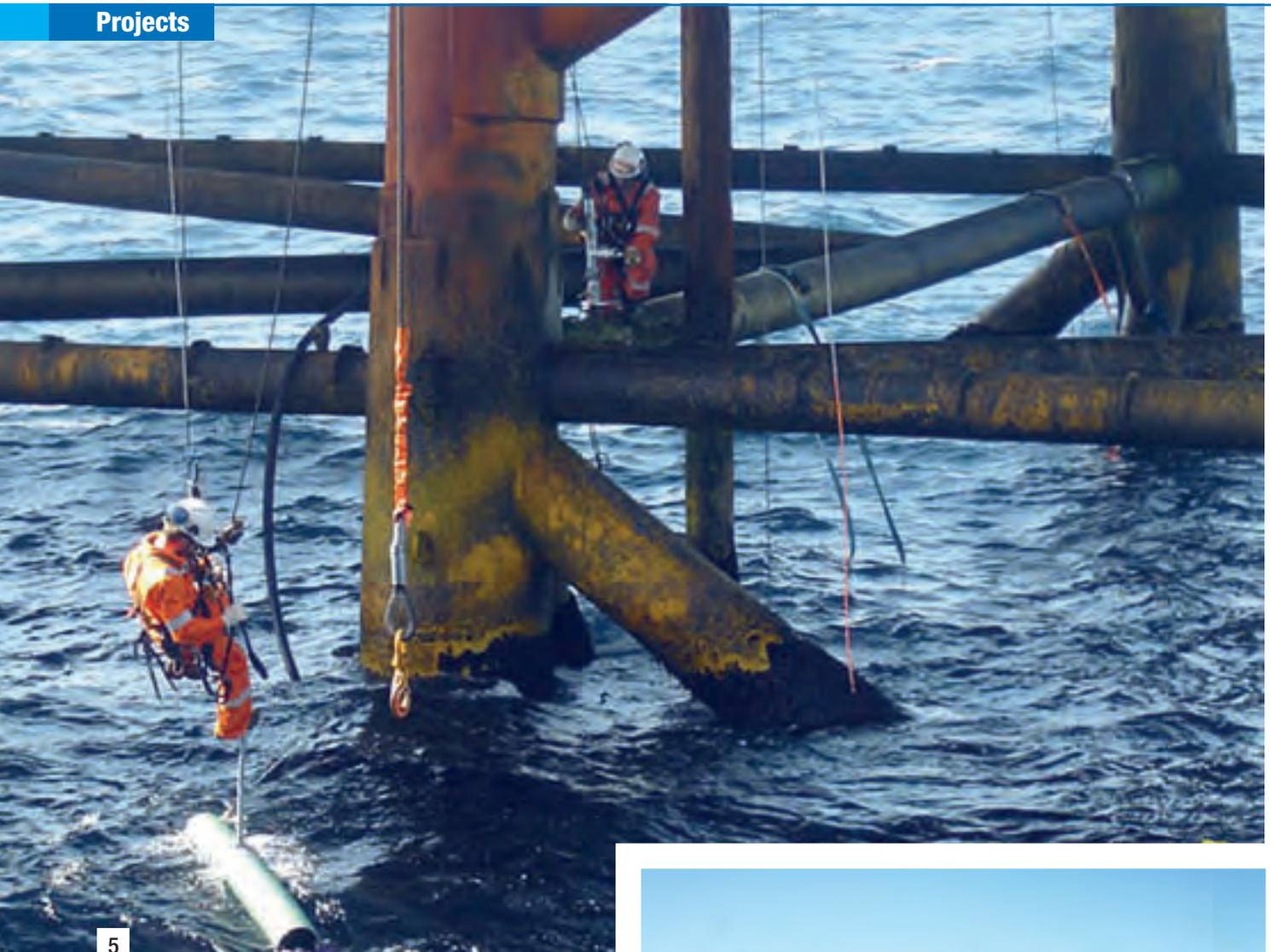


aggregates and special additives with an expansive agent formulated by the Mapei research laboratories. When mixed with water, it is transformed into a fluid grout without segregation that is able to fill intricate spaces.

MAPEFILL, due to its expansive agent, is characterized by a total absence of shrinkage in its plastic phase (ASTM norm 827) and its hardened phase (UNI norm 8147) and develops very high early flexural and compressive strength.

It also has the following qualities: excellent

impermeability to water; excellent adhesion to iron and concrete; excellent resistance to dynamic mechanical stress; modulus of elasticity and thermal expansion; coefficient similar to those of high quality concrete. MAPEFILL meets all the main requirements for **EN 1504-9** ("Products and systems for the protection and repair of concrete structures - Definitions, requirements, quality control and conformity assessment - General principles for the use of products and systems") and the minimum requirements for **EN 1504-6** ("Anchoring steel reinforcement").



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TECHNICAL DATA

Ekofisk 2/4 platform, Ekofisk oil field, North Sea (Norway)
Period of Construction: 1970 - 2000

Period of Intervention: 2008

Intervention by Mapei: supplying products for structural strengthening of the subsea concrete structure

Customer: Conoco Phillips

Contractor: Deep Ocean (Norway)

Mapei Co-ordinator: Trond Helgedagsrud, Rescon Mapei AS (Norway)

MAPEI PRODUCT

The product mentioned in this article belong to the Mapei "Admixture for concrete" range. The technical data sheets are available at the web site: www.mapei.com. Mapei plasticizers and superplasticizers for mortars and concrete have been awarded the CE mark in compliance with standard EN 934-2 and EN 932-4.

Dynamon SP-3 (CE EN 934-2, T11.1-11.2): superplasticizer based on modified acrylic polymer for precast concrete with low water/cement ratio and very high mechanical strengths at early age in winter time, without steam curing.

Rescon T is manufactured by Rescon AS and distributed on the Scandinavian countries. **Mapefill N/EG** was specially devised by Rescon AS for this project.



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Photo 5. Checking the pipes before injecting the mixture.

Photo 6. The product is being tested onshore: the pipe results to be completely filled.

after minor adjustments were made, a new test was performed. This time the result was perfect and Conoco Phillips authorized the start of the operations.

The offshore operation was performed by the Deep Ocean company, while responsible for mixing and pumping was Found Ocean. During this campaign 1300 tons of MAPEFILL N/EG were pumped into selected members of the steel structure of Ekofisk 2/4.

Mapei actively contributed to the oil platform's renovation with its usual attention to its customers' needs.

