GOVERNMENT OF MONGOLIA
MINISTRY OF MINING AND HEAVY INDUSTRY

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METHODICAL RECOMMENDATION APPLIED FOR CLASSIFICATION OF MINERAL RESOURCES AND CERTAIN TYPE DEPOSITS' RESERVES OF MONGOLIA

(SAND, GRAVEL)

ULAANBAATAR
2021

Disclaimer

Australia Mongolia Extractives Program is supported by the Australian Government and implemented by Adam Smith International.

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The recommendation is developed by the School of Geology & Mining, Mongolian University of Science and Technology on the order of the Ministry of Mining and Heavy Industry of Mongolia, with support of the Australian-Mongolian Extractives Program (AMEP) implemented by the Australian Government (Adam Smith International).

The recommendation is approved by the Decree No. XX-202X of the Mineral Resources Professional Council on date of 3 June 2021, approved by the Minister of Mining and Heavy Industry by the order no….

The METHODICAL RECOMMENDATION applied for classification of mineral resources and certain type deposits' reserves of Mongolia.

SAND AND GRAVEL

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This recommendation is designed for employees of enterprises and organizations operating in the sector of sand, gravel use, regardless of their departmental affiliation (or subordination) and ownership.

The application of the "METHODICAL RECOMMENDATION…" will useful to be provided geological information, the completeness and quality of which are sufficient to make decisions on further exploration or on the involvement of reserves of explored deposits in industrial development, as well as the design of new or reconstruction of existing enterprises for the extraction and processing of minerals.

This recommendation has been funded by the Australian Government through the Department of Foreign Affairs and Trade. The views expressed in this publication are the author's alone and are not necessarily the views of the Australian Government.

CONTENT

Introduction

The Minister of Mining and Heavy Industry was instructed to develop a “Methodological Recommendations for the Use of Mongolia's Mineral Resources and Resource Classification” in Annex 2 to Order A / 195 of August 13, 2018. Article 3.7 of the “Instructions on the classification and classification of mineral resources and deposit reserves” approved by the Order No. 203 of the Minister of Mining (former name) dated September 11, 2015 states that the grade and classification of mineral resources and deposits This guideline has been developed in accordance with the “Mineral prospecting, prospecting and exploitation procedure” approved by the Order A / 20 of the Minister of Mining and Heavy Industry on February 5, 2018, in accordance with the instructions issued on the basis of mineral specifications. Since the establishment and development of the geological sector in Mongolia, the “Instructions on the application of classification of sand and gravel reserves” recommendations in the Russian Federation (formerly the USSR) have been used in the geological study of sand and gravel deposits.

In line with the current level of development of the international and Mongolian geological sectors and research trends, there is a need to develop a “National Guidelines for the Use of Mineral Resources”. Therefore, the aim is to develop this methodological recommendation in accordance with the specific guidelines of our country in accordance with similar guidelines and recommendations currently being followed in international geological research. This is important for the geological research of Mongolia's mineral sector and for the research of organizations and companies.

Pure sand and sand-gravel deposits are commonly known as minerals, and the most widespread in nature in Mongolia is of alluvial origin. In terms of location, it is mainly distributed in the valleys of large rivers and is rich in sand and gravel, well classified, washed and cleaned.

Therefore, the sand and gravel of this type of deposit are very suitable for natural use in the production of heavy concrete products for construction and road construction, and they are economically viable as they do not require concentrating. Availability of sand and gravel is very limited in the Gobi provinces.

This recommendation is intended as a guideline for experts conducting exploration of sand and gravel deposits, as well as for mining companies, companies and organizations estimating the reserves of sand and gravel deposits, and for conducting expert assessments.

One. Basic terms

1.1. Sand and gravel are a mixture of rounded grains of rock fragments and granular materials. According to the classification used in Mongolia, 0.14 mm to 5.0 mm is sand and 0.5 mm to 70 mm is gravel. The most used classification in Russia and abroad is sand with a particle size of 0.05-2.0 mm and gravel with a particle size of 2.0 to 10.0 mm.

The gravel in the mixture, or parts larger than 0.5 mm, is included in the total mixture:

7% -15% gravel sand,

if it contains 15% -30%, it is called gravel-sand mixture,

if it contains more than 30%, it is called sand-gravel mixture.

1.2. Sand grains are same type if they are look like and generally similar in size.

Rocks larger than 70 mm in size are included in the mix.

1.3. Sand is classified as one type if it is composed of only one type of mineral and oligomic if it is composed of two or three minerals, as polemic if it is composed of several different rock fragments and minerals of different compositions.

The sand is predominantly quartz and feldspar, and contains a mixture of mica, carbonates, gypsum, magnetite, ilmenite, zircon, monazite, and other minerals.

Gravel is usually composed of rocks such as granite, gneiss, diabase, quartzite, and other hard minerals such as quartz, and sometimes large fragments, such as shale, limestone, dolomite, and sandstone.

1.4. Sand and gravel grains are classified into by shape; round, round-angled, angular by roundness type; angular, sub-angular, sub-angular & rounded, sub-rounded8 rounded.

1.5. Depending on its mineral, petrographic, chemical composition and particle size fluctuations, their ratios, as well as the state of siltstone pellets, organic and other admixtures, the possibility of using sand and gravel directly in nature or after washing, concentrating and screening is determined.

Gravel is an important commercial product, with several applications. Many roadways are surfaced with gravel, especially in rural areas where there is little traffic. Globally, far more roads are surfaced with gravel than with concrete or asphalt; Russia alone has over 400,000 km (250,000 mi) of gravel roads.[1] Both sand and small gravel are also important for the manufacture of concrete. Natural gravel has a high hydraulic conductivity, sometimes reaching above 1 cm/s. In the pottery and glassmaking industries very pure quartzose sands are used as a source of silica. Similar sands are required for lining the hearths of acid-steel furnaces. Molds used in foundries for casting metal are made of sand with a clay binder. Quartz and garnet sands are used extensively as abrasives. Ordinary sands find a multitude of other uses—e.g., in the preparation of mortar, cement, and concrete.

Quartz sand is widely used in the manufacture of glass and metal alloy molds, as well as in the production of cement and bricks, and in sand sprayed on train locomotives.

The sand will be used in the production of fine ceramics and building ceramics, as well as in the production of refractory products, abrasive and abrasive products, and in other areas such as filtering and soil thinning in water pipelines.

1.6. Rocks erode or weather over a long period of time, mainly by water and wind, and their sediments are transported downstream. Sand and gravel are classified by their transported downstream into alluvial, glacial, marine, lake, eluvial, deluvial, proluvial, and aeolian (wind).

• Alluvial deposits are the most widespread. They are usually elongated-mesh-shaped beds that can be several kilometers long and tens of centimeters to tens of meters thick. Here, sand and gravel are unstable in their total area and cross-sectional direction in terms of particle composition and mineral composition.

The classification of crushed materials (gravel) varies in mountain Rivers, plains, plains, and tributaries.

Alluvial sediments of mountain Rivers are mainly composed of large debris, the lower part of the mountain is dominated by gravel-gravel material, and the flat valleys and tributaries are dominated by a mixture of sand and gravel-sand.

The accumulation of sand and sand-gravel mixtures in the valleys and tributaries of modern rivers is temporary, and the shape and size of the strata change.

• Glacial deposits are classified as water-glacial (fluvioglacial) and bovine (moraine).

Water-glacial deposits are formed in flat and folded areas and valleys with surface formations formed during glaciation. In aquifer deposits, the debris is usually well washed and free of clay, poorly smoothed and poorly classified.

-Coal rock deposits are usually composed of cobblestones and are not classified at all.

• Marine and lake deposits are classified as modern and ancient (up to the Quaternary).

They accumulate on the shores of the sea and lakes, on the slopes of lakes and on the bottom.

The sands and gravels of these deposits are well graded, well-smoothed, and relatively fine-grained.

These types of sand and gravel deposits occur in small bays of lakes and seas and are usually stable in thickness and differ from other types of deposits in that the proportion of gravel in the mixture is much higher. The sand deposits in the coastal zone are characterized by a considerable length of tens of kilometers.

Deposits associated with lake sediments differ from marine deposits in that they are always fine-grained, clayey, and spread over a small area.

• Eluvial and deluvial bedrock deposits often form irregularly shaped horizontal bodies and are unstable in thickness, grains are unclassified, uneven, and highly clayey.

• Proluvial deposits are located in mountainous areas and the rock fragments are unclassified and uneven.

These sediments cover a relatively large area and reach tens of meters in thickness.

• Sand dunes are a consequence of dry conditions or wind deposition. The sand is usually fine-grained (0.25mm-0.05mm), rarely medium-grained, and contains a large amount of clay mixture.

Wind-derived sand is very well classified and does not contain any coarse-grained impurities.

Large sand deposits are mainly associated with ancient sediments, as well as modern alluvial sediments, which accumulate near the shores of seas and lakes and in river basins.

• Large deposits of sand-gravel mixture are often associated with water-glacial, alluvial, and modern marine sediments.

1.7 Depending on the size and type of mineral resources, deposits are classified as follows (Table 1). These include:

Deposit resource classification

Table 1

Resource calculation profitability	Unit of measurement	The amount of reserves			
		Very big (>)	big	Medium	small (<)
Sand-gravel mixture and construction sand	Million.м^3	50	15-50	10-15	10
Glass sand	Million. tons	50	10-50	1-100	1
Mold sand				5-10	5

Sand deposits are very common in nature and there are almost no gravel deposits.

Gravel, together with sand, forms a sand-gravel mixture and is rarely used directly in nature. Because they are often rich in clay and contain some amount of cobblestones, it is necessary to sift the sand-gravel mixture into sand and gravel, remove the boulders, wash the sand and gravel and separate them from the clay mixture.

1.8 Some sand and sand-gravel mixtures may contain gold, other precious metals, ilmenite, rutile, zircon, monazite, kaolinite, glauconitic, diamond and other minerals and must be separated.

The study of such deposits will be followed by the Placer Deposit Recommendation "Methodological Recommendations for the Use of Mineral Resources and Deposit Reserves Classification" for the type of minerals prepared by the Ministry of Mining and Heavy Industry in 2019.

Two. Grouping deposits' complexity of geologic settings for exploration purposes

2.1. Depending on the geological structure of the sand and gravel deposit, it shall be classified as one of groups I and II in accordance with the "Mineral resources and deposit resource classification and instructions" approved by the Minister of Mining Order No. 203 dated September 11, 2015.

Group I deposit include very large, large and medium-sized, stratified and stratified, geological formations, sand-gravel deposits that are stable in mineral thickness and quality.

This group includes proluvial quartz and poly / polymystic sand deposits of coastal, lake and river sedimentary conditions (Kichigin quartz sand deposit in Chelyabinsk Oblast, Solzen concrete sand deposit in Arkhangelsk Oblast, Tashlinsk and Lukyanovsky glass sand deposits in Ulyanovsk Oblast).

Group II deposits include very large, large, and medium-sized strata and strata, sandstones and sand-gravel deposits with unstable geological formations and mineral thicknesses, containing different types of non-standard sand grains.

This group also includes sand and sand-gravel deposits of small size and irregular shape, unstable mineral quality and abrupt change in layer thickness.

This group includes quartz and poly/polymic sand deposits in the form of dams along the shores of the sea and lakes, wind sand deposits (North Blagoveshchensk silicate sand in Novosibirsk region, Russia, Kuvshink formwork sand in Chuvashia), (Altangol and Central in Dornod province, Mongolia). Moltsog glass sand of the Tuv province and Salkhit form of sand of Darkhan-Uul province).

Also formed by ancient and modern flows in riverbeds and valleys and terraces (Kosy concrete sand in Arkhangelsk region, Russia, Privolsky quartz sand in Saratov region, Burtsov mold sand in Nizhny Novgorod region, Volkov sand-gravel mixture in Udmurtia, Mongolia), sand-gravel mixture, Darkhan sand-gravel mixture, Elst river silicate and construction sand) deposits. It belongs to the coastal and lake shores (Spassky glass sand in the Stavropol Territory of Russia). It belongs to the glacial sand and sand-gravel-boulder deposits (Velikodvor sand of Vladimir region of Russia, Strugo-Krasnensky sand of Pskov region).

Group III and IV sand and sand-gravel deposits are now considered insignificant. If sand and gravel are not readily available in the area, they can be explored to assess resource and quality and used for local needs. However, it is recommended that such deposits be included in Group IIb and explored with the appropriate mesh density.

2.2. Depending on the complexity of the geological structure of the bedrock and the amount of mineral resources of the deposits (occurrences) belonging to the above groups, the importance and use requirements of the deposit will be decided. This condition is not mandatory and, if necessary, the group may be specifically tailored to the individual deposit.

Three. Geologic settings of deposit and studies of mineral composition

3.1. For the explored field, it is necessary to have a topographic basis whose scale is appropriate to its size, geological features, and terrain or the shape of the surface. Topographic maps and plans for sand and sand-gravel deposits usually produced at scales 1:1000 to 1:2000 scales. The deposits with a flat surface, smooth slope of more than 3 km, have a topographic basis at 1:5000 scales. All exploration and operational workings (boreholes, ditches, open pits, trenches, quarries, mines/shafts etc.) shall be documented and sampled. All types of natural outcrops are tied by geodetic measurements and surveyed on a topographic base map.

3.2. The geological structure of the deposit should be studied in detail and reflected on a geological map of scale 1:1000-1:2000 (depending on the size and complexity) and detailed geological formation and survey accuracy.

The geological and geophysical materials of the deposit should give an idea of the size and shape of the sand deposits, the conditions of their occurrence, their internal structure and continuity, the degree of facial variability, the relief features of the roof belonging to productive sand, placement of various types of sand and sand gravel, the characters of pinch out of sand bodies, the characteristics of the change of the host rocks and the correlation of sand bodies to the host rocks, the folded structures and the tectonic faults in necessary and sufficient level of studies to be correlated the sand bodies and become justified for the reserve estimation.

For large deposits of glass and molding sand, these materials should contain a justification of the geological boundaries of the deposits and reflect the location of the sites which should be evaluated the predictive resources of category P_1.

Outcrops and near-surface parts of sand deposits should be studied by excavation works (trenches, main trenches, dug pits, cleanups) and shallow bore holes using geophysical and geochemical techniques and sampled in detail, which makes it possible to establish the morphology and conditions of the sand, the depth of development and the structure of the weathering zone, the degree of weathering of the sand and the characteristics of the change in the substance composition, the technological properties and content of sand and conducting reserve estimation for weathered and mixed sands separately by industrial (technological) sand types.

3.3. Exploration of deposits of sand and boulder-free gravel-sand deposits to a depth is carried out by borehole or pit with a subordinate role of mining workings (pits and pipes), which are passed to control drilling data, determine the volume mass and take large-volume technological samples.

If the gravel-sand deposit is dry, drill only with a trench, and if there is water, drill a large diameter hole.

Exploration methodology, mining and drilling work ratio, type of excavation, drilling method, exploration grid density, sample type, and sampling method must meet the requirements of the geological structure of the deposit and meet the requirements of the deposit group and resource estimation conditions.

Compliance with the above requirements will be assessed based on the composition and characteristics of the deposit's mineral strata, which will determine the effectiveness of both mining and drilling and geophysical methods, and will be confirmed by experience in exploration and exploitation of similar deposits.

Therefore, during the exploration phase, it is necessary to determine in advance the composition of the sand-gravel mixture of the deposit, especially the size of the gravel and the presence of boulders, and depending on these, it will be determined whether to drill or excavate.

Exploration excavations at the deposit are required to penetrate the mineral layer completely or to the lowest mining horizon specified in the Feasibility Study (FS). It is recommended that resource assessments not be based on relief unless an in-depth study has been conducted.

In this case, a small number of deeper exploration excavations should be carried out in the first instance to determine the full thickness of the mineral up to the deep horizon where the open pit can be mined.

In order to verify the quality of exploration wells and the accuracy of the information obtained from them, the geological and geophysical conditions of the deposit will be assessed by conducting measurements in the wells using modern geophysical research opportunities.

A comprehensive logging study is important to determine in the case the geologist and experts to see if the lithological structure of the mineral layer, the thickness of the stripping soil and its composition, the shape of the surface of the mineral layer, and whether it is affected by tectonic damage.

Logging survey indicators are important documents to be used to estimate the deposit's reserves and ensure the quality and reliability of the exploration work.

The accuracy of the logging parameters is determined by the mineral thickness and core yield found in the boreholes drilled in the deposit. If there is a significant discrepancy between the geological survey and the geophysical measurements, the reasons should be clarified and the results presented in a resource estimate report.

3.4 The diameter of the exploration boreholes depends on the size of pieces of the sand and gravel mixture of the deposit.

When we use core drilling in sand deposits, the borehole diameter should be at least 85 mm to get the core without damaging the mineral structure. However, when tube drilling the borehole diameter shall be at least 127 mm if the sand-gravel mixture does not contain coarse gravel, the exploration can be performed by drilling a 127 mm diameter hole, and in the case of large coarse gravel, a 152-203 mm diameter hole can be drilled.

In some cases, the borehole diameter can be increased to 400-500 mm in cobblestone-gravel-sand mix deposits.

When drilling with a percussion drill in the deposit, the installation of the anchor pipe should be done together, and the installation of the anchor pipe should always be 15-20 cm ahead of the drilling progress.

For example, the Songino sand and gravel deposit in Ulaanbaatar is located in the Tuul River valley with water under than 1.7 m and Darkhan sand and gravel deposit is located in the Kharaa river valley with water under than 2.1 m of water. So the drilling method was tube drilling. The diameter of the anchor pipe installed in the exploration boreholes was 8 inches or 203 mm, and the anchor pipe installation was 20-25 cm ahead of the drilling progress.

The sand-gravel mixture in the water of the Darkhan deposit is extracted by hydro mechanical methods, and after the suction is pumped by a floating pump, the material is piled on the surface, drained and dried.

Core drilling in sand-gravel mixture deposits does not require the use of mud solution, very little water washing, and the sand is drilled dry.

The core yield during column drilling should be at least 80% of all advances. If the core from the borehole is intact and the structure is intact, the yield of the core shall be determined by measuring the length, and the yield of the broken core shall be determined by comparing its weight and volume.

If the core yield is low, certain measures must be taken to increase it.

Excavations will be carried out on the surface of the deposit in order to determine the location and shape of the deposit, the distribution of minerals, and the internal formation of the stratum, the composition of mineral particles, to verify the results of drilling and geophysical surveys and to obtain technological samples.

Mining operations should be carried out in the areas of detailing, as well as in the areas of the field that are scheduled for priority development.

3.5. The distance between exploration excavations shall be determined by the geological structure of the deposit, the shape, size and location of the stratum, its thickness and quality stability, and the forecast of mining potential.

Table 2 provides an overview of the grid density of exploration excavations used in sand and gravel deposits. It is used in the planning and implementation of geological exploration work and, depending on the nature of the deposits, is not mandatory for all deposits.

Based on the analysis of geological formations, geological and geophysical survey data, and detailed assessment of mining data for similar deposits, the density of the exploration grid suitable for the study of the deposit can be selected.

Additional excavations may be performed to determine changes in the thickness of the stripping soil, the boundaries of the distribution and leaching of minerals, its changes, and the elevation of the surface, depending on the complexity of the surface shape of the deposit and the stratum.

Integration of sand and sand-gravel exploration grid densities

Table 2

Deposit group	Deposit type	The distance between exploration excavations (meters) and the grade of the resource		
		A	B	C
Group 1	Large and medium strata and strata-like, marine and lake, wind, and alluvial origin, geological formations, mineral thickness and quality stable sand and sand-gravel mixture deposits.	100-200	200-300	300-600
Group 2	Large and medium strata and strata-like, deposits of all origin (non-standard strata), geological formations, unstable in mineral thickness, variable quality of sand and gravel deposit (various varieties and brands are not classified by area)	-	100-200	200-400
	Small deposits and irregularly shaped deposits of all origins, geologically unstable, variable thickness, unstable sand and gravel quality Modern diversion and terrace sand and sand-gravel mixture deposits change location, shape and size over the years and perennials.	-	50-100	100-200

Note: 1. When exploring an elongated formation, the distance between the horizontal and horizontal exploration lines shall be as specified in the table above, and the distance between the excavations on the lines may be reduced depending on the shape, size and geological characteristics of the layer. 2. The distance between excavations shall be kept to a minimum in the case of sand exploration used in the manufacture of glass and metal casting molds and silicon carbide.

3.6. In the case of very large and large deposits, it is necessary to conduct a detailed study and assess the reserves and quality of the area selected for exploration in the first instance, so as to obtain relevant information on the quality of mineral resources in the total area of the deposit.

These areas should be studied and sampled with a slightly denser mesh than the rest of the deposit. For Group I deposits, the exploration grid will be selected for Proved (A) and Proved (B). For Group II deposit includes only for Measured (B). In the third group of deposits, the density of the exploration excavation grid shall be less than twice the distance between the exploration excavations to determine the (C) grade.

If the deposit is very large, the area studied in detail should be fully assessed for the location of the mineral layer, the shape and size of the layer, the reserves, and the quality of the sand and gravel.

The information from the detailed study areas will be used to identify the main group of deposits, select the density of the exploration grid, select the optimal exploration techniques, and objectively evaluate the results of sampling and resource estimates. It will be used to assess the feasibility and conditions of the entire deposit.

Also, the data collected during exploration and mining will be used to study and evaluate the deposits in detail.

3.7. All excavations and findings will be documented in accordance with applicable procedures and requirements. The initial documentation shall include geological records and markings of the samples taken.

Excavation documentation identifies the petrographic composition, structure, and texture of the rock, and classifies the layers and bundles contained in the sand-gravel layer that differ in composition and physical-mechanical properties.

The joints and sets identified in the excavations must be aligned with the location elements on the transverse and longitudinal sections. In addition, these strata must be classified according to lithological, facial, and textural characteristics.

The quality and completeness of the initial excavation documentation depends on how the geological structure of the deposit has been assessed, whether the structural features of the aquifer have been accurately determined over the entire deposit area, the maps have been properly designed, and the geological recordings have been accurate. The quality of the samples shall be evaluated by the competent commission and evaluated by the stability of the sampled section, the weight of the samples, its conformity to the geological structure, the completeness and continuity of the sample, and the presence of control samples.

3.8. Samples must be taken from all exploration excavations and natural outcrops in order to fully assess the mineral quality of the deposit and section, to determine the boundaries of the distribution of mineral strata, and to assess the resources.

3.9. The choice of sampling method will be made at the initial stage of the deposit exploration, depending on the shape of the deposit surface, internal formations, geological boundaries, their distribution, if any, and the degree of sand and gravel quality change.

The sampling method chosen should be as accurate, reliable, and efficient as possible, fully compatible with the raw material.

If sampling is to be performed in several ways, they should be interrelated so that the accuracy of the study can be fully determined.

The core, groove, scraping and other sampling methods obtained during the geological survey, the quality of the sample and the optimal evaluation of the sample processing method shall be followed by the relevant normative methodology.

If possible, sampling intervals should be planned using the results of logging and nuclear physics, magnetic and other studies to save labor costs in sampling and processing.

3.10. The following conditions must be observed when testing a deposit:

The density of the test grid depends on the geological composition of the deposit or section under study and is usually selected based on the experience of exploration of similar deposits. In the case of brand-new deposits, the selection will be based on experimental research.

Sampling shall be carried out continuously at the full thickness of the mineral layer, and other types of rocks that do not meet the quality requirements contained in the mineral layer may be added to the mineral depending on its thickness.

The selection of the most suitable sample length should take into account the mineral thickness and the thickness of the non-standard vein / layer, and if the thickness of the non-standard and hollow rock layer is small and cannot be separated, the mineral should be sampled together.

Samples are taken from each of the most distinct types in the mineral layer, and the length of these samples varies depending on changes in their composition, structural and textural characteristics, and physical, mechanical, and other qualitative characteristics.

As mentioned above, the sampling shall be carried out separately for the full thickness of each clearly distinguished layer, and if the layers are very thick or the layers are indistinguishable, and the small layers are alternated / branched, the samples shall be no more than 2-3 m long.

The minimum thickness of non-standard (non-compliant) and hollow rock layers that can be removed separately during mining is 1-2 m.

During the exploration phase, the geological formation, mineral composition and mineral thickness of the deposit have been sufficiently studied and, if homogeneous, the sample length can be selected to be the same length as the open pit bench being mined or planned to be mined. If they are not homogeneous, they shall be tested separately.

If the mineral layer of the deposit is low in thickness, uneven in grain structure, contains clay, loam and clayey sand grains, and if it is not possible to separate them during mining, the whole thickness of the mineral layer shall be taken into account.

If there are separate layers of sand and sand-gravel in the exploration borehole, separate samples shall be taken from each layer. Samples from gravel-free sand shall be reduced to the required weight by the compaction method. Samples from the sand-gravel mixture are sieved in a 5 mm mesh in the field to separate gravel and sand, and the gravel sections are sieved through a 70, 40, 20, 10 mm mesh to determine the percentage of each fraction.

In the laboratory, the sand is sieved through 5, 2.5, 1.25, 0.63, 0.33, and 0.14 mm mesh to determine the particle composition. The method of sampling in excavations of sand and gravel deposits varies depending on the stability of the debris in the sand-gravel mixture. If the debris is stable and does not collapse, the groove shall be sampled. The cross-section of the groove sample taken from the sand deposit shall be 5 x 10 cm and 10 x 10 cm, depending on the size of the sand grains.

Depending on the content and size of the large sand-gravel fractions, the cross-section of the grooved samples may be 40 x 40 cm, sometimes larger than the larger fractions.

However, if the content of the crushed material is not stable, or if the mineral contains cobblestones, all the materials from the excavation progress will be piled up and a lot of samples will be taken from them.

For advanced sampling, 8, 6, 4 and 2 progress samples are obtained by combining the materials. The number of samples taken depends on the weight of the material from the excavations. The weight of the sample to be obtained by the progressive method depends on the change in the cross-section of the hole (in the case of excavation), which is carried out by means of a trench and a large circular chain.

In bulk sampling, the material from each mineral layer is stockpiled separately, mixed thoroughly, and then compacted to the required volume.

Gravel-sand deposits containing boulders will also be sampled by advanced methods, and bulk samples will be taken after manual removal of boulders (> 70 mm in size) from the stockpile prepared for sampling.

In the case of aggregate samples taken from the deposit along the length of the mining bench or at the full thickness of each layer, the sample obtained must be qualitatively representative of the mineral quality of the deposit.

3.11. Samples will be taken from the excavations at the deposit where the mining is being carried out and from the strata in the natural gorge by the groove method and, if necessary, by clearing excavations. The number of clearance excavations will depend on the size of the footprint and open pit and whether the mineral is homogeneous. If the deposit consists of separable layers and it is not possible to sample them by the groove method, sufficient material shall be taken from each layer and the stockpile shall be sampled after separate stockpiling.

3.12. Special care should be taken during sampling, as small fractions may be lost from the sample, iron may be contaminated from the equipment used for sampling, and organic matter may be contaminated from the soil-vegetation layer.

3.13. To verify the correctness of the sampling method for exploration boreholes and excavations, control samples shall be taken and compared with each other in a way that is considered to fully meet the sampling requirements. Groove sampling is evaluated by the results of bulk sampling. For determining the volume and weight of technological samples taken, the control method can be compared with the results of the extraction process.

The accuracy of the marrow sampling will be verified by the results of the groove sample taken from the pit and compared with the sampling and mining results obtained during the exploration of the existing deposit. The weight of the control sample should be sufficient to assess whether an error occurred during the sampling of the deposit and, if necessary, to determine the correction factor. Particular attention should be paid to the coherence of geological documentation and sampling methods in monitoring. Accurately record the location of the sample from the deposit, regularly check that the thickness of the mineral body is determined correctly, and regularly monitor the cross section of the groove and core samples and the core yield (fluctuations should not exceed + 10-20%) in a timely manner

3.14. Sample processing and summarization will be carried out according to a pre-arranged scheme tailored to the specifics of each deposit and the mineral. The main and control samples are processed and summarized according to the same scheme. The accuracy of the sample processing scheme and the coefficient K can be verified by comparing the results of a well-tested deposit with those of a similar deposit or by using test results. In most sand and sand-gravel deposits, the K coefficient is assumed to be 0.04.

3.15. The quality of sand and gravel will be assessed depending on the industry in which it is used. One of the most important of these is the study of whether sand can be used in the manufacture of glass, in the preparation of alloys for steel, cast iron and other special molds, or as a raw material for welding and silicon-carbide production. In addition, the possibility of using sand to produce good quality building materials will be evaluated. The quality of sand and gravel is assessed based on its chemical and mineral composition, particle composition, physical and mechanical properties, and the results of technological experiments. The quality of the sand will be assessed by the simplest and cheapest test, the determination of mineral and particle composition, the shape of the sand grains, and the content of contaminants (dusty, clayey mixtures).

In the case of gravel, its quality is determined by addition to the above analysis of the sand by determining the strength and brittleness content of the fracture. The results of additional studies will be used to assess the feasibility of using sand and gravel in a particular area. Depending on the stage of exploration and the state of the formation, the physic-mechanical analysis will be performed in a complete or summary program.

A brief physic-mechanical analysis is performed to sift the sand through 2.5, 1.25, 0.63, 0.315, and 0.14 mm mesh to determine the particle composition, as well as the modulus of the sand grains, the content of clayey and dusty particles, and the density (specific gravity) and organic matter.

In addition, the mineral composition of the sand will be studied. If the properties of sand that need to be determined for use in certain specific areas (e.g. sand filtration coefficient) are determined, they should be added to the summary program.

If sand is to be used to protect the road from frost and to build a dewatering layer, the sand dewatering coefficient must be specified. A complete physical and mechanical analysis of the sand and gravel shall be performed on all parameters of the summary analysis in addition to other parameters relevant to the requirements of the raw material industry.

3.16. Chemical analysis is performed to the extent necessary to determine the quality requirements of raw materials for all industries in which sand can be used. The list of identifiable oxides must meet the requirements of the standards, specifications and specifications set by the public and private organizations that use the raw material. The content of oxides and components / components in the raw material must be fully determined by chemical, light, physical and geophysical and other tests certified by national standards.

The main (most) part of the sample taken during the first stage of exploration work at the deposit will be subjected to a brief chemical analysis. If sand is used in the manufacture of glass and ceramics and in the manufacture of molds, the following oxides shall be identified. These include: SiO_2, AI_2O_3 and Fe_2O_3. Complete analysis of a small number of samples and of all enlarged samples to determine the following oxides. These include: SiO_2, AI_2O_3, Fe_2O_3, FeO, TiO_2, CaO, MgO, K_2O, Na_2O, sulfate and sulfide sulfur, and combustion losses. In addition to the above oxides in the sand used as glass raw materials, Cr_2O_3 and other di-oxides, phosphorus and in some cases, fluorine are added. At this stage, a semi-quantitative light test is mandatory.

All enlarged (grouped) samples taken during the exploration phase and some of the normal samples shall be subjected to a complete chemical analysis, and most of the samples shall be subjected to a summary chemical analysis.

Grouped samples will be taken from the exploration excavations at the deposit in a thin section to form a complete cross-section, and samples will be taken from duplicate samples crushed to the same size as conventional samples and fully representing the quality of the deposit's raw materials. However, if the thickness of the individual layers of sand and gravel is large, the length of the grouped samples may be limited by the height of the open pit bench.

The weight of a simple sample taken from a duplicate sample is directly related to its length.

The number of grouped samples and the number of components / plants (oxides) to be determined shall be determined in accordance with the characteristics of the deposit and the plant requirements for the use of raw materials.

The study of other specific (accidentally contained) minerals in sand and gravel will follow the Placer Deposit Recommendation “Methodological Recommendations for the Classification of Mineral Resources and Deposit Reserves” prepared by the Ministry of Mining and Heavy Industry in 2019.

Radiation-hygienic parameters of raw materials required for all industries using sand and gravel shall be compared with the requirement that the amount of radium equivalent in construction materials currently used in Mongolia should not exceed 370 Bq/kg.

3.17. The quality of all laboratory tests of the samples shall be confirmed by internal and external control tests performed in accordance with Mongolian standards and internationally used test methods. The quality of the main laboratory tests is monitored throughout the exploration period. Monitoring includes the analysis of basic minerals, ancillary minerals, and toxic impurities.

3.18. If an accidental error occurs in the test, encrypted samples from the duplicate sample should be sent to the laboratory that analyzed the main samples of the deposit and the internal control analysis should be performed before the start of the next quarter. In the event of a significant discrepancy between the primary and internal control tests, an external control sample shall be taken from the duplicate sample of the internal control sample and tested at an authorized laboratory.

3.19. The size and quality of the samples submitted for internal and external inspection shall fully represent the typical samples tested quarterly and semi-annually. In the case of many samples (2000 or more), the control test should be performed on 5% of the total number of samples tested, and on a relatively small number of samples, on at least 30 samples.

3.20. The processing of the results of internal and external monitoring shall consider the time of analysis, quarterly, semi-annually, and annually, and shall be based on the laboratory method of analysis of the main samples. The Placer Deposit Recommendation "Guidelines for Applying the Classification of Mineral Resources and Deposit Reserves to a Specific Mineral" will be used to determine the extent of possible errors in laboratory analysis.

The standard deviation of the case calculated from the internal control results shall not exceed the values given in Table 3 below. If it is exceeding all previous reports are dismissed and the all samples will be done again. The cause of the error in the basic laboratory test should be identified and appropriate action taken.

The permissible squared error of the relative average of oxides and mineral content is given in Table 3 below.

The mean square error of the case of oxides and mineral content allowable amount

Table 3

Oxides	Oxide content classification *,%	Relative mean square error,%	Oxides, and minerals	Oxide content classification *,%	Relative average square error,%
Al_2O_3	10-15	5	CaO	1-7	11
	5-10	6.5		0.5-1	15
	1-5	12		0.2-0.5	20
SiO_2	>50	1.3	K_2O	>5	6.5
	20-50	2.5		1-5	11
	5-20	5.5		0.5-1	15
MgO	10-20	4.5	Fe_2O_3	<0.5	30
	1-10	9		10-20	3.0
	0.5-1	16		5-10	6.0
Na_2O	5-25	6.0	TiO_2	4-15	6.0
	0.5-5	15		1-4	8.5
	<05	30		<1	17
ш.г.а	20-30	2	S	1-2	9
	5-20	4		0.5-1	12
	1-5	10		0.3-0.5	15
	<1	25		0.1-0.3	17
Cr_2O_3	5-10	3	FeO	5-12	5.5
	1-5	5		3.5-5	10
	0.1-1.0	8.5		<3.5	20
* Note: If the content groups separated on the deposits differ from the content groups shown in the table, the allowable standardized error of the mean square is determined by interpolation.					

3.21. If there are persistent discrepancies between the results of the external inspection and the results of the main samples and the laboratories performing the control samples, the external (external inspection) inspection shall be performed by an internationally accredited laboratory.

External control test samples may be obtained from duplicate samples in the laboratory where the main samples and control samples were tested (the test results are stored) or, in their absence, from the remainder of the analyzed samples. 30-40 samples will be taken from the groups that have shown constant errors during the control analysis. Pre-prepared samples with the same composition as the test samples shall be included in the test kit and sent to an independent laboratory. At least 10 to 15 samples from each of the groups indicated for error should be tested in an external laboratory.

If the results of the analysis of the main samples show that there are persistent errors, it is necessary to take measures to identify and correct the cause and re-test all the samples. To do this, it is decided whether to invalidate the test results on the main samples or to use a correction factor for those test results. It is forbidden to use correction factors without external analysis.

3.22. Errors that may occur during the sampling and processing stages and in the process of determining the properties, composition and size of the mineral layer using the test results must be assessed.

3.23. In the evaluation of gravel-sand deposits, the most important indicator is the composition of the mineral particles (grains) by all fractions to determine the gravel and sand yield. This is important for the direction of use of the mineral and the design of the crushing plant technology scheme.

3.24. Cobblestones, gravel and sand yield in sand-gravel will be determined at all excavations during the geological exploration phase. Sand-gravel field screening shall be carried out in accordance with the requirements of the relevant standards and specifications and shall be performed on samples taken from all excavations during the initial phase of exploration and on 50% of samples taken from all excavations during the exploration phase. Field screening samples shall be taken from excavations located in a uniform mesh distribution in the exploration area.

During the field screening, petrographic separation of gravel will be performed to determine the content of brittle gravel, thin flat and grass-shaped gravel. These definitions will be made on the samples taken during the exploration phase to determine the composition of the gravel, and it will be determined that the excavations are evenly distributed over the entire deposit area. During the exploration phase, the number of samples to be separated will be determined depending on whether the gravel is homogeneous.

Gravel separation is performed on 20% of the total samples taken from the total exploration excavations. In the field, the gravel content of the sand, the smoothness of the sand grains and the mineral composition are predetermined. Another important parameter is the content of dusty and clayey mixtures in the sand to determine whether they are film-coated on the sand grains, contained in the sand as a solid sphere, or evenly distributed in the sand as particles. Dust and clay mixtures in the sand and organic matter content will be determined by sampling from all exploration excavations.

3.25. The results of field screening of gravel-sand samples must be monitored by laboratory screening, and control screening should be performed on 5-10% of all field screening samples. The difference in screening results should not exceed +1%.

3.26. The gas permeability of fine-grained siliceous sands of quartz sand and molds is determined by its moisture content in semi-oily and oily types of sand. These parameters are determined for all main sand samples taken from the deposit, and for enlarged samples taken to cover the full thickness of the mineral layer at the deposit being mined.

3.27. The chemical composition of the sand is not standardized to the requirements of building sand standards, but will be important for quality assessment if it is used for purposes other than construction. In particular, if sand is used as a glass raw material, it should be subjected to mineral-petrographic, physical, chemical and other tests in accordance with relevant methods and standards. The mineral composition is determined for each sand particle fraction. It is necessary to determine the smoothness and angularity of the grains in the sand used as a raw material for metallurgical molds. Particular attention should be paid to the amount of toxic admixture and the type of admixture (sand grains coated as a film, or mixed as individual particles, coarse-grained, etc.).

3.28. Physic-mechanical analysis of boulders is usually performed in fractions of 400-500 mm, which are economically viable for mining and crushing. Cobblestone samples are taken from excavations where a mixture of cobblestones and sand-gravel is present. Samples of boulders shall be taken from all types of rocks that make them up, and samples shall be taken specifically from boulders considered to be of uncertain hardness. If cobblestone materials are used in road construction, additional analysis of 50-150 mm gravel and crushed stone will be performed.

3.29. The specific gravity (density) and moisture content of a mineral are essential for the calculation of a deposit's mineral resources and are determined by the nature of all types of sand and the non-standard layers it contains. The specific gravity (density) is determined for all types of minerals in the deposit, and the specific gravity of the sand and sand-gravel mixture is determined by the method of mining penetration into the deposit. Excavation rates for specific gravity (density) are usually 1-3 m3, depending on the mineral composition. In addition to determining the specific gravity (density), the coefficient of loosening of sand and gravel and natural moisture, and the volume weight of each fraction of sand and gravel in sparse conditions shall be determined using excavated material. These parameters are determined for each type of mineral, and if the deposit consists of multiple layers, they are also determined for the sand and gravel in each layer.

The mineral composition of the samples, which determines the specific gravity (density), moisture content and coefficient of thinning, must be determined.

In order to ensure the accuracy of the measurement of specific gravity, regular calculations should be performed, such as excavation of the samples, measurement of the excavation volume, and measurement of the samples weight.

In gravel-sand deposits, gravel and sand yields are classified by all fractions, and the yield (volume) of each fraction of rock that is loosened by the penetration of a dense mass of 1 m3 of rock is determined.

3.30. Using the results of chemical and mineral composition, particle composition, physical and mechanical properties of sand and gravel, the natural types of raw materials of the deposit and the types of mineral production (technology) are classified. The possibility of enriching these raw materials will also be evaluated. Emphasis will be placed on the results of technological research in the final determination of the (technological) types and varieties of mineral production.

Four. Studies of ore technological properties

4.1. The technological properties of sand and gravel will be studied in laboratory and semi-industrial experiments.

In some cases, the results of technological tests performed on the same type of raw material, previously confirmed by laboratory tests, may be used to make a preliminary assessment of the industry, type, and quality of the product to be used. In addition to the results of complete and summary physical and mechanical analyzes, the results of other analyzes may be used to assess the quality of the mineral. For example, a mixture of natural gravel and sand can be used for direct testing of concrete using large and small aggregates for heavy concrete. Samples are sent for testing and the testing is carried out in accordance with a mutually agreed program developed jointly by the testing organization (laboratory) and the program clearly states the test methodology and the parameters to be studied. The pilot program should include an assessment of the raw material needs and quality of the sand and gravel industries.

If the technology test determines that the mineral does not meet the production requirements in its natural state, it is necessary to include in the pilot program the study of the possibility of enriching it. In addition, it is necessary to determine the type of ancillary plant in natural sand-gravel, its shape and size, and how it changes after enrichment. This will determine the economic benefits of extracting these components. The possibility of hydro mechanical mining of sand and sand-gravel must be explored, and factors such as the amount of water released during mining, the shape of the deposit surface, and the looseness of the stripping soil must be determined in advance. In addition to determining the method of removal of clayey and fine-grained mixtures in the sand during hydro mechanical mining, the possibility of concentrating and using these fine-grained wastes must be evaluated.

Technological sampling of the deposit will be carried out in accordance with the guidelines for technological sampling at the exploration stage. If this type of recommendation has not yet been developed, similar methodological recommendations can be used, such as “Technological Testing in the Process of Geological Exploration, 1998” by Russia

In addition, technological testing may be conducted in consultation with the organization proposing the use of the enriched raw material and based on a jointly developed program. Types and varieties of mineral technologies shall be classified according to geological-technological maps, and the size of the technological sampling grid shall be selected depending on the natural types of minerals and the frequency of the layers. Samples for mineralogical-technological and semi-technological (semi-industrial) experiments are taken from all types of minerals. Based on the results of technological experiments, geological-technological types of minerals will be determined, types and varieties of mineral production will be classified, mineral composition, physical-mechanical and technological properties of minerals will be determined, and geological-technological drawings, plans and sections will be prepared. The size of the grid for normal and enlarged laboratory samples should be determined by the geologist on site, which should allow the study of all types of minerals in the deposit in equal proportions. Samples were taken from the deposit separately from sand and gravel. The gravel sample shall be taken from each of the gravel fractions in equal proportions by weight. One or two samples of each type of raw material shall be taken for laboratory-technological testing, and more samples may be taken if deemed necessary. The weight and size of the technological sample shall be determined in consultation with the testing laboratory. Semi-industrial technology testing is intended to develop a technological scheme for the processing of minerals and to confirm the concentration of minerals determined by laboratory tests. Semi-industrial technology pilot programs shall be developed by agreement between the mineral exploitation organization and the testing organization.

Experiments with semi-industrial technology will explore the possibility of using quartz sand as a raw material for brick bricks, and dusty and fine-grained quartz sand as a raw material for brick blocks. If the quartz sand has a high content of iron oxide, the possibility of using it as a raw material for concentrating iron will be studied, and if a new good quality quartz sand deposit is discovered, the possibility of using sand as a raw material will be studied.

In the semi-industrial test, the samples shall be penetrated by boreholes, boreholes, and special pits, and if the mineral is very thick or deep, 3-5 holes shall be drilled at the same time and the aggregate sample shall be taken. The number of samples to be tested for semi-industrial production shall be determined depending on the stability of the mineral quality and the size of the deposit.

The technological sample must fully represent the technological requirements of the raw material in terms of chemical composition, particle composition, average physical and other properties. Low-grade mixed mineral layers and other small particles of non-mineral rocks, which cannot be separated during the mining and processing of the deposit's raw materials, will be included in the technological sample.

When sampling the technology, special attention should be paid to whether the quality of the raw material in the deposit changes according to the elongation and depth of the seam, and if so, whether it affects the quality of minerals across the deposit.

4.2. The composition of sand-gravel particles, their composition and technological properties need to be studied in detail. This is important for the optimal planning of the technological scheme for its extraction, processing, and efficient use. Technical requirements for sand and gravel mixes used in construction shall be controlled by 62 MNS 3216: 1982. Where technological testing is carried out in accordance with the requirements of a particular mining industry, the possibility of using sand and gravel in other industries and in other areas, as well as the disposal of mining wastes, should be considered together.

4.3. The composition of the sand, the amount of dust and clay admixtures, the presence of impurities in the sand, and the annual and seasonal operating procedures of the open pit are important factors in the design of the sand processing and concentrating technology scheme. Technological processing of sand is carried out by dry and wet methods. Clay and dust mixtures should not exceed 2-3% and relatively clean sand should be treated dry. Sandy soils containing 10% or more of clayey and dusty parts shall be wet treated. For wet processing, the sand should be cleaned 2-3 times using a mechanical washing tray and a water classifier.

4.4. The quality of the refined sand shall be assessed, and the relevant standards and specifications shall be followed in accordance with the agreement between the testing organization and the procuring entity. One of the main consumers of quartz sand is glass manufacturers. The basic quality requirements for sand to produce glass are in accordance with GOST-22551-77, which is currently in force in the Russian Federation (the national standard for glass sand is not yet available in Mongolia). According to the above-mentioned GOST requirements, the content of silica (SiO2) in high-grade glass sand may be not less than 99.8%, while in low-grade glass sand it may be up to 95%. In general, Fe2O3-0.01-0.25%, Al2O3-0.1-4.0% and heavy fraction should not exceed 0.05% in glass sand, but heavy fraction content is not normalized in low-grade glass sand. In addition, the content of CaO, MgO, Cr_2O_3, TiO_2, K_2O, Na_2O and clay admixtures in the sand shall be in accordance with the requirements of the above standard and the particle size shall be uniform. The purest quartz sand has a silicon oxide (SiO2) content of 99.8%, which is very rare in nature. Therefore, the sand used for glass raw materials is usually obtained by enriching natural sand with high quartz oxide content. The sand is usually enriched by a single flotation-flotation-cleaning-water wash, and sometimes a cleaning-water wash scheme. In rare cases, these methods may be combined with electromagnetic separators.

Sand, gravel and sand-gravel mixtures are used as aggregates for large and small aggregates in heavy construction concrete plants. The higher the quality of the aggregates, both large and small, the stronger the heavy concrete material and the higher the cement consumption. The quality of sand used as a small aggregate in concrete is determined by its particle composition, clay content, dust content, organic matter, mica, sulfur and sulfuric acid mixture and whether it meets the requirements of relevant MNS-2803-2004 and MNS-3089-1998.

In technological experiments, it is necessary to assess the possibility of using natural sand and crushed stone of natural stone as raw materials for heavy concrete and other construction purposes to determine whether the sand contains toxic impurities such as ore minerals, soluble silica, mica, and sulfur and sulfuric acid compounds. If the presence of the above admixture in the sand is determined, the capacity and type of concentrator should be considered.

If natural sands are found to be unsuitable for concrete production due to their particle size and content of toxic impurities, the sand shall be enriched by washing and grading. The technical requirements for washed and graded sand are the same as in 5.3. When gravel is used in concrete, its coarse and coarse grains should be in proportion to keep the cement content as low as possible. Also, the content of needle-shaped and thin flat gravel and brittle gravel should be within the standards. One of the most important parameters for determining the quality of gravel is its mechanical strength (crushing), which is determined by injecting gravel into a cylinder under laboratory conditions. Test for determination of gravel fragmentation MNS-2998-2009. It must be performed according to BS-12 test standard.

The technological requirements for sand and gravel for the production of hydraulic concrete are relatively high. Gravel and sand suitable to produce hydraulic concrete products shall be verified by direct testing of concrete and the concrete grade shall be determined. Direct tests should be used to determine the grade of hydraulic concrete, the cold resistance of the concrete, the limit of compressive strength, and the content of soluble silica that reacts with the alkali of the cement. In the production of cement, sand is sometimes used as an activating compound, and all brands of Portland cement are used as additives. It is also used to produce sandy cement. In this case, the quality of the sand is determined by the technical specifications of the user organization. Sand used as an activator in Portland cement should contain at least 70% silica (SiO_2) and in most cases 80-95%. Quartz sand is used as a modifier to increase the silicate modulus of cement clinker and reduce the modulus of clay. The suitability of quartz sand for use as a repair mixture shall be determined by semi-industrial testing.

When assessing the suitability of sand for the preparation of masonry and plastering mortars, its particle composition shall be determined in accordance with the technical requirements of MNS-392-1998 and MNS-392-2014. If the content of dusty, clayey particles and other impurities in the sand is higher than the technological requirements and the organic mixture is present, the quality of the sand will be adversely affected.

In road construction, sand and gravel shall be used in combination with binder materials for the construction of the main foundation, frost-resistant and drainage layers, and surface paving. The quality requirements of the sand and sand-gravel mixture to be used for the above-mentioned road facilities shall be determined in accordance with the local location and climatic conditions of the road construction.

The methodology for sand and gravel analysis to be used in railway dams is specified in MNS-2998-2009. In addition to determining the particle size, dust and clay content, agglomerated clay content and soluble silica content in all types of road and sand and gravel used for road construction, the strength of the gravel must be determined by crushing and wear resistance by rotating drums. The cold resistance of gravel and the content of brittle and weathered gravel in the gravel mass shall be determined.

The sand-gravel mixture is used in its natural form or in the construction of railway dams by crushed gravel and crushed stone. Their quality assessment shall be carried out in accordance with the technical requirements of MNS-AASHTO-M-43-2002. These include: the composition of the sand and gravel particles, the content of the brittle part in the gravel and the clay-dusty part. If gravel and cobblestones are to be used for the construction of a railway embankment, the quality shall be assessed by determining the particle size composition, abrasion resistance (on the floor drum), the content of crushed and brittle grains, cold resistance and gravel content of less than 0.16 mm.

In the metallurgical industry, quartz sand (in the form of molds) is used as the main raw material for the production of metal castings. The sand should be pure quartz and, in rare cases, slightly clayey. Formwork sand shall meet the requirements of GOST-2138-91 (Russia), be fire-resistant, have good gas permeability and shall not contain sulfur sulfide, plant residues, peat, coal and other impurities. The fire resistance of sand depends on the content of silica and iron oxides, alkali and alkaline earth metals, and clay mixtures. Depending on how well the sand grains are smoothed and the composition is the same, its gas permeability is high.

For the production of steel and cast iron molds, usually large and medium grains, silica (SiO_2) not less than 93%, iron oxide (Fe_2O_3) -1.0%, alkali and alkaline earth metal oxides not more than 2.0%, clayey Use no more than 2.0% sand in the mixture. The sulfur content of sulfide in the mold sand shall not exceed 0.05%. However, fine-grained sand with a clay content of more than 2.0%

can be used to produce molds for copper, aluminum and magnesium castings, and fine-grained clay sand can be used for the production of non-ferrous metal molds.

Formwork sand has a high compressive strength, and clay, bentonite, and liquid glass are added to the formwork mix to increase the strength of the sand. Clay sand usually does not require such a mixture. Therefore, the strength of semi-oily and oily sands must be determined by their natural state.

Pure quartz sand is used in the production of building bricks (bricks, concrete), the content of silica in the sand is not less than 50% in the production of bricks, the content of silica ($SiO2$) in the production of concrete is 70% - and not less than sulfur and sulfur compounds, alkalis, mica, dusty and clayey mixtures, and organic mixtures. However, the requirements for particle composition vary depending on the production of aggregate concrete and aggregate bricks from the sand. MNS 3213: 1982 standard shall be followed.

The quality of the sand used to produce lime-sand mixer wall blocks for the construction of multi-storey buildings will be the same as the sand used to produce bricks, and there are no independent technical requirements. The assessment of the quality of raw materials or sand is based on the quality of the finished product produced. Experience has shown that to produce lime-sand retaining wall blocks, a 0.6-2.0 mm section of sand should be at least 50%. If it is necessary to use fine-grained 0.15-0.6 mm sand, the composition of the binder can be adjusted by mixing gravel, gravel, slag and other coarse particles.

When using coarse and medium-grained sand as a small concrete aggregate, the content of clayey and dusty particles in the sand should not exceed 10%. When sand containing up to 10-15% of clayey and dusty parts is used for the production of lime-sandblasted wall blocks, the finished product is steam-strengthened.

Quartz sand for the production of welding products may contain not less than -97% silica ($SiO2$), not more than P-0.015%, only traces of sulfur (S), and other impurities up to 3%.

Suitable sand for train locomotive brake sand spreaders shall be pure quartz sand of the same composition and particle size of 0.1-0.2 mm.

The sand used for this purpose shall contain not less than 75% relatively high silica ($SiO2$) and not more than 3% of the clay mixture or 0.022 mm section. The main indicator of the quality of this sand is its grain and mineral composition.

For the production of building bricks and molds from high-elastic oily clay, coarse-grained, quartz sand is used as a hardening mixture, which does not contain carbonate rock and gypsum fragments and other rock gravel, and the particle size should be 0.15-1.5 mm. There are currently no specific standards or specifications for sand to be used for this purpose, and its suitability for that purpose will be determined by testing of the finished product.

The use of quartz sand as a clay mortar in the production of ceramic pottery can reduce the settling of ceramic products. The main requirement for the sand used for the above purposes in the production of ceramic pottery is its chemical composition. Toxic impurities in the sand include dye oxides such as iron and titanium, calcium oxide, and kaolin, as well as the amount of weight loss (p.p.p) that burns the sand.

In the production of fine ceramics, according to GOST-7031-75 (Russia), silica (SiO_2) not less than 93-95%, iron and titanium oxides not more than 0.2-0.3%, CaO-not more than 1-2%, kaolin1 Use sand with quartz-feldspar composition not more than -2% and weight loss not more than 1-2%. Depending on the composition of the sand, it is necessary to decide whether to use it in its natural state or after its sorting.

Sand is used as an abrasive / abrasive material for polishing glass, metal surfaces and stone slabs, and for the production of artificial abrasives-silicon-carbides (carborundums) used in the foundry industry. GOST-3647-80 (Russian) standard is followed.

The grains of quartz sand used as stone slab polishers should generally have the same shape with sharp corners. There should be no needle-shaped or flat-shaped sections in the sand. Silica (SiO_2) -98.5%, Fe_2O_3-0.3%, Al_2O_3-0.5% and CaO-0.3% shall be present in the quartz sand for silicon carbide production.

Quartz sand is used in the production of refractory products, especially metal alloy molds, to increase the fire resistance of the mold, to accelerate the mold forming process, and to line the metal alloy casting bucket. The size of the sand grains used for this purpose should be 0.5-1.0 mm and the grains should have sharp angles. Toxic admixtures that reduce the temperature of the alloy, such as mica, fluorspar and iron and alumina, should be kept to a minimum.

To keep the cement solution strong, use quartz sand (GOST-6139-2003 standard) with a particle size of 0.5-0.9 mm and no more than 0.3% clayey dust mixture.

Quartz sand is used to fill and seal cracks in the walls of oil wells, and gravel filters are used to improve the quality of water treatment. According to the Russian Technical Specifications TU-39-0147001-160-97, the particle size of quartz sand to be used for filling cracks in oil production wells should be 1.5-0.8 mm, 0.8-0.4 mm, 0.4-0.2 mm. the content of these fractions shall not be less than 90%. The spherical content in the sand grains should not exceed 0.6% and the acid clay content in the sand should not exceed 1%.

When the content of glauconitic in the sand is more than 25%, it is used in agriculture as a potassium fertilizer, and in some factories it is used for the production of paints with special filters.

Technological testing of sand and gravel will enable the development of a technological scheme and economic assessment for the complete extraction of minerals that may be of industrial interest.

In order to identify ancillary minerals and rocks in the sand and gravel mixture, it is necessary to assess their share in the bedrock, enrichment technology and economic significance in advance. Methodological recommendations for application of the classification to the type of mineral “Placer deposit” recommendation shall be followed.

The return and wastewater used during the screening and concentrating of sand and gravel will be calculated, the feasibility of the water treatment will be assessed and, if necessary, the waste will be collected and stored together.

Five. Studies of hydrogeology, engineering-geology, ecology, and other natural conditions of deposits

5.1. During the hydrogeological survey, “Thematic, medium and large-scale hydrogeological mapping, instructions and requirements for hydrogeological survey of the deposit during mineral exploration” approved by the Order No. A / 237 of the Minister of Mining and Heavy Industry dated December 12, 2017 followed.

Hydrogeological surveys identify the presence of aquifers that could flood the deposit, assess the feasibility of using water from highly irrigated areas and zones, or determine measures to remove water from the open pit. It is necessary to determine the thickness of each aquifer, lithological composition, type of infiltration and feeding conditions, determine the water level and determine the hydrogeological parameters of aquifers by hydrogeological pumping-experimental work to determine whether they interact with other aquifers and surface water. It is important to determine the amount of water that can enter the mine during mining, to include the protection of the mine from flooding in the feasibility study, to minimize the amount of water entering the mine, and to conduct research on water infiltration. The chemical composition of the water and the content of bacteria in the water must be determined. These will determine the impact on the strength of concrete, metal and plastic structures at the mine. The chemical composition of the water in the mineral layer and the water permeability must be determined at the mine where the mining is taking place.

In addition to exploring the possibility of using the effluent from the mine for water supply, it is necessary to determine how the infiltrated water will affect the presence of groundwater abstraction facilities in the vicinity of the deposit.

Therefore, research recommendations should be made in the above areas, and the recommendations should reflect the results of research on the environmental impact of mine drainage.

It is recommended that potential sources of water be identified to meet the drinking and technical water needs of the planned mining and processing plant workers.

Drainage water resources will be identified and used, and the relevant methodological guidelines will be followed. Using the results of hydrogeological surveys in mine planning, it will be possible to build drainage ditches to drain the mineral strata, drain the effluent, address the mine's water supply, and develop environmental protection measures.

5.2. Conducting parallel engineering and geological surveys during the exploration of the deposit will provide conditions for the development of mining projects and will enable the implementation of measures to improve safety during mining.

Engineering and geological studies show the physical and mechanical properties of minerals such as sand-gravel and bedrock and sedimentary rocks, the strength of rocks in their natural and water saturation, lithological and mineral composition, rock stratification and other parameters, which can occur during mining.

Landslides, mine floods and other physical and geological impacts are predicted.

In permafrost regions, the temperature regime of the rock, the upper and lower boundaries of the permafrost zone, the boundary of the permafrost distribution area, the effect of the physical properties of the rock on permafrost thawing, and the depth of seasonal freezing and thawing of mineral layers are determined.

The engineering-geological study will provide a preliminary assessment of the rock stability of the mine wall, which will be important in estimating key parameters for future open pit mining.

In conducting engineering-geological research, we will follow the “Guidelines for engineering-geological research of ore deposits” and “Methodological recommendations for engineering-geological, hydrogeological and geo-ecological research of ore deposits”.

5.3. In sand and sand-gravel mixed deposits, mining will be carried out by open pit excavation to a water depth of up to 15 m below the water level by a dragline (shovel excavator) and by a floating suction device (dredger) at a depth of up to 30 m. do. In addition, sand and gravel can be extracted from the borehole with water, which can be used when the stripping soil is thick or the mineral layer is below the critical agricultural and other valuable areas.

5.4. It is necessary to determine the presence of natural factors such as high doses of radiation and dangerous ionization that affect human health. If high doses of radioactive radiation are detected in rocks, they should be classified according to their radionuclide content.

5.5. The new deposit area identifies areas where industrial and civil facilities, waste rock and tailings have been found to be depleted.

5.6. The main purpose of geo-ecological research is to provide information on environmental protection measures required for project development.

When publishing information on environmental protection measures, pay attention to the relevant provisions of the Law of Mongolia “On Prohibition of Exploration and Mining of Minerals in Watersheds, Water Reservoirs and Forests” approved on July 16, 2009.

Geo-ecological studies determine the basic parameters of the environment and geological environment (natural radiation levels, surface and groundwater, air quality, soil cover, and the definition of flora and fauna).

Chemical and physical effects, dust, surface and groundwater pollution, and industrial wastes that may affect the environment of the proposed facility should be identified to assess soil and vegetation and air pollution, and the impact of these pollutants on the atmosphere should be assessed.

In addition, it is necessary to determine the amount of land that will be affected by natural resources, such as forests, water for technical purposes, and primary and secondary production. During mining, stripping and host rock, and in some cases low-quality mineral stockpiles, were selected. The dynamic impact limits, duration, sources of contamination, and the extent of their potential hazards should be identified.

In order to optimize the land reclamation, the thickness of the vegetation soil layer was determined and the possibility of establishing vegetation layer on the fluffy sediments was assessed by conducting agrochemical studies. Recommendations have been developed for the protection and rehabilitation of the deposit area.

5.7. Hydrogeological, engineering-geological, mining-geological and other natural conditions need to be studied in detail, which is essential for the development of a mineral development project. If there are other deposits with similar hydrogeological and engineering-geological conditions in the vicinity of the deposit, the degree of irrigation of the exploration area, the engineering-geological conditions of the mine and the experience of water drying measures can be used. If more specific studies are required due to the extreme hydrogeological and engineering-geological conditions of the deposit, the deposit owner and project developer should agree on the scope of work, timing and methodology.

5.8. If there are other types of minerals in the depository and in the cover rock that form an independent deposit, the production value, possible scope of use, and production significance will be studied, and the requirements for a comprehensive study of secondary minerals will be implemented.

5.9. Geological and exploration research, future mining and processing operations, archeological, historical monuments and paleontological finds in the mine boundaries, boundaries and districts shall be carried out in accordance with established procedures, instructions and requirements.

Six. Reserve estimation and resource evaluation

6.1. The calculation of sand and gravel reserves shall be carried out in accordance with the requirements of the “Mineral Resources and Deposit Classification and Guidelines” approved by the Order No. 203 of the Minister of Mining dated September 11, 2015. This guide classifies deposit reserves as geological reserves and production reserves. Geological reserves are calculated based on the results of exploration work at the deposit, while production reserves are calculated based on the feasibility study for the deposit.

6.2. The deposit's reserves are calculated in sections, and the sections are classified according to the complexity of the geological formation of the deposit and the level of research. The mineral layer included in one part of the resource shall meet the following parameters. These include:

• The quality and quantity of sand and gravel should be studied at the same level of exploration

• Homogeneous geological formations, internal formations of mineral strata, thickness, composition of sand and gravel, basic quality parameters, technological characteristics are the same or similar

• The location of the mineral layer is stable, the geomorphological elements are homogeneous, and the mining conditions are common.

6.3. The following additional conditions should be considered in the resource estimates that reflect the characteristics of the aluminum ore deposits:

Proved reserves (A): The Proved (A) class reserve is calculated in the first group of deposit subjected to its detailed study area. Boundaries of reserve blocks shall be restricted to only excavation workings and exploration boreholes.

In addition, it is considered as Proved (A) class, if the part of the deposit locating under operation has been getting prepared or ready for mining excavation in results of completing exploration and mining excavation works. The Proved (A) class reserves are stated in accordance to the requirements of (A) class reserves prescribed in "Classification and guideline of mineral resources and reserves of deposits" that practiced in Mongolia. Based on exploration results, the estimated Proved (A) class reserve of the deposit has to be sufficient reserves to cover the initial investment of the mining enterprise.

Measured reserves (B): The Measured (B) class reserve is calculated in an area of the 1st and 2nd groups of deposits subjected their detailed study area. Boundary of the reserve blocks shall be bordered with line connecting excavation workings and boreholes.

On the basis of detailed studies on the basic parameters like as thickness ranges of the ore-bodies and distribution pattern of major useful components, as well as identification of mining-geological condition, the border of blocks belonging to the Measured (B) classification can be contoured within frame of limited extrapolation.

Also, it can be considered as Measured (B) class, if the part of the deposit locating under operation has been getting prepared or ready for mining excavation in results of completing exploration and mining excavation works. In addition, the Measured (B) class reserves are stated in accordance to the requirements of (B) class reserves prescribed in "Classification and guideline of mineral resources and reserves of deposits" that practiced in Mongolia.

In case of 2nd group of deposit, major part of the reserves shall be estimated in Measured (B) classification.

Indicated reserves (C): The Indicated (C) class reserves are estimated in that part of deposit, where the exploration grid density allowed meeting the requirements to estimate the reserves in C-classification. For the area of the deposit that subjected to reserve estimation in Indicated (C) classification, the geological information and results have to be confirmed by the result of the detailed survey of the deposit, and for the mine operation area - by the results of exploitation of the deposit. In addition, boundary of area that subjected to reserve estimation in Indicated (C) class can be configured out along with lines connecting data of exploration workings and boreholes, and extrapolation lines taking in account the data of geological setting, morphology changes and geophysical survey of deposit.

The Indicated (C) class reserves are estimated in accordance to the requirements of (C) class reserves prescribed in "Classification and guideline of mineral resources and reserves of deposits" that practiced in Mongolia.

The evaluation of Identified resources (P_1) category is carried out on ore bodies explored by a few excavation and drillholes as well as marginal and depth parts of ore contacted with reserve estimated ore blocks. The boundary of the ore block selected for P1 category reserve estimation is delineated by using Indicated (C) category grid density or on the basis of available data resulted from geologic settings ang geophysics.

6.4. Feasibility studies precede mining operation on the basis of geological reserves estimated. In results of the feasibility study completion, part of the geological reserves located within frame of the deposit and remaining after dedication of mining waste and pollution is presenting the production reserves, which is divided into Proved (A') and Probable (B') reserves according to requirements of "Classification and guideline of mineral resources and reserves of deposits".

Proved (A') production reserve is based on the geological reserves of mineral resources of Proved (A) and Measured (B) classifications; and on background of pilot test results selecting mining technics and technology, relevant assessments and ore technology features; and defined in details the engineering solutions, environmental and occupational safety taking in account hygiene, rights, human resources, management organizational structure, supply infrastructure, social and economic services, and economic efficiency calculations and related factors in accordance to "Feasibility study for deposit exploitation of mineral resources".

Probable (B') production reserve is based on geological reserves of mineral resources of Measured (B) and Indicated (C) classifications; and on background of pilot test results selecting mining technics and technology, relevant assessments and ore technology features; and defined in details the engineering solutions, environmental and occupational safety taking in account hygiene, rights, human resources, management organizational structure, supply infrastructure, social and economic services, and economic efficiency calculations and related factors in accordance to "Feasibility study for deposit exploitation of mineral resources".

6.5. The width of the extrapolation zone, where the resource is estimated as possible, should be confirmed by each exploration document. The boundaries of the zone drawn through the extrapolation points shall not be drawn in areas where the mineral layer is depleting or splitting, as well as in areas where the quality of minerals is declining and mountain-geological conditions are becoming more difficult.

6.6. Sand and gravel reserves are calculated separately for each resource grade. Resource estimates must take into account mining methods, types of raw material production, grade (grade), grade, class, and their economic requirements. Mineral resources shall be assessed on a case-by-case basis based on the type of industry to be exploited and the requirements of the sector, and, if this is not possible, shall be determined by calculation. Sand and gravel reserves will be calculated separately for groundwater levels and below groundwater.

Reserves of sand and gravel contained in the deposit, which have been mined at the deposit and are being prepared for mining, shall be calculated according to the resource grade of the section.

Reserves are calculated separately by exploration grade, mining method, production (technological) type, raw material type and variety, and their economic significance (geological, production).

When classifying resources by grade, quantitative and predictive estimates of the reliability and accuracy of the definition of key calculation parameters may be used as additional classifications.

6.7. Some parts of sand deposits suitable for rare and high-demand glass and ceramic, mold and carbide-silicon raw materials may be located under large reservoirs, settlements, state special protected areas, historical, cultural and natural monuments and large-scale buildings. resources are not calculated. Also, if it is necessary to leave a safety block in some parts of the deposit depending on the situation of the area and surrounding buildings, the reserves of sand and sand-gravel mixture in that block will not be calculated.

6.8. Sand resources to be used for the production of glass, ceramics, molds and carbide-silicon will be assessed together within the geological boundaries of the deposit sand. Such deposits may not be valued for other uses. In this case, the sand resources to be used in the area may be pre-estimated to be no more than twice the exploration reserves.

Discovered resources must be identified, if possible, in deposits suitable for glass, ceramic, mold sand and carbide-silica raw materials.

6.9. Based on the geological resources of the deposit, a feasibility study for the development of the deposit will be developed. On this basis, the part of the geological resource that is within the boundaries of the mine, including mining waste and pollution, is included in the production reserve, and the requirement to classify the production resource as certified reserve (A) and Objective (B) is required. ”Shall be done in accordance with for comparison of deposit reserves, the material should be accompanied by graphs showing changes in mining and geological conditions of the deposit, including previously registered reserves in the General State Reserve Fund, resource movement data (extracted and remaining reserves), unconfirmed reserves, and increased resource boundaries.

However, if the exploration data is entirely confirmed by the mining results or if there are small differences that do not affect the technical and economic characteristics of the extractive industry, the exploration and mining data can be compared using the results of geological surveying calculations.

If the license holder proposes to use a correction factor in the raw material quality and resource estimates due to the fact that the quantity and quality of the minerals registered by the Minerals Professional Council of Mongolia (MPCM) have not been confirmed at the time of exploitation, additional exploration data will be used to recalculate the deposit.

The comparative analysis should identify the causes of changes in the number of resources previously discussed and recorded by the Minerals Professional Council of Mongolia (MPCM), the resource estimation data, such as fragmentation area, layer thickness, layer structure, quality, and volume weight.

6.10. Resource estimation using computer software is based on primary data such as the coordinates of the excavations, borehole deflection data, lithological-stratigraphic boundaries, sampling results, and geological features of the deposit. This method allows the calculation of reserves using three-dimensional geological maps of the deposit prepared by a special computer program, cross-sectional and longitudinal planes, and the calculation parameters must be able to be checked and corrected. Computer-generated reports must meet the requirements for the structure and format of documents approved by the State Central Administrative Body of the Geological Sector.

6.11. If sand and gravel contain other ancillary minerals, their reserves will be calculated based on the “Placer deposit” recommended by the Ministry of Mining and Heavy Industry in 2019.

6.12. Estimates and performance reports for sand and sand-gravel deposits will be prepared in accordance with the “Procedure for mineral exploration, prospecting and mining” approved by the Minister of Mining and Heavy Industry Order No. A / 20 of 2018.

Seven. Study degree of deposit

According to the “Guidelines for classification of mineral resources and deposit reserves” any deposits are classified into following two items: evaluated deposits and explored deposits.

The study degree of the evaluated deposit determines the feasibility of continuing exploration work at the object, while for the explored deposit, it determines the readiness of the deposit for industrial mining.

7.1. At the assessed deposits of aluminum ores, their industrial value and the feasibility of carrying out the exploration stage of work should be determined, the general scale of the deposit should be identified, the most promising areas should be identified to justify the sequence of exploration and subsequent development.

The results of the geology-exploration work of the evaluated aluminum deposits should determine whether there is a need for an exploration stage, the potential value of the deposit, the overall size of the deposit, and the prospective areas that justify further exploration and subsequent mining operations should be identified.

The standard parameters to be used in resource estimates should be based on a preliminary feasibility study of a temporary exploration standard developed on the basis of reports on the results of the evaluation of newly discovered deposits, and should be sufficient to conduct a preliminary geological and economic assessment of the deposit.

The mineral exploration and mining license holders establish the assumptions about mining methods, systems, and potential production levels based on analogous projects by an aggregate basis.

The enrichment technological schemes, the possible yield and quality of products will be determined based on laboratory pilot test assuming full utilization of raw materials.

The capital costs for the construction of the mine, the cost of marketable products and other economic indicators should be determined according to aggregated calculations based on analogous projects.

When assessing the industrial significance of solid mineral deposits, the issues of household and drinking water supply for mining enterprises are preliminarily characterized based on existing, explored and probable sources of water supply.

For the evaluated deposits, experimental extracting production and processing may be carried out in order to conduct a detailed study of the shape of the ore bodies and chemical composition and the technological scheme of ore beneficiation. This should be carried out in areas that are representative of the majority of the deposit and contain the most common ore bodies in the deposit, during the period up to three years with the official permission from the relevant authorities of mining and natural environment issues. The scope and timing of this work should be agreed with Mongolia's professional inspection bodies in charge of ecology, technology and nuclear issues.

The need for experimental extracting production must be justified in each case by defining its purpose and objectives.

The experimental extracting production has to be made to clarify the more specific characteristics of the geologic settings of the ore body (change in internal structure and shape), and the proper mining-geological and geo-technical conditions, as well as the ore enrichment and processing methods (identifying natural and production types of ore and determine their ratio, enrichment character and semi-industrial test). These issues can be solved when the ore bodies area revealed by excavations with high depth and length. This experimental work will be carried out when introducing new methods in mining of mineral resource such as during borehole extraction of loosened and sparse ores and mining-out new non-traditional types of ore. In addition, in the case of large and very large deposits, it is necessary to test and improve the technological scheme developed in small concentrators before the construction of large factories.

7.2. In order to implement the conditions and relevant procedures for putting the explored deposits into production, to obtain necessary and sufficient information for the feasibility study, and to develop a project to build a mining plant and renovate such plants, the deposit reserves, ore quality, technological parameters, hydrogeological and mining -technical and ecological conditions should be studied through boreholes and excavations.

The explored deposits must meet the following requirements at the level of study:

- It is possible to classify most of the resources in the category corresponding to the complexity group of the geological structure of the deposit;

- Industrial type of mineral resources and technological properties of ore sorts should be studied in detail to develop an optimal mode of ore technology processing, extract complex minerals that are of industrial importance, to determine the trend to use factory waste, and to provide the ratinal version of storage;

- By-products and useful component-containing complexes such as cover sediment and underground water should be sufficiently studied and evaluated to the extent sufficient for estimating their reserve, classifying them as geological reserve or resources based on standard, and determining their quantity and potential use.

- Hydrogeology, engineering-geology, geocryology, geo-technical and other natural conditions should be studied in sufficiently accurate providing the initial data necessary for the project development of the deposit, taking into account the requirements of environmental legislation and safety of mining operations;

- The accuracy of data on the geological structure, forming condition and morphology of ore bodies, the quality and quantity of reserves, should be confirmed at the detailed areas that can represent the entire deposit, as well as in each specific case, the size and location of this area should be determined depending on their geological characteristics;

- To give recommendation with appropriate normative documents to minimize and mitigate the expected negative ecological consequences considering the potential impacts on the environment due to the deposit exploitation;

- The conditional parameters to be used for reserve estimation, should be established on the basis of feasibility study that allow for determination of industrial significance and scale of the deposit;

The miner of the subsoil and experts of Mineral Resources Professional Council considering the level of business risk shall determine the appropriate ratio of different reserve category. The expert of Mineral Resources Professional Council will determine and decide as recommendation the each case of possibility to exploit the Probable (C) category reserve fully or part to develop the deposit-extracting plan. In this case, the solving factors are features of geological setting of ore bodies, their thickness, characteristics of mineralization distribution within them, assessment of random errors of exploration (methodical, technical tool, sampling and analytical etc.) and consideration of exploration and exploitation experience of similar deposits.

The explored deposits are considered as ready for the possession of the industrial purposes both after issues in these recommendation have been implemented and the reserve have been registered in accordance with established regulations.

Eight. Re-estimation and registration of reserve

Re-estimation and registration of reserves in accordance with the established procedure is carried out at the initiative of the subsoil user, as well as control and supervisory organizations in cases of a significant change in ideas about the quality and quantity of reserves of the deposit and its geological and economic assessment as a result of additional exploration and mining operations.

At the initiative of the license holder, re-estimation and registration of reserves are carried out to the deposit in following cases due to the economic situation has deteriorated dramatically:

- In case of substantial non-confirmation of previously approved reserves and its certain part and their quality;
- In case of steady fall (20% or more) of the product price in significant value when the production level of prime cost is stable;
- Changing industry requirements for the quality of mineral raw materials;
- When the total amount of reserve during completing, mining stage exploration and mining operation, the unapproved amount of deducted and deductible reserves, and also the amount of reserve that cannot be extracted due to technical and economic reasons, are higher (20% and more) and lower than a normative of regulation on the deduction of mineral reserves from the balance sheet of the mountain industry.

At the initiative of the supervisory and professional inspection organizations, the re-estimation and registration of reserves are carried out to the deposit in following cases such as the license holder (state)'s right has been violated, and especially unreasonable reductions in the taxable base:

- Increase in deposit's reserves, compared with previously approved or registered by 30% and more;
- a significant and stable increase in world prices for the products of the enterprise (more than 30% of the conditions laid down in the condition of feasibility studies);
- development and introduction of new technologies that significantly improve the production capacity;

- Identifying in the ores or host rocks, valuable components or harmful impurities that were not previously taken into account when assessing the deposit and designing the enterprise.

Economic issues of production due to temporary causes (complication in geology, technology, hydrogeology and mining conditions, temporary drop of price in the world market etc.,) are solved by the assistance of conditional mechanism of exploitation so, re-estimates, re-approval and registration of reserves are not required.

Reference materials

1. “Guideline for classification of mineral resources and deposits’ reserves”. 2015. Appendix 9, Mining Minister Order#203 dated on September 15, 2015

2. Project task of “Methodical recommendation applied for classification of mineral resources and certain type deposits’ reserves of Mongolia” (Appendix #2 of Order # d/195, Ministry of Mining and Heavy Industry dated on August, 13 2018)

3. Mineral processing plant design. Manual. 2013.

4. Requirements, classification, basic principles and methods of calculation of mineral ore, concentrate and product processing level**.** Resolution No. 193 of the Government of Mongolia of 2011**.**

5. Regulation for prospecting, exploration and exploitation of minerals. Annex to the Order A/20 of the Minister of Mining and Heavy Industry dated February 5, 2018.

6. General basis of construction engineering research /BNbD 11-07-19/ norm and rule. Order no.138 of 2019, Minister of Construction and Urban Development

7. Approval of a unified system of geodetic coordinates and datum, projection. Resolution no. 25 of the Government of Mongolia. Ulaanbaatar. 28 January 2009.

8. Guidelines for conducting geophysical survey. Guidelines and requirements for conducting and reporting electrical, magnetic, gravimetric and aerial geophysical mapping in the territory of Mongolia. 2019. Order A/237 of the Minister of Mining and Heavy Industry dated December 12, 2017.

9. Pre-Cambrian diaspora bauxite in Mongolia (in Russian). 1981. Mongolia-Russian joint scientific expedition. Zaitsev N.S., Luvsandanzan B., et al.

10. “Recommendations for a comprehensive study of the deposit and an estimate of the reserves of the by-products”. Russia, Moscow. 2007.

11. “Instructions for thematic and medium, large-scaled hydrogeological mapping and hydrogeological study during mineral exploration work of deposit and its requirement” Order #A/237 of Ministry of Mining and Heavy Industry dated on 12 December 2017

12. Mongolian Geology and Minerals Series, Volume VII. Non-metallic minerals

13. Methodical recommendations for the application of the Classification of reserves of deposits and forecast resources of solid minerals. Sand and gravel. Moscow, 2007. 41 pages

14. Mongolian Code for the Public Reporting of Exploration Results, Mineral resources, Mineral Reserves (MRC Code), 2016. “Mongolian Standard for Reporting Mineral Reserves”.

Appendix (sand and gravel)

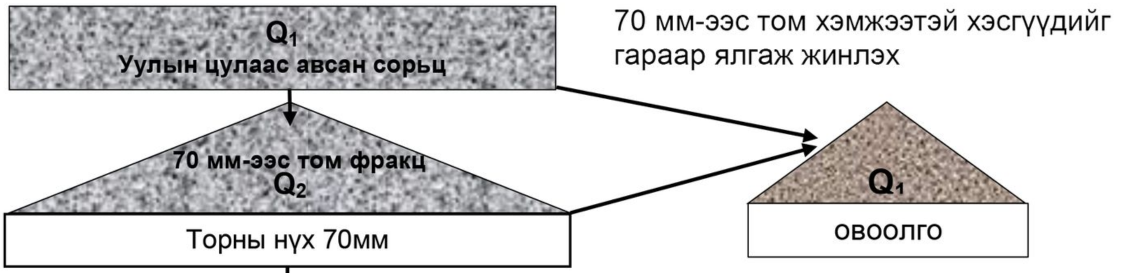
Appendix 1

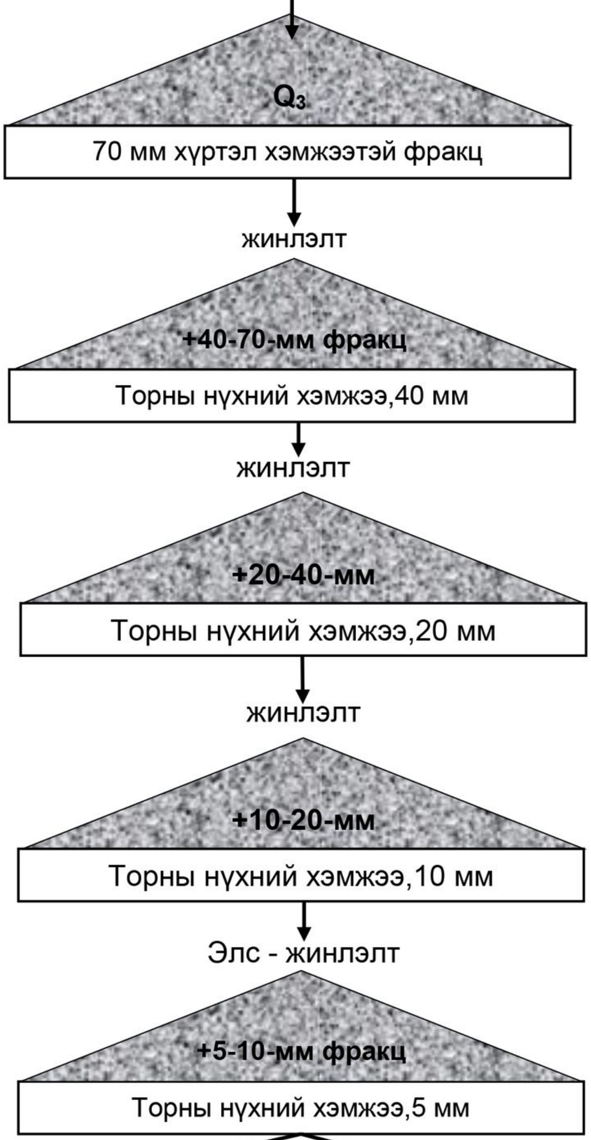
List of basic standards and specifications for sand and gravel and their products

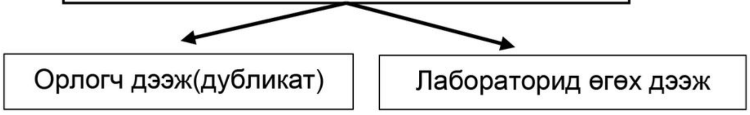
A. Sand and gravel used in the production of construction materials	
MNS 2803:2004	**Aggregates for heavy concrete are sand and gravel. Technical requirements.** This standard applies to precast and cast concrete, reinforced concrete structures, gravel, crushed gravel, crushed stone and sand for use in civil and industrial buildings and structures. Excludes aggregates for special purpose concrete (hydraulic, road, heavy concrete, etc.).
MNS 0346:2000	**Gravel and crushed gravel for construction General technical requirements** This standard applies to concrete, reinforced concrete structures, bulk concrete aggregates, pouring in other types of construction work, sieve gravel separating the natural gravel-sand mixture, and crushed gravel.
MNS392:1998, MNS392 :2014	**Sand for construction work. Technical requirements**
MNS AASHO M43:2000	**Composition of gravel and stone particles used in road and bridge construction. Technical requirements**
MNS 2917:2009	**Sand for construction. Test method**
MNS 3089:1998	**Sand and gravel mixture for construction. Test method**
MNS 2998-2009	**Physico-mechanical analysis of sand and gravel. Test method**
ГОСТ-9128-97	**Sand-gravel mixture for paved roads and runways. Technical requirements**
ГОСТ-7394-85	**Rail ballast sand-gravel. Technical requirements**
MNSISO 836:2000	**Use of sand as an additive to cement active minerals. Test method**
MNS2998-2009 AASHTOT 96	**Determining wear and tear with a Los Angeles instrument. Test method**
MNS2998-2009 BS-12	**Determination of the amount of fracture by compression in a cylinder, Test method**
Б. Sand used in the manufacture of glass	
ГОСТ-22551-77	**Quartz sand. Technical requirements**
B. Sand for casting production	
ГОСТ-2138-91	**Mold quartz sand. Technical requirements**
B. Sand for use in other industries	
ГОСТ-7031-75	**Quartz sand for fine ceramics. Technical requirements**
ГОСТ-4417-75	**The raw material for welding is quartz sand. Technical requirements**

Элс-хайрганы сорьцыг хээрийн нөхцөлд шигшиж ширхэгийн бүрэлдхүүний агуулгыг тооцоолох бүдүүвч (схем)

==Хавсралт №2







Сорьцын анхны жин- Q_1

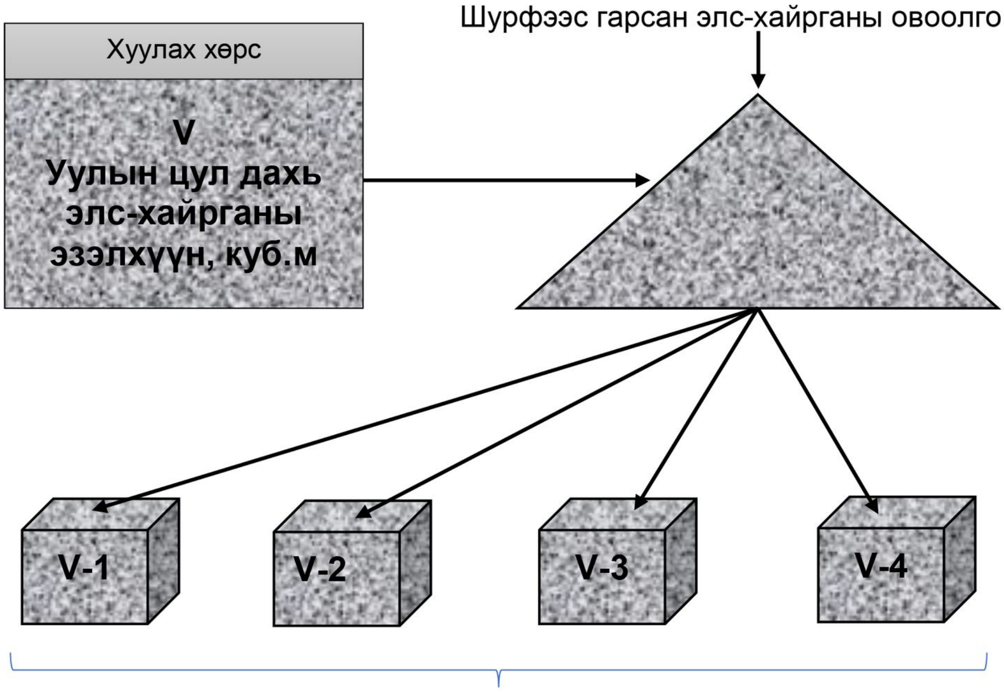
Шигшилтын явцад фракц тус бүрийг жинлэж, тэдгээрийн дээжийн анхны жинд эзлэх хувийг тооцож гаргана. Гэхдээ дараагийн буюу доод талын шигшүүр дээрхи фракцын жин нь шигшүүр тус бүр дээр доор үзүүлснээс ихгүй байх ёстой.

Үүнд: 40 мм-ийн тор дээр 100 кг
20 мм-ийн тор дээр 60 кг
10 мм-ийн тор дээр 30 кг
5 мм- ийн тор дээр 10 кг
5 мм-ийн торыг нэвтэрсэн-элс

Хэрэв шигшүүр бүр дээр эдгээрээс 2-3 дахин түүнээс их байвал тэдгээр фракц тус бүрийг дундчилсаны дараа хураангуйлалт хийж, хэд дахин хураангуйлсан тухай холбогдох журналд тэмдэглэнэ.

Хавсралт №3

ХЭЭРИЙН НӨХЦӨЛД ЭЛС БА ЭЛС-ХАЙРГАНЫ ХОЛИМГИЙН СЭВСГЭРЖИЛТИЙН ИТГЭЛЦҮҮР ТОДОРХОЙЛОХ АРГАЧЛАЛ



Эзэлхүүнийг нь хэмжсэн хайрцагнуудад хийсэн элс ба хайрга

$$\frac{\sum V\text{-}1+V\text{-}2+V\text{-}3+V\text{-}4.......}{V} = K_{св}$$

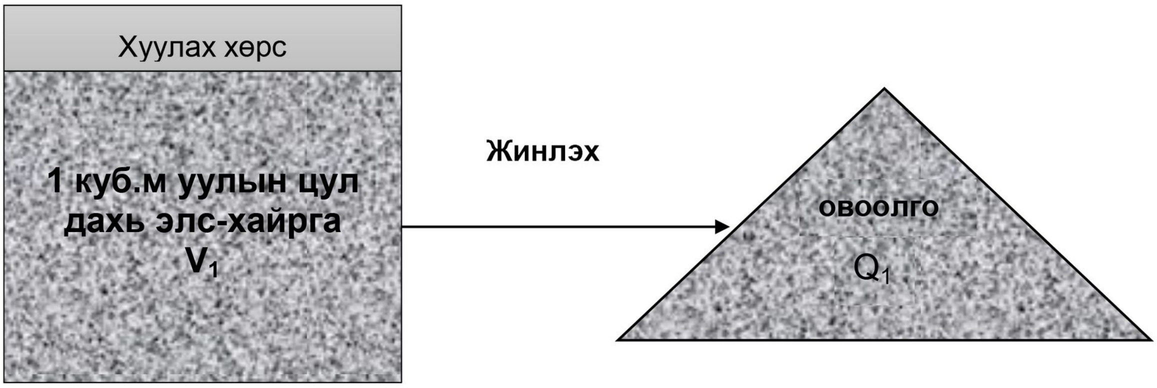
$K_{СВ}$-сэвсгэржилтийн итгэлцүүр

V-1+V-2+V-3+V-4......-эзэлхүүнийг нь хэмжсэн хайрцагнуудад хийсэн элс-хайрганы эзэлхүүн, куб.м

V- Уулын цул дахь элс-хайрганы эзэлхүүн, куб.м

Хавсралт №4

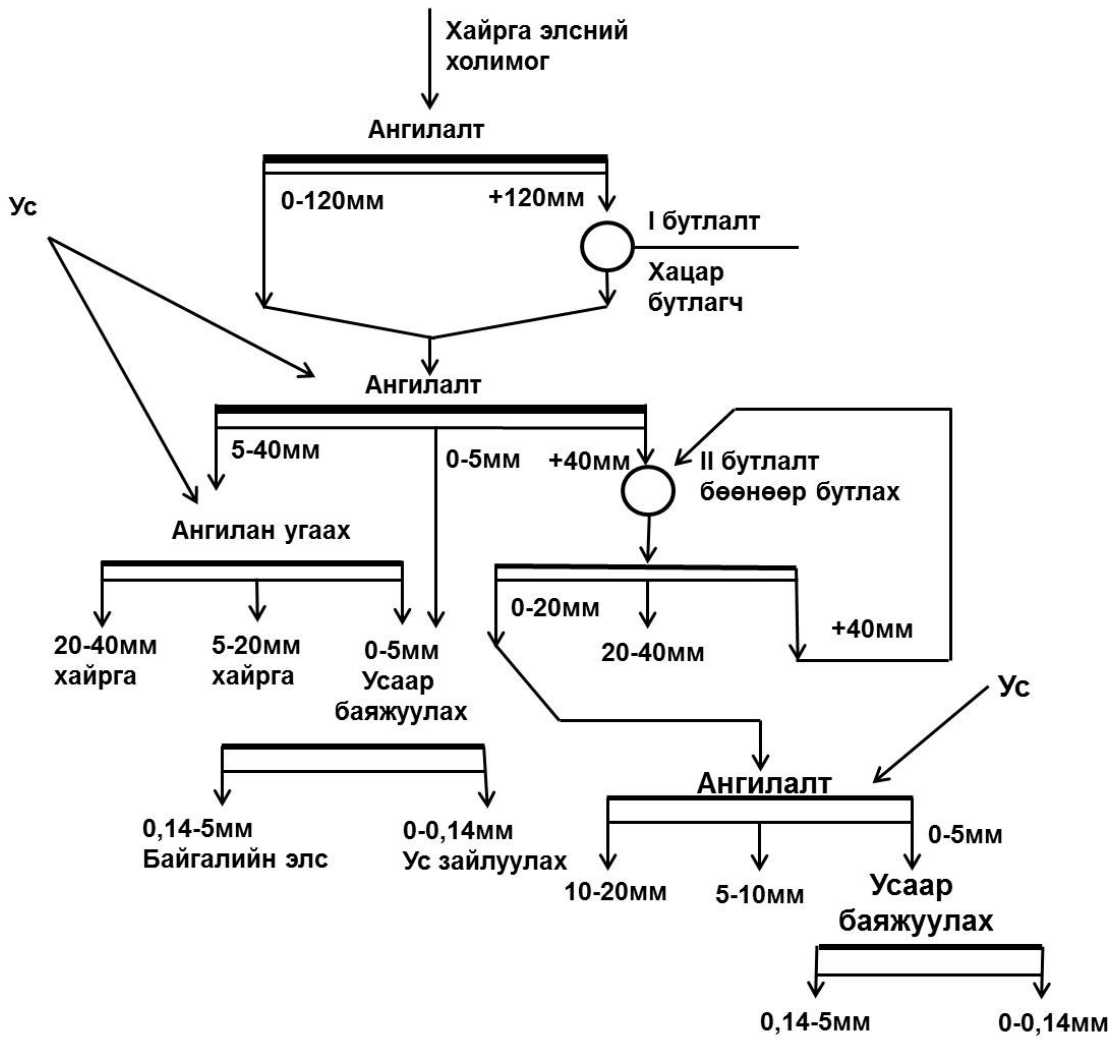
Хээрийн нөхцөлд элс-хайрганы холимгийн нягт (хувийн жин)-ыг тодорхойлох аргачлал



Q_1- уулын цулаас гарсан элс-хайрганы холимгийн жин

V_1 -Уулын цул дахь элс-хайрганы холимгийн эзэлхүүн, $м^3$
(тухайн тохиолдолд уулын цул дахь элс-хайрганы холимгийн эзэлхүүн-1 $м^3$)
g- элс-хайрганы холимгийн нягт, $г/см^3$ буюу $т/м^3$

$$g = Q_1 : V_1 = \text{...........} г/см^3 \approx т/м^3$$


Хайрга элсний холимог
Ангилалт
0-120мм
+120мм
Ус
I бутлалт
Хацар бутлагч
Ангилалт
5-40мм
0-5мм
+40мм
II бутлалт бөөнөөр бутлах
Ангилан угаах
0-20мм
20-40мм
+40мм
20-40мм хайрга
5-20мм хайрга
0-5мм Усаар баяжуулах
Ус
Ангилалт
0-5мм
0,14-5мм Байгалийн элс
0-0,14мм Ус зайлуулах
10-20мм
5-10мм
Усаар баяжуулах
0,14-5мм
0-0,14мм

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