Methodology for managing the timing of drilling exploration in ice conditions based on the management of the geometric parameters of ice formations

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ABSTRACT

The main factor affecting the operating conditions and the reliability of offshore structures in the production of exploratory drilling in the Russian Arctic is the ice regime of the water area.

The problems of exploration drilling in the Arctic are among the most pressing issues in the development of offshore hydrocarbon deposits in the Arctic. The article considers a new approach to assessing the exploration time of offshore drilling rigs in ice conditions and the possibility of their extension in a mode that ensures their normal (safe) operation in such conditions.

As an example, the article considers the interaction of ice formations in the form of flat ice fields and their fragments with the legs of the Jack-Up platform, and their geometric parameters (area and thickness) are determined at which the ultimate state of the marine engineering structure does not occur.

KEY WORDS: ice; managing, safety, Jack-Up, icebreaker

NOMENCLATURE

ODP – offshore drilling platform
JUP - Jack-Up platform

INTRODUCTION

Issues of reconnaissance drilling in water areas with ice regimes remain relevant for economic activities in the Arctic, as traditional drilling platforms such as Jack-Up, Semisubmersible and Drilling Rig, which are widely used in world practice for drilling offshore wells, are wave-resistant, i.e. not designed to work in ice conditions. In this regard, experts are developing new types of ice-resistant offshore drilling platforms to work in difficult ice conditions (For example, Urycheva and Gudmestad, 2014; Toropov, Mokhov, Semenov and Livshits, 2013).

One of the most important indicators for assessing the effectiveness of the use of such drilling platforms in the freezing sea is the duration of the navigation period. In the Arctic, the duration of the navigation period is usually insufficient for the construction of one well. Therefore, an urgent problem is the creation of a technology for managing the timing of drilling exploration work in ice conditions based on the management of the geometric parameters of ice formations in the water area using icebreakers. Such technology should include the destruction of drifting ice fields into fragments of controlled sizes and methods for assessing the reliability of a drilling platform depending on the size of ice formations. This technique is applicable to estimating the duration of the drilling season in ice conditions for both existing drilling platforms and newly developed drilling platforms. A description of the methodology for assessing the duration of drilling operations in order to ensure the minimum required drilling time under given ice conditions is given by the example of a Jack-Up platform.

DRILLING SEASON DURATION ASSESSMENT METHODOLOGY

General

The methodology for assessing the duration of the drilling season is applicable both to exploration platforms based on the seabed and floating. Moreover, the difference in the proposed methodology will concern only its third stage in terms of solving the problem of the stability of the structure under the influence of ice.

The methodology for determining the timing of exploratory drilling for the installation of wells by a drilling platform in ice conditions involves four successive stages:

1. Assessment of the limit values of the loads on a given structure according to the criterion of local strength;
2. Assessment of the overall stability of the structure for all design cases, taking into account the depth of water at the site of exploration work for