

Ivanhoe Mines Announces Results of a Positive, Independent, PEA of Initial Options for the Start-Up of World-Scale Copper Mining on the Kakula and Kamoa Deposits

13.12.2016 | [Marketwired](#)

A follow-on PEA now underway will examine a potential doubling of annual production beyond the limited scenarios covered in the initial PEA

The next PEA, expected in Q1 2017, will assess the potential for an 8-million-tonne-per-annum, stand-alone Kakula Mine, plus expanded, combined mining scenarios of 12 and 16 Mtpa from both the Kakula Deposit and the adjacent Kamoa Deposit's Kansoko Mine

A conference call will be held December 15 to discuss the initial PEA results and the expanded-case PEA now underway

HIGHLIGHTS

Initial option for a single 4 Mtpa mine

- The preliminary economic assessment (PEA) results finalized this week present two initial scenarios for development of the high-grade copper deposits at the Kamoa-Kakula Project on the Central African Copperbelt, west of the Democratic Republic of Congo's Katanga mining region.
- One initial option analyzed in the PEA is the development of a four-million-tonne-per-annum (Mtpa) Kakula Phase 1 Mine at the Kakula Deposit, in the southerly portion of the project's discovery area. For this option, the PEA envisages an average annual production rate of 216,000 tonnes of copper at a mine-site cash cost of US\$0.37/lb copper for the first 10 years of operations (see details Table 4, page 10), and peak copper production of 262,000 tonnes by year three.
- A pre-production capital cost of US\$1.0 billion for this option would result in an after-tax net present value at an 8% discount rate (NPV8%) of US\$3.7 billion - an increase of 272% compared to the after-tax NPV8% of US\$986 million that was projected in the March 2016 Kamoa pre-feasibility study. The internal rate of return of 38% would be more than double the return that was estimated in the March 2016 Kamoa pre-feasibility study.

Initial option for two mines producing a total of 8 Mtpa

- The PEA also analyzed an alternative initial option that could involve a two-phase sequential expansion of production to 8 Mtpa from the proposed Kakula Phase 1 Mine at the Kakula Deposit and also the Kansoko Mine at the adjacent Kamoa Deposit.
- Under this alternative, the PEA envisages US\$1.0 billion in capital costs and an average annual production rate of 292,000 tonnes of copper at a mine-site cash cost of US\$0.42/lb copper during the first 10 years of operations, (see details Table 8, page 18), and peak production of 370,000 tonnes by year seven.

Under study: New option for one mine producing 8 Mtpa, plus expanded output options of up to 16 Mtpa from two mines

- The follow-on PEA, now underway, is examining an alternative approach that would see development of a single 8 Mtpa mine on the Kakula Deposit. This option is expected to have substantial advantages over the development of two mines to achieve the same production rate. Planned studies also will assess higher mining rates of up to 16 Mtpa, which would utilize high-grade copper mineralization from both the Kakula Deposit and the Kansoko Sud and Kansoko Centrale areas of the adjacent Kamoa Deposit.

Update on strategic discussions

- In an update today of earlier announcements, Ivanhoe Mines also reported that strategic discussions are continuing with significant global mining companies and investors.

KOLWEZI, Dec 13, 2016 - Ivanhoe Mines (TSX:IVN)(OTCQX:IVPAF) Executive Chairman Robert Friedland and Chief Executive Officer Lars-Eric Johansson today welcomed the positive findings of an independent PEA for the development of the Kakula Deposit at the Kamoa-Kakula Project in the Democratic Republic of Congo.

The Kamoa-Kakula Project - a joint venture between Ivanhoe Mines, Zijin Mining Group and the government of the Democratic Republic of Congo (DRC) - has been independently ranked as the world's largest high-grade copper discovery by international mining consultant Wood Mackenzie.

The Kakula 2016 PEA was independently prepared by OreWin Pty. Ltd., Amec Foster Wheeler E&C Services Inc. and SRK Consulting Inc. (The same team of consulting engineers was involved in planning the development of the Oyu Tolgoi Project in Mongolia.)

The Kakula 2016 PEA assesses the planned first phase of development of the Kakula Deposit - a discovery that was announced in January this year - as a 4 Mtpa underground mining and processing complex that would be known as the Kakula Phase 1 Mine at the Kamoa-Kakula Project.

Incorporated within the Kakula 2016 PEA is an option for an integrated, 8 Mtpa, two-stage development scenario involving an initial mining operation at the Kakula Deposit and a subsequent, separate mining operation at the Kansoko Sud and Kansoko Centrale areas of the adjacent Kamoa Deposit, discovered in 2008, which would be known as the Kansoko Mine.

A NI 43-101 technical report will be filed on SEDAR at www.sedar.com and on Ivanhoe Mines' website at www.ivanhoemines.com within 45 days of the issuance of this news release.

The Kakula 2016 PEA is preliminary in nature and includes an economic analysis that is based, in part, on Inferred Mineral Resources. Inferred Mineral Resources are considered too speculative geologically to have the economic considerations applied to them that would allow them to be categorized as Mineral Reserves, and there is no certainty that the results will be realized. Mineral Resources do not have demonstrated economic viability and are not Mineral Reserves.

Ivanhoe Mines and Zijin Mining are continuing with the drilling program in and around the Kakula Deposit area, using six drill rigs, to expand the extent of the known mineralization and support potential upgrades in resource confidence categories. Ivanhoe Mines expects an updated resource estimate for the Kakula Deposit will be issued in the first quarter of 2017. In addition, a pre-feasibility study also is underway to enhance the findings of the Kakula 2016 PEA and to advance the project toward production.

Conference call will be held Thursday, December 15

A conference call to discuss the Kakula 2016 PEA results will be held on Thursday, December 15, 2016, at 9:00AM EST (6:00AM PST / 2:00PM GMT).

The conference call may be accessed by dialling +1-416-340-2216 or 1-866-223-7781 (Canada and U.S. toll-free number). Callers outside North America may check their country-specific, toll-free dial-in number at <https://www.confsoptions.ca/ILT?oss=1P29R8662237781>.

The conference call will be archived for later playback until January 18, 2017, and may be accessed by dialling +1-905-694-9451 or 1-800-408-3053 and entering the passcode 6300478.

Summary of the PEA's key results for an initial Kakula Phase 1 Mine

1. Very high-grade initial phase of production is projected to have a grade of 8.1% copper in year two and an average grade of 7.52% copper over the initial five years of operations, resulting in estimated average annual copper production of 209,000 tonnes.
2. Peak annual copper production is estimated at 262,000 tonnes in year three.
3. Initial capital cost, including contingency, is estimated at US\$1.0 billion, approximately US\$200 million lower than previously estimated in the March 2016 Kamoia pre-feasibility study.
4. Average mine-site cash cost of US\$0.37/lb of copper during the first 10 years (see details Table 4, page 10).
5. After-tax NPV, at an 8% discount rate, of US\$3.7 billion, an increase of 272% compared to the after-tax NPV, at an 8% discount rate, of US\$986 million estimated in the March 2016 Kamoia pre-feasibility study.
6. After-tax internal rate of return (IRR) of 38.0%, which is more than double the IRR of the 2016 Kamoia pre-feasibility study, and a payback period of 2.3 years.
7. Kakula is expected to produce a very-high-grade copper concentrate in excess of 50% copper, with extremely low arsenic levels.

Greatly expanded production scenario now under study as part of a new PEA could double the mining rate and is expected to further improve net present value

A subsequent PEA now is underway to examine a doubling of the proposed mining rate at the Kakula Phase 1 Mine to 8 Mtpa. This next PEA is expected to be released in early 2017. Michael Gray, Ivanhoe Mines' senior mining advisor and former President and co-founder of McIntosh Engineering, will assist with the expansion studies for the Kamoia-Kakula Project. Mr. Gray has extensive experience in underground mine development and previously has worked on major projects such as San Manuel (BHP), Grasberg (Freeport Indonesia), Bingham Canyon (Rio Tinto), El Teniente (Codelco), Olympic Dam (BHP Billiton) and Oyu Tolgoi (the original Ivanhoe Mines).

Given the extremely high copper grades and bottom-loaded nature of the mineralization at the Kakula Deposit, Ivanhoe Mines expects that the results of having a single, 8 Mtpa mine at the Kakula Deposit will be even better than the results of an integrated, 8 Mtpa, two-stage, two-mine development scenario. The project engineering team is targeting a life-of-mine average annual copper production scenario for a single 8 Mtpa mine at Kakula in excess of 400,000 tonnes per annum. Given that the initial capital costs for the two options examined in the Kakula 2016 PEA are the same at US\$1.0 billion, it can be expected that an expansion to 8 Mtpa also will have essentially unchanged initial capital costs and, in particular, given that the expansion then could be funded from future cash flows.

Based on initial metallurgical test work, the chalcocite-rich nature of the copper mineralization at the Kakula Deposit is expected to yield higher metallurgical recoveries and higher concentrate grades, which in turn are expected to reduce unit transportation costs and therefore improve financial returns.

Additional expansion studies are planned for 2017 in which the project engineering team will assess higher mining rates of up to 16 Mtpa, incorporating high-grade copper mineralization from both the Kakula Deposit and the Kansoko Sud and Kansoko Centrale areas of the Kamoia Deposit.

Strategic discussions continuing with potential partners

Continuing strategic discussions concerning Ivanhoe Mines and its projects are intensifying with several significant mining companies and investors across Asia, Europe, Africa and elsewhere. Several investors that have expressed interest have no material limit on the provision of capital.

Ivanhoe Mines will provide further comment only if a specific transaction or process is concluded, or if further disclosure is required or deemed appropriate. There can be no assurance that the company will pursue any

transaction or that a transaction, if pursued, will be completed.

"Kamoa-Kakula is an incredibly disruptive, district-scale, Tier-One copper project that is still in its early days of discovery and development," said Mr. Friedland. "Kakula's high copper grades and thicknesses establish Kamoa-Kakula as the most remarkable and rapidly-growing mineral discovery with which I've been associated during my 30-plus years in the exploration business.

"We've already discovered as much copper in Measured and Indicated Resources as we found with the original Ivanhoe Mines at Oyu Tolgoi, in Mongolia's South Gobi - but this time at much higher grades. Significantly, both the Kamoa and Kakula discoveries are open for future expansions. We remain focused on expediting development of Kamoa and Kakula. The engineering team has been assigned to produce an improved 8- to 10-million-tonne-per-annum study for Kakula, hopefully in time for the Mining Indaba conference in Cape Town in early February next year."

Mr. Johansson added, "We will be working with our partners Zijin Mining and the DRC government to develop Kamoa-Kakula into the world's next great copper mine, generating widely shared economic benefits that will help to sustain communities, and deliver jobs and skills training, in conjunction with effective environmental management."

Figure 1. Planned Kakula 2016 PEA development and infrastructure for Kakula and Kansoko mines:
<http://media3.marketwire.com/docs/1079994-F1.pdf>

Principal initial projections from the Kakula 2016 PEA

The report assesses the potential development of the Kakula Deposit as a 4 Mtpa mining and processing complex. The life-of-mine production scenario schedules 82.6 million tonnes to be mined at an average grade of 5.76% copper, producing 7.5 million tonnes of high-grade copper concentrate, containing approximately 9.1 billion pounds of copper.

Figure 2. Start-up of 4 Mtpa Kakula Phase 1 Mine development scenario:
<http://media3.marketwire.com/docs/1079994-F2.pdf>

The economic analysis uses a long-term price assumption of US\$3.00/lb of copper and returns an after-tax NPV at an 8% discount rate of US\$3.7 billion. It has an after-tax IRR of 38.0% and a payback period of 2.3 years.

The estimated initial capital cost, including contingency, is US\$1.0 billion. The capital expenditure for off-site power, which is included in the initial capital cost, includes a US\$147 million advance payment to the DRC state-owned electricity company, SNEL, to upgrade two hydropower plants (Koni and Mwadingusha) to provide the Kamoa-Kakula Project with access to clean electricity for its planned operations. The upgrading work is being led by Stucky Ltd., of Switzerland, and the advance payment will be recovered through a reduction in the power tariff.

Solar power and high-capacity, grid-scale battery storage of electricity under study

The project team also is evaluating the installation of up to 100 megawatts of solar power and large-scale vanadium redox batteries for high-capacity storage of both solar and hydro-electric power.

"It is our intention to implement new technologies in efficient, eco-friendly power generation and power storage and establish the Kamoa-Kakula Project as one of the 'greenest' mines in the world," said Mr. Friedland.

Key results of the Kakula 2016 PEA for a single 4 Mtpa mine are summarized in Table 1.

Table 1. Kakula Phase 1 Mine results summary for 4 Mtpa steady-state production.

Item	Unit	Total
Total Processed		
Quantity Milled	kt	82,566
Copper Feed Grade	%	5.76
Total Concentrate Produced		
Copper Concentrate Produced	kt (dry)	7,534
Copper Recovery	%	87.01
Copper Concentrate Grade	%	54.94
Contained Metal in Concentrate	Mlb	9,126
Contained Metal in Concentrate	kt	4,139
Key Financial Results		
Initial Capital	US\$M	999
After-Tax NPV8%	US\$M	3,664
After-Tax IRR	%	38.0
Project Payback Period	Years	2.3
Initial Project Life	Years	23

Table 2 summarizes the financial results and Table 3 summarizes planned mine production and processing statistics.

Table 2. Kakula Phase 1 Mine financial results for 4 Mtpa steady-state production.

Net Present Value (US\$M)	Discount Rate	Before Taxation	After Taxation
	Undiscounted	15,561	10,935
	4.0%	8,876	6,180
	6.0%	6,843	4,735
	8.0%	5,337	3,664
	10.0%	4,203	2,859
	12.0%	3,338	2,245
Internal Rate of Return	-	44.9%	38.0%
Project Payback Period (Years)	-	2.2	2.3

Table 3. Kakula Phase 1 Mine average estimated production and processing statistics for 4 Mtpa steady-state production.

Item	Unit	YEARS 1-5	YEARS 1-10	LOM AVERAGE
Total Processed				
Quantity Milled	Kt	3,163	3,584	3,590
Copper Feed Grade	%	7.52	6.90	5.76
Total Concentrate Produced				
Copper Concentrate Produced	kt (dry)	380	394	328
Copper Recovery	%	87.74	87.50	87.01
Copper Concentrate Grade	%	54.94	54.94	54.94
Contained Metal in Concentrate				
Copper	Mlb	460	477	397
Copper	Kt	209	216	180
Payable Metal				
Copper	Mlb	449	465	387
Copper	kt	204	211	176

The Kakula concentrator production is shown in Figure 3 and the concentrate and metal production is shown in Figure 4.

Figure 3. Kakula Phase 1 Mine estimated concentrator production for the first 20 years:
<http://media3.marketwire.com/docs/1079994-F3.pdf>

Figure 4. Kakula Phase 1 Mine estimated concentrate and metal production for the first 20 years:
<http://media3.marketwire.com/docs/1079994-F4.pdf>

Figure 5. World's projected top 20 largest copper concentrate mines by 2027:
<http://media3.marketwire.com/docs/1079994-F5.pdf>

Figure 6. Target annual production and head grade for Wood Mackenzie's "highly probable" and "probable" copper concentrate projects: <http://media3.marketwire.com/docs/1079994-F6.pdf>

Table 4 summarizes unit operating costs and Table 5 provides a breakdown of revenue and operating costs. The capital costs for the project are detailed in Table 6.

Table 4. Kakula Phase 1 Mine unit operating costs for 4 Mtpa steady-state production.

	\$/lb Payable Copper		
	YEARS 1-5	YEARS 1-10	LOM AVERAGE
Mine Site	0.34	0.37	0.45
Transport	0.31	0.31	0.31
Treatment & Refining Charges	0.15	0.15	0.15
Royalties & Export Tax	0.14	0.14	0.14
Total Cash Costs	0.94	0.97	1.05

Figure 7. 2021 estimated mine-site copper cash costs: <http://media3.marketwire.com/docs/1079994-F7.pdf>

Table 5. Kakula Phase 1 Mine estimated revenue and operating costs for 4 Mtpa steady-state production.

	YEARS 1-5	YEARS 1-10	TOTAL
	US\$/t Milled		US\$M
REVENUE			
Copper in Concentrate	426.00	389.65	26,729
Gross Sales Revenue	426.00	389.65	26,729
Less: Realisation Costs			
Transport	44.58	40.25	2,745
Treatment & Refining	21.24	19.43	1,333
Royalties & Export Tax	19.32	17.68	1,213
Total Realisation Costs	85.14	77.36	5,291
Net Sales Revenue	340.86	312.29	21,438
SITE OPERATING COSTS			
UG Mining	28.46	29.13	2,455
Processing	15.15	14.54	1,178
Tailings	0.31	0.28	22
General & Administration	6.81	6.47	521
SNEL Discount	-2.51	-2.46	-201
Customs	0.55	0.74	61
Total	48.77	48.70	4,037
Operating Margin	292.09	263.58	17,401
Operating Margin	85.69%	84.40%	81.17%

Table 6. Kakula Phase 1 Mine estimated capital investment summary for 4 Mtpa steady-state production.

Description	Initial Capital US\$M	Expansion Capital US\$M	Sustaining Capital US\$M	Total US\$M
MINING				
Underground Mining	275	-	404	679
Capitalised Pre-Production	16	-	-	16
Subtotal	291	-	404	695
POWER				
Power Infrastructure On Site	32	-	-	32
Power Supply Off Site	115	-	-	115
Subtotal	148	-	-	148
CONCENTRATE & TAILINGS				
Process Plant	143	31	78	253
Tailings	32	-	74	106
Subtotal	176	31	152	359
INFRASTRUCTURE				
Plant Infrastructure	23	-	52	75
Plant mobile equipment	3	0	-	4
Buildings & Structures	20	-	-	20
Camps	20	-	-	20
Rail	-	36	-	36
Subtotal	66	36	52	154
INDIRECTS				
EPCM	53	7	-	61
Owners Cost	80	7	-	86
Closure	-	-	67	67
Subtotal	133	14	67	214
CAPITAL EXPENDITURE BEFORE CONTINGENCY	812	81	676	1,569
CONTINGENCY	187	20	30	237
CAPITAL EXPENDITURE AFTER CONTINGENCY	999	101	706	1,806

Figure 8. Capital intensity for Wood Mackenzie's "highly probable" projects currently under construction:
<http://media3.marketwire.com/docs/1079994-F8.pdf>

The after-tax NPV sensitivity to metal price variation is shown in Table 7 for copper prices from US\$2.00/lb to US\$4.00/lb. The annual and cumulative cash flows for the combined base case and each operation are shown in Figure 9.

Table 7. Kakula Phase 1 Mine copper price sensitivity.

After Tax NPV (US\$M)	Copper Price - US\$/lb				
Discount Rate	2.00	2.50	3.00	3.50	4.00
Undiscounted	4,884	7,911	10,935	13,960	16,985
4.0%	2,629	4,406	6,180	7,954	9,728
6.0%	1,942	3,340	4,735	6,129	7,524
8.0%	1,433	2,551	3,664	4,778	5,891
10.0%	1,052	1,958	2,859	3,761	4,662
12.0%	762	1,506	2,245	2,984	3,723
IRR	23.2%	31.3%	38.0%	43.7%	48.9%

Figure 9. Kakula Phase 1 Mine projected cumulative cash flow for the first 20 years:
<http://media3.marketwire.com/docs/1079994-F9.pdf>

Alternative 8 Mtpa development scenario for the Kakula and Kamoas deposits

The Kakula 2016 PEA also assesses the development of the Kakula and Kamoa deposits as an integrated, 8 Mtpa mining and processing complex. This scenario envisages the construction and operation of two separate facilities: the Kakula Phase 1 Mine on the Kakula Deposit and the Kansoko Mine on the Kansoko Sud and Kansoko Centrale areas of the Kamoa Deposit. Each operation is expected to be a separate underground mine with an associated processing facility and surface infrastructure.

Summary of the PEA's key results for the alternative 8 Mtpa development scenario

1. Very high-grade initial phase projected to have a grade of 8.1% copper in year two and an average grade of 7.10% copper over the initial five years of operations, results in average annual copper production of 224,000 tonnes.
1. Combined, the Kakula and Kansoko mines are projected to produce an annual average of 292,000 tonnes of copper at an average grade of 5.81% copper during the first 10 years of operations.
1. Peak annual copper production of 370,000 tonnes by year seven.
1. Initial capital cost, including contingency, is US\$1.0 billion.
1. Average mine-site cash cost of US\$0.42 /lb of copper during the first ten years.
1. After-tax NPV at an 8% discount rate of US\$4.7 billion, an increase of 382% compared to the after-tax NPV at an 8% discount rate of US\$986 million estimated in the 2016 Kamoa pre-feasibility study.
1. After-tax IRR of 34.6%, which is more than double the IRR of the 2016 Kamoa pre-feasibility study, and a payback period of 3.5 years.

Figure 10. Alternative 8 Mtpa development scenario: <http://media3.marketwire.com/docs/1079994-F10.pdf>

Key results of this alternative development scenario are summarized in figures 11 & 12 and Table 8.

Figure 11. Kakula Phase 1 Mine & Kansoko Mine concentrator production for the first 20 years: <http://media3.marketwire.com/docs/1079994-F11.pdf>

Figure 12. Kakula Phase 1 Mine & Kansoko Mine concentrate and metal production for the first 20 years: <http://media3.marketwire.com/docs/1079994-F12.pdf>

Table 8. Alternative 8 Mtpa development results summary.

Item	Unit	Total
Total Processed		
Quantity Milled	kt	179,492
Copper Feed Grade	%	4.68
Total Concentrate Produced		
Copper Concentrate Produced	kt (dry)	15,548
Copper Recovery	%	86.66
Copper Concentrate Grade	%	46.83
Contained Metal in Concentrate Mlb		16,052
Contained Metal in Concentrate kt		7,281
Ten Year Average		
Copper Concentrate Produced	kt (dry)	586

Contained Metal in Concentrate kt	292
Mine-Site Cash Cost	US\$/lb 0.42
Total Cash Cost	US\$/lb 1.06
Key Financial Results	
Initial Capital	US\$M 999
After-Tax NPV8%	US\$M 4,748
After-Tax IRR	% 34.6
Initial Project Life	Years 29

Current partners in the Kamo-Kakula Project

The Kamo-Kakula Project is a very large, stratiform copper deposit with adjacent prospective exploration areas within the Central African Copperbelt, located approximately 25 kilometres west of the town of Kolwezi and about 270 kilometres west of Lubumbashi. The Kamo copper deposit was discovered by Ivanhoe Mines (then named Ivanhoe Nickel & Platinum) in 2008 and the Kakula Deposit in early 2016.

In August 2012, the DRC government granted mining licences to Ivanhoe Mines for the Kamo-Kakula Project that cover a total of 400 square kilometres. The licences are valid for 30 years and can be renewed at 15-year intervals. Mine development work at the project began in July 2014 with construction of a box cut for the decline ramps for the Kansoko Mine that will provide underground access to the high-grade mining areas in Kansoko Sud and Kansoko Centrale.

Following the recently signed agreement with the DRC government, Ivanhoe Mines and Zijin Mining each hold an indirect 39.6% interest in the Kamo-Kakula Project, Crystal River Global Limited (Crystal River) holds an indirect 0.8% interest and the DRC Government holds a direct 20% interest.

In addition, Ivanhoe Mines, Zijin Mining and Crystal River have recently amended their Shareholder, Governance and Option Agreement that originally became effective on December 8, 2015, and under which their relationship in the Kamo-Kakula Project is governed, to, among other things, codify the operation of the project committee and the management of the DRC subsidiary, Kamo Copper SA, so that the agreement is consistent with existing, on-the-ground practice. The amendments also clarify that if Ivanhoe Mines arranges project financing for 65% of the capital required to develop the first phase of the Kamo-Kakula Project, then Ivanhoe Mines will be entitled to acquire the indirect 0.8% interest in the Kamo-Kakula Project held by Crystal River for a price equal to the then current market value of that interest as determined by an independent expert valuator. The acquisition of Crystal River's indirect 0.8% interest in the Kamo-Kakula Project would give Ivanhoe Mines majority control of Kamo Holding Limited (the entity that presently owns 80% of the Kamo-Kakula Project). Zijin Mining already had committed to use its best efforts to arrange or procure project financing for 65% of the capital required to develop the first phase of the Kamo-Kakula Project, as set out in a feasibility study, without any recourse, and on terms acceptable to Ivanhoe Mines. In the event Ivanhoe Mines and Zijin Mining cannot agree on project financing, the matter will be referred to binding arbitration in Hong Kong.

At the request of Ivanhoe Mines and Zijin Mining and subject to the satisfaction of the applicable conditions, the DRC will provide its assistance in obtaining the advantages contemplated by the DRC's special law - No. 14/005, enacted to facilitate Sino-Congolese cooperation - relating to the tax, customs, parafiscal tax, non-tax revenues and currency exchange regime applicable to cooperation projects.

Kamo-Kakula Project Mineral Resource estimate

Indicated and Inferred Mineral Resources for the Kakula Deposit have an effective date of October 9, 2016. Indicated and Inferred Mineral Resources for the Kamo Deposit have an effective date of May 5, 2014. Mineral Resources are summarized in Table 9 and are reported on a 100% basis.

Table 9. Consolidated Mineral Resource statement, Kamo-Kakula Project, at a 1% copper cut-off over minimum thickness of 3 metres.

Deposit	Category	Tonnes (millions)	Area (sq. km)	Copper Grade	True Thickness (metres)	Contained Copper (kt)	Contained Copper (billion lbs)
Kamoa	Indicated	752	50.5	2.67%	5.2	20,110	44.3
	Inferred	185	16.8	2.08%	3.8	3,840	8.5
Kakula	Indicated	192	4.6	3.45%	14.3	6,630	14.6
	Inferred	101	3.3	2.74%	10.3	2,763	6.1
Total Kamoa-Kakula Project	Indicated	944	55.1	2.83%	6.0	26,740	58.9
	Inferred	286	20.1	2.31%	4.9	6,603	14.6

Notes to accompany Kamoa-Kakula Project Mineral Resource table

1. Ivanhoe Mines Mineral Resources Manager, George Gilchrist, Professional Natural Scientist (Pr. Sci. Nat) with the South African Council for Natural Scientific Professions (SACNASP), estimated the Mineral Resources under the supervision of Dr. Harry Parker and Gordon Seibel, both RM of Society of Mining, Metallurgy and Exploration (SME), who are the Qualified Persons for the Mineral Resource estimate. The effective date of the estimate for the Kakula Deposit is October 9, 2016 and for the Kamoa Deposit is May 5, 2014. Mineral Resources are estimated using the 2014 CIM Definition Standards for Mineral Resources and Mineral Reserves.
2. Mineral Resources are estimated assuming underground mining methods, a copper price of US\$3.30/lb (Kamoa) and US\$3.00/lb (Kakula Discovery), a cut-off of 1% total copper, a minimum thickness of 3 m, and that concentrates will be produced and sent to a smelter.
3. Tonnage and contained-copper tonnes are reported in metric units, contained-copper pounds are reported in imperial units and grades are reported as percentages.
4. Rounding as required by reporting guidelines may result in apparent summation differences between tonnes, grade and contained metal content.

The Kakula Deposit remains open along a northwesterly-southeasterly strike and there is considerable potential for resource expansion. High-grade copper mineralization has been outlined along a corridor that is currently approximately one kilometre wide and at least four kilometres in length. This high-grade corridor lies within an area of 8.7 square kilometres over which resources have been delineated. Given the outstanding success to date in delineating high-grade copper resources, the Kakula drilling program has been expanded by 60,000 metres and will continue unabated into 2017.

Combination of mining methods selected

Mining methods in the Kakula 2016 PEA are assumed to be a combination of controlled-convergence room-and-pillar mining and room-and-pillar mining with hydraulic fill. At the Kakula Phase 1 Mine, the room-and-pillar mining method with hydraulic fill was selected to maximize the extraction of the Mineral Resource where the selected mining height is greater than six metres and two or three mining lifts are required to achieve maximum extraction. At the planned Kansoko Mine, in the Kansoko Sud and Centrale areas, only the controlled-convergence room-and-pillar mining method is required as the mining height is six metres or less. The design for the Kansoko Sud and Centrale mining areas is based on the 2016 Kamoa pre-feasibility study mine design, which includes a service decline and a conveyor decline. The production rate envisaged in the Kakula 2016 PEA increased to 4 Mtpa compared to 3 Mtpa outlined in the 2016 Kamoa pre-feasibility study. At Kakula, the Kakula Deposit similarly is accessed by twin declines and the Kakula Phase 1 Mine also has a productive mining rate of 4 Mtpa.

Controlled-convergence room-and-pillar mining does not require cemented backfill and instead pillars are stripped to allow the controlled convergence of the backs and floors of the mine; this is a productive method that provides very good extractive rates at relatively low costs. The controlled-convergence room-and-pillar mining method has been successfully implemented by KGHM at its copper-mining operations in Poland for the past 20 years. Ivanhoe Mines engaged KGHM Cuprum R&D Centre Ltd. to study the applicability of this method to Kamoa. The results of the study indicate that the Kamoa Deposit is suited to the application of the controlled-convergence room-and-pillar mining method.

Metallurgical test work and concentrator design

Between 2010 and 2015, a series of metallurgical test work programs were completed on drill-core samples of known Kamoa copper mineralization. These investigations focused on metallurgical characterization and flow-sheet development for the processing of hypogene and supergene copper mineralization.

Bench-scale metallurgical flotation test work, carried out at XPS Consulting and Testwork Services laboratories in Falconbridge, Ontario, Canada, has shown positive results. This test work was conducted on composite samples of drill core from the Kansoko Sud and Kansoko Centrale areas in the southern part of the Kamoa Mineral Resource area. Test work on a composite grading 3.61% copper produced a copper recovery of 85.4% at a concentrate grade of 37.0% copper. The second composite, grading 3.20% copper, produced a copper recovery of 89.2% at a concentrate grade of 35.0% copper using the same flowsheet.

Additional bench-scale metallurgical flotation test work was carried out in 2016 on two chalcocite-rich composites from the Kakula Deposit at a Zijin Mining laboratory and by XPS Consulting and Testwork Services. The initial composite, grading 4.1% copper, produced a copper recovery of 86% at a concentrate grade of 53% copper at a Zijin Mining laboratory in July 2016. The second composite, grading 8.1% copper, produced a recovery of 87% at an extremely high concentrate grade of 56% copper. The flotation tests were conducted using the circuit developed during the 2016 Kamoa pre-feasibility study.

Average arsenic levels in the concentrate were measured to be approximately 0.02%, which is significantly lower than the limit of 0.5% imposed by Chinese smelters. Extremely low arsenic levels in concentrate are expected to attract a premium from copper-concentrate traders.

The concentrator design incorporates a run-of-mine stockpile, followed by primary and secondary crushing on surface. The crushed material with a design-size distribution of 80% passing (or p80) nine millimetres (mm), is fed into a two-stage ball-milling circuit for further size reduction to a target grind size p80 of 53 micrometres. The milled slurry will be passed through a rougher and scavenger. The high-grade, or fast-floating rougher concentrate, and medium-grade, or slow-floating scavenger concentrate, will be collected separately. The rougher concentrate is upgraded in two stages to produce a high-grade concentrate. The medium-grade scavenger concentrate and tailings from the two rougher cleaning stages, representing approximately 25% of the feed mass, will be combined and re-ground to a p80 of 10 micrometres before being cleaned in two stages. The cleaned scavenger concentrate then will be combined with the cleaned rougher concentrate to form the final concentrate. The final concentrate will be thickened before being pumped to the concentrate filter where the filter cake then will be bagged for shipment to market.

Electricity supply arrangements

Electrical power for the Kamoa-Kakula Project is planned to be sourced on a priority basis from the DRC national grid in return for the financing of the rehabilitation of three hydropower plants: Koni, Mwadingusha and Nzilo. A financing agreement with SNEL has been finalized for upgrading these plants to secure a long-term, clean, sustainable power supply to meet the requirements of the Kamoa-Kakula Project.

The Kakula 2016 PEA's estimated initial capital cost of US\$1.0 billion includes a US\$147 million advance payment to SNEL to upgrade two of the hydropower plants, Koni and Mwadingusha, to provide the Kamoa-Kakula Project with hydroelectric power for its operations. The upgrading work is being led by Stucky Ltd. and the advance payment will be recovered through a reduction in the power tariff. The Kamoa-Kakula Project initially will be powered by existing capacity on the national grid, until upgrading work on the hydropower plants has been completed.

The upgrading work on the first of six generators at the Mwadingusha hydropower plant was completed in August 2016 and the plant began supplying 11 megawatts of electricity to the national interconnected grid in September. The Kamoa-Kakula Project began drawing power from the national grid in October 2016.

Transportation routes to international markets

A phased logistics solution is proposed in the Kakula 2016 PEA. Initially, the corridor between southern DRC

and Durban in South Africa is viewed as the most attractive and reliable export route. As soon as the railway between Kolwezi and Dilolo, a town near the DRC-Angolan border, is upgraded, the Kamoa-Kakula Project's production is expected to be transported by rail to the Atlantic port of Lobito in Angola. In addition, there is the potential to negotiate off-take arrangements with smelters in Zambia.

Qualified persons

The following companies have undertaken work in preparation of the Kakula 2016 PEA:

1. OreWin - Overall report preparation, mining, logistics, power and economic analysis.
2. MDM/Amec Foster Wheeler - Mineral Resource estimation, processing and infrastructure.
3. SRK Consulting - Mine geotechnical recommendations.

The independent Qualified Persons responsible for preparing the Kakula 2016 PEA, on which the technical report will be based are Bernard Peters (OreWin); Dr. Harry Parker (Amec Foster Wheeler); Gordon Seibel (Amec Foster Wheeler); John Edwards (MDM/Amec Foster Wheeler); and William Joughin (SRK). Each Qualified Person has reviewed and approved the information in this news release relevant to the portion of the Kakula 2016 PEA for which they are responsible.

Other scientific and technical information in this news release has been reviewed and approved by Stephen Torr, P.Geol., Ivanhoe Mines' Vice President, Project Geology and Evaluation, a Qualified Person under the terms of National Instrument 43-101. Mr. Torr has verified the technical data disclosed in this news release.

Wood Mackenzie provided data based on public disclosure of comparable copper projects for the compilation of certain figures used in this release; however, Wood Mackenzie did not review the Kakula 2016 PEA.

A NI 43-101 technical report will be filed on SEDAR at www.sedar.com and on Ivanhoe Mines' website at www.ivanhoemines.com within 45 days of the issuance of this news release.

Kamoa 2016 PFS Mineral Reserve

The Kakula 2016 PEA assumes changes to the project production rate for both mining and processing of the Kamoa Mineral Resources and that a separate mine and processing plant is to be constructed at Kakula. The Kamoa 2016 PFS Mineral Reserve remains valid and is the current Mineral Reserve for the Kamoa-Kakula Project. The Mineral Reserve has an effective date of March 29, 2016 and has been estimated by Qualified Person Bernard Peters, Technical Director - Mining, OreWin Pty. Ltd. using the 2014 CIM Definition Standards for Mineral Resources and Mineral Reserves to conform to the Canadian NI 43-101 Standards of Disclosure for Mineral Projects. The Mineral Reserve is based on the planned Kansoko Mine operation at a production rate of 3 Mtpa and is entirely a Probable Mineral Reserve that was converted from Indicated Mineral Resources.

Data verification and quality control and assurance

Amec Foster Wheeler reviewed the sample chain of custody, quality assurance and control procedures, and qualifications of analytical laboratories. Amec Foster Wheeler is of the opinion that the procedures and QA/QC control are acceptable to support Mineral Resource estimation. Amec Foster Wheeler also audited the assay database, core logging and geological interpretations on a number of occasions between 2009 and 2015 and has found no material issues with the data as a result of these audits.

In the opinion of the Amec Foster Wheeler Qualified Persons, the data verification programs undertaken on the data collected from the Kamoa-Kakula Project support the geological interpretations. The analytical and database quality and the data collected can support Mineral Resource estimation.

Ivanhoe Mines maintains a comprehensive chain of custody and QA/QC program on assays from its Kamoa-Kakula Project. Half-sawn core is processed at its on-site preparation laboratory in Kamoa, prepared samples then are shipped by secure courier to Bureau Veritas Minerals (BVM) Laboratories in Australia, an ISO17025 accredited facility. Copper assays are determined at BVM by mixed-acid digestion with ICP finish. Industry-standard certified reference materials and blanks are inserted into the sample stream prior to dispatch to BVM. For detailed information about assay methods and data verification measures used to support the scientific and technical information, please refer to the current technical report on the Kamoa-Kakula Project on the SEDAR profile of Ivanhoe Mines at www.sedar.com.

About Ivanhoe Mines

Ivanhoe Mines is advancing its three principal projects in Sub-Saharan Africa: Mine development at the Platreef platinum-palladium-gold-nickel-copper discovery on the Northern Limb of South Africa's Bushveld Complex; mine development and exploration at the Kamoa-Kakula Project on the Central African Copperbelt in the DRC; and upgrading at the historic, high-grade Kipushi zinc-copper-lead-germanium mine, also on the DRC's Copperbelt. For details, visit www.ivanhoemines.com.

Cautionary statement on forward-looking information

Certain statements in this release constitute "forward-looking statements" or "forward-looking information" within the meaning of applicable securities laws, including without limitation: (i) the results of the preliminary economic assessment; (ii) the use of the controlled convergence room-and-pillar mining method; (iii) the expectation that concentrate with extremely low arsenic levels will attract a premium from traders; (iv) the expectation that the Kamoa-Kakula Project's production is to be transported by rail to the port of Lobito once the the railroad between Kolwezi and Dilolo is rehabilitated; (v) the timing, results and completion of future studies, including an expansion study to double the planned mining rate of the Kakula Phase 1 Mine to 8 Mtpa and an expansion to higher mining rates of up to 16 Mtpa, (vi) the potential that Ivanhoe Mines will be entitled to acquire Crystal River Global's indirect 0.8% interest in the Kamoa-Kakula Project, (vii) the completion of 60,000 metres of additional Kakula drilling into 2017, (viii) the expectation that the advance payment to SNEL will be recovered through a reduction in the power tariff, (ix) the expectation that the refurbished Koni and Mwadingusha hydroelectric plants will provide power to the Kamoa-Kakula Project, and (x) the expectation that an updated Mineral Resource estimate for the Kakula deposit will be completed in Q1 2017. Such statements involve known and unknown risks, uncertainties and other factors which may cause the actual results, performance or achievements of Ivanhoe Mines, or industry results, to be materially different from any future results, performance or achievements expressed or implied by such forward-looking statements or information. Such statements can be identified by the use of words such as "may", "would", "could", "will", "intend", "expect", "believe", "plan", "anticipate", "estimate", "scheduled", "forecast", "predict" and other similar terminology, or state that certain actions, events or results "may", "could", "would", "might" or "will" be taken, occur or be achieved. These statements reflect the Ivanhoe Mine's current expectations regarding future events, performance and results and speak only as of the date of this news release.

As well, all of the results of the 2016 Kakula preliminary economic assessment constitute forward-looking information, including estimates of internal rates of return (including an after tax internal rate of return of 38.0% with a payback period of 2.3 years), net present value (including a project NPV of US\$4.7 billion at an 8% discount rate in a two mine Kamoa and Kakula integrated development scenario and US\$3.7 billion at an 8% discount rate in the initial Kakula Phase 1 Mine option), future production (including an average annual production rate of 209,000 tonnes of copper during the first five years of operations and peak production of 262,000 tonnes in year three in the initial Kakula Phase 1 Mine option), estimates of cash cost (including average mine-site cash cost of US\$0.37/lb during the first ten years of operations), assumed long term price for copper of US\$3.00 per pound, proposed mining plans and methods (including the potential to use the controlled convergence room-and-pillar mining method), mine life estimates, cash flow forecasts, metal recoveries, production of copper concentrate in excess of 50% copper with extremely low arsenic levels, and estimates of capital and operating costs (including initial capital costs of US\$1.0 billion in either option considered in the Kakula 2016 PEA). Furthermore, with respect to this specific forward-looking information concerning the development of the Kamoa-Kakula Project, Ivanhoe Mines has based its assumptions and analysis on certain factors that are inherently uncertain. Uncertainties include among others: (i) the adequacy of infrastructure (including the rehabilitation of the Koni, Mwadingusha and Nzilo 1 hydroelectric power plants); (ii) unforeseen changes in geological characteristics; (iii) changes in the metallurgical characteristics of the mineralization; (iv) the ability to develop adequate processing capacity; (v) the price of copper; (vi) the availability of equipment and facilities necessary to complete development; (vii) the size of future processing plants and future mining rates, (viii) the cost of consumables and mining and processing equipment; (ix) unforeseen technological and engineering problems; (x) accidents or acts of sabotage or terrorism; (xi)

currency fluctuations; (xii) changes in laws or regulations; (xiii) the availability and productivity of skilled labour; (xiv) the regulation of the mining industry by various governmental agencies; (xv) political factors, including political stability; (xvi) the potential application of the DRC's special law - No. 14/005, enacted to facilitate Sino-Congolese cooperation to the Kamoa-Kakula Project; and (xvii) the completion of the railway upgrade between Kolwezi and Dilolo.

This release also contains references to estimates of Mineral Resources and Mineral Reserves. The estimation of Mineral Resources is inherently uncertain and involves subjective judgments about many relevant factors. Mineral Resources that are not Mineral Reserves do not have demonstrated economic viability. The accuracy of any such estimates is a function of the quantity and quality of available data, and of the assumptions made and judgments used in engineering and geological interpretation (including estimated future production from the Kamoa-Kakula Project, the anticipated tonnages and grades that will be mined and the estimated level of recovery that will be realized), which may prove to be unreliable and depend, to a certain extent, upon the analysis of drilling results and statistical inferences that may ultimately prove to be inaccurate. Mineral Resource or Mineral Reserve estimates may have to be re-estimated based on: (i) fluctuations in copper price; (ii) results of drilling, (iii) metallurgical testing and other studies; (iv) proposed mining operations, including dilution; (v) the evaluation of mine plans subsequent to the date of any estimates; and (vi) the possible failure to receive required permits, approvals and licenses or changes to existing mining licences.

Forward-looking statements involve significant risks and uncertainties, should not be read as guarantees of future performance or results, and will not necessarily be accurate indicators of whether or not such results will be achieved. A number of factors could cause actual results to differ materially from the results discussed in the forward-looking statements, including, but not limited to, the factors discussed here, as well as unexpected changes in laws, rules or regulations, or their enforcement by applicable authorities; the failure of parties to contracts with Ivanhoe Mines and its subsidiaries to perform as agreed; social, political or labour unrest; changes in commodity prices (and copper in particular); limitations and availability of capital; and the failure of exploration programs or studies to deliver anticipated results (including the actual results of drilling and exploration activities), or results that would justify and support continued exploration, studies, development or operations.

Although the forward-looking statements contained in this release are based upon what management of Ivanhoe Mines believes are reasonable assumptions, Ivanhoe Mines cannot assure investors that actual results will be consistent with these forward-looking statements. These forward-looking statements are made as of the date of this release and are expressly qualified in their entirety by this cautionary statement. Subject to applicable securities laws, Ivanhoe Mines does not assume any obligation to update or revise the forward-looking statements contained herein to reflect events or circumstances occurring after the date of this release.

Ivanhoe Mine's actual results could differ materially from those anticipated in these forward-looking statements as a result of the factors set forth in the "Risk Factors" section and elsewhere in the Ivanhoe Mines' most recent Management's Discussion and Analysis report and Annual Information Form, available at www.sedar.com.

Contact

Ivanhoe Mines - Investors:

Bill Trenaman

+1.604.331.9834

Ivanhoe Mines - Media

North America:

Bob Williamson

+1.604.512.4856

South Africa:

Jeremy Michaels

+27.82.939.4812

www.ivanhoemines.com

Dieser Artikel stammt von [Rohstoff-Welt.de](https://www.rohstoff-welt.de)

Die URL für diesen Artikel lautet:

<https://www.rohstoff-welt.de/news/250993--Ivanhoe-Mines-Announces-Results-of-a-Positive-Independent-PEA-of-Initial-Options-for-the-Start-Up-of-World-Scala>

Für den Inhalt des Beitrages ist allein der Autor verantwortlich bzw. die aufgeführte Quelle. Bild- oder Filmrechte liegen beim Autor/Quelle bzw. bei der vom ihm benannten Quelle. Bei Übersetzungen können Fehler nicht ausgeschlossen werden. Der vertretene Standpunkt eines Autors spiegelt generell nicht die Meinung des Webseiten-Betreibers wieder. Mittels der Veröffentlichung will dieser lediglich ein pluralistisches Meinungsbild darstellen. Direkte oder indirekte Aussagen in einem Beitrag stellen keinerlei Aufforderung zum Kauf-/Verkauf von Wertpapieren dar. Wir wehren uns gegen jede Form von Hass, Diskriminierung und Verletzung der Menschenwürde. Beachten Sie bitte auch unsere [AGB/Disclaimer!](#)

Die Reproduktion, Modifikation oder Verwendung der Inhalte ganz oder teilweise ohne schriftliche Genehmigung ist untersagt!
Alle Angaben ohne Gewähr! Copyright © by Rohstoff-Welt.de -1999-2025. Es gelten unsere [AGB](#) und [Datenschutzrichtlinien](#).