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Matthew Sprott
Department of Planning and Infrastructure
23-33 Bridge Street
Sydney NSW 2000

4 October 2013 *EN04281*

Dear Matthew,

Review of Drayton South Coal Project air quality impact assessments

This report has been prepared for the Department of Planning and Infrastructure (DoP&I) to assist with their assessment of the Drayton South Coal Project (the 'Project'). The report provides outcomes of a peer review of documents relating to potential air quality impacts of the Project, specifically:

- "*Drayton South Air Quality and Greenhouse Gas Assessment*", prepared by PAEHolmes, dated 25 October 2012, Job number 3617B.
- Response to Submissions Appendix C, titled "*Appendix C Revised Air Quality Modelling*". Letter dated 9 April 2013 from Pacific Environment Limited to Daniel Sullivan (Hansen Bailey on behalf of Anglo American Metallurgical Coal).

The scope of the review has been prescribed by the Department of Planning and Infrastructure as follows:

1) *Consider the adequacy and accuracy of the air quality modelling undertaken for the proposal, including consideration of relevant guidelines, suitability of the model used, and the reasonableness of the inputs used in the model.*
2) *Identify any significant gaps or inconsistencies in the assessment of air quality impacts, the reliability of the predictions, and provide advice to the Department about the likely project impacts based on the information in the assessment documentation.*
3) *Review the project against best practice dust mitigation, management and monitoring, including the following areas:*
    a. *haul roads;*
    b. *materials handling;*
    c. *real-time dust management; and*
    d. *minimising surface disturbance.*
4) *Consider and recommend any additional measures to further minimise and mitigate any identified impacts, particularly on receivers to the south of the project.*
5) *Consider the difference between predicted air quality impacts identified in the Environmental Assessment and the subsequent Response to Submissions, and advise the Department whether the significant reduction in predicted impacts is reasonable, reliable and suitably modelled. What is the likelihood that such reductions would be practically achievable?*

Review of potential health effects of airborne particulate matter, odour or greenhouse gas emissions was outside the scope of this review.

I am an Atmospheric Scientist with 15 years' air quality consulting experience. I have been specialising in meteorological studies, air dispersion modelling, emission estimation and air quality assessment for various industry sectors, but predominantly for coal mining in the Hunter Valley. It is in this capacity that I have undertaken the peer review of the prescribed documents.

The outcomes of the review are provided in the following sections. Please contact me on 4979 2663 if you have any questions on these outcomes.

Yours sincerely

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1. Background

Anglo American is seeking approval for the Drayton South Coal Project, a proposed open-cut coal mine (including highwall mining) located approximately 13 kilometres (km) south of Muswellbrook in the Hunter Valley. The Project is fully described in the Environmental Assessment (EA) (Hansen Bailey 2012) but can be summarised as follows:

- The development of an open-cut and highwall mining operation, extracting up to 7 Million tonnes per annum (Mtpa) of run-of-mine (ROM) coal over a period of 27 years.
- The use of the existing Drayton mine equipment fleet, with the addition of a highwall miner and coal haulage fleet.
- The use of the existing Drayton mine infrastructure including the coal handling and preparation plant (CHPP) and rail loop.
- The construction of a transport corridor between Drayton South and Drayton Mine infrastructure.

The EA of the Project was prepared by Hansen Bailey (2012) and included an *Air Quality and Greenhouse Gas Impact Assessment* (PAEHolmes 2012). A *Response to Submissions* document was subsequently prepared by Hansen Bailey (2013) following the EA public exhibition period and receipt of all submissions. The *Response to Submissions* document also included *Revised Air Quality Modelling* by Pacific Environment Limited (formerly PAEHolmes).

The main objectives of the air quality assessments (EA and revised) were to address the Director-General's Requirements relating to air quality, as well as the assessment requirements of the Environment Protection Authority (EPA).

The PAEHolmes assessments were based on the use of an air dispersion model to predict dust concentration and dust deposition levels in the vicinity of the project, including at the nearest sensitive receptors. Six operating years of the mine life were considered and the modelling referred to the procedures outlined by the EPA in their *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (DEC, 2005).

One of the conclusions of the EA assessment (PAEHolmes 2012) was that six (6) private residences would be impacted by the project (in terms of air quality), based on model predictions which exceeded relevant criteria. Following revisions to the proposed air quality controls, and collection of site-specific data, the *Response to Submissions* concluded that one private residence (226B and 226C) would be adversely affected.

The reports that were the focus of this peer review have been referenced as follows:

- The *Air Quality and Greenhouse Gas Impact Assessment* (PAEHolmes 2012) has been referred to as the "**October 2012 report**".
- The "*Appendix C Revised Air Quality Modelling*" letter (PEL 2013) has been referred to as the "**April 2013 report**".

2. Adequacy of air quality modelling

This section provides comments on the adequacy and accuracy of the air quality modelling described in the October 2012 report. It also identifies gaps and inconsistencies, and provides comments on the reliability of the model predictions.

1) Air quality impact assessment criteria from the EPA have been referenced. In Section 3.5 it was stated that the "criteria are applied to the cumulative impacts due to the Project and other sources". The assessment concluded that six (6) private residences would be impacted by the project, based on model predictions which exceeded relevant criteria. This outcome was based on maximum 24-hour average PM_{10} concentrations which were predicted to be above the 50 µg/m^3 criterion due to the Project alone. Table 8-4 provided a summary of the number of days above 50 µg/m^3 due to cumulative effects (that is, Project and other sources). This table suggests that more than the six private representative properties identified in the assessment conclusions (refer Section 11, Table 11-1) would experience an increase in the number of days above 50 µg/m^3 (for PM_{10}). Therefore, the way in which the 50 µg/m^3 criterion has been interpreted should be clarified; that is, project only or cumulative. It is also not clear how the "150 µg/m^3 acquisition criteria" (first introduced in Table 8-4) relates to the assessment of predicted impacts.
2) The models selected for the assessments have been approved for use on these types of projects by the EPA.
3) The calendar year 2005 was chosen as the meteorological modelling year. Section 4.2 notes a potential deterioration in the quality of the wind data, due to an increase in the proportion of recorded calm conditions (winds less than 0.5 m/s) over time. A new meteorological station was installed at the site in November 2010. The availability of new instrumentation in 2011 and concurrent, more recent, air quality monitoring data (which was used for the derivation of existing background levels as described in Section 7.5) seems to support 2011 as a more appropriate meteorological modelling year than 2005. The wind-roses for 2011 (Appendix A) also exhibit winds from the north-northeast, which would represent a 'worst-case' scenario for residences to the south of the Project (more so than 2005) as required by the EPA (Table 3-2). It is suggested that the choice of 2005 as the meteorological modelling year be further justified.

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4) There are some inconsistencies in the setup and use of TAPM:
   - Page 25 states the grid centre coordinates to be 32°31'S 151°18'E. This position does not match the stated UTM coordinates of 340 km 6432 km. This is unlikely to affect the outcomes of the assessment but the anomaly should be clarified.
   - Table E1 shows the TAPM model inputs. The grid centre coordinates are not representative of the project site and not consistent with those stated on Page 25. Presumably this is a typographical error but this should be checked. Use of the coordinates stated in Table E1 would represent a fatal flaw in the meteorological inputs which has potential implications for the air quality predictions.
   - TAPM was run down to a 1 km grid resolution, although the 1 km grid data were not used in the modelling. Data from the 1 km grid (if available) should generally be used in preference to the 3 km grid data, as the model has more information on the variation in topography and landuse. The reason for not using the 1 km grid data has not been provided. However, given that on-site meteorological data have been used in the model, the use of 3 km grid data instead of 1 km grid data is unlikely to change the conclusions of the assessment.
   - The grid centre coordinates used for TAPM (the location used is assumed to be 32°31'S 151°18'E) place the Project near the western edge of the 3 km model domain. The preferred modelling practice (according to model developers) is to make sure the model boundary regions (edges) are as far away as possible from the central region of interest. As for the previous point however, the use of on-site meteorological data in the model means that the conclusions of the assessment are unlikely to change.
5) Table 7-3 states the moisture content of the ROM coal to be 7.5%. Appendix C, equations 5 and 6 have used a different value, 9%, which will lead to lower emissions than if the 7.5% was used. The effect on overall project emissions is anticipated to be relatively minor (that is, unlikely to change the assessment outcomes as the difference would be around 1%) but should be quantified.
6) Section 7.5 describes the approach to estimating spatially varying background levels from non-modelled sources. This approach has clearly produced some anomalies, such as annual average PM_{10} concentrations as low as 3 µg/m^3 in some places (see for example Figure 7-3 near monitoring site DF-05 on the northern side of Denman Road). Monitoring data collected by the Office of Environment and Heritage (OEH) at rural sites in NSW have not shown annual average levels as low as 3 µg/m^3. The spatially varying background levels from this approach also do not reflect changes to other mining operations in the future, which will be relevant to proposed future operations for the Drayton South Project. Nevertheless, the derived background levels at key sensitive receptor areas near the Drayton South Project (for example, around Jerrys Plains and Arrowfield Estate) are in sensible ranges, that is, between 11 and 13 µg/m^3 for annual average PM_{10} and between 30 to 40 µg/m^3 for annual average TSP so this approach presents no significant issue.

7) The emission inventories are comprehensive and capture all significant dust-generating activities associated with the project. There are a couple of exceptions, listed below:
   - Emissions from graders do not appear to have been included in the modelling, although inclusion of this activity is unlikely to change the outcomes of the assessment.
   - Emissions for vehicles hauling material have not included the contribution from exhaust, brake wear and tyre wear (Table 13.2.2-4 AP42). Inclusion of this activity is unlikely to change the outcomes of the assessment as the emission will be insignificant relative to the emissions from the road surface.
8) Table 7-4 presents a summary of the estimated annual TSP emissions for each year. These data do not match the calculated emissions presented in Appendix C. These differences should be clarified by the proponent / consultant.
9) Random checks on the emission calculations in Appendix C tables have been undertaken. The following error was identified, which appears to be applicable to all pits and years:
   - Emission factor for dozers on ROM coal. The use of 5% silt content and 9% moisture content would result in an emission factor of 11.3 kg/h, not 14.1 kg/h. With the stated moisture content of 7.5% (Table 7-3) the emission factor would be 14.6 kg/h.
10) There are some inconsistencies in the emission inventories in terms of the total waste and ROM coal moved. For example:
   - In Table 7-2, Year 5 states the overburden handled by excavator to be 9.81 Mbcm (Whynot pit); this is approximately 22.6 Mt assuming 2.3 t/bcm. However, Table C.12-5 has used a value of 9.2 Mt. This means the modelled emissions represent the handling of much less material than proposed (by around 13 Mt). This difference has the potential to change the outcomes of the assessment and should be clarified by the proponent / consultant.
   - In Table 7-2, Year 5 states the ROM coal handled to be 2 Mt (Whynot pit). However, Table C.12-5 has used a value of 1.5 Mt. This means the modelled emissions represent the handling of less material than proposed. This difference should be clarified by the proponent / consultant.
   - In Table 7-2, for Year 5, the total waste (overburden) handled is stated to be 38.13 Mbcm which is approximately 87.7 Mt assuming 2.3 t/bcm. In the emission inventories the sum of overburden handled from the four pits is approximately 49.6 Mt (that is, the sum of overburden quantities loaded by excavator to trucks for the four pits, from Table C.12-5). These differences (and comments on Table 7-2 versus the information in Table C.12-5) should be clarified by the proponent / consultant as the modelled emissions and impacts would be lower than if the values in Table 7-2 were used. In addition these differences have the potential to change the outcomes of the assessment.
11) In Figure E3, the predicted impacts for Mine Plan 1 are higher than for Mine Plan 2. This appears to be a typographical error in the figure legend, but should be clarified.

12) The modelled source locations are shown in Figures C-1 to C-9. The sources along the haul routes are approximately 1 km spacing. This is a large spacing for volume sources to be representing line sources (that is, emissions from roads). The model results reflect the coarse spacing, evidenced by the "bulls-eye" contours around the sources (see for example Figure 8-7). These predictions are unlikely to be representative of the actual pattern of dust concentrations along the haul routes. However, this apparent lack of detail in the model is unlikely to affect the conclusions of the assessment since these model sources are not close to the key sensitive receptors areas the south of the Project site.
13) Figure C-9 shows the modelled sources for Year 20, conveyor option. There are no modelled sources in the active mining areas. The reason for not modelling any sources in the active mining areas should be more clearly explained.
14) Some model information could not be reviewed as it was not available in the report. This information is listed below:
    - A landuse map which shows the landuse categories as used by the model.
    - Information on how the emissions from each activity were distributed across sources, that is, the source allocations.
    - Modelled source dimensions, such as initial vertical and horizontal spread and source height.

The air quality assessment, based on dispersion modelling, has been undertaken in a manner which is consistent with the requirements of the EPA (DEC 2005) for these types of projects. In addition, the predicted extent of impacts as defined by the contour plots of maximum 24-hour and annual average PM_{10}, annual average TSP and annual average dust deposition is similar to the projected extent of impacts for other, similar sized operations in the Hunter Valley which are now operating and meeting air quality criteria at nearest private residences, as determined by air quality monitoring.

However, this review has identified anomalies in the assessment which should be addressed in order to confirm that there would be no more than the predicted six privately owned residences impacted by emissions from the project. The collective effect of (most significantly) items 1, 2, 5, 8, 9 and 10, has the potential to change the outcomes of the assessment, in terms of the number of properties impacted. Clarification on these items should be sought in order to assess more accurately any potential changes to the likely project impacts.

3. Best practice dust management

In Table 6-2 the emission reduction measures for each activity have been reviewed against the "best practice" controls identified by Katestone (2011). This approach is consistent with the current state of knowledge regarding measures to minimise particulate matter emissions from coal mining activities in Australia.

4. Additional measures

Section 9 of the assessment outlines the proposed monitoring and management measures that would be implemented with the Project. The approach focuses on managing short-term dust concentrations; this is an appropriate approach based on the assessment outcomes as 24-hour average PM_{10} concentrations were identified as being the highest risk in terms of exceeding criteria.

The two main air quality issues associated with mining projects tend to be (1) complaints and (2) compliance. The main goals would therefore be to minimise complaints related to dust to the maximum extent practicable, and to make sure the Project complies with air quality criteria.

It appears from the air quality assessments that managing compliance will be an important aspect of the Project. This is demonstrated by:

- Real-time dust monitoring to determine if short-term "trigger" levels are breached, resulting in a course of action by accountable personnel. No specific trigger levels (PM_{10} concentrations) have been defined in the air quality assessments, but there appears to be a commitment to set trigger levels (in the AQMP) to make sure air quality criteria are not exceeded at nearest sensitive receptor areas.
- Meteorological forecasting to identify the likely risk of dust emissions and impacts, and to assist with planning daily activities for managing dust.

It is suggested that the trigger levels referred to above should take into account of four factors, namely:

- Visual conditions;
- Meteorological conditions;
- Ambient air quality conditions (that is, PM_{10} concentrations); and
- Forecast dust risk conditions.

It will also be important that the AQMP outlines measures to minimise complaints related to dust to the maximum extent practicable. These measures may include mechanisms to manage visual dust such as:

- Screening or bunds between the mine and sensitive receptors.
- Controlling the times at which short-term, potentially high dust-generating activities occur, such as blasting.
- Methods to enhance the visual dust monitoring capabilities of operational personnel. For example, cameras, routine inspections, and/or training of personnel.

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5. Environmental Assessment and Response to Submissions

The *Response to Submissions* (April 2013 report) concluded that one private residence (226B and 226C) would be adversely affected by emissions from the Project. This outcome was based on revisions to the proposed air quality controls, and collection of site-specific data. The revisions included:

- 80% control of dust emissions from in-pit haul roads (previously 75%).
- 85% control of dust emissions from all out-of-pit haul roads, achieved by “Dust-A-Side”.
- 70% control of dust emissions from the exposed areas at the Houston pit, due to aerial seeding.
- Changes to the silt and moisture contents used to calculate emission factors. These changes followed local measurements.

The following items have been noted from review of the April 2013 report:

15) Comment 1 also applies to the April 2013 report. That is, clarification is required on whether the 50 $\mu g/m^3$ criterion for PM_{10} is applied as project only or cumulative for the purposes of determining an impacted property, as well as the role of the 150 $\mu g/m^3$ acquisition criteria.

16) Mine plans for Years 10 and 15 were chosen for the updated modelling on the basis that these were ‘worst-case’ scenarios, as determined from the October 2012 assessment. Tables 7-1 and 7-2 of the October 2012 report have been reproduced below to examine whether this approach is appropriate.

Table 7-1: Description of the Projects modelling years

Operation Year	Nominal Year	Operation description and notes
3A	2016	All mining areas are actively mined. This modelling scenario captures the conditions before the visual bund is completed south of the Houston mining area. Drayton Mine is operational.
3B		All mining areas are actively mined and the completed visual bund to the south of Houston. Drayton Mine is operational.
5	2018	All mining areas are actively mined, plus the inclusion of year 7 highwall mining in Houston.
10	2023	All mining areas are actively mined, except for Houston which is inactive during this period. Larger trucks replace the existing in-pit haul trucks. Year 8 Redbank is used to capture worst case ROM mined amounts.
15	2028	All mining areas are actively mined.
20	2033	Mining in Whynot and Houston, while only Highwall mining occurs in Redbank and Blakefield (actually Y18 mining).
27	2040	Actively mining Whynot only, while the most of remaining mining areas are completely rehabilitated.

Table 7-2: Open cut and highwall ROM coal and waste production schedule

Pit ID	Material removed		Year 3	Year 5	Year 10	Year 15	Year 20	Year 27
Whynot	Waste (Mbcm)	Dragline	10.41	7.14	11.01	10.29	11.51	7.04
		Excavator	2.81	9.81	10.05	8.62	17.79	0
		Partings	0.34	0.46	0.66	0.54	0.86	0.07
		Total	13.56	17.41	21.72	19.45	30.15	7.11
	ROM coal (Kt)	Total	1,553	2,002	3,072	2,369	3,938	551
Blakefield	Waste (Mbcm)	Dragline	5.52	9.31	4.59	2.2	0	0
		Excavator	0.05	0.56	0.32	0	0	0
		Partings	0.07	0.08	0.04	0.03	0	0
		Total	5.64	9.96	4.95	2.20	0	0
	ROM coal (Kt)	Total	722	815	292	98	564	0
Redbank	Waste (Mbcm)	Dragline	0	0	0	0	0	0
		Excavator	6.20	6.63	9.31	10	0	0
		Partings	0.32	0.38	0.36	0.34	0	0
		Total	6.53	7.02	9.66	10.71	0	0
	ROM coal (Kt)	Total	1,226	1,436	2,480	1,389	900	0
Houston	Waste (Mbcm)	Dragline	0	0	0	2.77	3.18	0
		Excavator	11.43	3.66	0	1.64	2.81	0
		Partings	0.16	0.08	0	0.07	0.12	0
		Total	11.59	3.74	0	4.48	6.12	0
	ROM coal (Kt)	Total	2,069	1,610	0	754	989	0
Total Waste (Mbcm)			**37.32**	**38.13**	**36.33**	**36.85**	**36.27**	**7.11**
Total ROM (kT)			**5,570**	**5,863**	**5,845**	**4,610**	**6,391**	**551**

17) The inconsistencies in the Year 5 emission inventory (in terms of the apparent errors in material quantities used for calculating emissions) should be resolved before Year 5 is excluded from the *Response to Submissions* modelling. This is because Year 5 would have the highest quantities of material handled of the six modelled years, and the use of smaller trucks may lead to more trips (for a given material handling quantity) and therefore potentially higher dust emissions from this activity.

18) The calculation for dozers on coal should be checked, as per comment 9.

19) The revisions to the assessment predict a 30% reduction in overall emissions, compared to the original project (presented in the EA). The reduction seems reasonable based on current processes for calculating emissions, given that the most significant dust generating activities are being targeted (that is, haul roads and wind erosion). Model predictions for annual average PM_{10} concentrations at residences are around 30% lower than originally predicted, which is as expected from the emission reductions.

20) Anglo American has undertaken tests on the silt and moisture contents at the existing Drayton mine, in order to improve the representativeness of dust emission estimates. Comments on the use of the measurement data are as follows:

- Collecting local data on silt and moisture contents, as described in the April 2013 report, is the preferred method (by the US EPA) for calculating emission factors.
- The most significant reductions in emissions are those associated with overburden handling (for example, dozers on overburden, and loading and unloading

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overburden). Reductions in the order of 90% or more (compared to using default silt and moisture contents) have been estimated.

- One round of sampling for silt and moisture content has been undertaken (on 26 February 2013). The US EPA recommends that samples reflect average conditions and, because of different evaporation rates, samples of moisture contents should ideally be collected at various times during the year. The US EPA also recommends that if one set of samples is to be collected, these must be collected during hot, summertime conditions. The Bureau of Meteorology (bom.gov.au) reported 62 mm of rainfall in the three days preceding the sampling day of 26 February 2013. The proponent / consultant should provide a comment on whether the silt and moisture contents are representative of long term (one year) values as, for example, the rainfall preceding the sampling may have led to moisture contents that are higher than longer term values (leading to lower calculated annual emissions).
- Most emission factor equations given by the US EPA are accompanied by the range of source conditions that were tested in developing the equation (refer Tables 11.9-3 and 13.2.2-3 in AP42). **Table 5.1** below shows the range of silt and moisture contents for which the emission factor equations have been tested (US EPA 1985), for comparison with the measurement data. These results show that some of the measurement data are outside the ranges tested for the equations. This outcome highlights a need for the proponent to verify emission factors (dozers on overburden, loading / unloading overburden and haul roads) if the project is approved.

- **Table 5.1 : Silt and moisture contents**

Activity (US EPA reference)	Range of silt and moisture contents for which the equation has been tested	Measured values presented in April 2013 report	Within range of equation test parameters?
Dozers on overburden (11-9.3)	Silt: 3.8 – 15.1 Moisture: 2.2 – 16.8	Silt: 1.8 Moisture: 10.9	Silt: No Moisture: Yes
Loading coal (11-9.3)	Moisture: 6.6 – 38	Moisture: 6.6	Moisture: Yes
Dragline (11-9.3)	Moisture: 0.2 – 16.3	Moisture: 10.9	Moisture: Yes
Haul roads / trucks (13.2.2-3)	Silt: 1.8 – 25.2 Moisture: 0.03 – 13	Silt: 0.4 (main roads), 4.1 (in-pit) Moisture: 2.8 (main roads), 2 (in-pit)	Silt: No (main). Yes (in-pit) Moisture: Yes (both)

Model predictions from the revised air quality assessment are as expected, based on the estimated reductions in emissions. Undertaking site-specific measurement of silt and moisture contents (as has been done) is the preferred approach for calculating emissions and the proponent / consultant has appropriately carried these data into the calculations and model.

However, the proponent / consultant should provide clarification on how representative the single measurement values are of long terms values. In addition, the emission factors for activities that are sensitive to silt and moisture content (dozers on overburden, loading / unloading overburden and haul roads) should be verified if the project is approved.

Again, the identified anomalies of the assessment (comments 15 to 20) should be addressed in order to confirm that there would be no more than the predicted one privately owned residence impacted by emissions from the project.

References

DEC (2005) "*Approved Methods for the Modelling and Assessment of Air Pollutants in NSW".* August 2005, prepared by the Department of Environment and Conservation (now EPA).

Hansen Bailey (2012) *Drayton South Coal Project Environmental Assessment.*

Katestone (2011) "*NSW Coal Mining Benchmarking Study: International Best Practice Measures to Prevent and/or Minimise Emissions of Particulate Matter from Coal Mining*". June 2011.

PAEHolmes (2012) "*Drayton South Air Quality and Greenhouse Gas Assessment*", prepared by PAEHolmes, dated 25 October 2012, Job number 3617B.

Pacific Environment Limited (2013) *"Appendix C Revised Air Quality Modelling"*, Response to Submissions Appendix C. Letter dated 9 April 2013 from Pacific Environment Limited to Daniel Sullivan (Hansen Bailey on behalf of Anglo American Metallurgical Coal).

SEWPaC (2012) "National Pollutant Inventory Emission Estimation Technique Manual for Mining, Version 3.1". January 2012. Department of Sustainability, Environment, Water, Population and Communities.

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