

**EDWARD ANTONOVICH BONDAREV**  
**(14.07.1936–09.05.2019)**

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On May 9, 2019, the prominent scientist, Doctor of Technical Sciences, Professor Edward Antonovich Bondarev passed away. Edward Antonovich will remain forever in his colleagues' and friends' memories as a gifted scientist, an outstanding educator, an organizer of science and a good person.

*Prominent scientist, thermohydrodynamics, oil and gas production and transport, hydrate formation, permafrost*



On May 9, 2019, Professor Edward Antonovich Bondarev, Doctor of Technical Sciences, Honored Researcher of Russian Federation (2007) and of the Yakut ASSR (1986) passed away.

Edward Antonovich Bondarev was born on July 14, 1936 in the town of Mozyr, Belorussian SSR. In 1954, he finished secondary school with a silver medal, and in 1959, he graduated from the Moscow Gubkin Institute of the Oil and Gas Industry. After graduation, Edward Bondarev was employed as a junior researcher in the department of the filtration theory of the Institute of Mechanics of the Academy of Sciences of USSR, headed by corresponding member of the Academy of Sciences L.A. Galin. In 1965, he joined the faculty of his Alma Mater (now the Gubkin Russian State Oil and Gas University) in the position of a senior researcher and defended a candidate's thesis a year after. In 1970, Edward Bondarev was invited to work in the Institute of Physical and Technical Problems of the North, SB AS USSR, by

the outstanding scientist Academician Nikolay Vasilyevich Chersky.

By that time, cases of formation of natural gas hydrates in the bottom-hole area in formation drilling, their deposition on the walls of wells and gas pipelines in production and transportation of gas in northern territories were already known. Accelerated production of gas in these territories required that the theoretical foundations of formation and decomposition of gas hydrates in the systems of gas production and transportation should be laid, and Edward Bondarev was one of the founders of these studies. He is one of the founders of the modern ground hydraulics, which is non-isothermal gas filtration. In 1981, Edward Bondarev defended a doctorate in mechanics of liquids and gases in the Institute of Thermal Physics, SB AS USSR. In 1970–1999, Bondarev occupied the positions of the head of a laboratory, the deputy director of the Institute of Physical and Technical Problems of the North, and in 1999–2019, he was the

deputy director and principal researcher of the Institute of Oil and Gas Problems, SB RAS.

Under the guidance of Edward Antonovich, a new scientific direction was established and has been successfully developed for already more than 40 years, mechanics of hydrate formation in the systems of gas production and transport. Here, based on the principles of mechanics of multiphase media, a mathematical model of multiphase non-isothermal filtration was developed, considering formation (dissociation) of hydrates in gas production and the model of hydrate formation during gas flow in pipelines. The first model allowed a number of new effects to be predicted in the behavior of forming hydrates in productive formations and an important practical problem of the effectiveness of thermal impact on the bottom-hole area of gas-bearing formations to be solved. The second model provided qualitative assessment of the growth of the hydrate layer in wells and in trunk pipelines and revealed those technological parameters of the process, the proper choice of which allowed either complete elimination of hydrate formation or minimization of its negative effect on the gas production and transport systems. The findings by Edward Bondarev found wide practical application in solving the tasks of raising the quality of managing the operating wells due to timely impact on the bottom-hole area of the wells by inhibitors of hydrate formation or by the bottom-hole area heaters, which allowed the gas production industry to raise the reliability of the gas supply systems.

Professor Bondarev proposed new approaches to the solution of the problems of thermal and mechanical interaction of wells and pipelines with frozen rocks, based on assessment of thermal processes (convective transport and thermal conductivity and phase transitions), as well as the new statement of the Stefan problem considering non-resilient deformity of frozen rocks. The use of these approaches contributed to enhancement of the reliability and effectiveness of operation of oil and gas wells in the regions of Far North (Republic of Sakha (Yakutia), Tyumen region and Krasnoyarsk krai). These results became part of the Regulations on Construction of Wells in the Permafrost Zone, approved by the Ministry of Oil and Gas Industry of the USSR (1986). A large part of the scientist's work was devoted to the study of interaction between engineering structures and frozen ground and rocks: he proposed models for a number of physical processes and developed methods of problem solution.

Bondarev authored more than 350 publications, including 12 monographs – devoted to various aspects of applied mathematics: multiphase flow of liquids and gas in porous media, pipe hydraulics, associated problems of heat and mass transfer in the systems of gas production and transport. Among the collective works, such monographs should be men-

tioned as “Mechanics of Hydrate Formation in Gas Flows” (1976), “Non-isothermal Flow of Gas in Pipes” (1978), “Thermohydrodynamics of Gas Production and Transport Systems” (1988), “Methods of Identification of Mathematical Hydraulics Problems” (2014), “Solution of Problems of Pipe Hydraulics in the Natural Gas Production and Transport Systems” (2017), etc.

The teaching experience of Edward Antonovich Bondarev is extensive and unique. Beginning with 1971, he was a professor of the Yakutsk State University, where he delivered lectures on applied gas hydrodynamics to physics students and lectures on the theoretical foundations of oil and gas production to students of mining and oil production engineering. He left behind a great number of thankful followers, including 5 doctors of science and 12 candidates of science.

Edward Antonovich Bondarev was a member of the Russian national committee on theoretical and applied mechanics, of dissertation councils for conferring scientific degrees in the Institute of Physical and Technical Problems of the North SB RAS, Melnikov Permafrost Institute, and Yakutsk State University named after M.K. Ammosov (now North-eastern Federal University). He often acted as an opponent during defense of candidate's and doctorate theses in many cities of Russia.

Edward Antonovich Bondarev was the honored veteran of SB RAS, the honored worker of science and technology of Russian Federation (2012), the honored member of the Russian Academy of Natural Sciences (2012), the holder of the first Academician Chersky medal (2004) and of the sign of the Republic of Sakha (Yakutia) “Civil Merit” (2016).

Edward Bondarev was a charismatic, lively and highly educated person with a considerable creative capacity. He was the kind of a person about whom people usually said: I was lucky to work with him; he is one of those people meeting with him enriches; we admire the depth of his knowledge and the diversity of his interests: literature, painting, music, chess, and more... At the same time, he is known for his assertiveness in science, hard work and readiness to share his ideas. If Edward Antonovich came somewhere, that meant the time of jokes and wit for all. The scope of his professional communication was amazing: he had colleagues and associates in Novosibirsk, Moscow, Tyumen, Kazan, Ufa, Baku, Irkutsk, Alaska, Canada, Israel, Norway, Great Britain, etc. He demonstrated a bright example of selfless and dedicated service to science. Next to him, one always wanted to be in shape, to learn, to develop and to become better.

Edward Antonovich Bondarev will be remembered by his numerous followers, colleagues and friends as a scientist of world importance, a teacher with a broad outlook, a faithful and helpful friend, and a remarkable and intelligent person.