Mineral Reserves and Mineral Resources estimation methods

The annual review of Mineral Reserves and Mineral Resources is focused on mine reserve reports, depletion through production, analysis of company plans, new exploration results, new technical reports and other changes affecting the Mineral Reserves and Mineral Resources.

Kazakhstan inherited the classification system and estimation methods for minerals that were established in the former Soviet Union. Updated 'Regulations for the Classification of Non-ferrous Metals Reserves' became law in Kazakhstan in 2006. In practice, this means that the statements of resources and reserves developed by KAZ Minerals (and the mining plans to which they relate) must be submitted for approval to the corresponding committees of the Ministry of Industry and Infrastructural Development, for which adherence to the standardised national system of reserve estimation is mandatory.

Under the Soviet inherited system, copper deposits are classified according to their degree of geological complexity into one of three deposit categories, which determine the density of exploration sampling and the proportions and classifications of the State Commission on Mineral Reserves (GKZ) reserves that must be estimated. As part of the exploitation licence for each mineral deposit, a set of 'Conditions for Estimation of Reserves' are prepared by a Kazakhstan licenced design institute and submitted for approval to the State. The Conditions for each deposit specify the minimum thickness for exploitation of the ore body and cut-off grades, plus special considerations which may apply where the conditions for mineral extraction are exceptional or present difficulties.

Kazakhstan is now in a transition period where it will relinquish the old GKZ based reporting system and will fully adopt the KAZRC reporting code by 2023.

The three operating mines in the East Region are moving to KAZRC reporting of Mineral Reserves and Resources. The estimation assumptions and ore body models used by GKZ have been reproduced using computer-based models. Resource estimates show almost identical tonnage values and similar, but arguably more accurate, grade values. Under the GKZ system, grade estimation was based on polygonal methods with no interpolation between data points. Under KAZRC, the estimation method is not prescribed but ordinary kriging has been selected which allows for interpolating data between data points and, in theory, produces a smoother grade distribution. When future exploration drilling results are received, the computer models and resource estimates will be updated independently of GKZ considerations.

To convert resources to reserves in the East Region, a system of computerised three-dimensional mine planning has been introduced. During 2020, the new system was first used at Artemyevsky and in 2021 it was introduced at Orlovsky mine with Irtyshsky mine to follow in 2022. The new method results in a more accurate assessment of Mineral Reserves by fully considering the economic, practical and safety aspects of mining virgin ore bodies and remnants of previously worked ore bodies.

At Bozymchak in Kyrgyzstan, a review has been made of the mine's reserves statements and they are presented in accordance with the criteria to meet JORC standards. The Committee for Mineral Reserves International Reporting Standards ('CRIRSCO') guidelines for the alignment of former Soviet reporting standards and the CRIRSCO Template have been used. Under these guidelines, categories of Kyrgyzstan reserves (B, C1 and C2) have been aligned with appropriate JORC Mineral Resource categories (Measured, Indicated and Inferred). The Competent Person, however, remains responsible for all reported Mineral Reserve and Mineral Resource estimates.

For the Company's large open pit mines at Aktogay and Bozshakol, the assessment of Mineral Reserves and Mineral Resources is based on computer modelling and estimated in accordance with the guidelines of KAZRC. At both mines during 2021, the on-site geologists updated the resource models to include the latest exploration drilling results. Mineral Reserves are based on life-of-mine plans developed by the mine planning engineers during 2021.

No further exploration drilling has been done at Koksay to change the resource model and hence the Mineral Resource is unchanged from last year. The Peschanka project released an updated JORC-compliant Mineral Resource estimate in 2021 which includes the results of additional exploration drilling. A Bankable Feasibility Study was completed and approved by the KAZ Minerals Limited Board of Directors in September 2021, and this forms the basis for the first estimate of JORC-compliant Ore Reserves (Mineral Reserves) for the project. The Competent Persons for this work have provided consent for the disclosure of the estimates for which they are responsible, as shown at the end of this report.

Stockpiling of mined ore is common practice at large open pit mines, usually as a means of providing a consistent tonnage and grade feed to the processing plant. Stockpiled ore is included in the inventory of Mineral Reserves and Mineral Resources, but reference is made to the quantity of material held in stockpile at year end. In the case of mined ore added to a heap leach pad, this is considered as 'in process' and hence is not included in the Mineral Reserve and Mineral Resource Statement.

All Mineral Reserves quoted in the following tables are discounted for ore losses and dilution and refer to estimates of tonnes and metal grades at the point of delivery to the processing plant. Tonnage figures refer to dry metric tonnes.

Mineral Resources are reported inclusive of Mineral Reserves, but not discounted for loss and dilution.

Summary of Mineral Reserves

		Reserves[1] Mt		Copper %		Gold g/t		Silver g/t		Zinc %		Lead %		Molybdenum %	
		2021	2020	2021	2020	2021	2020	2021	2020	2021	2020	2021	2020	2021	2020
Artemyevsky[2]	Proved	9.9	10.7	1.54	1.65	0.52	0.56	57	48	2.84	2.41	0.82	0.72	–	–
	Probable	8.7	11.0	1.70	1.56	1.17	1.07	107	108	4.08	4.28	1.40	1.41	–	–
	Total	18.6	21.7	1.61	1.60	0.82	0.82	81	79	3.42	3.35	1.09	1.07	–	–
Irtyshky[2]	Proved	1.0	1.5	1.24	1.29	0.20	0.19	38	40	2.29	2.29	0.26	0.29	–	–
	Probable	–	0.9	–	1.35	–	0.19	–	36	–	2.04	–	0.22	–	–
	Total	1.0	2.4	1.24	1.31	0.20	0.19	38	39	2.29	2.21	0.26	0.26	–	–
Orlovsky[2]	Proved	4.6	4.4	3.23	3.05	1.14	1.14	65	65	4.41	4.29	1.15	1.09	–	–
	Probable	3.6	3.0	3.24	4.16	0.39	0.48	24	26	2.37	2.58	0.55	0.60	–	–
	Total	8.2	7.4	3.23	3.50	0.81	0.87	47	50	3.51	3.59	0.89	0.89	–	–
Total East Region[2]	**Proved**	15.5	16.6	2.02	1.99	0.68	0.68	58	52	3.27	2.90	0.88	0.78	–	–
	Probable	12.3	14.9	2.15	2.07	0.94	0.90	83	87	3.58	3.80	1.15	1.17	–	–
	Total	27.8	31.5	2.08	2.03	0.80	0.79	69	69	3.41	3.32	1.00	0.96	–	–
Bozymchak	Proved	5.0	4.8	0.76	0.78	1.31	1.32	7.7	7.5	–	–	–	–	–	–
	Probable	5.1	6.1	0.76	0.74	1.17	1.17	8.6	8.8	–	–	–	–	–	–
	Total	10.1	10.9	0.76	0.76	1.24	1.23	8.2	8.3	–	–	–	–	–	–
Aktogay sulphide[3, 4]	Proved	853.9	556.2	0.32	0.32	–	–	–	–	–	–	–	–	0.008	0.008
	Probable	518.1	828.6	0.32	0.32	–	–	–	–	–	–	–	–	0.008	0.007
	Total	1,372.0	1,384.8	0.32	0.32	–	–	–	–	–	–	–	–	0.008	0.008
Aktogay oxide	Proved	30.4	49.5	0.24	0.25	–	–	–	–	–	–	–	–	–	–
	Probable	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	Total	30.4	49.5	0.24	0.25	–	–	–	–	–	–	–	–	–	–
Total Aktogay[3, 4]	**Proved**	884.3	605.7	0.32	0.31	–	–	–	–	–	–	–	–	0.008	0.008
	Probable	518.1	828.6	0.32	0.32	–	–	–	–	–	–	–	–	0.008	0.007
	Total	1,402.4	1,434.3	0.32	0.32	–	–	–	–	–	–	–	–	0.008	0.007
Bozshakol sulphide[4]	Proved	564.2	521.1	0.33	0.35	0.16	0.13	1.0	1.0	–	–	–	–	0.007	0.007
	Probable	323.4	375.5	0.32	0.33	0.14	0.12	0.9	0.8	–	–	–	–	0.008	0.007
	Total	887.6	896.6	0.33	0.34	0.15	0.13	1.0	0.9	–	–	–	–	0.007	0.007
Bozshakol clay[4]	Proved	86.4	106.5	0.40	0.38	0.19	0.19	1.2	1.0	–	–	–	–	0.006	0.006
	Probable	–	0.3	–	0.35	–	0.18	–	1.1	–	–	–	–	–	0.004
	Total	86.4	106.8	0.40	0.38	0.19	0.19	1.2	1.0	–	–	–	–	0.006	0.005
Total Bozshakol[4]	**Proved**	650.6	627.6	0.34	0.35	0.16	0.14	1.0	1.0	–	–	–	–	0.007	0.007
	Probable	323.4	375.8	0.32	0.33	0.14	0.12	0.9	0.8	–	–	–	–	0.008	0.007
	Total	974.0	1,003.4	0.33	0.34	0.16	0.13	1.0	0.9	–	–	–	–	0.007	0.007
Peschanka[5] (Baimskaya)	Proved	174.0	–	0.72	–	0.42	–	4.0	–	–	–	–	–	0.016	–
	Probable	1,301.0	–	0.41	–	0.24	–	2.3	–	–	–	–	–	0.010	–
	Total	1,475.0	–	0.45	–	0.26	–	2.5	–	–	–	–	–	0.011	–
Total KAZ Minerals	**Proved**	1,729.4	1,254.7	0.38	0.36	0.11	0.09	1.3	1.2	0.03	0.04	0.01	0.01	0.008	0.007
	Probable	2,159.9	1,225.4	0.39	0.35	0.17	0.05	2.0	1.3	0.02	0.05	0.01	0.01	0.009	0.007
	Total	3,889.3	2,480.1	0.38	0.35	0.15	0.07	1.7	1.3	0.02	0.04	0.01	0.01	0.009	0.007

1 Include allowances for ore loss and dilution (Reserve = Resource – ore loss + dilution).

2 East Region zinc, lead, gold and silver grades shown in the Proved Reserve are estimated only to the Probable Reserve confidence level.

3 The Aktogay molybdenum grade shown in the Proved Reserve is estimated to the Probable Reserve confidence level.

4 Proved Reserves include stockpiled material.

5 The Mineral Reserve estimate for the Peschanka deposit in the Baimskaya licence area was prepared by AMC Consultants Pty Ltd with an effective date of 30 November 2021.

Summary of Mineral Resources

		Resources[1] Mt		Copper %		Gold g/t		Silver g/t		Zinc %		Lead %		Molybdenum %	
		2021	2020	2021	2020	2021	2020	2021	2020	2021	2020	2021	2020	2021	2020
Artemyevsky[2]	Measured	9.1	10.4	1.77	1.95	0.61	0.62	67	53	3.33	2.74	0.96	0.81	–	–
	Indicated	8.2	10.6	1.96	1.77	1.35	1.21	123	121	4.69	4.81	1.62	1.59	–	–
	Total	17.3	21.0	1.86	1.86	0.96	0.92	94	88	3.97	3.79	1.27	1.20	–	–
Irtyshsky[2]	Measured	0.8	1.8	1.89	1.74	0.31	0.37	57	70	3.47	4.91	0.40	0.59	–	–
	Indicated	0.8	0.7	1.29	2.17	0.44	0.30	82	58	6.32	3.27	0.88	0.36	–	–
	Total	1.6	2.5	1.58	1.86	0.38	0.35	70	66	4.93	4.45	0.65	0.53	–	–
Orlovsky[2]	Measured	4.6	4.3	3.43	3.25	1.21	1.22	69	70	4.67	4.57	1.22	1.16	–	–
	Indicated	3.3	4.7	3.83	3.58	0.46	0.55	28	26	2.80	2.36	0.65	0.57	–	–
	Total	7.9	9.0	3.60	3.42	0.90	0.87	52	47	3.89	3.42	0.98	0.86	–	–
Total East Region[2]	**Measured**	14.5	16.5	2.30	2.26	0.78	0.75	67	59	3.76	3.45	1.01	0.88	–	–
	Indicated	12.3	16.0	2.41	2.32	1.05	0.97	95	91	4.30	4.03	1.31	1.23	–	–
	Total	26.8	32.5	2.35	2.29	0.91	0.86	80	75	4.01	3.74	1.15	1.05	–	–
Bozymchak	Measured	6.4	6.2	0.79	0.80	1.41	1.41	8.4	8.2	–	–	–	–	–	–
	Indicated	5.7	6.5	0.85	0.83	1.37	1.37	10.0	10.2	–	–	–	–	–	–
	Total	12.1	12.7	0.82	0.82	1.39	1.39	9.1	9.2	–	–	–	–	–	–
Aktogay sulphide[3, 4]	Measured	809.9	838.2	0.35	0.35	–	–	–	–	–	–	–	–	0.009	0.008
	Indicated	1,036.2	1,029.4	0.32	0.32	–	–	–	–	–	–	–	–	0.007	0.008
	Total	1,846.1	1,867.6	0.33	0.33	–	–	–	–	–	–	–	–	0.008	0.008
	Inferred	98.8	98.8	0.28	0.28	–	–	–	–	–	–	–	–	0.007	0.007
Aktogay oxide	Measured	28.9	46.9	0.26	0.27	–	–	–	–	–	–	–	–	–	–
	Indicated	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	Total	28.9	46.9	0.26	0.27	–	–	–	–	–	–	–	–	–	–
Total Aktogay[3, 4]	**Measured**	838.8	885.1	0.35	0.34	–	–	–	–	–	–	–	–	0.008	0.008
	Indicated	1,036.2	1,029.4	0.32	0.32	–	–	–	–	–	–	–	–	0.007	0.008
	Total	1,875.0	1,914.5	0.33	0.33	–	–	–	–	–	–	–	–	0.008	0.008
	Inferred	98.8	98.8	0.28	0.28	–	–	–	–	–	–	–	–	0.007	0.007
Bozshakol sulphide[4]	Measured	575.7	525.3	0.34	0.34	0.16	0.14	1.1	1.1	–	–	–	–	0.007	0.007
	Indicated	464.4	490.3	0.33	0.34	0.15	0.12	1.0	0.9	–	–	–	–	0.008	0.008
	Total	1,040.1	1,015.6	0.34	0.34	0.16	0.13	1.0	1.0	–	–	–	–	0.007	0.007
	Inferred	75.0	109.0	0.34	0.37	0.12	0.13	1.1	1.4	–	–	–	–	0.010	0.009
Bozshakol clay[4]	Measured	88.3	107.2	0.41	0.40	0.19	0.19	1.2	1.2	–	–	–	–	0.006	0.006
	Indicated	–	0.5	–	0.35	–	0.18	–	1.1	–	–	–	–	–	0.004
	Total	88.3	107.7	0.41	0.40	0.19	0.19	1.2	1.2	–	–	–	–	0.006	0.006
	Inferred	–	0.3	–	0.44	–	0.20	–	1.5	–	–	–	–	–	0.003
Total Bozshakol[4]	**Measured**	664.0	632.5	0.35	0.35	0.16	0.15	1.1	1.1	–	–	–	–	0.007	0.007
	Indicated	464.4	490.8	0.33	0.34	0.15	0.12	1.0	0.9	–	–	–	–	0.008	0.008
	Total	1,128.4	1,123.3	0.34	0.35	0.16	0.14	1.1	1.0	–	–	–	–	0.007	0.007
	Inferred	75.0	109.3	0.34	0.37	0.12	0.13	1.1	1.4	–	–	–	–	0.010	0.008
Koksay	Measured	425.6	425.6	0.37	0.37	0.06	0.06	–	–	–	–	–	–	0.004	0.004
	Indicated	223.4	223.4	0.51	0.51	0.08	0.08	–	–	–	–	–	–	0.004	0.004
	Total	649.0	649.0	0.42	0.42	0.07	0.07	–	–	–	–	–	–	0.004	0.004
	Inferred	235.5	235.5	0.45	0.45	0.06	0.06	–	–	–	–	–	–	0.004	0.004
Peschanka[5] (Baimskaya)	Measured	175.0	178.0	0.73	0.72	0.42	0.42	4.0	4.0	–	–	–	–	0.016	0.017
	Indicated	1,417.0	1,258.0	0.41	0.43	0.23	0.24	2.3	2.3	–	–	–	–	0.010	0.011
	Total	1,592.0	1,436.0	0.44	0.46	0.25	0.26	2.5	2.5	–	–	–	–	0.011	0.012
	Inferred	1,094.0	1,074.0	0.30	0.30	0.15	0.13	1.8	1.8	–	–	–	–	0.008	0.007
Total KAZ Minerals	**Measured**	2,124.3	2,143.9	0.40	0.40	0.11	0.10	1.2	1.1	0.03	0.03	0.01	0.01	0.008	0.007
	Indicated	3,159.0	3,024.1	0.38	0.40	0.14	0.13	1.6	1.6	0.02	0.02	0.01	0.01	0.008	0.009
	Total	5,283.3	5,168.0	0.39	0.40	0.13	0.12	1.4	1.4	0.02	0.02	0.01	0.01	0.008	0.009
	Inferred	1,503.3	1,517.6	0.32	0.33	0.12	0.11	1.4	1.3	–	–	–	–	0.007	0.008

1 Resources include undiscounted Reserves. No ore loss or dilution has been included.

2 East Region zinc, lead, gold and silver grades shown in Measured Resources are estimated only to Indicated Resource confidence level.

3 Aktogay molybdenum grades shown in Measured Resources are estimated only to the Indicated Resource confidence level.

4 Measured Resources include stockpiled material.

5 The Mineral Resource estimate for the Peschanka deposit in the Baimskaya licence area was prepared by KAZ Minerals and reviewed by AMC Consultants Pty Ltd with an effective date of 31 July 2021 and is based on a copper cut-off grade of 0.15%.

Revision of Mineral Reserves and Mineral Resources Statement to 31 December 2021

KAZ Minerals Limited has undertaken a review of the Company's Mineral Reserves and Mineral Resources estimates as the basis for the preparation of a Statement of Mineral Reserves and Mineral Resources for the Company as at 31 December 2021. The review was conducted by a Company appointed Competent Person.

The Company is reporting Mineral Reserves and Mineral Resources within Kazakhstan according to the 2017 KAZRC. Mineral Reserves and Mineral Resources outside Kazakhstan, in Kyrgyzstan and Russia, are reported according to the 2012 edition of the JORC Code.

The KAZRC sets out minimum requirements for public reporting by Kazakhstan mining and exploration companies. It was developed by representatives of the mining industry in Kazakhstan in conjunction with CRIRSCO, and with support from The Committee of Geology of the Ministry of Ecology, Geology and Natural Resources. Kazakhstan has now become a member of the CRIRSCO organisation and becomes aligned with international best practice for reporting within its mining industry.

The JORC Code is widely used internationally in jurisdictions where the national reporting standard is not consistent with the reporting requirements of stock markets such as the London Stock Exchange.

In most respects, the two codes are identical but there is a difference in terminology whereby KAZRC uses the term 'Mineral Reserve' where the JORC Code uses the term 'Ore Reserve'.

The full adoption of the KAZRC within Kazakhstan is currently in a transition period. New mining licences must comply with KAZRC requirements and existing licences, and subsoil contracts, can continue reporting to the standards of GKZ, or use KAZRC. The interim period lasts until the end of 2023 when the KAZRC system will become compulsory.

The consideration of Mineral Resources is based on the KAZRC/JORC definition, which says that a Mineral Resource is "an occurrence of minerals in such form, quality and quantity that there are reasonable prospects for eventual economic extraction". In converting Mineral Resources to Mineral Reserves in accordance with the KAZRC/JORC, a number of Modifying Factors are considered. Consequently, the codes define a Mineral Reserve as "the economically mineable part of a Measured and/or Indicated Mineral Resource. It includes diluting materials and allowances for losses, which may occur when the material is mined. Appropriate assessments and studies have been carried out, and include consideration of, and modification by, realistically assumed mining, metallurgical, economic, marketing, legal, environmental, social and governmental factors. These assessments demonstrate, at the time of reporting, that extraction could reasonably be justified."

The term 'economically mineable' has no fixed definition under KAZRC/JORC, and short-term fluctuations in factors such as metal prices or operating expenditure do not warrant the reclassification from Mineral Reserves to Mineral Resources. If, however, the changes are expected to be long-term or permanent in nature, then such reclassification is required.

The Competent Person is satisfied, from the review undertaken, that the recently revised estimates of reserves and resources prepared by the Company for its operating mines in Kazakhstan and Kyrgyzstan are in accordance with the classification system required by law and that, correspondingly, the estimates have a consistent basis for expressing the degree of confidence for stating quantities of exploitable minerals at specific grades of metal content. On the basis of the estimates supplied by the Company, the Competent Person has applied the same technical criteria as used in previous years, for preparation and restatement of Mineral Reserves and Mineral Resources as at 31 December 2021, in accordance with the KAZRC and JORC Codes.

Competent Persons

Mineral Reserve and Mineral Resource estimates are based on information compiled by Competent Persons (as defined by the KAZRC and JORC Codes). The Competent Persons have the appropriate professional membership and the relevant experience in relation to the Mineral Reserves and/or Mineral Resources being reported by them to qualify as a Competent Person as defined by the relevant code. They have consented to the inclusion of their Mineral Reserve and Mineral Resource estimates in the form and context in which they appear in this report.

Operating mines and Koksay

Simon Pepper – a Member of the Institute of Materials, Minerals and Mining, registered as a Chartered Engineer, a Fellow of the Professional Society of Independent Experts of the Subsurface Resources of the Republic of Kazakhstan and engaged by KAZ Minerals as a consultant.

Peschanka Mineral Resources

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Peschanka Mineral Reserves

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