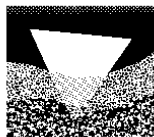# Guidelines for the Estimation and Reporting of Australian Black Coal Resources and Reserves

(as referred to in the Joint Ore Reserves Committee Code ('The JORC Code') 1999 edition)

2001 Edition

QUEENSLAND
MINING COUNCIL

Prepared by The Coalfields Geology Council of New South Wales and the Queensland Mining Council

GUIDELINES FOR THE ESTIMATION & REPORTING OF AUSTRALIAN BLACK COAL RESOURCES AND RESERVES.

PREFACE

1. Prior to September 1999 the estimation and reporting of Coal Resources and Reserves in Australia were prescribed by the "Australian Code for Reporting Identified Coal Resources and Reserves (February 1986)". This code was ratified by the Government Geologists Conference in April 1986 and appended to the "Australasian Code for Reporting of Identified Mineral Resources and Ore Reserves" (the Joint Ore Reserve Committee or JORC Code) in February 1989; and subsequently in the revised JORC Code (July 1996). The JORC Code was further revised and reissued in September 1999 under the title of the "Australasian Code for Reporting of Mineral Resources and Ore Reserves". The 1999 JORC Code provides minimum standards for public reporting to the investment community.

2. The "Guidelines for the Estimation & Reporting of Australian Black Coal Resources and Reserves" (the Guidelines) are referred to in the JORC Code, which now includes 'Coal' in its main body rather than as an appendix. The processes/procedures outlined in these guidelines are not considered compulsory, but their use is recommended. Some information in these guidelines has been paraphrased from the JORC Code and the *Estimator* should note that requirements of the JORC Code are mandatory.

SCOPE

3. The scope of this document is to outline the methodology that should normally be followed for estimating the quantity and quality of *Coal In Situ*, *Coal Resources* and *Coal Reserves*; and to provide guidelines for reporting to government and preparing technical documents for public and non-public (e.g. internal company) reporting. These guidelines are broad in nature to accommodate the wide variation of Australian coal deposits, in terms of rank, quality and geological environment. They also recognise that the *Estimator* bears the ultimate responsibility for the integrity of the Resources and Reserves estimates.

REPORTING TERMINOLOGY

4. Reports of Coal Resources and Coal Reserves should only use the terms set out in the attached Diagram. The Diagram shows the relationship between the various categories of *Coal In Situ, Coal Resources* and *Coal Reserves* and the classification system that reflects different levels of geological confidence and varying degrees of technical and economic knowledge.

Definitions

5. *Estimator.* A person responsible for the estimation of Coal Resources and/or Reserves (the ***Estimator***) should have tertiary qualifications in geology or mining engineering and must have a minimum of five years experience in the coal industry relevant to the activity that the person is undertaking. If the ***Estimator*** is estimating, or supervising the estimation of ***Coal Resources***, the relevant experience must be in the estimation, assessment and evaluation of ***Coal Resources***. If the ***Estimator*** is estimating, or supervising the estimation of ***Coal Reserves***, the relevant experience must be in the estimation, assessment, evaluation and economic extraction of ***Coal Reserves.*** In reporting for statutory purposes it is the ***Estimator's*** responsibility to meet any special conditions of the relevant State Government.

> ***Note.*** *To sign off on Public Reports in accordance with the JORC Code (i.e. reports prepared for the purpose of informing investors or potential investors and their advisers),* an ***Estimator*** *must be a Member or Fellow of The Australasian Institute of Mining and Metallurgy and/or the Australian Institute of Geoscientists; and must ensure that all requirements of the JORC Code are satisfied.*

6. *Points of Observation* are intersections of coal-bearing strata, at known locations, which provide information to varying degrees of confidence about the coal by observation, measurement and/or testing of the following: surface or underground exposures, bore cores, downhole geophysical logs and/or drill cuttings in non-cored boreholes. ***Points of Observation*** shall allow the presence of coal to be unambiguously determined. Points of Observation for coal quality estimation may not necessarily be used for coal quality evaluation. A ***Point of Observation*** for coal quality evaluation is normally obtained from testing samples obtained from: surface or underground exposures; or from bore core samples having an acceptable level of recovery (normally >95%).

7. **Interpretive Data** are observations supporting the existence of coal, gathered by interpretive or indirect methods. **Interpretive Data** may include results from mapping, seismic, magnetic, gravity and other geophysical and geological surveys but should not include estimates of coal quantity or quality. A company, when reporting **Interpretive Data,** shall disclose the technical basis of the report. I**nterpretive Data** may be used in conjunction with **Points of Observation** to improve confidence levels.

8. The reporting of ***Exploration Result*** s refers to any coal occurrence that, due to insufficient information, cannot be assigned specific tonnages or quality.

9. *Coal In Situ* is a newly introduced reporting category that enables the total "in-ground" coal inventory to be reported for Government or internal company purposes. ***Coal In Situ*** includes any occurrence of coal in the earth's crust that can be estimated and reported, irrespective of thickness, depth, quality, mineability or economic potential; and by definition, includes all ***Coal Resources***. ***Coal In Situ*** should be reported in terms of the following confidence categories: ***Inferred, Indicated*** and ***Measured***.

> ***Inferred Coal In Situ*** is that part of the total ***Coal In Situ*** estimate for which quantity and quality can only be estimated with low levels of confidence. The quantity and quality are inferred using ***Points of Observation*** that may be supported by ***Interpretive Data***.

Continuity is assumed but is not verified by geological evidence.

Indicated Coal In Situ is that part of the total *Coal In Situ* estimate for which quantity and quality can be estimated with reasonable levels of confidence, based on information gathered from *Points of Observation* that may be supported by *Interpretive Data*. The *Points of Observation* are too widely or inappropriately spaced to confirm geological and/or quality continuity; but are sufficient for continuity to be assumed.

Measured Coal In Situ is that part of the total *Coal In Situ* estimate for which quantity and quality can be estimated with a high level of confidence, based on information gathered from *Points of Observation* that may be supported by *Interpretive Data.* The *Points of Observation* are spaced closely enough to confirm geological and/or quality continuity.

10. A *Coal Resource* is that part of the *Coal In Situ* category in such form and quantity that there are reasonable prospects for eventual economic extraction. A *Coal Resource* must be reported in terms of *Inferred, Indicated* and *Measured* categories. (Refer above for descriptions of *Inferred, Indicated* and *Measured*.)

11. A *Coal Reserve* is the economically mineable part of a *Measured* or *Indicated Coal Resource* at the time of reporting. It includes diluting materials and allowances for losses that may occur when the coal is mined. Appropriate assessments, which may include feasibility studies, need to have been carried out. These assessments should include proper consideration of mining, beneficiation, economic, marketing, legal, environmental, social and governmental factors. These assessments demonstrate at the time of reporting that extraction could reasonably be justified.

A *Probable Coal Reserve* is the economically mineable part of an *Indicated*, and in some circumstances, *Measured Coal Resource,* where the modifying factors referred to above have reduced the level of confidence.

A *Proved Coal Reserve* is the economically mineable part of a *Measured Coal Resource*.

Probable and *Proved Coal Reserves* may be combined and reported as *Recoverable Coal Reserves*.

Marketable Coal Reserves are the tonnages of coal, at specified moisture and quality, available for sale after beneficiation of *Coal Reserves*. *Marketable Coal Reserves* may be reported in conjunction with, but not instead of, reports of *Coal Reserves.* The basis of the predicted yield to achieve *Marketable Coal Reserves* should be stated. If the coal is to be marketed without any beneficiation *Marketable Coal Reserves* may be the same as the *Coal Reserves*.

ESTIMATION AND DOCUMENTATION OF *COAL IN SITU* AND *COAL RESOURCES*

Coal In Situ

12. *Coal In Situ* covers estimates of all coal, including that for which there are important reasons for acknowledging the existence of coal, but for which there may not be reasonable prospects for **4**

economic extraction at this stage. **Coal In Situ** could include coal of uneconomic thickness and/or quality or coal sterilised by legislation (barriers), safety or environmental reasons. This category represents an important difference between public reporting as per the JORC Code and non-public reporting, for example, to Government Departments. Estimates of **Coal In Situ,** and the assignment of the appropriate confidence categories, should be prepared as outlined below for **Coal Resources**.

Coal Resources

13. **Coal Resources** can only be estimated from data obtained from **Points of Observation**; but the estimates may be supported by **Interpretive Data**. Geophysical techniques, apart from downhole logging, are not direct **Points of Observation;** but may increase confidence in the continuity of seams between **Points of Observation**, especially in the **Inferred Resources** category.

14. **Coal Resources** are estimated by multiplying the areal extent of the coal seam(s), by the thickness of the seam(s) and the in situ density. The areal extent is defined by the areas of influence of **Points of Observation** and other factors that limit the extent of the resources. Factors that limit the areal extent of resources may be technical or economic (eg. minimum or maximum seam thickness, depth, minimum separable parting thickness and quality). The **Estimator** should ensure that an appropriate in situ density is applied and stated.

15. **Coal Resources** should be estimated and reported for each seam in a deposit according to appropriate key variables (eg. thickness, depth, strip ratio, coal quality parameters).

16. If any seam parameter (eg. thickness, raw ash, yield) does not meet a level for which there are reasonable prospects of eventual economic extraction over a persistent area, then **Coal Resources** should not be estimated for the seam in that area. If there are compelling reasons to estimate resources in these areas (eg. the area has to be mined through to access a more prospective seam or higher quality resources), the **Estimator** should provide the necessary explanation. Similarly, if any geological, technical or cultural considerations (eg. extensive coking or intrusion, excessive depth to coal, mining height limit in underground mines, reserved surface areas) preclude reasonable prospects of eventual economic extraction of the seam, or a part of the seam, then **Coal Resources** should not be estimated for the seam, or the relevant part of the seam, in that area. The **Estimator** should document these considerations.

17. The following broad guidelines should be applied by the **Estimator** when determining the relevant resource categories for a deposit, under favourable geological conditions.

18. For **Inferred Coal Resources,** the density and distribution of **Points of Observation,** which may be supported by **Interpretive Data,** should provide sufficient understanding of the geological conditions to infer continuity of seams between **Points of Observation.** They should also allow an estimate of the range of coal thickness as well as coal quality to be made to a low level of confidence, (i.e. insufficient for mine planning purposes).

Inferred Coal Resources may be estimated using data obtained from *Points of Observation* up to 4km apart. Trends in coal thickness and quality should not be extrapolated more than 2km kilometres from *Points of Observation*.

19. For *Indicated Coal Resources,* the density, distribution and integrity of *Points of Observation,* which may be supported by *Interpretive Data,* are sufficient to allow a realistic estimate of average coal thickness, areal extent, depth range, quality and in situ quantity. They provide a level of confidence in the deposit sufficient to generate mine plans and determine the likely quality of product coal.

Indicated Coal Resources may be estimated using data obtained from *Points of Observation* normally less than 1km apart, but may be extended up to 2km with appropriate justification. Trends in coal thickness and quality should not be extrapolated more than 1km from *Points of Observation*.

20. For *Measured Coal Resources,* the density, distribution and integrity of *Points of Observation,* which may be supported by *Interpretive Data,* are sufficient to allow a reliable estimate of average coal thickness, areal extent, depth range, quality and in situ quantity. They provide a level of confidence in the deposit sufficient to generate detailed mine plans, determine mining costs and provide specifications for a marketable product.

Measured Coal Resources may be estimated using data obtained from *Points of Observation* normally less than 500 metres apart, but may be extended up to 1km with appropriate justification. Trends in coal thickness and quality should not be extrapolated more than 500 metres from *Points of Observation*.

21. In areas where seams are faulted, intruded, split, lenticular or subject to significant variations in thickness or quality, more closely spaced *Points of Observation*, possibly supported by *Interpretive Data,* will be required.

22. Estimates of *Coal In Situ* and *Coal Resources* must clearly state all factors used in the estimation, including areal extent, thicknesses and in situ densities. Tonnage estimates should be rounded commensurate with the accuracy of estimation. The estimation procedure should be transparent and repeatable.

23. Where estimates of *Coal In Situ* and *Coal Resources* are presented together, a statement must be included clearly indicating whether the estimates are reported separately or combined.

24. Notwithstanding all of the above, it is the responsibility of the *Estimator* to determine the appropriate *Coal In Situ* or *Coal Resource* categories for any given deposit. The *Estimator* should prepare a technical document that fully describes the estimation process and assumptions used; and contains relevant plans at appropriate scales. As a guide only, the document should include:-

·   Maps for each seam, showing the location and areal extent of each resource

        category, the factors used to limit the resources; and the *Points of Observation* (with

        the coal quality holes clearly differentiated) on which the resource estimates for that   **6**

seam are based

· **Tables of the estimates displaying resource categories, areas, seam thickness ranges, relative densities, depth ranges and coal quality ranges relevant to the estimate for each seam;**

· **The moisture basis of the estimate(s) and the moisture adjustment factor (if applied);**

· **A description of all factors used to limit the resource estimates; and**

· **A declaration as to whether or not the document is JORC compliant (a document reporting *Coal In Situ* would not be JORC compliant).**

ESTIMATION AND DOCUMENTATION OF *COAL RESERVES*

25. *Probable, Proved,* and *Recoverable Coal Reserves* are collectively called *Coal Reserves*.

26. *Coal Reserves* can only be derived from *Indicated* and/or *Measured Resources* contained within a mine plan. They represent the tonnages of coal at a specified moisture, expected to be mined and presented as run of mine (ROM) coal. *Indicated Coal Resources* are suitable to estimate *Probable Coal Reserves*. Only *Measured Coal Resources* are suitable for detailed mine planning and the estimation of *Proved Coal Reserves*.

27. In estimating *Coal Reserves*, mining recovery and mining dilution must be applied to the *Coal Resources*. Adjustments for changes in moisture, though not mandated by the JORC Code, are strongly recommended. Mining recovery and dilution depend on the proposed mining method and may be expressed in terms of specific coal losses and/or dilution for each seam or, alternatively, as a percentage mining recovery. Unless a specific factor has been determined from conceptual studies, the historically proven mining recovery for the proposed mining method in the particular area should be used. If such information is not available, or if the mining recovery is uncertain due to the complexity of geology, recovery factors of 50% and 90% may be applied to underground and surface *Coal Resources* respectively. The estimator should report what recovery factors have been used.

28. *Coal Reserves* may be limited by technical (eg. stability, maximum and minimum mining section, seam separation, depth), geological (eg. structure, stress, gas, groundwater), coal quality (eg. ash content, volatile matter, coking properties, yield), or economic factors (eg. strip ratio). *Coal Reserves* must be estimated separately for those parts of deposits mineable by surface and underground methods.

29. *Marketable Coal Reserves* are estimated by applying the predicted yield and product moisture factors to the *Coal Reserves*.

30. Estimates of *Coal Reserves* *must clearly state* all factors used in the estimation, including: the underlying *Coal Resources*, proposed mining methods, physical, quality or economic criteria limiting mining or the mining method(s); allowances for loss and dilution relevant to the proposed mining methods; moisture adjustment factors (if applied); and for *Marketable Coal Reserves*, if reported, the predicted yield and basis for predicting yield. Tonnage estimates of *Coal Reserves* should be rounded commensurate with the accuracy of estimation. The estimation procedure should be transparent and repeatable.

31. Notwithstanding all of the above, it is the responsibility of the *Estimator* to determine the appropriate *Coal Reserve* category for any given deposit. The *Estimator* should prepare a technical document that fully describes the estimation process and assumptions used; and contains relevant plans at appropriate scales. As a guide only, the document should include:-

·   Maps for each seam, showing the location and areal extent of reserves and the underlying resource categories
·   The resource category(s) on which the reserve estimate is based;
·   Seams to be mined;
·   The proposed mining methods;
·   Criteria used to limit the reserves;
·   Mining recovery and dilution factors and their derivation;
·   The moisture basis of the estimate(s) and the moisture adjustment factors (if applied);
·   The basis for predicting preparation plant yield(s) (if *Marketable Coal Reserves* are reported);
·   The quality specification(s) of the product coal(s);
·   A clear indication whether the *Coal Resources* are inclusive of, or additional to the *Coal Reserves;* and
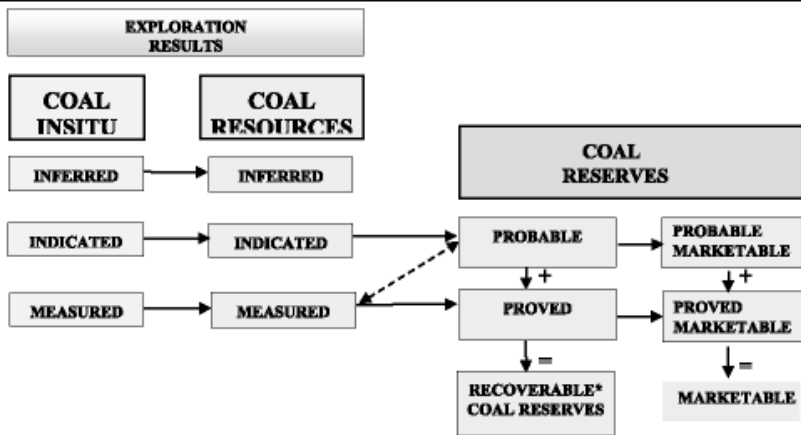·   A declaration as to whether or not the report is JORC compliant.

REVIEWS

32. These guidelines will be reviewed by December 2001 and subsequently in conjunction with reviews of the JORC Code, by a committee of industry and government representatives authorised by the Coalfield Geology Council of NSW and the Queensland Mining Council. The aim of subsequent revisions will be to provide any clarification considered appropriate and to extend the level of commentary within the Guidelines. Submissions in writing should be directed to the Secretary of the Coalfield Geology Council of NSW, c/o DMR Box 536, St Leonards, NSW, 2065; or Director of Operations, Queensland Mining Council, 60 Edward Street, Brisbane, Qld, 4000.

RELATIONSHIP BETWEEN COAL CATEGORIES OF INSITU, RESOURCES AND RESERVES

Diagram 1

INCREASING LEVEL OF CONFIDENCE

EXPLORATION RESULTS

COAL INSITU

COAL RESOURCES

COAL RESERVES

INFERRED	INFERRED
INDICATED	INDICATED
MEASURED	MEASURED

PROBABLE → PROBABLE MARKETABLE

PROVED → PROVED MARKETABLE

RECOVERABLE* COAL RESERVES

MARKETABLE

*For Public Reporting In Accordance With the JORC Code.

Consideration of Economic, Mining, Beneficiation, Marketing, Environmental, Social and Governmental factors