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Mine Design Stages in Russia

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ABSTRACT

Development of any mining project in Russia comprises several principal stages such as the geological exploration, design studies and economic valuation. The geological and economic valuation of a mineral resource site in Russia is carried out in compliance with the criteria and requirements defined by the federal mineral resource management authority which regulates the sequence and methods of the valuation activities. This article gives a summary of mine design stages to develop the prospective mineral deposit. The exploration and development of mineral deposits in Russia are carried out in compliance with a licence. The principal stages of mine designing in the Russian practice include the development of the several documents: investment justification, preliminary technical and economic justification (TEO), TEO of mine construction, and various working documents. The basic document is the working design (including construction TEO and working documents). It is the construction TEO which must be approved by Rostekhnadzor (Federal Agency for Environmental, Technological and Nuclear Supervision), Rosnedra (mineral resources supervision authorities) and Rosprirodnadzor (Federal Agency for Supervision over Natural Resource). Design documents are developed at each stage of the project. The format of these documents is slightly different in international and Russian practices. This article provides a comparison of various design stages of the Russian and international standards, assesses the detail level of the covered issues, volume and format of the documents. The article also notes the recent trend of harmonisation of the design documents with the international standards in Russia. This trend is bilateral. The practical aspects and problematic issues of development of the design documents, compliant with international standards, in CIS countries are also addressed.

INTRODUCTION

The Russian Constitution specifically notes a legacy of the former USSR is that the sub-surface ownership of raw commodities is a state monopoly. For this reason the system, on behalf of the nation that controls the use of the mineral resources, ensures that resources have been beneficiated in a maximum way for the benefit of the nation. This approach led to the development of complex documents which have historically been regulated by the laws. Hence, the reserve and resource reporting system in Russia is not only complex but also very robust. This is largely due to mining activities typically being complicated and hazardous operations that require essential pre-construction design and permitting documents before mine construction can commence. .

As the Russian economy and companies have rapidly started integrating into the world economy and attracting foreign investments into the mining industry, the Russian reserve assessment system has become an important topic to understand how the system operates and what the similarities and differences are between the Russian system and internationally accepted codes. Although there could be some major differences between them, the overall similarities are, however, more prominent. This is also evidenced by the acceptance of Russia's membership to CRIRSCO (Combined Reserves International Reporting Standards Committee) in 2011, which is the umbrella organisation for well known standards such as JORC and NI43-101. The Russian national code (the "NAEN Code") has now been developed by the Society of Experts on Mineral Resources (OERN, a component body of NAEN), in close co-operation with the State Commission on Reserves (GKZ) and with members of CRIRSCO (CRIRSCO - NAEN, 2011). The NAEN Code is modelled very closely upon the CRIRSCO Public Reporting Template.

This paper mainly addresses the specific features of the documents preparation and designing in Russia, as well as the issues of comparison of the studies, based on the extensive working experience of IMC Montan in Russia since its establishment.

STAGES IN DEVELOPING AND CONSTRUCTING MINES IN RUSSIA

The development of any mining project comprises several main stages:

- Gaining the rights to explore and develop (licensing in Russia);
- Geological exploration and assessment of the commercial value of a mineral deposit site;
- Preliminary feasibility study;
- Selection of the optimal investment targets and areas;
- Detailed engineering study;
- Funds allocation and mine construction;
- Commencement of the commercial operation, achievement of the design production capacity, active operation period, fadeout of mining operations; and
- Mine closure followed by rehabilitation.

The design documents which are dictated and regulated by laws in Russia are prepared at each stage of the project development, therefore, the format of the documents produced in compliance with the international and Russian standards can be significantly different.

One of the primary design documents is at the geological exploration stage, which should be agreed upon with the special subdivision of the Ministry of Natural Resources of Russia, called Rosnedra.

The geological exploration issues and general principles of the resource assessment are addressed in more detail in an article by H.Arden and A.Tverdov in this volume (2013) and readers are recommended to refer to this article to gain more insight information. A summary of the reserves assessment pathway is given in Figure 1.

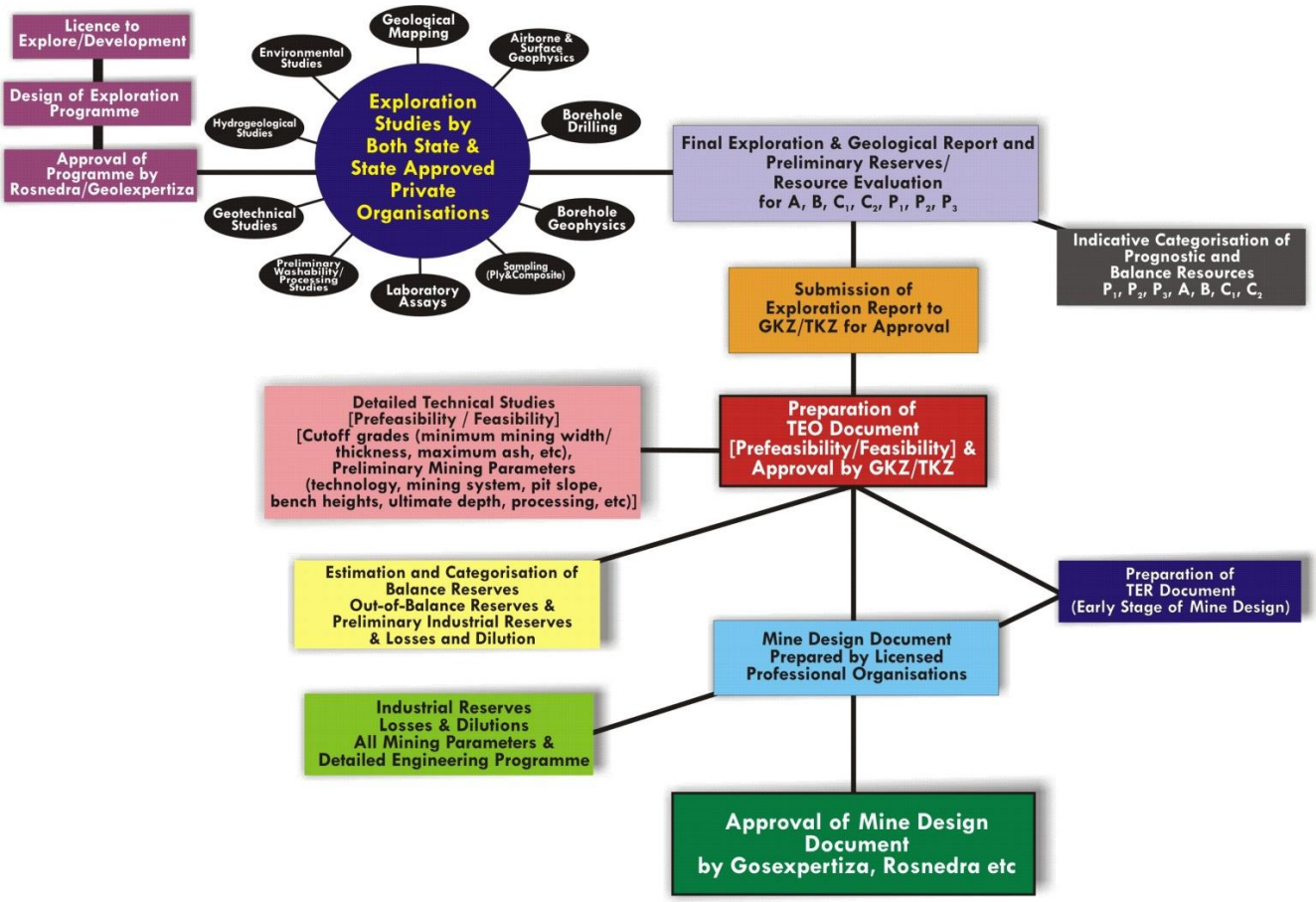

Figure 1 Simplified Framework of Resource/Reserve Assessment in Russia and CIS Countries (from Arden and Tverdov, 2013)

Many companies use the option of having pilot mining sites as part of the geological exploration programme since this approach enables them to study the mineral properties and the deposit characteristics in more detail and speed up the mine construction. An electronic database of drill holes is also created in the course of the geological exploration, which is then verified and serves as the basis for the deposit geological modelling.

The Technical and Economic Justification (TEO) of Mining Parameters is developed upon completion of all geological exploration activities and is a document which addresses all issues of the mining parameters and the mineral deposit site development in a comprehensive manner, which is considered

reasonable from the state authorities' viewpoint. In terms of the level of details and the range of issues covered, this document is similar to international Pre-Feasibility or Feasibility study documents (depending on the quality of studies). Approval of the mining parameters results in the estimation of the reserves, with the reserves statement to be approved by GKZ (State Committee for Reserves).

Hence, the sufficiently detailed technological studies of the deposit development and economic valuations are undertaken already at the stage of the mining parameters approval (Figure 1). Technical and technological solutions provided in these documents are taken into account for development of the mine construction design and are often included into it as separate chapters.

Unlike the TEO of Mining Parameters, the mine construction design is developed to address the deposit development issues in strict compliance with the valid standards, rules and national laws. The mine design addresses the issues of mechanisation, construction, safety, and other mining aspects in more details. An international analogue of the mine design is the detailed engineering study.

COMPARISON OF DESIGNING BETWEEN RUSSIAN AND INTERNATIONAL FORMATS

In addition to the compulsory design documents, there are also a number of intermediate formats of the design documents, which are not mandatory for mine construction in Russia. These include the technical and economic comparison of the deposit development options (TES - «Techniko Economicheskiye Sravneniya»), technical and economic estimations (TER - «Techniko Economicheskiye Rascheti»), technical and economic proposals (TEP - «Techniko Economicheskiye Predlogzheniya»), preliminary technical and economic justification (pred-TEO) of the mine construction, etc. These documents are developed on the initiative of a mineral resource user to investigate a certain issue of the deposit development in more details, and to update the economic valuation made at the stage of the TEO of Mining Parameters.

The mine designing i. e. the development of the official legal documents required for a mine construction (mine construction design), can start only after the reserves are registered at the GKZ balance (Figure 1).

The project designing practice around the world generally uses the following sequence: Scoping Study, Prefeasibility Study, Feasibility Study, and Detailed Engineering. These names unambiguously tell investors and bank specialists of the level of details for the project and the preparedness for its implementation. Table 1 lists the principal Russian and international mining project documents and the tentative timeframes of their development.

Table 1 Comparison of Design Documents

Russian format	International format*	Development period	Error margin, %
Investment justification, technical and economic report (TED), TEP, TES**, TER**, etc.	Scoping Study	2–3 months	Up to ±50 and higher
TES, TER, TEO of Mining Parameters**, preliminary TEO	Prefeasibility Study	5–8 months	±25-40
TEO of Mining	Feasibility Study	9–12 months	±10-15

Parameters**, TEO, investment justification**			
Design documents: mine design and engineering documents	Detailed Engineering	more than 1 year	less than ±10
* The comparison of the Russian and international formats largely depends on the quality and the detail level of documents. The documents cannot be considered exact equivalents. ** The detail level depends on the quality of the document preparation.			

A simplified pathway for the mine design stages is also given in Figure 2. The yellow colour in the diagram shows the non-mandatory stages of the mine construction in Russia. Consulting companies can be involved into the project valuation at these stages.

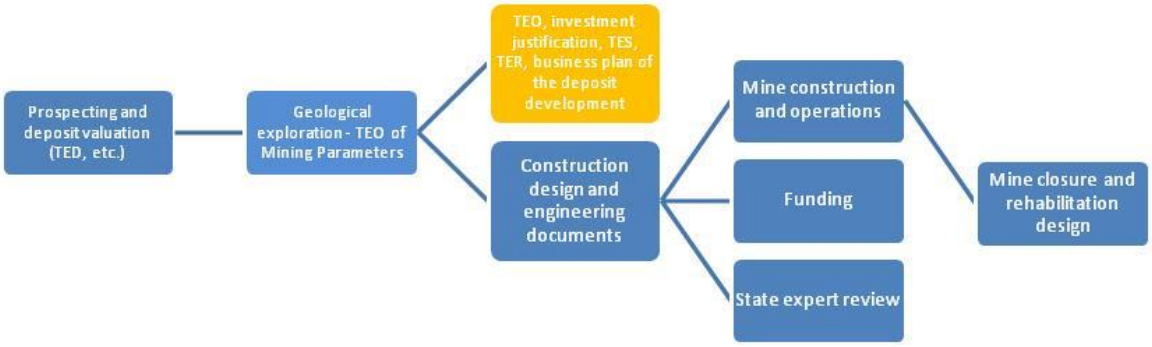

Figure 2 Simplified Pathway for Preparation of Mine Design Documents

DESIGNING ISSUES

In general, both the Russian and the international designing practices address the same issues which comprise several aspects including the legal framework, technical topics, health and safety issues, economic matters, overall infrastructure issues, and social and environmental concerns.

In Russia, the project valuation should cover the legal (including environmental), technical, economic and financial aspects of mining projects. All aspects are considered at each stage of the deposit development with the increasing level of details. It should be noted that requirements for upgrading of operating facilities and the development of a new deposit can be remarkably different. In the latter case, the risks are higher and require undertaking more detailed studies before a decision on investments feasibility can be taken.

In compliance with the Russian laws, the mine construction design should ensure the following:

- Compliance with the standards (requirements, rules) of operation methods, primary mineral processing and infrastructure construction;
- Prevention of over-limit losses, dilution and selective extraction of minerals;
- Safety of operations related to the subsoil resources use, mineral processing and operation of auxiliary facilities;

- Compliance with the standards (requirements, rules) regulating the protection of the subsoil resources, environment, air, land, forests, water, buildings and facilities against the harmful impact of operations related to the subsoil resources use, etc.;

- Civil defence actions in case of natural disasters, etc

Legal Matters

The legal aspect includes the issues of land management and licensing (in Russia, it also includes approval of the reserves at GKZ), and the expert review of the project. The project should comply with the valid construction and environmental requirements and should include the environmental section. Compliance with the valid Russian legal requirements is certified in the statement of the state expert review authority.

Technical and Economic Matters

The technical and economic aspects include the issues of technology, production capacity, marketing and economic analysis. The economic analysis results in estimation of the commonly used criteria of the project viability: the net present value (NPV), the internal rate of return (IRR) and the project payback period. These criteria are estimated using the cash flow model, which covers the project implementation period under review, taking account of the market demand for the saleable products.

Based on the interaction and experience between the western experts and the Russian counterparts the IMC Montan's experience generally indicates that the issues of the techniques and equipment for the deposit development and for the mineral processing are worked out in more detail in Russia because mining is included in dangerous industries by legislation. The western specialists visiting Russia note a high level of studies conducted by Russian design institutes with regard to these issues. However, the marketing issues are normally addressed in more detail when the design documents are produced in compliance with the Western standards.

The major issues considered at various stages of designing are listed in Table 2.

It should be noted that some of the sections of the Russian design documents differ from those of the international documents. For example, the social aspects are not addressed in much detail as these details are not specified in legislation.

. The proposals of the mineral resource user are considered when the licence is acquired on a competitive basis. The fundamental liabilities are then included into the licence agreement.

The labour issues are regulated by the Labour Code of the Russian Federation. Safety issues are covered in many regulatory documents such as the Law on Occupational Safety in Hazardous Production Facilities, Coal Mines Safety Rules, etc. The design compliance with the legal requirements is verified when it is agreed upon with Rostekhnadzor (Federal Agency for Environmental, Technological and Nuclear Supervision) of the Russian Federation.

The design documents rarely address the significant external infrastructure issues such as the external railway lines, products shipment through ports, etc. The general logistic issues may, in fact, require

additional investments. However, separate design documents are prepared for external facilities in Russia, which are not related to development of any specific deposit.

Table 2 Details of Design Documents

Area of studies	TED, TEP	Preliminary TEO, TER, TES, TEO of Mining Parameters	Working design – Mine construction Design
Timeframe	3 - 5 months	5 - 12 months	12-16 months
General information on a mineral deposit site (location, natural, weather, hydrographical and orographic conditions, etc.)	General information	Detailed description of all significant aspects	Detailed description of all significant aspects based on the studies undertaken during the site visit.
Social aspects and territory	General information	Description of the project impact on the territory development and the description of all significant aspects.	Social responsibility measures taken by the mineral resource user. Public hearings.
Resources and mineable reserves	It is sufficient to provide tentative data on the deposit structure, mineralisation nature, and general data on ore body structure. The in-situ resource tonnage is estimated approximately. The mineable reserves are estimated roughly, without detailed delineation and without detailed estimation of losses and dilution (using the recovery factor, analogues, etc.).	Detailed data on the deposit structure, ore bodies structure, distribution of commercial components in the strata. The in-situ resource tonnage is estimated in detail. The mineable reserves are estimated, based on the preliminary mining and geological modelling. Potential losses and dilution are estimated. The delineation of the mineable reserves is based on the detailed analysis.	Mineable reserves are estimated, based on the preliminary mining and geological modelling. Potential losses and dilution are estimated. The delineation of the mineable reserves is based on the detailed analysis.
Rock mechanics	General data on the tectonic structure and rock properties.	Detailed data on rock mechanics. Preliminary assessment of the stable parameters of workings, rock pressure, etc.	Detailed data on rock mechanics and subsidence issues. Estimation of the stable parameters of workings, rock pressure, etc. supported by calculations. Development of measures to control hazardous geodynamical and gas processes and workings deformation.
Hydrogeology	General data on the hydrogeological conditions and surface water courses.	Detailed data on the hydrogeological conditions and surface water courses. Approximate estimation of the water-make and mine water quality. An approximate estimation of drainage facilities.	Detailed data on the hydrogeological conditions and surface water courses. Estimation of water-make and mine water quality based on a number of factors. Drainage and water diversion programme. Estimation of drainage facilities capacity
Technological properties of the ore	Tentative data on the technological properties of the ore	Processing tests (laboratory studies), prediction of the principal processing parameters and quality of the saleable products.	Detailed ore processing studies (full scale and pilot tests), prediction of the principal processing parameters and quality of the saleable products for various ore types.
Infrastructure	Identification of the main constraints and needs in development of the internal and external infrastructure. Identification of the main capital construction targets.	Draft location and mine site layout plans. Identification of the main needs in infrastructure with a breakdown by specific aspects (power, heating, etc.). Principal infrastructure architectural and layout solutions.	Detailed location and mine site layout plans. Needs in infrastructure with a breakdown by specific aspects (power, heating, etc.) are justified in detail. Detailed infrastructure architectural and layout solutions.

Area of studies	TED, TEP	Preliminary TEO, TER, TES, TEO of Mining Parameters	Working design – Mine construction Design
Tailings	The expected needs in tailings facilities are indicated.	Estimation of the principal parameters of tailings dams, slurry pumps and the scope of construction. Identification of the location site.	Detailed estimation of the principal parameters of tailings dams, slurry pumps and the scope of construction. Precise localisation. Graphic representation of the tailings dams parameters. Geomechanical justification of the slope angles, estimation of the tailings transportation system parameters.
Mining methods and access layout	Consideration of several alternative options of the deposit development. Rough estimation of mine production capacity.	Comparison of the deposit development options and selection of the base mining method and access layout. Justification of range of the optimal mine production capacity. General estimation of losses and dilution. Conceptual mine layout and main issues of development operations.	Detailed studies of mining method, access layout and optimal mine production capacity. Comprehensive estimation of losses and dilution. Mine layout for various stages. Scheduling of development by years and stages.
Dumping	Expected needs in dumping facilities are indicated.	Estimation of the principal parameters of dumps, selection of the dumping method. Identification of the location site.	Detailed estimation of principal parameters of dumps. Precise localisation. Graphic representation of the dumps parameters. Geomechanical justification of the slope angles.
Principal parameters of workings	Issues are not considered in detail.	Principal parameters of main roadways and development headings are identified, and the roof support layout is set.	Detailed justification of parameters of main roadways, development headings and the roof support system, based on the rock mechanic factors, ventilation and transportation operations.
Drilling and blasting	Review of the need in drilling and blasting	Estimation of the need in drilling operations and drilling equipment by years. The principal parameters of drilling and blasting (hole spacing, specific consumption, drilling depth, etc.).	Detailed analysis of the need in drilling operations and drilling equipment by years. All key parameters of drilling and blasting (hole spacing, specific consumption, drilling depth, etc.). Estimation of safe distances, etc.
Degassing and ventilation	Preliminary data on the gas make and air quality control actions.	Development of degassing actions. Estimation of the air amount in the mine.	Mine ventilation layout. The detailed degassing and gas control layout.
Scheduling	Schedule is tentative and based on analogues.	Justified mining schedule with the estimation of the production output, the scope of stripping (roadways drivage and development) and the ore quality. Graphic representation of the mining outline by stages.	Mining schedule with the estimation of the production output, the scope of stripping (roadways drivage and development) and the ore quality. Graphic representation of the mining outline by stages and, in some cases, by years. Drawings of individual elements of mine workings.
Mining equipment	Consideration of applicable mining equipment. The capital expenditures for equipment are estimated by the main stages of operations and are based on analogues.	Selection of the equipment types and models. An approximate estimation of the needs in the mining equipment by years of operation.	The detailed justification of optimal types and models of the equipment. The estimation of the needs in the mining equipment by years of operation, supported by calculations.

Area of studies	TED, TEP	Preliminary TEO, TER, TES, TEO of Mining Parameters	Working design – Mine construction Design
Processing	An approximate estimation of the needs in processing facilities. The preliminary forecast of the potential amount and quality of the saleable products.	Justification of the principal parameters of processing plants. The preliminary estimation of the processing plant equipment by processing stages. Water/slurry balance and mass balance. The forecast of the amount and quality of the saleable products by years of operation.	Justification of parameters of processing plants including structural concepts and automation. Detailed estimation of the processing plant equipment by processing stages, including the auxiliary equipment. Detailed water/slurry balance and mass balance. Forecast of the amount and key quality parameters of saleable products by years of operation.
Environment protection	Review of the principal environmental requirements, risks and problems. Review of the main factors of the environmental impact. A rough plan for mitigation of the environmental impact. The major mine closure issues.	The principal stages of the environmental impact assessment. Development of environmental actions. Draft estimation of rehabilitation and mine closure activities.	Detailed environmental impact assessment and development of comprehensive environmental actions. Detailed estimation of rehabilitation and mine closure activities.
Human resources	The main personnel number is set, based on the analogues.	Draft estimation of the manpower by subdivisions in view of the operating mode.	Calculation of the manpower by subdivisions, professions and production processes. Estimation of the actual and payroll workforce factors.
Health and safety	Identification of the principal risk factors.	Development of the principal health and safety measures. Development of the principal emergency and incident prevention measures.	Comprehensive health and safety measures. Development of key emergency and incident prevention measures, including risk mitigation plans. Maximum adaptation of all solutions to the health and safety rules and standards.
Civil defence	The issues are not considered.	The issues are considered at a conceptual level.	Comprehensive civil defence measures, protection against natural and man-induced phenomena and emergencies. Warning and alarm measures.
Subsoil resources protection and rational use	A conceptual consideration of compliance with the requirements of the maximum possible extraction of mineral resources.	Draft justification of the general and mining losses, based on the regulatory documents. Losses can be estimated, based on the common standards only.	Detailed justification of the general and mining losses, based on the regulatory documents. Calculations and estimations for justification of losses.
Project risks	Principal risks are indicated.	Assessment of individual project risks significance. Development of the major measures for risk mitigation.	All principal risks are identified, taken into account in the course of designing and indicated. Risk minimisation measures are taken.
Economic and financial valuation	The major economic parameters (capital and operating expenditures, etc.) are based on analogues and experts' experience. The simplified cash flow model or the project capitalisation valuation, using the comparative method.	The major economic parameters (capital and operating expenditures, etc.) are based on direct calculations of the parameters of the major construction targets, mining operations (roadways drivage, development, etc.) and the mining equipment.	Major economic parameters (capital and operating expenditures, etc.) and project viability parameters are estimated, based on an accurate accounting of all latest project solutions. Capital and operating expenditures are adjusted as much as possible for the conditions of the

Area of studies	TED, TEP	Preliminary TEO, TER, TES, TEO of Mining Parameters	Working design – Mine construction Design
	Marketing review.	The cash flow model includes the estimation of revenues, capital and operating expenditures, taxes, depreciation, sustaining expenditures. The marketing studies are focused on the saleable products and market segments, including a detailed saleable product price forecast. The major project viability parameters (IRR, NPV, TV, payback period, etc.). Testing of the project sensitivity to variable parameters.	construction site and mining operations. Estimation of construction and assembly expenditures. The major costs of the capital construction targets and equipment are based on the latest prices of the material and equipment manufacturers. The operating expenditures are estimated by main processes and elements. Taxes estimation. Estimation of the macro-economic effect in some cases.

Mine Construction Design Contents and Requirements in Russia (Detail Engineering)

It should be noted that the mine design in Russia (mine construction and upgrading design) is an official legal document which has to be in place before the mine construction starts. The mine design can be developed by legal entities only (design institutes, design and engineering companies, etc.), that are members of a self-regulating organisation having special licences (e. g., for surveying) and other certificates and permits. If necessary, a mine design can be developed by a consortium of design institutions led by the General Designer.

The development of the design documents should comply with the laws of the Russian Federation. If the information is classified, it is necessary to formalise the access to the data. Such data may include large scale topographic maps and plans, materials on deposits classified as strategic, and materials on operations located close to the defence facilities.

The design documents for the mine construction comprise two sets/stages: the design documents and the engineering documents. The engineering documents are a non-mandatory component of the design documents and are developed for very complex facilities. The engineering documents include narrative documents, drawings, specifications of the equipment and products, which contain the detailed description of all details of the facility under review, including the estimation of the amount of consumables. The composition and contents of the engineering documents are defined by the client, depending on the detail level of solutions, and are indicated in the terms of reference for designing. The total volume of the mine design document may reach several thousand pages. Once completed, the mine design should be submitted for the state expert review. Unlike other types of documents (business plan, preliminary TEO, TER, TES, etc.), the design documents should meet the specific requirements set in the laws, in terms of their structure, contents and justification of design solutions.

The contents of the design documents for capital construction of production facilities, including mines, are regulated by the Ordinance of the Government of the Russian Federation No. 87 of 16 February 2008 – Provisions on the Composition of Sections of Design Documents and Requirements to Their Contents. The design documents comprise the narrative and graphic sections. The typical mine design topics include sections covering land plot layout, architectural concept, structural and spatial concepts, utility systems and their distribution networks, construction management plan, demolition plans, environmental activities, fire safety and construction cost estimate (Table 3).

Table 3 Topics Included in the Design Documents

Section	Contents, principal issues
Explanatory Note	Terms of reference for designing, findings of the engineering studies, entitlement documents for the capital construction target if the design documents are developed for the upgrading or the overhaul repair of the capital construction target, data on the capital construction target's needs in fuel, gas, water and power, data on the design capacity, data on the resource base, technical and economic parameters of the designed capital construction targets.
Land Plot Layout	Parameters of the land plot allocated for the capital construction target, geodetic conditions, justification of the boundaries of the sanitary and

Section	Contents, principal issues
	protection zones of capital construction targets, justification of the land plot layout, description of the plot levelling and improvement, general layout plan, etc.
Architectural Concept	Justification of the structural and spatial concepts and architectural solutions, description and justification of the interior and exterior of the capital construction target, protection of premises against noise, vibration and other impacts, etc.
Structural and Spatial Concepts	Data on topographic, engineering, geological, hydrogeological, meteorological and weather conditions of the land plot, data on the specific natural and weather conditions of the area where the capital construction target land plot is located, data on the strength and deformation of the soil at the basement of the capital construction target, ground water level and chemical composition, description and justification of the structural concepts of buildings and facilities, including spatial layouts used for the structural designing, floor plans of the buildings and facilities, typical cross sections, etc.
Utility Systems, Engineering Networks, Engineering and Technical Activities, Technological Solutions	Power Supply; Water Supply; Water Disposal; Heating, Ventilation and Air Conditioning, Heating Networks; Communication Networks; Gas Supply; Technological Solutions.
Construction Management Plan	Characteristics of the capital construction target location area and construction conditions, data on the potential local workforce, description of the specific features of the work undertaken at the operating facility, justification of the organisational and technological process charts which set the sequence of construction and development operations, proposals on quality control of construction and assembly work, etc.
Plan of Demolition or Dismantling of Capital Construction Targets	Section is included if it is necessary to demolish/dismantle the capital construction target or its part. It should contain the justification for development of the plan for demolition or dismantling of buildings, structures and facilities, the list of activities for decommissioning of buildings, structures and facilities, description of activities for removal and utilisation of waste, process charts and sequence of demolition/dismantling actions.
Environmental Activities	Environmental impact assessment of the capital construction target, the list of activities for mitigation of the potential adverse environmental impact, pollutants concentrations estimates, justification of solutions for waste water treatment, protection of air against emissions, subsoil resources protection, maps, diagrams and tables showing the air pollution, etc.
Fire Safety	Description of the fire safety system, justification of the fire safety distances between buildings, justification and description of design solutions for ensuring of the personnel safety in case of fire, description and justification of the plan for evacuation of people and material resources in case of fire, etc.
Construction Cost Estimate	The section should contain the narrative part (explanatory note) and the cost estimates, the list of estimate standards reference books and catalogues used for estimation of the construction costs, the name of the contractor (if any), justification of the specific features of the construction cost estimation for the capital construction target.

The laws and regulatory documents also set the requirements to the contents of the sections listed above and to the format of the narrative and graphic materials.

The narrative part should contain the data on the geological structure, detailed deposit development solutions, infrastructure, resource base, processing facilities, etc., as well as the description of the technological and other solutions supported by explanations which expound the solutions as much as possible.

If the design documents are developed in compliance with the international standards, it is often acceptable to show the final outcome and use the personal experience extensively, while the Russian design documents should be supported with as many transparent calculations and explanations as possible. All solutions related to operation of hazardous production facilities, health and household services, construction work should be based on the valid standards, safety rules, guidelines, methods

and techniques. For example, the calculations related to the ventilation system, pit slope stability, degassing, etc. can be made, using the approved and tested methods only. The calculations cannot be based on the non-approved methods/approaches or the personal experience. Hence, the detailed studies of individual aspects of the mine operation require engagement of a wide range of specialists.

It may be certainly argued that the legislative framework is not in line with the scientific and technological progress. However this helps reduce the risks of applying techniques, which have not been tested in practice and which may produce an unwanted impact on the operational safety.

This is particularly true if the level of details for the design documents used in international practices are adopted for the projects funded by the foreign entities in Russia. Unfortunately, they may not have the details required by the local Russian legislation and rules; therefore, this may require preparation of a parallel documentation which satisfies both the local rules and international requirements

Expert Review of Design Documents / Mine Construction Design

Once completed, the mine construction design document should undergo the expert review at Glavgosekspertiza (Chief State Expert Review Board), Rostekhnadzor (Federal Agency for Environmental, Technological and Nuclear Supervision), Rosnedra, Rosprirodnadzor (Federal Agency for Supervision over Natural Resource), Ministry for Emergencies, etc.

The outcome of the expert review is the approving/disapproving statement on compliance of the design documents with the requirements of the operating procedures, norms, GOST state standards, safety rules, subsoil resources protection laws, etc.

Funding

Funding at the stages of operations listed above is normally provided by the owner / mineral resource user only. The external project funding requires having the prepared design documents in place. Hence, when the mineral resource user acquires the licence, it should have sufficient funds to obtain the licence and to carry out the subsequent geological exploration. IMC Montan's experience can show a few examples of attracting funds for the geological exploration at stock exchanges, but this practice is not common, since it dilutes the owner's interest in the future operation profit.

Mine Closure

The mine closure and rehabilitation plan and costs are also included into the mine design. However, when the mine is actually closed, a separate design for the mine closure and rehabilitation is normally produced. This design contains the updated information on the actual scope of work and costs. Nevertheless, many large holding companies accumulate the so called 'rehabilitation and mine closure fund' in the amount approved by international consulting companies.

CONCLUSIONS

In general, the range of issues addressed in the design documents in Russia, which have to be produced for the deposit development, is in line with the international approaches. The difference is the sequence of the design studies and the investigation of the technical and economic aspects of the deposit development. In view of the specific features of the legislative framework, a number of sections of the mine construction design are not common in wider international practice (civil defence, rational use of mineral resources, etc.).

Effectively, designing in Russia includes the technical and economic valuation at the deposit exploration stage and the reserve estimation (TEO of Mining Parameters), as well as the mine designing proper, which is the undertaking of the most detailed feasibility study of the mine construction resulting in production of the official legal document.

The findings of the design studies contain a large amount of technical details and calculations and are not often easily understandable for the investors, including Russian financial institutions. Independent mining consultancy companies are engaged to convert the documents into a more friendly format for investment attraction. These companies may also be involved in undertaking the reserve and mine audits and may draw reliable conclusions on the project efficiency.

IMC Montan's experience demonstrates a high demand for such services with near to 60 projects a year in the CIS countries alone undertaken, which are also related to development of the internationally acceptable documents. The most common types of documents produced for interaction with banks include the JORC Evaluation of Reserves, and Prefeasibility and Feasibility Study. Such documents as the Scoping Study, Due Diligence, Resource Valuation and Geological Exploration Design Review are prepared for owners of the mines under construction. Another type of the most common works is the preparation of the Competent Person's Report for IPO activities of the companies.

It is also worth noting that in 2013 the President of Russia gave an assignment to produce a draft of the new mineral reserve public reporting which would be more in line with the international system. It is expected that the contents of the design documents will also become more transparent and compatible with the international approaches.

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