FIFTY YEARS AT THE GROZNYI PETROLEUM SCIENTIFIC-RESEARCH INSTITUTE

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After nationalization of the petroleum industry, which had been destroyed during the period of the civil war, the young Soviet Republic faced certain extremely important tasks in the fastest possible restoration and subsequent improvement of petroleum facilities, increases in petroleum production, improvements in the operating indices of petroleum refinery units, and the development of new and more efficient methods for petroleum production and refining.

Research studies in depth were required in order to achieve these goals. In this connection, one of the first petroleum research centers in the Soviet Union was organized; this was the Groznyi Petroleum Scientific-Research Institute (GrozNII), organized on the basis of personnel, equipment, and developments of the central oil-field and refinery laboratories of the production association Grozneft'.

During the organizational period, 350 persons were working at the Institute, including about 100 highly qualified engineers and chemists.

Over the course of many years, GrozNII was an institute for research in the fields of geology, drilling, petroleum production, and petroleum refining. In 1965, on the basis of the geological and oil-field laboratories of GrozNII, an independent institute was organized, the Northern-Caucasus Petroleum Scientific-Research Institute (SevKavNIPlneft').

GrozNII has become an institute for petroleum refining and petroleum chemistry, which today includes a pilot plant and a Lower Volga Branch (in Volgograd).

Working at the institute today are 69 Candidates and Doctors of Sciences, and more than 670 graduate engineers. Over the past half-century of activity, more than 30 major developments have been carried out here, with major impact on the growth of petroleum refining and petrochemical production.

In this institute, which was founded in one of the most important petroleum centers of the nation, fundamental research was carried out during the prewar period on the chemical composition of various crude oils, particularly the naphtha fractions; for the first time, scientific principles were developed for the thermal cracking of petroleum residues; the composition of gaseous raw materials in the Northern Caucasus was investigated; and a domestic process of sulfuric acid alkylation was developed. This research provided the scientific basis for the design of new process units for primary crude oil processing, thermal cracking, and alkylation, so that by 1940-1941 it was possible to raise Soviet petroleum refining to a qualitatively new level.

During the period of the Great Patriotic War [WW-2], the staff of the Institute, finding themselves under conditions of the front, did much for the armed forces protecting the Caucasus, as they turned their efforts over to the development and manufacture of products for defense. At the same time, they did not end their efforts in the development of processes for alkylation and catalytic cracking. The first experimental/commercial unit in the nation for catalytic cracking with a moving bed of bead catalyst was built in 1946 in Groznyi. For solving a number of basically new scientific and technical problems in the field of catalytic cracking, a group of workers of the institute — B. K. Amerik, Z. G. Orkina, and K. G. Lavrent'ev headed by V. S. Federov — was awarded a State Prize.

In the postwar period, research performed at GrozNII was used as the basis for development and commercialization of aluminosilicate cracking catalysts, various types of jet fuels, and the manufacturing technology for dewaxing diesel fuels with crystalline urea.
Zeolites were synthesized in 1959 and produced commercially in 1960, opening up new directions in the technology of a number of petroleum refining processes. At the end of the 1960's, granulated binder-free zeolites were developed; also, new zeolitic cracking catalysts with rare-earth elements, of the Tseokar type, were developed and commercialized, making it possible to step up the output of high-octane gasoline in existing units by a factor of 1.3-1.5.

An important place in the work of the Institute is occupied by research in the field of paraffins. At the end of the 1950's, scientific principles were worked out for the modern technology of paraffin wax production, and in 1972-1974 the technology was worked out and commercialized in four plants in the USSR for the production of high-purity paraffin waxes for the food industry.

Carrying out the decisions of the Party and Government on the establishment of large-scale production of liquid paraffins and low-pour diesel fuel in the USSR, a number of refineries have built urea dewaxing units; also, at the Lenin Petroleum Refinery in Groznyi, an experimental/commercial plant has been built for the recovery of liquid paraffin in a fluidized bed of microbead zeolite, using a feedstock distilling up to 360°C and containing sulfur in amounts up to 0.2%. The development of a large-scale commercial unit is going forward at the present time.

On the basis of recent research in the field of alkylation, guidelines have been developed for the design of units with feedstock capacities of 180,000 and 400,000 metric tons per year; also, in cooperation with the Institute of Organic Chemistry of the Academy of Sciences of the USSR, a basically new alkylation process, using solid catalysts, has been proposed.

The Institute was the first in the USSR to use the principle of combining manufacturing processes in broad-scale development work. Successfully operating at the Angarsk and Kremenchug refineries are GK-3 combination units developed by GrozNII and Grozgiproneftekhim [Groznyi State Design Institute for the Petroleum Refining and Petrochemical Industry], including processes for the atmospheric distillation of crude oil, redistillation of straight-run naphtha, vacuum distillation of long residuum, visbreaking of short residuum, catalytic cracking of vacuum distillates, distillation and stabilization of cracked products, and compression and fractionation of gases.

Together with Grozgiproneftekhim, GrozNII has developed KM-1 and KM-2 combination units for lube oil production for the Drogobyxh and Novo-Yaroslav refineries. Further development of the principles of combining units was accomplished in the KT-1 combination unit developed at Grozgiproneftekhim and GrozNII for the deep processing of long residuum, this unit including sections for vacuum distillation of the residuum, visbreaking of the tar, hydrotreating and catalytic cracking of the vacuum distillate (on the basis of a 43-107 unit), and fractionation of the reaction product.

During the past years, the Institute has investigated hundreds of crude oil samples from various fields and has issued recommendations on processing methods. The results from these studies have served as the basis for design and reconstruction of a number of refineries.

The scientists of GrozNII have tested their ideas and developments in many pilot units in the experimental plant. These units have capacities from a few liters to several hundred tons of feedstock per year. The experimental plant is also producing semicommerical batches of products, particularly zeolites and catalysts. At the Institute, a system for the automation of scientific experiment has been developed and introduced, on the basis of an M-6000 computer and pilot units in the experimental plan.

In investigating crude oils and petroleum products, the latest methods of analysis are being used, such as spectroscopic, x-ray, derivatographic, electron-microscopic, etc. In investigating the properties and activity of catalysts and zeolites, semiautomatic experimental units are being used. Fundamental research on basic problems is being performed in close cooperation with the scientists of 40 institutes in the country, including those in the scientific-research institutes of the Academy of Sciences of the USSR and the Union republics, the VUZs [institutions of higher education] of the country, and the scientific-research institutes and research branches at plants in a number of socialist countries, including the German Democratic Republic, the Czechoslovakian SSR, the People's Republic of Bulgaria, etc. Scientists of GrozNII are taking an active part in international petroleum symposia and scientific-technical conferences.