SUMMARIES

Artymiuk J.: **Drilling Pipes Made of Aluminum** • Drilling Oil and Gas 2007 • Volume 24 • No. 2

Pipe products and their connections constitute the most significant group of products oil industry, as the success and safety of exploration and exploitation depends on them. The transport of hydrocarbons greatly depends on these products. Pipes and connections have a variety of shapes and design. This especially applies to the connections and subs. In a majority of cases this is steel of various strength and chemical properties. The low resistivity to corrosion and considerable weight are the main disadvantages of steel products. Researches are made on finding new materials which would substitute the traditional steel pipe products. Pipes made of aluminum alloys reveal good results. The pipe products made of aluminum alloys and their applicability for exploration and exploitation works are discussed in the paper.

Keywords: *pipes, aluminum alloys, oil industry, drilling*

Artymiuk J.: **Comparison of Aluminum and Steel Drilling Pipes** • Drilling Oil and Gas 2007 • Volume 24 • No. 2

Drill string is a long cylinder with a longitudinal opening inside, consisting of sections (drilling pipes and collars) from 8.5 m to 9.5 m long and from $3^1/_2''$ to $6\ ^5/_8''$ in diameter, fastened by threaded connections. The most frequently applied material is steel of various strength parameters, of considerable weight as compared to the strength parameters. Analyses were made to find components which could substitute the traditional steel material with another one, equally strong but lighter. Every kilogram on hook means bigger energy consumption of the rig and bigger (and so heavier) elements in the drawing system. Attempts were made to compare mud pipes made of steel and aluminum alloys. It was indicated that further research and construction works on aluminum drilling pipes should be continued.

Keywords: *drill string, production pipes, aluminum alloys, comparison*

Artymiuk J., Bednarz S.: **Analysis of Corrosion Wearing of Production Pipes Used for Well in Underground Gas Storage Swarzów 22** • Drilling Oil and Gas 2007 • Volume 24 • No. 2

The presence of hydrogen sulfide in the natural gas exploited from the underground gas storage Swarzów is a serious problem. Hydrogen sulfide causes corrosion of the production pipes and the surface manifold, which affects the exploitation parameters of the USG and its technical condition. The destructive activity of hydrogen sulfide causes that the well loses its exploitation parameters, is much faster contaminated with the corrosion products, requires cleaning and washing with special agents. This effect is especially well visible in the well Swarzów 22. The well was worked over: the production pipes were tripped out and subjected to strength-structural analyses to confirm the degree of damaging with corrosion and the acid environment.

Keywords: *production pipes, H_2S corrosion*

Frodyma A., Wilk Z.: **Methods of Cumulative Perforation for Hydrocarbon Deposits Completion** • Drilling Oil and Gas 2007 • Volume 24 • No. 2

Perforation using shaped charges, as a method of deposit development in oil and gas mining is, in practice, the only commonly used method of obtaining hydraulic interconnection of cased borehole and productive reservoir layer. The study presents historical outline of cumulative perforation and development of basic techniques in this

domain. It discusses various conveyance methods – wireline, production tubing (TCP) and coiled tubing (CT), through tubing perforation (TTP), as well as methods of ignition depending on job technology used. Two basic carrier concepts – hollow carrier (closed type) and bar carrier (open type) are characterised, as well as sets of shooting means (detonating cords, shaped charges, detonation initiators) that can be purposefully used with them. The basic requirements, that should be fulfilled by shaped charges depending on main task of perforation (horizon opening, preparation for intensification job – fracturing, for example, as well as special jobs – i.e. restoring of lost circulation with perforator – puncher) has also been presented. In context of this review, currently used and approved sets of shooting equipment and means for cumulative perforation are presented, including some new approaches, such as technology of reactive liners and perfo-generators.

Keywords: *hole mining, completion, cumulative perforation, blast materials, perfo-generators*

Herman Z., Uliasz M.: **Protection of Oil and Natural Gas and the Environment during Completion and Workover Operations with the Use of Brines** • Drilling Oil and Gas 2007 • Volume 24 • No. 2

This paper presents laboratory test of dribling fluids based on potassium and cesium formats. Possibilities of field applications of above fluids are discussed for completions and workower operations.

Keywords: *completion and workover of wells, special muds, formate salt solutions*

Jewulski J., Wojnarowski P.: **Selected Aspects of Perfecting Secondary Methods of Oil Deposits Exploitation** • Drilling Oil and Gas 2007 • Volume 24 • No. 2

The mechanism of oil displacement with injected water and gas was presented in the paper. The correct selection of a displacing fluid is very important for these secondary recovery methods. Laboratory investigation results for water, Rokamid solution and air were presented. On the basis of measurements recovery factors were calculated and influence of fluid on secondary method efficiency was determined.

Keywords: *exploitation of deposits, secondary methods, water and gas saturation of deposits*

Kasza P.: **The Development of New Methods for Hydrocarbon Reservoirs Stimulation** • Drilling Oil and Gas 2007 • Volume 24 • No. 2

Last decade it is period of dynamic development of stimulation methods and technologies. The firs stage of this was purchase of new stimulation service and stimulation laboratory equipment. It allows to introduce new technologies for industry use. The new technologies was prepared for two types of stimulation acivities. The first on is hydraulic fracturing. New kind of stimulation fluids and new proppants were prepared to increase treatment efficiency. The second area of activities is development of novel acid fracturing and matrix acidizing methods. New technologies of gelled and emulsified acid were prepared for industry use. All prepared technologies are used for stimulation treatment of oil and gas wells in Poland and abroad.

Keywords: *exploitation of hydrocarbons, enhancement stimulation techniques, hydraulic fracturing, matrix acid-treatment*

Knez D., Bednarz S.: **Numerical Analysis of Efficiency of Reverse Wells for Percussion-Rotary Bits** • Drilling Oil and Gas 2007 • Volume 24 • No. 2

The percussion-rotary bits used for drilling blast holes in mining is still justifiable from the economical point of view. Cogged-bits are more frequently applied than the cross-blade bits. The drilling rate and footage are to some extent limited by the quality of washing the wellbore bottom. The disturbed process of cuttings removal from the

well with air mud in the zone where the bit is connected with the downhole hammer. Attempts at using the reverse holes in the bit body were made. The analytical description of the effect is hindered by the complex shape of the space in which the mud is flowing. Therefore, the use of numerical methods enables detailed description of drilling mud flow in view of the analyzed problem. The paper presents the results of computer simulations in the form of maps of pressure and flow rate in the zone of the bit and downhole hammer.

Keywords: *bit, simulation of flow, finite elements method*

Macuda J., Lewkiewicz-Małysa A., Konopka E.: **Technical and Technological Aspects of Injection of Reservoir Water to the Rock Mass** • Drilling Oil and Gas 2007 • Volume 24 • No. 2

Reservoir water injection to the rock mass through disposal wells should meet mining and environmental safety requirements. This problem is of special significance in the case of wells that are either abandoned wells or to be closed. The selection criteria for disposal wells and range of necessary tests and analyses of post-exploitation wells' construction designed for injection of reservoir water are presented in the paper. The results of laboratory analyses of reservoir water of known physicochemical properties were used for determining and eliminating original factors favorable to the colmatation of the near-well zone.

Keywords: *reservoir waters, injection zones, water treatment, sedimentation, flocculation, colmatation, near-well zone*

Nagy S.: **Computer Programs for Modelling Exploitation and Management of Hydrocarbon Deposits** • Drilling Oil and Gas 2007 • Volume 24 • No. 2

The common availability of computer system over the last twenty years exerted influence on the philosophy and practical use of calculation techniques for modelling exploitation and management of hydrocarbon deposits. Another factor having an influence on the development of software was the faster process of geologic data processing as well as the way in which deposit data were collected and monitored; in the case of gas transport – it is also the gas parameters during gas and oil transport operations. The great progress in hardware technology is accompanied by the software novelties. Some of them, i.e. selected calculation programs used for oil engineering are presented in the paper.

Keywords: *oil engineering, hydrocarbon exploitation, computer systems*

Rybicki C., Blicharski J.: **Movement of Water in Hydrocarbon Deposits and Underground Gas Storages** • Drilling Oil and Gas 2007 • Volume 24 • No. 2

When a well starts its operation on a deposit or underground gas storage, a zone of lowered pressure is formed around it, enabling reservoir fluid inflow. Later in time the pressure is disturbed, also affecting the hydrated zone, and causing water flux to the well. Irregular forms, e.g. „tongues" or „water cones" are formed at that time. In reservoir engineering there are various methods of determining the admissible yield in view of the water cone formation.
Irregular forms of water migration have a great influence on the process of gas exploitation from a deposit, especially from an underground gas storage. They are frequently the main reason of pressure drop in the well, needed for carrying up the gas-water mixture. In the extreme case, water flowing to the well may be not exploited with gas. Then it is accumulated on the wellbore bottom, stopping the gas inflow, and so leading to the gradual stopping of production. Thus the movement of reservoir water and its tracing is especially important during underground storing of gas, when the water cyclically moves within the reservoir.
The main methods of calculating the water flux to a well was analyzed and the movement of reservoir water was investigated in the case of a sharp gas-water interface. This signifies that capillary forces were neglected and gas is expelled by water as a result of "piston" effect. Piston expulsion of gas by water is a reasonable assumption owing to a much bigger density and viscosity of water as compared with gas.

Keywords: *oil engineering, hydrocarbon deposits, underground gas storages, reservoir water flow*

Rybicki C., Łuczyński S.: **Measurement of Flow Rate** • Drilling Oil and Gas 2007 • Volume 24 • No. 2

The quantitative measurement of gas in the master pipelines or distribution pipelines is usually made on gas stations. Three types of gas meters were characterized in the paper along with their principle, range of application and accuracy of measurement. The following types of gas meters were discussed:
– Contraction gas meters,
– Turbine gas meters,
– Rotary gas meters,
– Bellows gas meters,
– Ultrasound gas meters,
– Gas meters based on Coriolis force,
– Thermal gas meters,
– Optic gas meters.

The authors stressed that the gas meter should be selected on the basis of the range of measurement and also certain specific parameters, which can be either advantageous or disadvantageous. The positive and negative features of the most frequently applied flow meters were presented on the basis of literature data.

Keywords: *gas flow, gas meters, flow meters*

Siemek J., Nagy S.: **Underground Gas Storages of Natural Gas in Abandoned Coal Mines** • Drilling Oil and Gas 2007 • Volume 24 • No. 2

Restructuring of coal mining industry in Poland after 1989, and so the closing of about 40 deep mines, prompted analyses of the potential applicability of abandoned workings as gas or liquid fuels storages. Foreign solutions making use of abandoned excavation and natural pore space for storing hydrocarbons. The UGS should be construed when the dewatering system is operational. Issues related to the environmental hazard during construction and exploitation of UGS in abandoned mines as are described. The economic analysis of the cost of two separate UGS in selected mines has been done. The two selected mines have the largest methane capacity, accounting for total capacity of workings and old workings, as well as sorption capacity of the left out coal. The analyses prove that the conversion of mines from Upper Silesian into underground gas storages is possible.

Keywords: *abandoned coal mines, natural gas underground storage, UGS*

Stopa J., Rychlicki S., Wojnarowski P., Kosowski P.: **Use of Multilateral Wells on Oil and Gas Exploitation** • Drilling Oil and Gas 2007 • Volume 24 • No. 2

Multilateral wells in comparison with traditional, vertical wells may bring many benefits like: increase of the reserves, significant increase of production, decrease of operational and capital costs and higher profits. But on the other hand one multilateral well requires substantially higher capital costs than single vertical well and such wells are more risky and more technically complicated. In this paper authors present evaluation of technical and economic efficiency of multilateral wells applied to exemplary oil and natural gas fields in Poland. Variant, numerical simulations were conducted in order to evaluate productivity of multilateral and vertical wells and their results were used in economic estimation.

Keywords: *multilateral wells, numerical simulation, oil and gas exploitation*

Stryczek S., Gonet A., Wiśniowski R.: **New Generation and High Strength Sealing Slurries with Sodium Zeolites** • Drilling Oil and Gas 2007 • Volume 24 • No. 2

One of the most important factors influencing the efficiency of costly sealing operations of ground or rock mass is the properly selected durable sealing slurry. Many years' application experience reveals that hardened slurries used for sealing-reinforcing operations are exposed to extreme exploitation conditions. This mainly results from the aggressive character of their immediate environment. It follows from Polish and World's experience that special application role is played by alkaline-slag slurries, the high durability of which has been confirmed in practice. The properties of fresh and set slurries can be regulated in a vast range with mineral and chemical additives, e.g. klinoptilolite zeolites. The results of analyses of set alkaline-slag slurries admixed with Slovak klinoptilolite zeolites,

maturing in natural conditions characteristic of geoengineering works lying in sealing of ground and rocks as well as hydrothermal works in the case of casing cementation in deep wells, are presented in the paper.

Keywords: *sealing slurries, sodium zeolites, resistivity to corrosion*

Stryczek S., Wiśniowski R., Gonet A.: **Geopolymer Slurries for Sealing the Rock Mass with Hole Injection Methods** • Drilling Oil and Gas 2007 • Volume 24 • No. 2

Drilling, mining, hydrotechnical and engineering operations are frequently related with geotechnical problems requiring reinforcing and sealing of the ground and the rock mass. The basic works are usually carried out with the borehole injection methods and the properly applied sealing slurries. Portland cement sealing slurries have a number of shorcomings, e.g.: long time of setting, incorrect rheological properties. These disadvantages can be significantly improved by admixing selected mineral additives. Hence, recently this problem has been intensely investigated in view of further development of binders and sealing slurries to obtain a new generation of the so-called geopolymer slurries. Geopolymer slurries are based solely on inorganic components.

Keywords: *sealing slurries, hydraulic and puzzolan additives, borehole injection*

Warowny W., Rychlicki S.: **Some New Technologies of Natural Gas for Transport and Energy Applications** • Drilling Oil and Gas 2007 • Volume 24 • No. 2

There is a need for non-pipeline technologies that can capture and transport natural gas to markets, especially for stranded gas reserves and for shorter distance transport of the gas. For this purpose following technologies are developed: natural gas hydrate (NGH), compressed natural gas (CNG) and thermoacoustic liquefaction. All of these technologies are relatively new and not finally mature. In the second case, for energy applications have been considered fuel cells, CNG for vehicles and new energy measurement method. Applications of the fuel cells are very extensive, e.g. in: electronic devices, home, transportation, military, power and industrial installation. Fuel cells are still heavily under technological development and their present state are very expensive. The natural gas has a promising future as the cleanest an alternative fuel for vehicles, because reduces the emission toxic exhaust gases, greenhouse gases and noise level. It is especially important in the cities, where is the greatest concentration of people and vehicles. For energy measurement, instead conversion of volume for known composition, a correlation method is proposed. A new concept of the method is based on measurement of physical properties.

Keywords: *fuel cells, hydrate transport, CNG transport, natural gas for vehicles, thermoacoustic liquefaction, natural gas energy measurements*

Warowny W., Siemek J.: **Chemical and Electrochemical Processes in Some New Technologies of Natural Gas** • Drilling Oil and Gas 2007 • Volume 24 • No. 2

This paper contains basic information for chemical conversion of the natural gas, including reforming reactions of methane and picture with gathered reforming products of natural gas. Few new selected natural gas technologies have been shortly described, among them: gas to liquid (GTL), dry reforming, production (via synthesis gas) of the hydrogen, methanol, and dimethyl ether (DME) and some motor additions. Additionally, electrochemical processes for fuel cells have been given.

Keywords: *natural gas reforming, dry reforming, dry reforming, synthesis gas fuels, GTL technology, fuel cells*

Wiśniowski R., Stryczek S.: **Designing the Trajectory of a HDD Well** • Drilling Oil and Gas 2007 • Volume 24 • No. 2

Each year the number of new pipeline systems made for enginerring and environmental purposes increases. Apart from classic construction methods (open linear trenches) there are more and more frequently applied trenchless technologies, e.g. push-through methods, microtunneling and various near-wellbore methods. Horizontal directional well drilling methods are frequently applied. The efficiency of this use of this technology is conditioned by the

correctly designed and performed trajectory of the well's axis. The trajectory of a HDD well is a derivative of such factors as: geologic and hydrogeologic conditions, morphology, existing surface and underground infrastructure, as well as technical and technological feasibility. Basing on the assumed design data, a decision can be made as to the type of spatial trajectory of a HDD well. The paper presents principles of determining spatial coefficients of HDD well's trajectories for 2D and 3D spaces, worked out at the Faculty of Drilling, Oil and Gas, AGH-UST. Accordingly, profiles of drilling wells used in the engineering practice as well as mathematical bases for multivariant determining parameters characterizing rectilinear and curvilinear trajectories, were presented. The proposed methods are recommended to be used for engineering applications.

Keywords: *well's designing, horizontal drilling, HDD wells*

Wysocki S., Bielewicz D., Wysocka M.: L**ab Research of New Cationic-Starch Based Muds for Drilling in Shales** • Drilling Oil and Gas 2007 • Volume 24 • No. 2

In this paper results of inestigations of new muds with cationic polymers are presented. Research was conducted in simulted downhole conditions. Test results shown that new cationic-starch based drilling muds have very good technological parameters.

Keywords: *clay-free drilling muds, polymers*

Zawisza L.: **Determining Location of Reservoir Contours for Oil Deposits on the Basis of Hydrodynamic Criteria, and Accounting for the Changing Density of Reservoir Fluids and Capillary Pressures** • Drilling Oil and Gas 2007 • Volume 24 • No. 2

The size and magnitude of a reservoir trap are determined by the geologic boundaries of strata and contour of the reservoir. The location of contours is determined by the movement of the flowing reservoir water, reservoir properties of rocks and properties of reservoir fluids. An original methodics of mapping reservoir traps for oil is presented in the paper. The method employs both the influence of groundwater dynamics and also variability of density of reservoir fluids and the capillary pressure effect on the location of the contours. It enables determining locations of hydrodynamic traps in a 3D space, in the condition of flowing water and high variability of properties of reservoir rocks and reservoir fluids. The method also enables determining reservoir contours both in the structural and stratigraphic type of reservoir. The realization of the presented method of mapping reservoir traps in presented on the example of oil fields Pomorsko and Czerwieńsk, occurring in the Main Dolomite beds in the Fore-Sudetes area.

Keywords: *hydrodynamics, capillary pressure, petroleum traps, oil-water contacts*

Zawisza L., Nagy S.: **Existing and Perspective Hydrocarbon Deposits in Poland** • Drilling Oil and Gas 2007 • Volume 24 • No. 2

The present state and forecasts concerning the hydrocarbon resources are presented in the paper. The high-methane and nitrided natural gas fields as well as oil in the Polish Lowland in the Carpathian Foredeep, the Carpathians and in the economic zone of the Baltic Sea are discussed. The already exploited and predicted resources are presented. The present forecasts of hydrocarbon production and perspective prospecting potential are analysed. The maps of concessions for prospecting, exploration and production of oil and natural gas are listed, accounting for the zones of perspective prospecting in the selected geologic formations. The program of increasing storage capacities in underground gas storages is discussed.

Keywords: *hydrocarbon deposits, exploration, exploitation, resources*