

TECHNICAL AND REGULATORY NEWS No. 10/2016 – Casualty information

# DAMAGE TO TOPSIDE STRUCTURE OF COLUMN-STABILIZED UNITS DUE TO DIRECT WAVE IMPACT

Relevant for design offices, flag states, owners/managers of column-stabilized units.

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## Course of events

On 30 December 2015, when operating on the Troll field, a column-stabilized drilling unit was hit by a steep wave that impacted directly on the forward port side of the deck box.

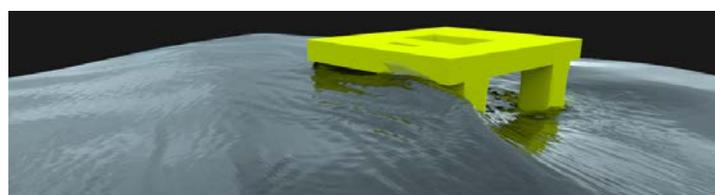
The accident was investigated by the Norwegian Petroleum Safety Authority (PSA) and the subsequent investigation report dated Friday, 8 April 2016 has now been published. One of the main conclusions in the report is that the sea state at the time of the accident was less severe than the wave condition for which the unit was designed.

The PSA's report further concludes that the unit did not comply with the requirement to have minimum 1.5-metre positive air gap between the bottom of the lower deck and the wave crest, ref. NMD-regulations for Mobile Offshore Units 2013. The forward bulkhead structure and windows were also not designed for such a wave hitting them.

## Lessons learned and new requirements for column-stabilized units

The accident has revealed that horizontal wave loads to the deckbox structure of column-stabilized units can occur from large and steep waves developed from storms which recur more frequently than 100 years. These loads have not been adequately considered in current industry standards, analytical tools and practices, and model tests. The accident is the first of its kind to any column-stabilized unit that DNV GL is aware of. Designers, yards, regulators and class societies have previously focused on structural risks posed from vertical loads caused by wave slamming and run-ups as well as horizontal forces from static water pressure in the event of damage stability conditions. This accident has provided new insight which need to be considered.

As a consequence, and in order to evaluate the adequacy of own rule requirements and pertinent industrial design practices, DNV GL has investigated and analyzed the technical circum-



stances surrounding the accident. The conclusion from this work is that horizontal wave loads must be considered for the deckbox structure if a column-stabilized unit is designed to operate with a negative air gap in storms recurring every 100 years or less.

DNV GL is currently developing two new Offshore Technology Guidelines (OTG) that can be used to document compliance with classification rules stipulated in DNV GL-OS-C103. These rules require that the annual probability of negative air gap is less than  $10^{-2}$  or require that loads are adequately accounted for in the design.

- Offshore Technology Guideline for calculation of the air gap for column-stabilized units and
- Offshore Technology Guideline for calculation of the slamming loads to be applied for design/reinforcement of structures exposed to direct horizontal slamming loads from waves

## Recommendations to owners

This accident has brought a deeper understanding with respect to air gap and wave slamming on column-stabilized units. The impact of this learning is relevant for all owners of column-stabilized units, as the original design documentation may be insufficient to prove the air gap that can occur during heavy storms and, consequently, the capacity to resist slamming loads to the deckbox structure.

All owners should therefore revisit the design documentation of their own rigs with particular focus on the air gap analysis. The DNV GL Guidance Notes, which will be available in June 2016, can be applied to substantiate that the unit has sufficient strength to withstand horizontal wave loads in accordance with existing rules.

## References

- DNVGL-OTG-13 Prediction of air gap for column-stabilized units - following soon
- DNVGL-OTG-14 Horizontal wave impact loads for column-stabilized units - following soon
- DNVGL-OS-C103

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