AUSTRALIAN GUIDELINES FOR

Estimating and Reporting of

Inventory Coal, Coal
Resources and Coal
Reserves

2003 EDITION

PREPARED BY THE COALFIELDS GEOLOGY COUNCIL OF NEW SOUTH WALES AND THE
QUEENSLAND MINING COUNCIL

Contents

AUSTRALIAN GUIDELINES FOR THE ESTIMATING AND REPORTING OF INVENTORY COAL, COAL RESOURCES AND COAL RESERVES

(Issued March 2003)

Preface 1

1.1 Prior to September 1999 the estimating and reporting of **Coal Resources** and **Coal 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, herein referred to as "the Code", provides minimum standards for public reporting to the investment community.

1.2 The Code is currently being reviewed. The new version of the Code is expected to be ratified and issued in 2003. The "Australian Guidelines for the Estimating and Reporting of Inventory Coal, Coal Resources and Coal Reserves", herein referred to as "the Guidelines", will be referred to in the new Code, and will be reviewed and re-issued when the new Code is released, to ensure consistency between the two documents.

1.3 Adherence to the processes and procedures outlined in the Guidelines is not considered compulsory, but is strongly recommended. Some of the wording in the Guidelines has been copied from the Code and the reader should note that requirements of the Code are mandatory if an estimate is to be compliant with the Code.

Scope 2

The Guidelines are broad in nature to accommodate the wide variation of Australian coal deposits, in terms of rank, quality and geological environment.

The scope of this document is to: -

■ Outline the methodology, reflecting best industry practice, that should be followed when estimating the quantity and quality of **Inventory Coal**, **Coal Resources** and **Coal Reserves**

■ Provide guidelines for reporting to government and other non-public organisations; and

■ Provide guidelines for preparing supporting technical documents.

Italicised explanatory notes are provided in the Guidelines to provide a clearer understanding of their intent. Where these notes occur they are indented and written in a slightly smaller italicised font, as illustrated in this example.

Definitions 3

3.1 An **Estimator** is a person responsible for the estimation of **Inventory Coal**, **Coal Resources** and/or **Coal Reserves**. The **Estimator** should have tertiary qualifications in geology or mining engineering and must have a minimum of five years experience in the relevant coal industry activity. If the **Estimator** is estimating or supervising the estimation of **Inventory Coal** and/or **Coal Resources**, the relevant experience must be in the estimation, assessment and evaluation of **Inventory Coal** and/or **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 comply with any special conditions or requirements of relevant State Government.

To sign off on Public Reports in accordance with the Code (i.e. reports prepared for the purpose of informing investors or potential investors and their advisers), an Estimator must qualify as a 'Competent Person' under the Code and ensure that all requirements of the Code are satisfied.

3.2 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 quantity estimation may not necessarily be used for coal quality evaluation. A **Point of Observation** for coal quality evaluation is normally obtained by testing samples obtained from surface or underground exposures, or from bore core samples having an acceptable level of recovery (normally >95 per cent linear recovery).

3.3 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 be used to estimate coal quantity or quality. A company, when reporting Interpretive Data, shall state the technical basis of the interpretation. **Interpretive Data** may be used in conjunction with **Points of Observation** to improve confidence levels.

3.4 Exploration Results are reports of coal occurrences that, due to insufficient information, cannot be assigned specific tonnages or quality.

3.5 Inventory Coal is any occurrence of coal in the ground that can be estimated and reported without necessarily being constrained by economic potential, geological or other modifying factors. By definition, it includes all **Coal Resources**. The location, quantity, quality, geological characteristics and continuity of **Inventory Coal** are known, estimated or interpreted from specific geological evidence and knowledge.

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Inventory Coal is sub-divided in order of increasing geological confidence into Inferred, Indicated and Measured categories.

Inventory Coal is a new term that enables a more complete estimate of coal 'in ground' to be reported for Government or internal company purposes. **Inventory Coal** is a category of coal not recognised by the Code.

Inventory Coal falls outside the ambit of the Code as it is not constrained by the phrase "…reasonable prospects for eventual economic extraction." used in the Code to define the term **Coal Resource**. *The category of* **Inventory Coal** *enables the quantification and reporting of coal which, in the opinion of the* **Estimator** *(at the time the estimate was made), has potential significance, but may not have potential for economic development in the foreseeable future.*

The category also serves another important function by enabling the reporting of coal tonnage and grade estimates in 'non-public' reports to government departments and other statutory authorities where the primary focus of the estimation and reporting is not only for statutory compliance purposes but also to provide the basis for establishing an inventory that may be used for land use or strategic planning purposes.

While the **Estimator** *has ultimate discretion regarding the coal included in this category, minor coal occurrences should be excluded. Examples of Inventory Coal estimates may include coal: that is not accessible for mining because of land access restrictions (e.g. proposed or gazetted national parks); that is alienated because of infrastructure or urbanisation; that is compromised because of technical feasibility issues (e.g. too deep, too steeply dipping, too thin etc.); or perhaps that is in an extremely remote area devoid of any infrastructure and where potential development in a reasonable timeframe may be difficult to justify.*

3.6 A **Coal Resource** is that portion of a deposit in such form and quantity that there are reasonable prospects for eventual economic extraction. The location, quantity, quality, geological characteristics and continuity of a **Coal Resource** are known, estimated or interpreted from specific geological evidence and knowledge. **Coal Resources** are subdivided, in order of increasing geological confidence, into **Inferred**, **Indicated** and **Measured** categories.

3.7 A **Coal Reserve** is the economically mineable part of a **Measured** or **Indicated Coal Resource**. **Coal Reserve** estimates include diluting materials and are adjusted for losses that may occur when the coal is mined. Appropriate assessments, which may include feasibility studies, have been carried out. These assessments should include proper consideration of all relevant 'modifying factors' such as: mining methods, beneficiation, and economic; marketing, legal, environmental, social and governmental factors. These assessments should demonstrate that at the time of reporting, economic extraction could reasonably be justified. **Coal Reserves** are subdivided in order of increasing confidence into **Probable Coal Reserves** and **Proved Coal Reserves**.

3.8 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**. If the coal is to be marketed without any beneficiation, **Marketable Coal Reserves** may be the same as the **Coal Reserves**. The basis of the predicted yield to achieve **Marketable Coal Reserves** should be stated, particularly whether the yields and ash values are from laboratory float/sink results, or if they are practical results that take the planned beneficiation process into consideration, or if they are reconciled historical data from an operating mine. **Marketable Coal Reserves** should be reported in terms of **Probable Marketable Coal Reserves** or **Proved Marketable Coal Reserves**.

3.9 Confidence Categories for Inventory Coal and Coal Resources

3.9.1 **Inferred Inventory Coal** or an **Inferred Coal Resource** is that part of the total **Inventory Coal** or **Coal Resource** 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**. Estimates for this confidence category are likely to change significantly with further exploration.

3.9.2 Indicated Inventory Coal or an **Indicated Coal Resource** is that part of the total **Inventory Coal** or **Coal Resource** 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 sufficient for continuity to be assumed; but are too widely or inappropriately spaced to confirm geological and/or quality continuity.

3.9.3 **Measured Inventory Coal** or a **Measured Coal Resource** is that part of the total **Inventory Coal** or **Coal Resource** 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.

3.10 **Confidence Categories for Coal Reserves**

3.10.1 A **Probable Coal Reserve** is the economically mineable part of an **Indicated Coal Resource**. It can also be the economically mineable part of a **Measured Coal Resource** if the modifying factors (referred to in

Section 3.7) need to be further resolved before the Estimator can confidently place the **Coal Reserve** in the **Proved category**.

3.10.2 A **Proved Coal Reserve** is the economically mineable part of a **Measured Coal Resource** for which the modifying factors (referred to in Section 3.7) have been satisfied.

3.11 Diagram 1 sets out the framework for classifying quality and quantity estimates to reflect different levels of confidence in the geology and the modifying factors. Reports of **Inventory Coal**, **Coal Resources** and **Coal Reserves** should only use the terms set out in **Diagram 1**.

4 Estimation and Documentation of Inventory Coal and Coal Resources

4.1 Inventory Coal and **Coal Resources** can only be estimated from data obtained from **Points of Observation**. **Interpretive Data** are not **Points of Observation** but may increase confidence in the continuity of seams between **Points of Observation**.

4.2 Inventory Coal and **Coal Resource** tonnage estimates are prepared using the area, thickness and in situ density determined by the **Estimator**. The **Estimator** should ensure that the in situ density applied is clearly stated and can be justified on technical grounds.

4.3 Inventory Coal and **Coal Resources** should be estimated and reported for individual seams or seam groupings within a deposit. They should also be subdivided and reported on the basis of 'key variables'; such as thickness, depth range, strip ratio, coal quality parameters, geographic constraints and geological or technical considerations. The key variables and assumptions for each deposit should be clearly stated in order to ensure clarity and transparency of the report.

Seam groupings comprise seams located in stratigraphic proximity that may be considered a single entity for the purposes of estimation.

4.4 If any key variable or combination of variables 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 reported for the seam in that area. If there are compelling reasons to report resources in these areas (e.g. the area has to be mined through to access a more prospective seam or higher quality resources), the **Estimator** should provide the necessary explanation.

4.5 The following are broad guidelines to assist the **Estimator** when determining the relevant confidence categories for estimates of **Inventory Coal** and **Coal Resources**. In areas where seams are faulted, intruded, split, lenticular, or subject to significant variations in thickness or quality, more closely spaced **Points of Observation**, which may be supported by **Interpretive Data,** will be required.

4.5.1 For an **Inferred** confidence level, the number 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 Inventory Coal** and **Inferred Coal Resources** may be estimated using data obtained from **Points of Observation** up to 4 kilometres apart. Trends in coal thickness and quality should not be unreasonably extrapolated beyond the last line of **Points of Observation**.

*'Extrapolated' refers to the distance the estimate is extended past the last line of **Points of Observation** into areas for which no data are available.*

4.5.2 For an **Indicated** confidence level, the number, 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 washplant yield and quality of product coal. **Indicated Inventory Coal** and **Indicated Coal Resources** may be estimated using data obtained from **Points of Observation** normally less than 1 kilometre apart, but the distance may be extended if there is sufficient technical justification to do so; for example, if supported by geostatistical analysis. Trends in coal thickness and quality should not be extrapolated more than half the distance between **Points of Observation**.

4.5.3 For a **Measured** confidence level, the number, 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 and beneficiation costs, washplant yield estimates and specifications for a marketable product. **Measured Inventory Coal** and **Measured Coal Resources** may be estimated using data obtained from **Points of Observation** normally less than 500 metres apart, but the distance may be extended if there is sufficient technical justification to do so; for example, if supported by geostatistical analysis. Trends in coal thickness and quality should not be extrapolated more than half the distance between **Points of Observation**.

4.6 Estimates of **Inventory Coal** and **Coal Resources** should reflect the order of accuracy of the estimate as set out in Clause 25 of the Code.

Tabulations of estimates should normally be rounded to two significant figures (N.B. not decimal places).

4.7 Where estimates of **Inventory Coal** and **Coal Resources** are presented together, a clarifying statement must be included in the report which clearly

indicates whether the **Inventory Coal**, as reported, is inclusive of, or additional to the **Coal Resources**. A resource report including **Inventory Coal** would not be JORC compliant for public reporting.

4.8 Notwithstanding all of the above, it is the responsibility of the **Estimator** to determine and justify the **Inventory Coal** and/or **Coal Resource** categories for any given deposit. The **Estimator** should prepare a technical document that fully describes the estimation process and assumptions used. The document should include:

- Project/deposit name

- Status of tenure over the **Inventory Coal** or **Coal Resources** being reported

- Tenure holder(s) and/or operators

- Outline of the geology of the area

- Summary of the status of the database and the geological model used and the steps taken by the **Estimator** to validate them

- Outline of the estimation methodology including the criteria used to differentiate between **Inventory Coal** and **Coal Resources**

- An explanation of how the confidence categories were defined

- Plans and cross-sections for each seam or seam grouping at appropriate scales, showing:

  tenures, the location and areal extent of each confidence category, including the boundary between open cut and underground (if applicable), the factors used to limit the estimates, the **Points of Observation** (with thecoal quality holes for that seam clearly differentiated) and any **Interpretive Data** on which the resource estimates for that seam were based.

- Tables of the estimates displaying: tenures, confidence categories, areas used in the estimates, seam thickness ranges, in situ densities, depth ranges and coal quality ranges relevant to the estimate for each seam or seam grouping. Reference should also be made to the probable mining method.

- The moisture basis of the estimate(s) and the moisture adjustment factor (if applied)

- A description of all factors used to limit the estimate(s)

- A comparison of the estimate(s) with previous estimates prepared for the deposit

- A comparison of the estimate(s) with current estimates prepared by alternative methods or during the process of peer review

- A declaration as to whether or not the resource report is JORC compliant

- The name, qualifications and experience of the **Estimator** and the relationship of the **Estimator** with the tenure holder(s) and/or operators

- The date of the estimate.

Estimation and Documentation of Coal Reserves   **5**

5.1 Coal Reserves can only be derived from **Indicated** and/or **Measured Resources** contained within a mine plan. They represent the tonnages of coal, at specified moisture, expected to be mined and delivered as run of mine (ROM) coal.

5.2 In estimating **Coal Reserves**, mining recovery and mining dilution must be applied to the **Coal Resources**. Adjustments for changes in moisture are also strongly recommended. Mining recovery and dilution 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 and dilution for the proposed mining method in the particular area should be used. The **Estimator** should report and justify the mining recovery and dilution factors used.

5.3 Coal Reserves must be reported separately for those parts of deposits mineable by surface and underground methods.

5.4 Marketable Coal Reserves are estimated by applying the predicted yield and product moisture factors to the **Coal Reserves**. They should be reported by broad product type; for example, coking, PCI or thermal.

5.5 Estimates of **Coal Reserves** must clearly state all factors used in the estimation, including: the **Coal Resource** estimates, proposed mining methods, the modifying factors limiting mining, allowances for mining loss and dilution, and moisture adjustment factors (if applied). For **Marketable Coal Reserves**, if reported, the predicted quality, yield and basis for predicting the yield should be stated. Tonnage estimates of **Coal Reserves** should be rounded, commensurate with the precision of the estimate.

5.6 Where estimates of **Coal Resources** and **Coal Reserves** are presented together, a clarifying statement must be included in the report that clearly states whether the **Coal Resources** are inclusive of, or additional to, the **Coal Reserves**.

5.7 The choice of the appropriate category of **Coal Reserve** is determined primarily by the confidence level of the corresponding **Coal Resource** and must be made by the **Estimator**. In the case of a **Measured Resource** the uncertainties in any modifying factor(s) may result in a **Probable** confidence level being applied to the **Coal Reserve**. The **Estimator** should

prepare a technical document that fully describes the estimation process and assumptions used. As a guide only, the document should include:

- Project/deposit name

- Status of tenure over the reserves being reported

- Tenure holder(s) and/or operators

- The resource category(ies) on which the reserve estimate is based

- Plans and cross-sections for each seam or seam grouping, at appropriate scales, showing:
  tenure boundaries, mine plan, reserve blocks, working sections and the resource categories

- Seams to be mined

- The proposed mining method(s)

- Criteria used to limit the reserves such as strip ratio or economic cut-offs

- 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)

- The quality specification(s) of the product coal(s)

- The basis for categorising product types

- Tabulation of reserves itemised on a pit/panel/ strip/block/seam basis, showing total **Coal**

Reserves and, if reported, **Marketable Coal Reserves**, waste volumes, preparation plant yields and product qualities

- A comparison with previous **Coal Reserve** estimates for the deposit

- A comparison with peer reviews of the current estimate

- The status and/or impact of the modifying factors on the **Coal Reserves**

- A declaration as to whether or not the Coal Reserve estimate is JORC compliant

- The name, qualifications and experience of the **Estimator** and the relationship of the **Estimator** to the owner/operator of the project/ mine

- The date of the estimate.

Future Reviews 6

These Guidelines will be reviewed, in conjunction with future reviews of the Code, by a committee of industry and government representatives authorised by the Coalfield Geology Council of NSW, the Queensland Mining Council and representatives from other coal producing states. 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 New South Wales Department of Mineral Resources, P.O. Box 536, St Leonards, NSW, 1590; or the Director of Operations, Queensland Mining Council, 133 Mary Street, Brisbane, Qld, 4000.

RELATIONSHIP BETWEEN INVENTORY COAL, COAL RESOURCES AND COAL RESERVES

Increasing level of geological knowledge and confidence →

INVENTORY COAL	COAL RESOURCES	COAL RESERVES
	EXPLORATION RESULTS (not quantified)	
INFERRED	INFERRED	
INDICATED	INDICATED	PROBABLE → PROBABLE MARKETABLE
MEASURED	MEASURED	PROVED → PROVED MARKETABLE

NON JORC CATEGORY   *JORC CATEGORY*

No "modifying factors"	Increasing need to consider mining, metallurgical, economic, marketing, legal, environmental, social and governmental factors (the "modifying factors") →