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GAZ AND GAS CONDENSATE WORK AND PREPARATION SYSTEMS METHODS OF USE ANALYSIS

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ANNOTATION

One of the most important components of the country's gas industry development strategy is the State Program for the Creation of a Unified System of Gas Production, Transportation and Supply in 2007. Solving the problems of effective gas pipeline management includes a set of tasks for modeling and optimal planning of the operating modes of the entire chain of gas pipeline technological facilities. The solution to these problems is based on the integration of models of facilities managed by the gas production company, from wells to the compression compressor station (SCS).

Currently, there is a significant gap between the capabilities of modern gas production, gathering and processing modeling systems, such as PIPESIM, OLGA (Schlumberger) and others, and the needs of subsoil users to solve problems of modeling and controlling the operating modes of objects that perform these processes as a single system. These gaps are mainly due to the lack of mathematical models and algorithms for modeling stable and unstable operating modes of the entire gas production organization, which usually includes wells, gas well networks, field gas gathering networks (GFG), gas primary treatment facilities (GPTP), inter-field gas gathering collectors (IGGC), integrated gas complex treatment facilities (IGCP), compression compressor stations (SCS) and main gas pipelines (MGP).

Thus , the development of mathematical methods and algorithms that solve the technological problems of modeling and management of gas production complex regimes is currently an urgent task.

ANNOTATSIYA

Mamlakat gaz sanoatini rivojlantirish strategiyasining eng muhim tarkibiy qismlaridan biri 2007-yil gaz qazib olish, tashish va yetkazib berishning yagona tizimini yaratish dasturi davlat dasturidir. Gaz quvurlarini samarali boshqarish muammolarini hal qilish gaz quvurlari texnologik inshootlarining butun zanjirining ish rejimlarini modellashtirish va optimal rejalashtirish vazifalari majmuasini o'z ichiga oladi. Ushbu muammolarning yechimi quduqlardan siquv kompressor stansiyasi (SKS) gacha bo'lgan gaz qazib olish kompaniyasi tomonidan boshqariladigan inshootlarning modellarini integratsiyalashga asoslangan.

Hozirgi vaqtda PIPESIM, OLGA (Schlumberger) va boshqalar kabi zamonaviy gaz qazib olish, yig'ish va tayyorlash jarayonlarini modellashtirish tizimlarining imkoniyatlari va yer osti boyliklaridan foydalanuvchilarning ushbu jarayonlarni yagona tizim sifatida amalga oshiradigan ob'ektlarning ish rejimlarini modellashtirish va boshqarish jarayon muammolarini hal qilishdagi ehtiyojlari o'rtasida sezilarli farqlar mavjud. Bu farqlar asosan butun gazni qazib oluvchi tashkilotining barqaror va nobarqaror ish rejimlarini modellashtirish uchun matematik modellar va algoritmlarning yo'qligi bilan bog'liq bo'lib, bu odatda quduqlar, gaz quduqlari tarmoqlari, kon gazini yig'ish tarmoqlari (KGYT), gazni dastlabki tayyorlash qurilmalari (GDTQ), konlararo gazni yig'ish kollektorlari (KGYK), integratsiyalashgan gazni kompleks tayyorlash qurilmalari (GKTQ), siquv kompressor stantsiyalari (SKS) va magistral gaz quvurlari (MGQ) ni o'z ichiga oladi.

Shunday qilib, gaz ishlab chiqarish kompleksining rejimlarini modellashtirish va boshqarishning texnologik muammolarini hal qilishni amalga oshiradigan matematik usullar va algoritmlarni ishlab chiqish hozirgi kunda dolzarb vazifa hisoblanadi.

АННОТАЦИЯ

Одним из важнейших компонентов стратегии развития газовой промышленности страны является государственная программа создания единой системы добычи, транспортировки и снабжения газа, принятая в 2007 году.

К настоящему моменту сохраняется значительный разрыв между возможностями современных комплексов моделирования процессов добычи, сбора и подготовки газа, таких как PIPESIM, OLGA (Schlumberger) и др., и потребностями недропользователей в рассмотрении технологических задач моделирования и управлении режимами работы объектов, реализующих указанные процессы, как единой системы. Этот разрыв обусловлен в значительной мере отсутствием математических моделей и алгоритмов моделирования стационарных и нестационарных режимов работы всего технологического комплекса ГДП, который в общем случае включает: скважины, кусты газовых скважин, промысловые газосборные сети (ГСС), установки предварительной подготовки газа (УППГ), межпромысловые газосборные коллекторы (МПК), установки комплексной подготовки газа

(УКПГ), дожимные компрессорные станции (ДКС), магистральный газопровод (МГ).

Таким образом, разработка математических методов и алгоритмов, реализующих решение технологических задач моделирования и управления режимами газодобывающего комплекса является в настоящий момент актуальной задачей.

Kalit so‘zlar: gaz, gazkondensat, konlar, qazib olish, quduq, tizim, modellashtirish, yig'ish, tayyorlash, bosim, ob'ekt.

Ключевые слова: газ, газовый конденсат, месторождения, добыча, скважина, система, моделирование, сбор, подготовка, давление, объект.

Key words: gas, gas condensate, fields, production, well, system, modeling, collection, preparation, pressure, object.

Introduction

A gas production enterprise (GFE) is one of the most important links in a single dynamic system that includes a gas layer or a series of gas layers located one above the other, a network of gas wells that tap these layers, as well as gas production facilities for preparing the gas for further transportation, and a system of gas gathering networks within the field and an interfield collector (Figure 1).

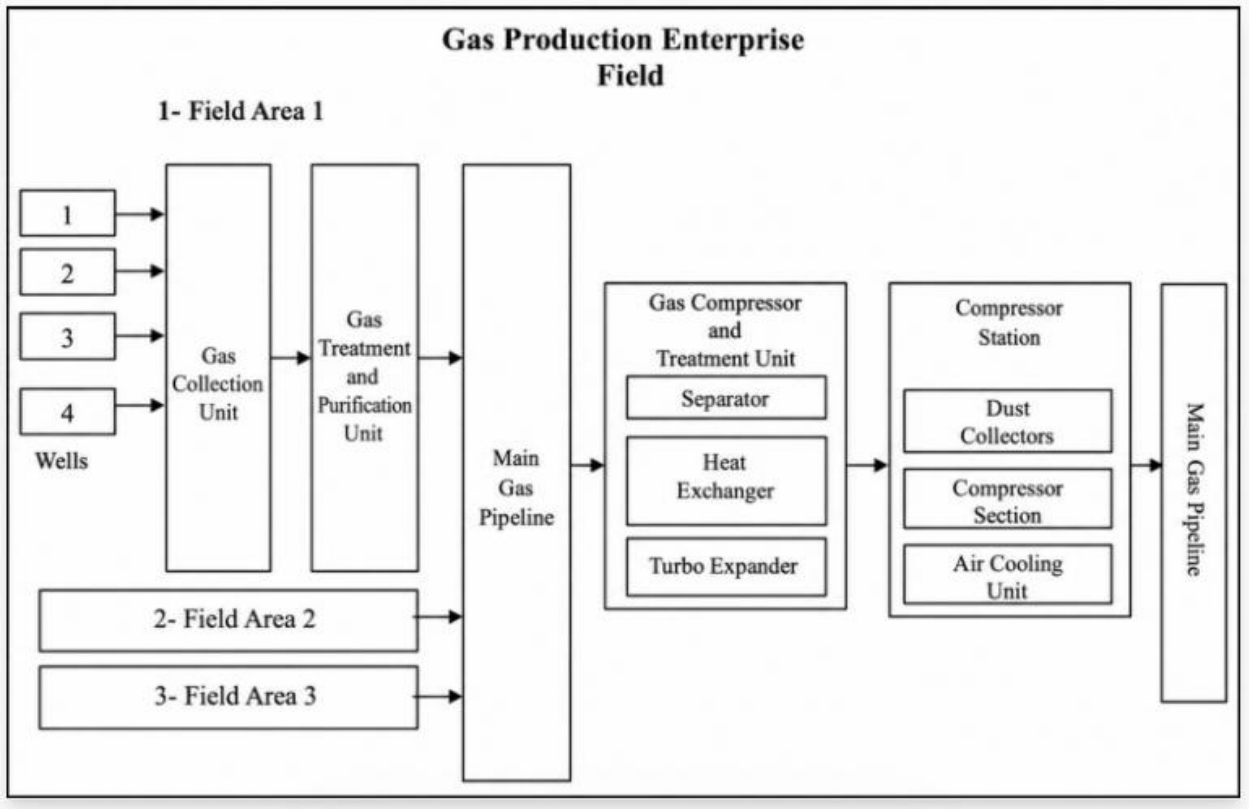

Figure 1 – Gas collection and preparation at a gas production plant scheme

A gas production facility, depending on the size of the field or fields being mined, may include several gas fields consisting of wells, a gas gathering network, a primary and advanced gas processing unit, compression stations, and auxiliary facilities [7].

The individual elements of this system are spread over an area of several tens or even hundreds of square kilometers, but they are interconnected and participate in a single technological process for the production of gas and gas condensate. In fact, a gas production enterprise is created to exploit the strata, and one of its main tasks is to maintain a rational mode of operation of the cells, which are the main production capacities of the gas production enterprise [6].

A natural gas resource is a gas-bearing layer, which is a complex hydrodynamic system and is controlled by a system of wells. Its productivity is determined by the filtration and capacity characteristics of the layer, the saturation of the liquid, its distribution over area and thickness, the location of contacts, the degree of opening, nature and quality, etc.

Analysis of literature on the topic

The fundamentals of design, exploitation and construction of gas and oil, gas condensate deposits, including modeling of the two- phase movement of hydrocarbon liquids and gases, are the subject of the work of many domestic and foreign scientists: Sh.K. Gimautdinov, A.I. Guzhov, Yu.P. Korotaev, G.R. Gurevich, R.G. Isaev, O.V. Klapchuk, G.G. Kornilov, O.L. Kuznetsov, A.N. Laperdin, B.B. Lapuka, L.S. Leibenzon, V.A. Mamaev, V.N. Maslov, V.F. Medvedev, A.Kh. Mirzadjanzade, G. E. Odishariya, A. I. Ponomarev, G. B. Pykhachev, S. A. Sardanashvili, R. M. Ter-Sarkisova, V. G. Titova, Yu. A. Kharchenko, A. I. Shirkovskiy, V. N. Shchelkacheva, M. Maskat, K. Aziz and others.

The analysis and generalization of the main results obtained by foreign researchers and the development of integrated modeling approaches in the design and operation of gas collection and purification systems allowed us to formulate the goals and objectives of this dissertation.

In modern conditions, it is difficult to imagine the process of designing the development of hydrocarbon deposits without mathematical modeling of the technological processes that occur in the layers, the well and the product collection and treatment system. In this case, equations, laws and relations from various fields of mathematics, physics, underground hydraulics, gas dynamics, probability theory and mathematical statistics are used. The works of many local and foreign scientists are devoted to the basics of development and equipment of gas and oil-gas condensate deposits: K.S. Basniev, Sh.K. Shirkovsky, M. Muskat, K. Aziz and others.

The practice of designing hydrocarbon field development involves the creation of development options based on 3D hydrodynamic modeling of field development

processes, which is carried out using such software as Navigator (RFD), Eclipse (Schlumberger), RN-KIM (Rosneft), and others. PIPESIM, OLGA (Schlumberger), PROSPER and GAP (Petroleum Experts Ltd.), and METTE (Emerson Electric Co.) are used to model the production and transportation technological processes. These software products are equipped with powerful modeling tools that allow you to create and use models of gas and condensate gathering and production systems. However, such models have very limited capabilities for taking into account the processing of extracted raw materials in the field, and well-known chemical process simulators such as HSYS (Aspen Technology, Inc.) and Unisim Design (Honeywell) can be used to solve problems of well production processing.

Research methodology

Complex modeling of gas and gas condensate collection and preparation systems is an urgent issue, the solution of which allows for the development of a coordinated technological mode of operation for all surface facilities in the mine.

The development of a comprehensive approach to the calculation of optimal operating modes for the collection and processing of well products consists in taking into account the interaction and interaction of all elements of the system.

Solving the specified tasks was carried out based on the analysis of mine data on the operation of gas collection and treatment systems, the use of gas dynamics models, and numerical methods of mathematical modeling of the movement of gas-liquid mixtures in pipelines, taking into account phase transitions.

Analysis and results

To propose an empirical linear dependence on the natural gas flow rate and the pressure at the inlet to the device to calculate the amount of helium in the natural gas after membrane separation in the gas and gas condensate field.

A methodology for calculating the operating modes of the system for collecting and preparing well products from gas and gas condensate deposits has been developed.

Development of algorithms for optimal planning of gas and gas condensate collection and treatment system operating modes and implementation of their software for modeling the coordinated operating modes of the complex of technological facilities of the "well-GYT-GDTQ-KGYK-GKTQ-SKS-MGKAQ-SKS" system of gas producing organizations.

software and computing system of gas producing organizations . The results of the presented calculations are based on real data obtained from gas fields.

An algorithm for calculating the maximum productivity of a gas field is proposed. This algorithm makes it possible to achieve the specified pressure at the outlet of the gas collection network while observing the process limitations of all elements of the gas and gas condensate collection and treatment system. It does not

require multivariate calculations, which distinguishes the proposed solutions from existing solutions that serve similar purposes.

Conclusions and suggestions

An analysis of the general principles of solving and resolving problems in the management of gas and gas condensate collection and purification systems was conducted. It was shown that for effective management of gas and gas condensate collection and preparation systems aimed at improving their technical and economic indicators, it is necessary to consider the entire complex of gas and gas condensate collection and preparation system facilities as a single system and coordinate their operating modes.

of gas and gas condensate collection and preparation systems as a conditional directed graph is considered. This approach is unlimited and can be used to model gas and gas condensate gathering and preparation systems with a variety of facility configurations that require appropriate process models .

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