

1996 EDITION



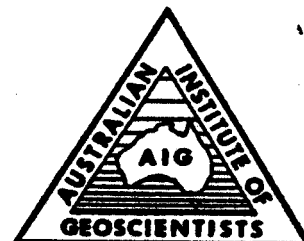
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AUSTRALASIAN CODE FOR REPORTING OF IDENTIFIED MINERAL RESOURCES AND ORE RESERVES

**REPORT OF THE JOINT COMMITTEE OF THE
AUSTRALASIAN INSTITUTE OF MINING AND METALLURGY,
AUSTRALIAN INSTITUTE OF GEOSCIENTISTS
AND
MINERALS COUNCIL OF AUSTRALIA**

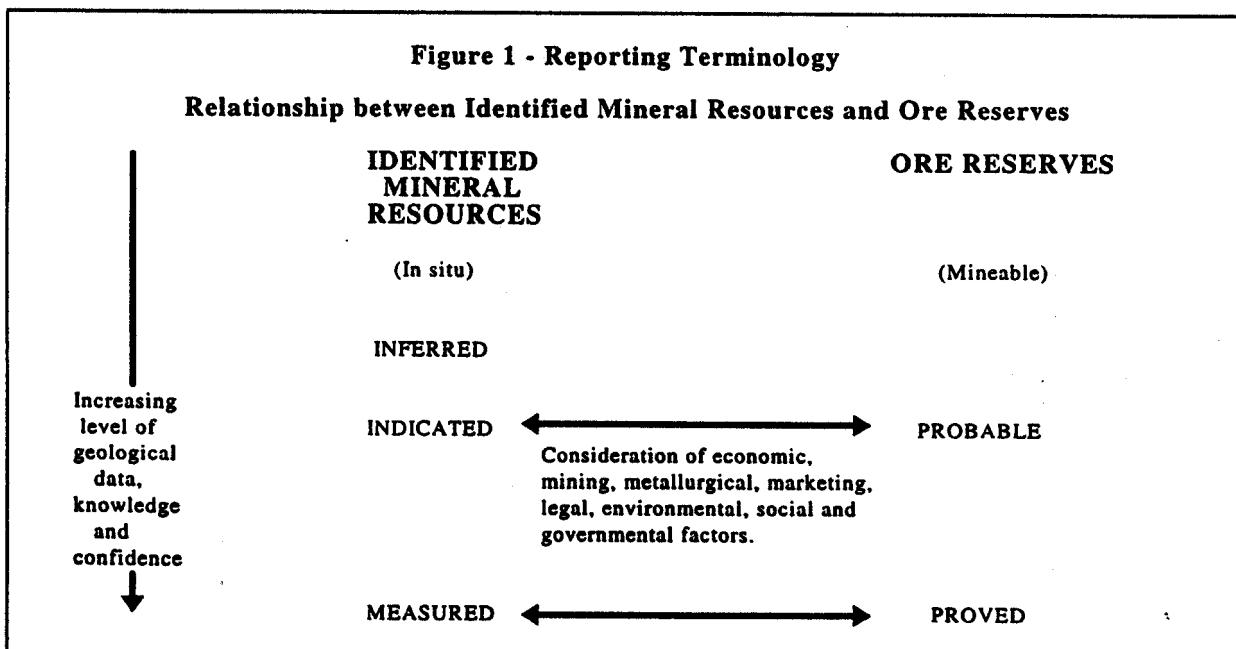
(JORC)

JULY 1996



Foreword

1. The Joint Ore Reserves Committee was established by The Australasian Institute of Mining and Metallurgy and the Australian Mining Industry Council in 1971 to consider and make recommendations on Australian stock exchange listing requirements appropriate to mining companies reporting Ore Reserves. Between 1972 and 1988, a number of reports were issued by the Joint Committee which made recommendations on classification and public reporting of Ore Reserves. The first version of the *Australasian Code for Reporting of Identified Mineral Resources and Ore Reserves* (the Code) was published in February 1989 and was incorporated into Australian Stock Exchange Listing Rules in July 1989. In 1990, the Joint Committee issued a set of *Guidelines* to the Code and, in 1992, published an updated version of the Code and Guidelines in a single document. In 1993, an Appendix (Appendix 2) covering the public reporting of diamond exploration results, Mineral Resources and Ore Reserves, was released.
 2. The 1996 updated version of the Code makes no fundamental changes with the exception that all references to 'Pre-Resource Mineralisation' have been changed to 'exploration results' and relevant text modified. This change has been introduced as an improvement in terminology and in order to ensure that estimates of tonnage/volume and grade are publicly reported only in relation to mineralisation which has been classified as a Mineral Resource or an Ore Reserve.
- In addition the document previously referred to as Appendix 2, covering public reporting of diamond mineralisation, has been incorporated into the body of the Code.
3. The Code has been adopted by The Australasian Institute of Mining and Metallurgy and the Australian Institute of Geoscientists and is therefore binding on members of those organisations. It is supported by the Minerals Council of Australia as a contribution to best practice.
 4. By virtue of incorporation of the Code into Australian Stock Exchange Listing Rules, it is mandatory for companies, when reporting exploration results, Mineral Resources and Ore Reserves to the Australian Stock Exchange, to abide by the Code. As from 1st July 1995, it is an Australian Stock Exchange requirement that such reports should also include the name(s) of the Competent Person(s) who compiled the information upon which public Mineral Resource/Ore Reserve statements are based.
 5. The standards outlined in the Code are the minimum to be applied in public reporting. Companies are encouraged to provide as comprehensive information as possible in their reports.
 6. The Joint Committee recognises that further review of the Code and Guidelines may be required from time to time.
 7. No Clause 7.



An 'IDENTIFIED MINERAL RESOURCE', otherwise referred to as a 'MINERAL RESOURCE', is an in situ (meaning as it occurs on surface or underground) mineral occurrence quantified on the basis of geological data and an assumed cut-off grade only.

The term 'ORE RESERVE' is only to be used if a study of technical and economic criteria and data

relating to a 'Mineral Resource' has been carried out to indicate potential feasibility and it is to be stated in terms of mineable tonnes/volume and grade.

Definitions for the terms 'Mineral Resource' and 'Ore Reserve' are provided later in this document.

Competence and Responsibility

8. A Mineral Resource or Ore Reserve report giving technical facts, interpretations or assessments of Mineral Resources or Ore Reserves must be prepared under the direction of, and signed by, a Competent Person or Persons.
9. A 'Competent Person' is defined as a person who is a Corporate Member of The Australasian Institute of Mining and Metallurgy and/or the Australian Institute of Geoscientists with a minimum of five years experience in the estimation, assessment and evaluation of Mineral Resources and Ore Reserves which is relevant to the style of mineralisation under consideration.
10. While the public release of information concerning a company's Mineral Resources and/or Ore Reserves remains the responsibility of the company acting through its Board of Directors, any such release must be based on, and fairly reflect, a Mineral Resource and/or Ore Reserve report prepared by a Competent Person(s).
11. A public release of information concerning a company's Mineral Resources or Ore Reserves should include a description of the style and nature of mineralisation.
12. A company must disclose relevant information concerning the status and characteristics of a mineral deposit which could materially influence the economic value of that deposit.
13. Companies must review and report on Mineral Resources and Ore Reserves annually.

Reporting of Exploration Results

14. A company may choose, or be required by virtue of Australian Stock Exchange Listing Rules, to report exploration results in order to keep the share market fully and properly informed. If a company decides to report exploration results in relation to mineralisation not classified as a Mineral Resource or an Ore Reserve, then estimates of tonnage/volume and average grade must not be assigned to the mineralisation.
15. In reporting exploration results which relate to mineralisation not classified as a Mineral Resource or an Ore Reserve, full information on the nature of the sampling, sample intervals, assay data and sample locations must be given (refer Table 1 and, in the case of diamond exploration results, Table 2).

Reporting of Identified Mineral Resources

16. A 'Mineral Resource' is defined as an identified in situ mineral occurrence from which valuable or useful minerals may be recovered. Mineral Resources are subdivided into:
 - Inferred Mineral Resources
 - Indicated Mineral Resources
 - Measured Mineral Resources
17. In defining a Mineral Resource, the Competent Person will only take into consideration geoscientific data. In reporting a Mineral Resource, there is a clear implication that there are reasonable prospects for eventual economic exploitation.
18. Mineral Resource estimates are not precise calculations, being dependent on the interpretation of limited information on the location, shape and continuity of the occurrence and on the available sampling results. Reporting of tonnage/volume and grade figures should reflect the order of accuracy of the estimate by rounding off to appropriately significant figures and, in the case of Inferred Mineral Resources, by qualification with terms such as 'approximately'.
19. The term 'Inferred Mineral Resource' means a Mineral Resource inferred from geoscientific evidence, drill holes, underground openings or other sampling procedures where the lack of data is such that continuity cannot be predicted with confidence and where geoscientific data may not be known with a reasonable level of reliability.
20. The term 'Indicated Mineral Resource' means a Mineral Resource sampled by drill holes, underground openings or other sampling procedures at locations too widely spaced to ensure continuity but close enough to give a reasonable indication of continuity and where geoscientific data are known with a reasonable level of reliability. An Indicated Mineral Resource estimate will be based on more data, and therefore will be more reliable, than an Inferred Mineral Resource estimate.
21. The term 'Measured Mineral Resource' means a Mineral Resource intersected and tested by drill holes, underground openings or other sampling procedures at locations which are spaced closely enough to confirm continuity and where geoscientific data are reliably known. A Measured Mineral Resource estimate will be based on a substantial amount of reliable data, interpretation and evaluation of which allows a clear determination to be made of shapes, sizes, densities and grades.
22. The choice of the appropriate category of Mineral Resource depends upon the quantity and quality

of data available and the level of confidence that attaches to those data. The appropriate Mineral Resource category must be determined by the Competent Person(s).

22. Mineral Resource reports must specify one or more of the categories of 'Measured', 'Indicated' and 'Inferred'. Reports should not contain Mineral Resource figures combined for two or more of the categories unless figures for individual categories are also provided.
23. Any public release of information in a report concerning a company's Mineral Resources should state the pertinent data and assumptions on which the report is based and contain a qualification drawing attention to any assessment criteria from Table 1 for which inadequate data are available.

24. The words 'ore' and 'reserves' should not be used in stating Mineral Resource estimates as the terms imply technical feasibility and economic viability and are only appropriate when technical and economic factors have been considered. Reports and statements should continue to refer to the appropriate category or categories of Mineral Resources until technical feasibility and viability have been established. If re-evaluation indicates that the Ore Reserves are no longer viable, the Ore Reserves must revert to the 'Mineral Resource' category.

Table 1

ASSESSMENT CRITERIA	EXPLANATION
Geological interpretation	Whether based on sufficient data or on postulated assumptions; whether constrained by one model or consideration given to possible alternative interpretations.
Data density	Whether sample density is sufficient to establish continuity as well as to provide an adequate data base for the estimation procedure used.
Accuracy of location of sampling points	How well the locations of sampling positions are known and the effect on the Mineral Resource or Ore Reserve estimate.
Drilling technique	Whether core, rotary, percussion or auger and if non-core, whether open hole or reverse circulation.
Sampling technique	If core, whether cut or chisel broken and whether quarter, half or all core taken. If non-core, whether riffled, section cut, tube sampled or whatever and whether sampled dry or wet. If wet, what precautions taken to maximise recovery and minimise fines loss. If underground chip samples, whether channel cut or chipped linearly or randomly taken from a face.
Drill sample recovery	An estimate, expressed in percentage terms, of the quantity of sample recovered as a proportion of the theoretical quantity which should have been recovered.
Tonnage factor (specific gravity)	Whether assumed or determined and, if determined, by what method and how frequently. If assumed, the basis for those assumptions should be stated.
Quality of assay data	Whether reproducible and whether representative; what quality control procedures undertaken.
Quality of data description	Whether core logged in detail; whether all significant, lithologic, structural, mineralogic, alteration or other geological or geotechnical characteristics and properties recorded.
Estimation techniques	A clear description of estimation techniques and key assumptions.
Cut-off grades	Assumptions regarding cut-off grade.

Reporting of Ore Reserves

25. An 'Ore Reserve' is defined as that part of a Measured or Indicated Mineral Resource which could be mined, inclusive of dilution, and from which valuable or useful minerals could be recovered economically under conditions realistically assumed at the time of reporting. Ore Reserves are subdivided into:
- Probable Ore Reserves and
 - Proved Ore Reserves
- Ore Reserve estimates are derived from estimates of Mineral Resources modified by economic, mining, metallurgical, marketing, legal, environmental, social and governmental factors.
26. Ore Reserve estimates are not precise calculations and tonnage/volume and grade figures in reports should be expressed so as to convey the order of accuracy of the estimates by rounding off to appropriately significant figures.
27. The term 'Probable Ore Reserve' means an Ore Reserve stated in terms of mineable tonnes/volume and grade where the corresponding Identified Mineral Resource has been defined by drilling, sampling or excavation (including extensions beyond actual openings and drill holes), and where the geological factors that control the ore body are known with sufficient confidence that the Mineral Resource is categorised as 'Indicated'.
28. The term 'Proved Ore Reserve' means an Ore Reserve stated in terms of mineable tonnes/volume and grade in which the corresponding Identified Mineral Resource has been defined in three dimensions by excavation or drilling (including minor extensions beyond actual openings and drill holes), and where the geological factors that limit the ore body are known with sufficient confidence that the Mineral Resource is categorised as 'Measured'.
29. The choice of the appropriate category of Ore Reserve is determined by the classification of the corresponding Mineral Resource and must be made by the Competent Person(s).
30. Ore Reserve reports must specify one or other of the categories of 'Proved' and 'Probable'. Reports should not contain combined Proved and Probable Ore Reserve figures unless figures for each of the categories are also provided.
31. Any public release concerning a company's Ore Reserve must state the nature of the data on which the report is based and contain a qualification drawing attention to any assessment criteria for which inadequate or uncertain data are available. Economic or political factors alone may be the basis for significant changes in Ore Reserves and should be reported accordingly.

Reporting of Coal Resources and Reserves

32. When public statements on coal Resources and Reserves are made, the recommendations outlined in the *Australasian Code for Reporting*

Identified Coal Resources and Reserves (February 1986) published as Appendix 1 should be followed.

Reporting of Diamond Exploration Results, Identified Mineral Resources and Ore Reserves

33. This section (Clauses 33 to 39) of the Code addresses aspects of the exploration and mining industry which relate specifically to public reporting of diamond exploration results, Identified Mineral Resources and Ore Reserves.
34. The necessity for this section arises from the following characteristics specific to diamond exploration and mining:
- The diamond content of most commercial ore deposits is extremely low, usually in the range 0.05 - 2.0 carats/tonne (equivalent to 0.01 - 0.4 ppm). The highest grade diamond ore deposit in the world, Argyle, has a grade of 6 carats/tonne (1.2 ppm).
 - Of equal or greater importance to grade is diamond value which reflects the overall quality, including size distribution, of the contained diamonds in the deposit. This value can range from a few cents to thousands of dollars per carat.
 - Diamond valuation is a highly specialised process and is only possible on parcels containing appropriate numbers of Macrodiamonds. Traditionally valuations have only been considered reliable on

parcels of at least 2000 carats of diamonds from a single deposit. The reliability of valuations of parcels smaller than 2000 carats decreases as the size of the parcels decrease to the point where valuations placed on a small number of diamonds from exploration samples become meaningless and are likely to be misleading.

- The low diamond content of Ore Reserves and Mineral Resources and the fact that the mineral is of a particulate nature complicates the sampling, assaying and valuation techniques used by the industry and in turn complicates the assessment and

interpretation of results. The presence of a few large diamonds can have a more extreme effect on the evaluation of diamond deposits than does the presence of a few coarse gold particles on the evaluation of gold deposits.

- The durability of diamonds in nature has led to residual quantities of this mineral persisting at 'background' levels in surficial deposits and stream sediments throughout Australia. This is an added complication to an objective interpretation of exploration results.

Competence and Responsibility

35. The requirements for and definition of Competence and Responsibility as described in Clauses 8 to 13 apply fully to reports dealing with diamond mineralisation with the addition that, if a valuation of a parcel of diamonds is reported,

the person(s) or organisations valuing the parcel must be named in the report and their professional valuation experience, competency and independence stated.

Reporting of Exploration Results

36. The reporting of exploration sampling or geophysical results must not be constructed so as to unreasonably imply that potentially economic mineralisation has been discovered.

37. The requirements for reporting of exploration results as described in Clauses 14 and 15 apply fully to public reports dealing with diamonds with the following additions:

- Reports of diamonds recovered from sampling programmes must specify the

number and total weight (in carats) of diamonds recovered. Details of the type and size of samples which produced the diamonds must also be specified including lower cut-off sieve size used in the recovery.

- The weight of diamonds recovered may only be omitted from the report when the diamonds are less than 0.4 mm in size (ie when the diamonds recovered are Microdiamonds).

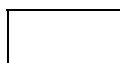
Reporting of Identified Mineral Resources

38. The requirements for reporting of Identified Mineral Resources as described in Clauses 16 to 24 apply fully when reporting Identified Diamond Mineral Resources with the following additions:

- Any release of information in a report containing a company's Identified Mineral Resources should state the pertinent data and assumptions on which the report is

based and contain a qualification drawing attention to any assessment criteria from Tables 1 and 2 for which inadequate data are available.

- Where Resource grade figures are based on the correlation of Macrodiamond grade with the grade of Microdiamonds, this must be stated and its reliability explained.



Reporting of Ore Reserves

39. The requirements for reporting of Ore Reserves as described in Clauses 25 to 31 apply fully when reporting diamond Ore Reserves with the following additions:
- Any release of information in a report containing a company's Ore Reserves should state the pertinent data and assumptions on which the report is based and contain a qualification drawing attention to any assessment criteria from Tables 1 and 2 for which inadequate data are available.
 - Where Reserve grade figures have been estimated in part on the basis of the correlation of Macrodiamond grade with the grade of Microdiamonds, this must be stated and its reliability explained.
 - If a valuation of a parcel of diamonds is reported, the weight in carats and size range of the contained diamonds must be stated and the value of the diamonds must be given in US dollars per carat.

Table 2

DEFINITIONS AND ASSESSMENT CRITERIA

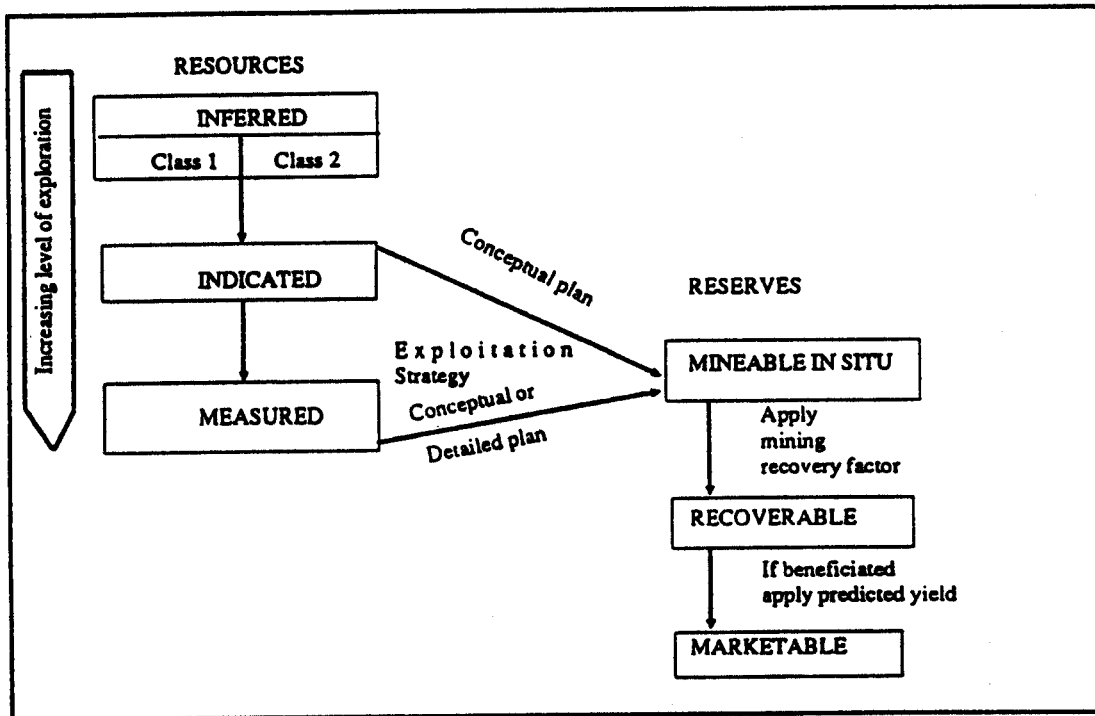
Primary rock source	Primary sources of diamonds in nature are variable and complex. Accordingly, information relating to primary sources should contain details of the nature of the rock type together with its form, shape and size.
Secondary rock source	Secondary sources of diamonds in nature are variable and complex. Accordingly, information relating to secondary sources should contain details of the nature of the rock type together with its form, age and size.
Sampling parameters	Reported discoveries of diamonds or Indicator Minerals from all samples must be accompanied by details of the sampling parameters used. Type of sample (stream sediment, soil, bulk, rock, etc) as well as sample size, sample frequency and screening parameters are required.
Microdiamonds	Current practice in Australia defines Microdiamonds as diamonds which will pass through a screen with 0.4 mm apertures, ie diamonds weighing less than 0.001 carats. Reports of Microdiamond recoveries should specify both the number of stones recovered and the top and bottom screen or crushing sizes used in the recovery process.
Macrodiamonds	Macrodiamonds are defined as diamonds larger than 0.4 mm in size. Reports of Macrodiamond recoveries should specify both the number of stones and the total carat weight recovered above a specified screen size.
Indicator Minerals	Conventional Indicator Minerals include garnet, ilmenite, chrome spinel and chrome diopsides having the requisite chemical and physical attributes that distinguish them from otherwise similar minerals found in non-diamond associated rock types. Reports of Indicator Minerals should be prepared by a suitably qualified person.
Diamond value	Diamond valuation is a highly specialised process and is only possible on parcels containing appropriate numbers of Macrodiamonds. It is not possible to evaluate diamond quality from Microdiamonds. Classification of diamonds as, for example, gem, near gem and industrial should be made by recognised experts who should be identified in the valuation report and their independence stated. The number of stones, the total carat weight and size range for the parcel valued should be stated.
Previous work	Referrals to previous work by other parties should be adequately referenced in the normal fashion.
Cut-off grades	Assumptions regarding cut-off grades should specify minimum screen size.
Carat	One fifth of a gram (often defined as a metric carat or MC).
Grades	Internationally, diamond grades for primary deposits are stated both in carats per tonne and carats per 100 tonnes. The Joint Ore Reserves Committee recommends the use of carats per tonne. In the case of alluvial deposits, industry practice is to quote grades in carats per tonne or carats per cubic metre.

APPENDIX 1

AUSTRALIAN CODE FOR REPORTING IDENTIFIED COAL RESOURCES AND RESERVES (FEBRUARY 1986)

Following a request from the Australian Minerals and Energy Council (AMEC) for the development of a national approach to the reporting of coal resources and reserves, the Government Geologists' Conference in 1984 established a subcommittee to examine the issue and report back to the Conference on its findings. The subcommittee consisted of A G Galligan, Chief Coal Geologist, New South Wales Department of Mineral Resources, and D C Mengel, Director, Fossil Fuels, Geological Survey of Queensland.

The Subcommittee used the Code for Calculating Coal Resources and Reserves' (Fifth Edition, June 1984) of the Standing Committee on Coalfield Geology of New South Wales as the base document, and modified this code to meet the requirements of both industry and government in other states, and the Bureau of Mineral Resources. The new Code was ratified by the Government Geologists' Conference in April 1986 and has been adopted by the Standing Committee on Coalfield Geology of New South Wales. The Code is published in full on the following pages.



INTRODUCTION

This Code outlines general concepts for reporting identified Coal Resources and Reserves. It is broad in nature to accommodate the wide range of coal deposits, in terms of rank, quality, and geological environment, that are present in Australia.

In this Code, the term Resources is used to refer to all of the coal in situ which may have potential for use, and the various categories indicate the level of confidence of the assessment. Reserves are those resources which are planned to be mined and for which

such planning has been undertaken. The Code sets only minimum guidelines for evaluating Resources and Reserves and the estimator is required to state clearly the criteria used in any assessment.

Additional guidelines and parameters may be required for reporting coal Resources and Reserves from specific basins or regions.

DEFINITIONS

Coal Resources

Coal Resources are all of the potentially usable coal in a defined area, and are based on points of observation and extrapolations from those points. Potentially usable coal is defined as coal which has, or could be beneficiated to give a quality acceptable for commercial usage in the foreseeable future and excludes minor coal occurrences. The estimator should state both the quality and thickness limits to define potentially usable coal in any resource evaluation.

Coal Reserves

Coal Reserves are those parts of the Coal Resources for which sufficient information is available to enable detailed or conceptual mine planning and for which such planning has been undertaken.

Points of Observation

A Point of Observation is an intersection, at a known location, of coal-bearing strata, which provides information about the strata by one or more of the following methods:

- Observation, measurement and testing of surface or underground exposures.
- Observation, measurement and testing of bore core.
- Observation and testing of cuttings, and use of down-hole geophysical logs of non-cored boreholes.

A point of observation for coal quantity may not be used necessarily for coal quality. The most reliable quality information is provided by testing of surface or underground exposures or by testing of bore core.

Geophysical techniques such as seismic surveys are not direct points of observation but may increase confidence in the continuity of seams between points of observation, especially in the broader Resource categories.

The distances between points of observation and extrapolations from points of observation quoted for each Resource category are normally the maximum under favourable geological conditions. More closely spaced points of observation will be required in areas where faulting, intrusion, seam splitting and other breaks in seam continuity are known to occur, or where the seam is subject to significant variation in thickness or quality.

CATEGORIES OF RESOURCES

Measured Resources are those for which the density and quality of points of observation are sufficient to allow a reliable estimate of the coal thickness, quality, depth and in situ tonnage.

Points of observation should provide a level of confidence sufficient to allow detailed planning, costing of extraction and specification of a marketable product.

The points of observation generally should be not more than 1 km apart. Where geological conditions are favourable it may be possible to extrapolate known trends a maximum distance of 0.5 km from points of observation.

Indicated Resources are those for which the density and quality of points of observation are sufficient to allow a realistic estimate of the coal thickness, quality, depth and in situ tonnage and for which there is reasonable expectation that the estimate of resources will not vary significantly with more detailed exploration.

Points of observation should provide a level of confidence sufficient to enable conceptual planning of extraction and to determine the likely quality of the product coal.

Points of observation generally should be not more than 2 km apart. Where geological conditions are favourable, it may be possible to extrapolate known trends a maximum distance of 1 km from points of observation.

Inferred Resources are those for which the points of observation are widely spaced and as a result, assessment of this type of resource may be unreliable.

Points of observation should allow the presence of coal to be unambiguously determined.

Inferred Resources Class 1 are those resources for which the points of observation allow an estimate of the coal thickness and general coal quality to be made, and the geological conditions indicate continuity of seams between the points of observation.

Points of observation generally should be not more than 4 km apart. Extrapolations of trends should extend not more than 2 km from the points of observation.

Inferred Resources Class 2 are those for which there is limited information and as a result the assessment of this type of resource may be unreliable.

Provided the coal thickness can be determined, the order of magnitude of Inferred Resources Class 2 may be expressed within the following ranges:

1-10	million tonnes
10-100	million tonnes
100-500	million tonnes
500-1000	million tonnes
greater than 1000	million tonnes

If a more specific quantitative estimate is made to determine exploration priorities, etc it should not be quoted in public reports or in any prospectus.

TYPES OF RESERVES

Mineable In Situ Reserves are the tonnages of in situ coal contained in seams or section of seams for which sufficient information is available to enable detailed or conceptual mine planning and for which such planning has been undertaken.

Mineable In Situ Reserves may be calculated only from Measured and Indicated Resources. Measured Resources are required for detailed mine planning, and are the preferred basis for Mineable In Situ Reserves. Indicated Resources may be used for conceptual mine planning. In general, further exploration will be required prior to commencement of mining operations.

Mineable In Situ Reserves should be quoted separately for surface and underground mines and an outline of the proposed mining method(s) should be provided.

Recoverable Reserves are the tonnages of Mineable In Situ Reserves that are expected to be recovered, ie that proportion of the seam(s) which will be extracted. If dilution is added to the Recoverable Reserves tonnage, the total equates to the 'run-of-mine' tonnage. If allowance is made for dilution it should be stated.

In calculating Recoverable Reserves, a Mining Recovery Factor must be applied to the Mineable In Situ Reserves. This factor will depend on the mining method to be used. Unless a specific factor has been determined for conceptual studies, the historically proven Mining Recovery Factor should be used. If such information is not available, a Mining Recovery Factor of 50 per cent for underground reserves and 90 per cent for surface reserves may be applied. An outline of the proposed mining method should accompany any statement of Recoverable Reserves.

Marketable Reserves are the tonnages of coal that will be available for sale.

If the coal is to be marketed raw, the Marketable Reserves will be the same as the Recoverable Reserves plus dilution, ie the 'run-of-mine' tonnage. If the coal is to be beneficiated, Marketable Reserves are calculated by applying the predicted yield to the Recoverable Reserves. The basis of the predicted yield should be stated, eg 200 mm cores, slim cores, pretreated cores.

REPORTING OF RESOURCES AND RESERVES

All factors used to limit Resources and Reserves and necessary to verify the calculations (including the types of observations, eg cored hole, outcrop) must be stated explicitly. The relative density value adopted in calculating the coal tonnage should be noted, together with the evidence on which it is based. Tonnage estimates always should be rounded, commensurate with the accuracy of estimation.

Resources and Reserves should be stated

- for each seam
- on a depth basis, in regular depth increments if sufficient information is available
- on a seam thickness basis, the minimum thickness used should be stated and separate tonnages should be quoted for seams less than 1.5 m thick and seams equal to or greater than 1.5 m (this limit may be greater for brown coal, eg 3 m). The maximum thickness of any included non-coal bands should be stated. Normally where a seam contains a non-coal band thicker than 0.3 m the two coal splits should be considered as separate seams and tonnages should be reported for each (the limit for non-coal bands may be greater for brown coal sequences, eg 1 m).
- on a quality basis, maximum raw coal ash should be stated and only that coal which can be used or beneficiated at an acceptable yield (to be stated) should be included in the estimate. Other raw coal quality parameters, particularly those which affect utilisation behaviour, should be stated and further

subdivision of the resources made if significant variations occur, eg heat affected coal, oxidised coal.

In addition, for reporting of Reserves the following information is required, as a minimum

- an outline of the proposed mining method
- physical criteria limiting mining such as maximum and minimum working section, thickness, minimum separation of seams, maximum dip, geological structure, areas of prohibition.
- quality criteria limiting mining such as ash content, volatile matter, yield, etc
- for Recoverable Reserves, the Mining Recovery Factor used
- for Marketable Reserves, the predicted yield if the coal is to be beneficiated and the quality specification of the product coal
- the overburden ratio expressed as bank cubic metres of overburden to tonnes of coal in situ for reserves amenable to surface mining
- the depth of planned mining
- the percentage of the Resources which are the Mineable In Situ Reserves within the area(s) proposed to be mined.

MAPS

Any report of Resource and/or Reserves must be substantiated, to the relevant Government authority, by maps at scales appropriate to the accuracy claimed for the Resources and/or Reserves, showing all relevant data including the areas considered for each category of

Resources and/or Resources and/or Reserves, the limits imposed (eg cover lines, seam isopachs, isoashes), the areas of prohibition, and seam thickness at points of observation.

A PUBLIC STATEMENT

A Public Statement of Resources and/or Reserves claiming the authority of the Code should be in the format described in the section 'Reporting of Resources

and Reserves'. The qualifications of the person(s) responsible for this 'Reporting' should be stated.

REFERENCE

For guidance in determining coal quality from bore cores, reference should be made to Australian Standard

2519-1982: Guide to the evaluation of hard coal deposits using borehole techniques.

**GUIDELINES TO THE
AUSTRALASIAN CODE FOR REPORTING OF
IDENTIFIED MINERAL RESOURCES AND
ORE RESERVES**

**PREPARED BY THE JOINT COMMITTEE OF THE
AUSTRALASIAN INSTITUTE OF MINING AND METALLURGY,
AUSTRALIAN INSTITUTE OF GEOSCIENTISTS
AND
MINERALS COUNCIL OF AUSTRALIA
(JORC)**

PUBLISHED AS AN ATTACHMENT TO THE JULY 1996 CODE

Introduction

These Guidelines are aimed at both technical and non-technical persons and are designed to assist in the use and application of the Code and to clarify certain points. The Guidelines are intended to be read in conjunction with the Code, hence repetition of the content of the Code has been avoided.

While every effort has been made both within the Code and within these Guidelines to cover most situations likely to be encountered in the reporting of Mineral Resources and Ore Reserves, there will inevitably be occasions when doubt exists as to the appropriate procedure to follow. In such cases, users of the Code and those compiling reports under the Code should be guided by its intent, which is to provide a standard for reporting and to ensure that such reporting contains sufficient relevant information to enable an informed layperson to make a reasoned and balanced judgement regarding the mineralisation reported.

The Code

The *Australasian Code for Reporting of Identified Mineral Resources and Ore Reserves* was first released by The AusIMM and AMIC in February 1989 and superseded *Reporting of Ore Reserves* last published in 1985. The 1996 revision of the Code makes no changes of substance with the exception that all references to 'Pre-Resource Mineralisation' have been changed to 'exploration results' and relevant text modified. This change has been introduced as an improvement in terminology and in order to ensure that estimates of tonnage/volume and grade are publicly reported only in relation to mineralisation which has been classified as a Mineral Resource or an Ore Reserve.

The 1989 Code differed from the 1985 Report in that it:

- identified a separate category of Pre-Resource Mineralisation (renamed 'exploration results' in the 1996 revision)
- introduced the concept of Identified Mineral Resources as the precursor to Ore Reserves and described the relationship between the two
- provided definitions for categories of Identified Mineral Resources
- defined Ore Reserves in terms of economically mineable tonnes and grade (defined as 'recoverable Ore Reserves' in the 1985 Report)
- eliminated both the classification 'Possible Ore' and the need for qualification of Ore Reserves as 'in situ' or 'recoverable' (it should also be noted that the commonly used term 'Geological Reserves' has no meaning under the Code)
- listed and explained Resource Assessment Criteria.

The Code therefore clearly distinguishes between **Mineral Resources**, which can be estimated mainly by a geologist on the basis of geoscientific information and

Ore Reserves, which are a modified sub-set of the Mineral Resources and which require consideration of those factors affecting practical and economic exploitation, including environmental, social and political factors, with necessary input from a range of disciplines.

In July 1989, the Code was adopted in its entirety by the Australian Stock Exchange Limited and was appended to its Listing Rules.

It should be emphasised that the Code is not intended as a means of regulating the methods by which Mineral Resources and Ore Reserves are estimated or of controlling in-house procedures for estimation and accounting. Its purpose is to provide a standard by which important information on Ore Reserves, Mineral Resources and significant mineralisation is reported to shareholders, other interested parties (including regulatory bodies) and the general public.

Exploration Results

A company may choose to report exploration results for reasons of its own, or be obliged to report them in accordance with Australian Stock Exchange Listing Rules, particularly those rules relating to continuous disclosure requirements. Where such results relate to mineralisation which is not classified as a Mineral Resource or an Ore Reserve, the Code does not allow estimates of tonnage/volume and grade to be assigned in public reports. A company may, of course, make estimates of tonnage and grade for internal purposes, however public reporting of such estimates in relation to mineralisation insufficiently known to allow classification even as an Inferred Resource could be misleading to shareholders and potential investors.

If the company decides to report exploration results, then it is necessary that sufficient information is provided to enable the informed layperson to make a reasoned judgement about the prospect. The Code provides a list of Assessment Criteria (Table 1 of the Code) which, if relevant, should be disclosed or commented upon when reporting exploration results. When such results relate to mineralisation not reported as a Mineral Resource or Ore Reserve, it is a requirement that full information on factors which bear on sampling and assaying of the mineralisation must be disclosed.

Identified Mineral Resources

This classification has been introduced as the precursor to Ore Reserves. It covers in situ mineralisation which has been identified and estimated through exploration and sampling and within which Ore Reserves may be defined by the consideration and application of technical, financial, legal, environmental, social and political factors.

The Code states that an Identified Mineral Resource (otherwise referred to as a Mineral Resource) is quantified on the basis of geological data and an assumed cut-off grade only. The latter term refers to a

lower limiting grade applied before constraints resulting from mine designs have been taken into account. The Code further states, however, that in reporting a Mineral Resource there is an implication that there are reasonable prospects for eventual economic exploitation. This implies a judgement (albeit preliminary) by the Competent Person of the order of lower limiting grade likely to be required to enable economic exploitation.

If cutting or reduction of high grades is considered to be appropriate to the mineralisation being reported, the technique should be applied to grade estimation at the Mineral Resource stage and not restricted to grade estimation at the Ore Reserve stage.

Identified Mineral Resources are subdivided into three categories which reflect the level of confidence in the estimate. Definitions are provided in the Code. Selection of appropriate categories is a matter for skilled judgement and must be made by a Competent Person.

Inferred Resources

This category is intended to cover situations where mineralisation has been identified and some measurement and sampling completed, but where the data are insufficient to allow the geological framework to be confidently interpreted and continuity of mineralisation to be predicted. It should not necessarily be assumed that all or part of an Inferred Resource will be upgraded to Indicated or Measured Resources by continued exploration. Caution should be exercised if this category is considered in preliminary economic studies.

Indicated Resources

Mineralisation may be classified as an Indicated Resource when the nature and amount of data is such as to allow the Competent Person determining the Mineral Resource to confidently interpret the geological framework and to assume continuity of mineralisation. Confidence in the estimate would be such as to allow the application of technical and financial parameters and to enable an evaluation of economic viability.

Measured Resources

Mineralisation may be classified as a Measured Resource when the nature and amount of data is such as to leave no reasonable doubt, in the opinion of the Competent Person determining the Mineral Resource, that the tonnage and grade of the in situ mineralisation can be estimated to within close limits and that any variation from the estimate would be such as not significantly to affect potential economic viability. This degree of confidence necessarily requires a firm understanding of the geology and controls of mineralisation.

Ore Reserves

The definition of Ore Reserves in the Code differs from that in the 1985 Report in that Ore Reserves are now restricted to what were qualified as 'recoverable reserves' in the former Report, that is, Ore Reserves are inclusive of diluting material which will be mined in conjunction with the Reserves and delivered to the treatment plant.

The Code provides for a direct relationship between Indicated Mineral Resources and Probable Ore Reserves and between Measured Mineral Resources and Proved Ore Reserves. In other words, the level of geoscientific confidence for Probable Reserves is the same as that required for the in situ determination of Indicated Resources and for Proved Reserves is the same as that required for the in situ determination of Measured Resources. In each case the Ore Reserve is that part of the Mineral Resource which, after the application of all mining factors, results in an estimated tonnage and grade which, in the opinion of the Competent Person or Persons making the estimates, can be the basis of a viable project after taking account of all relevant metallurgical, marketing, environmental, legal, social and governmental factors.

The direct relationship between categories of Mineral Resources and Ore Reserves implies that the decision as to whether an Ore Reserve is defined as Proved or Probable is governed solely by whether the corresponding Mineral Resource is defined as Measured or Indicated.

It should be noted that the Code does not necessarily require an economic operation to have Proved Ore Reserves and that situations could arise where Probable Ore Reserves alone are sufficient to justify exploitation, as for example with some alluvial tin or gold deposits.

Application of the category of Proved Ore Reserves implies the highest degree of confidence in the estimate with consequent expectations in the minds of readers of the report. These expectations should be borne in mind when categorising a Mineral Resource as Measured.

If a change to any of the parameters which affect viability results in some or all of the Ore Reserves becoming non-viable based on assumptions made at the time, then those Reserves should be re-classified as Identified Mineral Resources.

It is not intended, however, that such re-classification should be applied as a result of changes expected to be of a short term or temporary nature, or where company management has made a deliberate decision to operate on a non-economic basis. Examples of such situations might be a commodity price drop expected to be of short duration, mine flooding of a non-permanent nature, transport strike, etc.

Mineralised Stope Fill, Stockpiles, Remnants and Pillars

For the purposes of the Code, mineralised stope fill and stockpiles of mineralised material can be considered to be similar to in situ mineralisation when reporting Identified Mineral Resources and Ore Reserves. Consequently the Competent Person carrying out the assessment of the fill or stockpiles must use the bases of classification outlined in the Code.

If there are not reasonable prospects for the economic exploitation of a particular portion of the fill or stockpile, then this material cannot be classified as either Mineral Resources or Ore Reserves and must be regarded as waste. If some portion is currently sub-economic but there is a reasonable expectation that it will become economic, then this material may be classified as an Identified Mineral Resource. Such stockpile material may include old dumps and tailings dam material.

Stockpiles are defined to include both surface and underground stockpiles, including broken ore in stopes, and can include ore currently in the ore storage system. Mineralised material in the course of being processed (including leaching), if reported, should be stated accordingly.

Mineralised remnants, shaft pillars and mining pillars which are potentially mineable are in situ mineralisation and consequently are included in the Code definitions of Identified Mineral Resources and Ore Reserves.

Mineralised remnants, shaft pillars and mining pillars which are not potentially mineable are to be regarded as waste and must not be included in Identified Mineral Resource and Ore Reserve statements.

Mineral Resource/Ore Reserve Statements

In preparing the Ore Reserve Statement each year, the relevant Mineral Resource Statement on which it is based should first be developed. This can be reconciled with the Mineral Resource Statement estimated the previous year and differences (due, for example, to mine production, exploration, etc) identified. The application of appropriate factors to the Mineral Resource can then be made to develop the Ore Reserve Statement which can also be reconciled with the comparable statement for the previous year. Mining companies are encouraged to reconcile estimates whenever possible in their reports.

Assessment Criteria

There are critical technical parameters which should be considered when reporting exploration results or making an estimate of a Mineral Resource. These are listed in Table 1 of the Code under the heading Assessment Criteria and each item is accompanied by a brief description. It is presumed that the Competent Person will take full account of these parameters when preparing an estimate and it is not always necessary, when reporting, to comment on each item. The Code does however make two important references to Table 1:

- When reporting exploration results which relate to mineralisation not classified as a Mineral Resource or Ore Reserve, full information on factors bearing on sampling of the mineralisation must be disclosed. Reporting of isolated assays without placing them in perspective is unacceptable.
- When reporting Mineral Resources or Ore Reserves, reference should be made to Table 1 in stating where inadequate or uncertain data affect the reliability of, or confidence in, an estimate; for example, poor sample recovery, non-repeatability of assay results, limited information on tonnage factors, etc. The purpose of this requirement is to assist the reader of the report to make an informed judgement about the prospect or property.

If any of the data on which a Mineral Resource or Ore Reserve estimate is based are adjusted or modified for the purpose of making the estimate, this should be clearly stated in a Mineral Resource or Ore Reserve report and the nature of the adjustment or modification described. Such alterations might include cutting of high grades, the application of factors such as mine or mill 'call factors' and so on.

Precision

Mineral Resource and Ore Reserve estimates are not precise calculations, being dependent on a geological interpretation and on samples which represent only a minute fraction of the mineralised body. Statements of tonnage (or volume) and grade should be rounded so as to reflect this uncertainty. In most situations, rounding to the second significant figure should be sufficient. For example 10,863,000 tonnes at 8.23 per cent should be stated as 11 million tonnes at 8.2 per cent. There will be occasions, however, where rounding to the first significant figure may be necessary in order to convey properly the uncertainties in estimation. This would often be the case with Inferred Resources.

In order to reinforce the qualitative nature of a Mineral Resource or Ore Reserve estimate, it is recommended that the final result always be referred to as an estimation not a calculation.

Reporting

The purpose of the Code is to improve and standardise reporting practices in the mining industry.

In providing different categories within the classifications of Mineral Resources and Ore Reserves, the Code encourages reporting which reflects the estimator's confidence in the figures stated. This purpose is undermined if the categories are not reported separately and the practice of reporting only a combined figure for Proved and Probable Ore Reserves or for Measured and Indicated Mineral Resources is strongly discouraged. If a company cannot report in accordance with this standard, the reason for such non-compliance should be clearly explained in the report.

In situations where figures for both Mineral Resources and Ore Reserves are reported, it is consistent with the intent of the Code if the statement of Measured and Indicated Mineral Resources includes those Resources which can be modified to produce Ore Reserves, rather than being stated as additional to those Reserves. While the Joint Committee has a preference for the former mode of reporting, it is recommended that, whichever is adopted, a clarifying statement be included in the report. For example:

'The Measured and Indicated Mineral Resources are inclusive of those Mineral Resources modified to produce the Ore Reserves'

or

'The Measured and Indicated Mineral Resources are additional to the Ore Reserves'

In the former case, if any Mineral Resources have been specifically excluded from the Ore Reserve estimations, the relevant details should be included in the report.

Inferred Resources are, by definition, always additional to Ore Reserves.

Ore Reserves may incorporate material (dilution) which is not part of the original Mineral Resource. It is essential that this fundamental difference between Mineral Resources and Ore Reserves is borne in mind and caution exercised if attempting to draw conclusions from a comparison of the two.

For the same reason, Mineral Resource figures should not be added to Ore Reserve figures. The resulting total can be very misleading in economic terms and is capable of being misunderstood or, more seriously, of being misused to give a false impression of a company's prospects.

A Mineral Resource or Ore Reserve statement should include tonnage/volume figures and grade figures (except for Inferred Resources for which grade estimates may not always be possible). It is considered that the practice of providing only contained metal figures deprives the public of vital information on the mine or prospect and that such reporting is not in accordance with the Code. Mineral Resource estimates should not be reported in terms of contained metal figures (with or without tonnage/volume and grade figures) since there is a tendency for such figures to be misinterpreted as representing recoverable metal.

It is recommended that a public report of a company's Mineral Resource or Ore Reserve position should also make reference to figures released for a previous corresponding period. A detailed reconciliation of the two sets of figures is not essential, but sufficient comment should be made to enable significant differences to be understood by the reader.

In compiling Mineral Resource and/or Ore Reserve information for inclusion in a public report, a company may need to edit the report prepared by the Competent Person. Where such editorial license is taken, the Competent Person should approve the modified version as fairly representing his or her report.

Competent Person

The key qualifier in the definition of a Competent Person is the word 'relevant'. Determination of what constitutes relevant experience is a difficult area and a degree of common sense has to be exercised.

For example, in estimating vein gold mineralisation, experience in any high-nugget, vein-type mineralisation such as tin, uranium, etc is relevant whereas experience in (say) massive-type deposits is not.

As a second example, five years experience in beach sand deposits does not make a person 'competent' to evaluate and report on a river system of gold alluvials, since there is an order of magnitude difference in grades as well as considerable difference in the mechanism of transport and deposition.

In addition to experience in the style of mineralisation, a Competent Person must have sufficient experience in the sampling and assaying techniques relevant to the deposit under consideration to be aware of problems which could affect the evaluation. Some appreciation of extraction and processing techniques applicable to that deposit type would also be important.

As a general guide, persons being called upon to sign as a Competent Person should be clearly satisfied in their own minds that they could face their peers and demonstrate competence in the type of deposit under consideration. If doubt exists, the person should either seek opinions from other colleagues or should decline to sign as a Competent Person.

Estimation of Ore Reserves is a team effort involving a number of disciplines and more than one member of the team may qualify as a Competent Person. The Competent Person (or Persons) who signs the report is responsible and accountable for all aspects of the report under the Code. If the Competent Person is a Corporate Member of The AusIMM, he or she is answerable to The AusIMM Ethics Committee should that Committee become involved. If the Competent Person is a Corporate Member of the Australian Institute of Geoscientists (AIG) then he or she is answerable to the AIG Ethics and Standards Committee should that Committee become involved.

A difficulty may arise when a company with overseas interests wishes to report an overseas Mineral Resource or Ore Reserve estimate prepared by a person who may not be a resident of Australasia and who may therefore

not be a member of The AusIMM or of the AIG. In such situations the company must nominate a Competent Person or Persons to sign off the Mineral Resource or Ore Reserve estimate.

ASX Listing Rules

Australian Stock Exchange Limited (ASX) appended the Code to its Listing Rules with effect from 1st July 1989. Public reports relating to a period after that date must comply with the Code.

The Code is designed to provide for disclosure of sufficient information so that an informed layperson is able to make a reasoned and balanced assessment of the mineralisation being reported. It requires that releases by entities which make statements about Mineral Resources or Ore Reserves must be based on information compiled by a Competent Person as defined in the Code.

The Listing Rules require that a report must either state that the report is based on the information compiled by the Competent Person or be accompanied by a statement to that effect signed in the same manner as the report. The name of the Competent Person(s) and of the Competent Person's firm or company must be included in the report.

An appropriate form of a statement may be as follows:

'The following statements apply in respect of the information in this report that relates to Ore Reserves or Identified Mineral Resources:

- The information is based on, and accurately reflects, information compiled by (insert name of Competent Person(s)), who is(are) a Corporate Member(s) of The Australasian Institute of Mining and Metallurgy/the Australian Institute of Geoscientists (select as appropriate): or
- A statement signed in the same manner as the report accompanies the information and says that the information is based on, and accurately reflects, information compiled by (insert name of Competent Person(s)), who is(are) a Corporate Member(s) of The Australasian Institute of Mining and Metallurgy/the Australian Institute of Geoscientists (select as appropriate) *[Delete the first or second bullet point as required]*
- (Insert name of Competent Person) is employed by (insert name of Competent Person's employer)
- (Insert name of Competent Person) has relevant experience in relation to the mineralisation being reported on to qualify as a Competent Person as defined in the *Australasian Code for Reporting of Identified Mineral Resources and Ore Reserves.*