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THE SYSTEM OF HIGHER MINING EDUCATION IN RUSSIA

The system of higher education in Russia is under reform, significant changes occur in the network of universities. Federal Universities and National Research Universities were formed. Higher mining education is also under changing. Russian educational standards for the training of mining engineers provide continuous training throughout 5,5 years (330 credits). Programs of training of mining engineers are the programs of the second level of higher education, and graduate programs. The System of Higher Mining Education in Russia is based on 37 universitys, include National research universities — 9; Federal universities — 4; participants of the program of increase of competitiveness — 4.

Development of institutes of public administration in the system of training of mining engineers from the academic and professional communities allows us to create conditions for developing consolidated decisions in the content of educational programs.

Key words: *Higher Mining Education in Russia, mining companies, mining engineers, Bologna process, Mining universities, standard of a mining engineer, Federal Educational Methodical Association, training of mining engineers in Russia*

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Introduction

Substantial and institutional reforming of higher education system in Russia is objectively one of the main social and economic processes in the country. The core directions of reforms development at higher school consist in the following:

- Development of academic freedom of universities;
- The development of competition in the higher education system;
- Formation of a network of universities, in which the advanced and competitive scientific researches are concentrated;
- Development of new approaches for maintenance of control over efficiency of universities activity;
- Development of effective principles of evaluation of quality of training, including the participation of the public and professional associations and communities [1–4].

Along with new requirements to the higher education system,the government realizes essentially new methods of universities financing, based on design approaches, consecutive assessment of productivity of their realization, developing competitiveness in the university environment.

Historically, these processes started in 2006, when on the basis of the priority national project “Education” was a special contest selection of development programs of universities. The competition was attended by 200 higher educational institutions, and the winners were only 17, which indicates a high level of competition among the participants.

The second similar project started in 2007. Winners of the second competition became 40 universities, the most part of which was not universities from Moscow and St.-Petersburg.

In 2009, Russia has formed a network of national research universities (NRU). The result of specially conducted two competitions in 2009 and 2010, the status of the NRU received 30 universities. One of the first status of the NRU received Technological University “Moscow Institute of steel and alloys” (MISIS) (NUST “MISIS”).By 2014, the network of Federal Universities (one Federal University in each federal district of the country) has been generated.

In May 2013, was the start of a new Russian national project “5-100”. Selection of participants the project was carried out on the basis of competition road maps development. The competition selected 15 universities, including NUST “MISIS”.

The primary goals of the project became:

- Working out and realization of new strategies and measures, which will allow to create long-term competitive advantages of domestic universities in the world market;
- Involvement of universities, talented scientists, professors and managers, including advanced foreign research and educational centers;
- Creation of intellectual products, competitive at the world level and universities providing high academic reputation;
- Creation and realization of the educational programs which hold out the quality according to the best international samples;
- Creation of conditions for interaction development between universities and business;
- Providing of domestic educational services export growth, first of all on higher education levels;
- Active advancement of the Russian system of higher education, escalating of positions and reputation in international communities, including world ratings of universities (Times Higher Education World University Rankings, QSWorld University Rankings, Shanghai Academic Rankings of World Universities).

The system of training of mining engineers as a harmonious element of the entire high school, is also undergoing change. These changes are associated with the institutional changes (mergers of universities) and on a substantial level. In 2014 the main event in the training of mining engineers in Russia was the Union of the Moscow State Mining University and National Research and Technological University “MISIS”.The process of unification of universities is complex, but in many of the world’s national education systems are a priority in the formation of competitive universities. Joint research University, which became the legal successor of the Moscow Mining Academy founded in 1918, today showe significant results in its work, taking the No. 31 position in the subject ranking “Mining” QS World University Rankings.

A quantitative estimation of demand in mining engineers in Russia

The features of the technological processes and labor conditions at mining enterprises undoubtedly affect formation of potential labor resources [5–11].

Currently, the mineral sector employed 1 040 000. 29.07% from this part works on the territory of the Ural Federal district, 22,73% — Siberian Federal district is 10.05% — far Eastern Federal district, 38,15% is in other Federal districts of the Russian Federation. To highlight a segment of the labor force employed in the mining of solid minerals we’ll present in **Table 1** the results of the analysis of the actual employment of labor resources in the economic activity.

In the extraction of solid minerals employed 57,09% of all actual labor resources of the mineral complex. Almost 38% of the

Table 1

No	The name of a class of producedsolid mineral	Distribution of an actual manpower in federal districts of the Russian Federations, thousand people (%)				
		The Ural Federal District	The Siberian Federal District	Far East Federal District	Federal Districts of the European part of the Russian Federation	Indicators of the Russian Federation
1	Production of stone and brown coal, peat, processes of their enrichment and agglomeration	11.6 (6)	148 (61)	26.3 (11)	56(23)	241.9(100)
2	Production of metal ores	38.3(19)	53.3(26)	46.8(23)	63(32)	201.4(100)
3	Production of uranium and thorium ores and processes of their enrichment	0.22(1.4)	14.1 (88.3)	0	1.65 (10.3)	15.97 (100)
4	Production of mineral raw materials for the industry of building materials	12 (13.1)	12.9 (13.7)	2.9(3.1)	64 (69.9)	91.8(100)

workforce employed in the mining of solid minerals are concentrated in the Siberian Federal district, 15.6% in the far Eastern Federal district, 12% in the Urals Federal district.

This structure of labor resources is largely due to the geography of large deposits of relevant raw materials.

The quality of labor resources is one of the leading factors in the evaluation of investment attractiveness of regions. To assess the quality of labor resources of the industry, the most rational is the use of indicator the proportion of people working in the industry and with higher education. We will present the main indicators of the quality of the actual labor resources mineral complex by using the available results of national population census in **Table 2**.

Data show that the mineral-raw material complex of the Central Federal district is provided with engineering personnel. This situation is a consequence of a number of reasons: availability in the region of large mining companies using modern technologies and equipment for mining and mineral processing; the availability in the Central Federal district of a significant number of higher education institutions, leading to mining engineers training and able to provide qualified engineers which are in demand at mining enterprises; a high level of concentration in the Central Federal district of the Executive office and the offices of mining companies of Russia, which excavate mineral resources in regions. A comparison of the sustainability of mineral-raw material complex of Russia with engineering personnel data on employment in selected industries mineral complex allows obtaining data on number of employed mining engineers in Russia — 105,000. Taking into account that the duration of work of a mining engineer since classes engineering positions until retirement age is in average 20–25 years and, based on these values a quantitative estimation of corps of mining engineers, you can determine the annual requirement in mining engineers in Russia (Federal districts) during the present level of mining development in the country. This need is 4500–5000 people a year.

Mining universities OF RUSSIA. Statistics of training of mining engineers

The formation of a network of universities, leading to the preparation of mining engineers, in a historical and regional context on the basis of the demand in such specialists. At the moment, such training is carried out almost in all Federal districts of the country. **Table 3** provides a complete list of mining universities indicating their status.

Thus, among mining universities of Russia:

National research universities — 9;

Federal universities — 4;

Table 2

No	Federal District	Providing with engineering staff of a mineral-raw complex of Russia, %
1	Central	26.0
2	Northwest	15.4
3	Southern	17.2
4	Ural	18.8
5	Siberian	13.7
6	Far East	14.4

Participants of the program of increase of competitiveness — 4.

Data of Federal statistical agency shows following indicators of training of mining engineers at all universities of Russia in **Table 4**.

Assessing the role of universities, the formation of which was realized in recent years (national research and Federal universities), it should be noted that in 2016, from NIU was released 36,06% of the total output of mining engineers (full-time students) and from the Federal universities 14.8%, respectively. Thus, it can be argued that more than half the training of mining engineers in full-time education is carried out in universities of research type.

Standards and educational programs of training of mining engineers

In the beginning of 2004 in the Russian Federation started full-scale implementation of the Bologna process, of the main provisions of which emphasis was placed on strengthening the role of the two-level system (bachelor-master). It was assumed that the basic engineering training should be implemented at the undergraduate level with a four-year apprenticeship [12].

When forming a new concept of training of mining engineers in Russia, the members of the mining academic community has carefully examined the basic documents of the Bologna process, gathered the opinion on this question of leading mining companies, Union of miners of Russia, the world's leading mining universities of Russia. Analyzing the specifics of training of mining engineers in Russia, it was possible to identify the main features, which all of our educational programs can be given a unique continuous programs. It was the introduction of continuous programs of training with duration of not less than 5 years are most important for the country areas of training including in the field of mining, has become an important direction of our work. In 2009, a special resolution of the Government of the Russian Federation, in which our two main occupations are Mining and Physical processes of mining or oil and gas production received a special status.

On the basis of the accepted decisions, the Federal educational standard of training of mining engineers on the specified

Table 3

No	Mining universities	The program of increase of competitiveness 5/100
	National research universities	
1	National Research Technological University "MISiS", Moscow	+
2	National Research Tomsk Polytechnical University	+
3	St.-Petersburg MiningUniversity	
4	Russian State University of Oil and Gas (National Research University) named after Gubkin, Moscow	
5	Perm National Research Polytechnical University	
6	Perm State National Research University	
7	Belgorod State National Research University	
8	Irkutsk National Research Technical University	
9	Kazan National Research Technological University	
	Federal Universities	
10	Siberian Federal University, Krasnoyarsk	
11	Northeast Federal University Named After Ammosov, Yakutsk	
12	Far East Federal University, Vladivostok	+
13	Northern (Arctic) Federal University Named After Lomonosov, Arkhangelsk	
	The universities which carry out training of mining engineers	
14	Russian University of Friendship of People, Moscow	+
15	Kuzbass State Technical University Named After Gorbachev	
16	Samara State Technical University	
17	Ural State Mining University	
18	Russian State Prospecting University Named AfterSergo Ordzhonikidze, Moscow	
19	Uhtinsky State Technical University	
20	Moscow Polytechnical University	
21	Magnitogorsk State Technical University Named After Nosov	
22	Siberian State Industrial University, Novokuznetsk	
23	Transbaikal State University, Chita	
24	North Caucasian Mining-Metallurgical Institute (State Technological University), Vladikavkaz	
25	Pacific State University, Khabarovsk	
26	South Russian State Polytechnical University (NPI) Named After Platova, Novocherkassk	
27	Northeast State University, Magadan	
28	Murmansk Arctic State University	
29	Norilsk State Industrial Institute	
30	Belgorod State Technological University Named After Shuhov	
31	Siberian State University of Geosystems and Technologies, Novosibirsk	
32	Petrozavodsk State University	
33	Murmansk State Technical University	
34	Tula State University	
35	Southwest State University, Kursk	
36	Tuva State University	
37	TverState Technical University	

specialties with term of training of 5,5 years has been developed. In accordance with Federal legislation, the training of professionals, including mining engineers, related to the programs of the second higher education as master's degree.

A new standard preparation of a mining engineer, majoring in Mining includes training in twelve specializations at the Federal level:

"Underground mining of coal deposits";
"Underground mining of ore deposits";
"Open pit mining";
"Mine surveying";
"Mine and underground building";
"Mineral processing";
"Blasting";
"Mining-industrial ecology";
"Mining machines and the equipment";
"Electrification and automation in mining industry";
"Transport systems in mining industry ";
"Technological safety and mine-rescue".

This list of specializations at the Federal level allows implementing the leading mining universities in the country large-scale program of formation of personnel potential of the mining companies, providing the main service of the enterprise staff. This list of specializations that emerged as a result of discussions in academic and professional environment that reflects the core needs of mining in the specialized training of mining engineers.

For the specialty of Physical processes of mining or oil and gas production the standard provides three specializations:

"Physical processes in mining industry";
"Physical processes of oil and gas production";
"Mining geophysics control in mining".

The main purpose of these educational programs — a scientific substantiation of researches in mining and maintenance of interaction with adjacent fields of knowledge.

Another important difference in the new standard is determined by the term of training — 5,5 years (330 credits) and, therefore, increased the role of professional and practical training. In this case, we included the increase in the volume of training in science disciplines (Mathematics, Physics, Chemistry, Geology).

In the new educational standards, we were able to develop the disciplinary structure of the invariant basic training of future mining engineer, regardless of his specialization. It is primarily the Geology, the fundamentals of mining(including all types of geotechnologies — open, underground construction), mining ecology, geodesy and surveying, aerology, security of mining and mine rescue technology and security of blasting operations, mining machinery and equipment, mineral beneficiation etc. Only after studying this part of the future mining engineers begin to specialize in their fields, deepening their knowledge in the disciplines of specializations. Thus, a unity of educational space for the training of mining engineers, ensures a confident professional communication.

Table 4

Year	1992	1996	2000	2004	2006	2008	2010	2012	2014	2016
Release of mining engineers	4100	2700	3200	4200	5100	5100	4800	5000	4100	4300

This format is Federal state educational standard defines the special status of educational programs training of mining engineers in Russia in terms of the formation of the disciplinary structure, content and volume of training.

In addition, the increase in terms of training future mining up to 5.5 years to create a more effective path of training for engineering support of mining.

The new standard provides for significant expansion of academic freedoms of universities, faculty, students in the design and implementation of educational programs, and individualization of education.

For many years, the Russian Federation has successfully developed state and public mechanisms of management of contents higher education in various areas. From 1987 on the basis of Moscow State Mining University worked an Educational-methodical Association of Russian universities on education in the field of mining, in which was the development of national educational standards, exemplary educational programs, examination programs and educational literature [13].

New time poses new challenges to the system of Teaching unions, and in 2013, the national network of these associations have been transformed for new functions [14–16].

The basic principles of this transformation are as follows:

- expanding the powers of the EMA-level direction of training or specialty to the enlarged group of specialties and areas of training;
- the involvement of the Federal EMA representatives of relevant companies and associations of employers.

Thus in 2015, the Federal Educational-Methodical Association in the system of higher education has been established in the enlarged group of specialties and areas of training "Applied Geology, mining, oil and gas engineering and geodesy" (Federal Association).

The main activities of the new Federal Association include:

- participation in the development and discussion of projects of Federal State Educational standards of higher education in specialties and areas of training included in this group.
- to update the requirements of Federal state educational standards with the requirements of professional standards;
- providing methodological support for the implementation of Federal educational standards in the higher education system of the country;
- develop proposals on the composition of the list of special ties and directions of training;
- development and realization of scientific-methodical and educational-methodical support for the maintenance of basic educational programs on specialities and directions of training;
- organize the development and examination of approximate basic educational programs;
- to participate in the examination of the funds of assessment tools, including the examination of the funds of assessment tools final assessment of mining engineers;
- participation in the process of independent evaluation of the quality of educational programs realization.

The effective work of this institute of management as the formation maintenance in which activity almost all academic mining community of the country and representatives of the leading mining companies take part, allows to provide quality assurances of this preparation.

Conclusions

Training of mining engineers in Russia is carried out mainly in universities with the status of national research or Federal University that allows you to implement the educational program in a research environment.

Quantitative characteristics of the training of mining engineers in Russia reflect the objective need for graduates in the mining regions.

Implementation of educational programs for the training of mining engineers on the basis of educational programs of higher education of second level (equivalent to graduate level) with duration of 5.5 years enables to form professional competence of future mining engineer.

Development of institutes of public administration in the system of training of mining engineers from the academic and professional communities allows us to create conditions for developing consolidated decisions in the content of educational programs.

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