LG/11/13

11th Meeting of the London Group on Environmental Accounting
Johannesburg, 26-30 March 2007

Depletion in the SEEA - Narrowing down the options

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ISSUES PAPER: DEPLETION IN THE SEEA—NARROWING DOWN THE OPTIONS

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Paper prepared for the London Group meeting. Pretoria, 26-30 March 2007.

Executive summary

1. A characteristic of SEEA-2003 is the provision of multiple solutions to various environmental accounting issues, including for a number of aspects of natural resource depletion. The proposed elevation of SEEA-2003 to an international statistical standard requires that these options be replaced with unambiguous accounting recommendations.

2. Chapter 10 of SEEA-2003: "Making environmental adjustments to the flow accounts" is comprised of three sections—depletion, defensive expenditure and degradation. The five sets of treatment options in the depletion section relate to the topics listed below.

i. Identifying the income element of resource rent.

ii. Recording mineral exploration and mineral deposits.

iii. Recording the additions to and subtractions from the stock of environmental assets.

iv. Recording ownership of mineral-related assets.

v. Recording depletion -- asset recorded in the legal owner's balance sheet.

3. This paper examines the first two of these sets of depletion-related options. The aim is to promote broad agreement at the March 2007 meeting of the London Group on the preferred options for these two fundamental issues. Subsequent London Group meetings could then move toward an agreed resolution on the remaining depletion-related issues in SEEA-2003 chapter 10.

4. Previous meetings of the London Group, and decisions taken during the System of National Accounts (SNA) update process should help guide our decisions. That is, on the first issue 'identifying the income element of resource rent', it is suggested that part of the resource rent be considered as income and the remainder represents depletion. And for the second issue, 'recording mineral exploration and mineral deposits', knowledge arising from mineral exploration and 'new discoveries' of mineral deposits should be seen as separate assets—the latter generally being valued according to the net present value of the resource rent.

Overview of depletion-related issues to be resolved for the SEEA update

5. Depletion has been discussed within international fora for some time now and the essential natures of the issues are well documented. In addition to the London Group, the System of National Accounts (SNA) update process has dealt with issues impacting on the measurement of depletion. Draft chapters of the updated standard (1993 SNA Rev.1) are now available and to the extent possible, the impact of the 1993 SNA Rev.1 on issues related to depletion is described. The important SNA area of leases and licenses affecting attribution of ownership of an asset where the

user is not the legal owner and the nature of restrictive government permits, is yet to be finalised. London Group needs to monitor these developments.

6. The following two paragraphs provide a brief description of the depletion-related issues targeted for broad agreement at the March 2007 meeting of the London Group[1]. These two issues are pivotal because the choices made will substantially determine the nature and content of depletion-adjusted accounts. They have a consequential impact on the remaining sets of depletion-related options in chapter 10 of SEEA-2003 and decisions taken need to support a consistent and coherent system of environmental and economic accounting.

7. Agreement is needed regarding the essential nature of natural resources. Does the resource rent associated with the extraction of natural resources represent income, or is it all a decline in the value of the resource? Or should the resource rent be partitioned between income and depletion? (SEEA-2003, Box 10.1) All subsequent discussion of depletion and associated accounting options flow from this view of natural resources. This issue is considered in some detail further below.

8. Another fundamental question relates to the optimal way of viewing the discovery (and subsequent revisions) of mineral and energy resources[2] (SEEA-2003, Box 10.3). Do mineral and energy resources enter the balance sheet after being 'produced' by a process of mineral exploration? Or are mineral exploration assets and mineral and energy resources two completely separate assets? Should mineral exploration assets and mineral and energy resources be valued according to their market value? Or is it more realistic to value mineral and energy resources according to the net present value of the resource rent? (Though the two approaches are conceptually consistent and should produce identical results.) Again, the issue is considered in further detail below.

[1] There are many contentious issues related to natural resource depletion. For example, choice of discount rate, future prices for measuring resource rent and assumed extraction profile are all important matters that could benefit from further discussion. However, these issues mostly relate to techniques of measuring depletion rather than reflecting an underlying view of its nature. The scope of this paper is confined to those specific issues in SEEA-2003 chapter 10 where alternative treatment options are identified.

[2] The SEEA term 'mineral and energy resources' is equivalent to SNA's 'subsoil assets'. This paper generally uses the former description, though where discussion is focussed on the SNA the latter term is used. The terms are interchangeable.

9. The three remaining sets of depletion-related options in chapter 10 of SEEA-2003 are listed below but not discussed in this paper.

i. *Recording the additions to and subtractions from the stock of environmental assets.* (Box 10.4, SEEA-2003)

ii. *Recording ownership of mineral-related assets.* (Box 10.7, SEEA-2003)

iii. *Recording depletion -- asset recorded in the legal owner's balance sheet.* (Box 10.8, SEEA-2003)

Depletion and resource rent

10. Before discussing how best to view the income element of the resource rent, it is worth briefly defining key terms and describing the relationship between operating surplus arising from production and the associated elements of resource rent and depletion.

11. The unit price of a non-renewable natural resource contains a resource rent reflecting the value of a marginal resource unit with respect to its future extraction (Hotelling, 1931). However, resource rents are not directly observable but instead are typically derived as the difference between total revenue generated from the extraction of natural resources less costs incurred during the extraction process including the cost of produced capital (which itself includes a return to produced capital).

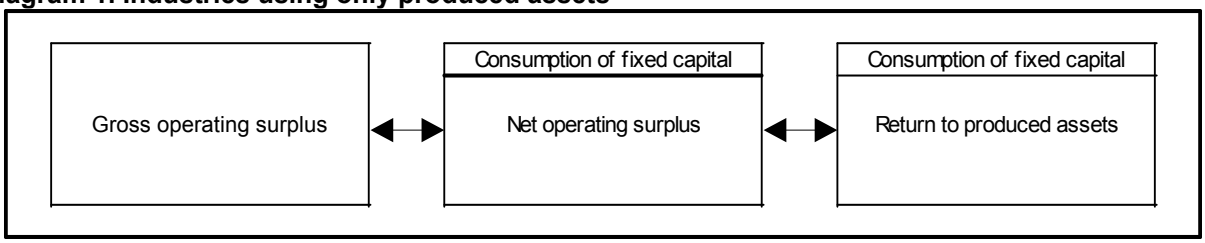
12. Or, as stated more simply in SEEA-2003:

> "the value of capital service flows rendered by the natural resources, or their share in gross operating surplus, is the...resource rent" (para 7.167)

13. Depletion is then derived as resource rent minus the opportunity costs of capital invested in the natural resource (SEEA-2003, para 10.30). Depletion represents the change in value of the natural resource and includes changes to the price and/or quantity of the natural resource. Depletion applies to 'normal' or expected rates of change and would not apply to, for example, the change in value caused by unforseen obsolescence of a particular mineral and energy resource.

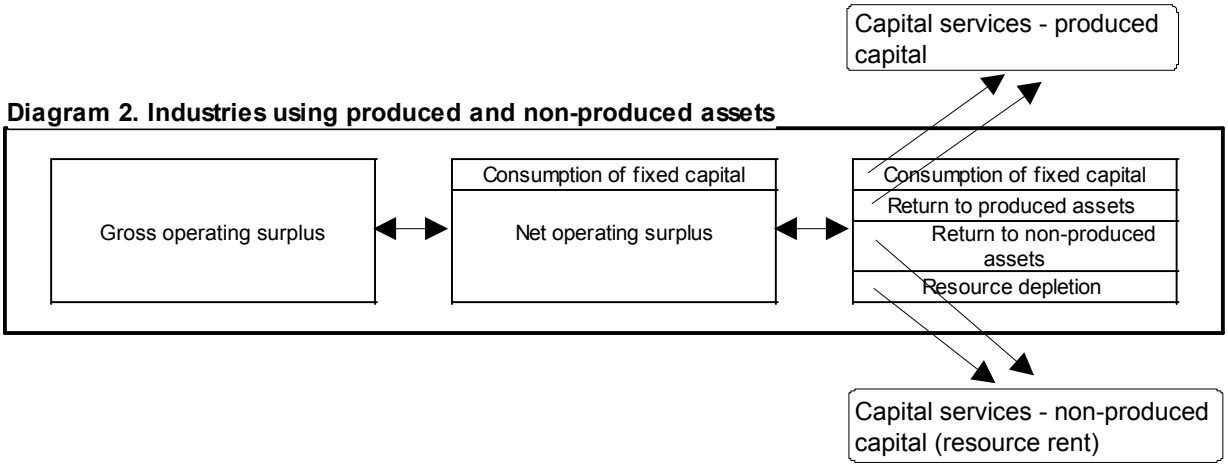
14. Enterprises may use either produced capital assets or a mixture of produced and non-produced capital assets as factors in the production process. For any enterprise or industry, its gross operating surplus can be decomposed into consumption of fixed capital and net operating surplus. For enterprises or industries using only inputs of produced assets the whole of its net operating surplus is a return to the produced assets employed. This relationship is described in diagram 1.

Diagram 1. Industries using only produced assets



15. For enterprises or industries using a mixture of produced and non-produced assets as capital inputs to the production process, the net operating surplus can be further decomposed into a return to produced assets, a return to non-produced assets and a measure of depletion (the latter two when added together are termed *resource rent*). This decomposition of net operating surplus is typical of a mining enterprise extracting subsoil assets, or a forestry enterprise harvesting natural forest. The relationship is depicted in diagram 2.

Diagram 2. Industries using produced and non-produced assets



How should the income element of resource rent be viewed?

Option A1: All resource rent represents income.

16. The first option outlined in SEEA-2003 (Box 10.1), i.e. that the entire resource rent represents income, is the implied position taken by the SNA68. The 1993 SNA takes a similar stance within its production account, where derived value added by definition includes depletion of natural resources. As SEEA-2003 (para 10.27) states it implies that natural resources are infinitely abundant, a view which is evidently not true for a great number of natural resources. This position is difficult to support, because if extraction of a natural asset reduces potential production in the future then an economic cost has occurred. The cost of using this asset should be reflected in the accounts of the nation.

Option A2: No resource rent represents income; it is all a decline in the value of the resource.

17. The second option, described in SEEA-2003 (Box 10.1) is that none of the revenue from selling natural assets is income from production and therefore all such revenue should be excluded from Net Domestic Product (NDP) and from the output and value added of the extractive industries.

The whole of the resource rent is to be treated as the decline in value of the stock of the natural asset i.e. the resource rent is equivalent to the depletion of the natural asset.

18. Vanoli (1995, pp128-129) supports this position and states that income from mining activities is akin to financing consumption expenditure out of a reduction in net worth from asset sales. That is, 'income' from extractive activity is not income at all but simply the sale of a non-produced asset. The sale of an asset does not constitute economic production. Vanoli reasons that extractive activity does not physically transform the natural resource, rather that this activity has more in common with transport or retail and wholesale activities. Therefore he deems it appropriate to exclude the value of natural resources sold by the extracting industries from the output of such industries thus reducing by this amount the value of output as currently measured in the national accounts. Alternatively, he suggests that the resource rent could be recorded as withdrawn from inventories. This position (option 2) is taken not only in respect of subsoil assets, but also for revenue arising from the sustainable use of a renewable asset (attributed to Vanoli in SEEA-2003, para 10.28).

19. One of the implications of this approach, i.e. reducing the value of output by the value of the natural resource sold, is that the price received by the extractor for the product they produce is no longer equivalent to the price paid by the purchaser. This 'price wedge' introduces a further level of complexity into the process of balancing the supply and use of products in the national accounts. In order to maintain a balanced system, adjustments would need to be made to the expenditure side of the national accounts, for example, to exports which would result in a different balance of trade. Although it is possible to compile balanced estimates on the basis of this option, the impact on a number of balances within the system as well as the impact on the detailed balance of products needs to be considered carefully.

20. One way option 2 can be made to 'work' in an accounting sense is by treating resource rent as a withdrawal from inventories, thereby removing the value of resource rent from measured output. Peter Hill, however, in a note written while working at the ABS (2000) emphasises that stocks of natural assets must be clearly distinguished from inventories. All goods held as inventories can be immediately withdrawn and sold on the market, if desired. On the other hand, quantities of a natural asset cannot all be immediately extracted and sold on the market but are instead delivered through a costly and time consuming process of production. This is a crucial economic difference between stocks of natural assets and inventories. The cost to the owner of the natural assets of extracting *some* quantities now (i.e. depletion) is less than the current market value of the quantities extracted. This is the basis of the owner's operating surplus. Quantities extracted from stocks of natural assets should not be treated in the accounts in the same way as withdrawals from inventories.

21. The complete removal of resource rent from measures of income may give rise to problems in the national accounts. If resource rent is not considered income then logically certain flows associated with the resource rent should be removed from the current accounts and somehow accounted for in the capital accounts. A failure to do so will lead to serious distortion of net saving recorded for the extractive industries. For example, income tax paid by a mining company would need to be partitioned into that which is attributable to depletion-related activity and that which is attributable to other activity (e.g. mineral exploration). The range of adjustments required come with a number of serious practical difficulties making them problematic to implement. They would reduce the utility of the national accounts because they are so far removed from generally accepted business and government accounting principles.

22. Because this option removes the entire resource rent from the output and value added of (particularly) the extractive industries, it does not recognise the often substantial incomes that resource-rich countries generate from extractive activities. As stated, it therefore widens the gap between income measures in business reporting and in the national accounts and distorts the financial reality of extractive industries as an often significant base for government revenue, among other

things. Both of these factors suggest that option 2 would undermine the practical value and relevance of the national accounts.

Option A3: Part of the resource rent represents a decline on the value of the asset and part is income.

23. The third option presented in SEEA-2003 (Box 10.1) views part of the resource rent as representing income and the remainder representing the using up of the natural resource (i.e. depletion). Essentially, it is a position coming in between options A1 and A2. Under this option revenue produced from the use of a natural asset in an accounting period is split into two elements: a return to the owner of the natural resource; and an element representing the value of the natural resource. As a resource becomes scarcer, the share of income diminishes and the value of the natural resource withdrawn increases until, in the limiting time period when the natural resource is finally exhausted, all the revenue represents the value of withdrawal of natural capital (Harrison, 1999).

24. The values of stocks of both fixed and natural assets depend upon their contribution to production and these values are realised only if their owners use them in a process of production. The relevant economic characteristic of both fixed and natural assets is that they are typically not used up in a single year but instead deliver services to their owners over a long period of time. This suggests that while natural assets are neither fixed assets nor inventories, they have more in common with the former and their treatment should follow that of fixed assets rather than inventories.

25. The value of a fixed asset can be understood as the net present value of the expected stream of benefits flowing from its future use. The entire stock of a natural asset cannot be extracted within a short period of time, regardless of the asking price. Therefore the value of the stock to its owner is *not* equal to the physical quantity of the stock multiplied by the current price of a unit extracted. It is valued in the same way as the aforementioned fixed asset, i.e. quantities scheduled to be withdrawn in the future must be valued at their present value so that the average price for all the quantities making up the stock will be lower than the current market price (Hill, 1998 p3). In fact, within the current period, the current value of the quantities extracted minus the decline in the present value of the total stock, constitutes the income receivable by the owner of the stock.

26. Using extractive industries as an example, if mineral extraction is a process of economic production, what then is the income generated from this process? Option 2 states that no income is earned and the entire resource rent constitutes depletion, in which case the payment of a royalty looks like an asset sale. The presence of income is a means of distinguishing production from, for example, an asset sale. The conventional viewpoint is that mineral extraction constitutes a process of economic production, albeit with a significant element of its operating surplus arising from the using-up of natural resources.

27. If SEEA-2003 serves the role of an analytical framework supporting a sustainable development information system (Smith, 2005 p12) then Option A3 displays a strongly intuitive sequence of adjustments within such a framework. It appears to send the appropriate message to policymakers, that is, the depletion of a non-renewable resource over time will have an increasing negative impact on NDP. The impact becomes more marked as complete exhaustion of the natural resource is approached. As a signal to alert policymakers to an emerging impact on production and income, this appears to be a wholly appropriate accounting sequence.

Question: *Which option best describes the income element of the resource rent:*

- *All of resource rent represents income (Option A1);*
- *None of the resource rent represents income (Option A2); or*

- *Part of the resource rent represents income and the remainder represents the using up of the natural resource (Option A3)?*

Mineral exploration and mineral and energy resources

28. SEEA-2003 (Box 10.3) sets out three options for the recording of mineral exploration and mineral and energy resources. The central question is whether mineral and energy resources are the result of some type of productive activity as defined in the 1993 SNA or whether they constitute non-produced assets. If the former, it is necessary to both identify the productive activity giving rise to the mineral and energy resource as well as ascertain that discoveries are in fact the output of that activity.

29. The 1993 SNA records new discoveries under 'other volume changes' which implies that they are not the result of transactions attributable to economic activities such as production and capital formation. This is not a perfect solution for a number of reasons. Firstly, the new discoveries arise from dedicated action by the units involved, that is, they are not accidental. In particular, discoveries are dependent on mineral exploration which is clearly a productive activity, and they are not totally unexpected. On the contrary, discoveries may be fairly predictable.

30. However, the alternative looks even less satisfactory. That is, if new discoveries are outputs, it is necessary to identify the productive process giving rise to the entry of this natural asset into the balance sheet. It has been argued that the activity of mineral exploration gives rise to the output of mineral and energy resources. But if mineral exploration 'creates' the appearance of the mineral and energy resource, then the value of the mineral and energy resource should equate to the price charged by the exploration enterprise to undertake the exploration. That this is clearly not the case (in the great majority of cases) should raise suspicions regarding this treatment.

31. A more compelling argument is that information obtained about mineral and energy resources is the output of mineral exploration activity. The activity of mineral exploration can thus be seen as distinct from other activities of the extractor. The exploration activity may be undertaken by a specialist mineral exploration enterprise which is completely separate from the mining company. The output of the exploration enterprise is the information provided about the existence (or otherwise) and characteristics of the deposit. The valuation of this output is equal to the fee charged by the exploration enterprise. The specialist exploration company has no claim over any discovered mineral and energy resources, and therefore cannot be considered to have sold or somehow passed on the mineral and energy resource to the extracting enterprise purchasing the mineral exploration services.

32. Under the 1993 SNA, the fee charged by the exploration enterprise gives rise to a gross fixed capital formation asset in the books of the extractive enterprise purchasing the information asset. If the enterprise undertaking the mineral exploration and the mineral and energy extraction is the same unit then the activity is treated as both own account production and gross fixed capital formation. Even under an own account production scenario the activities of mineral exploration and mineral extraction are nevertheless completely separate.

33. Treating new mineral and energy discoveries as ‘produced’ by the activity of mineral exploration would raise a number of questions. How is the mineral exploration asset used, that is, what production process does this capital asset facilitate? Is the knowledge asset used to 'produce' new mineral and energy resources previously unknown? Or is it used in the subsequent process of extracting the discovered deposits?

34. It is difficult to conceive of how the mineral exploration asset 'produces' new mineral and energy resources. Production is typically thought of as a process of *transforming* inputs into outputs. Using a conventional economic accounting perspective, it is difficult to conceive of how newly

discovered mineral and energy resources have been produced at all, let alone by a process utilising knowledge assets. More conceivably, the mineral exploration asset is used as part of the subsequent process of extracting the discovered deposits. For example, knowledge of the characteristics of a mineral deposit (such as its magnitude, structure and composition) could clearly be useful in the mineral extraction process. It would be reasonable to associate the mineral exploration capital asset with the process of mineral extraction.

Distinction between assets relating to mineral exploration and mineral and energy resources?

35. According to the 1993 SNA (and draft chapters of the 1993 SNA Rev.1) new mineral and energy discoveries are not the output of mineral exploration activity but instead enter the system through the 'other changes in volume of assets account' as a tangible non-produced asset. Mineral exploration expenditure is viewed as a form of gross fixed capital formation expenditure giving rise to an intangible produced asset. This is probably the most realistic interpretation of the relationship between mineral exploration and mineral and energy resources. Options B1 and B2 (below) are consistent with this perspective.

Option B1: Is to record values for both the mineral exploration and the mineral deposit which come from independent sources, neither depending on a calculation of the resource rent of the deposit. There is no guarantee in this case that the sum of the assets will exactly match the net present value of the stream of resource rents: the total may be either greater or smaller than this depending on the assumption underlying the value of the deposit. (SEEA-2003, Box 10.3)

36. The general 1993 SNA basis for valuation of assets is observable market price. However, subsoil assets are typically not sold on the market and therefore market prices for these assets are generally not observable. This is particularly true in those countries where subsoil assets are owned by the government rather than by private enterprise. Where market prices are not observable, the net present value of future expected benefits can be used to represent the value of holding the asset. In practice, countries have expressed a clear preference for net present valuation of subsoil assets (Report of London Group 2004, p72) and the draft 1993 SNA Rev.1 'Balance Sheet' chapter recommends use of net present value for assets such as subsoil assets where returns are spread over a lengthy period. SEEA needs to recognise the paucity of directly observable market values for these types of assets. Option B1 suffers on this point.

37. As stated, valuation of assets should generally be equal to the future stream of capital services expected to flow from their use in production. Option B1 is not necessarily consistent with this principle. It involves recording values for both the mineral exploration and the mineral and energy resource using independent sources, with neither component being systematically linked to the derivation of the resource rent. SEEA-2003 (para 8.55) speculates that values derived from a market for discovered fields are likely to be higher than the net present value of the resource rent for the mineral and energy resource because they reflect the combined asset value of the mineral exploration and the mineral and energy resource. In other words, the recorded asset values will tend to double-count the value of the mineral exploration asset because mineral exploration is recorded as a stand-alone asset and also (most likely) as a component of the reported value of the subsoil asset. If so, the latter will not equal the expected future stream of benefits arising from its use; a clear inconsistency with SNA accounting principles.

Option B2: Is to record the value of mineral exploration based on either market prices or costs (depending on whether it is carried out by a contractor or on own account) and to base the value of the mineral deposit on the net present value of the resource rent calculated to exclude the value of mineral exploration. (SEEA-2003, Box 10.3)

38. The two previous paragraphs describe some advantages to using the net present value approach (option B2). A further advantage of this approach is its capacity to minimise the risk of double counting mineral exploration with the associated subsoil deposit. It achieves this by excluding the value of mineral exploration from the resource rent used in calculating the value of the deposit. That is, the calculation of resource rent relates to operating surplus after making a deduction for usage of the mineral exploration asset.

Option B3. Leads to identical values as option B2 but treats the sum of the two values as attributed to a "developed natural asset" which would be recorded as a tangible produced asset. By contrast, in the SNA mineral exploration is classified as an intangible produced asset and the mineral resource as a tangible non-produced asset. There is no impact on the asset account or on the balance sheet of this change (except for the headings used) but there are changes implied for the flow accounts…(SEEA-2003, Box 10.3)

39. This option combines the value of mineral exploration expenditure with the value of the associated new mineral and energy discoveries to form a 'developed natural asset' which is classified as a produced tangible asset. In effect it assumes that mineral exploration expenditure gives rise to (and forms part of the valuation of) the new mineral and energy discovery. As stated above it is difficult to conceive of how mineral and energy resources are the result of any economic production process.

40. The chief attraction of this option is that it provides a means of accounting for new discoveries of mineral and energy resources (as well as depletion) in the SNA capital and production accounts. If discoveries of mineral and energy resources were the 'output' of mineral exploration activity (as an acknowledged SNA production activity) then new discoveries of mineral and energy resources could readily be recorded as outputs in the production account and as gross fixed capital formation. There is strong intuitive appeal in achieving a symmetrical recording of both new discoveries and depletion of mineral and energy resources in the system.

41. Option B3 however is inconsistent with the 1993 SNA because it implies that discoveries of mineral and energy resources are an 'output' of mineral exploration activity. The 'Capital Account' chapter of the draft 1993 SNA Rev.1 is even clearer in explicitly stating that the value of the mineral exploration asset is *not* measured by the value of new deposits discovered. The 'developed natural asset' is clearly a combination of an SNA intangible produced asset (mineral exploration) and an SNA tangible non-produced asset (subsoil asset). The draft 1993 SNA Rev.1 reinforces the distinction between mineral exploration and evaluation as a produced asset and the subsoil asset as a non-produced asset.

42. The use of Option B3 requires an amortisation/depletion of the 'developed natural asset' which looks difficult to justify in concept and in practice even harder to measure. One component of the 'developed natural asset' value relates to knowledge about the deposit and the remainder to the value of the physical asset itself. However, knowledge assets do not suffer physical decline, the depreciation of these assets is entirely due to obsolescence of the knowledge. This is in contrast to mineral and energy resources which are characterised by a progressive physical reduction in the quantity of the mineral and energy resource available to extract. The value of these two assets will not always decline at the same rate. It would seem a very difficult task to depreciate the 'developed natural asset' in an appropriate manner given its composition.

Question: *Which of the recording options B1, B2 or B3 in SEEA-2003 Box 10.3 best explains the nature of, and relationship between, mineral exploration and mineral and energy resources?*

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