

We have set out in this Appendix, executive summaries of each of the reports of the Competent Persons in respect of our Material Reserves. The full text of these reports can be accessed via the internet at the Stock Exchange's website at [www.hkex.com.hk](http://www.hkex.com.hk) and our website at [www.vale.com](http://www.vale.com) and are available for inspection as set out in Appendix VIII of this Listing Document.

This Appendix contains the following executive summaries:

- (a) Review of the Updated Statement of Reserves for Iron Ore Properties in the Northern, Southeastern, and Southern Systems, and SAMARCO Alegria Complex, Brazil prepared for our Company by Pincock Allen & Holt Brasil;
- (b) External Audit of Coal Reserves for Moatize Coal Project prepared for our Company by Golder Associates Africa (Pty) Ltd; and
- (c) External Audit of Nickel and Copper Mineral Reserves prepared for our Company by Golder Associates Ltd.

Each of the executive summaries set out in this Appendix discloses all material information about the estimates of our Material Reserves.

Each of the reports of the Competent Persons contains a breakdown of the major components of our historical or estimated cash operating costs in respect of our Material Reserves. We have not disclosed other cost components in respect of our historical or estimated cash operating costs listed under Rule 18.03(3) of the Listing Rules, as we do not consider them material with respect to each relevant Material Reserve.

Since the effective date of each of the reports of the Competent Persons, no material charge has occurred to the Material Reserves covered by such report.



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**Review of the Updated Statement  
of Reserves for Iron Ore Properties  
in the Northern, Southeastern, and  
Southern Systems, and SAMARCO  
Alegria Complex, Brazil**

**Prepared for**



**October 1, 2010  
BH-00015A,**

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## 1.0 INTRODUCTION

At the request of Companhia Vale do Rio Doce (Vale), the consulting engineering firm of Pincock, Allen & Holt — Brasil (Pincock) has completed a review of the updated statement of reserves for 13 iron ore properties in the Northern, Southeastern and Southern Systems and the SAMARCO Alegria Complex mines as of June 30, 2010.

Pincock has assisted Vale in the review and audit of estimated resources and reserves for the iron ore deposits of the Northern, Southeastern and Southern Systems of the Vale operations in Brazil since 2005. This report is presented to summarize this involvement, provide a listing of the qualifications of the personnel involved with each audit and provide the statement of reserves for the specific properties addressed herein, as of June 30, 2010. This statement of reserves is based on a review of Vale's depletion of audited reserves for actual mine production since the date of the most recent audit by Pincock. Accordingly, for these 13 properties in which Vale has 100 percent ownership and the two SAMARCO properties in which Vale is 50 percent owner, Pincock has completed the most recent reserve review and audit as well as the review of the depletion of reserves for production since the last audit.

It is understood this report will be included in Vale's documentation for listing on the Hong Kong Stock Exchange. Accordingly, reference is made to the requirements of Chapter 18 of the exchange listing rules.

This report uses the terms "Measured Mineral Resource," "Indicated Mineral Resource," and "Inferred Mineral Resources." We advise investors that while such terms are recognized and permitted under Canadian regulations, the U.S. Securities and Exchange Commission (SEC) do not recognize them. Any references to mineral resources, Net Present Value (NPV), costs and prices, in this report or any of its annexes, is solely intended to validate the certification of the reserves according to SEC rules and its' "Industry Guide 7," and shall not be considered by any investor, analyst, or any company or person outside this context.

## 2.0 PREVIOUS RESERVE REVIEWS

The following summarizes the previous reserve reviews and audits completed by Pincock for Vale properties and for the SAMARCO Alegria in which Vale is a 50 percent participant with BHP Billiton.

### 2.1 Vale Properties

Auditing of the reported resources of Vale iron ore properties in Brazil began in 1997 in support of the filing of an F-3 Form with the United States Securities and Exchange Commission (SEC) as a requirement of the initial listing and public offering of Vale shares on the New York Stock Exchange. In that the objective of the audits was to support the US SEC filings, the review and audit work focused on confirmation that the reserves estimated by Vale complied with US SEC Industry Guide 7 "Description of property by issuers engaged or to be engaged in significant mining operations."

From the initial audit in 1997 through the audit completed of the 1999 reserves, the external auditor was the U.S. based company Mineral Resources Development, Inc. (MRDI). MRDI was acquired by AMEC in May 2000, and subsequent audits through the end of 2002, were done as AMEC but involved essentially the same personnel as the prior MRDI work. Vale changed auditors for the end of year 2003 and 2004 reserve statements. The audit of reserves stated as of the end of 2003 was completed by Golder Associates in early 2004.

Pincock completed the audit of year-end 2004 reserves in March 2005. This work included a thorough review of the metallurgy, processing plants and environmental management, as these areas had not been completely addressed in previous audits. The primary focus of metallurgical and environmental assessments was to confirm there were no material issues that would present

impairments to production of the mineable reserves being stated. This review addressed the Fábrica Nova Mine of the Southern System which is included in the reserve statement discussed herein.

AMEC again audited the reserves in 2005. For 2006, a third-party audit was not conducted, but reserves were depleted for actual production since the date of the previous audit by Vale's technical personnel. In February 2008, Pincock completed a reserve reconciliation review of Vale stated reserves as of December 31, 2007. This work confirmed the reserve statement by Vale for end of year 2007, based on the assumption of the validity of the last reserve audit, but did not include an independent review of the AMEC audits for end of year 2005 reserves.

Pincock completed a review and audit of the reserves for nine of Vale's iron ore properties as of December 31, 2007, with the work beginning in September 2008. The properties consisted of the Fábrica Complex, the Vargem Grande Complex, and the Apolo project of the Southern System, and the N4E and N4W mines and Serra Sul Project of the Northern System of mines.

For the N5 mine of the Northern System, Pincock has just completed a review and audit of the estimated reserves as of December 31, 2009.

For the reserve estimation as of June 30, 2010, Pincock completed a review of the depletion process for all Vale's iron ore properties in Brazil for which reserves are reported. This included both properties for which Pincock completed the most recent reserve review and audit (properties discussed herein) as well as properties for which other entities completed the most recent third-party reviews.

Table 2-1 summarizes the relevant dates of the audits and depletion review leading to the reserve statement presented herein.

Copies of the 2010 depletion review report, the 2010 reserve audit report for the N5 deposit, the 2008 reserve audit report, the November 2005 audit report of the Pico-Galenherio Mine and the specific appendices from the 2005 reserve audit report that relate to the iron ore properties are presented in Appendices A to D, respectively.

**TABLE 2-1**  
**Vale**  
**Summary of Reserve Audits**  
**Reserve Review and Audit Summary**

Complex	Mine / Deposit	Status of Mine/Deposit	Last Audit of Reserves				Reserves after Depletion As of June 30, 2010		
			Date of the Reserve Statement	Date of Site Visit	Date of Final Report	Stated Reserve <sup>(b)</sup>		Reserves after Depletion As of June 30, 2010	
						Million tonnes	Fe%	Million tonnes	Fe%
Minas Centrais Complex	Apolo	project	December 31, 2007	Sept-October, 2008 <sup>(a)</sup>	August 14, 2009	632.1 <sup>(c)</sup>	56.1	632.1	56.2
	Fábrica Nova	operating	December 31, 2004	March 2005	May 13, 2005	1,046.5	47.1	829.6	45.2
	Segredo <sup>(e)</sup>	operating	December 31, 2007	Sept-October, 2008 <sup>(a)</sup> December 2008 <sup>(b)</sup>	August 14, 2009	311.6	50.1	340.8	50.2
	João Pereira <sup>(e)</sup>	operating	December 31, 2007	Sept-October, 2008 <sup>(a)</sup> December 2008 <sup>(b)</sup>	August 14, 2009	584.8	42.3	490.0	41.9
	Sapacado	operating	May 18, 2005	November 2005	January 3, 2006	341.8	54.8	210.5	53.0
Vargem Grande Complex	Galinheiro	operating	May 18, 2005	November 2005	January 3, 2006	353.8	54.9	294.8	54.3
	Tamanduá	operating	December 31, 2007	Sept-October, 2008 <sup>(a)</sup> December 2008 <sup>(b)</sup>	August 14, 2009	546.0	53.3	484.0	54.1
	Capitao do Mato	operating	December 31, 2007	Sept-October, 2008 <sup>(a)</sup> December 2008 <sup>(b)</sup>	August 14, 2009	839.1	52.2	758.5	51.9
	Abóboras	operating	December 31, 2007	Sept-October, 2008 <sup>(a)</sup> December 2008 <sup>(b)</sup>	August 14, 2009	469.3	45.2	444.5	44.3
	N4W	operating	December 31, 2007	Sept-October, 2008 <sup>(a)</sup> December 2008 <sup>(b)</sup>	August 14, 2009	1,613.0	66.5	1,499.2	66.4
Serra Norte Complex	N4E	operating	December 31, 2007	Sept-October, 2008 <sup>(a)</sup> December 2008 <sup>(b)</sup>	August 14, 2009	442.4	66.4	371.7	66.4
	N5	operating	December 31, 2009	July 2010	August 17, 2010 (draft)	1,143.4	67.1	1,105.7	67.1
	Serra Sul	project	December 31, 2007	Sept-October, 2008 <sup>(a)</sup> December 2008 <sup>(b)</sup>	August 14, 2009	4,239.6	66.8	4,239.6	66.8
SAMARCO Mina Alegria <sup>(d)</sup>	Samarco Norte Centro	operating	December 31, 2009	Sept-October, 2009 <sup>(a)</sup> December 2009 <sup>(b)</sup>	April 28, 2010	1,276.3	42.7	1,260.7	42.7
	Samarco Sul	operating	December 31, 2009	Sept-October, 2009 <sup>(a)</sup> December 2009 <sup>(b)</sup>	April 28, 2010	835.0	39.2	822.0	39.2
<b>Total Reserve</b>								<b>13,783.7</b>	<b>57.4</b>

a) Site visit for resource review was completed in September-October 2008 and site visit for reserve review was completed in December 2008. The exception was the Apolo Project which was only visited by the Geology team.

b) Tonnage based on natural (wet) moisture tonnage and iron grade is on a dry basis.

c) The audited reserve was 652.0 Mt at an average grade of 56.1% Fe which included a small mining decree which Vale does not currently have control but anticipates obtaining. The stated reserve is reduced to 632.1 Mt to reflect the impact of this area.

d) 50% ownership by Vale

e) At the time of the 2008 reserve audit, a portion of the reserves for Segredo had been included in with the João Pereira mine. The current accounting has placed the reserves back with Segredo Mine. The total for the Fábrica Complex is not affected by the distribution.

Appendix D of this report includes the following appendices from the May 2005 reserve audit report:

- Appendix A of the 2005 report which addresses the iron ore mines and projects which were operated by Vale in the Iron Quadrangle.
- Appendix B which addresses the iron ore mines operated by MBR in the Iron Quadrangle.
- Appendix C which addresses the Carajás iron ore mines.

These appendices were prepared as stand-alone technical reports and present the audit results and conclusions for these properties.

## 2.2 SAMARCO Alegria Complex

SAMARCO's Mina Alegria was first audited by Golder Associates in May 2005 for reserves as of December 31, 2004. This review addressed a reserve base (proven and probable) of 719.4 million tonnes at an average grade of 44.6 percent Fe.

Beginning in 2009, at the request of Samarco Mineração S.A. (SAMARCO), Pincock completed a review and audit of the resources and reserves estimated for the Alegria Mine Complex, which is located in Minas Gerais State, Brazil. Mina Alegria is currently producing from two open pit mines with three distinct zones of mineralization: Alegria North, Alegria Central, and Alegria South. Alegria Central has no mining operations and is primarily a drilled out area, located contiguous with the current Alegria North mine pit. The mine is referred to as Norte-Centro. Germano is a mined out former open pit with a small remaining reserve, but was not addressed in the audit.

Pincock began the audit in September 2008 to review the resource model and resource estimate that had been prepared by SAMARCO's staff as of June 2008. An initial letter report was provided on October 9, 2008 which presented the findings of the resource review. This initial audit conclusion was that the June 2008 resource figures met acceptable international standards for resource calculation and were suitable for reserve estimation.

Subsequent to the initial resource review, SAMARCO decided to revise the resource models with additional drilling results and develop mine plans and a reserve estimate on the updated resource models. For the reserve estimate as of December 31, 2009, SAMARCO staff developed a new resource model.

Pincock's work on this audit resumed with a site visit by the geology team to the operations at the Alegria Complex in October 2009 to review the revised resource model and resource estimate. A letter confirming these resources was provided to SAMARCO on December 9, 2009. Our review of the reserve calculation then began with a site visit from December 14 to December 18, 2009.

The objective of the review was to provide a confirmation of the reserves estimated by SAMARCO's technical staff. Since the results and findings of Pincock's audit report could possibly be referenced in public filings by the two partners with Securities Exchange Commissions in both Australia and the US, consideration was given to both the *Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves* (JORC Code) and US SEC Guide 7 definitions of reserves. The Pincock audit report was not, however, prepared as the JORC Competent Person's report for the SAMARCO reserve estimate.

As part of this project, Pincock conducted site visits with a multi-disciplinary team of engineers and geologists, observed mining operations, and reviewed the methodology used by SAMARCO's geologists and mining engineers in calculating reserves.

Appendix E includes a copy of the 2009 reserve review and audit report completed for the SAMARCO Alegria Complex.



### 3.0 APPROACH TO AUDITS

The following summarizes the project team qualifications and the general approach taken to each reserve review and audit.

#### 3.1 Project Team Qualifications

Reserve reviews and audits completed by Pincock for the Vale and SAMARCO properties were completed to meet US SEC criteria, which currently do not include a criterion for a Competent Person. However, our project teams included senior level personnel in each technical discipline, with at least two people on each team who do meet the Hong Kong Stock Exchange Chapter 18 definition for a Competent Person (CP). We would note that membership in a Recognized Professional Organization is the only reason the other people do not meet the CP criteria. The average experience level of each team is in excess of 30 years, and specific to their role in the project team.

Table 3-1 provides a summary of the area of technical expertise and years of experience of the project team members for each of the reserve audits and notes the people who do meet the Chapter 18 Competent Person criteria.

The following presents a summary of the experience of the project team members:

**Jorge Amirá, Principal Mine Engineer.** Mr. Amirá has over 33 years experience in the minerals industry including mine management, environmental risk management, and strategic planning. His experience includes mine planning and engineering for both open pit and underground mines, geostatistical evaluations, resource and reserve estimation, and economic evaluations. He participated in the 2008 and 2010 reserve audits for Vale iron ore and manganese properties, the 2010 Vale depletion review and the 2009 audit of SAMARCO.

**TABLE 3-1**  
**Vale**  
**Summary of Reserve Audits**  
**Qualifications and Experience of Project Personnel**

	Jorge Amira	Bipin Bhatt, Ph.D.	Darrel Buffington, P.E. Project Manager and Environmental	Ronald Harma	Barry Hansen	Douglas Jones	Don M. Larsen, Ph.D., P.E.	Leonel Lopez, PG, CPG	Landy Stimmitt, P.E.	Barton Stone, P.G.	Donald B. Tschabrun
Project Responsibility in Most Recent Audit	Mining and Economics	Geology and Geostatistics	Project Manager and Environmental	Metallurgical and Process	Metallurgical and Process	Mining and Economics	Metallurgical and Process	Geology and Geostatistics	Mining and Economics	Geology and Geostatistics	Mining and Economics
Years Experience	37	35	30	40	40	25	22	37	42	36	30
Currently affiliated with Pincock	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	No
Meets Competent Person Criteria	Yes	No	Yes	No	No	No	Yes	Yes	Yes	Yes	No
Project Participation Apolo		X	X	X		X		X			
Fábrica Nova		X	X		X			X	X		
Segredo		X	X	X		X		X			
João Pereira		X	X	X		X		X			
Sapecado			X	X				X			X
Galinheiro			X	X				X			X
Tamanduá		X	X	X		X		X			
Capitao do Mato		X	X	X		X		X			
Abóboras		X	X	X		X		X			
N4W	X	X	X	X				X			
N4E	X	X	X	X				X			
N5	X		X	X						X	
Serra Sul	X	X	X	X				X			
Samarco Norte Centro	X		X				X			X	
Samarco Sul	X		X				X			X	

**Bipin J. Bhatt, Ph.D., Geostatistician.** Dr. Bhatt has extensive experience in mine geology project management, project planning and supervision, budgeting, and bankable feasibility studies including open pit and underground mining operations on both domestic and international projects. He has conducted resource/reserve estimations, reserve updates and auditing, geostatistical studies, and ore reconciliation. He has completed numerous assignments in mine planning—short range and long range strategic, production optimization, exploratory and development drilling, ore control, ore dilution, ore movement, drilling and blasting plans, sampling and mapping, blast movements, and metallurgical evaluations. Dr. Bhatt was part of the Pincock team that recently conducted the VALE 2008 reserve reconciliation project as well as the 2005 Resource and Reserve audits.

**Darrel Buffington, P.E., Principal Engineer — Project Manager.** Mr. Buffington is located in the Belo Horizonte office and is responsible for direction of Pincock projects in Brazil. He has 30 years experience including reviewing environmental management systems as part of due diligence evaluation of operating mines, providing technical analysis of mine waste containment facilities, review of regulatory compliance issues, and developing strategies for addressing environmental impacts in the mine planning process. Mr. Buffington's experience in Brazil includes serving as team leader for the 2005 resource and review audit of VALE's Southern System and the proposed expansion of Minerações Brasileiras Reunidas' Sapecado-Galinheiro Project; due-diligences on an open pit copper-gold deposit in Pará state, completing a Canadian National Instrument 43-101 resource review for an iron ore project in Amapá state, and was the project manager for basic and detailed mine planning and design for two nickel projects in Pará state.

**Ronald O. Harma, Principal Process Engineer.** Mr. Harma has 40 years experience in mine and plant operations, research and development, engineering and project management, international project development and general management in ferrous and copper/ precious metals businesses. He has extensive iron ore experience having worked for a major iron ore mining and processing company for over 40 years. He has provided leadership for mergers and acquisitions and directed research, development, process engineering, environmental monitoring and geological and land activities. Mr. Harma completed an iron ore mine valuation for Mechel Iron and Steel Company in support of US SEC filings and participated in the 2005, 2008 and 2010 audits of Vale iron ore properties.

**Barry J. Hansen, Principal Process Engineer.** Mr. Hansen has over 40 years of technical experience in the engineering, design and operation of mining and metallurgical projects, including nickel, cobalt, iron, silicon, copper, lead, zinc, copper, molybdenum, gold and silver ores. He is an expert in the engineering and operation of high-temperature metal production facilities, with particular emphasis on technical trouble-shooting and problem solving, including nickel and silicon smelters, and iron ore pelletizing plants. He is skilled in R & D at all levels from bench-scale testing to complex program management. Mr. Hansen has managed large-scale development programs to produce Ferronickel from nickel laterite ore.

**Douglas M. Jones, Vice President, Mining & Geological Services.** Mr. Jones has 27 years experience in the minerals industry which includes progressive positions at four major mining companies. He was General Mine Manager for the large underground Stillwater platinum Mine, in charge of all functions at the mine site. As Mine Superintendent for Newmont Mining Corporation's Deep Star and Carlin East gold Mines, he was responsible for all aspects of the mine operations, starting up two underground mines from drill holes to full production. International experience includes positions as Senior Mine Engineer and Senior Project Engineer at the Grasberg, DOZ and Dom copper mines for Freeport McMoran, including two start-up mines. He was also a mine foreman and engineer for Molycorp's Questa molybdenum mine.

**Don M. Larsen, Ph.D., P.E., Principal Process Engineer.** Dr. Larsen has over 22 years experience in the minerals industry including metallurgical process auditing, evaluation and process improvements. He has managed metallurgical programs supporting feasibility studies on

international acquisitions. He has been involved in iron, gold, silver, copper and nickel mining projects and has worked for a major iron producer and two gold producers.

**Leonel Lopez, C.P.G., Principal Geologist.** Mr. Lopez has broad participative and productive experience in the mining industry including exploration for iron ores, coal, precious metals, base metals in copper porphyry, disseminated, sedimentary, vein and massive sulfide deposits. Has provided consulting services for numerous world private and public corporations in the area of resource/reserve definition, evaluation, and certification. He has proven leadership abilities for completion of successful negotiations and programs of exploration and development. Mr. Lopez completed geologic review of CVRD's iron ore properties in Brazil in 2005 and 2008 and conducted an audit of the MBR Pico Complex iron operation in the Iron Quadrangle in the state of Minas Gerias, Brazil.

**Landy A. Stinnett, P.E., Mine Engineering.** Mr. Stinnett is a Principal Mine Engineer with diversified experience in all unit operations associated with a variety of open pit and underground mining methods. He brings to the PAH team over 40 years of experience in mining engineering, valuations, appraisals, and economic cost evaluations. He has been involved in the preparation and/or review of many prefeasibility/feasibility studies in iron, coal, copper, precious metals, and industrial minerals. He specializes in the areas of mine method selection, equipment preference, and engineering cost estimations. His iron experience includes the reserve update for CVRD's Southeastern System iron properties in Brazil. Mr. Stinnett is registered in Colorado as a Professional Engineer, and with the Society of Mining Engineers as a Registered Member.

**Barton G. Stone, C.P.G., Chief Geologist.** Mr. Stone has expertise in the fields of geology, exploration, and resource estimation. He has more than 40 years experience in the evaluation of base and precious metal deposits around the world, including due diligence reviews, technical evaluations, and prefeasibility/feasibility studies. His experience is highlighted by 10 years with Kinross Gold as Exploration Manager. He also has 15 years with Anaconda/ARCO and managed a team of 12 geoscientists in base and precious metals exploration and evaluation.

**Donald B. Tschabrun, Principal Mining Engineer.** Mr. Tschabrun has 25 years of broad experience in world-wide base metal, precious metal and industrial mineral projects. He has extensive project experience in computerized drill hole database management, geological interpretation, ore deposit modeling, ore reserve estimation, mine planning and design, capital and operating cost estimation, economic and financial evaluations. He has prepared numerous feasibility studies and due diligence reviews and developed resource/ reserve evaluations within requirements established by United States, Canadian and Australian Securities Exchanges, respectively. Mr. Tschabrun is recognized by US courts as an Expert in mine operations and economic evaluations.

### 3.2 Approach to Audits

The typical approach to completing the reserve audits included:

- Review of the previous audits completed for the subject property.
- Completing site visits to the operating mines by the full Pincock audit team typically consisting of a geologist, a geostatistician, a mining engineer, an environmental/geotechnical engineer, and a process/metallurgical engineer. Undeveloped projects would be visited by at least the geologic team.
- Review and independent analysis of data provided by the company's staff.
- Preparation of an interim report of the findings of the resource review.
- Preparation of a final report of the findings of the audit.

Verbal and written reports would be presented to Pincock during the site visit to provide for our understanding of the data, geologic model, mineral processing, and mine designs in sufficient detail to confirm that the reported resources and reserves were estimated in accordance with generally accepted principles and practices of the mining industry.

Pincock reviewed the inputs to the reserve estimates to confirm that appropriate steps have been taken to properly classify the resources as reserves in accordance with US SEC criteria, and in the case of the SAMARCO Alegria Complex, the JORC Code. This includes information regarding the ability to technically, economically and legally extract the reserves.

Pincock teams included geologists to review the geology and geologic model, a geostatistician to examine the analytical approaches used in estimating resources, a mining engineer to assess mining methods and costs and the mine planning that supports definition of mineable reserves, a metallurgist to review processing operations and costs, and a geotechnical/environmental engineer to review geotechnical mine design, permitting status and compliance, environmental management and the existence of a satisfactory reclamation and rehabilitation program.

The following areas are included in this audit:

- Auditing the Geologic and Resource Models
  - Review of the current status of the exploration methods, sampling and assaying procedures, and the geologic interpretations with the geologists familiar with the projects.
  - Review of the statistical and geostatistical parameters used in the estimation of the in situ resources.
  - Review of the reconciliation of past production for operating mines, to the predicted model resources. This involves reconciliation of modeling based on bench face, trench and drill hole sampling during mining with the long-term resource model.
- Auditing of Mineable Reserves
  - Review of the direct operating costs, recoveries, and other economic data used to determine the mineable reserves in the ultimate pits.
  - Review of current mine progress, planned progress, and ultimate pit configuration.
  - Comparison of predicted direct operating costs to the costs currently being reported at the mines.
  - Review of ultimate pit determinations, mine designs, production scheduling and reserve classification. In general, Measured resources within the ultimate pit became Proven reserves and Indicated resources within the ultimate pit became Probable reserves. An exception to this is the N5 mine as discussed in Section 4.2 of this report and in more detail in the N5 reserve audit report in Appendix B.
  - Review of metallurgical test work and process facilities for each mining operation.
  - Review of mine geotechnics including approaches to design and monitoring of pit slopes, mine waste disposal areas, tailings impoundment dams and sediment or other impounding structures.
  - Review of the status of the surface and mineral rights, mine permits, closure plans, and environmental management.

The audit work was focused on the mining and mineral processing operations and did not typically include a review of concentrate pipeline systems, rail systems, or port facilities.

The specific audit reports presented in Appendices B to E provide detailed information on the resource and reserve estimation processes and the procedures used by Pincock in the reserve review.

#### 4.0 SUMMARY OF RESERVES

Pincock has reviewed reserve statements and the underlying estimation process for 11 iron ore mining operations and two development projects of Vale and the SAMARCO Alegria Complex as discussed in Section 2 of this report. The following discusses the status of the reserves as of June 30, 2010.

#### 4.1 Statement of Reserves

Based on the review of Vale's mineral reserves stated as of June 30, 2010, Pincock has developed Table 4-1, which presents the reserves Vale has reported for the Southern Systems Mines and the Northern Systems Mines and SAMARCO's staff has developed for the Mina Alegria Complex mines. The reserves are estimated by a combination of estimation of resources and reserves using industry accepted approaches to define a reserve as of a certain date which is then subject to a third party review and audit. Reports of the Pincock audits for each property are presented in Appendix B to E.

**TABLE 4-1 Vale  
Summary of Reserve Audits  
Vale's Iron Ore Reserves as of June 30, 2010**

	Reserves <sup>(a)</sup>	Proven		Probable		Total	
		Mt	% Fe	Mt	% Fe	Mt	% Fe
Minas Centrais Complex . . . . .	Apolo	292.4	57.4	339.7	55.1	632.1	56.2
Mariana Complex. . . . .	Fábrica Nova	480.1	46.0	349.6	44.1	829.6	45.2
Itabirito Complex . . . . .	Segredo	172.1	52.0	168.7	48.5	340.8	50.2
	João Pereira	202.3	42.2	287.7	41.7	490.0	41.9
	Sapicado	90.2	52.7	120.3	53.2	210.5	53.0
	Galinheiro	114.1	54.7	180.7	54.0	294.8	54.3
Vargem Grande Complex. . . . .	Tamanduá	280.3	56.1	203.8	51.3	484.0	54.1
	Capitao do Mato	200.2	55.6	558.3	50.6	758.5	51.9
	Abóboras	227.4	45.3	217.1	43.3	444.5	44.3
Serra Norte Complex . . . . .	N4W	1,212.3	66.5	286.9	66.1	1,499.2	66.4
	N4E	285.4	66.5	86.3	66.0	371.7	66.4
	N5	381.0	66.8	724.7	67.2	1,105.7	67.1
Serra Sul. . . . .	Serra Sul	3,045.8	66.8	1,193.7	66.7	4,239.6	66.8
SAMARCO Mina Alegria <sup>(b)</sup> . . . . .	Samarco Norte						
	Centro	706.0	44.2	554.7	40.7	1,260.7	42.7
	Samarco Sul	440.0	39.7	382.0	38.5	822.0	39.2
<b>Total Reserves</b>		<b>8,129.6</b>	<b>59.3</b>	<b>5,654.1</b>	<b>54.6</b>	<b>13,783.7</b>	<b>57.4</b>

a) Reserves stated in wet run-of-mine (ROM) million metric tons (Mt)

b) 50% ownership by Vale

The audited reserve was then depleted for actual production that has occurred between the time of the reserve estimate and June 30, 2010. The depletion estimation was primarily done using site topographic survey data to develop a mine surface as of June 30, 2010 and then determining the tonnes and average grade of proven and probable ore below this surface and above the limits of the ultimate pit considering the audited block model of reserves.

Checks were made against production records as well, to add confidence in the depletion process; however, primary consideration was given to the physical survey data as there were significant discrepancies in the mine production data. Economic analyses were made to confirm material classified as ore as of the date of the most recent reserve audit, still meets the economic viability criteria under today's operating costs and product sales values. The 2010 depletion report presented in Appendix A provides a detailed discussion of the depletion procedures and Pincock's review process.

It is Pincock's opinion that these reserves meet the requirements of the U.S. Securities and Exchange Commission. Recent site visits were not made as part of this report preparation, except for the N5 operations of the Northern System. However, Pincock is not aware of any material changes nor has Vale provided any information of material changes that would indicate material classified as reserve as of the date of the most recent audit from being ore today. We would, however, note the considerations presented in the following section regarding specific aspects of some of the properties regarding the legal right to mine.

## 4.2 Considerations

The following properties have specific considerations regarding permitting or legal right to mine which should be recognized. It is Pincock's opinion that there is a reasonable probability that these issues will be resolved and Vale will obtain the legal right to mine the full reserve, therefore, consider mining of the reserves to be legally viable.

### 4.2.1 *Apolo Project*

The federal department responsible for issuing the mining rights in Brazil is the National Department of Mineral Production (DNPM). Mining rights given by the Mining Decree are transferable with approval of the DNPM. As part of the information provided to Pincock for this audit, Vale presented information concerning the validity of mining rights for the ore bodies that comprise the stated reserves. While Pincock's work did not include a legal opinion on the validity of these rights, it is our opinion that Vale has demonstrated that the right to mine exists for all the reserves stated except for a small portion of the Apolo Project. Relative to the Apolo Project, a portion of the ultimate pit that has been designed for the Apolo Project for the reserve estimation includes an area for which Vale does not currently hold the DNPM mining rights. There is one concession for this area that is not currently controlled by Vale. Pincock understands negotiations are well under way with the company holding the concession.

The stated reserves in Table 4-1 of this report exclude the reserves for which the DNPM concessions are held by other companies but will likely become available to Vale. Vale has evaluated the impact of this concession on the overall resource being stated for the Apolo Project and have provided Pincock with data which demonstrated the reserve to be 632.1 Mt as compared to a reserve of 652.9 Mt, which is addressed in the 2008 reserve review and audit report presented in Appendix C. Pincock believes it is reasonable to expect Vale will be able to resolve this issue through either negotiation with the current concession holder or through legal action through DNPM. In that DNPM has an obligation to assure the mineral resources of the nation are developed in the manner that provides the best value to the people of Brazil, allowing Apolo Project to be developed without mining all the material within the ultimate pit would not achieve this mandate.

Beyond the DNPM Mining Decree, additional regulatory approvals must be obtained for the Apolo Project to address environmental and social impacts of a mining project. There is concurrent regulatory authority by the Federal, State and Local governments over nature conservation, soil and natural resources protection, environmental preservation and pollution control. For the Apolo operations, which are located entirely within the State of Minas Gerais, environmental licensing is through the State Secretary for Environment and Sustainable Development (SEMAD). The State Council for Environmental Policies (COPAM) is responsible for formulating the technical norms and



guidelines for environmental quality. The State Foundation for the Environment (FEAM) is the lead agency within SEMAD and under COPAM for permitting mining operations. FEAM is responsible for review and evaluation of mining projects to confirm the proposed mineral development will comply with the environmental policies formulated by COPAM. As part of the regulatory review process, the State Institute for Forestry (IEF) and the Water Management Institute (IGAM) are responsible for review and comment on issues related to agriculture and forestry and water resources, respectively.

Permitting of the Apolo Project is currently in progress with a projected date of October 2010 to receive the Preliminary License. In accordance with the regulatory requirements, Vale has prepared the EIA and RIMA with the assistance of third party consultants. Public meetings have been held to identify concerns of the local population as part of the scoping of the EIA/RIMA document preparation. The approximately two years is scheduled to obtain the Installation License (LI) for the Apolo Project.

From Pincock's review of the provided schedule and scope of EIA/RIMA, it is our opinion that Vale's schedule for permitting is reasonable, considering the overall project implementation schedule. As in the permitting of any major, greenfields mining project involving the regulatory process and public review and comment, the exact schedule and the need for additional studies or evaluation are uncertainties. Comments received during the public meetings during the EIA/RIMA scoping process indicate a significant public concern for impacts to water resources due to the water demands for the project and the environmental risks associated with the tailings disposal and sediment containment dams, which are common public concerns. Impacts due to the inflow of workers during construction and operation were also identified. The changing land use in the area resulting from development of residential areas is changing focus from the historic agricultural land use. This brings additional public concerns with noise, dust and visual impacts. Vale's success in expanding the operations of the portions of the Southern System that were previously operated as MBR which are adjacent to commuter communities around Belo Horizonte would indicate Vale has the ability to successfully operate within this environment. However, the lack of the environmental license presents a risk to the development of the project, although a reasonable risk, typical of projects at this phase of development.

#### ***4.2.2 Segredo, João Pereira, Tamanduá, Capitão do Mato, and Abóboras Mines***

As discussed in the 2008 report in Appendix C, the reserves for the Segredo and João Pereira of the Fábrica Complex and the Tamanduá, Capitão do Mato and Abóboras Mines of the Vargem Grande Complex consider the future process of hard itabirite materials which were previously considered waste. These ores are to be treated in new processing plants through crushing, grinding, and flotation to produce pellet feed. While this processing technology to treat hard, lower grade itabirite ores is relatively new to the Brazil iron ore industry, similar materials are being successfully treated in other parts of the world.

The new itabirite processing projects for Fábrica Complex and Vargem Grande Complex will require regulatory approval and modification of the existing Operating Licenses through FEAM. In that these will be expansion projects to the existing operation, an Installation License will be needed to allow construction of the plants, then a modification of the existing Operating License will be issued by FEAM. Pincock understands that this is primarily an administrative process with technical review to confirm the expansion project will meet the environmental performance standards of the original Operating License.

#### ***4.2.3 N4E, N4W, and N5 Mines***

The Northern Complex of mines and most of the associated operations and activities are located on federal land within the Floresta Nacional de Carajás (National Forest of Carajás), which was established by federal law in 1998, after the Carajás mining complex was in operation. Two tailing ponds (Gelado and Geladinho) for the existing Carajás Processing Plant are located in the Gelado



Area of Environmental Protection (APA), a federal conservation unit situated immediately north of the National Forest. Both areas are overseen by the Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis (IBAMA: Brazilian Institute of Environment and Renewable Natural Resources). New projects or significant revisions to the existing operations require approval by IBAMA as discussed in more detail in the N5 reserve audit report in Appendix B and the 2008 report for the Northern System mines presented in Appendix C.

As part of the licensing process, an environmental impact analysis is required. The level of detail of the analysis is determined by the significance of potential impacts. For significant projects, a full environmental impact assessment is required which includes inter-agency review and PUBLIC consultation, public announcements of availability of documents for review and certain taxes or fees to be paid.

The N4E, N4W and N5 Mines of the Carajás Complex are currently in operation and feeding an existing 100 Mtpy process plant and there will be an additional 30 Mtpy (nominal) plant completed in the near term. At the time of the 2008 audit, the installation license for the 30 Mtpy process plant construction had not been received. The license has been received and the plant is under construction as of the time of the July 2010 site visit for the N5 audit.

The northern portion of the N5 deposit has two active mining areas that are included in the existing Operating License. The 338 ha area designated as N5S, located to the south of the existing operation requires regulatory approval by IBAMA. Vale has elected to permit N5S in two steps as a result of the occurrence of caverns in the southern most part of the N5S area. These caverns are developed in the iron formations through dissolution and mobilization of minerals in a similar manner as karst features develop in limestone. Recent changes in Federal environmental regulations has raised the significance of the caverns in iron formations, requiring more detailed mapping and analysis to assess the cultural and ecological significance of caverns in the area to be impacted by mining. There is a classification system developed for classification of the importance of each cavern, which aids in defining the level of protection or mitigation required. It is possible that highly important caverns will require preservation, preventing mine development in those areas.

Vale is proceeding with permitting of approximately 128 ha adjacent to the existing mining operations and is conducting studies of the caverns in the remaining area to identify and classify caverns. An EIA/RIMA has been prepared and submitted in December 2009 for the first part of N5S and public meetings were held in April 2010. Based on the limited public interest exhibited in the project, Vale has requested that future public meetings be waived and IBAMA complete the administrative review of the EIA/RIMA. Vale anticipates obtaining approval of the first portion of the N5S mining area soon.

For the southern most area, studies are being conducted to assess the number and significance of caverns within the ultimate pit area considered in defining the reserves reported for the N5 mine. The studies are ongoing and are not expected to be finalized until May 2011.

In that there is a risk that there may be caverns of significance that could impact development of the final pit in the N5S area, Vale has considered the areas that caverns have been identified and placed a 250 meter buffer zone around each and calculated the reserve outside these area influenced by the caverns to define the Proven reserves. Reserves within the ultimate pit and inside the buffer areas were classified as Probable reserves.

Pincock considers this a reasonable approach to address the uncertainty of the impact of the caverns on the currently designed ultimate pit for the N5S area. Based on the cavern surveys conducted for the northern portion of N5S which is currently being permitted, it appears highly unlikely that a significant number of the caverns would be determined to be of sufficient importance to preclude mining, although mitigation measures will certainly be necessary.

#### 4.2.4 SAMARCO Alegria

Mining of the full reserve reported for the SAMARCO Norte-Centro and Sul Mines of the Mina Alegria Complex will require a new waste disposal pile and the diversion of a small stream that extends through the mining area. In that these will be expansion projects to the existing operation, an Installation License will be needed to allow construction of the facilities, then an Operating License will be issued by FEAM. This is primarily an administrative process with technical review to confirm the expansion project will meet the environmental performance standards of the original Operating License.

Of greater interest relative to potential impacts to the stated reserves is the surface use status of the future waste disposal area which is a private property preservation area established under Federal law to conserve ecological processes, biodiversity and for protection of flora and fauna. In 2005, SAMARCO entered into an agreement with the State Institute of Forestry (IEF) to reserve certain areas within the mine limits to meet these requirements. The reserved areas include the proposed location of the future waste disposal area and haul road. SAMARCO is currently discussing alternative land parcels that can be exchanged for the current reserve area which would allow development of the new waste disposal area.

From Pincock's review of the provided schedule and scope of permitting activities, it is our opinion that SAMARCO's schedule for permitting of the new waste disposal area and the stream relocation. In addition, SAMARCO's technical staff has completed alternative studies that indicate there is a viable alternative to the new waste disposal area with in-pit disposal of waste rock. Regardless, lack of environmental license for a major project such as the new waste rock disposal area or the relocation of the stream presents a risk to the development of these reserves, although a reasonable risk.

Information provided to Pincock in the review of the SAMARCO operation indicates current DNPM authorization to mine exist except in the north and northeast sides of the North-Central pit. In these areas the slopes of the ultimate pit extend into that adjacent Alegria Mine owned by Vale. In that Vale is mining the same ore body as SAMARCO; Vale's mining operations will extend up to the SAMARCO property limits as well. A mining agreement is being finalized between SAMARCO and Vale to allow joint mining of the ore between the two properties. For SAMARCO's reserve estimation, only the ore that is within SAMARCO's DNPM concession limits is considered and both waste and Vale ore that must be moved to access this ore is being considered as waste in the mine plan and cost model.

## 5.0 LIMITATIONS

Pincock has independently reviewed information and data supplied by Vale and its affiliates and consultants. Although, Pincock's opinions expressed in this report rely on the accuracy of the supplied data, Pincock has no reason to believe that any material facts have been withheld. Vale's technical staff has been open and forthcoming with information. Pincock does not accept responsibility for any errors or omissions in the supplied information and does not accept any consequential liability arising from investment or other financial decisions or actions resulting from them.

All disclosure about properties in this report conforms to the standards of United States Securities and Exchange Commission Industry Guide 7, Description of Property by Issuers Engaged or to be Engaged in Significant Mining Operations, other than disclosure of "Mineral Resources," "Measured Mineral Resources," "Indicated Mineral Resources," and "Inferred Mineral Resources," which are Canadian geological and mining terms as defined in accordance with Canadian National Instrument 43-101 under the guidelines set out in the CIM Standards.

Mineral resource estimates are inherently forward-looking statements and may be subject to change. Although Pincock exercises due diligence in reviewing the supplied information,

uncontrollable factors or unforeseen events can have significant positive or negative impacts on mineral resource statements. Uncontrollable factors or unforeseen events consist of risks related to the business such as, the cyclical nature of the mineral industry, the internationally competitiveness of the industry, price fluctuations based on varying levels of demand and international or local monetary or political policy changes. Any one or combination of factors could significantly influence mineral resource statements.

This report uses the terms "Measured Mineral Resource" and "Indicated Mineral Resource." We advise U.S. investors that while such terms are recognized and permitted under Canadian regulations, the U.S. Securities and Exchange Commission do not recognize them. U.S. investors are cautioned not to assume that any part or all of the Mineral Resources in these categories will ever be converted into Mineral Reserves.

This report uses the term "Inferred Mineral Resource." We advise U.S. investors that while such terms are recognized and permitted under Canadian regulations, the U.S. Securities and Exchange Commission do not recognize resources. "Inferred Mineral Resources" have a great amount of uncertainty as to their existence, and great uncertainty as to their economic and legal feasibility. It cannot be assumed that all or any part of an Inferred Mineral Resource will ever be upgraded to a higher category. Under Canadian rules, estimates of Inferred Mineral Resources may not form the basis of feasibility or other economic studies. U.S. investors are cautioned not to assume that any part or all of an Inferred Mineral Resource exists, or is economically or legally mineable.

The results and opinions expressed in this report are based on Pincock's observations and the technical data provided by Vale and are conditional upon the technical data being current, accurate, and complete as of the date of this report, and the understanding that no information has been withheld that would affect the conclusions made herein. Pincock reserves the right, but will not be obligated, to revise this report and the conclusions contained within, if additional information becomes known to Pincock subsequent to the date of this report. Pincock does not assume responsibility for Vale's actions in distributing this report.

## 6.0 UNITS AND ABBREVIATIONS

Pincock has based all measurements in the metric system, and has identified exceptions to this, notably when listing both English and Metric standards.

Unless otherwise stated, Dollars are United States Dollars, and weights are in metric tonnes of 1,000 kilograms (2,204.62 pounds). The following abbreviations are used in this report:

<u>Abbreviation</u>	<u>Unit or Term</u>
AA	Atomic Adsorption
BIF	Banded iron formation
DCF	Discounted Cash Flow
FEL	Front-End Loaded Project Evaluation Study
ft	feet
ft <sup>3</sup>	cubic feet
G&A	General and Administrative
IDS	Inverse Distance Squared
ICP	Inductively Coupled Plasma
In	inch
ISO	International Standards Organization
JORC	Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves
k	Thousands
kg	kilogram

<u>Abbreviation</u>	<u>Unit or Term</u>
km	Kilometer
LI	Installation License
LMC	Linear co-regionalization model
LO	Operating License
LP	Preliminary License
LOI	Loss On Ignition
M	Millions
Mt or mt	Million tonnes
mm	millimeters
m <sup>3</sup>	cubic meter
mtpy	Million tonnes per year
NI 43-101	Canadian National Instrument 43-101
NPO	Natural Pellet Ore
NPV	Net Present Value
OCK	Ordinary Co-Kriging
OK	Ordinary Kriging
oz	ounces
Pincock	Pincock Allen & Holt
ROM	run-of-mine
T or t	Metric Tonne (1,000 kg or 2,204.6 lbs)
TDA	Total De-clustered Average
TDS	Total Dissolved Solids
TSS	Total Suspended Solids
Tpa or tpy	Tonnes per annum
tpd	Tonnes per day
tph	Tonnes per hour
UTM	Universal Transverse Mercator coordinate system
Vale	Companhia Vale do Rio Doce
yd <sup>3</sup>	cubic yards
XRF	X-Ray Fluorescence
\$	United States Dollars
R\$	Brazilian Reals
%	Percent by weight

#### Common Chemical Symbols

Aluminum	Al
Calcium	Ca
Chlorine	Cl
Cobalt	Co
Copper	Cu
Gold	Au
Iron	Fe
Lead	Pb
Magnesium	Mg
Manganese	Mn

Common Chemical Symbols

Molybdenum	Mo
Nickel	Ni
Oxygen	O <sub>2</sub>
Potassium	K
Silver	Ag
Sulfur	S
Titanium	Ti



**Effective Date: 30 June 2010**

## **VALE SOUTH AFRICA**

### **EXTERNAL AUDIT OF MOATIZE COAL RESERVES**

#### **VOLUME 1**

# **SUMMARY REPORT**

**Submitted to:**

Vale South Africa (Pty) Ltd  
13 Fredman Drive  
2nd Floor, Fredman Towers  
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2196

**Report Number.** 12779-10083-2

**Distribution:**

2 Copies - Vale South Africa (Pty) Ltd  
1 Copy - Golder Associates Africa (Pty) Ltd  
1 Copy - Project File

  
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## EXECUTIVE SUMMARY

Golder Associates Pty Ltd (Golder) was requested by Vale to carry out an audit of the Coal Reserves of the Moatize coal project in Mozambique.

The work included review of the following main areas:

- Mining and Reserves
- Economic Analysis

This document reports the findings of the audit. The Maputo office of Moatize and the site itself were visited during the period 11 June to 15th June by Ross Bertinshaw (Principal Mining Engineer) and Johan Swart (Senior Coal Geologist) of Golder Associates. Sue Bonham-Carter (Principal Mining Engineer) and Al Tatersall (Senior Engineer) of Golder Associates met Vale staff in the Johannesburg offices 20 June 2010 to review the project financials.

The project is based on a mine producing 26 Mt/a of Run-of-Mine (ROM) which is sent to a processing plant outputting about 8.5 Mt/a of 10.5% coking coal and 2 Mt/a of export thermal coal (27.2 MJ/kg) for a period of at least 35 years.

Golder finds the Coal Reserves documentation and data put together to a good standard. The Reserves are based on two main studies. These are the 2006 BFS (Snowden 2006c) and the 2009 update (Snowden 2009a and 2009b). The BFS provides the basis for all the Mining Sections except 2A. The plan was updated for this Section in 2009 with extra holes and more detailed planning for what will be the initial mining area.

Golder believes that the Reserves are fully supported by the work and studies carried out to date.

The main problem has been a lack of solid audit trail at this time. This is not because the work and data is not available but because Moatize is in a transitional period between the Feasibility and implementation planning carried out by Snowden and the operational planning that is now being taken over by the Moatize staff on site.

These on site people will in the next year no doubt redo much of the work and hopefully produce a new set of Reserves which will be fully documented and backed up by their own work. During this work it is important they create a proper audit trail.

Construction of the CHPP and other mine infrastructure are well underway, so risk in these areas are rapidly reducing. Much of the initial mining equipment is already on site and is now operating in the box-cut.

Golder believes that the Reserves published at June 2009 and as given below (after correction for tabulation error) are reasonable and supportable.

Golder has not expressed any opinion on mineral resources and any reference to mineral resources, NPVs, costs and prices in this report or any of its annexes. Golder audited the Coal Resources as part of this project and found no material problems with the estimation of the Coal Resources, and they were used for the validation of basic supporting information which is required to determine that the reserves are certified according to the SEC Rules and Industry Guide 7 and shall not be considered or relied upon by any investor, analyst or any company or person other than in relation to this specific purpose. The results from this audit can be found in the complete report "External Audit of Mineral Resources and Reserves for Moatize Coal Project, Report Number 12779-9783-1."

## Coal Reserves at June 2009

Section	Class	ROM Coal	ROM Coal	Saleable Coking Coal	Saleable Coking Coal	Saleable Thermal Coal	Saleable Thermal Coal
		Mt (adb)	Mt (arb)	Mt (adb) (10.5% Ash)	Mt (arb)	Mt (adb) (27.2 MJ/kg)	Mt (arb)
1	Proved	78	82	28	31	7	7
	Probable	47	47	16	17	5	5
2A	Proved	73	76	25	28	4	4
	Probable	115	120	40	44	7	7
3	Proved	56	59	15	17	4	4
	Probable	4	4	1	1	0	0
4	Proved	150	157	54	59	14	15
	Probable	41	43	14	15	4	4
6	Proved	66	69	18	20	4	4
	Probable	325	340	98	107	29	31
<b>Total Proved</b>		423	443	140	155	33	34
<b>Total Probable</b>		532	554	169	184	45	47
<b>Total Reserves</b>		955	997	309	339	78	81

**Notes**

ROM(arb) assumes moisture added to give 4.6% total moisture

Coking Coal Product (arb) assumes moisture added to give 10% total moisture

Thermal Coal Product (arb) assumes moisture added to give 6% total moisture

**Report Structure**

The Mineral Reserve Statement consists of two reports.

This report provides a summary of:

- Context of the Audit
- Basis for Coal Reserve Reporting
- Competent Persons
- Financial Assumptions
- Coal Reserve Estimates
- Results of Economic Evaluations
- Opinions of the Competent Persons

A detailed report with supporting documentation has been supplied to Vale.



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No table of figures entries found.

**APPENDICES****APPENDIX A**

Document Limitations

## 1.0 INTRODUCTION

Golder Associates Africa (Pty) Ltd. (Golder) has been retained to audit Vale's Moatize coal reserves as of 30 June 2010. Between 11 June and 15 June, Golder's competent persons visited the Moatize project site and interviewed key personnel from Vale at the site in order to ascertain the validity of the information gathered and the coal reserves being declared in this document. This report will support Vale's application for listing on the Stock Exchange of Hong Kong Limited. Accordingly, reference is made to the requirements of Chapter 18 of the exchange listing rules.

Golder has prepared this document in a manner consistent with that level of care and skill ordinarily exercised by members of the engineering and science professions currently practising under similar conditions in the jurisdiction in which the services are provided, subject to the time limits and physical constraints applicable to this document.

This document, including all text, data, tables, plans, figures, drawings and other documents contained herein, has been prepared by Golder. It represents Golder's professional judgement based on the knowledge and information available at the time of completion.

The factual data, interpretations, suggestions, recommendations and opinions expressed in this document pertain to the specific operation or project, site conditions, design objective, development and purpose described to Golder by Vale, and are not applicable to any other project or site location. In order to properly understand the factual data, interpretations, suggestions, recommendations and opinions expressed in this document, reference must be made to both this summary report and the full report.

In this document and the full report the terms Qualified Persons and Competent Persons are interchangeable.

## 2.0 BASIS FOR COAL RESERVES REPORTING AS OF 30 JUNE 2010

The key elements used for reporting Vale's coal reserve estimates are as follows:

- Coal reserves are estimated only in areas where Vale has legal rights to the property and only for the period that the mining rights exist.
- The economic viability of a coal reserve is demonstrated by full feasibility study. This principle is consistent with the requirements of the South African Code for Reporting of Coal Resources and Coal Reserves (The SAMREC Code) and also the US SEC Industry Guide 7.
- Coal reserves are estimated using industry best practices and are consistent with the definitions and standards under the SAMREC Code and also SEC Industry Guide 7.
- Coal reserves are scheduled in the Project's long-term production plan.
- Mining, processing, overhead and marketing costs are assigned based on the assumption that the operation is operating at a production level that is generally near the capacity of its production facilities.
- The economic viability of the coal reserves is demonstrated by the evaluation of the Project's long-term production plan against all applicable costs.

### 2.1 Guidelines and Definitions

As part of routine validation of the Moatize coal reserves, Golder is obliged to confirm that the following items are the result of sound engineering and geological practise, and that the final estimations are compliant with reporting codes such as SAMREC, SEC Industry Guide 7, HKEx Chapter 18, or NI 43-101, as required.

The items are:

- The Mining plan that is based on acceptable resource estimation practices.
- The Coal Reserves Statement is based on the mining plan.
- The positive cash flow resulting from the mining plan.
- Vale's sensitivity analysis on the cash flow, concluding that the project is robust under reasonably expected market conditions.

### 3.0 COMPETENT PERSONS

The following Golder Competent Persons were involved in the audit of Vale's Moatize Project.

- Johan Swart, Resource Geologist
- Ross Bertinshaw, Mining Engineer
- Sue Bonham-Carter, Mining Engineer
- Al Tattersall, Mining Engineer

### 4.0 ECONOMIC ANALYSIS

The Vale June 2010 cost model was audited during a meeting at the Johannesburg Vale offices on 21 June 2010. The model shows a fairly robust internal rate of return and profit within a project payback of 7 years. The revenue model assumes a discounted coal sale price due to coal quality of:

- 3% for hard coking coal.
- 22% for export thermal coal.

A domestic thermal coal scenario was not modelled.

*The revenue model is considered reasonable. Golder considers the hard coking coal sale price may be slightly optimistic for the first few years for an untried brand. Later years were more conservative and there exists some upside.*

#### 4.1 Life of Mine Plan

The Life of Mine plan (LOM) remains unchanged with that presented in the BFS from years 5 to 35. The first five years of the plan was updated in the current vale budget 2010-2015 to reflect the delayed start date and ramp up using the modified truck and excavator fleets.

*Golder considers the LOM plan productivity assumptions achievable and calculated to an appropriate level of detail.*

The ramp up schedule of 4.5 years is considered achievable given that Vale is a large mining company with well established technical standards and operating procedures. The ability to meet production targets will depend on a smooth transition from feasibility mine design to production.

#### 4.2 Cost Estimates (Mining, Processing, G&A, others)

Golder reviewed the 2010 cost estimates at a high level. Golder has not sighted detailed calculation data. A summary of the June 2010 Budget costs in comparisons to the IBFS is included in Table 1. Capital costs generally increased in comparisons to the IBFS. The logistics category was the highest to date with an additional \$125M spent on rail/port transport costs. In addition the delayed project start date resulted in increased capital costs for some of the equipment generally due to escalation clauses in the contract or unfavourable changes in exchange rate.

Operating costs per product tonne also generally rose with logistics again being the most significant. A rise in diesel cost and additional power costs attributed to the increases. The mining cost per tonne of total material moved remained fairly consistent at \$1.55/t.

Site personal and labour were in general consistent with the IBFS. A total of 750 staff is budgeted for 2011 ramping up to 893 by 2015.

**Table 1: 5 Year Summary of Unit Costs (\$US/product tonne)**

<u>Area</u>	<u>IBFS</u>	<u>Budget 2010</u>
Mine.....	13.58	17.74
CHPP .....	3.20	4.66
Infrastructure.....	0.45	0.83
Logistics.....	12.43	31.64
Administration.....	4.81	5.84
<b>Total.....</b>	<b>34.47</b>	<b>60.71</b>

*Golder considers the cost model assumptions used to be reasonable.*

#### 4.3 Cash Flow Model and Sensitivity Analysis

Updated cash flows were completed for year 1 to 5 only. The updated cash flows were calculated using methods similar to those discussed in the BFS of 2006.

*Golder considers the financial model assumptions used to be reasonable and the cash flow model to be well constructed and to a high standard.*

Golder did not sight any sensitivity analyses done by Vale during the audit. However, the original BFS costs and revenues were roughly compared to the 2010 budget cash flow model. Although costs have increased the coking coal price has risen significantly from 66\$/t to the long term average of \$160/t.

In preparing coal reserve data, Vale used price assumptions that did not exceed the following (2007 to 2009) historical average prices (based on realized sales or reference prices): for hard metallurgical coal for Moatize reserves US\$175 per metric ton (hard coking coal FOB Australia reference price).

#### 5.0 COAL RESERVE ESTIMATES

In preparing coal reserve data, Vale used price assumptions that did not exceed the following (2007 to 2009) historical average prices (based on realized sales or reference prices): for hard metallurgical coal for Moatize reserves US\$175 per metric ton (hard coking coal FOB Australia reference price).

*Golder supports the Coal Reserves as given in Table 2.*

Table 2: Coal Reserves at June 2009

Section	Class	ROM Coal Mt (adb)	ROM Coal Mt (arb)	Saleable Coking Coal Mt (adb) (10.5% Ash)	Saleable Coking Coal Mt (arb)	Saleable Thermal Coal Mt (adb)	saleable Thermal Coal Mt (arb)
1	Proved	78	82	28	31	7	7
	Probable	47	47	16	17	5	5
2A	Proved	73	76	25	28	4	4
	Probable	115	120	40	44	7	7
3	Proved	56	59	15	17	4	4
	Probable	4	4	1	1	0	0
4	Proved	150	157	54	59	14	15
	Probable	41	43	14	15	4	4
6	Proved	66	69	18	20	4	4
	Probable	325	340	98	107	29	31
Total Proved		423	443	140	155	33	34
Total Probable		532	554	169	184	45	47
Total Reserves		955	997	309	339	78	81

**Notes**

ROM(arb) assumes moisture added to give 4.6% total moisture

Coking Coal Product (arb) assumes moisture added to give 10% total moisture

Thermal Coal Product (arb) assumes moisture added to give 6% total moisture

## 6.0 OPINIONS OF COMPETENT PERSONS

The following opinions pertain to June 30, 2010 Coal Reserve Statement for Vale's Moatize Project:

*Golder concurs with the selection of a truck/shovel system.*

*Golder believes that the scheduling parameters and ramp-up are aggressive but achievable.*

*Golder believes that the water management strategy is appropriate for the operation.*

*The waste dump design parameters are reasonable and Golder supports their use.*

*Golder believes that there is no particular reason why the mix of in-pit and out-of-pit dumps cannot be used to handle the waste from all the sections plus the coarse rejects from the preparation plant.*

*The mine design parameters are reasonable industry standards and Golder concurs with their use.*

*Golder believes that the wall design is appropriate for the level of study.*

*Highwalls that intersect underground workings in Sections 1 or 6 may need a reduced slope angle.*

*Golder finds the mining method and equipment selected suitable for the operation.*

*Golder considers this to be all industry standard equipment from good suppliers and see no particular problem with the equipment selection.*

*Golder has sighted detailed equipment productivity calculations supporting the planned BFS primary production fleet, and finds the assumptions and methods of calculations used for equipment fleet and cost projections to be reasonable.*

*Marketing is a risk to the Reserves but Vale is a strong company with excellent contacts and links around the world and should be able to secure suitable markets for its production.*

*Golder finds the mine services area layout and facilities to be suitable for the likely operations at Moatize.*

*Golder considers the coal mining and quality control methods planned to be used are reasonable for the size of operation and the geometry and consistency of the coal quality.*

*Golder believes that the dilution and mining loss allowances are reasonable.*

*The correction factor used for converting slim core yield to practical yield may be overestimating product coal by 7% particularly for the saleable coking coal.*

*Golder finds that the scheduling has been carried out to appropriate standard using industry standard software.*

*Golder supports the Coal Reserves as reported. These are corrected for the tabulation error within the reported FS.*

*Golder believes that it may be possible to achieve the best of both a high production with some more selectively mined areas for product improvement but this is likely to be at the cost of more equipment and therefore higher cost to allow for loss of production and the need for greater selectivity.*

*The CHPP design and process selection appears to be appropriate for the Moatize coal deposit and the style of operation envisaged by Vale.*

*Golder considers the LOM plan productivity assumptions achievable and calculated to an appropriate level of detail.*

*The revenue model is considered reasonable. Golder considers the hard coking coal sale price may be slightly optimistic for the first few years for an untried brand. Later years were more conservative and there exists some upside.*

*Golder considers the LOM plan productivity assumptions achievable and calculated to an appropriate level of detail.*

*Golder considers the cost model assumptions used to be reasonable.*

*Golder considers the financial model assumptions used to be reasonable and the cash flow model to be well constructed and to a high standard.*

## GOLDER ASSOCIATES AFRICA (PTY) LTD.



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# **APPENDIX A**

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**Effective Date: 30 June 2010**

CELEBRATING  
**50**  
YEARS  
in 2010

**VALE INCO LIMITED**

**EXTERNAL AUDIT OF NICKEL AND COPPER  
MINERAL RESERVES**

**VOLUME 1**

# **SUMMARY REPORT**

**Submitted to:**

Vale Inco Limited  
2060 Flavelle Blvd., Sheridan Park  
Mississauga, Ontario  
Canada L5K 1Z9

**Project Number:** 10-1117-0032

**Distribution:**

1 e-copy: Vale Inco Limited  
1 e-copy: Golder Associates Ltd.

**REPORT**



**A world of  
capabilities  
delivered locally**



## EXECUTIVE SUMMARY

Vale's nickel and copper estimated proven and probable mineral reserves as of June 30, 2010 are compiled for Ontario, Manitoba, Vale Inco Newfoundland (VINL), PT Inco TBK (PT Inco) and Sossego operations and Vale Inco Nouvelle Calédonie S.A.S. (VINC), Onça Puma, and Salobo development projects. For the purposes of this report these sites are referred to collectively as "Vale's Operations and Projects".

This Mineral Reserve Statement summarizes the mineral reserve estimates at each of Vale's Operations and Projects as of June 30, 2010. It also outlines the basis of the estimates, demonstrates the economic viability of the mineral reserves and discusses the information supporting the estimates for disclosure to investors.

The Mineral Reserve Statement is a summary of the statements from each of Vale Operations and Projects. The format of the Statement is in general consistent with the format of the Technical Report as required in National Instrument (NI) 43-101. This Mineral Reserve Statement reflects the value of Vale's estimated payable metals (mainly nickel and copper but also includes other recovered metals found in association with nickel and copper mineralization).

Monetary units are in US dollars and tonnages are expressed in metric tonnes unless otherwise stated.

### Report Structure

The Mineral Reserve Statement consists of two volumes.

Volume 1 (this volume) provides a summary of:

- Context of the Audit
- Basis for Mineral Reserve Reporting
- Qualified Persons
- Financial Assumptions
- Mineral Reserve Estimates
- Results of Economic Evaluations
- Opinions of the Qualified Persons

Volume 2 contains a detailed report supporting the Mineral Reserve Statement for each of Vale's Operations and Projects, divided into sections as follows;

- Section 1: Ontario (operation)
- Section 2: Manitoba (operation)
- Section 3: VINL (operation)
- Section 4: PT Inco (operation)
- Section 5: VINC (project)
- Section 6: Onça Puma (project)
- Section 7: Salobo (project)
- Section 8: Sossego (operation)

Each Section has been organized to cover the following areas:

- Summary, with auditor recommendations and conclusions

- Location, ownership and land tenure
- Infrastructure, production process, products, metal recoveries and markets
- Historic production, if applicable
- Description of the type of mineral deposits and exploration activity in 2009
- Deposit sampling methods, sampling and analysis, database management and validation of the data
- Geological interpretation, mineral resource modelling and mineral resource estimation and reporting
- Mine planning, deposit feasibility and mineral reserve estimation and reporting
- Mineral reserve estimates and classification
- Reconciliation studies and audits
- Environmental, government and community affairs and labour issues
- Operating, administrative and corporate cost estimates
- Capital cost estimates
- Economic evaluation, payback and sensitivities
- The potential life of the Operation or Project

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## 1.0 INTRODUCTION

Golder Associates Ltd. (Golder) has been retained to audit Vale's nickel and copper operations and projects mineral reserves as of June 30, 2010. Between June 21 and July 9 Golder's qualified persons visited each of Vale's Operations and Projects and interviewed key personnel from Vale at each of the sites in order to ascertain the validity of the information gathered and the mineral reserves being declared in this document.

Golder has prepared this document in a manner consistent with that level of care and skill ordinarily exercised by members of the engineering and science professions currently practising under similar conditions in the jurisdiction in which the services are provided, subject to the time limits and physical constraints applicable to this document.

This document, including all text, data, tables, plans, figures, drawings and other documents contained herein, has been prepared by Golder. It represents Golder's professional judgement based on the knowledge and information available at the time of completion.

The factual data, interpretations, suggestions, recommendations and opinions expressed in this document pertain to the specific operation or project, site conditions, design objective, development and purpose described to Golder by Vale, and are not applicable to any other project or site location. In order to properly understand the factual data, interpretations, suggestions, recommendations and opinions expressed in this document, reference must be made to both Volume 1 and Volume 2 of the report.

In this document and Volume 2 the terms Qualified Persons and Competent Persons are interchangeable.

## 2.0 BASIS FOR MINERAL RESERVES REPORTING AS OF JUNE 30, 2010

The key elements used for reporting Vale's mineral reserve estimates are as follows:

- Mineral reserves are estimated only in areas where Vale has legal rights to the properties and only for the period that the mining rights exist.
- The economic viability of a mineral reserve is demonstrated by a preliminary or full feasibility study. This principle is consistent with the requirements of the Canadian Securities Administrators' NI 43-101 and also the US SEC Industry Guide 7.
- Mineral reserves are estimated using industry best practices and are consistent with the definitions and standards under NI 43-101 and also SEC Industry Guide 7.
- Mineral reserves are scheduled in each Operation's or Project's long-term production plan.
- Mining, processing, overhead and marketing costs are assigned based on the assumption that the operation is operating at a production level that is generally near the capacity of its production facilities.
- The economic viability of the mineral reserves is demonstrated by the evaluation of the Operation's or Project's long-term production plan against all applicable costs.

### 2.1 Guidelines and Definitions

For the purposes of data collection, data verification, geological modelling, block modelling, mineral resource estimation and mineral reserve estimation, Golder used the Canadian Institute of Mining and Metallurgy (CIM) "Estimation of Mineral Resources and Mineral Reserves Best Practice Guidelines" dated May 30, 2003, adopted by CIM Council on November 23, 2003 ("CIM Best Practice Guidelines") for all Operations and Projects.

The definitions used for estimating mineral reserves follow the definitions used in NI 43-101 and as described in the "CIM Definitions Standards For Mineral Resources and Mineral Reserves"



prepared by the CIM Standing Committee on Reserve Definitions and adopted by the CIM Council on December 11, 2005. Golder also followed the definition of "ore reserves" for the purpose of reporting mineral (ore) reserves estimates under the requirements of the US Securities and Exchange Commission ("SEC") as described in the SEC Industry Guide 7. Vale Inco provides estimates of mineral (ore) reserves that comply with SEC Industry Guide 7. Golder has also verified that the Mineral Reserve Statement would comply with the Hong Kong Exchange Commission for mineral producers.

It is emphasized that mineral reserves have demonstrated economic viability based on a preliminary feasibility study or full feasibility study. The SEC requires a full feasibility study for greenfield projects and mining plans for current operations, which is equivalent to a preliminary feasibility study for operating sites.

### 3.0 QUALIFIED PERSONS

The following Golder Qualified Persons were involved in the audit of Vale's Operations and Projects.

#### Ontario (operation)

- Kevin Beauchamp, Mine Engineer
- Greg Greenough, Resource Geologist

#### Manitoba (operation)

- David Sprott, Mine Engineer
- Paul Palmer, Geological Engineer

#### VINL (operation)

- Jean-Pierre Nicoud, Mine Engineer
- Kevin Palmer, Resource Geologist

#### PT Inco (operation)

- Iain Cooper, Mine Engineer
- Ian Lipton, Resource Geologist
- Richard Gaze, Geostatistician
- Gustavo Pilger, Geostatistician

#### VINC (project)

- Ross Bertinshaw, Mine Engineer
- Sia Khosrowshahi, Geostatistician

#### Onca Puma (project)

- Honorio Lima, Mine Engineer
- Frederico Carmo, Geostatistician
- Jani Kalla, Resource Geologist

**Salobo (project)**

- Marcelo Godoy, Mine Engineer
- Ronald Turner, Resource Geologist

**Sossego (operation)**

- Marcelo Godoy, Mine Engineer
- Ronald Turner, Resource Geologist

**4.0 FINANCIAL ASSUMPTIONS****4.1 Metal Price, Exchange Rate and Product Premium/Discount Assumptions**

Vale's Executive Management reviews the market supply and demand for each commodity with input from its marketing department and derives long-term price and exchange rate assumptions to be used for estimating future cash flows.

For June 30, 2010, Vale's metals prices, currency exchange rate assumptions and product premiums/discounts are used for the purpose of reporting the Mineral Reserves Statement tonnes and grades. Vale's long term price assumptions for the main payable metals and exchange rates are lower than the suggested three year average metal price by the SEC. In order to comply with U.S. security law requirements, Golder is utilizing the last three-year average metal prices (based on LME daily morning cash prices each day of the month for the period from July 1, 2007 to June 30, 2010) and exchange rates in Table 4-1, and the metal premium and discounts in Table 4-2, to assess cash flows and Net Present Values (NPV) for each project and operation.

**Table 4-1: Metal Price and Exchange Assumptions**

<u>Commodity</u>	<u>SEC Assumptions</u>
<b><u>Base Metals</u></b>	<b><u>3-yrMA (US\$/lb)</u></b>
Nickel.....	9.26
Copper.....	2.94
Cobalt.....	20.58
<b><u>Precious Metals</u></b>	<b><u>3-yrMA (US\$/oz)</u></b>
Platinum.....	1,379.47
Palladium.....	329.64
Gold.....	941.03
Rhodium.....	4,209.84
Rubidium.....	264.31
Iridium.....	352.68
Silver.....	14.60
	<b><u>3-yrMA</u></b>
C\$/US\$.....	0.93
Rupiah/US\$.....	10,000
Real/US\$.....	1.87

Table 4-2: Premiums (Discounts) on Vale Pricing Assumptions, Forecasts

<u>Operation</u>	<u>Product</u>	<u>Premium (Discount) LT (US\$/lb)</u>
Manitoba .....	Ni	0.34
Ontario .....	Ni	0.20
VINL .....	Ni	—
PTI .....	Ni	(1.60)
VINC .....	Ni	(1.09)
MOP .....	Ni	—
Sossego .....	Cu	(0.30)
Salobo .....	Cu	(0.46)
VINC .....	Co	(1.80)

#### 4.2 Vale Inco Corporate Costs

Vale's Operations and Projects corporate costs used to estimate the mineral reserves include estimates of future cash costs, such as delivery expense, primary metals sales, general and administrative (SG&A), Vale Inco corporate SG&A, demolition and a charge for stand-by mines.

Vale's Operations and Projects corporate SG&A represents head office costs, excluding head office marketing costs. The amount excludes one-time costs such as bonus, stock options expensed, legal and consulting fees. The basis for excluding these costs is that they are one-time costs not directly related to mine development. The allocation is done in two stages. Directly attributable costs are allocated to Operations based on the internal transfer pricing study completed by Vale Inco in 2004 (Golder did not review this document). The remaining corporate SG&A costs are allocated based on the relative value of nickel and copper revenues.

Direct marketing costs, which represent the SG&A of the Regional Marketing Units and of the head office Marketing Group, are allocated to Ontario and Manitoba Operations based on the relative value of nickel and copper revenues. Indirect marketing costs, representing largely unallocated parent company SG&A, are allocated based on the transfer pricing study results and the relative value of nickel and copper revenues.

Stand-by mine charges are excluded from the indicated costs of production for mineralization to be evaluated. However, these costs are included in the respective Operation's base case economic model used in the determination of the base case economic results.

Demolition costs other than those included in a closure plan are included in the economic evaluation for estimated mineral reserves as these costs represent a real future cash outflow that will need to be sourced in the future. However, these costs should be excluded from the indicated costs of production for mineralization to be evaluated. The demolition costs in a closure plan are included in the indicated costs of production for mineralization, as the cost to reclaim a property after its closure that should be part of the operating cost. The cash outflow, related to the closure of a mine or plant, is included in the economic evaluation for mineral reserves.

#### 4.3 Basis of Cost Allocations at Operating Sites

The site processing and administrative cost allocations are based on an assumed sustained production rate for each of the Operations and Projects based on the 2010 production plans.

#### 4.4 Discount Rates

Discount rates are **real after tax rates** based on the Company's nominal weighted average cost of capital (WACC) and are applied to cash flows that are not escalated. These rates are used only for testing the economic viability of the mineral reserve estimates.

## 5.0 MINERAL RESERVES ESTIMATES

Vale has a mineral reserve base, of approximately 492 million tonnes at 1.5% nickel and 1,405 million tonnes at 0.8% Cu as of June 30th 2010 based on 100% ownership. Based on such mineral reserves (and not taking into account measured and indicated or inferred mineral resources), production is expected to continue at the operations in the Canadian provinces of Ontario, Manitoba, Newfoundland and Labrador, in Indonesia and in Brazil for between 12 to 32 years.

The tables below set forth information regarding the proven and probable nickel mineral reserves and projected exhaustion dates for the periods indicated. The estimates shown in the following mineral reserve may reflect rounding differences and accordingly may not be consistent with certain of the numbers shown. Certain minor rounding differences have been made to grade reported on June 30, 2010 versus grade reported in previous years.

The laterite operation and projects mineral reserves are adjusted to account for actual or projected losses due to screening at the feed preparation plants.

### 5.1 Nickel Reserves

The table below sets forth information regarding the proven and probable nickel mineral reserves and projected exhaustion dates for the periods indicated.

**Table 5-1: Nickel Mineral Reserve Estimates as of June 30, 2010**

Operations	Classification	Began operations	Projected exhaustion date	Proven and probable reserves for the year ended <sup>(1)</sup>				
				Type	2009		June 30, 2010	
					Ore tonnage (millions of tonnes)	Grade (percent)	Ore tonnage (millions of tonnes)	Grade (percent)
Ontario (Canada) . . . . .	Total	1885	2040	Underground	116.9	1.20	116.5	1.19
	Proven				69.9	1.23	69.5	1.22
	Probable				47.0	1.15	47.0	1.15
Manitoba (Canada) <sup>(2)</sup> . . . . .	Total	1961	2023	Underground	26.1	1.72	24.9	1.72
	Proven				9.1	1.89	8.0	1.93
	Probable				17.0	1.63	17.0	1.63
VINL (Canada) . . . . .	Total	2005	2022	Open pit	25.0	2.71	24.6	2.71
	Proven				21.8	3.01	21.4	3.00
	Probable				3.2	0.66	3.2	0.66
PT Inco (Indonesia) <sup>(3),(4)</sup> . . . . .	Total	1977	2035	Open pit	121.1	1.79	119.0	1.79
	Proven				82.3	1.84	—	—
	Probable				38.8	1.70	—	—
VINC (New Caledonia) Project <sup>(3)</sup> . . . . .	Total		2041	Open pit	124.3	1.46	124.3	1.46
	Proven				100.8	1.35	110.8	1.35
	Probable				23.5	1.91	23.5	1.91
Onça Puma (Brazil) Project . . . . .	Total		2042	Open pit	82.7	1.73	82.7	1.73
	Proven				55.1	1.79	55.1	1.79
	Probable				27.6	1.62	27.6	1.62

**Notes:**

- (1) Mineral reserves listed are totals for the operation/projects that Vale owns, or has all of the necessary rights to mine, extract and process, 100% of such mineral reserves and, accordingly, are not based upon Vale's ownership interest in the operation or project or properties. Mineral reserves are of in-place material after adjustment for mining dilution and mining (or screening in the case of PT Inco and VINC) recoveries. However, no adjustments have been made for metal losses due to processing.
- (2) If Vale is unable to renew the OIC Leases beyond their expiry dates, the mineral reserves for Thompson Mine would be reduced by 1.2 million tonnes.
- (3) Vale has rights to other properties in Indonesia, New Caledonia and in certain other locations, which have not yet been fully explored.
- (4) If Vale is not able to renew its concessions beyond year 2035 the mineral reserves for PT Inco would be reduced by approximately 3 million tonnes.

## 5.2 Copper Reserves

The table below sets forth information regarding the proven and probable copper mineral reserves and projected exhaustion dates for the periods indicated.

**Table 5-2: Copper Mineral Reserve Estimates as of June 30, 2010**

Operations	Classification	Began operations	Projected exhaustion date	Proven and probable reserves for the year ended <sup>(1)</sup>				
				Type	2009		June 30, 2010	
					Ore tonnage (millions of tonnes)	Grade (percent)	Ore tonnage (millions of tonnes)	Grade (percent)
Ontario (Canada) . . . . .	<b>Total</b>	1885	2040	Underground	<b>116.9</b>	<b>1.51</b>	<b>116.5</b>	<b>1.50</b>
	Proven				69.9	1.49	69.5	1.48
	Probable				47.0	1.53	47.0	1.53
Manitoba (Canada) <sup>(2),(3)</sup> . . .	<b>Total</b>	1961	2023	Underground	<b>26.1</b>	<b>1.72</b>	<b>24.9</b>	<b>0.10</b>
	Proven				9.1	1.89	8.0	0.11
	Probable				17.0	1.63	17.0	0.10
VINL (Canada) . . . . .	<b>Total</b>	2005	2022	Open pit	<b>25.0</b>	<b>1.58</b>	<b>24.6</b>	<b>1.57</b>
	Proven				21.8	1.76	21.4	1.75
	Probable				3.2	0.38	3.2	0.38
Salobo (Brazil) Project . . . .	<b>Total</b>	2011 <sup>(4)</sup>	2059	Open pit	<b>928.5</b>	<b>0.77</b>	<b>1123.3</b>	<b>0.70</b>
	Proven				508.2	0.80	569.2	0.75
	Probable				420.3	0.74	554.1	0.64
Sossego (Brazil) . . . . .	<b>Total</b>	2004	2022	Open pit	<b>161.4</b>	<b>0.91</b>	<b>159.4</b>	<b>0.88</b>
	Proven				122.1	0.91	119.6	0.89
	Probable				39.3	0.91	39.8	0.88

**Notes:**

- (1) Mineral reserves listed are totals for the operation/projects indicated that Vale owns, or has 100% of the necessary rights to mine, extract and process, all of such mineral reserves and, accordingly, are not based upon Vale's ownership interest in the operation or project or properties. Mineral reserves are of in-place material after adjustment for mining dilution and mining (or screening in the case of PT Inco and VINC) recoveries. However, no adjustments have been made for metal losses due to processing.
- (2) If Vale is unable to renew the OIC Leases beyond their expiry dates, the mineral reserves for Thompson Mine would be reduced by 1.2 million tonnes.
- (3) Cu reserves are based on historical factors derived from corrections between Ni and Cu in assay data of diamond drill core. Thompson Mine has validated the factors by reconciling with mill credited production numbers over a 5 year period.
- (4) Projected date of commissioning

## 5.3 Cobalt Reserves

The table below provides information regarding the proven and probable cobalt mineral reserves and projected exhaustion dates for the periods indicated. The cobalt mineral reserve estimates reported from lateritic mineralization is restricted to hydrometallurgical projects as cobalt is not credited from pyrometallurgical processing operations being fed by lateritic mineralization.

Table 5-3: Cobalt Mineral Reserve Estimates as of June 30, 2010

Operations	Classification	Began operations	Projected exhaustion date	Type	Proven and probable reserves for the year ended <sup>(1)</sup>			
					2009		June 30, 2010	
					Ore tonnage (millions of tonnes)	Grade (percent)	Ore tonnage (millions of tonnes)	Grade (percent)
Ontario (Canada)	Total	1885	2040	Under-ground	116.9	0.04	116.5	0.04
	Proven				69.9	0.04	69.5	0.04
	Probable				47.0	0.03	47.0	0.03
VINL (Canada)	Total	2005	2022	Open pit	25.0	0.13	24.6	0.13
	Proven				21.8	0.15	21.4	0.15
	Probable				3.2	0.03	3.2	0.03
VINC (New Caledonia) Project <sup>(2),(3)</sup>	Total	2010	2041	Open pit	124.3	0.11	124.3	0.11
	Proven				100.8	0.12	100.8	0.12
	Probable				23.5	0.08	23.5	0.08

**Notes:**

- (1) Mineral reserves listed are totals for the operation/projects indicated that Vale owns, or has 100% of the necessary rights to mine, extract and process, all of such mineral reserves and, accordingly, are not based upon Vale's ownership interest in the operation or project or properties. Mineral reserves are of in-place material after adjustment for mining dilution and mining (or screening in the case of PT Inco and VINC) recoveries. However, no adjustments have been made for metal losses due to processing.
- (2) Cobalt mineral reserves for laterite projects and operations include only material for hydrometallurgical processing.
- (3) Vale has rights to other properties in Indonesia, New Caledonia and in certain other locations, which have not yet been fully explored.

**5.4 Precious Metals Reserves**

The table below provides information regarding the proven and probable precious metals mineral reserves and projected exhaustion dates for the periods indicated.

Table 5-4: Precious Metals Mineral Reserve Estimates as of June 30, 2010

Operations	Metal	Began operations	Projected exhaustion date	Type	Proven and probable reserves for the year ended <sup>(1)</sup>			
					2009		June 30, 2010	
					Ore tonnage (millions of tonnes)	Grade (g/tonne)	Ore tonnage (millions of tonnes)	Grade (g/tonne)
Ontario (Canada)	Platinum	1885	2040	Underground	116.9	0.9	116.5	0.9
	Palladium			116.9	1.0	116.5	1.0	
	Gold			116.9	0.4	116.5	0.4	
Salobo (Brazil) Project	Gold	2011 <sup>(2)</sup>	2059	Open pit			1,123.3	0.5
Sossego (Brazil)	Gold	2004	2022	Open pit			140.6	0.3

**Notes:**

- (1) Mineral reserves listed are totals for the operation/projects indicated that Vale owns, or has 100% of the necessary rights to mine, extract and process, all of such mineral reserves and, accordingly, are not based upon Vale's ownership interest in the operation or project or properties. Mineral reserves are of in-place material after adjustment for mining dilution and mining (or screening in the case of PT Inco and VINC) recoveries. However, no adjustments have been made for metal losses due to processing.
- (2) Projected date of commissioning.

**6.0 RESULTS OF ECONOMIC EVALUATIONS**

All financial and economic estimates are based on mineral reserves that are part of a life of mine plan. The discounted cash flow values for some Operations and Projects are calculated using end-of-year convention while others use a mid-year convention; however, Golder has used a mid-year convention for calculation of all NPVs.

Metal premiums and discounts vary from one project or operation to the other and have been applied accordingly. Vale commodities price forecasts are based on realised prices for previous years. Historic corporate realised prices are provided in Table 6-1.

**Table 6-1: Realised prices (all Vale operations and business units)**

<u>Commodity</u>	<u>Unit</u>	<u>2007</u>	<u>2008</u>	<u>2009</u>
Nickel .....	(US\$/t)	37,442.28	21,662.14	14,596.50
Copper .....	(US\$/t)	6,611.27	6,331.07	5,229.39
Cobalt .....	(US\$/lb)	24.56	31.01	10.03
Platinum .....	(US\$/oz)	1,314.25	1,557.07	1,073.98

Cash flows and NPV's from all Operations and projects were positive under both Vale's long term price assumptions and three year average LME metal prices.

## 7.0 OPINIONS OF QUALIFIED PERSONS

The following opinions pertain to June 30, 2010 Mineral Reserve Statement for Vale's Operations and Projects.

### General (all operations and projects)

Vale's mineral reserves estimates are in compliance with accepted reporting standards including: SEC GUIDE 7 and NI 43-101 including the CIM DEFINITION STANDARDS on Mineral Resources and Mineral Reserves adopted on November 14, 2004.

The metal prices used to derive the Mineral Reserve Statement do not exceed the July 1, 2007 to June 30, 2010 rolling average as demonstrated in the Results of Economic Evaluation section above.

All nickel operations visited are mature mine sites that have been operating for years or decades and as such the expertise and knowledge gained throughout the years by Vale's personnel are reflected in the data collection and mineral reserve estimation process. This coupled with Vale's lower future price assumption in comparison with the 3 year price rolling average provides a strong confidence that the mineral reserves reported are indeed economic. While Sossego has been in production for a limited time the economics of this project are strong.

For the nickel and copper projects there is a greater uncertainty about the forecasted operating costs and capital costs than for well established producing mines. However, since most of the projects visited are in their final phase of construction and soon to be commissioned the uncertainty about capital expenditures is less. Nonetheless, considering the strong economics for all projects the declaration of mineral reserves is supported.

Golder recommends that Vale select a standard approach for the discounting period. For the purpose of this reporting Golder has adopted a mid year discounting approach.

### Ontario (operation)

- Potential post Labour Dispute Issues: Engagement and productivity of the Steelworkers Local 6500 employees may be affected as a result of the long and contentious labour dispute. Ongoing labour relations may result in lower than expected performance of baseline business.
- The mineral resource block modelling methods and factors for mining recovery and dilution employed at the Ontario Operations are completed to accepted industry standards and appropriate for mineral reserve reporting.
- Geotechnical issues are likely to persist at the mines in the Ontario Operations. Furthermore, orebodies at greater depth have an increased likelihood of issues with regard

to mining recovery, productivity and mining costs. However, it is the opinion of the QP that the ground control programs at the Ontario Operations have an established track record in addressing these geotechnical issues.

- The Ontario Operations is required to meet proposed government regulations on sulphur dioxide emissions reduction. Economically and technically feasible solutions for reducing emissions will be required to prevent closure of the smelter and refinery, or a significant reduction in plant throughput.

### **Manitoba (operation)**

- Tailings facility capacity: A number of options for long-term management of the tailings area were reviewed and a three-phase capital plan was developed. To date, only two phases have been initiated. The third phase of the basin capital plan is to raise dam levels by approximately 10 ft (3 m). Once the final capital project phase is approved and all three projects are successfully implemented, these changes are expected to increase the life of the tailings basin to support the life of mine of the plant site, maintain compliance to MMER, and improve the closure plan for the facility. Therefore, in order to support the life of mine plan, all three phases will need to be implemented.
- Sulphur dioxide reduction at the smelter complex: The Manitoba Operations (MO) is required to meet government regulations proposed which requires that the smelter and refineries reduce their greenhouse gas emissions by 18% by 2010 and by 2% year upon year until 2020. These requirements may result in the closure of the smelter and refinery if an economically and technically feasible solution for reducing emissions cannot be devised. However, evaluations have shown that the MO would remain economic as a mine-mill operation that sold concentrate to smelters located elsewhere (either owned by Vale or third parties).
- Infrastructure Issues: The 3600 Tram is recognized as a future bottleneck to production at the Thompson Mine and studies are ongoing to address this issue. As both the Thompson and Birchtree Mines go deeper, the delivery of key mine services like backfill and ventilation will incur greater challenges and costs. Cemented rockfill is currently planned to be the predominant backfill for future mining.
- Maintaining current production rates at the MO has been challenging due to ground instability issues at the Birchtree Mine and infrastructure inefficiencies from moving personnel and material in the 1D area.
- Sample assay data is being entered in manually through exporting CSV files into the database. Control checks are completed regularly, but were done by manual checks of spreadsheets. Opportunities to improve the process are being used at other Vale operations (Ontario and VINL) and should be considered at the MO.
- A small portion of older mineral resources were estimated using polygonal models and have not been updated using block models and the MO Mineable Reserves Optimizer process. Areas supported by polygonal models under estimate tons and over estimate grade. This was noted at the T1 Mine where mined grade in the current year was lower than the stated mineral reserve grade for particular blocks. It was suggested that this was due to the polygonal estimation method.
- A review was completed of the SRK pit design pre-feasibility reports and an update to the economic pit shells may be warranted given changes to metal price and exchange rate.
- The cash flow forecast review showed that positive project economics support conversion of mineral resources to mineral reserves. A sensitivity analysis indicated the NPV remained positive in all cases tested, suggesting robust project economics.



**VINL (operation)**

- The current open pit mining method is suitable for Voisey's Bay.
- Geotechnical consultants conduct regular audits.
- The limited production in 2013 is due to constraints required by the Development Agreement between Vale and the province of Newfoundland and Labrador.
- The mining rate is appropriate in light of the constraints imposed by the Development Agreement and the risk of not achieving production from a mining perspective is low.
- The storage capacity for overburden, clean rock, PAG rock and tailings appears adequate for the period considered by the mining schedule. VINL conducts regular bathymetry surveys.
- VINL has a good understanding of the geology related to the Main and Mini Ovoid. Sampling is carried out to an industry standard and the associated data is suitable for inclusion in the mineral resource database. The database is well organised and no errors were noted. The wireframes generated for coding the drill holes and calculating volume are appropriate.
- The methods and the procedures used for mineral resource estimation are appropriate and the mineral resource model meets the standards required for estimating mineral reserves.
- The safety statistics demonstrate an improving trend from 2008 in terms of Lost Time Injury Frequency and Total Recordable Injury Frequency. Continued efforts to decrease these trends are a key component of sustainable development.
- Golder reviewed the 2009 MRMR production schedule and related assumptions. The approach is consistent with the constraints imposed by the Development Agreement.
- Meeting the production targets for the mine and the mill should not present significant challenges as extra capacity exists. The extra capacity might have to be used during short periods.
- The Ni/Cu blend constraints present a very significant mill operating constraint and don't allow for efficient mining operations.

**PT Inco (operation)**

- Golder is satisfied that PTI has met all legal obligations and accordingly considers there is no impediment to the declaration of a mineral reserve. However, given the complex conditions of the CoW, the recent changes to the Mining Law there is some risk to PTI's security of tenure and ability to operate the SPA (Sorowako Project Area) effectively. PTI is managing this risk by on-going discussions with relevant government agencies.
- Based on the analysis for the QAQC data from SPA, sampling preparation and assaying at SPA are of industry standard suitable for use in mineral reserve estimation and has acceptable errors of precision and no significant bias can be observed. Considerable improvements in cross sample contamination have been made since the 2008 Audit (AMEC, 2009).
- The general approach for estimation in saprolite of using accumulations is supported and correctly accounts for the support effect of the size fraction grades and their corresponding dry weights.
- The overall procedure of applying the economic, geographical, operational and environmental constraints to the mineral resources before they can be considered for the mineral reserves is supported.

- The mineral reserve modifying factors have been developed over a number of years and are reasonable.
- The mining method has been developed and improved over the life of the mine. Selective mining, closure and rehabilitation of mined out areas is an integral part of the mining method. The objective of the selective mining is to ensure that the blend parameters are met. The mining is well supervised.
- In both cost and pricing assumptions scenarios used (Vale and three-year moving average), positive project economics support conversion of mineral resources to mineral reserves. Under sensitivity analysis, in all cases tested, the NPV remained positive, suggesting robust project economics.
- The PTI mine life takes into consideration the new mining law and accordingly the current mineral reserve does not report mineralized material beyond 2035.

#### VINC (project)

- Tonnages and grades for coarse rejects and for +6 mm -50 mm Saprolite are important for reconciliation, process control and operational performance. Failure to correctly determine such tonnages and grades may lead to reduced processing of high grade saprolite, with consequences for the mineral reserve.
- The dilution from the BRK (bedrock) material is very high in MgO and will therefore have an important effect on acid consumption.
- The standard samples show excellent accuracy and precision. Some minor biases were identified, but these are not expected to materially impact on the quality and representativity of the data to support mineral resources.
- In relation to bulk density measurements, there is insufficient documentation available for a rigorous assessment of the wet and dry bulk density values which are interpolated and used as tonnage factors in the Mineral Resource estimate.
- The new data drilled since January 2009 has had a major impact on the volume of SAP (saprolite) that is present in the modelled area due to the highly variable nature of the SAP and BRK contact. A moderate drop in amount of LATR (red laterite) and TRN (transition) is noted with a significant increase in the proportion of SAP and moderate increase in LATJ (yellow laterite) material.
- The new data drilled since January 2009 has increased in the volume of potential mineralization bearing material (by 5%) provides further confidence on the conservative nature of the current geology resource model.
- Introduction of 1 m re-blocked mining model has resulted in significant re-distribution of various mineralized material types. The 1 m re-blocked model represents a highly selective mining model and may prove difficult to achieve in actual mining. A moderate to low impact is expected on the final mineral reserves.
- The 1 m high model will better represent the seam mining approach, which appears to be the presently followed mining method at Goro.
- The planned mining production ramp-up is ambitious but should be an achievable considering the equipment already on-site.
- The mining production schedule is achievable at least on a yearly basis. Once the pit is opened up sufficiently, it should be possible to achieve a reasonable blend on a shorter term basis.

- The allowances for dilution and recovery to generate expected plant feed are reasonable considering that no full reconciliation of production from the FPP (feed preparation plant) has yet occurred. However, prediction of the expected dilution, mineralisation loss and overall mining recovery is complex and means that there is no simple conversion of mineral resource to mineral reserve. This will make it difficult to determine the cause of any variation from the predicted mineral reserve when interpreting the reconciliation results.
- The development and conversion of mineral resources to mineral reserves is appropriate with reasonable factors having been applied.
- In addition to the mineral reserves there are considerable measured and indicated mineral resources (approximately 150 Mt of comparable grade to the mineral reserves).
- VINC has a reasonable plan for tailings disposal (with potential back-up options), meeting one of the requirements for defining mineral reserves.
- Based on the DCF economic analysis using prices from two scenarios, the high grade cut-off of 1.2% Ni and low grade of 1.0%Ni are reasonable.
- Golder considers the basis and reporting mineral reserve used by VINC for the Goro Nickel Project to be appropriate.

#### **Onca Puma (project)**

- Golder believes that the deposits are sufficiently drilled with appropriate drill spacing, depth, orientation and location of drill holes for accurate estimation of mineral resources.
- Drilling and logging procedures are industry standard and Golder considers them to be appropriate for Nickel laterite deposits. Golder reviewed the sampling procedures and considers these to be appropriate for geological modelling and mineral resource estimation.
- The equipment fleet seems to be properly sized considering the required production targets and mining selectivity. A dispatch system is currently installed and will generate a useful database that can be used for planning and production control. It is important that periodic reports be produced not only with the historic information but pointing to trends in the evolution of the main control variables. This will allow for pro-active decision making to react to grade trends that may be detrimental to meeting production targets.
- In both cost and pricing assumptions scenarios used (Vale and three-year moving average) positive project economics support conversion of mineral resources to mineral reserves. Under sensitivity analysis, in all cases tested the NPV remained positive, suggesting robust project economics.
- The results of the test mining program confirm the effectiveness of operational mining parameters used to estimate mineral reserves. The reconciliation system designed by MOP (Mineração Onca Puma) will assist in improving the understanding about mining selectivity and equipment performance which will be key factors controlling the effective mining recovery.

#### **Salobo (project)**

- The Salobo area is currently undergoing pre-stripping. Contracted mining operations effectively started in April 2009 with the target mining of approximately 500,000 m<sup>3</sup> per month until the start of the mining operations. The operation will be a typical large-scale truck/shovel operation with 240 tonne trucks and 26-32m<sup>3</sup> hydraulic and electric shovels.

- Golder considers the sample preparation procedures to be of an appropriate standard for the purpose of resource estimation.
- Due to the high fluor content present in the Salobo concentrate having a suitable buyer for the concentrate is key to allow for the conversion of mineral resources into mineral reserves. The technology to deal with fluor exists and can be applied with relatively uncomplicated changes to standard smelters. In current contracts the fluor content penalty to Vale has been fixed in 0.04c/lb.
- The Salobo mine has adequate areas available for waste dumping and tailings deposition that support the LOM plan and therefore the mineral reserve. The geotechnical recommendations have been properly applied in the mine design.
- Conversion of the mineral resource estimate to a mineral reserve is based on appropriate mine design and planning. The tonnes and grades are reported at an appropriate economic cut-off grade. Both pit optimization and economic analysis use reasonable operating costs as long term estimates. Consumable costs are based on current contracts in place at Sossego.
- The differences in terms of waste tonnage between the final pit design and the selected Whittle pit shell is considered excessive and should be reviewed. The differences are probably due to a marginal phase incorporated in the mine design. In any case these differences should be properly documented with the appropriate explanations. There may be a considerable upside potential related to mine design optimisation. Standard differences in open pit mining are between 5% and 10%.

#### **Sossego (operation)**

- Golder considers the sample preparation and chemical analysis procedures to be of an appropriate standard for the purpose of mineral reserve estimation. The standard samples show acceptable accuracy and precision.
- For the purposes of an in situ mineral resource estimate, the overall estimation approach adopted by Vale for total copper, gold and density is acceptable.
- The slope regimes for the Siqueirinho and Sossego pits are modeled appropriately during pit optimization and the pit slopes are considered a low risk area for the Mineral Reserves.
- The Sequeirinho open pit will be approximately 500 m deep at completion. This is a very deep open pit excavation and extra care will need to be taken in the mining operations to ensure stability of the final pit walls to allow for full extraction of the reserve.
- The copper and gold prices used for pit optimisation are considered appropriate for the development of a mineral reserve estimates. In particular the values adopted meet generally accepted SEC guidelines which suggest using values that are less or equal the average price for the last 3 years.
- The differences in terms of waste tonnage between the final pit design and the selected Whittle pit shell is considered excessive and should be reviewed in detail. The differences are probably due to a marginal phase incorporated in the mine design. In any case these differences should be properly documented with the appropriate explanations. There may be a considerable upside potential related to mine design optimisation.
- The mining equipment fleet considered in LOM (Life of Mine) plan was reviewed and is considered suitable for purpose. The effectiveness of the mining fleet has been demonstrated over the last couple of years. The mine appears to be adequate areas available for waste dumping and tailings deposition that support the LOM plan and therefore the mineral reserve.

- Reconciliation results for 2009 indicate conformance of planned versus realised production. The reconciliation process is considered to be of high standard. The process plant is clean, well-maintained and employs modern and appropriate process control. In general it gives the impression of a very efficient and well-designed operation. Process control uses modern instrumentation.
- Vale holds all environmental permits required by Brazilian legislation to operate the Sossego mine. No fatal flaws regarding environmental aspects of the Sossego operation have been identified by Golder. The Sossego operation manages environmental responsibilities and liabilities appropriately.
- Conversion of the mineral resource estimate to a mineral reserve is based on appropriate mine design and planning. In particular, dilution and mine recovery are supported by historical data. The tonnes and grades are reported at an appropriate economic cut-off grade. The mine has demonstrated sufficient economic viability to justify the conversion of mineral resources to mineral reserves.

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