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KGHM Polska Miedź S.A.

TECHNICAL REPORT ON THE COPPER-SILVER PRODUCTION OPERATIONS OF KGHM POLSKA MIEDŹ S.A. IN THE LEGNICA-GLOGÓW COPPER BELT AREA OF SOUTHWESTERN POLAND

February, 2013

Effective date for resource and reserve estimates: 31 December, 2011
Effective date for all other information: 30 June, 2012

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1.0 SUMMARY

Under contract number KGHM-BZ-U-0386-2012, dated 13 July, 2012, Micon International Co. Limited (Micon) has been retained by KGHM Polska Miedź S.A. (KGHM) to prepare an independent Technical Report on KGHM's copper-silver mining, processing, smelting and refining operations in the Legnica-Glogów Copper Belt area of Lower Silesia in southwestern Poland. The Technical Report is to be compliant with the requirements of Canadian National Instrument 43-101. The location of KGHM's operations in Poland is shown in Figure 1.1.

Figure 1.1
Location of KGHM's Operations in Poland

Figure obtained from KGHM website.

1.1 KGHM

KGHM, which has been in operation in the Legnica-Glogów Copper Belt continuously since 1961, is a major mining company, the shares of which are listed on the Warsaw stock exchange. KGHM's operations are fully integrated from mining to the manufacture of fabricated metal products. Its principal products are electrolytic copper and refined silver. In 2011, KGHM was the ninth largest producer of mined copper in the world, with an output of 571,000 tonnes of electrolytic copper, and the world's largest producer of silver, with an output of 40.5 million ounces of refined metal. Saleable by-products, which together contribute only a minor proportion of total revenue, are gold, platinum-palladium concentrate, rhenium, selenium, lead, nickel sulphate, sulphuric acid, and rock salt which is mined from a halite horizon in the hanging wall of the copper-silver ore zone.

KGHM's principal productive facilities in the Legnica-Glogów Copper Belt comprise:

- Three large underground mines, Lubin, Polkowice-Sieroszowice and Rudna, which extend over a strike length of approximately 40 kilometres and have the capacity to produce approximately 30 million tonnes of copper-silver ore per year.
- Three processing plants, Lubin, Polkowice and Rudna, which have a throughput capacity of approximately 30 million tonnes of ore per year and produce 1.8 to 1.9 million tonnes of copper-silver flotation concentrates per year.
- Two smelters and refineries, Legnica and Glogów, which have the capacity to treat purchased scrap and concentrates, in addition to all concentrate produced by KGHM.
- The Cedynia copper rolling mill, which produces 230,000 tonnes of copper wire rod per year, including approximately 17,000 tonnes per year of specialty oxygen-free copper rod.

Micon inspected all of these facilities and found them to be operating efficiently, with a uniformly high standard of housekeeping. KGHM also maintains a high standard of environmental awareness and responsibility.

1.2 MINING CONCESSIONS

The Minister of Environmental Protection, Natural Resources and Forestry has granted to KGHM the exclusive right to extract ore from eight contiguous mining concessions which extend northwestwards for approximately 40 kilometres between the towns of Lubin and Glogów. Details of the mining concessions held by KGHM are provided in Table 1.1 and the locations of the concessions are shown in Figure 1.2. The total area held by KGHM under these concessions is nearly 470 square kilometres.

Table 1.1
Mining Concessions

Mining Area	Concession Number	Expiry Date	Area (km^2)	Operator
Lubin I	231/93	31 December, 2013	82.6	Lubin mine
Malomice I	232/93	31 December, 2013	75.7	Lubin mine
Rudna I	233/93	31 December, 2013	75.6	Rudna mine
Rudna II	24/96	30 June, 2046	2.2	Rudna mine
Polkowice II	234/93	31 December, 2013	75.3	Polkowice-Sieroszowice mine
Sieroszowice I	235/93	31 December, 2013	97.0	Polkowice-Sieroszowice mine and Rudna mine
Radwanice Wschód (east)	10/95	21 May, 2015	3.3	Polkowice-Sieroszowice mine[1]
Deep Glogów (Glogów Gleboki-Przemyslowy)[2]	16/2004	24 November, 2054	56	Polkowice-Sieroszowice mine and Rudna mine[3]

[1] Mined 85% by Polkowice-Sieroszowice mine, 15% by Rudna mine.
[2] The Deep Glogów area is being developed from the Polkowice-Sieroszowice and Rudna mines.
[3] The Deep Glogów deposit will be mined 50% by the Polkowice-Sieroszowice mine and 50% by the Rudna mine.

Figure 1.2
Location of Mining Concessions

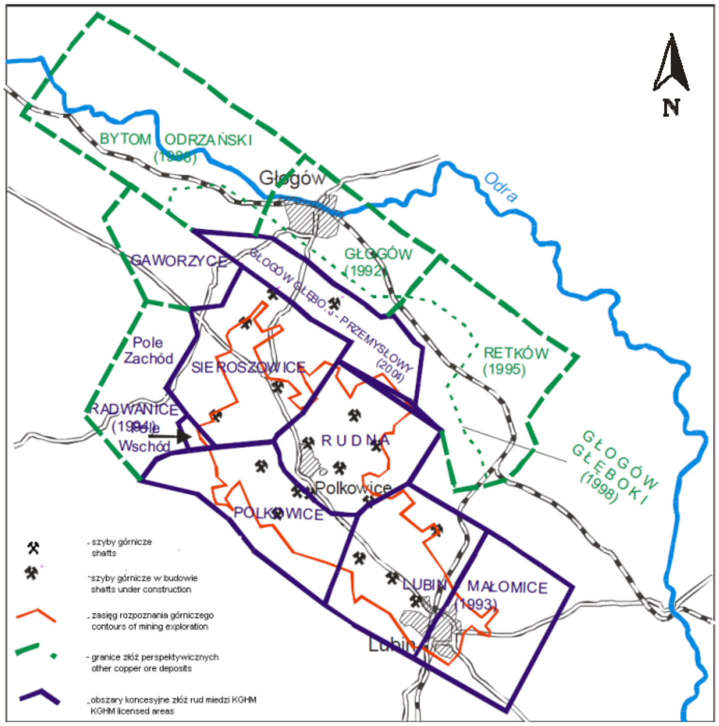


Figure provided by KGHM.

KGHM currently conducts its mining operations on the Lubin I, Malomice I, Rudna I and II, Polkowice II, Sieroszowice I and Radwanice Wschód concessions, in three underground mines.

Several of KGHM's mining concessions are scheduled to expire at the end of 2013. KGHM reports that, on 4 December, 2012, it submitted to the Minister of the Environment the application for renewal of these concessions. It is anticipated that the concessions will be renewed well in advance of the expiry date.

In addition to its mining concessions, KGHM also holds three exploration licenses for copper deposits in the Radwanice and Gaworzyce areas, the locations of which are also shown on Figure 1.2, as well as in the Boleslawiec area, which is described in Section 10 of this report.

1.3 METHOD OF PRODUCTION

The copper-silver deposits in the Legnica-Glogów Copper Belt represent the extension into Poland of the Kupferschiefer stratum in Germany, which has been mined for copper since the twelfth century. Copper mineralization in the area currently being mined by KGHM was discovered by deep drilling in 1957.

KGHM's three underground mines operate at depths of between 600 and 1,250 metres below surface and produce a total of approximately 30 million tonnes of ore per year, at average grades of approximately 1.6% copper and 45 grams of silver per tonne. Mining of the gently-dipping ore zone is by room-and-pillar methods. Ore thickness averages approximately 3 metres but locally exceeds 20 metres. An additional mining area, Deep Glogów, is presently being developed and will be mined from both the Polkowice-Sieroszowice and Rudna mines, commencing in 2013.

All mined ore is beneficiated at KGHM's three processing plants, which produce copper-silver concentrate by conventional crushing, grinding and flotation processes. All flotation tailings from the three concentrators are delivered, as a slurry, to the Żelazny Most tailings storage facility. Żelazny Most is a substantial structure, with a perimeter of more than 14 kilometres and an area of approximately 1,400 hectares. It is reported to be the largest tailings storage facility in Europe.

All of KGHM's concentrates, together with purchased feedstocks are treated at KGHM's two smelters and refineries:

- The Legnica smelter and refinery, which uses shaft furnace technology and has a capacity of approximately 100,000 tonnes of electrolytic copper per year.

- The Glogów smelter and refinery, which consists of two units, Glogów I, which uses shaft furnace technology and Glogów II, which uses flash furnace technology. The two units together have a capacity of approximately 470,000 tonnes of electrolytic copper per year. A precious metals plant at the Glogów refinery produces silver, gold, a sludge containing platinum and palladium, and selenium.

The Cedynia rolling mill has the capacity to produce approximately 230,000 tonnes of copper wire rod per year, including approximately 17,000 tonnes of oxygen-free copper rod.

KGHM's mines in the Legnica-Glogów Copper Belt have been operating at essentially steady-state production levels for many years, and further expansions are not being considered. It is planned, however, that, in future, all of KGHM's concentrate will be treated at the Glogów smelter and refinery, leaving the Legnica smelter and refinery free to operate entirely with purchased feedstock.

The principal technical challenges faced by KGHM's operations relate to seismicity and rock temperature in the underground mines. The mines experience rock burst phenomena. It is KGHM's opinion, with which Micon agrees, that tectonic movement on faults in the strata above the mining horizon are more influential in causing rock bursts, than are mining induced stress concentrations.

Conceptually, it would seem feasible to use a more positive backfill system than the current hydraulic sandfill system, in order to reduce closure of the mined voids and, hence, deformation of the overlying strata, which in turn may reduce tectonic movements and rock burst hazards. KGHM reports that trials are in progress to use paste fill from thickened tailings. KGHM also reports that there is no consideration for the use of cement. However, any fill system which limits roof closure should also reduce the risk of rock bursts and Micon endorses KGHM's investigation of the use of paste backfill.

KGHM's mines operate in an area of severe geothermal gradient. It was reported that the virgin rock temperature at the Rudna mine is 35°C at 850 metres below surface and is 46°C at 1,200 metres. This computes to an average geothermal gradient of 1°C per 32 metres. It is understood that the average geothermal gradient is similar over all three KGHM mines.

Historically, KGHM controlled the underground ambient air temperature by circulating very large volumes of ventilation air through the workings. As mining proceeded to greater depths at Rudna and Polkowice-Sieroszowice, however, ventilation with ambient air was insufficient to maintain underground working temperatures within the regulatory limits. Accordingly, in 2005, KGHM commissioned a chilled water refrigeration plant on surface at shaft R-9 of the Rudna mine, initially with 10 megawatts (MW) of cooling power, which was then increased to 16.5 MW, to supply cooled air to working areas 1,050 m below surface. At the end of 2011, another chilled water refrigeration plant was commissioned at the SG-1 shaft at the Polkowice-Sieroszowice mine, with a target cooling power of 15 MW. Additional refrigeration plants are planned to be installed progressively in the future. In some areas, air-conditioned cabs are provided on mining equipment. The use of air-conditioned cabs is also expected to increase in the future.

Inevitably, KGHM's mining operations will proceed to progressively greater depths in the future. Although there is presently no evidence that the frequency of rock bursts increases with depth, rock temperature will certainly increase, resulting in greater requirements for refrigeration and, hence, a slow but progressive increase in the costs associated with ventilation of the underground workings.

1.4 MINERAL RESERVES

Micon has reviewed the procedures used by KGHM to estimate Mining Reserves under the Polish system of classification. In Micon's opinion, the Mining Reserves as estimated by KGHM qualify as Proven and Probable Mineral Reserves under the Canadian Institute of Mining, Metallurgy and Petroleum (CIM) standards and definitions. KGHM's Mineral Reserves in the Legnica-Glogów Copper Belt area, at 31 December, 2011, are summarized in Table 1.2.

In Micon's opinion, the Proven and Probable Mineral Reserves contained within KGHM's mining concessions, as of 31 December, 2011, amounted to 1,181 Mt at grades of approximately 1.58% Cu and 48 g/t Ag, containing 18.6 Mt of copper and 1,800 Moz of silver. These Mineral Reserves include allowances for both mining losses and dilution, but do not include an allowance for metallurgical recovery. The Mineral Reserves are sufficient to maintain the current production rate of about 30 Mt/y for 30 to 40 years.

Micon is not aware of any environmental, permitting, legal, title, taxation, marketing, political or technical factors which would adversely affect the economic extraction of these Mineral Reserves.

Table 1.2
KGHM's Mineral Reserves at 31 December, 2011

Deposit	Category	Tonnes (millions)	Grade		Contained Metal	
			Copper (%)	Silver (g/t)	Copper (Mt)	Silver (Moz)
Lubin-Malomice	Proven	156.2	1.05	51	1.65	254.8
	Probable	168.3	0.95	35	1.59	187.6
	Total	**324.5**	**1.00**	**42**	**3.24**	**442.4**
Polkowice	Proven	42.2	1.78	33	0.75	44.1
	Probable	54.5	1.66	36	0.91	62.4
	Total	**96.8**	**1.71**	**34**	**1.66**	**106.6**
Sieroszowice	Proven	75.0	1.98	48	1.49	115.2
	Probable	197.7	1.91	50	3.78	318.9
	Total	**272.7**	**1.93**	**50**	**5.27**	**434.1**
Radwanice Wschód	Proven	-	-	-	-	-
	Probable	7.8	1.25	18	0.1	4.4
	Total	**7.8**	**1.25**	**18**	**0.1**	**4.4**
Rudna	Proven	182.5	1.60	41	2.91	242.8
	Probable	63.7	1.60	56	1.02	114.2
	Total	**246.2**	**1.60**	**45**	**3.94**	**357.0**
Deep Glogów	Proven	0.1	1.80	77	0.002	0.2
	Probable	233.0	1.90	61	4.42	460.5
	Total	**233.1**	**1.90**	**61**	**4.42**	**460.7**
TOTAL	**Proven**	**456.0**	**1.49**	**45**	**6.80**	**657.1**
	Probable	**725.0**	**1.63**	**49**	**11.82**	**1,148.1**
	Total	**1,181.1**	**1.58**	**48**	**18.62**	**1,805.2**

1.5 OUTLOOK FOR PRODUCTION

KGHM's planned production from its three underground mines for the five-year period 2012 to 2016 is summarized in Table 1.3.

Table 1.3
KGHM Mine Five-Year Production Plan

Facility	Units	Annual Production				
		2012	2013	2014	2015	2016
MINE PRODUCTION						
Lubin						
Tonnage	Mt	7.13	7.15	7.15	7.15	7.15
Copper Grade	%	0.94	0.92	0.89	0.89	0.94
Silver Grade	g/t	47.41	43.34	40.00	44.00	48.00
Polkowice-Sieroszowice						
Tonnage	Mt	11.13	10.95	10.92	11.07	10.91
Copper Grade	%	1.79	1.82	1.82	1.80	1.83
Silver Grade	g/t	35.32	32.02	31.73	30.27	32.90
Rudna						
Tonnage	Mt	11.68	11.53	11.53	11.54	11.54
Copper Grade	%	1.80	1.75	1.75	1.76	1.77
Silver Grade	g/t	49.79	47.16	47.06	48.61	49.66
Total Mine Production						
Tonnage	Mt	29.94	29.63	29.61	29.76	29.60
Copper Grade	%	1.59	1.57	1.57	1.57	1.59
Silver Grade	g/t	43.84	40.64	39.70	40.68	43.08
Contained Copper	Mlb	1,051	1,029	1,024	1,027	1,036
Contained Silver	Moz	42.2	38.7	37.8	38.9	41.0

This overall plan calls for sustained mine production at full hoisting capacity, with ore being drawn principally from existing developed areas. It is Micon's opinion that the production schedule summarized in Table 1.3 represents a realistic and attainable objective for the KGHM mines.

KGHM's forecast of production from its metallurgical facilities in the Legnica-Glogów Copper Belt area, for the five-year period 2012 to 2016, is summarized in Table 1.4.

Table 1.4
KGHM Five-Year Production Plan for Metallurgical Facilities

Facility	Units	Forecast Annual Production				
		2012	2013	2014	2015	2016
TOTAL CONCENTRATOR PRODUCTION						
Mill Feed	Mt	29.88	29.63	29.61	29.76	29.60
Copper Grade	%	1.59	1.57	1.57	1.57	1.59
Silver Grade	g/t	43.85	40.64	39.70	40.68	43.08
Copper Recovery	%	88.9	88.9	89.1	89.3	89.6
Silver Recovery	%	85.6	85.7	85.8	86.0	86.1
Concentrate Produced	Mt	1.858	1.826	1.817	1.825	1.855
Copper Grade of Concentrate	%	22.8	22.7	22.8	22.8	22.7
Silver Grade of Concentrate	g/t	603	565	555	570	592
Contained Copper	Mlb	932.0	915.0	913.0	917.3	928.1
Contained Silver	Moz	36.1	33.2	32.4	33.5	35.3
METAL PRODUCTION						
Legnica						
Electrolytic Copper	Mt	0.106	0.110	0.110	0.110	0.110
Glogów						
Electrolytic Copper	Mt	0.458	0.452	0.414	0.467	0.467
Refined Silver	Moz	38.6	30.4	30.5	32.2	27.6
Total Metal Production						
Electrolytic Copper	Mt	0.564	0.562	0.524	0.577	0.577
Refined Silver	Moz	38.6	30.4	30.5	32.2	27.6
Cedynia						
Copper Wire Rod	t	221,000	210,000	210,000	210,000	210,000
Oxygen-Free Copper Rod	t	14,370	17,000	17,000	17,000	17,000

It is Micon's opinion that KGHM's forecast of concentrator performance for the five-year period 2012 to 2016 is realistic and achievable. The average copper grade of the ore forecast to be processed over the next five years, at 1.58%, is the same as the average grade of the Mineral Reserves. The average silver grade for the next five years is 41.6 grams per tonne, which is less than the average grade of 48 grams per tonne reported for the Mineral Reserves. It is anticipated that average silver grades will increase in subsequent years, when significant production commences from the Deep Glogów area, which has an average silver grade of 61 grams per tonne.

1.6 COST STRUCTURE

1.6.1 Capital Expenditures

KGHM incurs substantial annual capital expenditures for mine development and shaft sinking, for upgrading and modernizing its systems and facilities, and for replacing obsolete or worn out equipment. Over the five-year period 2007 to 2011, these capital expenditures averaged approximately 400 million US dollars (USD) per year. KGHM's preliminary forecast is that capital expenditures for the five-year period 2012 to 2016 are likely to be somewhat higher than those of the previous five years, and may average as much as USD 600 million per year.

1.6.2 Operating Costs

KGHM's total cash operating costs over the five-year period 2007 to 2011 are summarized in Table 1.5.

Table 1.5
KGHM Total Cash Operating Costs, 2007 - 2011

Operation	Unit Operating Cost (USD/t processed)				
	2007	2008	2009	2010	2011
Mining	34.77	44.73	35.76	39.96	43.60
Processing	8.21	9.62	7.27	7.72	8.38
Smelting and Refining	7.63	7.65	7.84	7.65	7.60
General and Administration	2.34	2.45	2.41	2.37	3.96
Total	**52.95**	**64.45**	**53.28**	**57.70**	**63.54**

Since KGHM's smelters and refineries treat purchased feedstocks in addition to KGHM's own concentrate, it is difficult to segregate the operating cost of smelting and refining of KGHM concentrate. For this reason, smelting and refining costs have been evaluated in Table 1.5 under the following normal commercial terms:

- Payable copper : 96%.
- Payable silver : 95%.
- Smelting charge : USD 75.00 per tonne of concentrate.
- Copper refining charge : USD 0.075 per pound.
- Silver refining charge : USD 0.50 per ounce.

KGHM incurs its operating costs in PLN. Thus, in future years, those costs, when expressed in USD, will fluctuate with variations in the exchange rate between PLN and USD. KGHM's budget for mining, processing, and general and administrative costs for 2012, expressed in PLN, is summarized in Table 1.6, together with actual and budgeted costs for the first half of the year.

Table 1.6
KGHM Operating Costs for 2012, Expressed in PLN

Operation	Unit Operating Cost (PLN/t Processed)		
	2012 Budget	First Half, 2012	
		Budget	Actual
Mining	138.8	137.3	134.7
Processing	27.0	26.9	26.4
General and Administration	13.8	12.8	12.5
Total	**179.6**	**177.0**	**173.6**

It is Micon's opinion that, over the five-year period 2012 to 2016, KGHM's direct cash operating costs, expressed in constant zlotys of 2012 value and excluding smelting and refining charges, are likely to range between PLN 180 and PLN 190/tonne of ore processed.

The financial analysis discussed in Section 1.7 is based on a cost of PLN 180/tonne for 2012, increasing linearly to PLN 188/tonne in 2016, in order to reflect modest increases in the costs associated with ventilation of the underground workings.

1.7 OVERALL ECONOMICS OF PRODUCTION

1.7.1 Operational Economic Performance, 2007 to 2011

Based on KGHM's operating and cost records, and the commercial smelter terms stated above, Micon has computed the approximate pre-tax cash flows generated by KGHM's mining and processing operations in the Legnica-Glogów Copper Belt area for each of the last five years, as shown in Table 1.7.

Table 1.7
KGHM Pre-Tax Cash Flow from Operations, 2007 - 2011

	Units	Source	2007	2008	2009	2010	2011
PRODUCTION							
Ore Mined	Mt	Table 6.3	30.26	29.42	29.73	29.30	29.72
Ore Processed	Mt	Table 6.4	30.25	29.52	29.68	29.23	29.78
Concentrate Produced	Mt	Table 6.4	1.875	1.866	1.929	1.841	1.875
Contained Copper	Mlb	Table 6.4	996.7	946.5	965.5	937.4	941.4
Contained Silver	Moz	Table 6.4	38.6	37.3	38.8	38.0	37.5
Payable Copper	Mlb	96%	956.8	908.6	926.9	899.9	903.7
Payable Silver	Moz	95%	36.7	35.4	36.9	36.1	35.6
METAL PRICES							
Copper	USD/lb	KGHM	3.23	3.15	2.34	3.42	4.00
Silver	USD/oz	KGHM	13.38	14.99	14.67	20.19	35.12
REVENUE AND EXPENDITURE							
Sales Revenue - Copper	million USD		3,091	2,862	2,169	3,078	3,615
Sales Revenue - Silver	million USD		491	531	541	729	1,251
Total Sales Revenue	**million USD**		**3,581**	**3,393**	**2,710**	**3,807**	**4,866**
Mining Cost	million USD	Table 21.2	1,052	1,320	1,062	1,168	1,299
Processing Cost	million USD	Table 21.3	248	284	216	226	250
Smelting and Refining	million USD	Table 21.4	231	226	233	224	226
General and Administration	million USD	Table 21.3	71	72	71	69	118
Total Cash Operating Cost	**million USD**		**1,602**	**1,903**	**1,581**	**1,686**	**1,892**
Unit Cash Operating Cost	USD/t		52.95	64.46	53.28	57.69	63.54
Cash Operating Profit	**million USD**		**1,980**	**1,491**	**1,128**	**2,120**	**2,974**
Capital Expenditure	million USD	Table 21.1	299	473	343	418	512
PRE-TAX CASH FLOW	**million USD**		**1,681**	**1,018**	**785**	**1,702**	**2,462**

With elevated prices of both copper and silver, KGHM's operations in the Legnica-Glogów Copper Belt area have been highly profitable in recent years. By Micon's calculation, operating profit from the mining and processing operations averaged nearly USD 2 billion per year over the five-year period 2007 to 2011. KGHM has taken advantage of these high levels of profitability to undertake modernization programs at its production facilities. Total capital expenditures from 2007 to 2011 averaged approximately USD 400 million per year, with the result that the mining and processing operations generated overall pre-tax cash flows averaging approximately USD 1.5 billion per year over the same five-year period.

1.7.2 Economic Outlook for Operations, 2012 to 2016

In April, 2012, the Parliament of Poland introduced new extraction taxes on the production of copper and silver within the country. These taxes, which are based on the value of copper and silver contained in concentrate, are substantial and, by Micon's calculation, will amount to approximately 30% of the future operating profit generated by the mining and processing operations. It is also the general consensus among analysts that the prices of copper and silver are likely to soften over the next five years.

Micon's forecast of the pre-tax cash flow to be generated by KGHM's mining and processing operations over the five-year period 2012 to 2016, which is summarized in Table 1.8, is based on KGHM's production plans, a modest increase in unit operating cost, a continuation of relatively high capital expenditures, a decrease in price of copper from USD 3.50/pound in 2012 to USD 3.00/pound in 2015 and a decrease in the price of silver from USD 33/ounce in 2012 to USD 25/ounce in 2015.

Table 1.8
KGHM Projected Pre-Tax Cash Flow from Operations, 2012 - 2016

	Units	Source	2012	2013	2014	2015	2016
PRODUCTION							
Ore Mined	Mt	Table 16.10	29.94	29.63	29.61	29.76	29.60
Ore Processed	Mt	Table 17.6	29.88	29.63	29.61	29.76	29.60
Concentrate Produced	Mt	Table 17.6	1.858	1.826	1.817	1.825	1.855
Contained Copper	Mlb	Table 17.6	932.0	915.0	913.0	917.3	928.1
Contained Silver	Moz	Table 17.6	36.1	33.2	32.4	33.5	35.3
Payable Copper	Mlb	96%	894.7	878.4	876.5	880.6	891.0
Payable Silver	Moz	95%	34.3	31.5	30.8	31.8	33.5
METAL PRICES							
Copper	USD/lb	Micon	3.50	3.25	3.25	3.00	3.00
Silver	USD/oz	Micon	33.00	30.00	27.50	25.00	25.00
REVENUE AND EXPENDITURE							
Sales Revenue - Copper	million USD		3,132	2,855	2,849	2,642	2,673
Sales Revenue - Silver	million USD		1,132	946	846	796	838
Total Sales Revenue	**million USD**		**4,263**	**3,801**	**3,695**	**3,437**	**3,511**
Mining Cost	million USD		1,274	1,302	1,344	1,504	1,516
Processing Cost	million USD		247	249	254	280	278
Smelting and Refining Cost	million USD		224	219	217	219	223
General and Administration Cost	million USD		128	129	132	145	144
Total Cash Operating Cost	**million USD**		**1,873**	**1,899**	**1,947**	**2,148**	**2,162**
Unit Cash Operating Cost	USD/t		62.70	64.08	65.75	72.16	73.03
Cash Operating Profit	**million USD**		**2,390**	**1,902**	**1,748**	**1,290**	**1,350**
Copper Extraction Tax	million USD		346	426	416	318	322
Silver Extraction Tax	million USD		132	154	131	115	121
Capital Expenditure	million USD		630	950	700	500	300
Extraction Tax as % of Operating Profit	%		20.0	30.5	31.3	33.6	32.8
PRE-TAX CASH FLOW	**million USD**		**1,282**	**372**	**501**	**357**	**606**

Note: The copper and silver extraction taxes were introduced in April, 2012. For the year 2012, these taxes have been calculated on two-thirds of the total copper and silver production.

KGHM incurs its operating costs in PLN. The exchange rates used to convert these costs to USD, as shown in Table 1.8, are the median of forecasts published by a number of financial institutions. These forecasts reflect a progressive strengthening of the PLN against the USD, which has the effect of reducing KGHM's operating cash flows, when these are expressed in USD. In recent years, however, there has been a strong correlation between the price of copper and the exchange rate between PLN and USD, with the PLN weakening against the USD when copper prices are low. Since projections in Table 1.8 are based on decreasing copper prices, combined with a strengthening of the PLN, it is Micon's opinion that the forecast cash flows in Table 1.8 are likely to prove highly conservative.

Even with the combined effect of the new extraction taxes, the forecast reductions in metal prices and the forecast strengthening of the PLN, KGHM's operations in the Legnica-Glogów Copper Belt area are expected to remain highly profitable, with average pre-tax cash flows of more than USD 450 million per year from 2013 to 2016. The projections shown in Table 1.8 make no allowance for the profits generated by KGHM's smelters, refineries or the rolling mill, or for the revenues obtained from the sale of by-products.

1.7.3 Sensitivity Analysis

The profitability of KGHM's operations is more sensitive to changes in copper and silver prices than it is to changes in any other factor. Sensitivity analysis indicates that, after allowing for a capital expenditure program which totals approximately USD 2.5 billion over the period 2013 to 2016, KGHM's mining and processing operations would maintain essentially a cash break-even position at metal prices as low as USD 2.50/lb for copper and USD 20/oz for silver, without allowing for profits from the downstream operations, or for revenues obtained from the sale of by-products.

1.8 CONCLUSION AND RECOMMENDATIONS

KGHM, which has been operating in the Legnica-Glogów Copper Belt area continuously since 1961, is a major mining, smelting and refining company, and one of the world's leading producers of electrolytic copper and refined silver. Micon inspected all of KGHM's mining, processing, smelting and refining facilities, and the copper rolling mill, and found them to be operating efficiently, with a uniformly high standard of housekeeping. KGHM also maintains a high standard of environmental awareness and responsibility. In addition, KGHM maintains a research staff for the purpose of identifying and testing potential improvements in all of its operations and these efforts are to be encouraged.

The recommendations that flow from Micon's review of KGHM's operations are:

- That, in addition to estimating its resources and reserves under the procedures and classifications used in Poland, KGHM also consider reporting resources and reserves under the standards and classifications of one of the internationally-recognized codes, such as the CIM standards and definitions or the Australasian Joint Ore Reserve Committee (JORC) code. This would facilitate the acceptance of the resource and reserve estimates by investors and securities regulators in the major western mining jurisdictions.

- That KGHM critically review the cut-off grades used for resource and reserve estimation on an annual basis, to ensure that these cut-off grades properly reflect current and reasonably foreseeable metal prices, operating costs and metallurgical recoveries.

- That KGHM, as a matter of priority, continue its research into using a more positive system of backfill, such as thickened tailings or paste fill, in the underground workings, with the objective of limiting the closure of mined-out areas and minimizing the risk of rock bursts.

2.0 INTRODUCTION

Under contract number KGHM-BZ-U-0386-2012, dated 13 July, 2012, Micon International Co. Limited (Micon) has been retained by KGHM Polska Miedź S.A. (KGHM) to prepare an independent Technical Report on KGHM's copper-silver mining, processing, smelting and refining operations in the Legnica-Glogów Copper Belt area of Lower Silesia in southwestern Poland. The Technical Report is to be compliant with the requirements of Canadian National Instrument 43-101 (NI 43-101). The location of KGHM's operations in Poland is shown in Figure 2.1.

Figure 2.1
Location of KGHM's Operations in Poland

Figure obtained from KGHM website.

2.1 KGHM

KGHM, which has been in operation continuously since 1961, is a major mining company, the shares of which are listed on the Warsaw stock exchange. KGHM's principal products are electrolytic copper and refined silver. In 2011, KGHM was the ninth largest producer of mined copper in the world, with an output of 571,000 tonnes (t) of electrolytic copper, and the world's largest producer of silver, with an output of 40.5 million ounces (Moz) of refined metal. Saleable by-products, which together contribute only a minor proportion of total revenue, are gold, platinum-palladium concentrate, rhenium, selenium, lead, nickel sulphate, sulphuric acid, and rock salt which is mined from a halite horizon in the hanging wall of the copper-silver ore zone.

KGHM's principal productive facilities in southwestern Poland comprise:

- Three large underground mines which extend over a strike length of approximately 40 kilometres (km) and have a combined capacity of about 100,000 tonnes per day (t/d) of ore, or approximately 30 million tonnes per year (Mt/y):
    - The Lubin mine, with a capacity of approximately 7 Mt/y ore.
    - The Polkowice-Sieroszowice mine, with a capacity of approximately 11 Mt/y of ore.
    - The Rudna mine, with a capacity of approximately 12 Mt/y of ore.
- Three processing plants which produce copper-silver concentrates by crushing, grinding and flotation of the mined ore:
    - The Lubin concentrator, with a capacity to treat approximately 7 Mt/y of ore.
    - The Polkowice concentrator, with a capacity to treat approximately 9 Mt/y of ore.
    - The Rudna concentrator, with a capacity of treat approximately 15 Mt/y of ore.
- Two smelters and refineries which have the capacity to treat scrap and purchased concentrates, in addition to all concentrate produced by KGHM:
    - The Legnica smelter and refinery, which uses shaft furnace technology and has a capacity of approximately 100,000 t/y of electrolytic copper.
    - The Glogów smelter and refinery, which consists of two units, Glogów I, which uses shaft furnace technology and Glogów II, which uses flash furnace technology. The two units together have a capacity of approximately 470,000 t/y of electrolytic copper. A precious metals plant located at the Glogów refinery produces silver, gold, a sludge containing platinum and palladium, and selenium.
- The Cedynia copper rolling mill, with a capacity to produce approximately 230,000 t/y of copper wire rod, including approximately 17,000 t/y of specialty oxygen-free copper rod.

KGHM has also decided to develop the reserves in the Deep Glogów area, which is adjacent to, and will be mined from the Polkowice-Sieroszowice and Rudna mines. Sinking of a ventilation and service shaft in the Deep Glogów area is schedule to commence in 2013. Estimated reserves at all three mines, including Deep Glogów, are sufficient to sustain operations for at least another thirty to forty years. In general, however, the mines in the Legnica-Glogów Copper Belt area are mature. They are planned to continue at current levels for many years, but further increases in annual production are not being considered.

KGHM's strategic policy, then, is to expand principally by acquisition of other properties or companies, with the objective of increasing its copper production to 700,000 t/y by 2018. Significant acquisitions made to date by KGHM are:

- An 80% interest in the Afton-Ajax copper-gold project in British Columbia, Canada.
- All of the shares of Quadra FNX Mining Ltd., (now renamed KGHM International Ltd.) through which KGHM acquired a portfolio of operating assets in Canada, Chile and the United States, as well as development projects, including a 55% interest in Sierra Gorda (a copper-gold-molybdenum project in northern Chile) and Victoria (a polymetallic project in Ontario, Canada).

KGHM was originally a state-owned corporation. It was privatized in 1997.

2.2 THE REPUBLIC OF POLAND

The Republic of Poland, with an area of 312,700 square kilometres (km^2) and a population of 38.5 million people, is a member of the European Union, NATO, the United Nations, the World Trade Organization, the Organization for Economic Co-operation and Development (OECD), the International Energy Agency, the Council of Europe, the International Atomic Energy Agency and a number of other international organizations. With a nominal gross domestic product (GDP) of approximately 489 billion United States dollars (USD), Poland is reported to be the seventh largest economy within the European Union (2010 data, International Monetary Fund).

Over the past twenty years or so, Poland has transformed itself from being essentially a satellite state of the Soviet Union with a centralized economy, into a fully-functional democratic state, with a free-market economy. It is reported to have been the only member of the European Union which did not fall into recession during the recent worldwide financial crisis. It has a strong and stable banking sector, and a solid industrial base. Although Poland suffered inflation rates in the order of 30% per year throughout much of the 1990s, inflation over the last five years, from 2007 to 2011, has ranged between 3% and 4% per year. Over the same period, the exchange rate between Polish zlotys (PLN) and United States dollars has ranged between extremes of USD 1 = PLN 2.0 and USD 1 = PLN 3.6, with an average of USD 1 = PLN 3. The economic climate in Poland is reported to be favourable for foreign investment.

The transformation from a centralized economy to a free-market economy has been relatively smooth, but not entirely without problems. In common with other former communist countries, there were temporary slumps in social and economic standards. Poland was, however, the first former communist country to regain its pre-1989 GDP levels, which it did by 1995.

The Constitution of Poland, which was ratified in 1997, enshrines the principles of democratic government, a multi-party state, freedom of religion, speech and assembly, and a free-market economic system. It requires public officials to pursue ecologically sound public policy and acknowledges the right to form trade unions and the right to strike.

2.3 QUALIFIED PERSONS

The Qualified Persons responsible for the preparation of this report are:

- Stanley C. Bartlett, P.Geo., a geologist, Managing Director of Micon International Co. Limited in Norwich, United Kingdom. Micon International Co. Limited is a wholly-owned subsidiary of Micon International Limited, Toronto.

- Harry Burgess, P.Eng., a mining engineer, former Vice-President of Micon International Limited and now an associate consultant, based in Toronto.

- Bogdan Damjanović, P.Eng., a metallurgical engineer in Micon's Toronto office.

- Richard M. Gowans, P.Eng., a metallurgical engineer, President of Micon International Limited, based in Toronto.

- Christopher R. Lattanzi, P.Eng., a mining engineer, former President of Micon International Limited and now an associate consultant, based in Toronto.

Mark Dodds-Smith, Ph.D., a former employee of Micon and now an independent consultant based in the United Kingdom, was responsible for reviewing the employee health, safety, corporate social responsibility and environmental aspects of KGHM's Polish operations. Dr. Dodds-Smith is not a Qualified Person, as defined by NI 43-101, but is known by Micon to be highly competent in his field.

All of the Qualified Persons responsible for this report are independent of KGHM. None of Micon, Dr. Dodds-Smith or any of the Qualified Persons responsible for this report has any interest in KGHM. This report is being prepared in return for an agreed fee which is in no way contingent upon the results of the report.

Messrs. Bartlett, Burgess, Damjanović and Lattanzi, and Dr. Dodds-Smith, visited the head office of KGHM in Lubin, Poland, from July 30 to August 2, 2012, inclusive. During the visit, all mining, processing, smelting and refining operations, and the copper rolling mill, the precious metals plant, the tailings storage facility and the new automated analytical laboratory were toured and inspected, and discussions were held with personnel responsible for their operation. Discussions were also held with geological staff responsible for the estimation of resources and reserves; mine planning, ventilation and geotechnical personnel; metallurgical staff; accounting, financial and marketing personnel; and personnel responsible for employee health and safety, corporate social responsibility and environmental monitoring and compliance.

Both during the site visit and subsequently, KGHM provided Micon with comprehensive data relating to its historical and projected future operations. These data have formed the basis for this report. Micon acknowledges the cooperation of the management and staff of KGHM, who made all requested information available and who responded openly and thoroughly during discussions.

The effective dates of this report are 31 December, 2011 for the resource and reserve estimates, and 30 June, 2012 for all other data.

2.4 USE OF THIS REPORT

This Technical Report has been prepared in accordance with the terms of the contract between KGHM and Micon. That contract provides that KGHM may use the report for any lawful purpose, including filing the report with the Canadian Securities Administrators. The contract also provides that, if KGHM publishes a summary of the report in a press release, information memorandum, prospectus or similar public document, Micon will have the right and obligation to review and approve such summary, prior to its dissemination to the public. Any use of this report, by a party other than KGHM, is at that party's sole risk.

The conclusions and recommendations of this report reflect the informed professional judgment of the authors at the time of writing. The authors and Micon reserve the right, but will not be obliged, to revise this report if additional information becomes known to them subsequent to the date of this report. Use of this report acknowledges acceptance of that condition.

2.5 UNITS OF MEASURE AND ABBREVIATIONS

In this report, physical units of measure are expressed in the metric system, with metric tonnes (t), kilograms (kg) or grams (g) for mass; kilometres (km), metres (m) or centimetres (cm) for distance, and hectares (ha) for area. For copper, ore and concentrate grades are expressed as a percentage (%) and quantities may be expressed as pounds (lb) or millions of pounds (Mlb). For silver, ore and concentrate grades are expressed as grams per tonne (g/t) or ounces per tonne (oz/t), and quantities are typically expressed as ounces (oz) or million ounces (Moz). As used herein, the word "ounces" means troy ounces. One troy ounce = 31.1035 g.

The principal unit of currency employed in this report is the USD. KGHM reports its financial results in PLN. KGHM's historical revenues, costs, cash flows and financial indices have been converted to USD at the annual average exchange rates shown in Table 2.1.

Table 2.1
Historical Exchange Rates

Year	Average Exchange Rate (PLN per USD)
2007	2.7686
2008	2.4061
2009	3.1181
2010	3.0179
2011	2.9636

In mid-August, 2012, the exchange rate was USD 1 = PLN 3.3. Actual financial data for the first six months of 2012, and projected data for the full year 2012, including KGHM's operating costs, have been converted from PLN to USD at this exchange rate. The exchange rates used for projecting future operating cash flows are described in Section 22.3.

A list of the abbreviations used in this report is provided in Table 2.2.

Table 2.2
List of Abbreviations

Abbreviation	Meaning	Abbreviation	Meaning
º	degrees of longitude, latitude	mg	milligrams
ºC	degrees Celsius	mg/L	milligrams per litre
′	minutes of longitude, latitude	Micon	Micon International Limited and/or Micon International Co. Limited
=	is equal to	min	minute(s) of time
%	percent	ML	million litres
µm	micron(s)	Mlb	million pounds
Ag	silver	Mlb/y	million pounds per year
As	arsenic	mm	millimetre(s)
atm	atmosphere(s)	Mm^3	million cubic metres
Au	gold	Mn	manganese
cm	centimetre(s)	Mo	molybdenum
CIM	Canadian Institute of Mining, Metallurgy and Petroleum	Moz	million ounces
Co	cobalt	Moz/y	million ounces per year
Cu	copper	Mt	million tonnes
Cu_{eq}	copper equivalent grade	Mt/y	million tonnes per year
d/y	days per year	MW	megawatts
		MWh	megawatts hours
EMS	environmental management system	Ni	nickel
ERU	emergency rescue unit	NI 43-101	Canadian National Instrument 43-101
EU	European Union	OECD	Organization for Economic Cooperation and Development
Fe	iron	OHSMS	occupational health and safety management system
g	gram(s)	oz	ounce(s)
g/t	grams per tonne	oz/t	ounces per tonne
GDP	gross domestic product	oz/y	ounces per year
GDR	Global Depositary Receipts	Pb	lead
h	hour(s)	Pd	palladium
ha	hectare(s)	P. Eng.	Professional Engineer (Canada)
h/d	hours per day	PGE	platinum group elements
kg	kilogram(s)	P. Geo.	Professional Geoscientist (Canada)
kg Cu/m^2	kilograms of copper per square metre	Ph. D.	Doctor of Philosophy
kg/t	kilograms per tonne	PLN	Polish zloty(s)
KGHM	KGHM Polska Miedź S.A.	ppm	parts per million
km	kilometre(s)	Pt	platinum
km^2	square kilometres	QA/QC	quality assurance and quality control
kW	kilowatt	s	second(s) of time
kWh	kilowatt hour(s)	SG	specific gravity
L	litre(s)	t	tonne(s)
lb	pound(s)	t/d	tonnes per day
LHD	load-haul-dump mining machine	t/y	tonnes per year
LME	London Metal Exchange	US	United States of America
M	million	USD	United States dollar
m	metre(s)	V	vanadium
m/min	metres per minute	wt. %	percent by weight
m^3	cubic metres	XRF	x-ray fluorescence
m^3/m	cubic metres per minute	Zn	zinc

3.0 RELIANCE ON OTHER EXPERTS

Micon has reviewed and analyzed data provided by KGHM and has drawn its own conclusions therefrom, augmented by its direct field examinations. While exercising all reasonable diligence in checking, confirming and testing it, Micon has relied upon KGHM's presentation of information relating to its operations in Poland. Micon has no reason to doubt the validity of the information provided by KGHM.

Dr. Mark Dodds-Smith, an independent consultant who is not a Qualified Person, was responsible for reviewing the employee health, safety, corporate social responsibility and environmental aspects of KGHM's operations. Dr. Dodds-Smith is well known to Micon, and Micon has relied on his work. Dr. Dodds-Smith is responsible for Section 20 of this report.

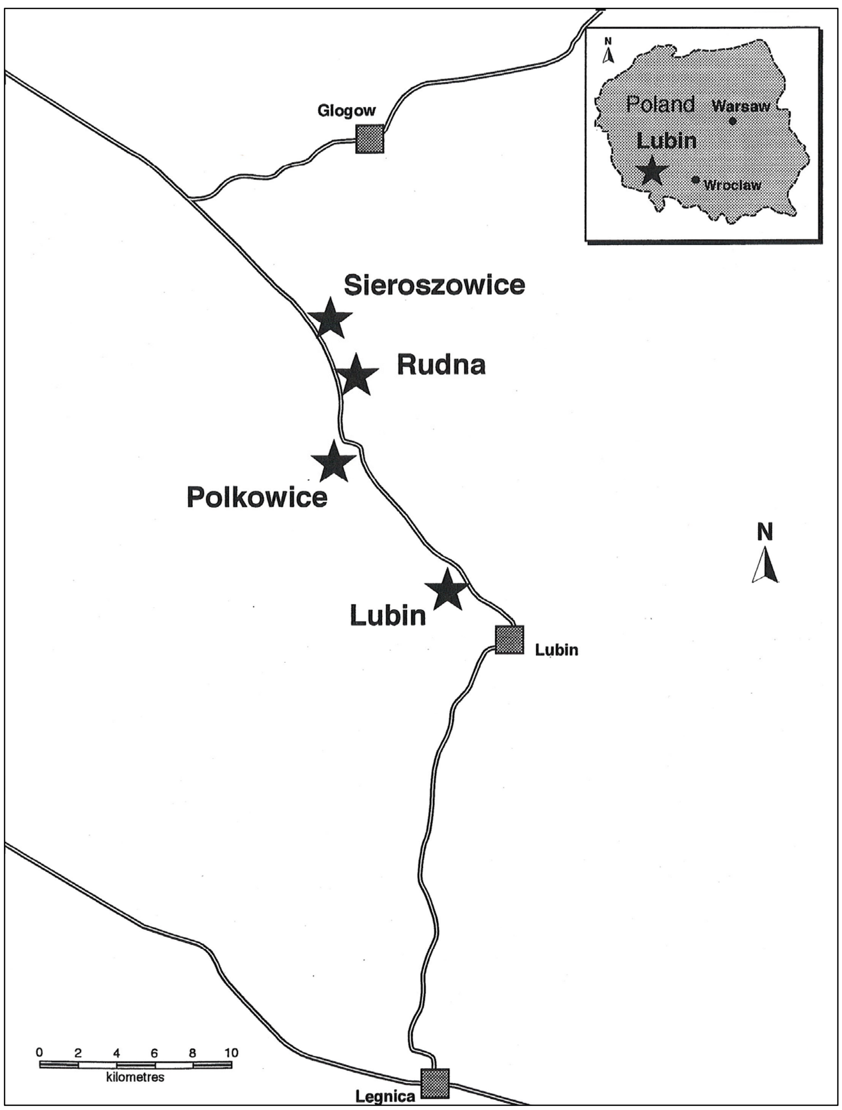
Micon is not qualified to express an opinion as to the validity of KGHM's title to its mining concessions and other property holdings. KGHM, however, has been operating in the Legnica-Glogów Copper Belt area continuously since 1961 and there is a reasonable inference that it holds valid title. As described in Section 4, some of KGHM's mining concessions are due to expire in 2013. KGHM is in the process of renewing these concessions.

4.0 PROPERTY DESCRIPTION AND LOCATION

4.1 LOCATION

With the exception of the Legnica smelter which is located approximately 25 km south of Lubin, all of KGHM's mining, processing, smelting and refining operations are located in an area that extends northwestwards for about 40 km, between the towns of Lubin and Glogów in southwestern Poland, as shown in Figure 4.1. This area is bounded by approximate longitude 15°52' and 16°22' east, and approximate latitude 51°21' and 51°35' north, and lies within and at the foot of the Dalkowskie Hills, in the northwestern part of the Silesian Lowlands.

Figure 4.1
General Location of KGHM's Operations



4.2 MINING CONCESSIONS, EXPLORATION LICENCES AND SURFACE OWNERSHIP

4.2.1 Mining Concessions

The Minister of Environmental Protection, Natural Resources and Forestry has granted to KGHM the exclusive right to extract ore from eight contiguous mining concessions located between the towns of Lubin and Glogów in the Legnica-Glogów Copper Belt. The locations of the mining concessions held by KGHM are shown in Figure 4.2 and details of the concessions are provided in Table 4.1. The total area held by KGHM under these concessions is nearly 470 km^2.

Figure 4.2
Location of Mining Concessions

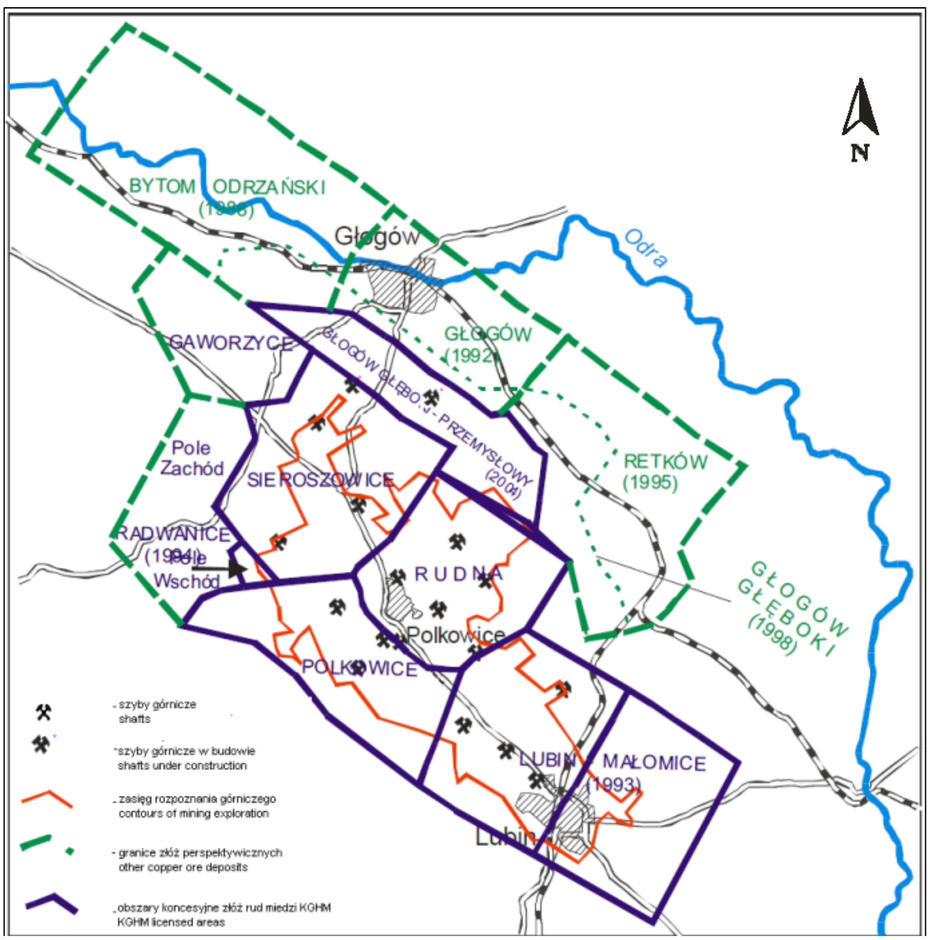


Figure provided by KGHM.

Table 4.1
Mining Concessions

Mining Area	Concession Number	Expiry Date	Area (km^2)	Operator
Lubin I	231/93	31 December, 2013	82.6	Lubin mine
Malomice I	232/93	31 December, 2013	75.7	Lubin mine
Rudna I	233/93	31 December, 2013	75.6	Rudna mine
Rudna II	24/96	30 June, 2046	2.2	Rudna mine
Polkowice II	234/93	31 December, 2013	75.3	Polkowice-Sieroszowice mine
Sieroszowice I	235/93	31 December, 2013	97.0	Polkowice-Sieroszowice mine and Rudna mine
Radwanice Wschód (east)	10/95	21 May, 2015	3.3	Polkowice-Sieroszowice mine[1]
Deep Glogów (Glogów Gleboki-Przemyslowy)[2]	16/2004	24 November, 2054	56	Polkowice-Sieroszowice mine and Rudna mine[3]

[1] Mined 85% by Polkowice-Sieroszowice mine, 15% by Rudna mine.
[2] The Deep Glogów area is being developed from the Polkowice-Sieroszowice and Rudna mines.
[3] The Deep Glogów deposit will be mined 50% by the Polkowice-Sieroszowice mine and 50% by the Rudna mine.

KGHM currently conducts its mining operations on the Lubin I, Malomice I, Rudna I and II, Polkowice II, Sieroszowice I and Radwanice Wschód concessions, in three underground mines. The approximate locations of the principal mining areas, in relation to the towns of Lubin and Glogów, have been identified in Figure 4.1.

Several of KGHM's mining concessions are scheduled to expire at the end of 2013. KGHM reports that, on December 4, 2012, it submitted to the Minister of the Environment the application for renewal of these concessions. It is anticipated that the concessions will be renewed well in advance of the expiry date.

4.2.2 Exploration Licenses

In addition to its mining concessions, KGHM holds three exploration licenses for deposits in areas adjacent to its current mining operations:

- Exploration license No. 68/98/p, dated 17 November, 1998 and valid until the end of 2014, which permits KGHM to explore the Kazimierzów salt deposit which occurs above the copper horizon being mined at Sieroszowice.
- Exploration license No. 13/2009/p, dated 31 March, 2009 and valid until 31 March, 2018, which permits KGHM to explore the Radwanice copper deposit, located adjacent to the Polkowice II and Sieroszowice I mining concessions.
- Exploration license No. 20/2008/p dated 30 April, 2008 and valid until 30 April, 2018, which permits KGHM to explore the Gaworzyce copper deposit, located adjacent to the Sieroszowice I mining concession and the Radwanice exploration license.

The locations of the Radwanice and Gaworzyce exploration licenses are shown in Figure 4.2, which also shows the Bytom Odrzański, Glogów and Retków areas, on which copper mineralization is known to occur and on which KGHM may apply for exploration licenses in the future.

In consideration for the granting of the exploration licenses, KGHM was required to pay a one-time fee for each license which, on average, amounted to approximately PLN 212/km^2 (USD 64/km^2).

KGHM's exploration activities in the Legnica-Glogów Copper Belt area, and in other areas of Poland and in Germany, are described in Section 10 of this report.

4.2.3 Surface Rights

KGHM either owns or controls the rights to all surface areas occupied by its facilities. Except for these areas, KGHM generally does not own the surface overlying its underground workings.

4.3 EXTRACTION ROYALTIES AND EXTRACTION TAXES

It is understood that, in consideration for being granted its mining concessions, KGHM must pay to those municipalities in which mining is being conducted and to the National Environmental Protection and Water Management Fund an extraction royalty which is set annually. For 2012, the extraction royalty is PLN 3.10/t of ore mined. At a mining rate of 30 Mt/y of ore, the extraction royalty for 2012 will amount to PLN 93 million (USD 28 million).

In April, 2012, the Parliament of Poland introduced a tax on the extraction of copper and silver within the country. The tax is based on the amount of copper and silver contained in concentrate, and is computed as follows:

- For copper, the monthly tax payable is the number of tonnes of copper produced, multiplied by the tax rate determined from the following formulae:

  - If the average copper price exceeds PLN 15,000/t (approximately USD 4,550/t or USD 2.05/lb at the current exchange rate), the per-tonne tax rate is:

    Tax rate per tonne = (0.033 x the average copper price) + (0.001 x the average copper price)$^{2.5}$, with the maximum rate being PLN 16,000/t (approximately USD 2.20/lb).

  - If the average copper price does not exceed PLN 15,000/t, the per-tonne tax rate is:

    Tax rate per tonne = 0.44 x (the average copper price minus PLN 12,000), with the minimum tax rate being 0.5% of the average copper price.

- For silver, the monthly tax payable is the number of kilograms of silver produced, multiplied by the tax rate determined from the following formulae:

  - If the average price of silver exceeds PLN 1,200/kg (approximately USD 11.30/oz), the per-kilogram tax rate is:

Tax rate per kilogram = (0.125 x the average silver price) + (0.001 x the average silver price)[4], with the maximum rate being PLN 2,100/kg (approximately USD 19.80/oz).

- If the average silver price does not exceed PLN 1,200/kg, the per-kilogram tax rate is:

  Tax rate per kilogram = 0.75 x (the average silver price minus PLN 1,000), with the minimum tax rate being 0.5% of the average silver price.

KGHM estimates that, for 2012, it will pay approximately PLN 1.3 billion (approximately USD 400 million) in copper and silver taxes. It is understood that these taxes are not deductible when computing profits subject to income tax.

4.4 ENVIRONMENTAL LIABILITIES

KGHM is responsible for the progressive reclamation and ultimate closure of its operating sites. Given the nature of the operations, only a limited amount of progressive reclamation is possible. The former Gilów tailings storage facility has been partially reclaimed, and the outer wall of the existing tailings storage embankment, Żelazny Most, is seeded progressively, as the embankment is raised.

The operations of KGHM cover a very substantial area and it is evident that the cost of final reclamation and closure will be high. The bulk of that cost, however, will be long deferred. The major individual item will be reclamation and closure of the Żelazny Most tailings storage facility, which covers an area of nearly 1,400 ha and has a perimeter of more than 14 km. It is planned to extend tailings storage capacity by more than 40% by constructing a new southern tailings storage facility, adjacent to Żelazny Most. This will be sufficient to contain the tailings produced during the next thirty years.

The estimated future costs of reclamation and closure of KGHM's facilities are included in detailed schedules of required activities, prepared by technical personnel and external consultants. These schedules are updated every two years. The most recent estimate of the ultimate cost of reclamation and closure is PLN 1.3 billion, or approximately USD 400 million.

For financial reporting purposes, at the end of each quarter, KGHM determines the present value of the estimated future costs of reclamation and closure. All estimated future costs are discounted to present value, using a discount rate based on an interest rate equivalent to the return on treasury bonds with maturities closest to the estimated dates on which the future reclamation costs will be incurred, and an inflation rate based on forecasts of future inflation.

The environmental liabilities included in KGHM's financial statements at 30 June, 2012, consist of a provision for reclamation and closure of PLN 508 million, or approximately USD 155 million, representing the present value of the estimated future expenditures, and a Mine Closure Fund of PLN 153 million, or approximately USD 47 million.

5.0 ACCESSIBILITY, CLIMATE, LOCAL RESOURCES, INFRASTRUCTURE AND PHYSIOGRAPHY

KGHM's head office in Lubin is located approximately 80 km northwest of Wroclaw, a major city with a population of about 650,000 people, and the capital of Lower Silesia. Wroclaw is served by regularly-scheduled flights from several European cities. Lubin is accessible from Wroclaw by a modern paved highway, in a driving time of slightly more than one hour. All of KGHM's operations, other than the Legnica smelter and refinery, lie along the paved road running northwestwards from Lubin towards Glogów and Zielona Gora. The Legnica smelter and refinery, some 25 km south of Lubin, is also accessible by paved road. There is a good network of secondary roads, providing local access to all of KGHM's facilities.

The mining district contains the towns of Lubin (population 75,000) and Polkowice, as well as several village areas, all being part of the Lower Silesian Voivodship (province). The area has relatively flat relief, with elevations about sea level ranging between 130 m and 150 m near Lubin, to between 200 m and 223 m in the Dalkowskie Hills, in the area from Polkowice to Glogów. Approximately 59% of the area is used for arable land and pasture, and about 32% is covered by forest.

Lower Silesia is the warmest region of Poland. The mean annual temperature at Lubin is $8^{o}C$. The coldest month is January, with an average temperature of $-2^{o}C$, and snow is common in the winter. The warmest month is July, with an average temperature of $18^{o}C$. Extreme temperatures measured in Wroclaw are $-30^{o}C$ and $39^{o}C$. Average annual precipitation in Lubin is approximately 575 millimetres (mm), with rain falling on an average of 150 days per year (d/y), spread evenly throughout all months. Most of KGHM's productive facilities operate 24 hours per day (h/d) and 365 d/y.

The area in which KGHM now operates was the scene of heavy fighting, as the Russian army advanced on Berlin in the closing stages of World War II. Infrastructural facilities, however, have been fully redeveloped. Roads are maintained in good condition, power supply is adequate and reliable, and all of the supplies and services required to support KGHM's operations are readily available. Mining in the area has been on-going for some 50 years and, as a direct result of this activity, the region has been transformed from an agricultural base to a major industrial centre.

6.0 HISTORY

6.1 CORPORATE HISTORY

The copper deposits of southwestern Poland occur in the geological extension of the Kupferschiefer stratum in Germany, which has been mined for copper since the twelfth century. Copper mineralization in the area currently being mined by KGHM was discovered by deep drilling in 1957. The Polish Geological Institute of Warsaw, with the cooperation of the Ministry for Heavy Industry, then carried out the first phase of exploration and delineation, involving drilling from surface on a 3 km by 3 km grid, with the main profiles being perpendicular to the overall northwest geological strike. This work was completed in 1959. In 1961, the Mining, Smelting and Refining Industrial Combine was established for the purpose of developing copper mines, smelters and refineries, based on the extensive resources identified by the earlier exploration drilling. In 1991, the Industrial Combine was restructured into a state-owned joint-stock company, under the name KGHM Polska Miedź S.A.

In 1997, KGHM was privatized by the Government of Poland and the shares were listed on the Warsaw stock exchange. The shares were also listed on the London stock exchange, in the form of Global Depositary Receipts (GDR). In connection with the privatization, Micon was retained to prepare a Competent Person's report on KGHM's mining operations. Micon's report, entitled "Review of the Mining Operations of KGHM Polska Miedź S.A., Republic of Poland", was issued in March, 1997, and was used in the Offering Circular of 7 July, 1997. In 1997, the GDRs listed on the London stock exchange represented 17% of KGHM's outstanding shares. In 2009, however, the GDRs represented only 0.1% of the shares, and KGHM withdrew the London listing.

Today, the share capital of KGHM is divided into 200 million outstanding shares. The Government of Poland retains ownership of 32% of the shares, 39% are held by foreign institutional investors, 25% are held by Polish institutional investors and only 4% are held by private investors. With the exception of the Government of Poland, no single investor owns more than 5% of the outstanding shares.

Over the period 1 June, 2011 to 31 December, 2012, the shares of KGHM traded at between approximately PLN 110 and PLN 190 per share, or approximately USD 33.30 to USD 57.60, implying a range of market capitalization between USD 6.7 billion and USD 11.50 billion. On 9 January, 2013 , the shares were trading at approximately PLN 191, equivalent to a market capitalization of approximately USD 12 billion, at the current exchange rate of USD 1 = PLN 3.15.

6.2 HISTORY OF DEVELOPMENT

The history of the development of KGHM's productive facilities is summarized in Table 6.1 and is described below.

Table 6.1
History of Development Milestones

Year	Milestone
1953	Copper refinery commissioned at Legnica
1959	Copper smelter commissioned at Legnica refinery
1960	Shaft sinking commenced at Lubin mine
1963	Shaft sinking commenced at Polkowice mine
1968	Start-up of Lubin mine and processing plant
1969	Start-up of Polkowice mine and processing plant
1970	Shaft sinking commenced at Rudna
1971	Copper refinery and smelter commissioned at Glogów (Glogów I)
1974	Start-up of Rudna mine and concentrator
1977	Shaft sinking commenced at Sieroszowice
1978	Glogów II copper refinery and smelter commissioned, with flash furnace
1979	Rolling mill commissioned at Orsk
1980	Start-up of Sieroszowice mine
1993	Precious metal recovery plant commissioned at Glogów
1997	Privatization of KGHM
2000	Sinking of Rudna shaft R-11 commenced
2001	Modernization of the lead plant
2006	Sinking of Sieroszowice shaft SW-4 commenced
2010	Modernization of Glogów smelter commenced
2013	Planned commencement of production from Deep Glogów

In 1953, prior to the discovery of copper in the Lubin-Glogów area, a copper refinery had been constructed at Legnica, approximately 25 km south of Lubin, principally to refine imported converter copper. By 1959, a smelter had been added and the Legnica plant began producing refined copper from concentrate, principally of domestic origin but supplemented by imported feed. The Legnica smelter and refinery now operate as a division of KGHM, treating concentrate supplied by KGHM's mineral processing plants, as well as scrap and purchased concentrates.

The development of mining operations in the area started in 1960, with the commencement of shaft sinking at the Lubin mine. A mineral processing plant was also built, concurrently with the shaft sinking operation. The eastern shaft at Lubin reached the ore horizon in March, 1968, and the mine and processing plant began production in July, 1968.

In the meantime, shaft sinking had commenced on the Polkowice concession in 1963. The Polkowice mine, with its associated processing plant, ultimately began commercial production in 1969. Shaft sinking at Rudna then commenced in 1970 and the official opening ceremony for the Rudna mine and processing plant was held in July, 1974.

To accommodate the increase in concentrate production from the new mines and processing plants, an additional smelting and refining facility, at Glogów (Glogów I), was commissioned in 1971.

In 1977, the decision was taken to develop a mine at Sieroszowice, and underground production from this operation commenced in January, 1980.

In 1978, a new smelter using flash furnace technology, and a new refinery were commissioned at Glogów (Glogów II).

The Cedynia copper rolling mill was established at Orsk, approximately 26 km north of Lubin, in 1979. The Cedynia plant produces copper wire rod and specialty oxygen-free copper rod, KGHM's most highly manufactured copper product.

In 1993, a precious metals plant was commissioned at the Glogów facility, to recover silver, gold and platinum group metals from anode slimes.

With the high prices of copper and silver, KGHM has been very profitable in recent years, and has generated large cash flows. A significant portion of free cash flow has been invested in modernization of the equipment installed at its operating facilities, particularly at the Glogów smelter.

Most recently, a decision was taken to develop the copper reserves in the Deep Glogów area, in order to maintain KGHM's total ore production at approximately 30 Mt/y well into the future. Shaft GG-1, with a planned depth of 1,380 m, will be sunk starting in 2013, as a ventilation and service shaft for Deep Glogów. Underground access will be provided from both the Rudna and Polkowice-Sieroszowice mines. The ore from Deep Glogów will be extracted from both the Rudna and Polkowice-Sieroszowice mines, and will be processed in both the Rudna and Polkowice concentrators. Ore production from Deep Glogów is scheduled to commence in the second half of 2013.

6.3 HISTORICAL RESERVES, 2007 TO 2011

As described in Section 14 of this report, KGHM uses a system of resource and reserve classification that is very similar to the system used in the Russian Federation. The classification system starts with the estimation of "Balance Reserves" and continues progressively through the estimation of "Industrial Reserves", "Operational Reserves" and "Mining Reserves". Mining Reserves represent that sub-set of resources which satisfies economic cut-off criteria, and to which allowances have been applied for mining losses and dilution. In Micon's opinion, the Mining Reserves estimated by KGHM meet the requirements of the Canadian Institute of Mining, Metallurgy and Petroleum (CIM) standards and definitions for estimating Mineral Reserves. KGHM's estimated Mining Reserves at the end of each of the last five years are summarized in Table 6.2.

Table 6.2
KGHM Mining Reserves, 2007 to 2011*
(as at December 31 of each year)

Mine	Units	Mining Reserves				
		2007	2008	2009	2010	2011
Lubin						
Tonnage	Mt	238.5	236.1	234.3	235.9	324.5
Copper Grade	%	1.11	1.10	1.13	1.13	1.00
Silver Grade	g/t	51	51	51	50	42
Polkowice-Sieroszowice						
Tonnage	Mt	419.3	395.5	421.0	351.9	336.4
Copper Grade	%	1.70	1.72	1.69	1.93	1.85
Silver Grade	g/t	35	34	36	42	44
Rudna						
Tonnage	Mt	301.4	270.3	259.3	248.4	287.1
Copper Grade	%	1.78	1.81	1.79	1.75	1.65
Silver Grade	g/t	43	44	44	43	46
Deep Glogów						
Tonnage	Mt	247.5	246.1	255.6	232.6	233.1
Copper Grade	%	1.79	1.80	1.73	1.94	1.90
Silver Grade	g/t	58	58	56	63	61
Total						
Tonnage	Mt	1,206.7	1,148.0	1,170.1	1,068.8	1,181.0
Copper Grade	%	1.62	1.63	1.61	1.71	1.58
Silver Grade	g/t	45	45	45	49	48
Contained Copper	Mlb	19.57	18.74	18.83	18.31	18.62
Contained Silver	Moz	54.0	51.9	52.6	51.9	56.1

*** Throughout this report, tabulated data have been rounded and totals may not add precisely.**

While the reserves shown in Table 6.2 were not originally estimated strictly in accordance with the CIM standards and definitions, the historical reconciliations discussed in Section 15 demonstrate good agreement between the estimated tonnage and grade of the Mining Reserves and the actual tonnage and grade mined, lending support to the validity of KGHM's estimates of Mining Reserves.

6.4 HISTORICAL PRODUCTION, 2007 TO 2011 AND FIRST SIX MONTHS OF 2012

KGHM's production of ore (expressed as dry tonnes) for each of the last five years, and for the first six months of 2012, is summarized in Table 6.3. Data for the production of concentrate (dry tonnes), electrolytic copper, refined silver and copper wire rod over the same period are provided in Table 6.4.

Table 6.3
KGHM Ore Production, 2007 – 2011 and First Six Months of 2012

Facility	Units	Annual Production					
		2007	2008	2009	2010	2011	2012 (six months)
MINE PRODUCTION							
Lubin							
Tonnage	Mt	7.12	6.89	7.15	7.16	7.25	3.58
Copper Grade	%	1.09	1.08	1.12	1.02	0.96	0.95
Silver Grade	g/t	62.11	66.47	68.78	63.53	51.87	50.37
Polkowice-Sieroszowice							
Tonnage	Mt	10.70	10.41	10.37	10.37	10.73	5.63
Copper Grade	%	1.77	1.75	1.83	1.84	1.82	1.78
Silver Grade	g/t	32.40	32.34	33.75	34.96	35.17	36.91
Rudna							
Tonnage	Mt	12.44	12.12	12.21	11.77	11.74	6.05
Copper Grade	%	1.92	1.86	1.87	1.84	1.83	1.81
Silver Grade	g/t	49.92	46.27	46.66	48.61	51.33	50.62
Total Mine Production							
Tonnage	Mt	30.26	29.42	29.73	29.30	29.72	15.26
Copper Grade	%	1.67	1.64	1.68	1.64	1.61	1.60
Silver Grade	g/t	46.59	46.07	47.48	47.43	45.63	45.50
Contained Copper	Mlb	1,115	1,062	1,101	1,059	1,057	537
Contained Silver	Moz	45.3	43.6	45.4	44.7	43.6	22.3

Table 6.4
KGHM Concentrate and Metal Production, 2007 – 2011 and First Six Months of 2012

Facility	Units	Annual Production					
		2007	2008	2009	2010	2011	2012 (six months)
CONCENTRATOR PRODUCTION							
Total Concentrator Production							
Mill Feed	Mt	30.25	29.52	29.68	29.23	29.78	15.18
Copper Grade	%	1.67	1.64	1.67	1.64	1.61	1.60
Silver Grade	g/t	46.59	46.10	47.54	47.42	45.65	45.54
Copper Recovery	%	89.4	88.9	88.3	88.8	88.8	88.9
Silver Recovery	%	85.1	85.3	85.5	85.2	85.8	85.8
Concentrate Produced	Mt	1.875	1.866	1.929	1.841	1.875	0.943
Copper Grade of Concentrate	%	24.1	23.0	22.8	23.1	22.8	22.8
Silver Grade of Concentrate	g/t	639	622	625	641	622	629
Contained Copper	Mlb	996.7	946.5	965.5	937.4	941.4	475.8
Contained Silver	Moz	38.6	37.3	38.8	38.0	37.5	19.1
METAL PRODUCTION							
Legnica							
Electrolytic Copper	Mt	0.102	0.100	0.105	0.106	0.103	0.051
Glogów							
Electrolytic Copper	Mt	0.431	0.427	0.398	0.441	0.468	0.222
Refined Silver	Moz	39.1	38.3	38.7	37.3	40.5	21.0
Total Metal Production							
Electrolytic Copper	Mt	0.533	0.527	0.503	0.547	0.571	0.273
Refined Silver	Moz	39.1	38.3	38.7	37.3	40.5	21.10
Cedynia							
Copper Wire Rod	t	250,907	206,191	177,457	237,317	226,235	114,731
Oxygen-Free Copper Rod	t	10,866	11,789	13,847	15,465	15,225	7,656

In 2011, in additional to its primary production of copper and silver, KGHM produced the following saleable by-products:

- Gold : 22,627 oz
- Platinum, palladium concentrate : 2,505 oz
- Lead : 25,234 t
- Ammonium perrhenate : 8.7 t
- Selenium : 85 t
- Nickel sulphate : 2,481 t
- Sulphuric acid : 636,248 t
- Rock salt : 457,172 t

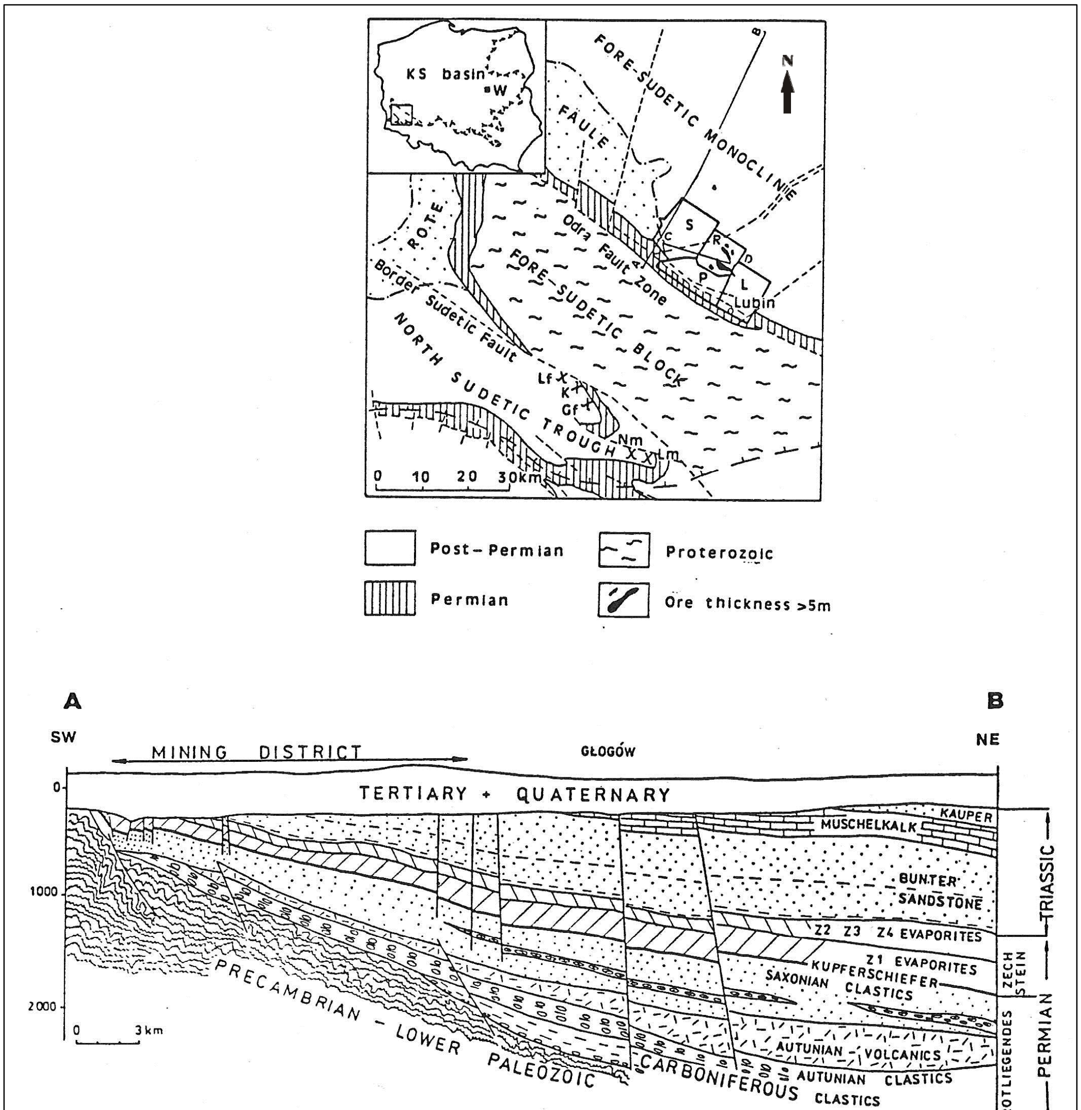
For each year from 2007 to 2011, and for the first half of 2012, Micon has compared the actual production achieved by KGHM's mines, concentrators, smelter and refineries against budgeted performance for the same period. No significant discrepancies were found.

7.0 GEOLOGICAL SETTING AND MINERALIZATION

7.1 REGIONAL GEOLOGICAL SETTING

The Legnica-Glogów Copper Belt area is situated in a southern marginal part of the Fore-Sudetic Monocline. In gross terms, the stratigraphy incorporates three main units: a metamorphosed Proterozoic-Palaeozoic basement, a Permo-Triassic sedimentary succession, which is gently dipping to the northeast, and thick, overlying, sub-horizontal Caenozoic sediments above (Figure 7.1).

Figure 7.1
Geological Setting of the Legnica-Glogów Copper Belt*



Geologic cross-section through the district along *line A-B* Vertical scale5 x horizontal scale

* All of the illustrations in this Section are taken from Micon's report of March, 1997. The illustrations are still current.

The Permo-Triassic succession, a part of which hosts copper mineralization, begins with two reddish-brown conglomerate-sandstone-mudstone sequences of early Permian age, totalling up to 150 m in thickness. These sediments are covered by rhyolites and trachybasalts of variable thickness, which, in turn, are overlain by red quartz sandstones of late Lower Permian age. Due to pervasive hematite and goethite staining, the whole Lower Permian suite is termed the Red Footwall Sandstone (Rotliegendes). Within the mining area, the thickness of this unit is in the range of 230 m to 300 m. The uppermost part of this succession (from less than a metre to over 40 m in thickness) lacks hematite and goethite and consists of fine-grained white sandstones with kaolin, carbonate, clay or anhydrite cement. Because of its colour, this unit is termed the White Footwall Sandstone (Weissliegendes). The colour transition is irregular, suggesting that the white sandstone probably represents the Rotliegendes reworked during the Zechstein transgression.

The Lower Permian rocks are conformably overlain by four Upper Permian evaporitic cyclotherms and by Triassic red beds and carbonates. The Upper Permian sequence generally begins with a very thin bed of grey micritic dolomite, termed the Boundary Dolomite, which is then followed by black fissile shale carrying copper sulphides and hence called Cupriferous Shale (Kupferschiefer). Its thickness typically varies between 30 cm and 50 cm. Normally, the Cupriferous Shale grades upwards into dolomites and limestones up to 80 m in thickness, collectively referred to as the Basal Limestone or Basal Dolomite. However, the Cupriferous Shale is missing along several northwest-trending elevations of the White Footwall Sandstone floor, and the sandstones along these elevations are directly overlain by limestones and dolomites. The Cupriferous Shale passes laterally westwards into a red shale horizon without copper sulphides. This is an oxide facies known as the Red Spotted Facies (Rote Fäule). The Upper Zechstein sequence in the mining district ends with thick evaporites (anhydrite and halite).

Copper mineralization occurs in the uppermost part of the White Sandstone and in the lowest Zechstein units, including the Boundary Dolomite, Cupriferous Shale and the lowermost part of the overlying dolomites (Figure 7.2). Because its vertical extent does not coincide with stratigraphic boundaries, the mineralization can be best described as stratabound. The ore is divided into sandstone ore, shale ore and carbonate ore and, for practical reasons, the last two types are grouped together as shale-carbonate ore.

Over most of the mined area, the hanging wall of the copper-bearing horizon is formed by calcareous dolomite. The dolomite splits into sub-horizontal partings, typically 0.1 m to 0.7 m in thickness, immediately above the ore horizon, creating potentially hazardous working conditions and inevitable dilution. Higher in the profile, the dolomite increases in thickness. There are small areas at Rudna where the ore horizon is covered by anhydrite.

The highest grades of copper and the accompanying metals are recorded in the Cupriferous Shale. The White Footwall Sandstone sometimes carries significant mineralization, as at Rudna, or patchy mineralization, as at Polkowice. Likewise, the dolomites are in some areas weakly mineralized, such as at Lubin, but in other areas, such as Polkowice, they are the main carriers of the mineralization. Figure 7.3 illustrates a range of typical vertical profiles of the mineralization. Red shale of the Rote Fäule is devoid of copper mineralization but the transitional zone between the oxide and sulphide facies carries gold and platinoids.

Figure 7.2
Schematic Profile of Cupriferous Horizon

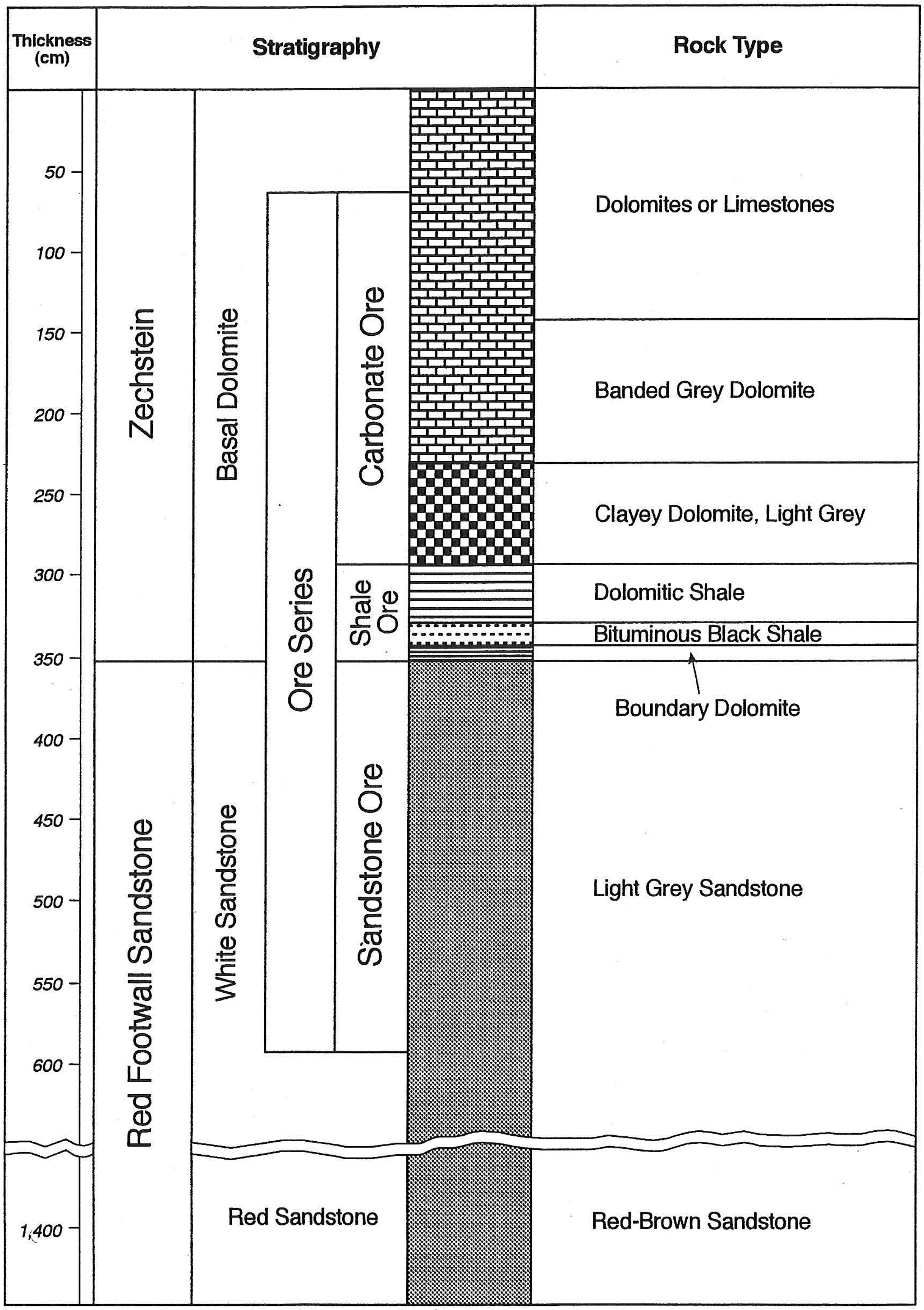
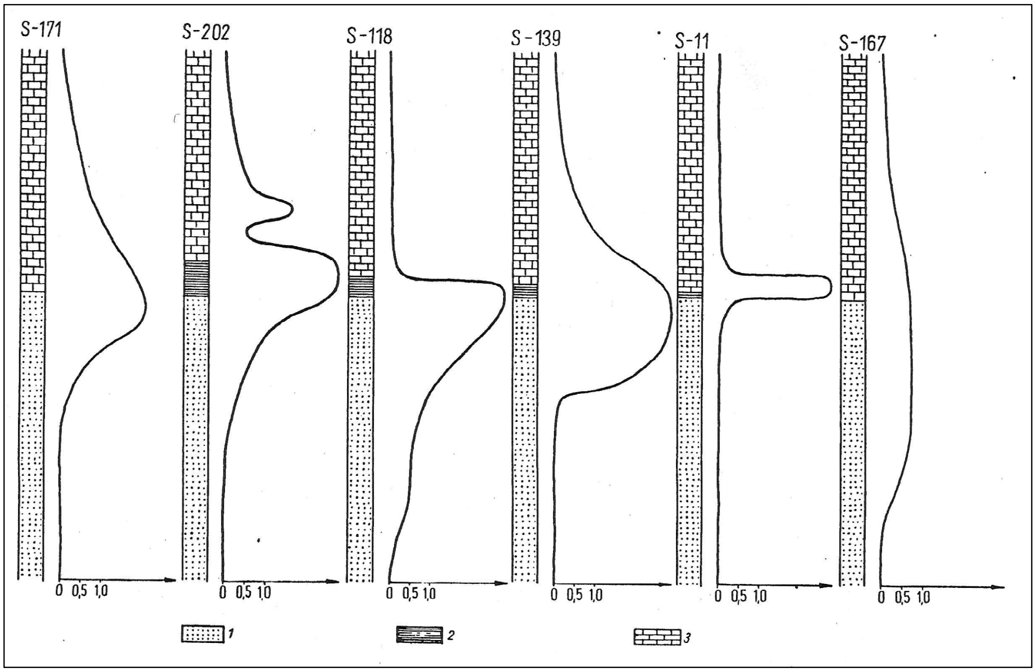


Figure 7.3
Typical Vertical Profiles of Copper-Bearing Horizon



Legend: Horizontal scale reflects percentage copper (% Cu).
1: White footwall sandstone, 2: Cupriferous shale, 3: dolomites and limestone.

The southwestern perimeter of the mining district is defined variously by northwest-trending faults, the pre-Tertiary Zechstein outcrop (Figure 7.4) or by the Rote Fäule boundary. The boundary faults, as well as northwest-trending faults in the adjacent marginal portion of the area, belong to the Middle Odra Fault System, which separates the Fore-Sudetic Monocline from the Fore-Sudetic Block of crystalline basement. The intensity of faulting gradually dies out northeastwards, giving way to a relatively simple monoclinal structure with Permo-Triassic beds dipping 2° to 6° northeast. Displacements on east-northeast-trending faults that are shown in Figure 7.4 are relatively insignificant.

7.2 LOCAL GEOLOGY

7.2.1 Lubin-Malomice

Copper mineralization in the Lubin-Malomice concession covers an area of 70 km^2 at depths of 638 m to 1,006 m below surface. When fully developed, a typical ore profile consists of (in descending order):

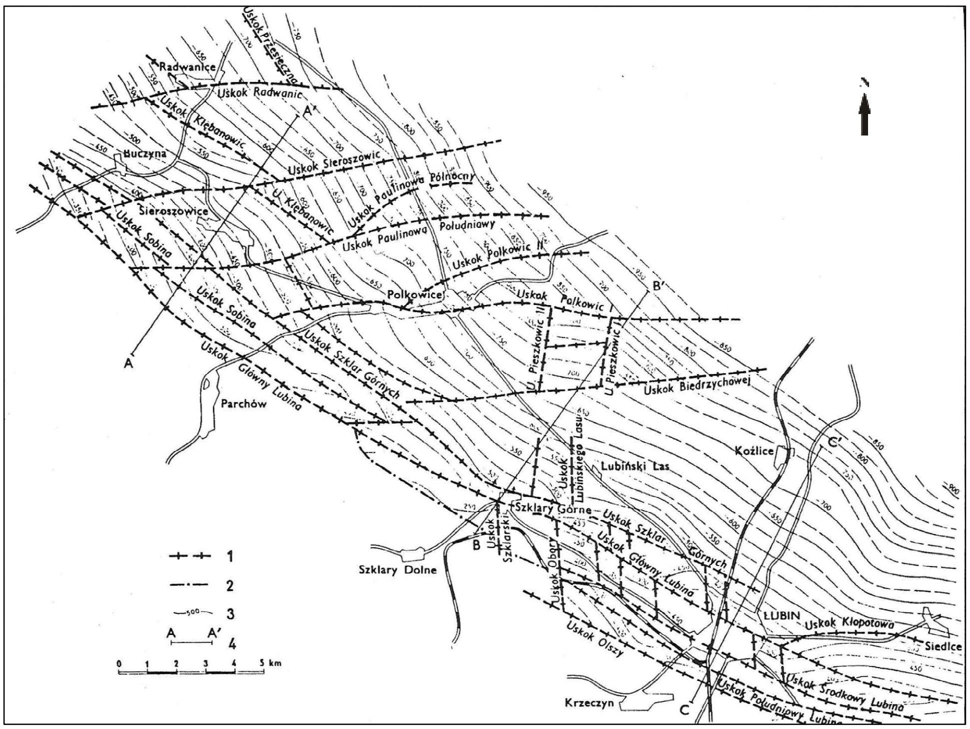
- Calcareous dolomite.
- Streaky dolomite, generally banded.
- Clayey dolomite.

- Cupriferous Shale, bituminous in the lower part and dolomitic in the upper part; upper interface sharp or transitional; thickness variable, generally 30 cm to 50 cm.

- Boundary Dolomite; grey micritic dolomite, about 5 cm thick.

- White Footwall Sandstone, fine-grained with calcareous cement passing downwards into clay cement; thickness 8 m to 10 m of which the uppermost 2 m to 3 m may be mineralized.

Figure 7.4
Structural Map of the Legnica-Glogów Copper Belt



1 – faults, 2- pre-Tertiary outcrops of Zechstein, 3 – contours of Zechstein footwall, 4 – section line.

Locally, a second mineralized horizon is encountered in the White Footwall Sandstone, generally separated from the Cupriferous Shale by a 2 m to 3 m thick interval carrying only traces of sulphide mineralization. Because of its small lateral extent and patchy occurrence, this horizon has no economic importance, except where copper mineralization extends upwards through the whole interval to the Cupriferous Shale. The base of copper mineralization in the White Footwall Sandstone is sometimes marked by the so-called "bornite smear", in which the copper content can attain 3% to 4% over a thickness of as much as 10 cm to 20 cm.

There are two contrasting structural domains within the combined Lubin and Malomice mining area. The southern part of the area, from the pre-Tertiary Zechstein outcrop to the Szklary Górne Fault Zone, about 2 km to the north, is traversed by a series of west-northwest striking faults with throws ranging from 10 m to 100 m. Movements on these faults have led to a local steepening of the strata to 10 to 15°, and sometimes up to 40°, and to local reversals of dip. In contrast, the northern part of the mining area is little disturbed by faults and maintains a more or less constant dip to the northeast, typically 2° to 6°.

Sandstone ore constitutes 64.5% of the current Balance Reserves and provides about 76% of the mine output. The sandstone ore typically contains 0.7% to 5.5% Cu. Shale-carbonate ore is absent over large areas in the central and southeastern parts of the Lubin-Malomice concessions but it occurs on its own, without the underlying sandstone ore, in the southwest part of the Lubin mine. The copper content in shale-carbonate ore ranges from 0.7% to 16%.

The highest copper grades occur in the Cupriferous Shale, with a gradual decrease in grade both above and below this unit. On the whole, horizontal grade variations are insignificant. The ore thickness generally varies from 1 m to 7 m but, in places, exceeds 17 m. The average ore thickness for both Lubin and Malomice is 3 m. In broad terms, there is a northwest-trending zone of relatively thick ore (greater than 4.5 m) running between the central and western shafts. Another thick zone occurs to the northeast of the eastern shafts, straddling the boundary between the Lubin and Malomice mining areas. In this area, ore reaches a thickness of up to 9 m but is unusual because mineralization occurs in a basin-like depression within the White Footwall Sandstone, 3 m to 9 m from the top of the sandstone unit. There is no shale over the dome and the sandstone is overlain by reef, algal and sandy dolomites. Because of its relative position to the surrounding area and problems with access, reserves in this part of the deposit are classified as Non-Industrial.

7.2.2 Polkowice-Sieroszowice

In the Polkowice concession, copper mineralization covers an area 22.2 km^2 at depths of 381 m to 893 m below surface. In the Sieroszowice concession, which is contiguous with Polkowice, copper mineralization extends over an area of 59.6 km^2 at depths greater than 657 m below surface.

There are significant variations in the development of the Zechstein. In the western and southwestern part of the Polkowice mining area, the lowermost Zechstein is developed in the oxidized facies (Red Spotted Facies) characterized by red hematite-bearing shale and red patches and spots in the underlying White Footwall Sandstone. Copper sulphides and silver mineralization are absent, but gold and platinoids appear instead, at least at the transitional zone between the oxidized and sulphide facies. The Red Spotted Facies passes laterally (north and northeastwards) into the Cupriferous Shale, which is overlain by sulphide-bearing dolomite. The underlying White Footwall Sandstone is barren, except near the boundary with the Lubin mining area and in the northern and northwestern parts of Sieroszowice.

Structurally, the Polkowice area is divided into two domains by the Biedrzychowa Fault. This is an east-northeast striking scissor fault with a throw up to 50 m and with short northeast-trending splay faults. The area situated to the northwest and north of the fault, including the Red Spotted Facies, has a simple monoclinal structure with a gentle dip to the northeast. In contrast, the area to the southeast and east of the fault is cut by reverse south-dipping faults with vertical displacement components of 50 m to 100 m. The southern margin of the area is marked by a pre-Tertiary outcrop. Reverse faulting dies out northeastwards and, eventually, the structure assumes fairly uniform monoclinal characteristics.

There are relatively few faults in the Sieroszowice area. Those that do occur have throws ranging from 0.5 m to several metres and some are flexures rather than faults. The monoclinal structure is gently folded into west-east trending open folds. This is unique to Sieroszowice and is due to the damping effect of a salt horizon that occurs some 15 m to 25 m above the Cupriferous Shale.

Shale-carbonate ore, which predominates in Polkowice and in the developed part of Sieroszowice, generally varies from 0.6 m to 4.5 m in thickness and decreases southwards towards the pre-Tertiary outcrop. Over much of the central part of the Sieroszowice area, the thickness is reduced to 1 m to 1.5 m. Despite a relatively small variability in copper grade, the internal structure is complicated because there are low grade and barren intercalations of variable thickness. Sandstone ore appears beneath shale-carbonate ore in the southern part of the Polkowice area where it adjoins the Lubin mine and over two large areas in the undeveloped northern part of the Sieroszowice area.

Much of the relatively rich shale-carbonate ore in the central part of the Polkowice area has been exhausted and some of the rich ore still remaining, including sandstone ore, is sterilized in shaft support pillars. The richest ore in Sieroszowice (200 kg Cu/m^2 to more than 350 kg Cu/m^2) occurs in the developed part of the area. The richest sections of the undeveloped portion of the mining area coincide with the occurrence of sandstone underlying the carbonate-shale ore. Yields in excess of 200 kg Cu/m^2 to more than 350 kg Cu/m^2 are indicated by drilling in the northwestern and northeastern parts of the area, respectively. Yields of this magnitude are significantly in excess of the cut-off of 50 kg Cu/m^2.

7.2.3 Radwanice Wschód

Copper mineralization that was delineated by drilling from surface occurs over an area of 12.8 km^2 in the central-eastern part of the documented area called Radwanice Wschód (east). This area has been accessed and mined from the Polkowice-Sieroszowice mine.

Copper mineralization above the cut-off grade is contained only in the basal part of the Zechstein. Grades in the underlying sandstone do not exceed 0.4% Cu. The depth to the footwall varies from 503 m to 691 m below surface. The thickness of the drill intersections varies from 1.1 m to 4.2 m, and averages 2.89 m. Because of the proximity to the oxidized facies, copper grades change rapidly in both horizontal and vertical directions. The highest grades are in the Cupriferous Shale (maximum 13.1% Cu). Within the resource perimeter, grades vary from 1.51% to 3.55% Cu, averaging 2.11%. Silver grades vary from 25 g/t to 45 g/t, with an average of 32 g/t.

Tertiary sands and clays occur in the hanging wall in the southeast part of the resource area. Elsewhere, the hanging wall is formed by limestones and dolomites covered with Zechstein anhydrite.

7.2.4 Rudna

Copper mineralization in the Rudna concessions occurs over an area of 40.0 km^2. The distribution of the various lithological types of ore is controlled by the relief of the top of the White Footwall Sandstone, principally by the disposition of elevations (hills) and flats (depressions or valleys). From south to north, the main elevations are:

- Southern Rudna Elevation on the 900 m level : isometric dome with a size of 1 km by 1 km in plan view.

- Central Rudna Elevation between the 950 m and 1,000 m levels : 300 m to 1,000 m wide ridge elongated west-northwest with flanks sloping 10^o southeast and northwest.

- Northern Rudna Elevation on the 1,050 m level : west-northwest elongated ridge with dimensions similar to the Central Rudna Elevation.

- Tarnówek Elevation on the 1,100 m level, with a width of about 800 m.

- Żelazny Most Elevation, interpreted from drill intersections in the northern margin of the Rudna mining area.

It appears that these elevations are simply ridges between broad and flat valleys of pre-Zechstein origin. This hypothesis is supported by wedging out of the Cupriferous Shale over the elevations.

There are fundamental lithological differences between the elevations and the flats. A typical profile for the flats contains all lithological units, such as the White Footwall Sandstone, Boundary Dolomite, Cupriferous Shale and Basal Dolomite. Profiles through the elevations, on the other hand, begin with the White Footwall Sandstone which contains irregular patches of anhydrite cement and is overlain directly by the Basal Limestone unit, which begins with patches of algal dolomite and organogenic dolomite, locally covered by sandy dolomite. The higher units, beginning with streaky dolomite, are similar to those on the flats.

The monoclinal structure is complicated by two east-northeast-trending structures. The southwestern part of the mining area is cut by east-northeast-trending faults of the Biedrzychowa Fault system, extending from the Polkowice area. Throws are to the northwest and range from 40 m to 140 m. There are local elevations around shaft R-6 in the footwall block and, further north, the block is traversed by the west-northwest-striking Main Rudna Fault (200 m wide) with a throw up to 30 m to the north. This fault abuts the Biedrzychowa Fault. The second main structure, called Paulinowa, is situated to the west of the western shafts. The Paulinowa structure is a 20 m to 30 m deep syncline parallel to the Biedrzychowa Fault.

Characteristics and parameters of copper mineralization are controlled by lithological differences between the flats and elevations. The main zone in the south of the mining area follows a broad flat that extends into the Polkowice and Lubin areas. Mineralization extends from the top part of the White Footwall Sandstone (0.8 m to 4 m), through the Cupriferous Shale (0.4 m), clayey dolomite (0.1 m to 0.6 m) and streaky dolomite (1.2 m to 3 m), into the bottom part of the calcareous dolomite. The overall thickness of mineralization varies from 2 m to 6.5 m, the average being 4.5 m. Profiles through other flats are similar. The mineralized thickness in the flat between the Central Rudna Elevation and the Northern Rudna Elevation varies from 2 m to 7 m, but does not exceed 6 m in the flat between the Northern Rudna Elevation and the Tarnówek Elevation. In contrast, copper mineralization in elevated areas occurs in the White Footwall Sandstone and calcareous dolomite only. The mineralized thickness generally exceeds 7 m and locally exceeds 20 m. The extent of mineralization within the White Footwall Sandstone is controlled by the type of cement. Typically, the top parts of the elevations contain irregular patches of sandstone cemented by anhydrite or a mixture of anhydrite and clay cement and this type of sandstone is barren. When patches of anhydrite sandstone are thin, copper mineralization may continue uninterrupted beneath, but when anhydrite cement persists to greater depths, copper will not occur at all. On the whole, sandstone ore is more important and makes up a dominant proportion of the Balance Reserve at Rudna.

7.2.5 Deep Glogów

The Deep Glogów area covers a strip of land running from northwest to southeast, bordered to the south by the Polkowice-Sieroszowice and Rudna mines and covering an area of approximately 56 km^2. The deposit will be mined from the Rudna mine (50%) and the Polkowice-Sieroszowice mine (50%), and not as a separate operation.

The copper ore deposit in the Deep Glogów area is a continuation of the deposit from the existing adjacent mining areas. The deposit has been delineated by 42 holes drilled from the surface. The depth of the deposit ranges from 1,200 m to 1,400 m below surface. The thickness of the deposit ranges from 0.74 m to 4.13 m (average 2.11 m), with a varying intensity of mineralization and a varied lithological structure.

The thinnest parts of the deposit are in the western and central region (to the north of the Polkowice-Sieroszowice mine), where the ore occurs in the Cupriferous Shale and in the roof of the White Footwall Sandstone, as well as locally in the eastern region, to the north of the Rudna mine. Three lithological types of ore have been identified: carbonate ore with an average thickness of 0.49 m (27%), shale ore with thicknesses from 0.02 m to 0.81 m (13%), and sandstone ore with thicknesses from 1.15 m to 3.59 m (60%).

The mineralization occurs mainly in the form of small grains of sulphides, most often distributed evenly, but sometimes concentrated in the form of smudges and extended pockets. Locally, coarse-grain forms of mineralization occur as veins of varying thicknesses or irregularly located pockets.

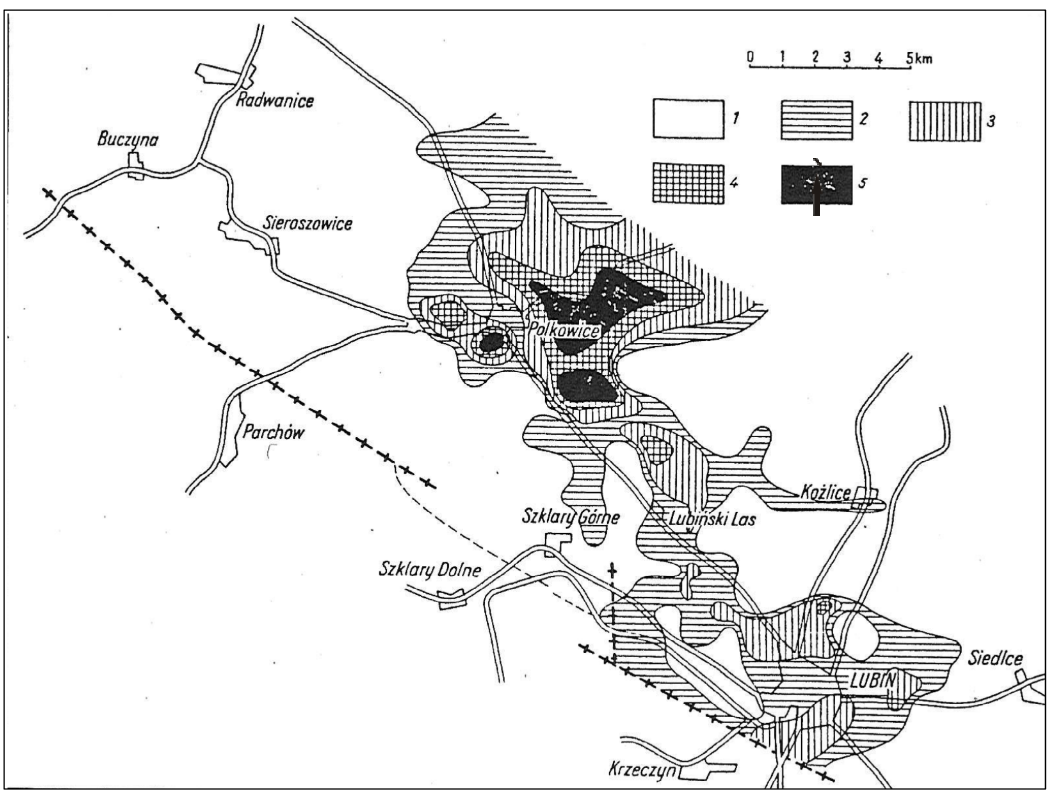
All of the ore types found in the Deep Glogów deposit are dominated by simple copper sulphides: chalcocite and digenite. The accompanying elements include lead, silver, cobalt, zinc and nickel. The average copper content of the Mining Reserves of the Deep Glogów deposit is 1.9%. The average silver content is 61 g/t.

7.3 MINERALIZATION

The main copper minerals in all types of ore are chalcocite and digenite, which generally occur together in concentrations up to 6% by weight (wt.%). Also abundant are bornite (up to 3.5 wt.%), chalcopyrite (up to 1 wt.%), covellite (also up to 1 wt.%) and, locally, minerals from the tetrahedrite group. Accessory minerals include tenorite, azurite, cuprite, native copper, enargite, galena, sphalerite, smithsonite, loellingite, arsenopyrite, cobaltite, nickeline, native silver and stromeyerite.

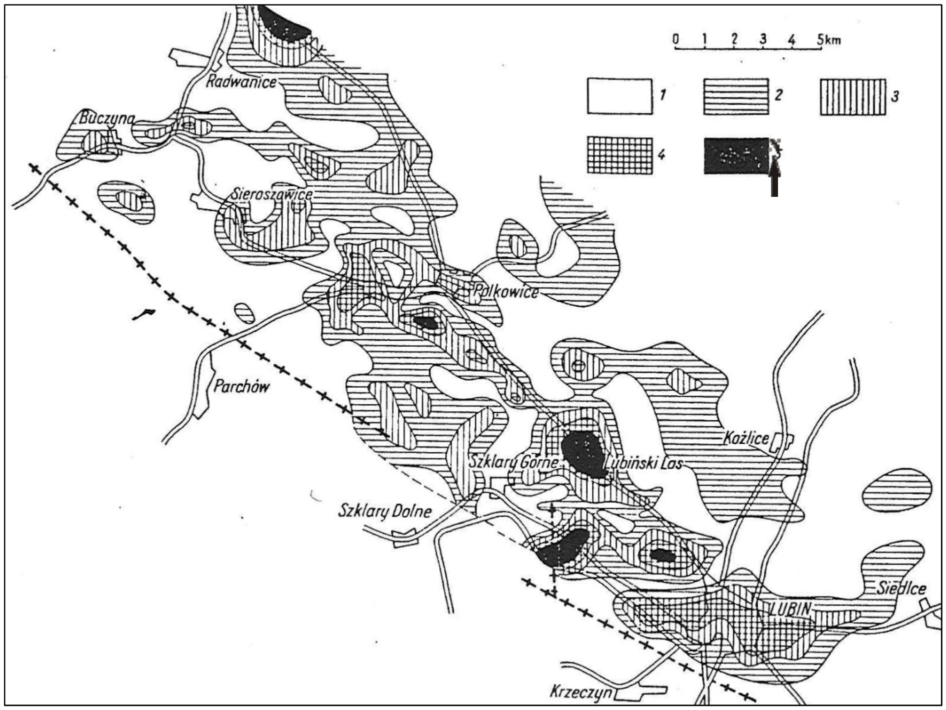
Proportions of various minerals depend on the type of ore and, in each type, vary both in a vertical profile and laterally. Figures 7.5 to 7.7 show the lateral extent and thickness of the three types of ore: sandstone ore, shale ore and carbonate ore.

Figure 7.5
Schematic Map of the Distribution of Sandstone Ore



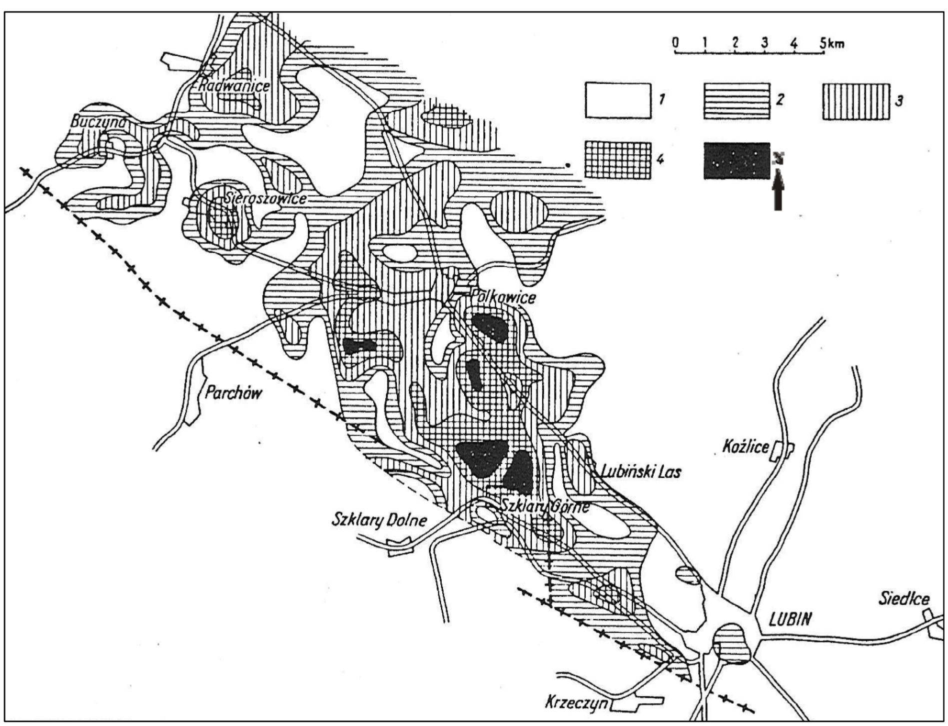
Thickness: 2. <2m, 3. 3-4m, 4. 4-6m, 5. >6m.

Figure 7.6
Schematic Map of the Distribution of Shale Ore



Thickness: 2. <0.4m, 3. 0.4 – 0.6m, 4, 0.6 – 0.8m, 5. >0.8m.

Figure 7.7
Schematic Map of the Distribution of Carbonate Ore



Thickness: 2. <1m, 3. 2 – 2m, 4. 2 – 3 m, 5. >3m.

7.3.1 Sandstone Ore

The predominant mineral associations in sandstone ore at the Lubin mine are bornite-chalcopyrite and bornite-chalcocite. The most common non-copper mineral is pyrite. Accessory minerals include tetrahedrite. Pyrite and chalcopyrite, accompanied by minor bornite, prevail at the base of the mineralized horizon but the proportion of bornite increases upwards until it assumes the dominant role. Accompanying minerals in the upper part of the profile include chalcopyrite, digenite and chalcocite.

The main copper minerals in sandstone ore at Polkowice, Sieroszowice, Rudna and Deep Glogów are chalcocite and digenite. These minerals form cement or occur as small grains and aggregates in clay cement. Chalcocite predominates. Bornite assumes local importance at Rudna.

7.3.2 Shale Ore

The mineralogy of shale ore is far more complex. The content of copper-bearing minerals often exceeds 4 wt.%. Chalcocite-bornite and bornite-chalcopyrite associations predominate. Copper minerals are accompanied by pyrite, galena, sphalerite and marcasite. Accessories include minerals of the tetrahedrite group. Shale ore also contains abundant organic carbon. There is a lateral zonation with bornite-chalcopyrite prevailing near Lubin east, bornite with chalcopyrite and minerals of the chalcocite group predominating in the vicinity of the main shafts at the Lubin mine, and chalcocite assuming the major role further northwestwards. In Sieroszowice, digenite predominates and chalcocite is second in importance. Bornite and chalcopyrite occur in subordinate quantities.

Shale ore is enriched in silver minerals, particularly in the eastern and central parts of the Lubin mine. Silver concentrations vary from 10 g/t to over 5,500 g/t, and occasionally to 10 kg/t. Silver occurs mainly in isomorphic admixtures in bornite, chalcocite, djurleite, digenite and galena. Silver also occurs in the native form and forms its own minerals such as stromeyerite, cupriferous stromeyerite and jalpaite. These minerals often occur with calcite in veinlets and nests. Native silver often replaces bornite and stromeyerite commonly replaces chalcocite.

Minerals of nickel and cobalt generally occur with barite and gypsum in calcite veins. The most important nickel and cobalt bearing mineral is pyrite. Nickel minerals associated with pyrite include rammelsbergite, tennantite, nickelite and gersdorffite. Cobalt minerals include smaltite and nickel-bearing cobaltite. The highest concentrations occur at the base of the Cupriferous Shale in the eastern and central parts of the Lubin mine and in the Boundary Dolomite in the western part of the Lubin mine. Molybdenum minerals (castaingite, molybdenite and jordisite) occur in highest concentrations in the Boundary Dolomite near the western shafts at Lubin.

Gold, palladium, platinum and, associated with them, minerals of cobalt, molybdenum, nickel, bismuth and mercury, occur in significant quantities in the Red Shale and the underlying White Sandstone with hematite spots at the transitional zone between the sulphide and oxide facies in the Polkowice-Sieroszowice mine. They also occur, in smaller quantities, at the base of the Cupriferous Shale along a narrow north-south belt parallel to the extent of organodendritic limestone in the western part of the Lubin mine.

7.3.3 Carbonate Ore

The most important copper mineral in carbonate ore is chalcocite, which is commonly associated with digenite, bornite and covellite but rarely with chalcopyrite. Bornite is less abundant, but locally predominates over chalcocite. Chalcopyrite generally accompanies bornite but occasionally predominates, in which case bornite and other sulphide minerals occur as inclusions or intergrowths. Covellite tends to be associated with digenite and bornite. Accessory minerals include tetrahedrite, which occurs on its own or with bornite, and galena. Pyrite is abundant and predominates in some parts near the hanging wall of the carbonate ore horizon. Silver is contained in stromeyerite.

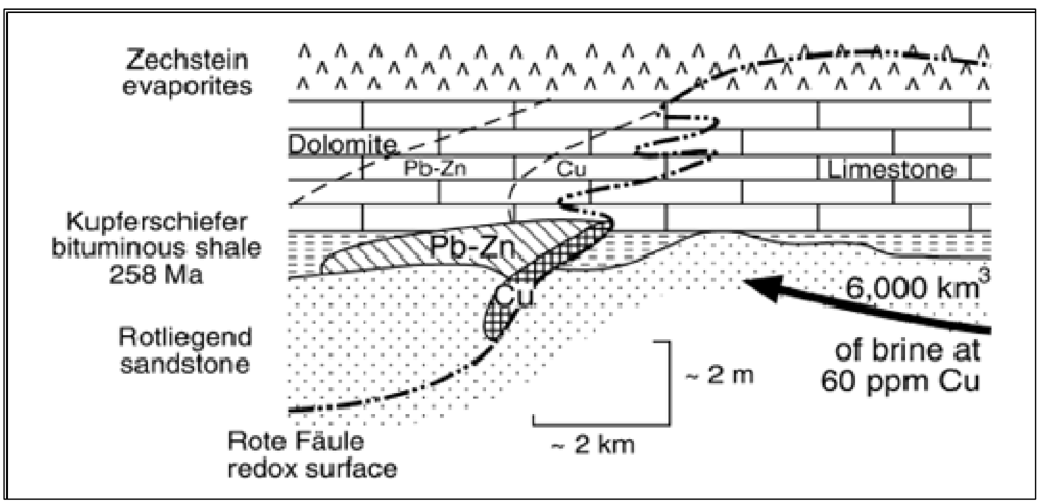
8.0 DEPOSIT TYPES

The following description of the origin of the Kupferschiefer copper-silver mineralization in Poland is adapted from S. Oszczepalski, 1999. The deposits are stratabound and associated with Permian sediments.

The Kupferschiefer copper-silver sulphide deposits occur across the contact between the Upper Permain Zechstein restricted marine sequence and the Lower Permian Rotliegende continental volcanic and clastic sequence. The Kupferschiefer ore series can be split into two types of deposits, a reduced zone composed of dark-grey, organic rich and metal sulphide-containing sediments and an oxidized zone of red-stained organic matter-depleted and iron oxide-bearing sediments, known as the Rote Fäule. The transition zone from oxidized to reduced rocks occurs both vertically and horizontally and is characterized by sparsely disseminated remnant copper sulphides within hematite-bearing sediments, replacements of copper sulphides by iron oxides and covellite, and oxide pseudomorphs after framboidal pyrite. These textural features and copper sulphide replacements after pyrite in the reduced sediments imply that the main oxide/sulphide mineralization postdated formation of an early-diagenetic pyrite. The hematite rich sediments locally contain enrichments of gold and platinum group elements.

The Kupferschiefer mineralization resulted from upward and laterally flowing fluids which oxidized originally pyritiferous organic matter-rich sediments to form hematitic areas (Rote Fäule) and which emplaced base and noble metals into reduced sediments (Figure 8.1).

Figure 8.1
Schematic Cross-Section of the Polish Kupferschiefer Copper Mineralization
(modified from Rentzsch (1974)



The Variscan basement and the Rotliegende volcanics both contain hydrothermal polymetallic mineralization and can be considered as primary sources for the metals.

It is argued that long-lived and large-scale lateral fluid flow caused the cross-cutting relationships, expansion of the hematitic alteration front, redistribution of noble metals at the outer parts of oxidized areas, and the location of copper orebodies directly above and around oxidized and gold-bearing areas The Rote Fäule zone may be a guide to favourable areas for both Cu-Ag and new Au-Pt-Pd Kupferschiefer-type deposits.

A Middle Triassic palaeomagnetic age has been assigned to the metal zoning of the deposit indicating that the mineralizing event coincided with continental rifting associated with the opening of the Tethys ocean.

9.0 EXPLORATION

The deposit being mined by KGHM in the Legnica-Glogów Copper Belt area does not outcrop and all of the original exploration was performed by drilling from surface. KGHM is currently conducting exploration in the Lubin-Glogów area, and in other areas but, again, drilling is overwhelmingly the principal activity, and this is described in Section 10.

Surface geophysical and seismic surveys have been used to some extent, to provide indications of the most favourable locations for drill holes.

10.0 DRILLING

10.1 HISTORICAL DRILLING

The copper-silver deposit in the Legnica-Glogów Copper Belt area was discovered in 1957 by the blind deep drilling of a hole, now designated S-1, in the Sieroszowice area. The prospective area was then divided into three sections: Lubin (96 km^2), Polkowice (70.6 km^2) and Sieroszowice (53.9 km^2). By January, 1968, 312 holes for 241,000 m had been drilled in the Lubin-Sieroszowice area and the Lubin mine was about to commence production. By the early 1970s, drilling had delineated the deposit down dip at depths of 1,000 m to 1,300 m and these areas were scheduled for extraction by the Rudna and Sieroszowice mines.

During the initial reconnaissance drilling on a 3 km by 3 km grid, core samples were taken over the entire drilling intervals for all holes. Later, during drilling on a 1.5 km grid and during the 1.1 km by 1.1 km in-fill drilling, only selected intervals were cored and sampled, including all mineralized intervals and stratigraphic contacts. All holes were vertical and had final diameters of 112 mm, 93 mm and 76 mm. Core recovery from mineralized intervals varied from 70% to more than 90%. At Sieroszowice, average core recovery was 91% in carbonate ore, 86% in shale ore and 90% in sandstone ore. At Rudna, average recovery was 87% in carbonate ore, 77% in shale ore and 86% in sandstone ore.

10.2 CURRENT OR RECENT DRILLING

In 1990 and 1991, prior to sinking of the R-11 shaft at the Rudna mine, two drill holes were completed to examine the geological conditions in the area around the shaft and to define the lithological profile of the designed shaft axis. In 2005, two holes were drilled for the same purpose, prior to sinking of the SW-4 shaft at the Polkowice-Sieroszowice mine.

In 2008 and 2009, KGHM drilled 34 holes on its mining concessions, to obtain additional information with respect to geological and mining conditions. All holes were drilled from surface, and the total drilling amounted to 23,776.6 m, of which 8,221.6 m were cored. The holes were drilled on the following mining concessions:

- Lubin I and Malomice I : 3 holes.
- Polkowice II : 13 holes.
- Sieroszowice I : 16 holes.
- Radwanice Wschód : 2 holes.

The average depth of the holes was 720.5 m, with the maximum depth being 1,245 m.

KGHM is currently conducting exploration activities, principally drilling, in four areas, the locations of which are shown in Figure 10.1.

- The Radwanice-Gaworzyce exploration licenses in the Lubin-Glogów area.
- The Grodziecka Syncline area, to the southwest of Lubin and west of Legnica.
- The Weisswasser area, in the extreme east of Germany, to the west of Lubin.

- The Szklary area, approximately 60 km south of Wroclow.

Figure 10.1
KGHM Exploration Activities, Location Map

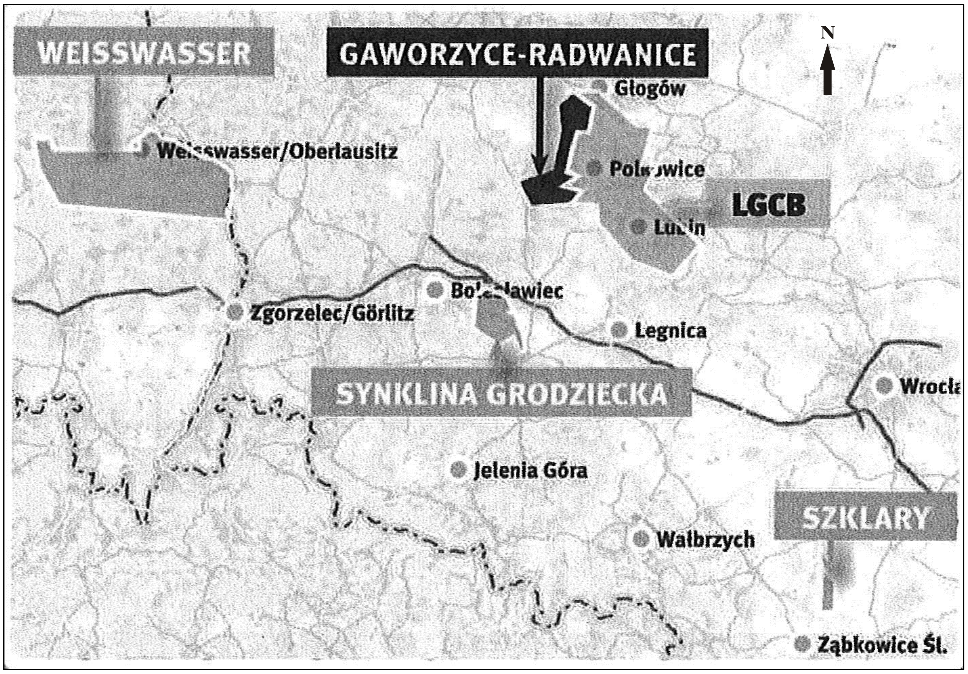


Figure provided by KGHM.

10.2.1 Radwanice-Gaworzyce

The Radwanice and Gaworzyce exploration licenses adjoin the Polkowice and Sieroszowice mining concessions to the west and northwest, as shown previously in Figure 4.2. It is understood that widely-spaced reconnaissance drilling was undertaken in this area in the past.

KGHM had originally proposed two phases of drilling in each area. At Radwanice, phase I was to consist of 13 holes and phase II of 9 holes. At Gaworzyce, 6 holes were planned for phase I and 8 holes for phase II. The area to be covered by this drilling was to be approximately 52 km^2 at Radwanice and 48 km^2 at Gaworzyce. The conceptual objective of the drilling was to delineate a deposit containing 82 Mt at an average grade of about 2.4% Cu.

To date, 3 holes have been drilled at Radwanice and 2 at Gaworzyce.

In February, 2012, applications were submitted to change both the scope and the timing of the work permitted under these exploration licenses. It is now planned to reduce the number of holes drilled on each license, in favour of additional geophysical surveys. Completion of the originally-proposed drilling program will be contingent upon the results of the geophysical work.

10.2.2 Grodziecka Syncline

The Grodzieka Syncline is located in the Boleslawiec area of Poland, which has previously been mined for copper and lies generally to the southwest of the Legnica-Glogów Copper Belt area. This district hosted the former Konrad, Lena and Nowy Kosciol mines, all of which have now been closed. The Grodziecka Syncline area hosts the documented Wartowice copper deposit, which remains intact and is situated at greater depth than the deposits previously mined in this area. The geological documentation for the Wartowice deposit is owned by the Polish State Treasury.

KGHM planned two phases of drilling in this area. Phase I was planned for 9 holes and phase II for 6. The drilling in phase I has now been completed and phase II is planned to commence in the first quarter of 2013. Under the terms of the current license, all exploration work in this area is to be completed in 2015.

10.2.3 Weisswasser

KGHM holds an exploration license, valid until 31 December, 2013, covering an area of 364 km^2 in the Weisswasser area of Saxony, Germany, adjacent to the Polish border. The area was selected on the basis of an intersection of copper mineralization in a single historical drill hole. The conceptual exploration target is a deposit containing at least 1.5 million tonnes of copper equivalent.

The first stage of exploration, which was completed in June, 2012, consisted of a seismic survey, drilling of four holes and down-hole geophysical measurements

KGHM is in the process of analyzing the results obtained from this first stage of exploration.

10.2.4 Szklary Area

Between 1890 and 1982, a nickel deposit within a serpentine ophiolite complex was mined by both open pit and underground methods at Szklary, near the town of Ząbkowice Śląskie, approximately 60 km south of Wroclaw. The current exploration program is investigating the possibility of resuming the production of nickel from this area.

Between 2006 and 2011, 93 holes were drilled for a total of 2,466 m, to test the near-surface mineralization. In 2010, laboratory tests were undertaken with the objective of developing a waste-free technology for the processing of nickel ore. In December, 2011, work commenced on preparing a geological and hydrogeological model of the deposit, potential mining scenarios and processing flowsheets, and potential locations for waste storage areas and infrastructure. These studies, and additional drilling, are expected to continue in 2013.

11.0 SAMPLE PREPARATION, ANALYSES AND SECURITY

11.1 HISTORICAL CORE SAMPLING

Core obtained from the early surface drilling campaigns was logged and sample intervals were selected. Samples were typically 10 to 20 cm long, but shorter intervals were selected in the Cupriferous Shale. Sample intervals were marked on the core, which was then split along its axis with a corundum saw. One half of the core was sent for preparation and analysis to the Geological Enterprise in Kraków, while some of the remaining core is reported still to be retained at the Central Geological Archives.

Core samples were prepared for analysis in accordance with procedures specified by the Ministry of Heavy Industry. Early core samples were analyzed by laboratories contracted by the Polish Geological Institute in Warsaw or the Geological Enterprise in Kraków. Later analyses were performed in KGHM's laboratories.

11.2 UNDERGROUND SAMPLING

With the exception of the relatively minor exploration drilling in the Radwanice-Gaworzyce area, described in Section 10, KGHM currently conducts no surface drilling in the Legnica-Glogów Copper Belt area. The principal sampling activities undertaken in this area at the present time are at the three underground mines.

11.2.1 Channel Sampling Procedures

Underground samples are taken from all mining and development excavations. Samples are taken from one wall, except in areas of complex structure and lithological variability, in which case samples are taken from both walls. KGHM's practice is to take chip samples along vertical channels. Each channel is subdivided into sample lengths of 20 cm, or less if dictated by lithological contacts or a sudden change in other properties. Until the end of 1978, samples had been taken at 15 m intervals from all development openings and on a 20 m by 20 m grid from stopes. From January 1, 1979, the sampling interval along development openings was increased to 25 m at Lubin Main and to 20 m at Lubin West and Polkowice East, and the grid of stope sampling was increased to 30 m by 30 m. The 15 m interval for development sampling was retained at Lubin East and Polkowice Main and West. The instruction issued on 24 September, 1996, specified the maximum spacing between samples as 40 m, but recommended that it should be up to the mine geologist to use judgment on the spacing appropriate to the complexity of the mineralization. The 40 m maximum spacing was established on the basis of geostatistical studies. Channel sampling was supplemented by underground diamond drilling when ore thickness exceeded the height of development tunnels or when analyses indicated that mineralization may extend up or down from the sampled intervals. There was a minimum requirement for 90% core recovery. The core was divided into samples not exceeding 20 cm in length.

Currently, sampling procedures are regulated by a new instruction, issued on 5 May, 2011, which changed the length of the samples from supplemental drilling to 50 cm. Selection of the sample interval remains at the discretion of the chief mine geologist.

Footwall and hanging wall rocks are described on the basis of underground core drilling for a distance of not less than 5 times the height of the tunnel and at intervals not exceeding 500 m.

In Micon's opinion, the underground sampling procedures and sampling intervals used by KGHM are appropriate to the deposit, and Micon endorses KGHM's practices in this regard.

11.2.2 Historical Channel Sample Preparation and Analysis

Historically, the preparation and analysis of underground channel samples was performed in three laboratories, one at each of the Lubin, Polkowice-Sieroszowice and Rudna mines. The three laboratories were owned and operated by KGHM. More recently, the preparation and analysis of all underground samples has been centralized in a new, modern and highly-automated laboratory, owned and operated by a subsidiary of KGHM and located at the Lubin mine. This laboratory, and its quality assurance/quality control (QA/QC) procedures, are described in Section 11.2.3. The historical procedures used at the three individual mine laboratories are described below. These procedures were reviewed by Micon in 1997.

At each of the three laboratories, all channel and core samples were analyzed for copper. One in three samples from development openings and working faces along stopes was analyzed for silver. Analyses for accompanying elements (Zn, Pb, Co, Mo, Ni, V) were performed on composites with intervals up to 50 cm long, representing each of the three types of ore, selected so that the grid was 200 m by 200 m.

After drying in ovens at temperatures over 110°C for 3 to 4 hours, channel samples were crushed in jaw crushers to minus 2 mm and cone-and-quartered to obtain 100 g splits. This was sufficient for copper analyses. Samples for XRF and chemical analyses were pulverized to minus 0.16 mm.

Copper analyses were performed by the photo-activation method using the Betatron analytical line. The method and equipment (Betatron B-30S) were developed in Poland. Each mine had its own equipment and the turnover at each laboratory was 4,000 to 5,000 analyses per month (one analysis took about 4 minutes). The detection limit was 0.01% Cu and there were no interference problems. The method is non-destructive. Micon, in 1997, regarded these analytical procedures as entirely appropriate.

The backup equipment for copper analyses included X-MET 880 and X-MET 920 analyzers utilizing the rentgenofluorescent method. This method was also used for lead analyses and experimentally for arsenic, silver, cobalt, nickel and iron analyses. In addition, all three laboratories were equipped and staffed to conduct chemical iodine copper analyses and other wet chemical analyses.

Silver and other elements accompanying copper (Pb, Zn, Mn, Fe, As, Co, Ni, etc.) were determined by the atomic absorption method on spectrometers manufactured by PYE Unicam and Varian. The detection limit for silver was 0.5 ppm. The laboratories at Rudna and Lubin were also equipped with modern XRF analyzers that were capable of detecting silver at parts per billion levels.

Analytical control procedures included inserting standards, cross-correlation between the three laboratories, frequent calibration of analytical equipment and electronic scales, and external control.

11.2.3 Current Sample Preparation and Analysis

KGHM, through a subsidiary, operates a state-of-the-art assay laboratory located at Lubin. The laboratory processes geological and flotation samples for resource estimation, grade control, mineral processing control and process balance purposes. The laboratory features two parallel lines of robotic sample preparation. Core or channel samples pass through a circuit of crushing and grinding that ultimately produces a disk (o-ring) that is fed to Philips MagiX Pro and Philips PW2540 spectrometers, and to a Philips Axios spectrometer with an automatic sample changer. The laboratory can process approximately 45 samples per hour and can achieve in excess of 1,000 samples per day when operated at full capacity.

This modern laboratory was inaugurated in 2012 and operates with a crew of four on each of three shifts. The robotics have enabled the laboratory staff to be reduced from more than 32 to around 20. The surplus technicians were reassigned to other duties within the KGHM operations.

11.2.3.1 Laboratory Certification

The KGHM laboratory is accredited by the Polish Centre for Accreditation and holds certificate No. AB 412, appropriate for the determination of copper and silver in copper ore and its products, and for the determination of lead and arsenic in copper concentrates.

11.2.3.2 Core and Channel Samples

Core and channel samples weighing from 200 g to 1 kg enter the laboratory and are bar coded for sample identification. Samples greater than 1 kg are split and processed separately. Samples are loaded in pans that are moved by robot to electric ovens where they are dried. Dried samples are passed to one of two jaw crushers and reduced to minus 25 mm. Although the two lines are designed to operate in parallel, when demand is low, only one line is operated. If a backlog develops at any operation along the line, samples are automatically passed from the first robot to the second robot and the second parallel crushing and grinding circuit becomes operational.

Crushed material is directed to one of four mortar crushers that reduce sample particles to 1 mm. Fine-crushed samples are split using a sample splitter to provide two analytical and archive subsamples. One sample is retained in a plastic container for storage and the other sample is sent to one of five pulverizers where it is reduced to 80% finer than 75 µm. Pulverized material is pressed into a metal ring to produce a sample disk for analysis. Throughout the operations, each piece of equipment is automatically cleaned after each stage, using compressed air and a test sample.

Multi-element XRF analyses, including Cu, Ag, Ni, Co, S, SiO_2, As, Pb, Fe, Al_2O_3, MgO and CaO, are determined using Philips MagiX Pro and PW2540 spectrometers, and a Philips Axios spectrometer with an automatic sample changer.

11.2.3.3 Assay Quality Control

KGHM relies on an internal quality control protocol based in the assay laboratory. A series of standard samples prepared from KGHM materials are analyzed systematically at the beginning and end of each shift, as well as twice during each shift. The standards represent low and average grade copper mineralization and medium and high grade copper concentrate. Examples of standard samples and thresholds are presented in Table 11.1.

Table 11.1
Examples of KGHM Laboratory Standard Samples

Standard ID	Reference Value	Lower Limit	Upper Limit
2.603.01	0.26 % Cu	0.24 % Cu	0.28 %Cu
2.604.01	1.78 % Cu	1.76 % Cu	1.80 % Cu
	30 ppm Ag	27 ppm Ag	33 ppm Ag
2.605.01	29.6 % Cu	29.3 % Cu	29.90 % Cu
	650 ppm Ag	640 ppm Ag	660 ppm Ag
2.605.02	22.25 % Cu	22.05 % Cu	22.45 % Cu
	385 ppm Ag	375 ppm Ag	395 ppm Ag

Standard samples were prepared using KGHM mineralization and concentrate and certified at an external laboratory. To check crushing efficiency, samples are subject to a particle size analysis once a month to ensure that samples are pulverized to the desired size range.

Blind certified reference materials purchased from independent suppliers such as Rock Labs are not systematically submitted to the assay laboratory by the geology department. It is KGHM's view that the long history of assaying of the copper ore, the relative simplicity of the mineralization, and the relatively low potential for human error in the highly-automated assay laboratory renders analysis of a potentially high volume of purchased certified reference materials an unwarranted expense. At present, the laboratory, in cooperation with the Non-Ferrous Metals Institute, is commencing a program in which new, independently certified standard reference materials will be created.

Figures 11.1 to 11.4 are photographs of some of the equipment in the automated laboratory.

Figure 11.1
Laboratory Sample Delivery Area

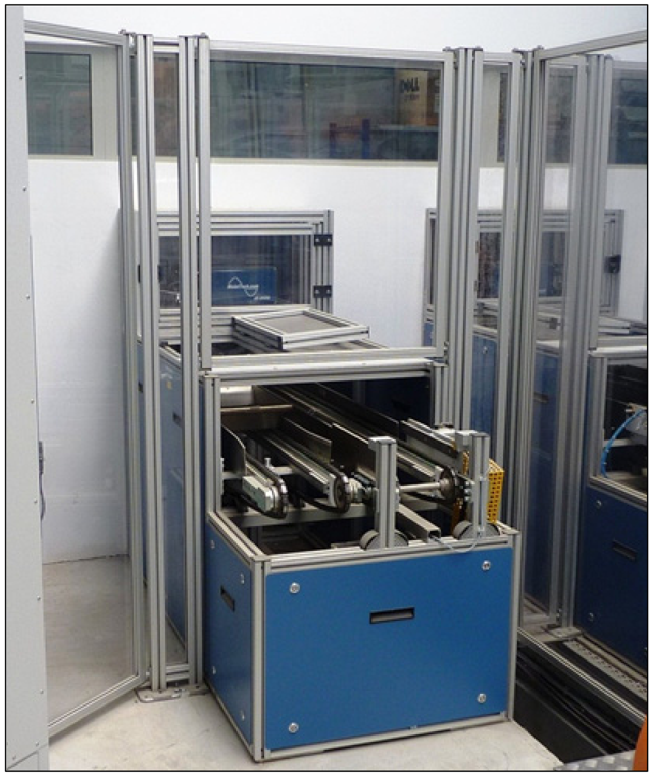
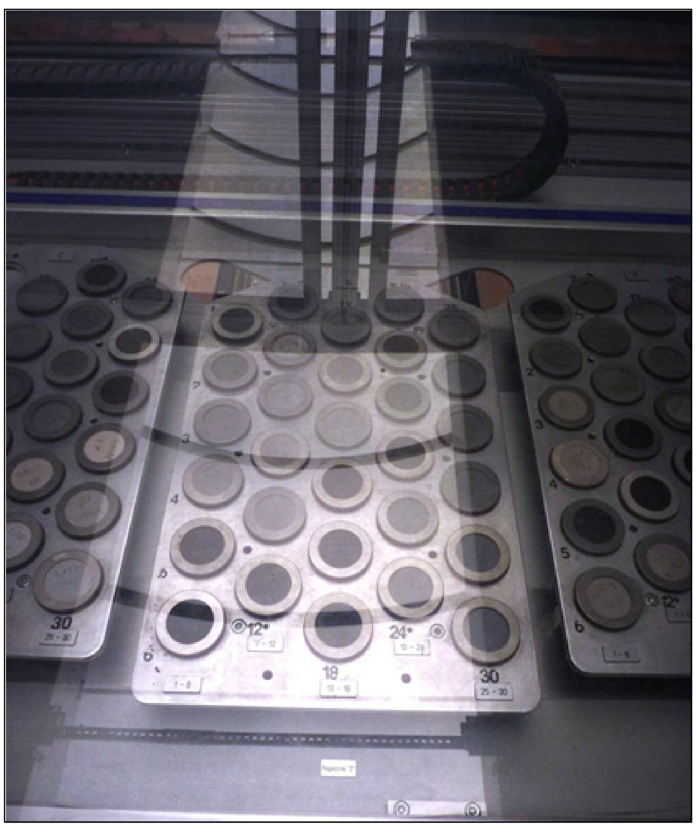


Figure 11.2
Robotic Sample Handling

Figure 11.3
Crushing, Grinding and Cleaning Stations

Figure 11.4
Sample Briquettes



12.0 DATA VERIFICATION

Prior to undertaking its site visit, Micon provided to KGHM a detailed and comprehensive list of the data required to complete each section of this Technical Report. All of the data requested were provided by KGHM, either during the site visit or subsequently. Micon's verification of those data consisted of:

- Physical inspections and discussions during the site visit.
- Independent estimation of the resources in four selected mining blocks.

12.1 VERIFICATION OF DATA DURING THE SITE VISIT

During the site visit:

- All of KGHM's productive facilities were inspected. All were found to have sufficient personnel and sufficient equipment in good working order to meet the production levels planned for the next five years, and beyond.

- Production and cost records for the past five years were compared against budgeted figures for the same period. No significant discrepancies were found.

- Extensive discussions were held with personnel responsible for the planning and supervision of operations, the reporting and forecasting of costs and other financial data, corporate strategic planning, the sale of products, environmental compliance, and the development and monitoring of safety policies and practices. Micon was satisfied that KGHM responded fully and openly during these discussions.

- Micon reviewed all aspects geological mapping, channel sampling, drilling, and drill core logging and sampling. Micon also visited the primary assay laboratory in Lubin to inspect the sample preparation and analytical facilities and discuss assay methodologies. Micon concluded that all aspects of the geological activities and data collection were to a high standard.

- Extensive discussions were held with geological staff responsible for the estimation of resources and reserves, in order to gain a thorough understanding of the procedures used by KGHM to estimate resources and reserves in each of the classifications used (Balance Reserves, Industrial Reserves, Operational Reserves and Mining Reserves).

12.2 VERIFICATION OF RESOURCE AND RESERVE ESTIMATES

In order to verify KGHM's estimates of resources and reserves, Micon reviewed KGHM's reconciliations of reserve tonnages and grades against actual tonnages and grades for the ore mined in each of the last five years. A portion of the assay database was subject to validation methods using tools within Surpac mining software to ensure that no false sample intervals were included in the database. The range of assay data was inspected to ensure that the database contained no assay outliers, which represent potential sampling errors. Micon concluded that the assay database was reliable and appropriate for mineral resource estimation. Micon also independently estimated the resources in four selected mining blocks and compared the results with KGHM's estimates for the same blocks. This is discussed in Section 14.7.

13.0 MINERAL PROCESSING AND METALLURGICAL TESTING

13.1 HISTORICAL TESTWORK

Early metallurgical testwork, conducted in conjunction with the initial drilling of the copper-silver deposits in the Legnica-Glogów Copper Belt area, demonstrated that a conventional crushing, grinding and flotation flowsheet was the most economical process for producing marketable concentrates from these ores. That basic flowsheet is still in use today. Over time, smelters, refineries and a rolling mill have been constructed, to provide complete vertical integration, from the mining of ore to the manufacture of fabricated metal products.

Since the first concentrator at Lubin commenced operation in 1968, progressive improvements have been made in metallurgical performance, and research is continuing into other means by which performance may be further enhanced. Recent improvements that have been made, and others that are being studied, are described below. The metallurgical plants themselves are described in Section 17.

13.2 METALLURGICAL IMPROVEMENTS RECENTLY COMPLETED OR IN PROGRESS

Sufficient testwork has been completed to support the following improvements to KGHM's metallurgical facilities:

- Under the Smelter Modernization Project, the implementation of which is planned in 2014, all copper concentrate will be smelted at the Glogów I and Glogów II smelters. The Legnica smelter will then be used to process copper scrap and electronic scrap (in accordance with the European Union's Waste Electrical and Electronic Equipment Directive).

- New flotation cells are being installed in all three concentrators. It is anticipated that this modification will result in an increase in copper recovery of 0.6 percentage points when the installation is completed in 2014.

- Process automation has been improved, including the installation of cameras on the flotation cells to permit continuous remote observations of froth conditions and optimization of the flotation circuit from a central control room.

- Modernization of the classification systems in the grinding circuits is planned. The existing spiral classifiers will be replaced with hydrocyclones, with the expectation that copper recovery will increase and that circulating loads will reduce, with a resulting saving in energy costs.

- Tests were undertaken in 2011 and are continuing in 2012 to investigate the potential benefits of using high-chrome grinding media in the primary and regrind circuits of the concentrators. Bench-scale testwork has been completed and plant trials are in progress at the Polkowice concentrator. In Micon's experience, the use of high-chrome grinding media has had a positive effect on flotation performance at other operations.

- Modernization of grinding mill drives is planned, to permit variable rotation speed. It is anticipated that this modification will result in reduced power consumption.

13.3 AREAS OF FUTURE RESEARCH

KGHM plans to undertake research and metallurgical testwork in investigating the following areas:

- The influence of grain size and concentrate grade on the operation of flash furnaces.
- The influence of the degree of oxidation of ore on metal recovery.
- The application of new impeller designs to improve flotation performance.
- The potential benefits of modernizing the manufacturing process for sulphuric acid.
- The application of high-pressure grinding rolls in the comminution circuits.

13.4 METALLURGICAL RECOVERIES

13.4.1 Copper Recovery

On average, KGHM's concentrators recover approximately 89% of the copper contained in mill feed. In gross terms, the three concentrators process 30 Mt/y of ore, containing 1.1 billion pounds of copper. An increase of one percentage point in copper recovery would yield an additional 11 Mlb/y of copper in concentrate, or an added value of USD 35.8 million at a copper price of USD 3.25/lb. The implication of this observation is that KGHM would benefit economically if an additional expenditure of up to, say, USD 1.15/t processed would increase average copper recovery from 89% to 90%.

13.4.2 Silver Recovery

On average, KGHM's concentrators recover approximately 85.5% of the silver contained in mill feed. The quantity of silver contained in mill feed is approximately 44 Moz/y, so that an increase of one percentage point in recovery would yield an additional 440,000 oz/y of silver in concentrate. At a silver price of USD 25/oz, this additional silver would have a value of USD 11 million, suggesting that KGHM would be justified in spending up to USD 0.35/t processed to increase average silver recovery from 85.5% to 86.5%.

14.0 MINERAL RESOURCE ESTIMATES

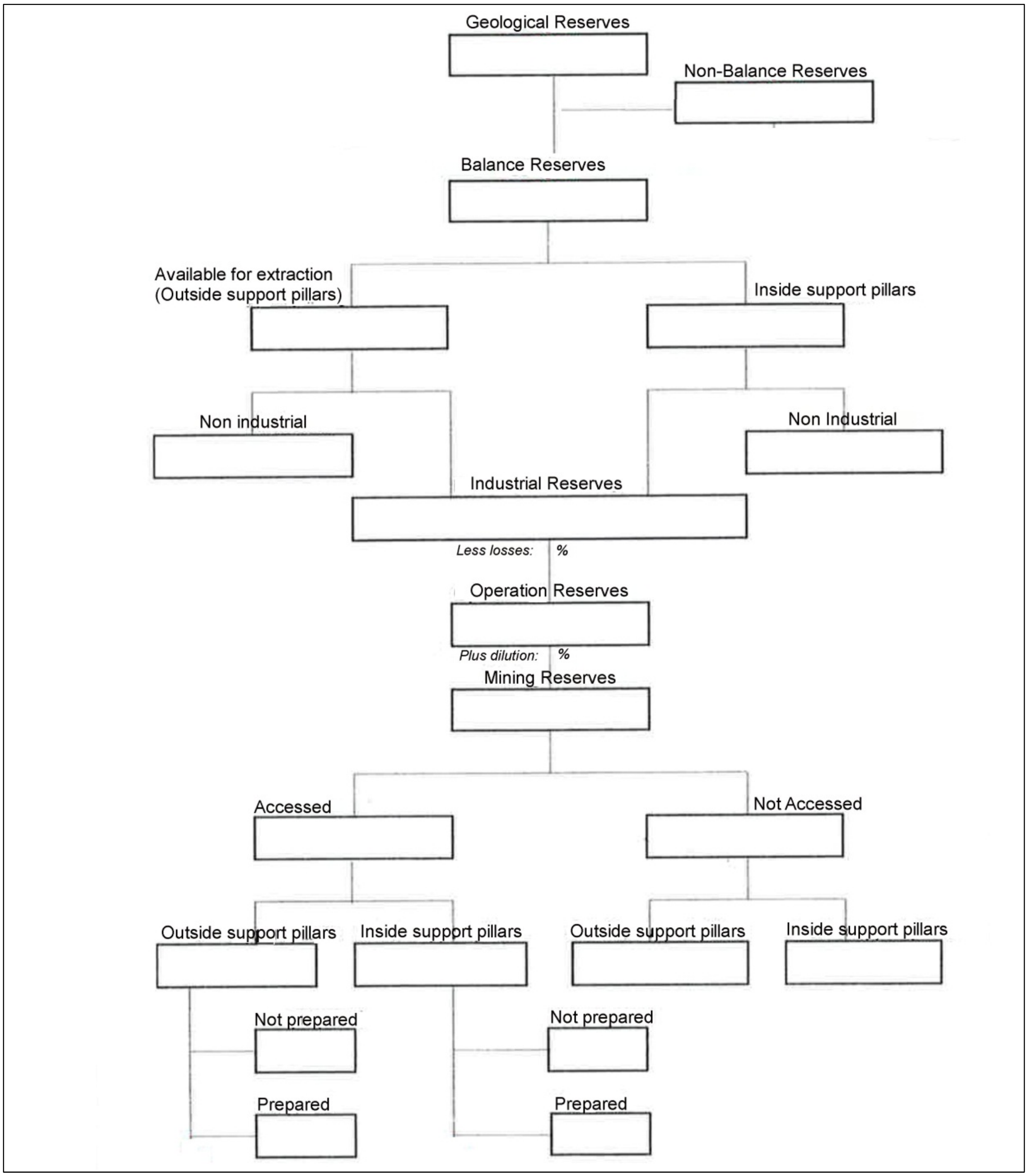
14.1 KGHM'S CLASSIFICATION SYSTEM

The resource and reserve classification system used by KGHM follows the "Rules of the Geological Documentation of Mineral Deposits", issued in 1999 by the Ministry of the Environment (Geological Department and Commission for Mineral Reserves). The 1999 document constituted an update of the previous version issued in 1994. In accordance with that document and KGHM's working practices, resource and reserve statements show Geological Reserves (Balance and Non-Balance), Non-Industrial Reserves, Industrial Reserves, Operational Reserves and Mining Reserves. Definitions of each group are provided below. It is Micon's opinion that, under the CIM standards and definitions for the estimation of resources and reserves, only the Mining Reserves reported by KGHM would qualify as Mineral Reserves. The "reserves" reported by KGHM in all other categories would be classified as Mineral Resources.

- **Geological Reserves** include all mineralization contained within a deposit.
- **Balance Reserves** are that portion of a deposit, in-situ, which satisfies defined cut-off criteria and is considered capable of being extracted.
- **Non-Balance Reserves** are that portion of a deposit, in situ, which does not meet the cut-off criteria for Balance Reserves or which, for physical reasons, is not expected to be mined. Non-Balance Reserves may be converted to Balance Reserves by technological advances or favourable changes in macroeconomic conditions
- **Industrial Reserves** are that part of the Balance Reserves for which economic extraction can be justified under conditions determined in the Deposit Development Plan (Plan Zagospodarowania Zloza – (PZZ)), while fulfilling the requirements of environmental protection.
- **Non-Industrial Reserves** are that part of the Balance Reserves which cannot be extracted under conditions determined in the PZZ, for technical, economic or environmental reasons.
- **Operational Reserves** are Industrial Reserves reduced by anticipated mining losses.
- **Mining Reserves** are Operational Reserves adjusted to account for anticipated dilution by waste rock.

The relationships among these various categories of reserves are shown diagrammatically in Figure 14.1. Each category is subdivided into reserves available for extraction (beyond support pillars) and reserves in support pillars. The latter are not available for extraction at the time of preparation of the PZZ, but may be mined during mine closure. First category pillars are cylindrical pillars around mine shafts and the pillar beneath the Żelazny Most tailings impoundment area. These pillars are not expected to be mined until the facilities which they protect are removed from service. Second category pillars are outer rings around the shaft pillars left to support installations and buildings near the mine shafts. Reserves in pillars under the towns of Lubin and Polkowice, and reserves in the pillar beneath the Gilów tailings impoundment area may be only partially extracted, in order not to jeopardize the stability of the overlying surface structures.

Figure 14.1
KGHM Resource and Reserve Classification System



Under the classification system used in Poland, resources and reserves are divided into seven categories (E, D_2, D_1, C_2, C_1, B and A), with specific guidelines for each category concerning the sampling density required for resource and reserve classification. Copper deposits should be drilled on a 0.5 km to 1.5 km grid, to outline the extent and indicative parameters of the mineralization to the degree of confidence required for the C_1 category. A grid of 1.5 km was used initially to delineate C_1 reserves in the Legnica-Glogów Copper Belt area, with in-fill drilling in more complex zones. Delineation in the B category requires mining development.

All of KGHM reserves are subdivided into categories B and C_1, reflecting the degree of confidence of delineation.

Structurally, there are also three defined groups of deposits. The deposits in the Legnica-Glogów Copper Belt belong to Group II of stratabound copper deposits, which is defined as being difficult to interpret due to structural disturbances and local discontinuities, and characterized by complex hydrogeological and mining conditions.

In overall terms, although there are marked differences for individual reserve blocks, the B reserves estimated on the basis of underground development are in reasonable agreement with the C_1 reserves originally estimated on the basis of the surface drilling. It is Micon's opinion, therefore, that the density of surface drilling has been adequate to support the reliable estimation of C_1 reserves.

14.2 REGULATIONS, REPORTING REQUIREMENTS AND PRACTICE

The current cut-off grade criteria for the estimation of Balance Reserves of the deposits in the Legnica-Glogów Copper Belt area were defined by the Regulation of the Minister of the Environment, issued on 22 December, 2011. In accordance with the provisions defined in Articles 101 to 103 of the Geological and Mining Law dated 9 June, 2011, and its implementing provisions, qualified mining geologists employed in KGHM's mines annually estimate the current resources and reserves for the deposits within the mining areas, and document the changes that have occurred since the prior year's estimate. The current report on the inventory of resources and reserves for each deposit, signed by an authorized geologist and the director of the mine, and then approved by the appropriate director in KGHM's head office, is attached to the geological documentation of the deposit. Statistical forms for the reporting of resources and reserves are submitted to the relevant geological authorities each year, by 15 March.

The division of Balance Reserves into Industrial and Non-Industrial Reserves was made on the basis of the assumptions used in the PZZ. Estimates were carried out by KGHM and the results for each mining area were also reported in the form of reserve statements as at 31 December, 2011. The reporting of reserves is done in accordance with the Regulation of the Minister of the Environment, issued on 15 November, 2011.

Losses and dilution are also regularly monitored and summary statistics are prepared for the end of each calendar year.

Any change in cut-off criteria for Balance Reserves requires the preparation of additional geological information justifying the change, which is then submitted to the appropriate geological authority for review and approval. With respect to subdivisions into Industrial and Non-Industrial Reserves, each mine is allowed to transfer reserves from Industrial to Non-Industrial and vice versa without ministerial approval, provided that the reserves transferred are not greater than one half of the annual production of the mine.

14.3 ESTIMATING PROCEDURES

KGHM's reserve estimates are based on the primary data contained in the Geological Documentation of each mine. Supplements are issued to update that documentation and to include the results of on-going development sampling. The most recent supplements for each mine were prepared by KGHM Cuprum in Wroclaw, effective 31 December, 2010.

Estimates of Balance Reserves in the C_1 category are based on drilling results, augmented by the results of development sampling in blocks adjoining the B reserves. The method of estimation is polygonal, with polygons centred on drill intersections and bounded by lines perpendicular to lines connecting the neighbouring intersections, at a distance half way to those intersections. Each polygon is assigned grade and thickness parameters equal to the composited grade of the central drill intersection and to the thickness of the composited interval, respectively. The average copper grade for combined polygons is estimated by calculating the arithmetic mean of the grade composites of constituent polygons, weighted by the appropriate volumes. The same method is used to estimate reserves of carbonate, shale and sandstone ore and reserves of silver and lead. Reserves of cobalt, nickel, vanadium and molybdenum are estimated by weighted arithmetic means within the three lithological types of ore.

The average copper grade is checked by comparing it to the weighted arithmetic mean of copper grades of all intersections within the perimeter of the C_1 reserve. The total tonnage of the C_1 reserve is checked by comparing it to the tonnage calculated by multiplying the arithmetic mean thickness of all intersections by the total area covered by the polygons, and reducing that result by the ratio of the number of intersections above the cut-off grade to the total number of intersections. This analysis confirmed that the estimates were free of major errors.

Balance Reserves in category B are estimated by the method of geological blocks using the SEZA (2012 upgrade) computer program developed by KGHM. Each block covers an area of similar thickness, grade and the same lithological type of ore. Block boundaries coincide with development workings, but do not transgress the boundaries of the C_1 polygons, thus enabling reconciliation between the B and C_1 reserves. Block areas are measured digitally on AutoCAD (Microstation Digitized). Each block is allocated the arithmetic mean thickness and arithmetic mean weighted copper grade of all channel sample composites inside the block.

The procedures used by KGHM for the estimation of B and C_1 reserves are similar to the methods used in other relatively flat-lying and continuous mineral deposits throughout the world, and are endorsed by Micon.

14.4 GEOLOGICAL RESERVE INVENTORIES

Balance Reserves of each mine conform to cut-off criteria that were approved by the Minister of the Environment. These criteria are summarized in Table 14.1.

Table 14.1
Cut-Off Criteria, Geological Reserves

Parameter	Cut-Off Values	
	Balance Reserves	Non-Balance Reserves
Sample cut-off grade	0.7% Cu	0.7% Cu
Minimum Cu equivalent in sample composite[1]	0.7% Cu	0.7% Cu
Minimum yield (copper metal per unit area)[2]	50 kg/m^2	35 kg/m^2
Maximum depth to footwall[3]	1,400 m (1,500 m)[3]	

Notes: (1) Cu equivalent is calculated from the formula Cu_{eq} = % Cu + g/t Ag/100.
(2) This parameter refers to copper equivalent.
(3) The 1,500 m depth is applicable only if reserves to that depth can be developed.

With respect to these criteria:

- The cut-off grade is applied to each sample in order to draw external perimeters of the geological reserve and perimeters of internal waste inclusions.

- In practical terms, the minimum copper equivalent grade is applied to sample composites to eliminate small internal waste inclusions. In theory, it is possible for the composites to include samples containing 70 g/t Ag and no copper, since a grade of 70 g/t Ag is equivalent to the cut-off grade of 0.7% $Cu_{eq.}$

- Composites grading 0.7% Cu with thicknesses of 2.75 m in shale-carbonate ore (SG 2.6) and 3.1 m in sandstone ore (SG 2.3) will satisfy the third criterion of 50 kg Cu/$m^{2.}$

- At present, KGHM estimates reserves to a maximum depth of 1,400 m below surface. The possibility of mining safely at depths as great as 1,500 m is being studied and KGHM may revise its reserve criteria, pending the outcome of these studies.

The inventory of Balance Reserves in the B and C_1 categories as at 31 December, 2011, based on the 2010 supplements by KGHM Cuprum in Wroclaw and updated by KGHM's mine geological department, is given in Table 14.2 for Category B, Table 14.3 for Category C_1, and Table 14.4 for total Balance Reserves.

Table 14.2
Balance Reserves, Category B
(at 31 December, 2011)

Deposit	Location	Tonnes (million)	Grade		Contained Metal	
			Copper (%)	Silver (g/t)	Copper (Mt)	Silver (Moz)
Lubin-Malomice	Available for Extraction	82.47	1.25	55.5	1.03	147.2
	In Support Pillars	124.18	1.22	62.4	1.51	249.2
	Total Lubin-Malomice	**206.65**	**1.23**	**59.7**	**2.55**	**396.4**
Polkowice	Available for Extraction	45.07	2.19	40.0	0.99	58.0
	In Support Pillars	11.88	2.79	59.0	0.33	22.5
	Total Polkowice	**56.95**	**2.32**	**44.0**	**1.32**	**80.5**
Sieroszowice	Available for Extraction	61.03	3.08	74.3	1.88	145.7
	In Support Pillars	4.203	3.00	79.2	0.13	10.7
	Total Sieroszowice	**65.23**	**3.07**	**74.6**	**2.00**	**156.4**
Radwanice Wschód	Available for Extraction	-	-	-	-	-
	In Support Pillars	-	-	-	-	-
	Total Radwanice Wschód	-	-	-	-	-
Rudna	Available for Extraction	216.47	1.69	43.7	3.65	304.3
	In Support Pillars	71.02	1.77	40.5	1.26	92.5
	Total Rudna	**287.49**	**1.71**	**42.9**	**4.91**	**396.8**
Deep Glogów	Available for Extraction	0.10	1.80	108.9	0.003	0.35
	In Support Pillars	-	-	-	-	-
	Total Deep Glogów	**0.10**	**1.80**	**108.9**	**0.003**	**0.35**
TOTAL CATEGORY B	Available for Extraction	405.14	1.87	50.3	7.56	655.6
	In Support Pillars	211.29	1.53	55.3	3.23	375.3
	Total Category B	**616.43**	**1.75**	**52.0**	**10.79**	**1,030.9**

Table 14.3
Balance Reserves, Category C_1
(at 31 December, 2011)

Deposit	Location	Tonnes (millions	Grade		Contained Metal	
			Copper (%)	Silver (g/t)	Copper (Mt)	Silver (Moz)
Lubin-Malomice	Available for Extraction	175.86	1.43	50.8	2.52	287.1
	In Support Pillars	5.01	1.36	53.5	0.07	8.6
	Total Lubin-Malomice	**180.87**	**1.43**	**50.8**	**2.58**	**295.7**
Polkowice	Available for Extraction	57.08	2.36	51.8	1.35	95.1
	In Support Pillars	-	-	-	-	-
	Total Polkowice	**57.08**	**2.36**	**51.8**	**1.35**	**95.1**
Sieroszowice	Available for Extraction	226.19	2.48	62.3	5.60	453.4
	In Support Pillars	6.19	2.62	54.4	0.16	10.8
	Total Sieroszowice	**232.38**	**2.48**	**62.1**	**5.76**	**464.2**
Radwanice Wschód	Available for Extraction	6.48	2.01	28.1	0.13	5.9
	In Support Pillars	-	-	-	-	-
	Total Radwanice Wschód	**6.48**	**2.01**	**28.1**	**0.13**	**5.9**
Rudna	Available for Extraction	70.97	1.82	63.3	1.29	144.5
	In Support Pillars	39.16	1.41	50.1	0.55	63.0
	Total Rudna	**110.13**	**1.68**	**58.6**	**1.85**	**207.5**
Deep Glogów	Available for Extraction	282.26	2.40	78.6	6.76	712.9
	In Support Pillars	9.23	2.53	81.8	0.23	24.3
	Total Deep Glogów	**291.49**	**2.40**	**78.7**	**7.00**	**737.2**
TOTAL CATEGORY C_1	Available for Extraction	818.83	2.16	64.5	17.65	1,698.9
	In Support Pillars	59.59	1.71	55.7	1.02	106.7
	Total Category C_1	**878.42**	**2.13**	**63.9**	**18.66**	**1,805.6**

Table 14.4
Total Balance Reserves
(at 31 December, 2011)

Category	Deposit	Tonnes (million)	Grade		Contained Metal	
			Copper (%)	Silver (g/t)	Copper (Mt)	Silver (Moz)
Category B	Lubin-Malomice	206.65	1.23	59.7	2.56	396.4
	Polkowice	56.95	2.32	44.0	1.32	80.5
	Sieroszowice	65.23	3.07	74.6	2.00	156.4
	Radwanice Wschód	-	-	-	-	-
	Rudna	287.49	1.71	42.9	4.91	396.8
	Deep Glogów	0.10	1.80	108.9	0.003	0.35
	Total	**616.46**	**1.75**	**52.0**	**10.79**	**1,030.9**
Category C_1	Lubin-Malomice	180.87	1.43	50.9	2.58	295.7
	Polkowice	57.08	2.36	51.8	1.35	95.1
	Sieroszowice	232.38	2.48	62.1	5.76	464.2
	Radwanice Wschód	6.48	2.01	28.1	0.13	5.9
	Rudna	110.13	1.68	58.6	1.85	207.5
	Deep Glogów	291.49	2.40	78.7	7.00	737.1
	Total	**878.42**	**2.13**	**63.9**	**18.66**	**1,805.6**
Total	Lubin-Malomice	387.52	1.33	55.6	5.13	692.1
	Polkowice	114.03	2.34	47.9	2.67	175.7
	Sieroszowice	297.61	2.61	64.9	7.77	620.6
	Radwanice Wschód	6.48	2.01	28.1	0.13	5.9
	Rudna	397.62	1.70	47.3	6.76	604.4
	Deep Glogów	291.59	2.40	78.7	7.00	737.5
	Total	**1,494.85**	**1.97**	**59.0**	**29.45**	**2,836.2**

The percentage distribution of tonnage, contained copper and contained silver between the category B and category C_1 Balance Reserves, for each deposit, is summarized in Table 14.5.

At the more mature mining areas of Lubin, Polkowice and Rudna, at least 50% of the Balance Reserve is classified in the B category, due to the extent of the underground development. At the younger and less extensively developed Sieroszowice mining area, only 22% of the Balance Reserve tonnage is in the B category and, at the undeveloped Radwanice Wschód and Deep Glogów deposits, the entire Balance Reserve remains in the C_1 category.

Table 14.5
Percentage Distribution of Category B and C_1 Balance Reserves

Deposit	Category	Distribution of Balance Reserves (%)		
		Tonnage	Contained Copper	Contained Silver
Lubin-Malomice	B	53	50	57
	C_1	47	50	43
Polkowice	B	50	50	46
	C_1	50	50	54
Sieroszowice	B	22	26	25
	C_1	78	74	75
Radwanice Wschód	B	0	0	0
	C_1	100	100	100
Rudna	B	72	73	66
	C_1	28	27	34
Deep Glogów	B	0	0	0
	C_1	100	100	100
Total	**B**	**41**	**37**	**36**
	C_1	**59**	**63**	**64**

14.5 DISCUSSION

14.5.1 Cut-Off Grade

The overall grade shell for the Balance Reserves is drawn at a cut-off grade of 0.7% Cu, without consideration of silver values. At a copper price of USD 3.50/lb, material grading 0.7% Cu has a gross value, in-situ, of USD 54/t. As shown subsequently in Section 21, KGHM's average direct cash cost of mining, concentrating, smelting and refining, including general and administrative costs, was approximately USD 64/t of ore mined and concentrated in 2011. This would imply that, if copper only is considered, the cut-off grade of 0.7% Cu is too low to support the principle of reasonable prospects of economic extraction.

On average, however, KGHM's Balance Reserve contains 59 g/t silver. In Micon's opinion, it is reasonable to estimate that the marginal grade of 0.7% Cu would be accompanied by an average silver content of approximately 20 g/t. At a silver price of USD 25/oz, the silver would have a gross value, in-situ, of approximately USD 16/t. Combined with the in-situ value of USD 54/t for copper, this would provide a total in-situ value of USD 70/t for mineralization at the cut-off grade, comparing reasonably with the 2011 cash cost of approximately USD 64/t. Micon, therefore, agrees with the cut-off grade of 0.7% Cu for the reporting of Balance Reserves, as stipulated by the Minister of the Environment and used by KGHM.

14.5.2 Minimum Mining Thickness

KGHM's Balance Reserves are also constrained by an effective minimum mining thickness criterion, in that the concentration of copper, in the plane of the deposit, must be at least 50 kg/m^2.

The specific gravity of KGHM's ores has been determined by extensive measurements carried out by both KGHM itself and by the Geological Enterprise in Kraków. The average specific gravities used for the estimation of resources and reserves, which are supported by the empirical measurements, are 2.6 for shale-carbonate ore and 2.3 for sandstone ore. At these specific gravities, minimum thicknesses of 2.75 m in shale-carbonate ore and 3.1 m in sandstone ore would be required to satisfy the criterion of 50 kg Cu/m^2. These are reasonable minimum thicknesses.

14.5.3 Copper Equivalent Grades

Within the boundaries of the grade shell drawn at a cut-off grade of 0.7% Cu, composited sampled intersections are included in the Balance Reserves if they satisfy a cut-off grade of 0.7% copper equivalent. In calculating the copper equivalent grade, KGHM uses a value of 100 g/t Ag = 1% Cu.

At an average metallurgical recovery of 85.5%, 100 g of silver would yield 85.5 g, or 2.75 oz, of recovered silver per tonne of ore. At a price of USD 25/oz, this is equivalent to a recovered value of USD 68.70/t ore. Similarly, at an average metallurgical recovery of 89%, 1% copper would yield a recovery 19.6 lb Cu/t of ore. At a price of USD 3.50/lb, this is also equivalent to a recovered value of USD 68.70/t ore. Micon, therefore, agrees with KGHM's calculation of copper equivalent grades.

14.6 MINERAL RESOURCE STATEMENT

In light of the foregoing discussion, it is Micon's opinion that the cut-off grades and effective minimum mining thicknesses used by KGHM in estimating Balance Reserves are sufficient to satisfy the principle of reasonable prospects of economic extraction, and that the Balance Reserves qualify as a Mineral Resource, under the CIM standards and definitions.

It is also Micon's opinion that:

- Since inclusion in the B category requires at least partial delineation by underground development, the Balance Reserves in the B category are equivalent to Measured Mineral Resources, under the CIM standards and definitions.

- Since Balance Reserves in the C_1 category have been drilled and sampled at spacings found to be reliable in the past, the Balance Reserves in that category are equivalent to Indicated Mineral Resources, under the CIM standards and definitions.

- All of KGHM's Balance Reserves have been estimated with a level of confidence in excess of that associated with classification as an Inferred Mineral Resource, under the CIM standards and definitions.

In Micon's opinion, the Mineral Resources contained within KGHM's mining concessions in the Legnica-Glogów Copper Belt area, as of 31 December, 2011, are as shown in Table 4.6. The Qualified Person responsible for this estimate of Mineral Resources is Stanley C. Bartlett, P. Geo.

Table 14.6
KGHM's Mineral Resources at 31 December, 2011

Deposit	Category	Tonnes (millions	Grade		Contained Metal	
			Copper (%)	Silver (g/t)	Copper (Mt)	Silver (Moz)
Lubin-Malomice	Measured	206.6	1.23	59.7	2.56	396
	Indicated	180.9	1.43	50.9	2.58	296
	Total	**387.5**	**1.33**	**55.6**	**5.13**	**692**
Polkowice	Measured	57.0	2.32	44.0	1.32	81
	Indicated	57.1	2.36	51.8	1.35	95
	Total	**114.0**	**2.34**	**47.9**	**2.67**	**176**
Sieroszowice	Measured	65.2	3.07	74.6	2.00	156
	Indicated	232.4	2.48	62.1	5.76	464
	Total	**297.6**	**2.61**	**64.9**	**7.77**	**621**
Radwanice Wschód	Measured	-	-	-	-	-
	Indicated	6.48	2.01	28.1	0.13	6
	Total	**6.48**	**2.01**	**28.1**	**0.13**	**6**
Rudna	Measured	287.5	1.71	42.9	4.91	397
	Indicated	110.1	1.68	58.6	1.85	208
	Total	**397.6**	**1.70**	**47.3**	**6.76**	**604**
Deep Glogów	Measured	0.1	1.80	108.9	0.003	0.4
	Indicated	291.5	2.40	78.7	7.00	737
	Total	**291.6**	**2.40**	**78.7**	**7.00**	**737**
TOTAL	**Measured**	**616.4**	**1.75**	**52.0**	**10.79**	**1,031**
	Indicated	**878.4**	**2.13**	**63.9**	**18.66**	**1,086**
	Total	**1,494.9**	**1.97**	**59.0**	**29.45**	**2,836**

In Micon's opinion, the Measured and Indicated Mineral Resources contained within KGHM's mining concessions, as of 31 December, 2011, amounted to 1.5 billion tonnes at average grades of approximately 2% Cu and 60 g/t Ag, containing nearly 30 Mt of copper and 3 billion ounces of silver. These Mineral Resources are quoted in-situ, with no allowances for mining losses, dilution or metallurgical recovery. Mineral Resources are not Mineral Reserves and do not have demonstrated economic viability. KGHM's mineral reserves are discussed in Section 15.

Micon is not aware of any environmental, permitting, legal, title, taxation, marketing, political or technical factors that would materially affect this estimate of Mineral Resources.

14.7 VALIDATION

In order to validate KGHM's estimate of Balance Reserves, Micon obtained KGHM's geological, drilling and sampling database for four selected mining blocks, and independently estimated the resources contained in each block. The blocks selected were:

- Lubin mine : Block G-6.
- Sieroszowice mine : Block G-1.
- Rudna mine : Block G-26.
- Deep Glogów deposit : Block G-22.

Micon's estimate of the resources contained in each of these blocks is compared with KGHM's estimate in Table 14.7.

Table 14.7
Comparison of Micon and KGHM Resource Estimates

Block	Micon Estimate			KGHM Estimate		
	Tonnes (million)	Grade		Tonnes (million)	Grade	
		Copper (%)	Silver (g/t)		Copper (%)	Silver (g/t)
Lubin, G-6	21.4	0.69	22.0	12.8	0.64	31
Sieroszowice, G-1	15.2	2.02	43.9	14.0	2.08	54
Rudna, G-26	12.0	2.10	106	13.0	1.45	77
Deep Glogów, G-22	11.9	2.08	63.8	12.0	1.98	58

It can be seen that three of the block resource estimates compare well on a tonnage basis; however, Micon's estimate for Block G-6 is anomalously high. Considering that the grades for this block compare reasonably well, the difference in tonnage is attributed to the proportion that KGHM considers to be recoverable. Copper grades for three blocks compare well; Micon's copper grade estimate for Block G-26 is higher and may be attributed to the presence of high grades, which Micon has not cut. Silver grades demonstrate greater variation and this may be attributed to the fact that more recent channel sample data were used for the KGHM estimate. Micon did not use the channel sample data. Globally, Micon's estimates show slightly higher tonnage, which in part may be attributed to mining depletion, particularly in Block G-1. The Micon estimates generally contain higher amounts of copper and silver, which may be due to new geologic interpretations and assay data available from on-going channel sampling. The results of Micon's calculations suggest that the KGHM estimates are generally conservative.

15.0 MINERAL RESERVE ESTIMATES

Under the classification system used by KGHM, Balance Reserves are converted to Mining Reserves in the following sequence of steps:

- Industrial Reserves, in which the Balance Reserves, estimated at a cut-off grade of 0.7% Cu, are subjected to cut-off grades specific to each individual deposit.
- Operational Reserves, in which the Industrial Reserves are reduced to account for anticipated mining losses.
- Mining Reserves, in which the Operational Reserves are adjusted to account for anticipated dilution by waste rock.

15.1 INDUSTRIAL RESERVES

Table 15.1 provides a comparison of KGHM's estimate of Balance Reserves and Industrial Reserves for each deposit.

Table 15.1
Comparison of Balance Geological Reserves and Industrial Reserves

Deposit	KGHM Reserve Category	Tonnes (million)	Grade		Contained Metal	
			Copper (%)	Silver (g/t)	Copper (Mt)	Silver (Moz)
Lubin-Malomice	Balance	387.5	1.33	55.6	5.13	692
	Industrial	330.3	1.29	54.9	4.26	583
Polkowice	Balance	114.0	2.34	47.9	2.67	176
	Industrial	95.6	2.28	45.6	2.18	140
Sieroszowice	Balance	297.6	2.61	64.9	7.77	621
	Industrial	256.8	2.60	66.6	6.67	550
Radwanice Wschód	Balance	6.48	2.01	28.1	0.13	6
	Industrial	6.48	2.01	28.3	0.13	6
Rudna	Balance	397.6	1.70	47.3	6.76	604
	Industrial	295.7	1.72	48.4	5.09	461
Deep Glogów	Balance	291.6	2.40	78.7	7.00	737
	Industrial	266.9	2.40	77.8	6.41	668
Total	**Balance**	**1,494.9**	**1.97**	**59.0**	**29.45**	**2,836**
	Industrial	**1,251.8**	**1.98**	**59.8**	**24.73**	**2,407**

The percentage of the Balance Reserves which reports to the Industrial Reserve category for each deposit is summarized in Table 15.2.

Table 15.2
Percentage of Balance Reserve Reporting to Industrial Reserve

Deposit	Percentage (Industrial Reserve / Balance Reserve)				
	Tonnage	Copper Grade	Silver Grade	Contained Copper	Contained Silver
Lubin-Malomice	85.2	97.0	98.7	83.0	84.3
Polkowice	83.9	97.4	95.2	81.7	80.0
Sieroszowice	86.3	99.6	102.6	85.8	88.6
Radwanice Wschód	100.0	100.0	100.0	100.0	100.0
Rudna	74.4	101.2	102.3	75.3	76.3
Deep Glogów	91.5	100.0	98.9	91.6	90.6
Total	**83.7**	**100.5**	**101.4**	**84.0**	**84.9**

It can be seen that, in overall terms, more than 15% of the tonnage and the contained metal are lost in the conversion from Balance Reserves to Industrial Reserves, with little change in grade. Of the total reduction in tonnage and contained metal, approximately 40% is due to a reduction in the Balance Reserves classified as available for extraction and 60% is due to a reduction in the Balance Reserves classified as being in support pillars.

15.2 MINING LOSSES

Mining losses are accounted for in the conversion from Industrial Reserves to Operational Reserves, and are based principally on past operating experience. Losses are allowed for ore left in stope pillars and, to a lesser extent, for incomplete extraction due to undulations of footwall or hanging wall, and for ore left adjacent to pillars and in fault zones. The allowances for mining losses, by deposit and based on the PZZ for each deposit, are summarized in Table 15.3.

Table 15.3
Allowance for Mining Losses

Deposit	Allowance for Mining Losses (percent of tonnage)
Lubin-Malomice	23.0
Polkowice	24.0
Sieroszowice	21.0
Radwanice Wschód	25.0
Rudna	21.0
Deep Glogów	31.0

Micon has reviewed KGHM's allowances for mining losses and regards them as generally appropriate.

15.3 DILUTION

From its operational experience, KGHM makes allowances for mining dilution on the basis of the thickness of the mineable copper horizon, using the dilution factors summarized in Table 15.4.

Table 15.4
Allowance for Dilution

Thickness of Mining Horizon (m)	Allowance for Dilution (percent of in-situ tonnage)
0.1 to 1.0	70.9
1.01 to 2.0	34.6
2.01 to 3.0	13.6
3.01 to 7.0	3.8
Greater than 7	2.7

Variations in the thickness of the mineable horizon throughout KGHM's mining concessions in the Legnica-Glogów Copper Belt area are illustrated in Figure 15.1. The thickness distribution of each deposit is summarized in Table 15.5.

Table 15.5
Thickness Distribution of Industrial Resources

Deposit	Thickness Distribution of In-Situ Tonnage (%)					
	0.1 to 1.0 m	1.0 to 2.0 m	2.0 to 3.0 m	3.0 to 7.0 m	Greater than 7.0 m	Total
Lubin-Malomice	0.3	9.6	6.7	8.5	1.4	26.4
Polkowice	0.1	4.4	1.7	1.4		7.6
Sieroszowice	0.6	3.2	16.5	0.2		20.5
Radwanice Wschód		0.5				0.5
Rudna		0.6	3.4	12.1	7.6	23.6
Deep Glogów		8.7	12.6			21.3
Total	**1.0**	**27.0**	**40.9**	**22.2**	**9.0**	**100.0**

The average allowances made for dilution at each deposit, based on the distribution of thickness, are summarized in Table 15.6.

Figure 15.1
Thickness of Mineable Horizon

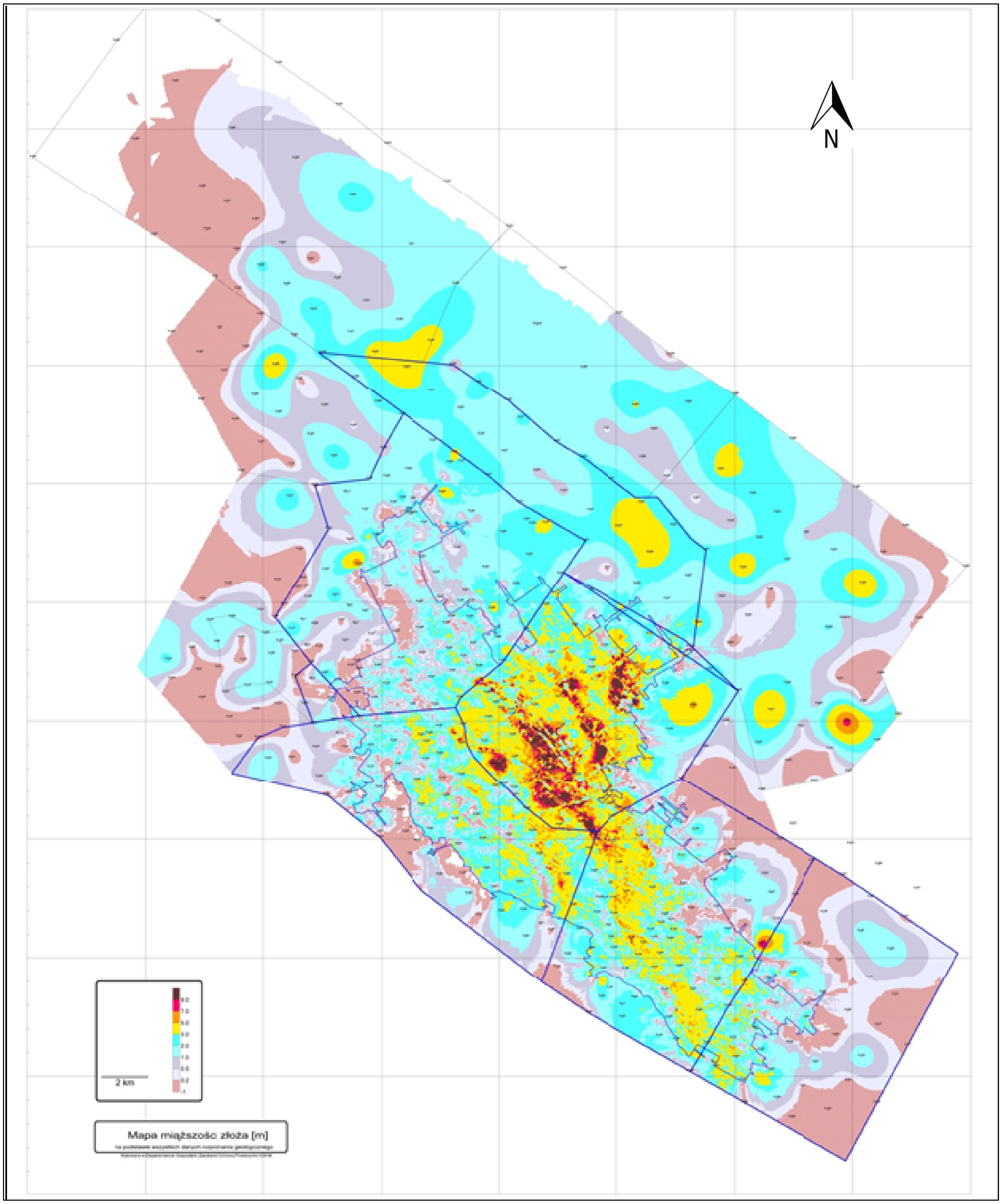


Table 15.6
Average Dilution Allowances

Deposit	Average Dilution Allowance (percent of in-situ tonnage)				
	A+B	C_1	Pillars A+B	Pillars C_1	Total
Lubin-Malomice	13.5	33.0	10.0	31.9	22.6
Polkowice	18.8	29.7	12.9		24.9
Sieroszowice	35.6	21.8	60.0	39.3	25.6
Radwanice Wschód		37.7			37.7
Rudna	5.4	11.9	4.2	41.2	7.1
Deep Glogów	29.5	21.0		12.9	21.0

15.4 RECONCILIATION OF PLANNED AND ACTUAL MINED TONNAGE AND GRADE

KGHM prepares annual reconciliations for each of its mines, comparing the actual tonnage and grade or ore mined, against the estimated Mining Reserves in the areas scheduled for extraction. These reconciliations for each of the last five years, for all three underground mined combined, are summarized in Table 15.7.

Table 15.7
Annual Reconciliations, 2007 to 2011, All Mines Combined

Year	Plan or Actual and Comparison	Tonnes (million)	Grade		Contained Metal	
			Copper (%)	Silver (g/t)	Copper (t)	Silver (Moz)
2007	Plan	29.47	1.73	45.4	509,533	42.879
	Actual	30.26	1.67	46.6	505,390	45.043
	Actual/Plan (%)	102.7	96.7	102.6	99.3	105.1
2008	Plan	29.60	1.62	45.6	479,607	43.370
	Actual	29.42	1.64	46.1	481,616	45.379
	Actual/Plan (%)	99.4	101.1	101.1	100.4	104.6
2009	Plan	29.59	1.67	46.2	493,700	43.979
	Actual	29.73	1.68	47.5	499,509	45.379
	Actual/Plan (%)	100.5	100.7	102.8	101.2	103.2
2010	Plan	29.10	1.64	46.6	477,054	43.550
	Actual	29.30	1.64	47.4	480,557	44.682
	Actual/Plan (%)	100.7	100.0	101.7	100.7	102.6
2011	Plan	29.47	1.61	43.8	477,065	41.542
	Actual	29.72	1.61	45.6	479,257	43.597
	Actual/Plan (%)	100.8	100.2	104.1	100.5	105.0

It is clear that, as would be expected of a company that has been mining a large, continuous and tabular deposit for so long, KGHM's reconciliations show that the planned and actual extraction of its Mining Reserves are in substantial agreement. Analysis of the reconciliations for each individual mine shows a somewhat broader scatter, but in no instance over the last five years, has the variation between planned and actual tonnage or grade exceeded 7%. These data support the validity of KGHM's estimates of Mining Reserves and of the estimates of dilution included therein.

15.5 MINERAL RESERVE STATEMENT

In light of the foregoing discussion, it is Micon's opinion that the allowances for mining losses and dilution included in KGHM's estimates of Mining Reserves are appropriate, and that those Mining Reserves qualify as Mineral Reserves under the CIM standards and definitions. KGHM's history of profitability demonstrates that the Mining Reserves can be extracted and processed economically, at current and reasonably foreseeable prices of copper and silver.

It is also Micon's opinion that:

- The portion of the Measured Mineral Resource (Polish category B) identified in Table 14.6 which is included in the Mining Reserves, is equivalent to a Proven Mineral Reserve under the CIM standards and definitions.
- The portion of the Indicated Mineral Resource (Polish category C_1) identified in Table 14.6 which is included in the Mining Reserves, is equivalent to a Probable Mineral Reserve under the CIM standards and definitions.

In Micon's opinion, the Mineral Reserves contained within KGHM's mining concessions in the Legnica-Glogów Copper Belt area, as of 31 December, 2011, are as shown in Table 15.8. The Qualified Person responsible for this estimate of Mineral Reserves is Stanley C. Bartlett, P.Geo.

In Micon's opinion, the Proven and Probable Mineral Reserves contained within KGHM's mining concessions, as of 31 December, 2011, amounted to 1,181 Mt at grades of approximately 1.58% Cu and 48 g/t Ag, containing 18.6 Mt of copper and 1,800 Moz of silver. These Mineral Reserves include allowances for both mining losses and dilution, but do not include an allowance for metallurgical recovery. The Mineral Reserves are sufficient to maintain the current production rate of about 30 Mt/y for 30 to 40 years.

Micon is not aware of any environmental, permitting, legal, title, taxation, marketing, political or technical factors which would adversely affect the economic extraction of these Mineral Reserves.

Table 15.8
KGHM's Mineral Reserves at 31 December, 2011

Deposit	Category	Tonnes (millions)	Grade		Contained Metal	
			Copper (%)	Silver (g/t)	Copper (Mt)	Silver (Moz)
Lubin-Malomice	Proven	156.2	1.05	51	1.65	254.8
	Probable	168.3	0.95	35	1.59	187.6
	Total	**324.5**	**1.00**	**42**	**3.24**	**442.4**
Polkowice	Proven	42.2	1.78	33	0.75	44.1
	Probable	54.5	1.66	36	0.91	62.4
	Total	**96.8**	**1.71**	**34**	**1.66**	**106.6**
Sieroszowice	Proven	75.0	1.98	48	1.49	115.2
	Probable	197.7	1.91	50	3.78	318.9
	Total	**272.7**	**1.93**	**50**	**5.27**	**434.1**
Radwanice Wschód	Proven	-	-	-	-	-
	Probable	7.8	1.25	18	0.1	4.4
	Total	**7.8**	**1.25**	**18**	**0.1**	**4.4**
Rudna	Proven	182.5	1.60	41	2.91	242.8
	Probable	63.7	1.60	56	1.02	114.2
	Total	**246.2**	**1.60**	**45**	**3.94**	**357.0**
Deep Glogów	Proven	0.1	1.80	77	0.002	0.2
	Probable	233.0	1.90	61	4.42	460.5
	Total	**233.1**	**1.90**	**61**	**4.42**	**460.7**
TOTAL	**Proven**	**456.0**	**1.49**	**45**	**6.80**	**657.1**
	Probable	**725.0**	**1.63**	**49**	**11.82**	**1,148.1**
	Total	**1,181.1**	**1.58**	**48**	**18.62**	**1,805.2**

16.0 MINING METHODS

The mining operations of KGHM in the Legnica-Glogów Copper Belt are carried out over a very large extent of some 470 km^2 and include three contiguous underground mines, Lubin, Polkowice-Sieroszowice and Rudna. The Deep Glogów area will be developed and mined in the future, as part of the Rudna and Polkowice-Sieroszowice mines.

16.1 TECHNICAL CONSIDERATIONS

In Micon's judgment, the principal technical factors that will influence the future performance of KGHM's mining operations are seismicity, rock temperature and the potential to automate operations.

16.1.1 Seismicity

KGHM's mines operate at depths of 600 to 1,250 m below surface and experience rock burst phenomena. KGHM regards the occurrence of rock bursts as serious, since they result in occasional fatalities, equipment damage and lost production.

The historical frequency of major rock bursts and rock mass destressings at KGHM's mines is presented graphically in Figures 16.1 and 16.2.

Figure 16.1
Number of Rock Bursts and Rock Mass Destressings per Year, by Mine

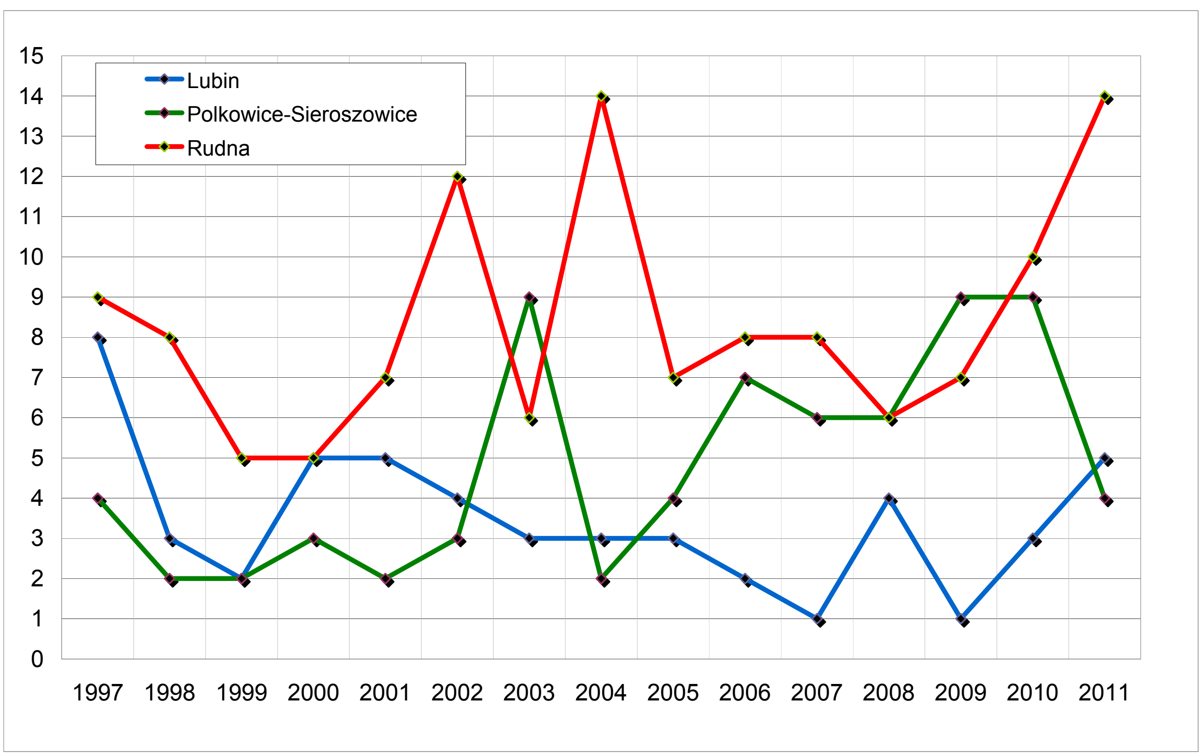
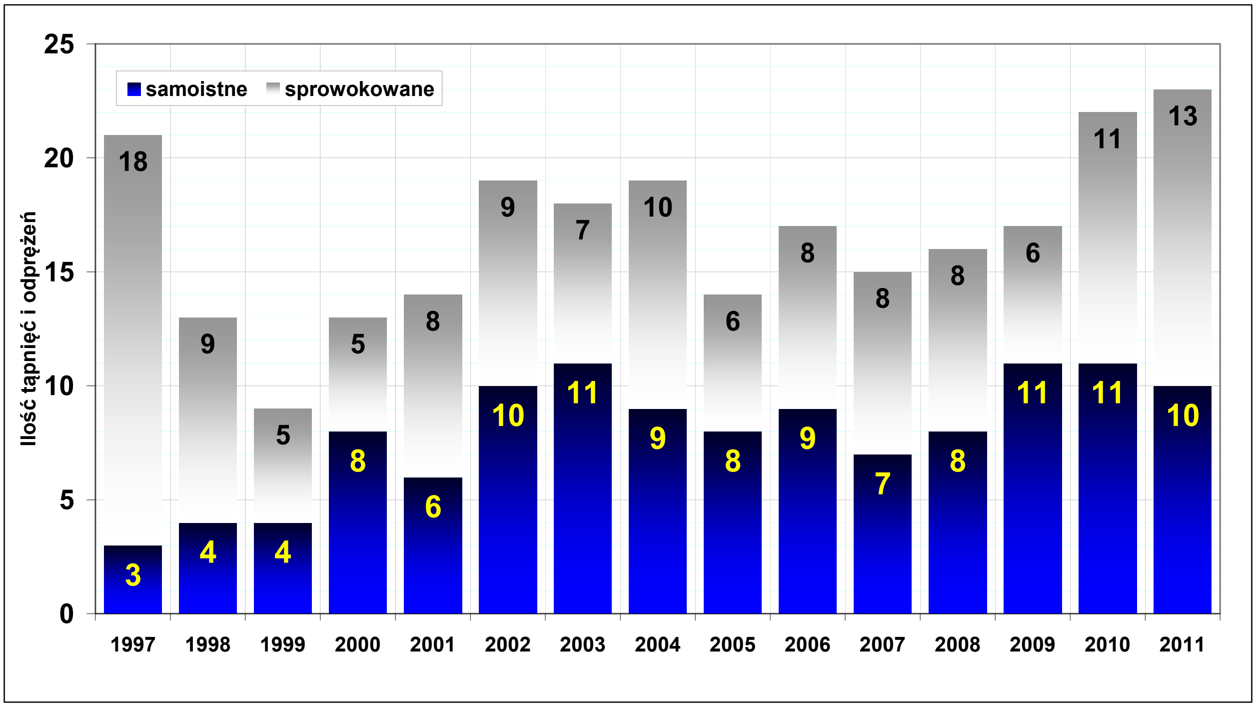


Figure 16.2
Total Number of Rock Bursts and Rock Mass Destressings per Year
(Events after blasting and before worker re-entry)



Grey: Bursts and rock mass destressings induced after blasting.
Blue: Spontaneous bursts and rock mass destressings during operation.
Figure provided by KGHM.

Figure 16.2 indicates that some rock bursts and rock mass destressings are induced by blasting. Accordingly, in areas prone to rock bursts, re-entry after blasting is delayed.

KGHM reports that analysis of rock bursts, tremors and seismic data indicates that the frequency of seismic events is not increasing with depth of mining. Also, KGHM's current opinion is that tectonic movement on faults in the strata above the mining horizon are more influential in causing rock bursts, than are mining induced stress concentrations. Given the relatively shallow depths of mining, approximately 1,000 m, and the high frequency of seismic events and rock bursts, Micon agrees with KGHM's opinion. It is considered likely that the reduced average mining thickness, in areas with less major faulting, will more than offset the effects of the stress associated with increasing depth of mining.

It is KGHM's opinion, with which Micon agrees, that the principal factors influencing the occurrence of rock bursts are the high strength of the roof rock, and its consequent tendency to store elastic energy. The scale of the rock burst hazard is also determined by the inherent stress distribution in the rock mass resulting from the depth of mining, the intensive tectonics of the deposit and the geometry of the active mining areas and the worked-out areas.

Figure 16.3 illustrates the major fault systems in the KGHM mines. It can be seen that Rudna and Polkowice have more major faults than the northern areas of Lubin and Sieroszowice.

Figure 16.1 indicates that Rudna is more prone to seismic activity and rock bursts than the other mines, and it is considered significant that Rudna also mines the greatest thickness of ore.

Figure 16.3
Fault Systems in the KGHM Mining Areas

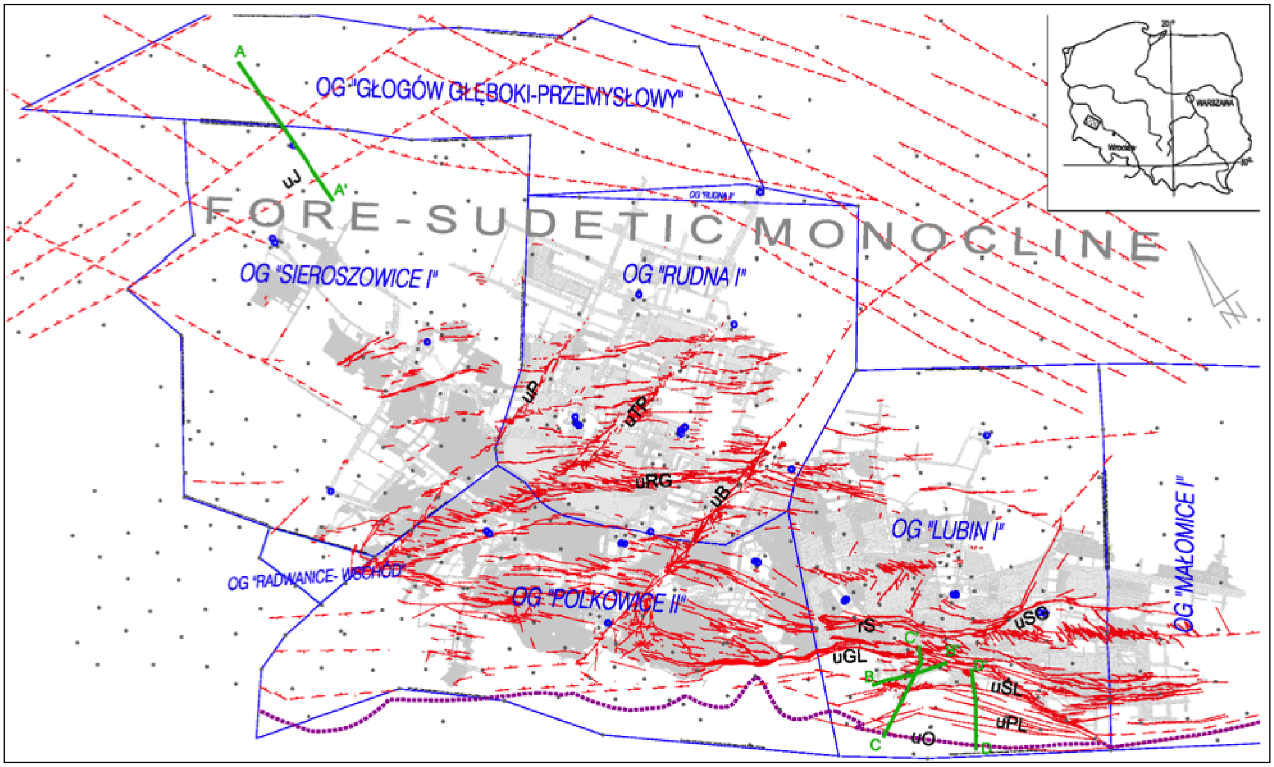


Figure provided by KGHM

In essence, rock bursts are sudden and frequently violent failures of pillars caused by dynamic increases in stress in excess of rock strength. It is thought that these rapid loadings of pillars results from downward movements of the overlying high-strength dolomite above the Cupriferous Shale unit. It is considered likely that these rapid downward movements of the overlying strata of dolomites are caused by tectonic movements on faults in the strata above. These movements on faults are likely caused by settlement and fracturing of the overlying strata as closure occurs in the mined-out voids below. With the greatest thickness of mined ore, Rudna creates the largest voids and, hence, the greatest opportunity for settlement of the overlying strata.

Conceptually, it would seem feasible to use a more positive backfill system than the current hydraulic sandfill system, in order to reduce closure of the mined voids and, hence, deformation of the overlying strata, which in turn may reduce tectonic movements and rock burst hazards. KGHM reports that trials are in progress to use paste fill from thickened tailings. KGHM also reports that there is no consideration for the use of cement. However, any fill system which limits roof closure should also reduce the risk of rock bursts.

In all of KGHM's mines, seismic monitoring is conducted based on a complex network of seismic stations, both underground and on surface, which covers all areas of the mines. These stations use analogue and digital equipment for the continuous recording of seismic and seismic-acoustic phenomena.

KGHM has developed a rock burst catalogue that is based upon data from seismometers, deformation stations, features of the surrounding rocks, and other information. The seismic monitoring system is capable of locating epicentres of seismic events with reasonable precision. The location of the rock bursts induced by seismic events, causing damage to underground openings, typically occurs some distance from the epicentre of the seismic event.

Seismological data are routinely used in the detailed planning of mining operations and in the sizing of rooms and pillars. Generally, the operational objective is to keep all active faces in a given area in a straight line, to blast regularly, and to release stress selectively in specific areas.

The principal method of ground support in active mining areas is roof bolting, most commonly with 1.6 m long grouted bolts on a 1.5 m square pattern. In places, there is clear evidence of failure along bedding planes in dolomite roofs, leading to potentially unsafe mining conditions and increased waste rock dilution. For this reason, the loose rock in the dolomite roof is brought down by mechanical scalers after blasting. Ultimately, however, while roof bolting provides a generally adequate system of support, it cannot provide a high degree of protection against rock bursts.

In instances in which the roof is likely to deteriorate, and in some primary tunnels or excavated service and auxiliary chambers, supplementary support is installed, using additional rock bolts, shotcrete and/or wire mesh.

Hydraulic sandfill is used in mining areas in which ore thickness exceeds 7 m or where surface settlement must be minimized in order to protect existing towns or structures. In such areas, an initial bench is excavated on the hanging wall of the ore, under the roof, with subsequent mining of a lower bench of ore. The resulting void is filled with uncemented hydraulically-placed sandfill. Filling of the void limits the closure due to downward movement of the overlying strata, thus reducing the risk of rock bursts induced by tectonic movements.

At the present time, then, the principal means of minimizing rock burst hazards is careful mine planning. Through its experience, KGHM has developed a number of empirical standards governing the size and shape of rooms and pillars, the favoured direction of advance, and the optimum sequence of extraction required to minimize local concentrations of stress.

16.1.2 Rock Temperature

KGHM's mines operate in an area of severe geothermal gradient. It was reported that the virgin rock temperature at the Rudna mine is 35°C at 850 m below surface and is 46°C at 1,200 m. This computes to an average geothermal gradient of 1°C per 32 m. It is understood that the average geothermal gradient is similar over all three KGHM mines.

The mining industry in Poland is heavily regulated, and these regulations are understood to require that underground working times for personnel be reduced as ambient temperature increases, in accordance with the schedule shown in Table 16.1.

Table 16.1
Underground Working Times at Various Temperatures

Temperature Range (dry bulb)	Maximum Working Time
Less than 28°C	8 hours
28°C to 35°C	6 hours
Greater than 35°C	Nil

KGHM is currently controlling the underground ambient air temperature by intensive ventilation and, in deeper areas, with the use of refrigerated air. Very large volumes of air, totalling 425,500 cubic metres per minute (m^3/min), are circulated through the underground workings. This air is circulated throughout the three mines via 17 air intake shafts and 10 upcast exhaust air shafts. Two additional ventilation shafts are in development to provide refrigerated air to the future deeper sections of Rudna and Polkowice-Sieroszowice, and Deep Glogów, below 1,200 metres, for planned production up to 2047. KGHM reports that temperatures in underground openings are maintained at the levels shown in Table 16.2.

Table 16.2
Temperature Ranges in Active Mining Levels

Temperature Range (dry bulb)	Per cent of Production Areas Within Range		
	Lubin	Polkowice-Sieroszowice	Rudna
Less than 28°C	90 - 95%	30%	10%
28°C to 35°C	5 - 10%	70%	90%
Greater than 35°C	-	-	-

The most recent ventilation shaft was completed at Rudna in 2005. Currently, a new 1,300 m deep, 7.5 m diameter, ventilation shaft (SW-4) is being sunk at Sieroszowice and is scheduled for completion by mid-2013. An additional 7.5 m diameter ventilation shaft (GG-1), to a depth of 1,380 m, is currently being prepared for sinking in the Deep Glogów area, with freezing of sections of saturated sandstones which have to be traversed. Sinking is expected to commence by mid-2013, with planned completion in 2019.

As mining proceeded to greater depths at Rudna and Polkowice-Sieroszowice, ventilation with ambient air was insufficient to maintain underground working temperatures within the regulatory limits. Accordingly, in 2005, KGHM commissioned a chilled water refrigeration plant on surface, at the R-9 shaft of the Rudna mine, initially with 10 megawatts (MW) of cooling power. This was then increased to 16.5 MW, to supply cooled air to working areas

1,050 m below surface. At the end of 2011, another chilled water refrigeration plant, with a target of 15 MW of cooling power, was commissioned at the SG-1 shaft at the Polkowice-Sieroszowice mine.

KGHM's plans for future construction of additional surface air cooling stations are as follows:

- At Shaft R-11 – 25.0 MW (for the Rudna mine and Deep Glogów area).
- At Shaft GG-1 – 15.0 MW (for the Deep Glogów area).
- At Shaft SW-4 – 19.0 MW (for the Polkowice-Sieroszowice mine and Deep Glogów area).
- Upgrading of the existing refrigeration plant at the R-9 shaft to 21.5 MW (to support the Rudna mine).

In areas in which ambient conditions are severe, whether or not refrigerated air is supplied, air-conditioned cabs are installed on mining equipment. The introduction of central and work station air-conditioning has allowed mining to continue which otherwise would not be permitted under current laws.

16.1.3 Gases

The mine workings encounter occasional occurrences of gases of natural origin in the rock mass (methane, hydrogen sulphide, sulphur dioxide). These occasional occurrences, involving relatively small quantities of methane, are such that the deposits may be considered as non-methane deposits, although legally-mandated safety measures are followed during mining operations. Appropriate ventilation of the working areas is sufficient to dilute the methane to safe levels.

At Rudna and Polkowice-Sieroszowice, in mining areas where the anhydrite layer is close to the roof, hydrogen sulphide can be released into the workings. At times, the workers are required to wear protective face masks.

16.1.4 Surface Subsidence

Subsidence of the surface has been reported above all of the underground workings, with a maximum current displacement of about 3.5 m above one portion of the Rudna mine. As subsidence of the surface occurs, potentially harmful deformation also occurs to buildings and surface infrastructure. Once mining operations in a given area are complete, subsidence essentially ceases and there is no further risk of damage to surface installations.

In the early 1980s, surface subsidence resulted in significant damage, to the extent that in some urban areas, certain buildings had to be strengthened, and gas and water mains had to be replaced. Today, mining beneath the towns in the district is conducted only to a small extent, since most of the orebody in these areas has been mined out. This, combined with the use of hydraulic backfill in mined-out voids, has meant that surface subsidence is no longer a serious problem.

Seismic events resulting from movements in the overlying strata as closure of the mined-out voids occurs, produce tremors which can be felt at surface. Only a small number of tremors, those which emanate from particularly high-energy seismic events, result in damage to buildings, but the damage is not significant.

16.2 MINING METHODS

KGHM employs the room-and-pillar mining method at all of its mines, although the detailed application of the method varies from place to place, depending on ore thickness and the geotechnical parameters of the orebody and surrounding rocks.

KGHM's mines were initially developed using longwall mining methods, but the room-and-pillar method is now used exclusively. Under the current system of ore development, primary access to production areas is provided by main development headings driven from the shafts. Each production area is divided into mining sections and each section is prepared for mining by driving tunnels on all four sides to verify geological continuity and ore grade. Mining sections are located primarily beyond the limits of the major pillars required to protect shafts, permanent underground installations and surface facilities.

To gain access to the ore in a mining section, a network of headings are driven from the shaft, with support provided by roof bolts. Then, a series of parallel rooms and cross-cuts are driven, essentially at right angles. The result is that a series of rectangular pillars are left in place between the rooms and the cross-cuts. This phase of mining is referred to as primary extraction.

A subsequent phase of secondary extraction involves removing ore from all sides of the pillar, thereby reducing its size. At KGHM's mines, mining areas are sealed following secondary extraction, in order to prevent further access, and are then allowed to cave naturally. It is understood that the current system of primary and secondary mining is capable of extracting 75% to over 90% of the in-situ ore.

KGHM utilizes many variations of the basic room-and-pillar system. The basic technical parameters which determine which of the variations will be used under given conditions include:

- Method of Support : natural caving of the hanging wall.
  : hydraulic sandfill or backfilling with waste rock.
- Thickness of Ore : up to 2.5 metres.
  : 2.5 to 5 metres.
  : 5 to 7 metres.
  : 7 to 15 metres.

- Dip of Ore : up to 8 degrees.
  : 8 to 16 degrees.
  : greater than 16 degrees.

For each of the variations, there is a defined range of permitted pillar dimensions. Actual pillar dimensions from within the specified range are determined after consideration of additional criteria, such as depth, degree of folding or faulting, proximity to other working areas, stress conditions and the potential for rock burst hazards. Typically, where the ore is less than about 7 m thick, large open stopes are created, with pillar dimensions varying from 6 m to 12 m in width by 8 m to 38 m in length. Production pillars are designed with their long axes parallel to the working front. In the thicker ore zones at Rudna the ore may be extracted in two horizontal slices, starting at the top, directly under the roof, and benching down in steps. The resulting void is filled with hydraulically-placed sand.

KGHM's underground mining operations are fully mechanized and, generally, employ sufficient units of equipment of appropriate size. Surface facilities at all shafts visited were extensive and entirely adequate. Housekeeping, both on surface and underground, is of a uniformly high standard.

The impression gained upon inspection is that the face operations are efficient, with productivities similar to those achieved at large underground mines in other countries. KGHM is continually introducing progressive systems in order to increase efficiency and reduce unit operating costs. Systems presently under study or recently introduced include:

- Air-conditioned cabins in units of mining equipment.
- Escape trap doors in the floor of mining equipment cabins.
- Automatic fire protection systems.
- Improved electronics.
- Stronger hydraulic hoses.
- Collecting machine data to report wirelessly.
- Alternative hybrid electric generator drives for mining equipment.
- Automation of mining equipment.

Figures 16.4 to 16.12 show some of the mining equipment currently utilized in the KGHM operations.

16.3 DEVELOPMENT

All three mines are developed and mined in a similar manner. There are 27 shafts in operation for production, ventilation and transportation of personnel and materials. An additional two ventilation shafts are being developed for future operations at depth, at Sieroszowice and at Deep Glogów, which is to be mined from both Rudna and Polkowice-Sieroszowice. The shafts are sunk to intersect the ore horizon at varying depths, in order to exploit the gently dipping, but very extensive, tabular orebody. All accessways, rail haulages and conveyorways are developed in the ore horizon.

16.4 OPERATING SCHEDULE

All mines operate on a regular schedule of four overlapping, 7.5-hour shifts per day, with operators changing over at the work place, for five days per week. Either one or two additional shifts typically are worked on Saturdays. There is no underground production on Sundays. This schedule provides an effective underground working time equivalent to about 290 full days per year.

Figure 16.4
Single Boom Drilling Rigs

Figure 16.5
Roof Scaler

Figure 16.6
Front-End Loader

Figure 16.7
Loader in Thick Ore Horizon

Figure 16.8
Truck Haulage to the Conveyor System

Figure 16.9
Truck Loading in Production Area

Figure 16.10
Low Profile Equipment

Figure 16.11
Roof Bolter in Low Height Ore Horizon

Figure 16.12
Low Profile Loader in Polkowice-Sieroszowice

Photograph provided by KGHM.

Given the extensive and widespread nature of the operations, underground travel time to the working areas is significant. The use of four overlapping shifts per day, with shift change over at the work place, maximizes the use of the productive mechanized equipment.

16.5 MINE PLANNING

KGHM's mine planning process follows the normal cycle of life-of-mine plans, medium term plans, and shorter term operating plans and budgets.

16.5.1 Life-of-Mine Plan

The reserves at KGHM's existing mines, including those in the Deep Glogów area, are sufficient for the statistical life of the mines to be estimated at 30 to 40 years, at the current production rate of about 30 Mt/y. It is planned to extend this life further, by future exploration and development of areas such as Bytom Odrzański, Glogów and Retków, which are adjacent to the areas currently being mined.

KGHM's mining activities are presently based on a long term plan prepared by KGHM Cuprum in 2008. The essential purpose of a life-of-mine plan is to provide the basic framework of development and extraction, within which shorter term plans are then prepared in progressively greater detail. It is Micon's opinion that KGHM's life-of-mine plan fulfills this purpose, and that the plan itself has been compiled in accordance with accepted engineering practice. It is to be noted, however, that, while the prices of copper and silver in recent years have been higher than historical averages, all elements of operating cost have risen significantly in the same period. While this does not invalidate the life-of-mine plan, it does mean that the economic criteria, including cut-off grades, used for short term planning should be subjected to scrutiny on an annual basis.

16.5.2 Medium Term Plan

In general, the medium term plan envisages the systematic continuation of mining operations in the existing producing sections, coupled with extensive development in the unmined northern portions of both Rudna and Sieroszowice, as well as sinking of the new ventilation shafts for the Deep Glogów area (GG-1) and Sieroszowice (SW-4).

Since future mining operations will be conducted at greater depth, the costs associated with ventilation and air-conditioning can be expected to increase.

16.5.3 Short Term Plans

KGHM prepares detailed mining plans, which typically cover the next three years of operation. These plans are updated regularly and form the basis for the development of detailed one-year production schedules and budgets. The basic philosophy underlying the short term plans, at the present time, is that all mines should continue to operate at full capacity, which is approximately as shown in Table 16.3.

Table 16.3
Underground Production Capacity

Mine	Production Capacity (thousand tonnes wet)	
	Daily	Annual
Lubin	27	7,700
Polkowice-Sieroszowice	37	10,600
Rudna	56	16,000
Total	**120**	**34,300**

16.6 HYDROLOGY

Average inflow of water to the KGHM mines, compared with available pumping capacity, is shown in Table 16.4, which is based on data provided by KGHM.

Table 16.4
Average Water Inflow and Available Pumping Capacity

Mine	Average Inflow (m^3/min)	Pumping Capacity (m^3/min)
Lubin	23.6	107
Polkowice-Sieroszowice	30.7	63
Rudna	7.7	32

Given the extent of the developed underground area, water inflow to the KGHM workings is extremely low. Underground inspection and monitoring of rock mass saturation confirm that there is minimal evidence of any significant water inflow. As shown in Table 16.4, the installed pumping capacity provides a substantial margin of safety in comparison to average inflows to the underground workings.

In certain portions of the mining area, the overlying dolomite and limestone beds form an aquifer that has the potential to release significant short term water inflows to the underground workings. In such areas, retention reservoirs have been constructed to provide storage in the event that short term inflows exceed pumping capacity.

Both the Lubin mine and the Rudna mine employ hydraulic backfill in certain mining areas, and drainage from the backfill contributes to the overall mine pumping requirement.

It is understood that all water pumped from the mines to the surface is used in the preparation of hydraulic backfill, or as process water at the concentrators, from which the water is recycled to the Żelazny Most tailings storage facility. Periodically, and depending on the absorption capacity of the river, excess water is discharged to the Odra river, in accordance with the terms of Integrated Permit No. PZ 200/2012, for operation of the Żelazny Most facility, dated 30 April, 2012 and issued by the Marshall of the Voivodship of Lower Silesia.

In overall terms, it is Micon's opinion that the management of underground water inflows is not now, and will not be in the future, a matter of either technical or economic concern.

16.7 BACKFILL

Mined-out voids at KGHM's mines may be filled with hydraulic backfill, filled with waste rock, or left to cave naturally. Hydraulically-transported sand backfill is used at both Lubin and Rudna when mining in thick portions of the ore zone and when mining under areas requiring protection of surface installations.

The annual requirement for sand will amount to 1.3 Mm^3 in 2012 and approximately 1 Mm^3 in 2018. Hydraulic backfilling will no longer be required when effective technology utilizing flotation tailings as backfill is developed, or when the thick orebodies are mined, or when extraction from the protective pillars under the towns is completed.

The principal source of sand, at the present time, is KGHM's Obara quarry, located near the Lubin mine shafts. This sand resource is sufficient to meet all current and future backfill requirements of KGHM's mines. Ultimately, however, the tailings from the processing plants must be regarded as an alternative backfill material, the use of which may turn out to be economically viable. It is understood that tests are being conducted to determine the suitability of tailings as fill material, as well as field trials with a paste fill. Micon believes that a high priority should be placed on expediting the use of process tailings as underground fill, both with and without the addition of cement.

In some areas of the mines, waste rock, originating principally from development headings, is used at its point of generation as backfill in excavated areas.

16.8 CHARACTERISTICS OF THE DEPOSIT

The existing underground workings at the three KGHM mines, together with the areas planned for development and extraction up to the year 2014, are shown in Figure 16.13.

16.8.1 The Lubin Mine

The Lubin mine extracts both sandstone and shale-carbonate ore, with the bulk of production coming from the sandstone. Ore thickness typically ranges from 1 to 7 m, with an average of about 3.0 m, but there are places in which thicknesses exceed 17 m. Hydraulic backfill is used to facilitate the mining of the thicker ore zones (more than 7 m), as well as when excavating the support pillars.

The roof of the underground excavations is typically in dolomite. As noted previously, the dolomite has a tendency to fail along bedding planes, creating potentially unsafe conditions in some places and leading to an increase in waste rock dilution.

Operating conditions vary widely throughout the Lubin mine. In the southernmost area of the mine, close to the major boundary faults, the ore zone is extensively faulted and folded, rendering mining conditions difficult. The intensity of faulting, however, tends to decrease progressively towards the north, so that the northern portion of the Lubin mine is relatively undisturbed and operating conditions are much easier.

Figure 16.13
Current and Planned Short Term Workings at the KGHM Mines

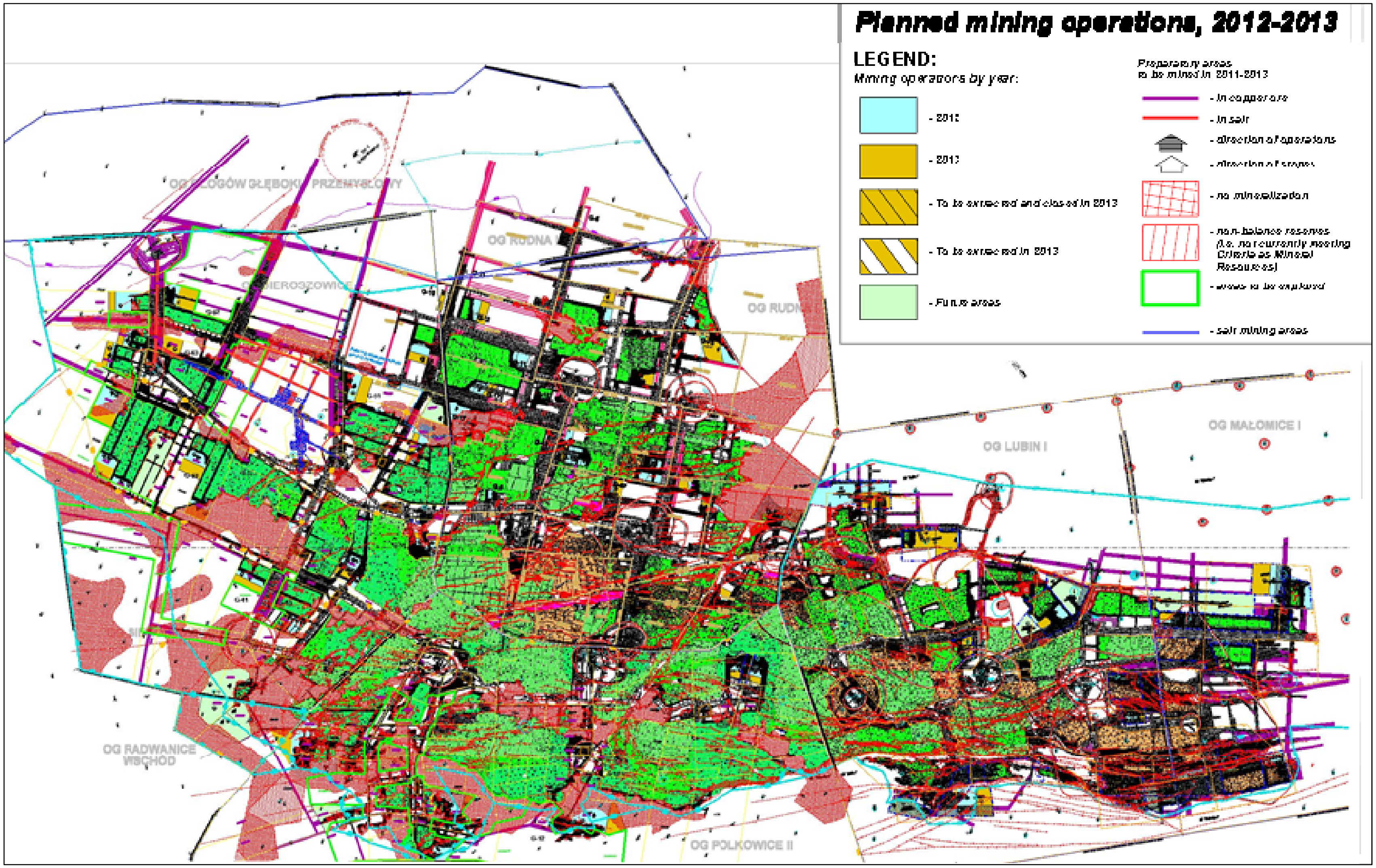


Figure provided by KGHM.

Lubin is the shallowest of KGHM's mines, operating at depths of between about 680 and 890 m. Generally speaking, rock temperatures are lower than at the other mines and underground ambient air temperatures can be maintained within acceptable limits purely by ventilation.

In terms of copper content, Lubin has the lowest grade of all of KGHM's mines, with run-of-mine ore typically averaging about 1.0% Cu. On the other hand, the silver content is higher than at the other mines and typically averages 35 to 60 g/t Ag.

16.8.2 The Polkowice-Sieroszowice Mine

Polkowice and Sieroszowice were originally developed as separate mines but are now consolidated into a single operation for administrative purposes.

The Polkowice-Sieroszowice mine extracts both sandstone and shale-carbonate ore but, in contrast to the Lubin mine, the bulk of production is obtained from shale-carbonate ore. Ore thickness at Polkowice typically ranges from 0.6 to 4.5 m, with an average of about 2.5 m, while, at Sieroszowice, the typical range of thickness is from 0.7 to 4.5 m, with an average of about 2.0 m. Thicknesses in excess of 7 m are rarely encountered and hydraulic backfill is not used at the Polkowice-Sieroszowice mine.

The developed mining area at Polkowice-Sieroszowice ranges in depth between roughly 600 and 1,200 m. Operating conditions are generally relatively good, except at the more heavily faulted southern extremity of the mining area, where more difficult conditions may be encountered. Mining at greater depths in recent years has required the use of refrigerated air.

The current ore grade at Polkowice-Sieroszowice is about 1.82% Cu and 35 g/t Ag.

16.8.3 The Rudna Mine

The Rudna mine extracts both sandstone and shale-carbonate ore, with sandstone being the more predominant ore type. As described in Section 7.2.4, the ore at the Rudna mine occurs both in flats (valleys) and in elevations (hills). The flats contain the full mineralized geological section of sandstone, shale and carbonate rocks, while, in the elevations, the shale horizon is missing. Ore in the flats typically ranges in thickness between 2 and 6.5 m, with an average of about 4.5 m. In the elevations, on the other hand, ore thickness typically exceeds 7 m and locally exceeds 20 m. The overall average ore thickness at Rudna, at about 5 m, is significantly greater than at either Lubin or Polkowice-Sieroszowice. Hydraulic backfill is used to facilitate mining of the thicker ore zones, as well as excavating the support pillars.

Rudna is the deepest of KGHM's mines, with the underground workings extending between depths of about 920 and 1,170 m. Rock temperatures at the deeper elevations are higher than at KGHM's other mines and this required the introduction of refrigerated air earlier than at Polkowice-Sieroszowice.

In general, Rudna has the highest overall grade of any of KGHM's mines. It is currently operating at an average grade of approximately 1.83% Cu and 51 g/t Ag.

16.9 CURRENT OPERATIONS

Micon visited all three mining operations and observed some of the mining method variations, including operations in thick ore horizons with hydraulically-placed sandfill at Lubin and Rudna, and thinner areas with roof settlement at Polkowice-Sieroszowice. Feeder breakers at the conveyor systems and a large equipment maintenance shop also were visited.

All three mines utilize similar methods to develop and extract the ore. Apart from the shafts, all development and working drifts are carried out in the ore horizon. The only waste rock mined is where it is necessary to take the roof or floor to provide height for access and operations. Ore from the mechanized room-and-pillar operations is hauled, either by truck or loader, to a rock-breaker/grizzly which feeds a conveyor or rail haulage system, for transport to the hoisting shafts. Figures 16.14 and 16.15 illustrate typical rock-breaker/feeder and conveyor systems, respectively.

Figure 16.14
Front-End Loader at Rock-Breaker/Feeder to the Conveyor

Photograph provied by KGHM.

Figure 16.15
Typical Underground Conveyor

Photograph provied by KGHM.

16.9.1 Underground Infrastructure

16.9.1.1 Lubin

Lubin is the oldest of KGHM's mines, with initial shaft sinking having commenced in 1960. Today, the mine is divided into the main, eastern and western operating areas and is serviced by a total of seven shafts. The main mining area, located more or less in the centre of the Lubin concession, is serviced by shafts L-1 and L-2, the eastern area is serviced by shafts L-3 and L-7 and the western area is serviced by shafts L-4 and L-5. Shaft L-6, which is currently used solely for ventilation purposes, is located close to the northern border of the concession.

Of the seven shafts, one (L-2) is a production shaft, four (L-1, L-3, L-4, L-5) operate as service and ventilation shafts and two (L-6, L-7) are dedicated solely to ventilation. A summary description of each shaft, and its current duty, is provided in Table 16.5. The capacity of the L-2 production shaft is 27,000 tonnes per day and it is this hoisting capacity that imposes the limit on underground production from the Lubin mine. Total capacity of all fans in the main ventilation system, including those constituting standby reserve, is about 110,000 m^3/min, and actual air flow through the mine is reported to be about 91,000 m^3/min.

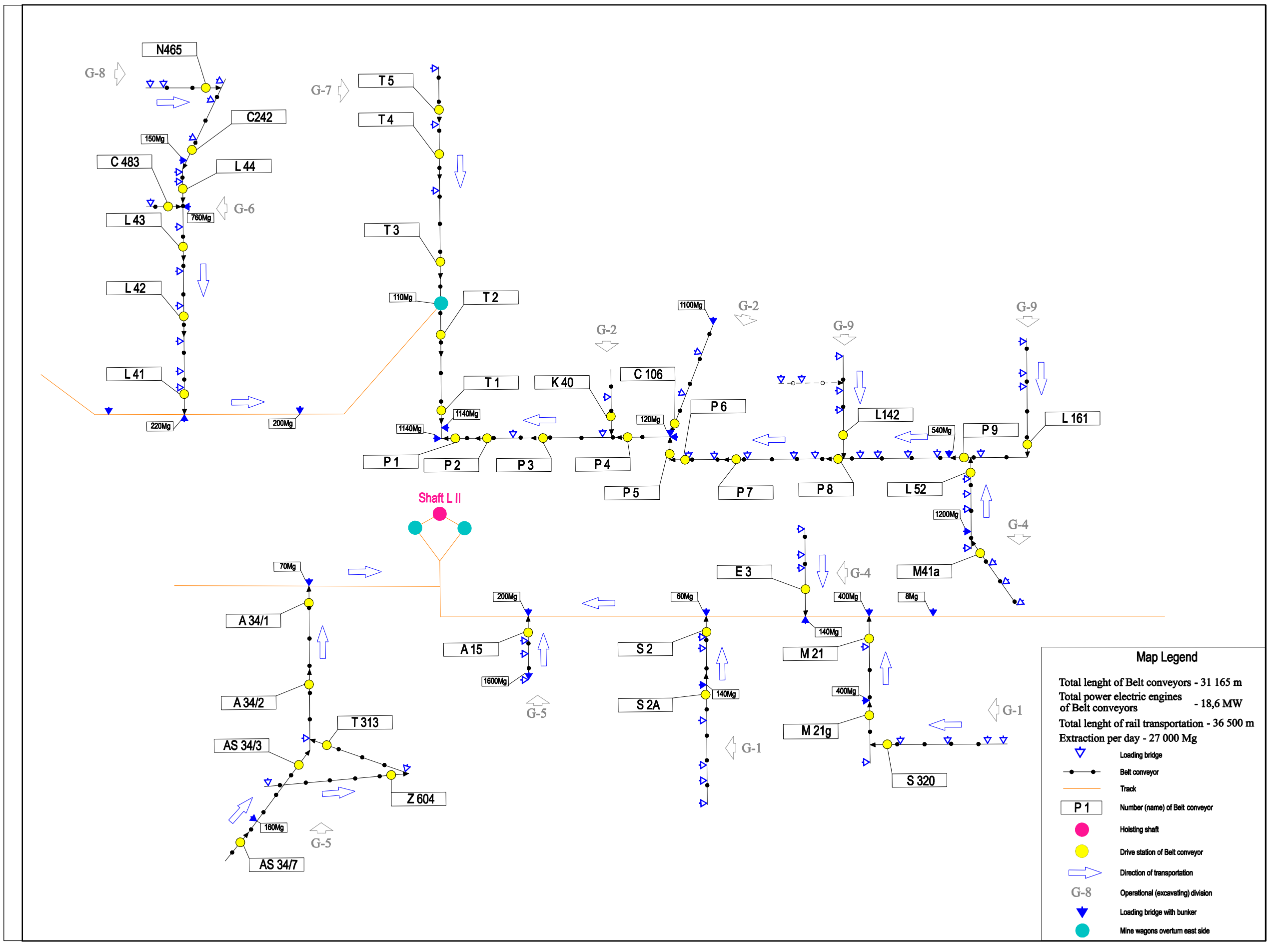
Table 16.5
Lubin Mine - Shaft Data

Shaft Number	L-1	L-2	L-3	L-4	L-5	L-6	L-7
Purpose	Service	Prodn.	Service	Service	Service	Vent.	Vent.
Depth (m)	648	691	633	764	767	963	494
Diameter (m)	6	6	6	6	7.5	7.5	7.5
Production							
Capacity (t/d)		27,000					
Rope speed (m/s)		16					
Skips (number)		2 x 2					
Skip size (t)		18					
Ventilation							
Air flow	Down	Down	Up	Up	Up	Down	Down
Air volume (m^3/min)	15,470	13,900	23,200	22,000	37,000	26,430	24,400
Fan power (kW)			1,250	1,250	1,600		
Pressure (atmosphere)			0.047	0.047	0.047		
Service							
Cage capacity (persons)	2 x 21		2 x 25	2 x 21	2 x 33		
Cage capacity (t)	9.5		9.5	9.5	9.5		
Cycle time (s)	300		250	250	250		

The Lubin mine is developed by four levels, from four shafts, at depths below surface of 610, 670, 740 and 910 m. All production, accesses and conveyorways are developed in the ore horizon. The 610 m level is the main operating level. It is connected to the main, east and west shaft systems, and also extends into the Malomice concession. The 670 m level is understood to be used essentially for the control of air flow, while the 740 m level provides the main haulageway for the transportation of ore to the production shaft from the western, northern and eastern areas of the Lubin mine, and from Malomice. The 910 m level is developed from the northernmost shaft (L-6) and provides access westward to the boundary of the Rudna mine. The areas below the 910 m level are equipped with conveyors for the delivery of ore from the extreme northern portions of the Lubin mine to the main transportation system on the 740 m level. The various levels of the Lubin mine are interconnected by a series of accessways and conveyors in the ore horizon. The underground ore transportation system, which utilizes both belt conveyors and rail haulage, is shown diagrammatically in Figure 16.16.

In general, underground development of the Lubin concession has reached a relatively mature stage, with primary access available to most of the areas scheduled for future mining.

Figure 16.16
Lubin Mine Rail and Conveyor Haulage System



16.9.1.2 Polkowice-Sieroszowice

The Polkowice-Sieroszowice mine was created in 1996 by the merger of the Polkowice mine, which has been in operation since 1969, with the Sieroszowice mine, which commenced operation in 1980. Today, Polkowice has reached a mature stage of development, with primary access available to virtually all of the areas scheduled for mining, while Sieroszowice is only partially developed.

The Polkowice-Sieroszowice mine is serviced by a total of nine shafts, of which five are on the Polkowice concession and four are on the Sieroszowice concession. Of the shafts, three (P-2, P-6, SW-1) are production shafts, and six (P-1, P-5, P-7, SW-3, SG-1, SG-2) operate as service and ventilation shafts. A summary description of each shaft, and its current duty, is provided in Table 16.6. The combined capacity of the three production shafts is about 37,200 tonnes per day. Total ventilation capacity of all fans in the main ventilation system, including those on constituting standby reserve, is approximately 191,000 m^3/min, and the actual air flow through the mine is reported to be 142,000 m^3/min.

Table 16.6
Polkowice-Sieroszowice Mine - Shaft Data

Shaft Number	P-1	P-2	P-5	P-6	P-7	SW-1	SW-3	SG-1	SG-2
Purpose	Service	Prodn.	Service	Prodn.	Service	Prodn.	Vent.	Service	Vent.
Depth (m)	885	908	870	839	758	1,027	703	1,057	1,052
Diameter (m)	6	6	6	6	7.5	7.5	7.5	7.5	7.5
Production									
Capacity (t/d)		22,400		8,000		6,800			
Rope speed (m/s)		16		16		16			
Skips (number)		2x2		2		2			
Skip size (t)		18		16		20			
Ventilation									
Air flow	Down	Down	Down	Down	Up	Down	Up	Down	Up
Air volume (m^3/min)	19,000	17,000	24,500	19,000	39,000	36,000	55,000	39,000	27,000
Fan power (kW)					1,600		3,150		4,000
Pressure (atmosphere)					0.045		0.055		0,042
Service									
Cage capacity (persons)	2x24		2x28			3x37		2x50	
Cage capacity (t)	9.5		9.5		20	25		25	
Cycle time (s)	200		200			200		200	

The Polkowice-Sieroszowice mine covers a substantial area extending down the dip of the deposit to the north. The mine is developed by a series of levels, at depths below surface of 740, 810 and 850 m at Polkowice, and 700, 850, 1,000, 1,100 and 1,200 m at Sieroszowice. All levels are interconnected by access and conveyorways in the ore horizon.

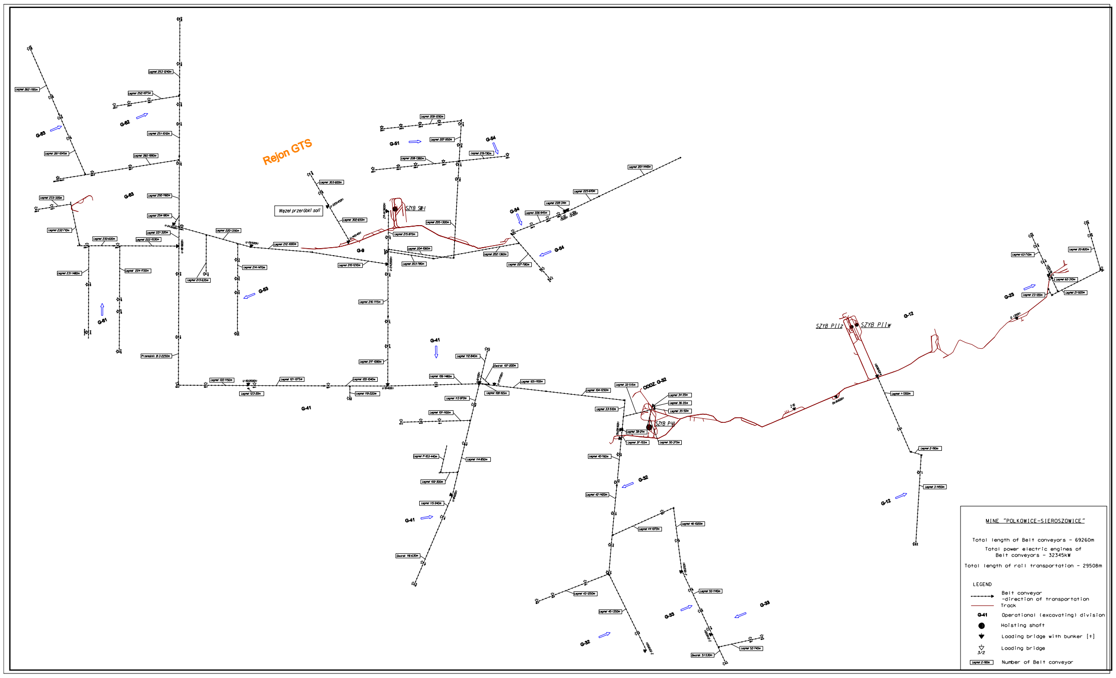
As is the case at the Lubin mine, the ore transportation system at Polkowice-Sieroszowice utilizes a combination of belt conveyor and rail haulage, as shown diagrammatically in Figure 16.17. The underground workings at Polkowice-Sieroszowice are connected by conveyor haulage to the hoisting shafts at both Polkowice-Sieroszowice and Rudna.

16.9.1.3 Rudna

Initial shaft sinking commenced at Rudna in 1970, with start-up of the mine and processing plant in 1974. The mine, which is currently well developed throughout its southern, shallower area, remains relatively undeveloped down-dip, to the north.

The Rudna mine is serviced by a total of eleven shafts, of which one (R-2) is dedicated solely to production, two (R-1, R-3) operate as both production and service shafts, one (R-7) is used for both service and ventilation purposes, and seven (R-4, R-5, R-6, R-8, R-9, R-10, R11) are used almost exclusively for ventilation. A summary description of each shaft, and its current duty, is provided in Table 16.7. The total capacity of the three production shafts is about 56,000 tonnes per day, and it is this hoisting capacity which imposes the limit on underground production. Total intake ventilation capacity is of the order of 180,000 m^3/min, with a total exhaust capacity of 240,000 m^3/min. The additional exhaust air is drawn from the Lubin and Polkowice-Sieroszowice mines.

Figure 16.17
Underground Ore Transportation System at Polkowice-Sieroszowice



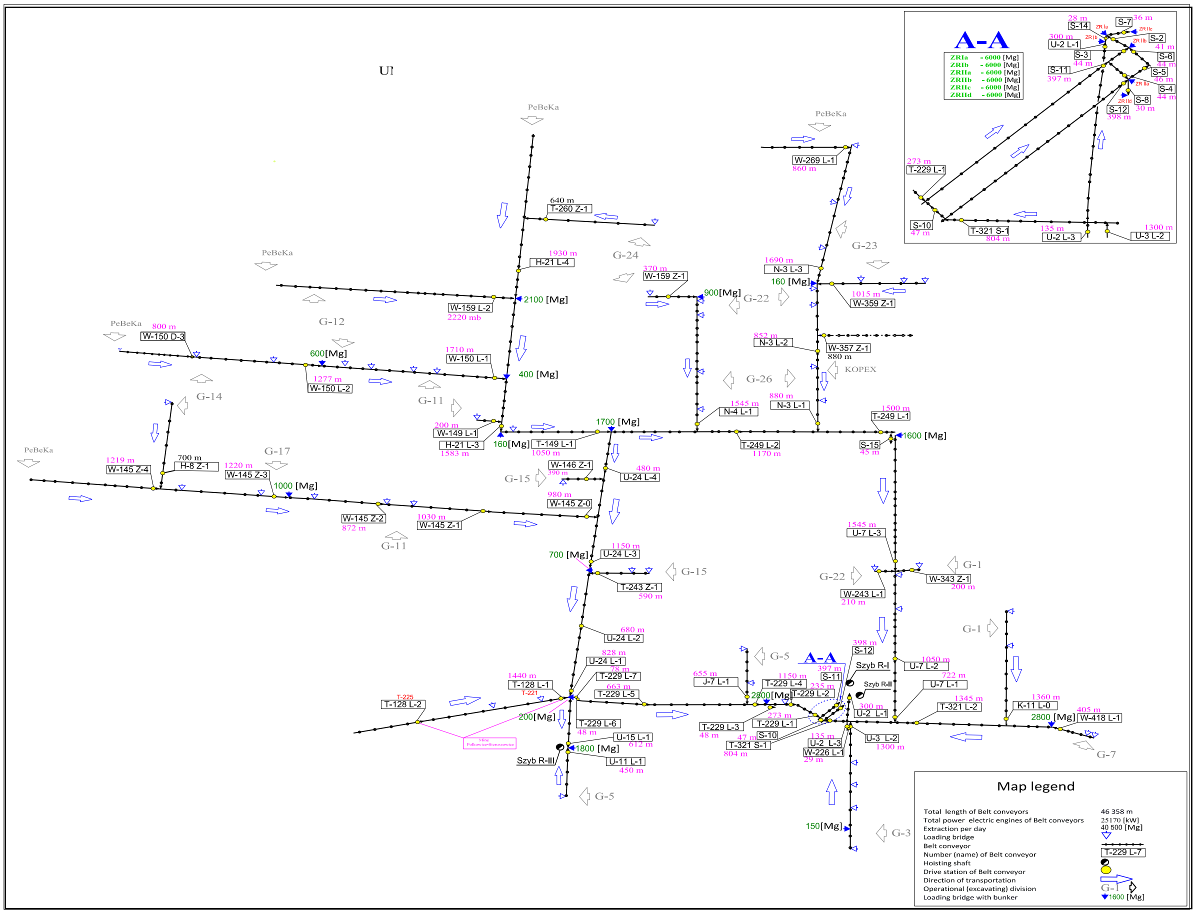
The Rudna mine is developed by a series of levels, at depths below surface of 900, 950, 1,000, 1,050, 1,100, 1,150 and 1,200 m.

Ore transport is based entirely on the use of belt conveyors. The underground ore transportation system at Rudna is shown diagrammatically in Figure 16.18.

Table 16.7
Rudna Mine - Shaft Data

Shaft Number	R-1	R-2	R-3	R-4	R-5	R-6	R-7	R-8	R-9	R-10	R-11
Purpose	Service Prodn.	Prodn.	Service Prodn.	Vent.	Vent.	Vent.	Service	Vent.	Service	Vent.	Vent.
Depth (m)	1,052	1,070	998	940	1,024	900	1,120	973	1,120	981	1,241
Diameter (m)	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5
Production											
Capacity (t/d)	8,300	39,000	8,600								
Rope speed (m/s)	16	20	16								
Skips (number)	2	4	2								
Skip size (t)	23	33	17								
Ventilation											
Air flow	Down	Down	Down	Down	Up	Down	Down	Up	Down	Up	Up
Air volume (m^3/min)	22,350	20,500	26,500	15,450	73,400	35,400	28,500	58,400	30,600	68,900	40,000
Fan power (kW)					3,150			3,150		3,150	3,400
Pressure (atmosphere)					0.051			0.040		0.036	0.037
Service											
Cage capacity (persons)	120		135				78		100		
Cage capacity (t)	19		20				12		16		
Cycle time (s)	200		200				200		200		

Figure 16.18
Rudna Mine Conveyor Ore Haulage System



16.9.2 Mining Areas

16.9.2.1 Lubin

There are currently eight production areas at the Lubin mine, which include 17 mining districts. The individual areas produce between 500 and 1,500 tonnes of ore per shift. Micon visited production area G-4, which is located approximately 45 minutes of travelling time south of the main shaft system.

Operations in the G-4 area are in thick sections of ore below the town of Lubin. The area is mined in two passes, with a top slice below the dolomite roof and a lower pass benched below. The resulting void is filled with hydraulically-transported sand.

The face operations, which are mechanized with a mixture of equipment produced by a subsidiary of KGHM and imported equipment, appeared to be conducted efficiently. The air temperature in the area visited was in the range of 25 to 27° C. Generally, however, because of the extensive nature of the underground workings at Lubin, the overall efficiency of the ventilation system is relatively low, with air losses of about 10% to 12%.

16.9.2.2 Polkowice-Sieroszowice

Mining at Polkowice-Sieroszowice is carried out in 11 production areas, which extract ore from 25 mining districts located mainly in the southern and southwestern parts of the Polkowice II mining area and in the northwest, central and eastern parts of the Sieroszowice I mining area.

Appropriate mine development is carried out to support output at the planned level. Development at the Polkowice-Sieroszowice mine currently progresses in a westerly direction. The Polkowice-Sieroszowice mine, together with the Rudna mine, is also developing the Deep Glogów mining area. In total, some 42 km of development drifts are planned for 2012 in Polkowice-Sieroszowice and in the Deep Glogów mining area. The work is performed both by the mine's own staff and by contractors.

The Polkowice-Sieroszowice mine typically excavates rooms which are 6 m wide and up to 2.5 m high, extracting an ore horizon which averages 1 to 2.5 m in thickness. The ore is typically exposed on the footwall and a lower bench is mined prior to drilling and blasting the upper layer of waste. Backfill is not used and the roof is allowed to cave naturally.

The area visited by Micon was less than 2 m in thickness, and was one of eleven production areas. Individually, these areas produce between 500 and 1,200 tonnes of ore per shift. The total production at Polkowice-Sieroszowice is reported to be some 38,000 tonnes per day. The rock burst hazard in all areas is characterized as low.

In the section visited, mining conditions are good, with the stable hanging wall dolomites adequately supported by roof bolts. There is evidence of occasional minor flexures and faults. Primary extraction is on a square room-and-pillar pattern which provides primary recovery of approximately 75%, with total extraction, after secondary mining, of between 85 and 90%.

Minor failures of the hanging wall tend to occur about 40 to 50 m behind the active face and, ultimately, due to the natural caving system employed, there is significant closure of the mined areas. As described previously, the surface expression of this subsidence has, in the past, affected the town of Polkowice.

The ventilation system at Polkowice-Sieroszowice appeared to be operating effectively.

A salt deposit occurs some 20 to 120 m above the copper-bearing horizon, and is mined at a rate of about 1,000 tonnes of rock salt per day. The existence of the salt is thought to have a damping effect on the severity of faulting in the lower, hard rock strata.

16.9.2.3 Rudna

There are currently 13 production areas at Rudna, which include 25 mining districts. Individual areas produce between 750 and 1,500 tonnes of ore per shift. Five of the areas are categorized as "high temperature", typically experiencing temperatures of between 28 and 35° C. The mine currently produces about 38,000 to 40,000 tonnes of ore per day at an average grade of about 1.8% Cu.

The ore in the Rudna mining area is essentially accessed. Development at Rudna is being carried out to prepare other areas for future production, including the Deep Glogów mining area. Approximately 35 km of development are planned for 2012 at Rudna, including access to the Deep Glogów mining area.

Micon visited an area where a thick horizon of 10 to 12 m of ore was being mined. An initial cut, about 5 m high, is taken in the upper level under a competent dolomite roof. The lower portion of the ore zone is then mined by bench blasting. Hydraulically-transported and placed sand backfill is used to fill the resulting void as tight to the hanging wall roof as possible. The fill line is carried at a minimum of 70 m and a maximum of 120 m from the active face. Overall mining conditions are good.

There are two main faults at Rudna, striking northwest and with displacements of 20 to 70 m. There are associated parallel rolls and faults at irregular intervals, but these subsidiary faults have displacements of only 2 to 5 m. These faults do not have a significant impact on mineability or dilution control.

Rock bursts are a cause for concern. Rudna, which is the most tectonically disturbed of the three mines, experiences the most seismic activity and the most rock bursts. In areas of high rock burst hazard, mined-out areas are backfilled completely. Backfill is currently used in about 10% of the stopes at Rudna.

The ventilation system at Rudna appears to be operating satisfactorily.

16.9.3 Equipment, Manpower and Productivity

The mining equipment used at the three KGHM mines includes, among other units, mechanized drilling rigs, scalers, rockbolters, load-haul-dump (LHD) units and haulage trucks. Low profile equipment is used in thin sections of the orebody, principally at Polkowice-Sieroszowice, in order to reduce dilution. The equipment is a mixture of imported and equipment produced by KGHM's subsidiary. The equipment inspected appeared to be in reasonable condition and was primarily three to five years old. In addition to routine maintenance, the equipment is typically comprehensively serviced every 3,000 to 5,000 hours, with replacement generally scheduled at 12,000 hours. The average life of equipment is some 4 to 8 years, with a drill rig life of 8 years and loaders 4 years. Underground maintenance facilities at Lubin, and also at KGHM's other mines, are adequate. A summary of the principal equipment at each mine is provided in Table 16.8.

Table 16.8
Principal Equipment at KGHM's Mines

Type of Equipment	Number of Units		
	Lubin	Polkowice-Sieroszowice	Rudna
Loaders	43	88	83
Mining Trucks	30	60	60
Drill Rigs	24	46	37
Bolters	33	55	60
Scalers	11	12	20
Bulldozers	12	13	18
Secondary Loaders	41	37	44
Secondary Bolters	-	6	5
Transport Vehicles	54	94	112
Explosives Vehicles	19	12	33

Radio communication systems are used underground, with some 340 km of leaky-feeder cable installed in the three mines to date. Wireless systems are being introduced, as well as remote operation of feeder/breaker units at the conveyor feed points.

The overall productivity of mining operators and staff has remained relatively constant over the last five years, after increasing significantly prior to that time, as more mechanized equipment was introduced.

Table 16.9 summarizes the annual productivity per person from 2007 to 2011.

In Micon's experience, these productivities are comparable to those achieved at large-scale underground mines elsewhere.

Table 16.9
Underground Productivity, 2007 to 2011
(tonnes per person-year)

	2007	2008	2009	2010	2011
Lubin	2,444	2,310	2,384	2,325	2,341
Polkowice-Sieroszowice	2,599	2,369	2,366	2,360	2,391
Rudna	2,984	2,821	2,813	2,669	2,678
Average	**2,676**	**2,500**	**2,521**	**2,454**	**2,470**

16.10 FUTURE OPERATIONS

16.10.1 Potential for Expansion

The current productive capacity of the KGHM mines is approximately 30 Mt/y of ore, with the limitation to production being imposed by the capacity of the hoisting shafts. Any increase in underground production, therefore, would require the sinking of a new shaft, equipped for hoisting duty. KGHM has no plans to sink such a shaft. Future production at current levels will require the commissioning of two additional ventilation shafts to provide for production from deeper ore horizons at Polkowice-Sieroszowice, Rudna and Deep Glogów.

The strategy of KGHM is based on a constant level of ore extraction for the long term at the current level of 29 to 30 Mt/y. The Mining Reserves of the existing mines, and the Deep Glogów project, are sufficient to maintain this level of production for the next 30 to 40 years. In order to continue at this level of production over a longer period, KGHM is exploring the possibility of developing the deposits directly abutting the currently mined areas. It is estimated that the current Radwanice-Gaworzyce and future Bytom Odrzański, Glogów and Retków projects could increase the geological resources of KGHM by some 987 million tonnes, containing approximately 17 million tonnes of copper.

Further development of the mines involves mining at a depth of up to 1,500 m. The virgin rock temperature at these depths reaches more than 45°C and mining will require a significant amount of refrigeration of the ventilating air. Achieving acceptable thermal conditions in the mines is one of the priorities of KGHM. Currently, the Rudna and Polkowice-Sieroszowice mines use central air-conditioning systems to chill water at surface to approximately 2ºC. The chilled water is piped to heat exchangers for air cooling at the underground working areas. KGHM is also implementing an individual work station air-conditioning program in the mines for the years 2010-2015, which includes the introduction of air-conditioned cabins in mobile mining equipment and at work stations.

Approximately 28% of the deposit being mined by KGHM has a seam thickness of less than 2 m, and a project has been initiated involving the design and implementation of a system for mechanical excavation of thin ore, as an alternative to the current use of blasting technology. If this project is technically and economically successful, KGHM may implement the system for mining all thin seams.

16.10.2 Outlook for Production

KGHM's five-year plan for production from its three mines is summarized in Table 16.10.

This overall plan calls for sustained mine production at full hoisting capacity, with ore being drawn principally from existing developed areas. It is Micon's opinion that the production schedule summarized in Table 16.10 represents a realistic and attainable objective for the KGHM mines.

Table 16.10
KGHM Mine Five-Year Production Plan

Facility	Units	Annual Production				
		2012	2013	2014	2015	2016
MINE PRODUCTION						
Lubin						
Tonnage	Mt	7.13	7.15	7.15	7.15	7.15
Copper Grade	%	0.94	0.92	0.89	0.89	0.94
Silver Grade	g/t	47.41	43.34	40.00	44.00	48.00
Polkowice-Sieroszowice						
Tonnage	Mt	11.13	10.95	10.92	11.07	10.91
Copper Grade	%	1.79	1.82	1.82	1.80	1.83
Silver Grade	g/t	35.32	32.02	31.73	30.27	32.90
Rudna						
Tonnage	Mt	11.68	11.53	11.53	11.54	11.54
Copper Grade	%	1.80	1.75	1.75	1.76	1.77
Silver Grade	g/t	49.79	47.16	47.06	48.61	49.66
Total Mine Production						
Tonnage	Mt	29.94	29.63	29.61	29.76	29.60
Copper Grade	%	1.59	1.57	1.57	1.57	1.59
Silver Grade	g/t	43.84	40.64	39.70	40.68	43.08
Contained Copper	Mlb	1,051	1,029	1,024	1,027	1,036
Contained Silver	Moz	42.2	38.7	37.8	38.9	41.0

16.10.2.1 Lubin Mine

The Lubin mine plans to maintain copper ore extraction for the next five years at the current level of 7.2 Mt/y. During this time, the mining operations will move to areas north and east from shaft L-6, which will be modified from ventilation to material and personnel hoisting. The mine does not plan closing any of the shafts. Exploration of the southern and eastern part of the mine will also be carried out. Due to the enlargement of the Żelazny Most tailings storage facility, to the south, the mining operations at Lubin, to the northwest, will be increased, from mid-2012, in order to complete them in this area before the tailings facility expansion commences.

16.10.2.2 Polkowice-Sieroszowice

In the recent past, Polkowice-Sieroszowice has continued to increase annual output, in spite of mining at increasing depth. It is expected that the current production level of some 11 Mt/y will be maintained in the medium term. No closure of any of the existing shafts is planned in the near future.

In 2011, the mine began preparing a pilot section to carry out trials of non-explosive methods of mechanical rock cutting in thin ore seams of up to 2 m. This technology may become technically and economically competitive with the traditional technology of using explosives. The start-up of this new section is planned in early 2013.

By the end of the first quarter of 2013, it is planned to obtain a license for mining the Kazimierzów rock salt deposit. At present, a project aimed at achieving rock salt production at the level of 1 M/y is in progress. This should permit an increase in the production and sale of rock salt in 2013.

The current productive capacity of the Polkowice-Sieroszowice mine is approximately 11 Mt/y of ore, with the limitation being imposed by the capacity of the existing hoisting systems. Given the relatively limited nature of the remaining reserves, it is Micon's opinion that there is no realistic potential for increasing production from the Polkowice concession.

16.10.2.3 Rudna

Operations to 2014 at Rudna will be conducted within the boundaries of the developed mining areas. By this time, additional areas will have been developed in the northwest direction. Further development and production requires commissioning of the surface air-conditioning station near shaft R-11, with a total effective cooling capacity of 25 MW. The planned start-up date is 2015. Developing the mining operations to below 1,200 m, given the hazards associated with gas and rock bursts, will require the development of rules and guidelines for conducting operations at these depths. The first mining area will begin operating under these conditions by mid-2013.

Over the next few years extraction of ore will remain at around the current level, approximately 12 Mt/y. Maintaining the same production level, with decreasing thickness of the ore seam, will require increased productivity from each mining area. In order to optimize the use of existing infrastructure, KGHM plans to close the R-6 shaft, with its functions being replaced by other shafts. This will permit mining of reserves in the shaft pillar area. In order to maintain the production level from the Rudna Central area, it is planned to reduce the size of the support pillar of shaft R-8 and commence mining of the newly available resources in that area.

In April, 2013 testing will begin on a belt conveyor measurement system, which will continuously analyze the copper content in the entire ore stream. If successful, analyzers may be introduced throughout the mine.

17.0 RECOVERY METHODS

Within the Legnica-Glogów Copper Belt, KGHM operates fully integrated metallurgical facilities, comprising:

- Three concentrators : Lubin, Polkowice and Rudna.
- Two smelters and refineries : Legnica and Glogów.
- The Cedynia copper rolling mill at Orsk.

The principal end products from these facilities are electrolytic copper cathode, copper wire rod, round copper billets and refined silver. By-products include gold, platinum-palladium concentrate, rhenium, selenium, lead, nickel sulphate and sulphuric acid.

During its visit to KGHM's operations, Micon inspected all three concentrators, the Legnica and Glogów II smelters and refineries, and the Cedynia rolling mill, and discussed their operation with responsible personnel. The impression gained from visual inspection and discussion is that all of the metallurgical facilities are well maintained and are operated efficiently. Housekeeping is of a uniformly high standard. Opportunities to increase efficiency and reduce operating costs are continuously being researched and tested.

17.1 CONCENTRATORS

All three concentrators use the same basic flowsheet, comprising:

- Closed-circuit crushing and screening.
- Closed-circuit grinding and classification, generally with two stages of grinding.
- Rougher, cleaner and scavenger flotation, generally with re-grinding of the rougher concentrate.
- Thickening, filtration and drying of the concentrate.

A schematic diagram of the processing flowsheet is provided in Figure 17.1. The flotation tailings from all three concentrators are pumped, as a slurry, to the Żelazny Most tailings storage facility, which is described in Section 17.5.

While the basic flowsheet remains the same, each of the concentrators uses a different configuration of equipment, particularly in the grinding circuit, depending on the type of ore being treated in that concentrator. Both the Lubin and Rudna concentrators treat predominantly sandstone-carbonate ore. These concentrators use rod mills for primary grinding and ball mills for secondary grinding. The Polkowice concentrator, on the other hand, treats predominately shale-carbonate ore, and uses ball mills for all grinding duty. A typical grinding circuit, in this case using spiral classifiers, is shown in Figure 17.2. KGHM plans to replace all remaining spiral classifiers with hydrocyclones, for closer control of the grain size of the flotation feed.

Figure 17.1
Simplified Schematic Diagram of Process Flowsheet

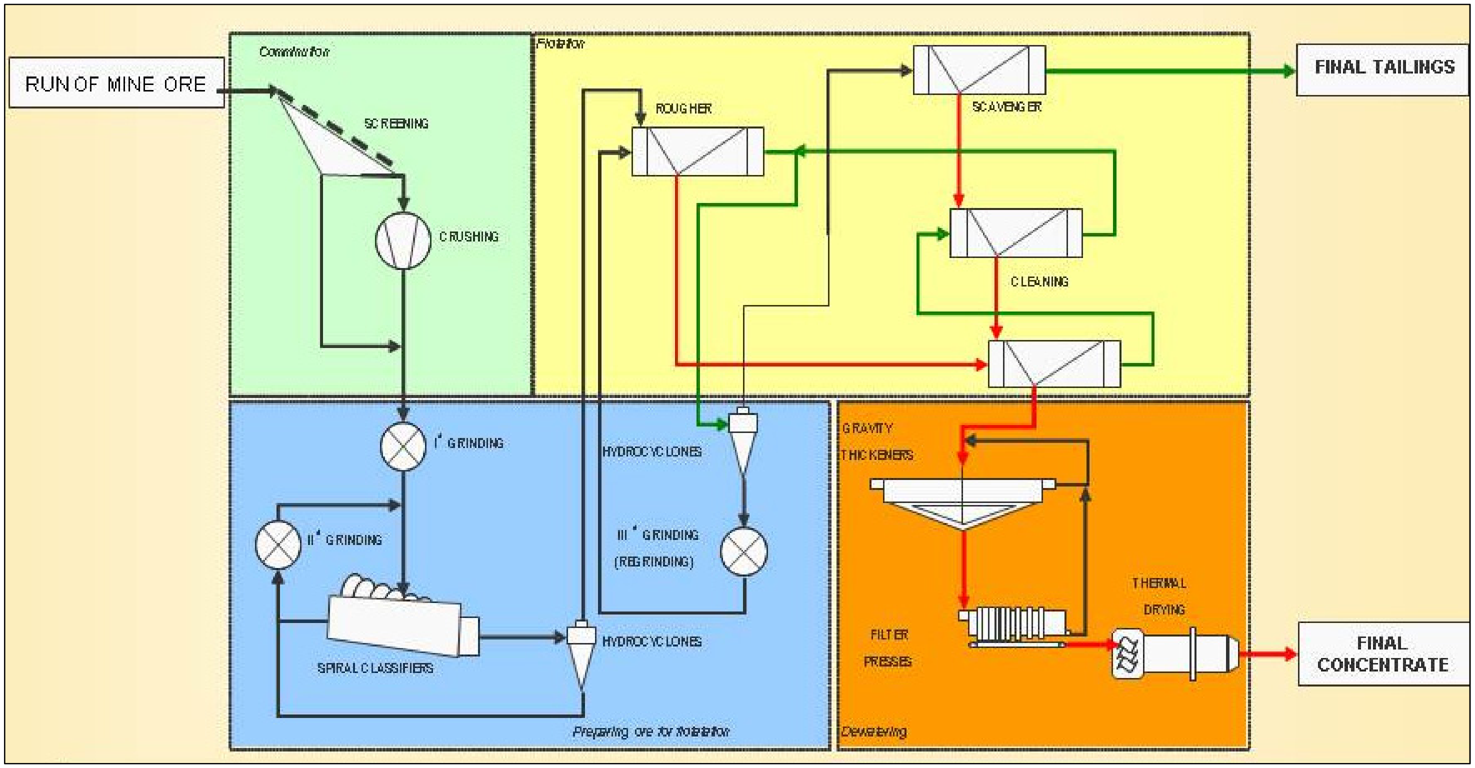


Figure provided by KGHM.

Figure 17.2
Typical Grinding Circuit

Photograph provided by KGHM.

Figure 17.3 is a view of the Rudna concentrator.

Figure 17.3
The Rudna Concentrator

Photograph provided by KGHM.

All three concentrators have been in operation for a considerable period of time. The Lubin concentrator, which processes all ore produced from the Lubin mine, began production in 1968. The Polkowice concentrator, which processes approximately 75% of the ore produced from the Polkowice-Sieroszowice mine, commenced production in 1969. The Rudna concentrator, which processes all ore produced from the Rudna mine and approximately 25% of the ore from the Polkowice-Sieroszowice mine, was commissioned in 1974. Table 17.1 summarizes the principal operating parameters of the three concentrators, combined.

Table 17.1
Operating Parameters of the Concentrators

Parameter	Units	Value
Throughput	Mt/y	30
Copper Feed Grade	%	1.6
Silver Feed Grade	g/t	45
Copper Recovery	%	89
Silver Recovery	%	86
Concentrate Produced	Mt/y	1.9
Copper Grade	%	23
Silver Grade	g/t	625
Concentrate Moisture	%	8.5

The concentrates produced at KGHM's concentrators contain mercury, bismuth, selenium and arsenic, with only arsenic being at a level which would be likely to incur penalties under arm's length commercial smelter contracts. The arsenic contained in the copper concentrate is removed in two ways:

- For shaft furnace smelting, arsenic is removed by wet scrubbing of the flue gas, with capture of approximately 80% of the arsenic.

- For flash furnace smelting, arsenic is removed by dry scrubbing of the flue gas, with capture of approximately 70% of the arsenic.

All captured arsenic is treated in the lead recovery circuit, where it is converted to ferric arsenate, which is then disposed of in the storage facility. The remaining 20% to 30% of the arsenic is sent to the electrorefining circuit, where approximately 14% is removed in the waste acid and is recycled to the concentrators. The remaining arsenic, contained in "copper sponge", is recycled to the shaft furnaces.

Selenium contained in the concentrate is recovered for sale. The concentrates also contain minor quantities of lead, nickel and rhenium, which are also recovered and sold.

All concentrates are transported by rail to either the Legnica or Glogów smelter. The Glogów smelter consists of two units, Glogów I and Glogów II. The current distribution of concentrates between the smelters is approximately as shown in Table 17.2.

Table 17.2
Concentrate Shipment to Smelters

Smelter	Distribution of Concentrate Shipments (%)		
	Lubin	Polkowice	Rudna
Legnica	52	-	14
Glogów I	47	82	30
Glogów II	1	18	56
Total	**100**	**100**	**100**

17.2 SMELTERS AND REFINERIES

17.2.1 Legnica

The Legnica smelter and refinery (Figure 17.4) produces approximately 100,000 t/y of electrolytically refined copper from the following feed materials:

- Concentrate produced by KGHM (approximately 61% of smelter feed).
- Purchased concentrates (approximately 1% of feed).
- Purchased blister copper (approximately 1% of feed).
- Purchased copper scrap (approximately 37% of feed).

Figure 17.4
The Legnica Smelter and Refinery

Photograph provided by KGHM.

The typical grade of KGHM concentrate fed to the Legnica smelter is summarized in Table 17.3.

Table 17.3
Typical Grade of Concentrate Fed to the Legnica Smelter

Element	Units	Concentrate Grade
Copper	%	18
Silver	g/t	700
Iron	%	6
Sulphur	%	12
Mercury	g/t	8
Bismuth	g/t	7
Arsenic	g/t	1,990
Selenium	g/t	45

The flowsheet used to produce copper cathodes at the Legnica smelter and refinery is shown diagrammatically in Figure 17.5.

Figure 17.5
Diagrammatic Flowsheet of the Legnica Smelter and Refinery

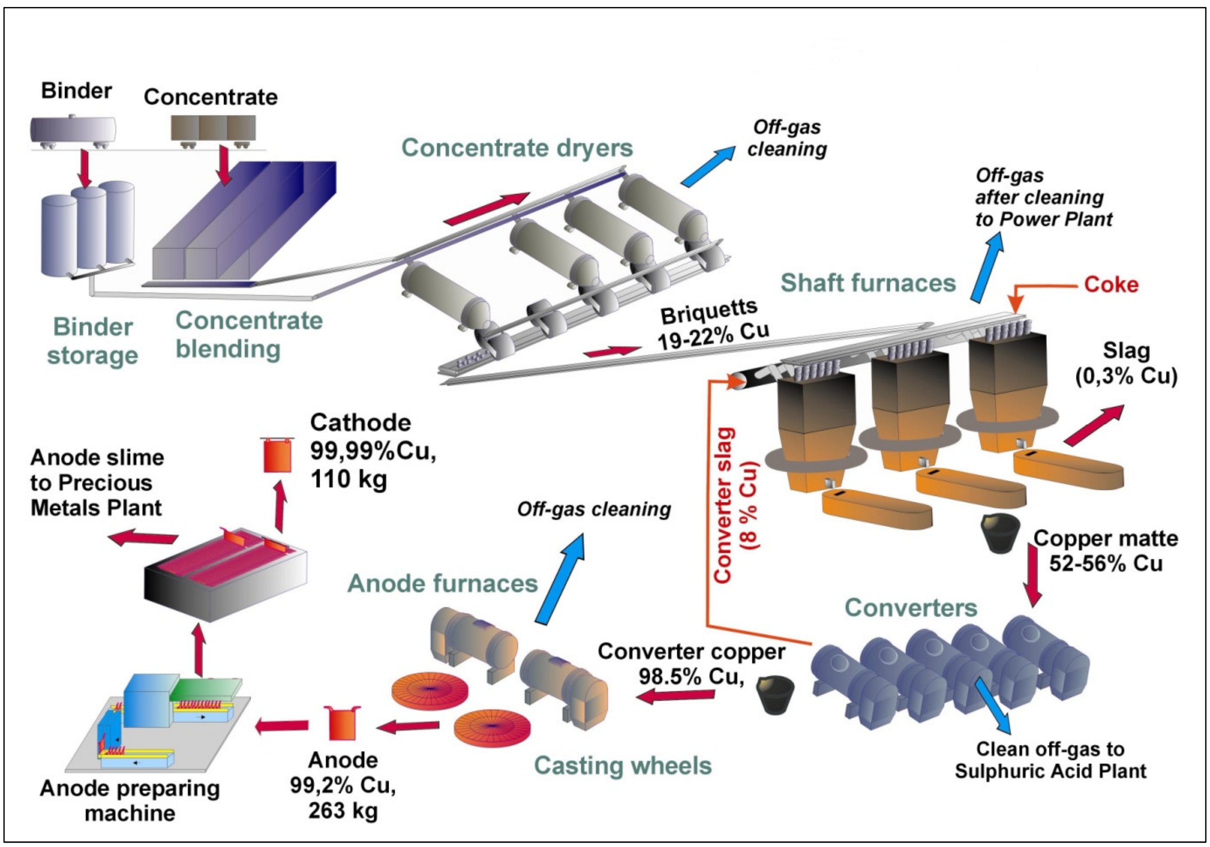


Figure provided by KGHM.

The smelting and refining process used at Legnica involves a series of sequential operations. Initially, the copper concentrate feed, which comes from both the Lubin and Rudna concentrators, is blended and is converted into briquettes in rotary presses using sulphate lye as a binder.

The concentrate briquettes, and recycled slag from the subsequent converter process, are smelted in conventional shaft furnaces, to produce a copper matte, containing approximately 60% Cu in the form of sulphides. Some of the waste slag from the smelting process is crushed for use as aggregate for road building and other applications. Some slag is disposed of underground.

The copper matte is then fed to conventional converter furnaces, in which the sulphides are oxidized and blister copper, containing approximately 98.5% Cu, is produced. Slag from the converter furnaces is recycled to the shaft furnaces.

The blister copper from the converters is subjected to fire refining in anode furnaces, the product from which is cast copper anodes. The anodes are then subjected to an electrowinning process. The anodes are submerged in an electrolyte, through which a steady electrical current is passed. The anodes progressively dissolve, the impurities settle to the bottom of the electrolytic cell as anode sludge, and pure, saleable copper, typically containing 99.99% Cu, is collected in the form of cathodes.

Most of the cathode copper produced by the Legnica refinery is used for the manufacture of round copper billets, in a continuous casting facility located at Legnica.

17.2.2 Glogów

The Glogów smelter and refinery (Figure 17.6) consists of two units, Glogów I and Glogów II, each with the capacity to produce approximately 235,000 t/y of electrolytically refined copper (total capacity of 470,000 t/y), from the following feed materials:

- Glogów I
    - Concentrate produced by KGHM (approximately 84% of smelter feed).
    - Purchased concentrates (approximately 1% of feed).
    - Purchased copper scrap (approximately 15% of feed).
- Glogów II
    - Concentrate produced by KGHM (approximately 81% of smelter feed).
    - Purchased concentrates (approximately 5% of feed).
    - Purchased blister copper (approximately 10% of feed).
    - Purchased copper scrap (approximately 4% of feed).

Figure 17.6
The Glogów Smelter and Refinery

Photograph provided by KGHM.

The typical grade of KGHM concentrate fed to the Glogów smelter is summarized in Table 17.4.

Table 17.4
Typical Grade of Concentrate Fed to the Glogów Smelter

Element	Units	Concentrate Grade
Copper	%	22
Silver	g/t	700
Iron	%	6
Sulphur	%	12
Mercury	g/t	8
Bismuth	g/t	7
Arsenic	g/t	1,900
Selenium	g/t	45

The Glogów I smelter utilizes shaft furnace technology and the basic smelting and refining flowsheet is the same as that described above for Legnica. The Glogów II smelter, on the other hand, uses flash furnace technology, based on a modified license from the Finnish company, Outukumpu (now Outotec). The flowsheet used to produce copper cathodes at the Glogów II smelter and refinery is shown diagrammatically in Figure 17.7.

In essence, flash furnace technology combines into a single process the three traditional stages of drying the concentrate, smelting the concentrate to produce copper matte, and converting the copper matte into blister copper. Concentrate and oxygen-enriched air are injected, through a set of burners, into the reaction shaft of the flash furnace. The concentrate melts, sulphur is oxidized and impurities are incinerated. The end products of the flash furnace process are blister copper containing approximately 99% Cu, and a slag containing approximately 14% Cu. The slag is treated in an electric furnace, to produce an alloy of copper, iron and lead, containing approximately 70% Cu. This alloy is treated in conventional converters to produce blister copper. The blister copper from both the flash furnace and the converters is cast into anodes, which are then subjected to conventional electrowinning, to produce pure, saleable copper cathodes.

Figure 17.7
Diagrammatic Flowsheet of the Glogów II Smelter and Refinery

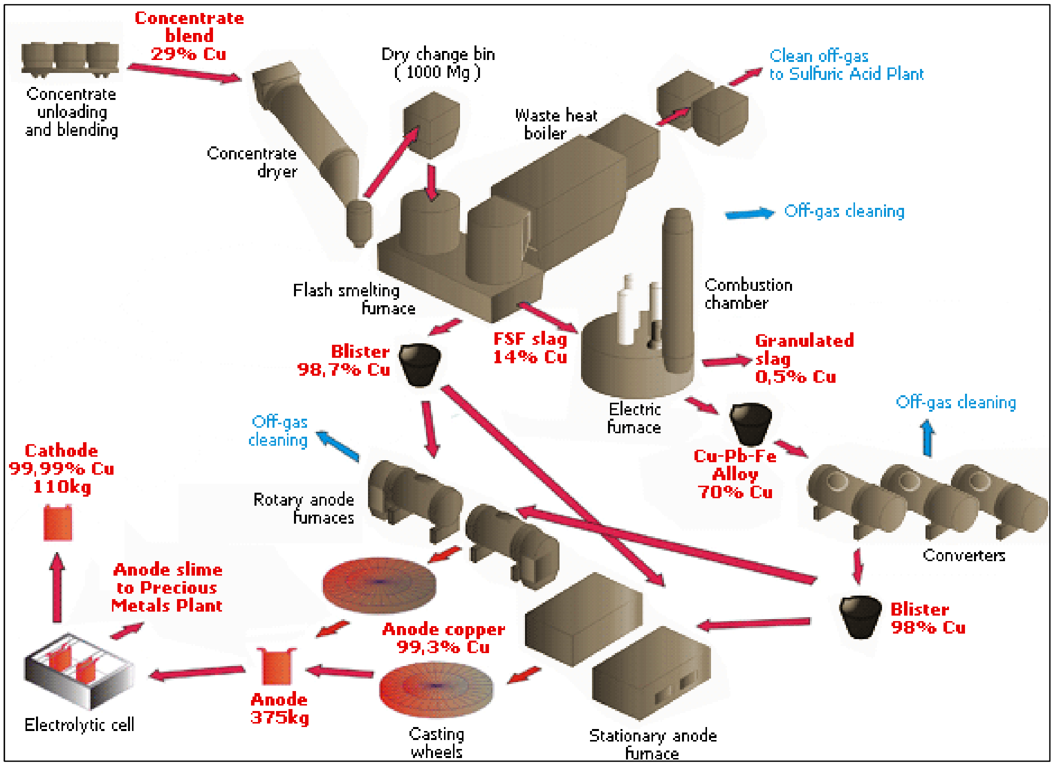


Figure provided by KGHM.

With completion of the Smelter Modernization Project, the Glogów smelter as a whole will have the capacity to treat all of the concentrate produced by KGHM. It is intended in the future to divert the KGHM concentrate currently smelted at Legnica to Glogów, leaving the Legnica smelter to operate entirely with purchased feedstocks, particularly copper scrap and electronic scrap.

17.2.3 Treatment of Smelter and Refinery Gases and Residues

KGHM makes extensive use of the residues and waste products from the smelting and refining processes. Exhaust gases from the smelting process are de-dusted and the resulting solid residue is smelted in an installation at the Glogów smelter for the recovery of crude lead, which is then refined at the Legnica smelter. De-dusted gases from the shaft furnaces are incinerated in boilers, and the heat generated is used for area heating and the production of electricity.

Exhaust gas from the converters is predominantly sulphur dioxide, which is captured and used to produce sulphuric acid. Flue gases in the sulphuric acid production unit are initially sprinkled to remove gaseous sulphur trioxide, and the remaining washing acid is treated for the recovery of ammonium perrhenate.

The residual anode slimes from the electrowinning process at both the Legnica and Glogów refineries are treated at a precious metals plant, located at the Glogów smelter and refinery, for the production of silver, gold, platinum-palladium concentrate and selenium. The electrolyte remaining after the electrowinning process is treated for the recovery of nickel sulphate.

17.2.4 The Cedynia Copper Rolling Mill

The Cedynia rolling mill (Figure 17.8) manufactures copper wire rod and oxygen-free copper wire rod, using cathode copper produced by the Legnica and Glogów refineries as a feedstock.

Figure 17.8
The Cedynia Copper Rolling Mill

Photograph provided by KGHM.

Figure 17.9 is a diagrammatic flowsheet of the rolling mill.

Figure 17.9
Diagrammatic Flowsheet of the Cedynia Copper Rolling Mill

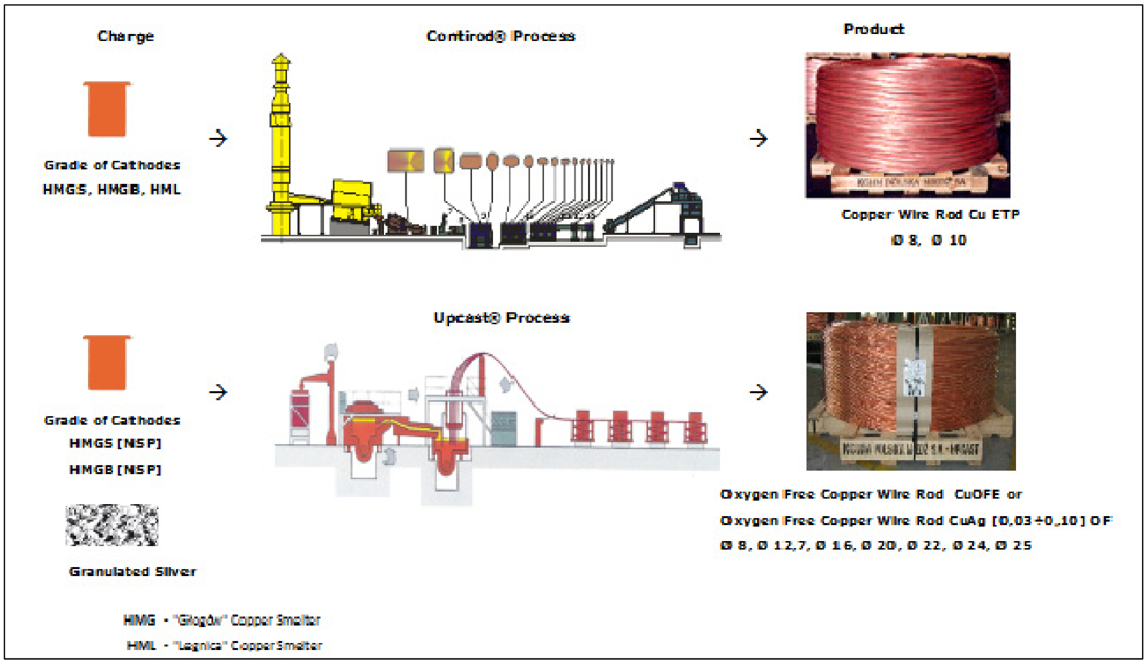


Figure provided by KGHM.

The Cedynia plant employs the Contirod process, which permits the continuous production of copper wire rod without the use of billets. Copper cathode feedstock is melted at 1,120°C in an Asarco furnace with a capacity of 45 t/h of copper. The molten copper is fed to a Hazelett casting machine which operates at a temperature of 850°C and produces a copper strip at a rate of 12 m/min. The copper strip is processed through rollers to produce copper wire rod, most commonly of 8 mm diameter, which is packaged for sale in 5 t coils.

In 2006, the Cedynia plant was expanded to permit the production of approximately 17,000 t/y of specialty oxygen-free copper rod, including silver-bearing oxygen-free rod, using the Upcast process. The oxygen-free rod represents KGHM's most highly manufactured copper product. The addition of silver to the oxygen-free rod renders the rod more ductile and enables the subsequent production of copper wire with a very small diameter.

The Upcast process for producing oxygen-free wire rod comprises a melting furnace, a casting machine with crystallizers for vertical casting, rolling machines and coiling machines.

17.3 TOTAL COPPER PRODUCTION, 2011

During 2011, KGHM produced 571,000 t of electrolytic copper from its facilities in the Legnica-Glogów Copper Belt. Of this total, 427,000 t were produced from KGHM's own concentrates produced in 2011, with the remainder coming from purchased feedstocks and KGHM concentrates that had previously been stockpiled. The electrolytic copper was either sold in the open market under normal commercial terms or used internally by KGHM to produce the manufactured copper products summarized in Table 17.5.

Table 17.5
KGHM Copper Production in 2011

Product	2011 Production (t)
Electrolytic Copper	571,041
Copper Wire Rod	226,235
Oxygen-Free Wire Rod	15,225
Silver-Bearing Oxygen-Free Wire Rod	1,198
Round Billets	20,320
Granulated Copper	2,260

17.4 OUTLOOK FOR PRODUCTION, 2012 TO 2016

KGHM's forecast of production from its metallurgical facilities in the Legnica-Glogów Copper Belt area, for the five-year period 2012 to 2016, is summarized in Table 17.6.

Table 17.6
KGHM Five-Year Production Plan for Metallurgical Facilities

Facility	Units	Forecast Annual Production				
		2012	2013	2014	2015	2016
TOTAL CONCENTRATOR PRODUCTION						
Mill Feed	Mt	29.88	29.63	29.61	29.76	29.60
Copper Grade	%	1.59	1.57	1.57	1.57	1.59
Silver Grade	g/t	43.85	40.64	39.70	40.68	43.08
Copper Recovery	%	88.9	88.9	89.1	89.3	89.6
Silver Recovery	%	85.6	85.7	85.8	86.0	86.1
Concentrate Produced	Mt	1.858	1.826	1.817	1.825	1.855
Copper Grade of Concentrate	%	22.8	22.7	22.8	22.8	22.7
Silver Grade of Concentrate	g/t	603	565	555	570	592
Contained Copper	Mlb	932.0	915.0	913.0	917.3	928.1
Contained Silver	Moz	36.1	33.2	32.4	33.5	35.3
METAL PRODUCTION						
Legnica						
Electrolytic Copper	Mt	0.106	0.110	0.110	0.110	0.110
Glogów						
Electrolytic Copper	Mt	0.458	0.452	0.414	0.467	0.467
Refined Silver	Moz	38.6	30.4	30.5	32.2	27.6
Total Metal Production						
Electrolytic Copper	Mt	0.564	0.562	0.524	0.577	0.577
Refined Silver	Moz	38.6	30.4	30.5	32.2	27.6
Cedynia						
Copper Wire Rod	t	221,000	210,000	210,000	210,000	210,000
Oxygen-Free Copper Rod	t	14,370	17,000	17,000	17,000	17,000

The average annual actual concentrator performance for the period 2007 to 2011 is compared against the average forecast performance for the period 2012 to 2016 in Table 17.7.

Table 17.7
Actual Concentrator Performance, 2007 to 2011, and Forecast Performance, 2012 to 2016

Parameter	Units	Average Annual Performance	
		2007 – 2011	2012 - 2016
Average Annual Mill Feed	Mt/y	29.69	29.70
Average Copper Grade	%	1.65	1.58
Average Silver Grade	g/t	46.65	41.59
Average Copper Recovery	%	88.8	89.2
Average Silver Recovery	%	85.4	85.8
Average Concentrate Produced	Mt/y	1.877	1.836
Average Copper Grade of Concentrate	%	23.1	22.8
Average Silver Grade of Concentrate	g/t	630	577
Average Contained Copper	Mlb/y	958	921
Average Contained Silver	Moz/y	38.0	34.1

KGHM's concentrators have been operating in steady-state fashion for many years and can be expected to continue in that manner in the future. The comparison shown in Table 17.7 indicates that forecast concentrator performance for the next five years will be similar to that achieved over the past five years in terms of ore throughput, but with somewhat lower copper and silver grades and, hence, with somewhat lower quantities of copper and silver contained in concentrate.

It is Micon's opinion that KGHM's forecast of concentrator performance of the five-year period 2012 to 2016 is realistic and achievable. The average copper grade of the ore forecast to be processed over the next five years, at 1.58% Cu, is the same as the average grade of the Mineral Reserves reported in Section 15. The average silver grade for the next five years is 41.6 g/t Ag, which is less than the average grade of 48 g/t Ag reported for the Mineral Reserves. It is anticipated that average silver grades will increase in subsequent years, when significant production commences from the Deep Glogów area, which has an average silver grade of 61 g/t of ore.

17.5 TAILINGS MANAGEMENT

All flotation tailings from the three concentrators (approximately 28 Mt/y) are delivered, as a slurry, to the Żelazny Most tailings storage facility. Water pumped from the underground mines is used in the concentrators and is then delivered to Żelazny Most with the tailings. Żelazny Most is a substantial structure, with a perimeter of more than 14 km and an area of approximately 1,400 ha. It is reported to be the largest tailings storage facility in Europe.

Tailings disposal at Żelazny Most started in 1974. Since then, the height of the embankment has been raised progressively and it now holds more than 800 Mt of tailings. Further raises of the embankment are planned and the ultimate capacity of the facility will be reached in several years. A lateral extension of capacity is planned adjacent to and southwest of

Żelazny Most. This extension will cover an area of approximately 600 ha and is designed to accommodate all tailings produced from processing of the remaining reserves.

Supernatent water from Żelazny Most is recirculated to the concentrators for use as process water. Excess water is discharged, under controlled conditions, to the Odra river. Water containing less than 35 mg/L of total suspended solids is discharged directly to the river. Water with a higher loading of total suspended solids is clarified in a water treatment plant prior to discharge.

18.0 PROJECT INFRASTRUCTURE

All required infrastructure is in place to service fully and efficiently KGHM's operations in the Legnica-Glogów Copper Belt. All facilities are interconnected by a comprehensive network of paved roads. Adequate and reliable electric power is available from the Polish grid, with an independent second connection to provide emergency power to essential facilities in the event of a disruption to the primary supply. Major consumables, such as diesel fuel and gasoline, are purchased at normal commercial rates by a wholly-owned subsidiary of KGHM, and distributed to the points of use.

In 2011, KGHM's operations in the Legnica-Glogów Copper Belt consumed 2.5 million megawatt-hours (MWh) of electricity, at a cost equivalent to approximately USD 94/MWh, or USD 0.094/kWh. Also in 2011, 31 million litres (ML) of diesel fuel were consumed, at an average delivered cost equivalent to USD 1.34/L.

19.0 MARKET STUDIES AND CONTRACTS

19.1 MARKETING

KGHM's principal products, electrolytic copper and refined silver, are readily traded on world markets. KGHM's electrolytic copper is registered as Grade A with the London Metal Exchange (LME) and is marketed under the following brand names:

- Legnica smelter and refinery : HML
- Glogów I smelter and refinery : HMG-S
- Glogów II smelter and refinery : HMG-B

KGHM's refined silver, which is marketed as bars under the KGHM-HG brand, holds a certificate of Good Delivery from the London Bullion Market Association, enabling it to be used in bank settlements.

KGHM reports that its electrolytic copper is sold principally under contracts with terms ranging from one year to five years, and at prices tied to LME quotations. Manufactured copper products, such as billets and wire rod, are sold under normal commercial terms. Bars of refined silver are sold principally at the prices established by the London Bullion Market. KGHM also has a subsidiary which manufactures silver and silver-plated flatware and tableware.

The several by-products of KGHM's operations are all sold under normal commercial terms but, in total, contribute only a small proportion of KGHM's gross revenue.

19.2 CONTRACTS

KGHM has many contracts for the supply of goods and services, all of which are negotiated and renegotiated in the normal course of business. Some of these contracts, including those for the purchase of gasoline and diesel fuel, and for contracted underground mine development, are with wholly-owned subsidiaries of KGHM, but are based on normal arm's-length business terms.

20.0 ENVIRONMENTAL STUDIES, PERMITTING, AND SOCIAL OR COMMUNITY IMPACT

20.1 REGULATORY FRAMEWORK IN POLAND

Although most of the KGHM operations were founded under the regulatory regime that existed pre-1990, reforms that were introduced subsequently have resulted in profound changes to the system of regulatory controls that governs the management of current operations. The development of the regulatory system in Poland was given further impetus and direction by the accession of Poland to the European Union (EU) in 2004. Transposition of the requirements of EU Directives into national legislation, including those covering environmental and occupational health and safety, is a fundamental requirement of EU membership and has been a priority of the Polish government before and after accession.

The importance of environmental controls is enshrined in the Polish Constitution and reflected in primary legislation including the Environmental Protection Act 2001 (as amended), the Water Act 1990 (as amended), the Waste Act 2001 (as amended) and the Nature Conservation Act 2004 (as amended).

Environmental protection is administered by both central and regional agencies. At the central governmental level, control over the implementation of legislation and government policy rests with the Minister of the Environment. Devolved responsibility lies with a series of provincial marshals, county executives, mayors and local communes. Routine inspections to confirm the adequacy of environmental controls are carried out by the Inspectorate for Environmental Protection.

Other governmental departments also develop policy and administer control of some critical areas. The control of hazardous substances, including the implementation of the provisions of EU Directive 1907/2006 on the registration, evaluation, authorization and restriction of chemicals (REACH), is administered through the Inspector of Chemical Substances and the Polish Sanitary Inspectorate.

The Polish Labour Code 1974 (as amended) establishes the framework for the rights and obligations of employers and employees with respect to occupational health and safety, including occupational illnesses and work accidents. The Geological and Mining Act of 2011 establishes conditions concerning mining rescue. The supervision and control of compliance with regulatory requirements is administered by the National Labour Inspectorate and the State Mining Authority in accordance with the requirements of the national standard for occupational health and safety, PN-N 18001:2004.

Poland continues to implement changes in national legislation in response to new EU Directives and, consequently, further changes in the permitting regime can be expected. For example, in early 2012, the EU reported that Poland was still implementing the full requirements of the EU Waste Framework Directives and Water Framework Directives. The implementation of other EU Directives continues within an agreed timeframe. The

Geological and Mining Act of 2011 (replacing the 1994 Act of the same name) strengthens health and safety and environmental controls in the mining industry and introduces, for example, improved management of funds for closure and decommissioning. The 2011 Act also implements the provisions of EU Directives 92/91 and 92/104, concerning the minimum requirements for improving safety and health protection in the mineral extraction industry.

20.2 ENVIRONMENTAL PERMITTING

The key regulatory requirements that apply to the operations at KGHM include:

- The need for Integrated Environmental Permits under the Provisions of the Environmental Protection Act at facilities for which they are required. These Integrated Environmental Permits ensure the application of Best Available Technology and incorporate the provisions formerly introduced under the requirement for Integrated Pollution Prevention and Control (European Directives covering these issues were updated in 2007).

- For those facilities not covered by the requirement for an Integrated Environmental Permit, the need for separate permits covering water abstraction and discharge, emissions to atmosphere and waste management.

- The requirement to pay a series of fees for activities including the abstraction and discharge of water, emissions to the atmosphere and waste disposal. These charges reflect both the quantity and quality of discharges, emissions and waste disposal, with unit rates set nationally and reviewed annually.

- The requirement to register facilities involved in the production of chemicals covered under the REACH regulations.

KGHM operates a number of facilities that are covered under the requirements for integrated Environmental Permits, including:

- An installation for the production of metallic copper at the Glogów smelter: Integrated Permit No. PZ 83/2007 (as updated in 2008, 2010 and 2011) (valid until 2017).

- The industrial waste storage facilities at the Glogów smelter: Integrated Permits No. PZ 70/2007 and PZ 149/2007 (as updated in 2008, 2010 and 2012) (valid until 2017).

- An installation for the production of lead at the Legnica smelter: Integrated Permit No. PZ69/2007 (as amended in 2009 and 2011) (valid until 2017).

- An installation for the production of metallic copper at the Legnica smelter: Integrated Permit No. PZ22/2005 (as updated 2009, 2010, 2011) (valid until 2015).

- An installation for the production of continuously cast copper wire rod at Cedynia: Integrated Permit No. PZ 45/2006 (valid until 2016).
- The Żelazny Most tailings management facility (incorporating the requirements of the EU Mine Waste Directive): Integrated Permit No. PZ 200/2012 (valid until 2022).
- An installation at the Polkowice concentrator for the neutralization of waste sulphuric acid generated at the smelters: Integrated Permit No. PZ 52.1/2012 (valid until 2016).

Some of these facilities also have separate additional permits covering specific activities, including:

- Glogów smelter: permit to discharge waste water into the sewage system (valid until 2014).
- Glogów smelter: permit to emit greenhouse gases (valid until 2020).
- Legnica smelter: permit to emit greenhouse gases (valid until 2020).
- Legnica smelter: permit for water usage (valid until 2014).
- Cedynia wire rod plant: three permits for water abstraction (valid until 2014, 2027 and 2030).

Other facilities deemed less sensitive environmentally operate under separate permits relating to waste, water and air. The current status of these permits is as follows:

Lubin Mine

- Permit DM-S.IV.7651-14/10 for the emission of dust and gases (valid until 2020).
- Permit DM-S.KB.7664-51/348 for the production of waste (valid until 2018).
- Permit SR.1e.I.6811 for the abstraction and use of groundwater (valid until 2013).

Polkowice-Sieroszowice Mine

- Permit DOW-S.VI.7321-12/11 for the emission of dust and gases (valid until 2020).
- Permit SR.III.6620-45/04 for the production of waste (valid until 2014).
- Permit SR.1e.I.6811 for the abstraction and use of groundwater (valid until 2013).
- Permit SR.IV.6621-3/2 for the use and eventual closure of the waste rock dump (valid until 2020).

Rudna Mine

- Permit S.LS.7661-10/167 for the emission of dust and gases (as amended) (valid until 2019).
- Permit DOW-S.V.7221 for the production of waste (valid until 2022).
- Permit SR.1e.I.6811 for the abstraction and use of groundwater (valid until 2013).

In 2010, KGHM completed the process of registering seven products under the REACH regulations: copper, silver, lead, copper sulphate, nickel sulphate, furnace slag and sulphuric acid.

As part of the regulatory control system, KGHM pays environmental fees based on the quantity and quality of discharges, emissions and waste disposal. In 2011, these fees amounted to PLN 25.5 million (approximately USD 8 million). This represented a reduction of some approximately PLN 1 million from the fees paid in 2010 (despite the unit rates being increased annually in line with inflation) and reflected a series of on-going environmental improvements implemented by KGHM. The largest part of the fee payments relates to the discharge of excess water from the Żelazny Most tailings management facility.

20.3 ENVIRONMENTAL AND OCCUPATIONAL HEALTH AND SAFETY MANAGEMENT

In recent years, KGHM has progressively developed and implemented a series of management systems. Initially, each division developed a separate system for quality management, occupational health and safety management and environmental management. More recently, KGHM has acted to combine these different systems into a single Integrated Management System.

Currently, all of the metallurgical divisions of KGHM operate in accordance with an externally certified Integrated Management System that encompasses quality management and environmental and occupational health and safety management, in accordance with the requirements of PN-EN ISO 9001, PN-EN ISO 14001 and PN-N 18001. A Safety and Hygiene at Work System also operates in the Legnica and Glogów smelters and complies with the requirements of OHSAS 18001 and PN-N 18001.

The Żelazny Most tailings management facility continues to be managed under the provisions of a separate Environmental Management System (EMS) and Occupational Health and Safety Management System (OHSMS), both externally certified under PN-EN ISO 14001 and PN-N 18001, respectively.

Separate occupational health and safety management systems complying with the requirements of PN-N 18001 also operate in each of the mining divisions.

The OHSMS incorporate risk identification, assessment and analysis; risk management; continuous staff training (in 2011, safety training accounted for 47,000 working hours); loss evaluation, and actual and potential accident recording and investigation.

KGHM also maintains a dedicated Emergency Rescue Unit (ERU) with a permanent staff of 114, supplemented as required by a further 400 other employees trained to assist in certain roles. The ERU is divided into three units: two units specialize in fire-fighting and incidents involving hazardous chemicals, while the third specializes in underground rescue. KGHM's ERU has attained an international reputation and members have been dispatched to assist in international emergency response programs, following natural disasters such as earthquakes, in a number of countries worldwide. The ERU has a certified safety management system complying with PN-N 18001 with regard to conducting underwater operations underground.

20.4 KEY ELEMENTS OF ENVIRONMENTAL MANAGEMENT

20.4.1 Tailings Management

The Żelazny Most tailings storage facility has been described in Section 17.5. Environmental management of the facility includes:

- Disposal of tailings, management of supernatant water, and ensuring the stability and security of the facility.
- Operation of a peripheral interception ditch, which collects an estimated 80% of seepage from the facility. This seepage is returned to the tailings impoundment.
- Operation of a water treatment plant to remove suspended solids from excess supernatant water prior to discharge to the Odra river.
- The use of water sprays and bitumen emulsion to control dust blow from exposed tailings beaches.

KGHM also has responsibility for monitoring of the closed Gilów tailings management facility, which received tailings from the Lubin process plant and operated from 1968 to 1980.

20.4.2 Smelter Wastes

Wastes from the operation of the smelters are managed as follows:

- 1 Mt/y of copper furnace slag is re-used for road building.
- Granulated slag from the Glogów II smelter is used for backfill underground.
- Lead-bearing dusts are re-processed to produce a saleable lead product.

- Calcium sulphate from the flue-gas desulphurization is used in the metallurgical processes, and the remainder is stored.

20.4.3 Waste Rock

The impact of mining operations on the surface is reduced by leaving the waste rock, which originates principally from development work, at its point of generation underground, for use as backfill in excavated areas and to form the foundation for retaining structures. Some waste rock from the sinking of new shafts is stored in the waste rock storage facility at the Polkowice-Sieroszowice mine.

20.4.4 Water Management

All mine water pumped from underground is used as process water in the concentrators and is then delivered to the Żelazny Most tailings facility with the process tailings. In 2011, some 31 Mm^3 were pumped from the three mines. Mine water quality is generally good, although the water has a high salinity related to the character of the ore being mined. In 2011, a total of 137 Mm^3 of water was recycled from the tailings storage facility to the concentrators.

Excess supernatant water from Żelazny Most is discharged directly to the Odra river if the total suspended solids are less than 35 mg/L. If the total suspended solids are 35 mg/L or higher, the supernatant is clarified in a dedicated water treatment plant, prior to being discharged to the river. In 2011, the total discharged volume amounted to some 21 Mm^3. Apart from a high salinity (12 to 13.3 g/L chlorides), the quality of the discharge water is generally good. The discharge rate is carefully managed to ensure adequate dilution of the high salinity water.

Abstraction from surface water is the primary source of process water for the three smelters. In 2011, this amounted to a total of 8 Mm^3.

Water treatment plants at the three smelters have been progressively upgraded over the last 20 years, most recently in 2010-2011, to meet the requirements of the Integrated Environmental Permits. Operation of these plants was moved into a separate company of the KGHM group (Energetyka) in 2005. Concentrations of heavy metals, chlorides and suspended solids in the discharges currently meet stringent EU and national standards.

20.4.5 Air Quality Management

Historically, emissions of sulphur dioxide, lead and other heavy metals from the smelters have been a significant issue for human health, both in the workplace and in the surrounding communities. However, a major program of emission controls has been implemented since 1990, and KGHM has developed effective controls for all gaseous and particulate emissions from the smelters. Since 1980, emissions of sulphur dioxide have been reduced by 96% and emissions of copper, lead and carbon monoxide by over 99%. Emissions now conform to stringent EU and national emission standards.

The principal source of emissions from the mining operations is from the ventilation shafts (dust and gaseous emissions) and these emissions are carefully controlled. Emissions of odour-causing compounds have given rise to concerns at the community in the vicinity of the Polkowice-Sieroszowice mine. KGHM is currently conducting investigations to evaluate the source of these odours, prior to identifying the most appropriate control measures.

Dust blow from the surface of the tailings management facility is controlled by irrigation and the application of bitumen emulsion from the ground and air.

20.4.6 Energy Usage

As a major energy consumer, KGHM has invested heavily in energy efficiency in recent years. By 2011, total energy consumption had been reduced by 42% from its peak. KGHM currently has further energy related initiatives, including renewable energy production (wind-power and biogas) and shale gas exploration.

20.4.7 Subsidence

Subsidence in certain areas associated with underground mines is a long-standing concern impacting on both buildings and land use, with a maximum recorded displacement at surface of approximately 3.5 m. In 2011, KGHM spent a total of PLN 7.4 million (USD 2.5 million) on the repair of and compensation for subsidence related claims and on prevention-related activities.

20.4.8 Closure and Decommissioning

KGHM has estimated both the timing and the cost of eventual closure and decommissioning for all of its facilities, as described previously in Section 4.4.

KGHM maintains a Mine Closure Fund which was introduced as a requirement of the 1994 Geology and Mining Act (now updated as the 2011 Geology and Mining Act). By law, an amount equivalent to 5% of the depreciated value of the fixed assets of each division is transferred to the fund each year. At 30 June, 2012 this fund amounted to some PLN 153 million (USD 47 million).

In the relatively near future, the fund will be utilized to support closure and rehabilitation of the following facilities:

- Piaskownia Obora, a small sand pit used to generate material for backfill and for building the embankment of the Żelazny Most facility. Worked-out areas are already subject to progressive restoration.

- The waste rock storage facility associated with the Polkowice-Sieroszowice mine.

- The R-6 shaft at the Rudna mine.

20.5 OCCUPATIONAL HEALTH AND SAFETY PERFORMANCE

The accident statistics for 2011 are summarized in Table 20.1. Accident classification is undertaken according to the Polish system, which defines accidents as follows:

- Fatalities: an accident at the place of work resulting in the death of the victim within a maximum of 6 months after the incident occurred.

- Serious accidents: an accident at the place of work that results in serious bodily harm, (loss of sight, hearing, speech, fertility), or which results in other bodily harm or in health-related problems, disrupting primary bodily functions, as well as which results in incurable and life-threatening diseases, permanent mental illness, a permanent, total or significant inability to work in the profession or in a permanent significant disfigurement or distortion of the body.

- Light accidents: all recorded accidents not considered as serious.

This system of accident classification differs somewhat from international norms. In particular, the recorded accidents do not include a number of minor accidents of the type usually recorded, as illustrated by the high number of lost working days per accident (at over 50 days, despite more than 99% of accidents being classified as "light").

Table 20.1
Recorded Accidents (2011)

Divisions	Recorded Accidents				Number of Lost Days per Accident	Number of Accidents per 1,000 Employees
	Fatal	Serious	Light	Total		
Mines	2	4	385	391	55.5	31
Smelters	0	0	55	55	55.9	10
Other	0	0	21	21	42.5	10
Total	**2**	**4**	**461**	**467**	**54.9**	**25**

Most fatalities and serious accidents are associated with the underground operations and often reflect the incidence of rock bursts. The trend in recorded accidents, however, is one of steady improvement (Table 20.2), with the number of recorded accidents per 1,000 employees declining from 35 in 2007 to 25 in 2011. (The comparable figures for the 1990s gave accident rates of over 40 per 1,000 employees).

Table 20.2
Recorded Accidents 2007 - 2011

Year	Total	Fatalities	Total per 1,000 employees
2007	629	6	35
2008	614	4	33
2009	569	2	31
2010	556	10	30
2011	467	2	25

KGHM maintains a comprehensive health monitoring program for employees. The total number of cases of industrial disease recorded is as follows:

- 2007: 18
- 2008: 17
- 2009: 18
- 2010: 6
- 2011: 9

The principal categories of industrial disease recorded over the period 2007 to 2011 include respiratory diseases (55%) and hearing loss (32%).

20.6 SOCIAL ISSUES AND COMMUNITY RELATIONS

In 2003, KGHM established the Polish Copper Foundation as a vehicle for the coordinated management of all charitable activities. The initiative stemmed from the active social policy of KGHM which, since the beginning of the copper industry in Lower Silesia, has supported numerous regional and national projects. Between 2003 and 2011, the Foundation spent a total of some PLN 90 million (USD 27 million) on 1,385 separate community projects.

In 2010 and 2011, the Polish Copper Foundation spent over PLN 22.6 million (USD 7 million) on 717 projects conducted by institutions of social benefit, including, among others, health care (PLN 6.2 million), sports (PLN 2.8 million), arts (PLN 1.9 million) and environment (PLN 1.2 million). The Foundation also provides donations to individuals to subsidize the cost of treatment, rehabilitation, or purchase of orthopaedic rehabilitation equipment. In 2010 and 2011, 2,925 donations were made, amounting to nearly PLN 7 million. The focus of the Foundation is communities in the immediate vicinity of the operations, but the Foundation also supports projects across Lower Silesia and, occasionally, elsewhere in Poland.

Due to the nature of its activities, KGHM considers itself to be especially responsible for the region in which it conducts its operations. Thus, one of the priority objectives of the Foundation, and one of the pillars of KGHM's corporate social responsibility, is health care. An example of a health-related and pro-ecological project is the Health Promotion and Environmental Risk Prevention Program launched in 2011, as a joint initiative with local medical facilities. The initiative focuses on child health and, in particular, lead-related health issues. As part of this program, the Polish Copper Foundation subsidizes children's trips to green schools and year-round activities at the pool, with swimming lessons. In addition, funds are provided for construction of sports and recreational facilities, including sports fields and playgrounds.

KGHM publishes a report on its Corporate Social Responsibility activities on its website (www.kghm.pl).

21.0 CAPITAL AND OPERATING COSTS

21.1 CAPITAL EXPENDITURES

KGHM incurs substantial annual capital expenditures for mine development and shaft sinking, for upgrading and modernizing its system and facilities, and for replacing obsolete or worn-out equipment.

21.1.1 Actual Capital Expenditures, 2007 to 2011

KGHM's actual capital expenditures for the five-year period 2007 to 2011 are summarized in Table 21.1. These expenditures were reported in PLN and have been converted to USD at the historical exchange rates shown previously in Table 2.1.

Table 21.1
KGHM Capital Expenditures, 2007 - 2011

	2007	2008	2009	2010	2011
Capital Expenditure (million PLN)	828.1	1,139.9	1,069.8	1,263.0	1,513.9
Exchange Rate (PLN/USD)	2.77	2.41	3.12	3.02	2.96
Capital Expenditure (million USD)	299.0	473.0	342.9	418.2	511.5

Capital expenditures over the last five years have averaged approximately USD 400 million per year. The principal areas of expenditure were on-going mine development, sinking of the SW-4 shaft, mining equipment replacement and modernization, and modernization of the Glogów smelter.

21.1.2 Forecast Capital Expenditures, 2012 to 2016

KGHM's preliminary forecast is that capital expenditures over the five-year period 2012 to 2016 are likely to be somewhat higher than those of the previous five years, and may average as much as USD 600 million per year. The principal areas of expenditure are expected to be on-going mine development, continued replacement and modernization of mining equipment, sinking of the GG-1 shaft and completion of the Smelter Modernization Project.

21.2 OPERATING COSTS

21.2.1 Actual Operating Costs, 2007 to 2011

KGHM's actual cash operating costs for mining, over the five-year period 2007 to 2011, are summarized in Table 21.2. These costs have been converted from PLN to USD at the historical exchange rates shown previously in Table 2.1. On an annual basis over the past five years, average mining costs have ranged between approximately USD 34.75 and USD 44.75/t of ore mined, with an overall average of approximately USD 39.75/t.

Table 21.2
KGHM Mine Operating Costs, 2007 - 2011

Operation	Units	2007	2008	2009	2010	2011
Lubin Mine						
Total Operating Cost	million USD	254.3	315.6	253.6	282.4	313.4
Tonnes Mined	Mt	7.12	6.89	7.15	7.16	7.16
Unit Operating Cost	USD/t mined	35.70	45.82	35.48	39.43	42.45
Polkowice-Sieroszowice Mine						
Total Operating Cost	million USD	389.4	509.8	398.7	439.3	500.9
Tonnes Mined	Mt	10.70	10.41	10.37	10.37	10.73
Unit Operating Cost	USD/t mined	36.38	49.98	38.44	42.37	46.70
Rudna Mine						
Total Operating Cost	million USD	408.0	495.0	409.1	446.1	489.9
Tonnes Mined	Mt	12.44	12.12	12.21	11.77	11.74
Unit Operating Cost	USD/t mined	32.81	40.84	33.51	37.90	41.73
Total Mining						
Total Operating Cost	million USD	1,051.7	1,320.4	1,061.5	1,167.9	1,298.6
Tonnes Mined	Mt	30.26	29.82	29.73	29.30	29.72
Unit Operating Cost	USD/t mined	34.75	44.89	35.70	39.85	43.70
Unit Operating Cost	USD/t processed	34.77	44.73	35.76	39.96	43.60

Actual cash costs for processing and general and administration over the last five years are summarized in Table 21.3.

Table 21.3
KGHM Process and General and Administration Operating Costs, 2007 - 2011

	Units	2007	2008	2009	2010	2011
Total Processing						
Total Operating Cost	million USD	248.4	284.1	215.8	225.7	249.6
Tonnes Processed	Mt	30.25	29.52	29.68	29.23	29.78
Unit Operating Cost	USD/t processed	8.21	9.62	7.27	7.72	8.38
General and Administration						
Total Operating Cost	million USD	70.7	72.4	71.4	69.2	117.8
Tonnes Processed	Mt	30.25	29.52	29.68	29.23	29.78
Unit Operating Cost	USD/t processed	2.34	2.45	2.41	2.37	3.96

On an annual basis, over the period 2007 to 2011, process operating costs have ranged between approximately USD 7.25 and USD 9.60/t of ore processed, with an overall average of approximately USD 8.25/t. General and administration costs have ranged between approximately USD 2.35 and USD 4.00/t processed, with an overall average of approximately USD 2.70/t.

Since KGHM's smelters and refineries treat purchased feedstocks in addition to KGHM's own concentrate, it is difficult to segregate the operating cost of smelting and refining of

KGHM concentrate. For this reason, smelting and refining costs have been evaluated herein under the following normal commercial terms:

- Payable copper : 96%.
- Payable silver : 95%.
- Smelting charge : USD 75.00/t concentrate.
- Copper refining charge : USD 0.075/lb.
- Silver refining charge : USD 0.50/oz.

KGHM's costs of smelting and refining over the period 2007 to 2011, under the above commercial smelter terms, are summarized in Table 21.4.

Table 21.4
KGHM Smelting and Refining Costs, 2007 - 2011
(based on current commercial terms)

	Units	2007	2008	2009	2010	2011
Concentrate Produced	Mt	1.875	1.866	1.929	1.841	1.875
Contained Copper	Mlb	996.7	946.5	965.5	937.4	941.4
Contained Silver	Moz	38.6	37.3	38.8	38.0	37.5
Payable Copper (96%)	Mlb	956.8	908.6	926.9	899.9	903.7
Payable Silver (95%)	Moz	36.7	35.4	36.8	36.1	35.6
Smelting and Refining Cost (USD 75/t)	million USD	140.6	140.0	144.7	138.1	140.6
Copper Refining (USD 0.075/lb)	million USD	71.8	68.2	69.5	67.5	67.8
Silver Refining USD 0.50/oz)	million USD	18.4	17.7	18.4	18.0	17.8
Total Smelting and Refining Cost	**million USD**	**230.8**	**225.9**	**232.6**	**223.6**	**226.2**
Ore Processed	Mt	30.25	29.52	29.68	29.23	29.78
Unit Smelting and Refining Costs	**USD/t processed**	**7.63**	**7.65**	**7.84**	**7.65**	**7.60**

Under current commercial terms, KGHM's cost of smelting and refining over the last five years would have been equivalent to approximately USD 7.65/t of ore processed.

KGHM's total cash operating costs over the last five years are summarized in Table 21.5.

Table 21.5
KGHM Total Cash Operating Costs, 2007 - 2011

Operation	Unit Operating Cost (USD/t processed)				
	2007	2008	2009	2010	2011
Mining	34.77	44.73	35.76	39.96	43.60
Processing	8.21	9.62	7.27	7.72	8.38
Smelting and Refining	7.63	7.65	7.84	7.65	7.60
General and Administration	2.34	2.45	2.41	2.37	3.96
Total	**52.95**	**64.45**	**53.28**	**57.70**	**63.54**

21.2.2 Outlook for Operating Costs

KGHM's operating budget for 2012 is summarized in Table 21.6. Also shown is a comparison between budgeted and actual performance for the first six months of 2012. Smelting and refining costs are again evaluated under current commercial terms. Data reported in PLN have been converted to USD at an exchange rate of USD 1 = PLN 3.3.

Table 21.6
KGHM Budgeted Operating Cost, 2012, and Comparison of Budgeted and Actual Operating Costs for First Six Months, 2012

Operation	Unit Operating Cost (USD/t Processed)		
	2012 Budget	First Half, 2012	
		Budget	Actual
Mining	42.07	41.62	40.82
Processing	8.17	8.16	8.00[1]
Smelting and Refining	7.54	7.64	7.51
General and Administration	4.17	3.89	3.80
Total	**61.95**	**61.31**	**60.13**

[1] Reported actual processing cost includes copper and silver extraction taxes. These have been excluded from the processing cost of USD 8/t included in this table. The cost of USD 8/t is approximately only.

During the first six months of 2012, 15.2 Mt of ore were mined and processed, compared to a budget of 15.0 Mt. Total direct operating costs, including calculated costs for smelting and refining, were approximately USD 60/t, compared to a budget of approximately $61.30/t. In light of the performance in the first half of the year, it is Micon's opinion that KGHM's production and cost budget for all of 2012 is reasonable and attainable.

KGHM incurs its operating costs in PLN. Thus, in future years, those costs, when expressed in USD, will fluctuate with variations in the exchange rate between PLN and USD. KGHM's budget for mining, processing, and general and administrative costs for 2012, expressed in PLN, is summarized in Table 21.7, together with actual and budgeted costs for the first half of the year.

Table 21.7
KGHM Operating Costs for 2012, Expressed in PLN

Operation	Unit Operating Cost (PLN/t Processed)		
	2012 Budget	First Half, 2012	
		Budget	Actual
Mining	138.8	137.3	134.7
Processing	27.0	26.9	26.4
General and Administration	13.8	12.8	12.5
Total	**179.6**	**177.0**	**173.6**

It is Micon's opinion that, over the five-year period 2012 to 2016, KGHM's direct cash operating costs, expressed in constant zlotys of 2012 value, and excluding smelting and refining charges, are likely to range between PLN 180 and PLN 190/t of ore processed. The financial analysis discussed in Section 22 is based on a cost of PLN 180/t for 2012, increasing linearly to PLN 188/t in 2016, in order to reflect modest increases in the costs associated with ventilation of the underground workings.

22.0 ECONOMIC ANALYSIS

22.1 PROFITABILITY, 2007 TO 2011

Overall indices of KGHM's consolidated profitability over the five-year period 2007 to 2011 are summarized in Table 22.1. Data reported in PLN have been converted to USD at the historical exchange ratios shown previously in Table 2.1.

Table 22.1
KGHM Profitability Indices, 2007 - 2011

Index	Units	2007	2008	2009	2010	2011
Exchange Rate	PLN/USD	2.77	2.41	3.12	3.02	2.96
Gross Sales	million PLN	12,183	11,303	11,061	15,945	20,097
	million USD	4,398	4,690	3,545	5,280	6,790
Net Profit after Tax	million PLN	3,799	2,920	2,540	4,569	11,335
	million USD	1,371	1,211	814	1,513	3,829
Earnings per Share	PLN/share	18.99	14.60	12.70	22.84	56.67
	USD/share	6.86	6.06	4.07	7.56	19.15
Return on Assets	%	30.6	21.0	18.2	23.0	38.7
Return on Equity	%	42.4	27.6	24.4	31.6	49.0

Source: KGHM website.

It is clear that KGHM has been highly profitable over the last five years, with net earnings after tax typically well in excess of USD one billion per year.

22.2 PRE-TAX CASH FLOW FROM OPERATIONS, 2007 TO 2011

Based on the production and cost data discussed in prior sections of this report, combined with average metal prices as reported by KGHM, Micon has computed the approximate pre-tax cash flows generated by KGHM's mining and processing operations in the Legnica-Glogów Copper Belt for each of the last five years, as shown in Table 22.2.

Despite incurring substantial capital expenditures, KGHM's mining and processing operations generated pre-tax cash flows averaging approximately USD 1.5 billion per year, over the five-year period 2007 to 2011. KGHM's smelters and refineries, and the rolling mill, also contributed to KGHM's overall cash flow, but those contributions, and the revenues obtained from the sale of by-products, are not included in Table 22.2.

Table 22.2
KGHM Pre-Tax Cash Flow from Operations, 2007 - 2011

	Units	Source	2007	2008	2009	2010	2011
PRODUCTION							
Ore Mined	Mt	Table 6.3	30.26	29.42	29.73	29.30	29.72
Ore Processed	Mt	Table 6.4	30.25	29.52	29.68	29.23	29.78
Concentrate Produced	Mt	Table 6.4	1.875	1.866	1.929	1.841	1.875
Contained Copper	Mlb	Table 6.4	996.7	946.5	965.5	937.4	941.4
Contained Silver	Moz	Table 6.4	38.6	37.3	38.8	38.0	37.5
Payable Copper	Mlb	96%	956.8	908.6	926.9	899.9	903.7
Payable Silver	Moz	95%	36.7	35.4	36.9	36.1	35.6
METAL PRICES							
Copper	USD/lb	KGHM	3.23	3.15	2.34	3.42	4.00
Silver	USD/oz	KGHM	13.38	14.99	14.67	20.19	35.12
REVENUE AND EXPENDITURE							
Sales Revenue - Copper	million USD		3,091	2,862	2,169	3,078	3,615
Sales Revenue - Silver	million USD		491	531	541	729	1,251
Total Sales Revenue	**million USD**		**3,581**	**3,393**	**2,710**	**3,807**	**4,866**
Mining Cost	million USD	Table 21.2	1,052	1,320	1,062	1,168	1,299
Processing Cost	million USD	Table 21.3	248	284	216	226	250
Smelting and Refining	million USD	Table 21.4	231	226	233	224	226
General and Administration	million USD	Table 21.3	71	72	71	69	118
Total Cash Operating Cost	**million USD**		**1,602**	**1,903**	**1,581**	**1,686**	**1,892**
Unit Cash Operating Cost	USD/t		52.95	64.46	53.28	57.69	63.54
Cash Operating Profit	**million USD**		**1,980**	**1,491**	**1,128**	**2,120**	**2,974**
Capital Expenditure	million USD	Table 21.1	299	473	343	418	512
PRE-TAX CASH FLOW	**million USD**		**1,681**	**1,018**	**785**	**1,702**	**2,462**

22.3 ECONOMIC OUTLOOK, 2012 TO 2016

Micon's projection of the pre-tax cash flows to be generated by KGHM's mining and processing operations in the Legnica-Glogów Copper Belt, over the five-year period 2012 to 2016, is summarized in Table 22.3. The projection is based on the general consensus among analysts that copper and silver prices are likely to soften over the next five years. The copper prices adopted in Table 22.3 decrease from USD 3.50/lb in 2012 to USD 3.00/lb in 2015, while the silver prices decrease from USD 33/oz in 2012 to USD 25/oz in 2015.

The exchange rates used in Table 22.3 for converting mining, processing, and general and administrative costs from PLN to USD for the years 2013 to 2016 reflect the median of the forecasts published by a number of financial institutions, and are shown below. For 2012, the actual exchange rate of PLN 3.26 = USD 1 has been used.

Year	Exchange Rate (PLN/USD)
2013	3.21
2014	3.15
2015	2.87
2016	2.87

In recent years, there has been a strong correlation between the price of copper and the exchange rate between PLN and USD. The PLN has tended to strengthen against the USD when copper prices are high and has weakened when copper prices are low. The financial forecasts shown in Table 22.3 are based on decreasing copper prices between 2012 and 2016, suggesting that the PLN should weaken against the USD over this period. The consensus forecasts of exchange rates used in Table 22.3, however, indicate a progressive strengthening of the PLN, which has the effect of reducing KGHM's operating cash flows, when these are expressed in USD. Given the demonstrated correlation between the copper price and the exchange rate, it is Micon's opinion that the cash flow forecasts shown in Table 22.3 are likely to prove highly conservative.

Smelting and refining costs in Table 22.3 have been calculated directly in USD, using the commercial terms described in Section 21.2.1.

Table 22.3
KGHM Projected Pre-Tax Cash Flow from Operations, 2012 - 2016

	Units	Source	2012	2013	2014	2015	2016
PRODUCTION							
Ore Mined	Mt	Table 16.10	29.94	29.63	29.61	29.76	29.60
Ore Processed	Mt	Table 17.6	29.88	29.63	29.61	29.76	29.60
Concentrate Produced	Mt	Table 17.6	1.858	1.826	1.817	1.825	1.855
Contained Copper	Mlb	Table 17.6	932.0	915.0	913.0	917.3	928.1
Contained Silver	Moz	Table 17.6	36.1	33.2	32.4	33.5	35.3
Payable Copper	Mlb	96%	894.7	878.4	876.5	880.6	891.0
Payable Silver	Moz	95%	34.3	31.5	30.8	31.8	33.5
METAL PRICES							
Copper	USD/lb	Micon	3.50	3.25	3.25	3.00	3.00
Silver	USD/oz	Micon	33.00	30.00	27.50	25.00	25.00
REVENUE AND EXPENDITURE							
Sales Revenue - Copper	million USD		3,132	2,855	2,849	2,642	2,673
Sales Revenue - Silver	million USD		1,132	946	846	796	838
Total Sales Revenue	**million USD**		**4,263**	**3,801**	**3,695**	**3,437**	**3,511**
Mining Cost	million USD		1,274	1,302	1,344	1,504	1,516
Processing Cost	million USD		247	249	254	280	278
Smelting and Refining Cost	million USD		224	219	217	219	223
General and Administration Cost	million USD		128	129	132	145	144
Total Cash Operating Cost	**million USD**		**1,873**	**1,899**	**1,947**	**2,148**	**2,162**
Unit Cash Operating Cost	USD/t		62.70	64.08	65.75	72.16	73.03
Cash Operating Profit	**million USD**		**2,390**	**1,902**	**1,748**	**1,290**	**1,350**
Copper Extraction Tax	million USD		346	426	416	318	322
Silver Extraction Tax	million USD		132	154	131	115	121
Capital Expenditure	million USD		630	950	700	500	300
Extraction Tax as % of Operating Profit	%		20.0	30.5	31.3	33.6	32.8
PRE-TAX CASH FLOW	**million USD**		**1,282**	**372**	**501**	**357**	**606**

Table 22.4
Supporting Schedules for Table 22.3

	Units	Source	2012	2013	2014	2015	2016
Operating Costs (Conversion from PLN to USD)							
Mining Cost	PLN/t		139	141	143	145	147
Processing Cost	PLN/t		27	27	27	27	27
General and Administration Cost	PLN/t		14	14	14	14	14
Exchange Rate	PLN/USD		3.26	3.21	3.15	2.87	2.87
Mining Cost	USD/t		42.6	43.9	45.4	50.5	51.2
Processing Cost	USD/t		8.3	8.4	8.6	9.4	9.4
General and Administration Cost	USD/t		4.3	4.4	4.4	4.9	4.9
Smelting and Refining Cost							
Smelting	million USD	USD 75/t conc.	139	137	136	137	139
Copper Refining	million USD	USD 0.075/lb	67	66	66	66	67
Silver Refining	million USD	USD 0.5/oz	17	16	15	16	17
Total Smelting and Refining Cost	million USD		**224**	**219**	**217**	**219**	**223**
Schedule of Copper Extraction Tax							
Copper in Concentrate	Mt		0.423	0.415	0.414	0.416	0.421
Copper Price	USD/t		7,716	7,165	7,165	6,614	6,614
Exchange Rate	PLN/USD		3.26	3.21	3.15	2.87	2.87
Copper Price	PLN/t		25,154	22,999	22,570	18,982	18,982
Tax Rate - First Tier	PLN/t		830	759	745	626	626
Tax Rate - Second Tier	PLN/t		3,174	2,537	2,420	1,570	1,570
Copper Tax Payable	million PLN		1,128	1,368	1,311	914	925
Copper Tax Payable	million USD		346	426	416	318	322
Schedule of Silver Extraction Tax							
Silver in Concentrate	Mkg		1.123	1.033	1.008	1.042	1.098
Silver Price	USD/kg		1,061	965	884	804	804
Silver Price	PLN/kg		3,459	3,096	2,785	2,307	2,307
Tax Rate - First Tier	PLN/kg		432	387	348	288	288
Tax Rate - Second Tier	PLN/kg		143	92	60	28	28
Silver Tax Payable	million PLN		431	495	411	330	348
Silver Tax Payable	million USD		132	154	131	115	121

Note: The copper and silver extraction taxes were introduced in April, 2012. For the year 2012, these taxes have been calculated on two-thirds of the total copper and silver production.

Two things are evident from Table 22.3:

- The effect of the extraction taxes is significant. On the basis of Micon's calculation, these taxes will amount to approximately 30% of the operating cash flow from KGHM's mining and processing operations, from 2013 onwards.

- Even with the combined effect of the extraction taxes, the forecast reductions in metal prices and the forecast strengthening of the PLN, KGHM's operations in the Legnica-Glogów Copper Belt are expected to remain highly profitable over the next five years, with average pre-tax cash flows of more than USD 450 million per year from 2013 to 2016.

The profitability of KGHM's operations is more sensitive to changes in copper and silver prices than it is to changes in any other factor. Table 22.5 summarizes the results of a sensitivity analysis, computing the forecast pre-tax cash flows of KGHM's mining and processing operations under a range of future metal prices. The cash flows under each price series are calculated over the four-year period 2013 to 2016. The reported cash flows do not include profits from KGHM's smelters, refineries and the rolling mill, nor do they include revenues obtained from the sale of by-products.

Table 22.5
Sensitivity of Pre-Tax Cash Flow to Variations in Metal Price

		Units	Metal Price Series			
			High	**Base**	**Low**	**Break-Even**
Copper Price	- 2012	USD/lb	3.50	**3.50**	3.50	3.50
	- 2013	USD/lb	3.50	**3.25**	3.00	2.50
	- 2014	USD/lb	3.50	**3.25**	3.00	2.50
	- 2015	USD/lb	3.50	**3.00**	3.00	2.50
	- 2016	USD/lb	3.50	**3.00**	3.00	2.50
Silver Price	- 2012	USD/oz	33.00	**33.00**	33.00	33.00
	- 2013	USD/oz	33.00	**30.00**	25.00	20.00
	- 2014	USD/oz	33.00	**27.50**	25.00	20.00
	- 2015	USD/oz	33.00	**25.00**	25.00	20.00
	- 2016	USD/oz	33.00	**25.00**	25.00	20.00
Total Pre-Tax Cash Flow, 2013 - 2016		million USD	3,374	**1,836**	1,348	(5.9)
Average Annual Pre-Tax Cash Flow		million USD/y	844	**459**	337	(130)

This analysis suggests that, after allowing for the forecast capital expenditure program which totals approximately USD 2.5 billion over the period 2013 to 2016, KGHM's mining and processing operations maintain essentially a cash break-even position at metal prices as low as USD 2.50/lb for copper and USD 20/oz for silver, without allowing for profits from the smelters, refineries and the rolling mill, or for revenues obtained from the sale of by-products.

23.0 ADJACENT PROPERTIES

The following properties and areas, the locations of which have been shown previously in Figure 4.2, adjoin KGHM's mining concessions in the Legnica-Glogów Copper Belt:

- The Radwanice and Gaworzyce properties, on which KGHM holds exploration licenses, lie immediately to the northwest of the Sieroszowice mining concession.
- The Bytom Odrzański, Glogów and Retków areas, on which copper mineralization is known to occur, lie immediately to the northeast of the Sieroszowice and Rudna mining concessions. KGHM may apply for exploration licenses in these areas in the future.

There are no other adjacent properties which have any bearing on KGHM's operations in the Legnica-Glogów Copper Belt area.

24.0 OTHER RELEVANT DATA AND INFORMATION

All data and information relevant to KGHM's operations in the Legnica-Glogów Copper Belt area have been provided in other Sections of this report.

25.0 INTERPRETATION AND CONCLUSIONS

KGHM, which has been operating in the Legnica-Glogów Copper Belt area continuously since 1961, is a major mining, smelting and refining company, and one of the world's leading producers of electrolytic copper and refined silver. Micon inspected all of KGHM's mining, processing, smelting and refining facilities, and the copper rolling mill, and found them to be operating efficiently, with a uniformly high standard of housekeeping. KGHM also maintains a high standard of environmental awareness and responsibility.

Micon has reviewed the procedures used by KGHM to estimate Mining Reserves under the Polish system of classification. In Micon's opinion, the Mining Reserves as estimated by KGHM qualify as Proven and Probable Mineral Reserves under the CIM standards and definitions. KGHM's Mineral Reserves in the Legnica-Glogów Copper Belt area, at 31 December, 2011, are summarized in Table 25.1.

Table 25.1
KGHM's Mineral Reserves at 31 December, 2011

Category	Tonnes (millions)	Grade		Contained Metal	
		Copper (%)	Silver (g/t)	Copper (Mt)	Silver (Moz)
Proven	456.0	1.49	45	6.80	657.1
Probable	725.0	1.63	49	11.82	1,148.1
Total	**1,181.1**	**1.58**	**48**	**18.62**	**1,805.2**

In Micon's opinion, the Proven and Probable Mineral Reserves contained within KGHM's mining concessions, as of 31 December, 2011, amounted to 1,181 Mt at grades of approximately 1.58% Cu and 48 g/t Ag, containing 18.6 Mt of copper and 1,800 Moz of silver. These Mineral Reserves include allowances for both mining losses and dilution, but do not include an allowance for metallurgical recovery. The Mineral Reserves are sufficient to maintain the current production rate of about 30 Mt/y for 30 to 40 years.

Micon is not aware of any environmental, permitting, legal, title, taxation, marketing, political or technical factors which would adversely affect the economic extraction of these Mineral Reserves.

The principal technical challenges faced by KGHM's operations relate to seismicity and rock temperature in the underground mines. These mines operate at depths of 600 to 1,250 m below surface and experience rock burst phenomena. It is KGHM's opinion, with which Micon agrees, that tectonic movement on faults in the strata above the mining horizon are more influential in causing rock bursts, than are mining induced stress concentrations.

Conceptually, it would seem feasible to use a more positive backfill system than the current hydraulic sandfill system, in order to reduce closure of the mined voids and, hence, deformation of the overlying strata, which in turn may reduce tectonic movements and rock burst hazards. KGHM reports that trials are in progress to use paste fill from thickened tailings. KGHM also reports that there is no consideration for the use of cement. However, any fill system which limits roof closure should also reduce the risk of rock bursts and Micon endorses KGHM's investigation of the use of paste backfill.

KGHM's mines operate in an area of severe geothermal gradient. It was reported that the virgin rock temperature at the Rudna mine is 35°C at 850 m below surface and is 46°C at 1,200 m. This computes to an average geothermal gradient of 1°C per 32 m. It is understood that the average geothermal gradient is similar over all three KGHM mines.

Historically, KGHM controlled the underground ambient air temperature by circulating very large volumes of ventilation air through the workings. As mining proceeded to greater depths at Rudna and Polkowice-Sieroszowice, however, ventilation with ambient air was insufficient to maintain underground working temperatures within the regulatory limits. Accordingly, in 2005, KGHM commissioned a chilled water refrigeration plant on surface at shaft R-9 of the Rudna mine, initially with 10 MW of cooling power, which was then increased to 16.5 MW, to supply cooled air to working areas 1,050 m below surface. At the end of 2011, another chilled water refrigeration plant was commissioned at the SG-1 shaft, at the Polkowice-Sieroszowice mine, with a target cooling power of 15 MW. Additional refrigeration plants are planned to be installed progressively in the future. In some areas, air-conditioned cabs are provided on mining equipment. The use of air-conditioned cabs is also expected to increase in the future.

Inevitably, KGHM's mining operations will proceed to progressively greater depths in the future. Although there is presently no evidence that the frequency of rock bursts increases with depth, rock temperature will certainly increase, resulting in greater requirements for refrigeration and, hence, a slow but progressive increase in costs associated with ventilation.

With elevated prices of both copper and silver, KGHM's operations in the Legnica-Glogów Copper Belt area have been highly profitable in recent years. By Micon's calculation, operating profit from the mining and processing operations averaged nearly USD 2 billion per year over the five-year period 2007 to 2011. KGHM has taken advantage of these high levels of profitability to undertake modernization programs at its production facilities. Total capital expenditures from 2007 to 2011 averaged approximately USD 400 million per year, with the result that the mining and processing operations generated overall pre-tax cash flows averaging approximately USD 1.5 billion per year over the same five-year period.

In April, 2012, the Parliament of Poland introduced new extraction taxes on the production of copper and silver within the country. These taxes, which are based on the value of copper and silver contained in concentrate, are substantial and, by Micon's calculation, will amount to approximately 30% of the future operating profit generated by KGHM's mining and processing operations. It is also the general consensus among analysts that the prices of copper and silver are likely to soften over the next five years.

Micon has based its forecast of the pre-tax cash flow to be generated by KGHM's mining and processing operations over the five-year period 2012 to 2016 on KGHM's production plans, a modest increase in unit operating cost, a continuation of relatively high capital expenditures, a decrease in the price of copper from USD 3.50/lb in 2012 to USD 3.00/lb in 2015 and a decrease in the price of silver from USD 33/oz in 2012 to USD 25/oz in 2015. Even with the combined effect of the new extraction taxes and the forecast reductions in metal prices, KGHM's operations in the Legnica-Glogów Copper Belt area are expected to remain highly profitable over the next five years, with average pre-tax cash flows in excess of USD 450 million per year.

The profitability of KGHM's operations is more sensitive to changes in copper and silver prices than it is to changes in any other factor. Sensitivity analysis indicates that, after allowing for a capital expenditure program which totals approximately USD 2.5 billion over the period 2013 to 2016, KGHM's mining and processing operations would maintain essentially a cash break-even position at metal prices as low as USD 2.50/lb for copper and USD 20/oz for silver.

The forecast cash flows for the years 2012 to 2016, as reported herein, do not include profits from KGHM's smelters, refineries and the rolling mill, nor do they include revenues from the sale of by-products.

26.0 RECOMMENDATIONS

KGHM mining and processing facilities in the Legnica-Glogów Copper Belt area have been operating at essentially steady-state production levels for many years. Further expansions are not being considered, nor are they recommended. KGHM maintains a research staff for the purpose of identifying and testing potential improvements in all of its operations and these efforts are to be encouraged.

The recommendations that flow from Micon's review of KGHM's operations are:

- That, in addition to estimating its resources and reserves under the procedures and classifications used in Poland, KGHM also consider reporting resources and reserves under the standards and classifications of one of the internationally-recognized codes, such as the CIM standards and definitions or the Australasian Joint Ore Reserve Committee (JORC) code. This would facilitate the acceptance of the resource and reserve estimates by investors and securities regulators in the major western mining jurisdictions.

- That KGHM critically review the cut-off grades used for resource and reserve estimation on an annual basis, to ensure that these cut-off grades appropriately reflect current and reasonably foreseeable metal prices, operating costs and metallurgical recoveries.

- That KGHM, as a matter of priority, continue its research into using a more positive system of backfill, such as thickened tailings or paste fill, in the underground workings, with the objective of limiting the closure of mined-out areas and minimizing the risk of rock bursts.

27.0 DATE AND SIGNATURE PAGE

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Effective date for resource and reserve estimates : 31 December, 2011
Effective date for all other information : 30 June, 2012

Date signed 7 February, 2013

28.0 REFERENCES

Essentially all of the information upon which this report is based was obtained from the production and cost records and forecasts provided by KGHM. The following business and geological references were consulted:

- Blundell, D.J., Karnokowski, P.H., Alderton, D.H.M., Oszczepalski, S., and Kucha, H., 2003, Copper mineralization of the Polish Kupferschiefer: A proposed basement fault-fracture system of fluid flow, *Economic Geology*, vol. 98, p 1487-1495.

- Jowett, E. C., 1986, Genesis of Kupferschiefer Cu-Ag deposits by convective flow of Rotliegend brines during Triassic rifting: *Economic Geology*, vol. 81, p. 1823-1837.

- Rentzsch, J., 1974, The Kupferschiefer in comparison with the deposits of the Zambian copperbelt, in Bartholomé, P., ed, Gisements stratiformes et provinces cupriferes: Liege, Societé Géologique de Belgique, p 395-418.

- Oszczepalski, S., 1999, Origin of the Kupferschiefer polymetallic mineralization in Poland, Mineralium Deposita, Volume 34, Nos. 5-6 (1999), p. 599 - 613.

- Ernst & Young, 2010, Doing Business in Poland.

29.0 CERTIFICATES OF AUTHORS

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CERTIFICATE OF AUTHOR
STANLEY CURRIE BARTLETT, P. Geo.

As a co-author of the report entitled "Technical Report on the Copper-Silver Production Operations of KGHM Polska Miedź S.A. in the Legnica-Glogów Copper Belt Area of Southwestern Poland", dated February, 2013, I, Stanley Currie Bartlett, hereby certify that:

1. I am employed by, and conducted this assignment for, Micon International Co Limited, Suite 10, Keswick Hall, Norwich, United Kingdom. tel. 0044(1603) 501 501, fax 0044(1603) 507 007 e-mail sbartlett@micon-international.co.uk.

2. I hold the following academic qualifications:

   B.Sc. Geological Sciences, University of British Columbia, Vancouver, Canada, 1979
   M.Sc. (Mining Geology), Camborne School of Mines, Redruth, England, 1987

3. I am a registered Professional Geoscientist with the Association of Professional Engineers and Geoscientists of the Province of British Columbia (membership # 19698); as well I am a member in good standing of the Society for Mining, Metallurgy and Exploration;

4. I have worked as a geologist in the minerals industry for 32 years.

5. I am familiar with NI 43-101 and, by reason of education, experience and professional qualifications, I fulfill the requirements of a Qualified Person as defined in NI 43-101. My work experience includes five years as an exploration geologist developing tungsten, gold, silver and base metal deposits, more than 14 years as a mining geologist in both open pit and underground mines and 13 years as a consulting geologist working in precious, ferrous and base metals and industrial minerals. I have previous experience with mineral resource estimation.

6. I have read NI 43-101 and this Technical Report has been compiled in compliance with that instrument.

7. I am responsible for the preparation of Sections 7 to 11, 14 and 15 of the Technical Report.

8. I visited the operations of KGHM Polska Miedź S.A. from July 30 to August 2, 2012.

9. I have had no prior involvement with the operations of KGHM Polska Miedź S.A.

10. As of the date of this certificate, to the best of my knowledge, information and belief, the Technical Report contains all scientific and technical information that is required to be disclosed to make this report not misleading.

11. I am independent of KGHM Polska Miedź S.A. as defined by NI 43-101.

Dated this 7 day of February, 2013.

Stanley C. Bartlett, M.Sc., P. Geo.

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CERTIFICATE OF QUALIFIED PERSON
HARRY BURGESS, P. Eng.

As a co-author of the report entitled "Technical Report on the Copper-Silver Production Operations of KGHM Polska Miedź S.A. in the Legnica-Glogów Copper Belt Area of Southwestern Poland", dated February, 2013, I, Harry Burgess do hereby certify that:

1. I am an Associate of, and carried out this assignment for, Micon International Limited, Suite 900, 390 Bay Street, Toronto, Ontario, M5H 2Y2, telephone (416) 362-5135, fax (416) 362-5763, e-mail hburgess@micon-international.com.

2. I hold the following academic qualifications:

B.Sc. (Mechanical Engineering)	London University	1966
B.Sc. (Mining Engineering)	London University	1968
M.Sc. (Engineering)	University of Witwatersrand	1980

3. I am a registered Professional Engineer with the Association of Professional Engineers of Ontario (membership number 6092506); as well, I am a member in good standing of several other technical associations and societies, including:

   The Australasian Institute of Mining and Metallurgy (Fellow)
   The Institution of Mining and Metallurgy (Fellow)
   The Canadian Institute of Mining, Metallurgy and Petroleum (Member)

4. I have worked as a mining engineer in the minerals industry for more than 40 years;

5. I am familiar with NI 43-101 and, by reason of education, experience and professional registration, I fulfill the requirements of a Qualified Person as defined in NI 43-101. My work experience includes 13 years as a mining engineer working in mine planning and production operations in underground copper and gold mining and over 30 years as a consulting mining engineer working in open pit and underground operations involving many minerals and all aspects of mining from mine design to financial evaluation.;

6. I have read NI 43-101 and this Technical Report has been compiled in compliance with that instrument.

7. I am responsible for the preparation of Section 16 of the Technical Report.

8. I visited the operations of KGHM Polska Miedź S.A. from July 30 to August 2, 2012.

9. I have had no prior involvement with the operations of KGHM Polska Miedź S.A.

10. As of the date of this certificate to the best of my knowledge, information and belief, the Technical Report contains all scientific and technical information that is required to be disclosed to make this report not misleading.

11. I am independent of KGHM Polska Miedź S.A. and related entities, as defined by NI 43-101.

Dated this 7 day of February, 2013.

REGISTERED PROFESSIONAL ENGINEER H. BURGESS PROVINCE OF ONTARIO

Harry Burgess, P.Eng.

micon INTERNATIONAL LIMITED | mineral industry consultants

CERTIFICATE OF AUTHOR
BOGDAN DAMJANOVIĆ, P. Eng.

As a co-author of the report entitled "Technical Report on the Copper-Silver Production Operations of KGHM Polska Miedź S.A. in the Legnica-Głogów Copper Belt Area of Southwestern Poland", dated February, 2013, I, Bogdan Damjanović, do hereby certify that:

1. I am employed as a metallurgist by, and carried out this assignment for, Micon International Limited, Suite 900 – 390 Bay Street, Toronto, Ontario, M5H 2Y2, telephone (416) 362-5135, fax: (416) 362-5763, email: bdamjanovic@micon-international.com.

2. I hold the following academic qualifications:

   B.A.Sc., Geological and Mineral Engineering, University of Toronto, 1992.

3. I am a Professional Engineer registered with the Professional Engineers of Ontario. (registration number 90420456); as well, I am a member in good standing of The Canadian Institute of Mining, Metallurgy and Petroleum.

4. I have worked in the minerals industry for 20 years; my work experience includes 8 years as a metallurgist on gold, copper/nickel and lead/zinc/gold deposits; and the remainder as an independent consultant working on a variety of precious and base metal deposits.

5. I do, by reason of education, experience and professional registration, fulfill the requirements of a Qualified Person as defined in NI 43-101.

6. I have read NI 43-101 and this Technical Report has been compiled in compliance with that instrument.

7. I am responsible for Sections 13 and 17 of the Technical Report.

8. I visited the operations of KGHM Polska Miedź S.A. from, July 30 to August 2, 2012.

9. I have had no prior involvement with the operations of KGHM Polska Miedź S.A.

10. As of the date of this certificate, to the best of my knowledge, information and belief, the Technical Report contains all scientific and technical information that is required to be disclosed to make this report not misleading.

11. I am independent of KGHM Polska Miedź S.A. as defined by 43-101.

Dated this 7 day of February, 2013

B. Damjanović

Bogdan Damjanović, P. Eng.

CERTIFICATE OF AUTHOR
RICHARD M. GOWANS, P. ENG.

As a co-author of the report entitled "Technical Report on the Copper-Silver Production Operations of KGHM Polska Miedź S.A. in the Legnica-Glogów Copper Belt Area of Southwestern Poland", dated February, 2013, I, Richard Gowans do hereby certify that:

1. I am employed by, and carried out this assignment for, Micon International Limited, Suite 900, 390 Bay Street, Toronto, Ontario M5H 2Y2, tel. (416) 362-5135, fax (416) 362-5763, e-mail rgowans@micon-international.com.

2. I hold the following academic qualifications:

   B.Sc. (Hons) Minerals Engineering, The University of Birmingham, U.K. 1980.

3. I am a registered Professional Engineer of Ontario (membership number 90529389); as well, I am a member in good standing of the Canadian Institute of Mining, Metallurgy and Petroleum.

4. I have worked as a process metallurgist in the minerals industry for more than 30 years.

5. I am familiar with NI 43-101 and by reason of education, experience and professional registration, I fulfill the requirements of a Qualified Person as defined in NI 43-101. My work experience includes the management of technical studies and design of numerous metallurgical testwork programs and metallurgical processing plants.

6. I have read NI 43-101 and this Technical Report has been compiled in compliance with that instrument.

7. I am not responsible for any individual section of the Technical Report but, as peer reviewer on behalf of Micon, I have approved the report.

8. I have not visited the operations of KGHM Polska Miedź S.A.

9. I have had no prior involvement with the operations of KGHM Polska Miedź S.A.

10. As of the date of this certificate, to the best of my knowledge, information and belief, the Technical Report contains all scientific and technical information that is required to be disclosed to make this report not misleading.

11. I am independent of KGHM Polska Miedź S.A., as defined by NI 43-101.

Dated this 7 day of February, 2013

LICENSED PROFESSIONAL ENGINEER
R. M. GOWANS
PROVINCE OF ONTARIO

Richard Gowans, P. Eng.

micon INTERNATIONAL LIMITED | mineral industry consultants

CERTIFICATE OF AUTHOR
CHRISTOPHER R. LATTANZI, P. Eng.

As a co-author of the report entitled "Technical Report on the Copper-Silver Production Operations of KGHM Polska Miedź S.A. in the Legnica-Glogów Copper Belt Area of Southwestern Poland", dated February, 2013, I, Christopher R. Lattanzi, do hereby certify that:

1. I am an Associate of, and carried out this assignment for, Micon International Limited, Suite 900, 390 Bay Street, Toronto, Ontario, M5H 2Y2, tel. (416) 362-5135, fax (416) 362-5763, e-mail clattanzi@micon-international.com.

2. I hold the following academic qualifications:

   B. Eng. (Mining) University of Melbourne, Australia 1959

3. I am a registered Professional Engineer with the Association of Professional Engineers of Ontario (membership number 25705013); as well, I am a member in good standing of the Canadian Institute of Mining, Metallurgy and Petroleum.

4. I have worked as a mining engineer in the minerals industry for more than 50 years.

5. I am familiar with NI 43-101 and, by reason of education, experience and professional registration, I fulfill the requirements of a Qualified Person as defined in NI 43-101. My experience includes the planning and direct supervision of open pit mines and more than 40 years as a consultant in the mineral industry.

6. I have read NI 43-101 and this Technical Report has been compiled in compliance with that instrument.

7. I am responsible for the preparation of Sections 1 to 6, 10, 12, 18, 19 and 21 to 26 of the Technical Report.

8. I visited the operations of KGHM Polska Miedź S.A. initially in 1996 and, more recently, from July 30 to August 2, 2012.

9. I was a co-author of a report by Micon International Limited entitled "Review of the Mining Operations of KGHM Polska Miedź S.A., Republic of Poland, dated March, 1997.

10. As of the date of this certificate, to the best of my knowledge, information and belief, the Technical Report contains all scientific and technical information that is required to be disclosed to make this report not misleading.

11. I am independent of KGHM Polska Miedź S.A. and related entities, as defined by NI 43-101.

Dated this 7 day of February, 2013

REGISTERED PROFESSIONAL ENGINEER
C. R. LATTANZI
PROVINCE OF ONTARIO

Christopher R. Lattanzi, P. Eng.