26 October 2012

National Inventory Systems and International Reporting Branch
Land Division
Department of Climate Change and Energy Efficiency
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(via e-mail to: nationalgreenhouseaccounts@climatechange.gov.au)

RE: NGER MEASUREMENT DETERMINATION FUTURE EMISSION ESTIMATION METHODS FOR COAL SEAM GAS – APPEA COMMENTS

The Australian Petroleum Production & Exploration Association (APPEA) is the peak national body representing Australia's oil and gas exploration and production industry. APPEA has more than 90 full member companies exploring for and producing Australia's oil and gas resources. These companies currently account for around 98 per cent of Australia's total oil and gas production and the vast majority of exploration. APPEA also represents over 240 associate member companies providing a wide range of goods and services to the industry.

APPEA welcomes the opportunity to provide comments on future emission estimation methods for coal seam gas (CSG) within the *National Greenhouse and Energy Reporting (Measurement) Determination 2008*. APPEA notes that our 31 May 2012 submission to the *National Greenhouse and Energy Reporting (Measurement) Amendment Determination 2012* consultation contained a number of suggested areas requiring clarity for CSG activities. A copy of that submission can be found at Attachment 1.

APPEA also understands that a number of our members will provide their own submissions to this consultation process. APPEA's submission should be considered in conjunction with those of our members.

General Comments

APPEA considers that the existing emission estimation methods applicable in Australia for natural gas production sufficiently cover all material sources of greenhouse gas emissions, including for production of natural gas from coal seams.

This means that concerns that have been expressed that existing estimation methods do not adequately account for the greenhouse gas emissions associated with the production of natural gas from coal seams, are unfounded. APPEA is not aware of any peer-reviewed, rigorous research that has identified any material gaps in the existing methodology that warrant revision of the methods applicable to natural gas

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production set out in the Determination. Any revision to the existing methods must be based on relevant, robust research and analysis.

With that in mind, APPEA supports the commencement of independent research and data-gathering with respect to emissions from all Australian natural gas production techniques that can be used to inform development of revised emissions factors and methodologies that better reflect current Australian gas production operations. APPEA notes that a number of our members have expressed an interest in participating in such an independent study, and we are happy to work with the Department, should this option be considered.

Until such research is complete, APPEA's view is that the existing methods applicable to natural gas emissions, as specified in the Determination, should continue to be applied to all natural gas production.

The following sections of APPEA's submission will focus in more detail on the pitt&sherry literature review commissioned by the Department, as well as comments on the widely discredited Cornell University study by Howarth R, Santoro T, and Ingraffea A (the Howarth study) and other public material of interest to Australia's gas industry.

Pitt&Sherry Literature Review

APPEA welcomes the release of the report prepared by pitt&sherry (August 2012) which was commissioned by the Department earlier this year to: "*review literature on international practice for estimating greenhouse gas emissions from coal seam gas production.*" APPEA considers that determining methods used for natural gas emissions estimation applicable to Australia is an important step in recognising the differences that may exist with methods develop in other jurisdictions.

With that in mind, APPEA makes the following points on the content of the pitt&sherry Report:

- pitt&sherry's analysis of US Greenhouse Gas Inventory data in section 3.2 concludes that well completions and workovers with hydraulic fracturing are likely to be the largest sources of methane emissions for coal seam gas operations. Measurements of these emissions are already captured (as vented volume) and reported by many companies using available composition data and are not estimated from factors. This is the case regardless of whether the well has been hydraulically fractured.

- Section 3.2 of the pitt&sherry Report suggests that methane production from produced formation water (PFW) is a potentially significant source of emissions that needs to be accounted for in future revised estimation methods. Methane from PFW is already taken into account in reporting of coal seam gas emissions at the point of separation, as the gas separated from the PFW is either combined with other gas, vented, or flared. Emissions from each of those activities are captured by existing reporting methods.

Dissolved methane is not solely a source of emissions associated with CSG production that requires specific estimation methods to be applied. Methane is equally dissolved in PFW generated in conventional gas production and most mine sites, including bauxite mines, iron ore mines, copper-gold mines and coal mines. Emissions associated with PFW for CSG production can and should be calculated in exactly the same way as the emissions from PFW across other industries.

- The development of new technologies over the past two decades is likely to have reduced the amount of fugitive emissions associated with the natural gas industry. The pitt&sherry Report acknowledges that the emission factor values for natural gas recommended in the 2004 API Compendium (currently in use in Australia pursuant to the Determination) are mostly derived from measurements made in the USA in the 1990s, and therefore may not be appropriate for use in Australia. Consequently, it is likely that the current factors lead to an overestimation of emissions rather than an underestimation.

- The pitt&sherry Report repeatedly references data and methodologies relevant to US shale gas operations in drawing its conclusions in relation to natural gas produced from coal seams. As mentioned our opening comments, this is not appropriate without further analysis on Australian natural gas production.

- The pitt&sherry Report includes a discussion at section 3.1 on the Howarth studies, without mentioning that those studies have been disputed in a number of fora (in addition to the Cathles et al paper in 2011 mentioned in the pitt&sherry Report). Given that the Howarth studies focus on shale gas, APPEA questions the relevance of their inclusion in a report commissioned to specifically review CSG extraction. A more detailed discussion on the Howarth studies is presented in the following section.

Review of the Howarth study

As noted in APPEA's comments above, the conclusions of the Howarth studies have repeatedly been refuted in other fora, as being based on poor science, erroneous assumptions and materially flawed methodology.

A list of nine articles criticising the Howarth paper is provided below. Some of the criticisms focus on the comparison of life cycle emissions from the use of shale gas and coal to produce electricity. In addition, much of the criticisms directly refute the conclusions reached on fugitive emissions during gas production.

1. Nathan Hultman, Dylan Rebois, Michael Scholten and Christopher Ramig, *The greenhouse impact of unconventional gas for electricity generation*, University of Maryland (iopscience.iop.org/1748-9326/6/4/044008/):

   - [W]*e have demonstrated that the fugitive emissions from the [shale] drilling process are very likely not substantially higher than for conventional gas.*

- [A]*rguments that shale gas is more polluting than coal are largely unjustified.*

2. Mohan Jiang, W Michael Griffin, Chris Hendrickson, Paulina Jaramillo, Jeanne VanBriesen and Aranya Venkatesh, *Life cycle greenhouse gas emissions of Marcellus shale gas*, Carnegie Mellon University (iopscience.iop.org/1748-9326/6/3/034014/fulltext)

   - *We don't think* [Cornell] *is using credible data and some of the assumptions they're making are biased. And the comparison they make at the end, my biggest problem, is wrong.* (Lead researcher Paula Jaramillo, August 2011)

3. Timothy J. Skone, P.E., Office of Strategic Energy Analysis and Planning, *Life Cycle Greenhouse Gas Analysis of Natural Gas Extraction & Delivery in the United States*, US Department of Energy (cce.cornell.edu/EnergyClimateChange/NaturalGasDev/Documents/PDFs/SKONE_NG_LC_GHG_Profile_Cornell_12MAY11_Final.pdf)

   - [The Cornell study] *found a large fraction of produced gas from unconventional wells never made it to end users, assumed that all of that gas was vented as methane, and thus concluded that the global warming impacts were huge. As the* [Dept. of Energy] *work explains, though, 62 per cent of that gas isn't lost at all – it's 'used to power equipment.'"* (CFR blog, May 20, 2011.)

4. Michael Levi, *Some Thoughts on the Howarth Shale Gas Paper, Council on Foreign Relations* (blogs.cfr.org/levi/2011/04/15/some-thoughts-on-the-howarth-shale-gas-paper/)

   - *Alas,* [the Cornell] *analysis is based on extremely weak data, and also has a severe methodological flaw (plus some other questionable decisions), all of which means that his bottom line conclusions shouldn't carry weight.*

5. Mary Lashley Barcella, SamanthaGross, Surya Rajan, *Mismeasuring Methane: Estimating Greenhouse Gas Emissions from Upstream Natural Gas Development*, IHS CER (heartland.org/sites/default/files/Mismeasuring%20Methane.pdf)

   - *The Howarth estimates assume that daily methane emissions throughout the flowback period actually exceed the wells' IP at completion. This is a fundamental error, since the gas stream builds up slowly during flowback. Compounding this error is the assumption that all flowback methane is vented. Vented emissions of the magnitudes estimated by Howarth would be extremely dangerous and subject to ignition.*

6. Navigant, *How Does the Cornell Report Affect Natural Gas Development?*, NGMarket Notes (www.navigant.com/~/media/site/downloads/energy/ng_notes_may2011.shx)

- *The* [Cornell] *report concludes that the average* [Haynesville] *well spits 250 million cubic feet of methane into the sky. That's about a million and a half dollars' worth of gas at today's prices. … I have to wonder whether the authors have ever seen a working drilling / fracturing operation.*

7. American Gas Association, *Reducing Greenhouse Gas Emissions With Natural Gas – Have The Benefits Lessened?*, AGA Energy Analysis (http://www.aga.org/Kc/analyses-and-statistics/studies/efficiency_and_environment/Documents/Reducing%20Greenhouse%20Gas%20Emissions%20with%20Natural%20Gas%20-%20Have%20the%20Benefits%20Lessened.pdf)

   - *Some of the major flaws include … use of data that the authors note is limited and questionable; failure to adequately consider industry control technologies; and misinterpretation of industry terms and data such as 'lost and unaccounted for' gas.*

8. Andrew Revkin, Dot Earth (bloggingheads.tv/diavlogs/35645?in=12:03&out=17:37)

   - *One thing that disturbed me and some of the scientists I consulted was the big gap in the definitiveness of* [Cornell's] *abstract summary and the actual paper. I find that they are more value judgments than scientific judgments.*

9. David McCabe, *Let's Fix Dangerous, Climate-Warming Methane Leaks From All Fossil Fuels: Coal, Oil, and Natural Gas*, Clean Air Task Force (www.catf.us/blogs/ahead/2011/04/13/lets-fix-dangerous-climate-warming-methane-leaks-from-all-fossil-fuels-coal-oil-and-natural-gas/#more-167)

   - *This paper is selective in its use of some very questionable data and too readily ignores or dismisses available data that would change its conclusions.*

Other Public Reports

A report by The Australia Institute (TAI), *Measuring Fugitive Emissions: Is coal seam gas a viable bridging fuel?*, released on 15 August 2012, was riddled with calculation errors that meant the emissions estimation and carbon liability calculations set out in the report were out by a factor of at least 2,500. APPEA correspondence to the TAI, pointing out the serious calculation errors, led to the following post on their website:

> **Please note this is a revised version of the original paper published on 15 August 2012 which excludes calculations of the potential fugitive emissions and, in turn, the potential under collection of carbon tax revenue.*

APPEA looks forward to on-going consultation with the Department on greenhouse and energy reporting. Should you wish to discuss any of the issues raised in this letter, please feel free to contact Adam Welch, APPEA's Senior Analyst – Economics & Operations on (08) 9426 7205 or via e-mail at awelch@appea.com.au.

Yours sincerely

DAMIAN DWYER
Director – Economics

Enc.

Attachment 1
31 May 2012

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RE: CONSULTATION DRAFT – *NGER (MEASUREMENT) AMENDMENT DETERMINATION 2012*: APPEA COMMENTS

APPEA welcomes the opportunity to provide comments on the draft of amendments to the *National Greenhouse and Energy Reporting (Measurement) Determination 2008*, provided to APPEA via e-mail on 1 May 2012.

General comments

APPEA notes that, in general, the consultation draft incorporates many of the comments provided to the DCCEE by APPEA on the past. That said, there remain several areas where the draft determination requires amendment

APPEA has identified a key issue in the Determination on reporting of emissions from fuel flared using Method 1. This is outlined in more detail below. A range of other issues covering fugitive emissions, energy production and consumption and general matters are outlined in Attachment 1.

Reporting of emissions from fuel flared using Method 1

As reporters have to currently report fuel flared in tonnes in OSCAR, using the appropriate density value is important. This was raised recently as part of the NGER audit for the 2010-11 reporting period.

The Technical Guidelines and the Measurement and Determination guidelines documents provided by the DCCEE, do not have a gas density value that reporters can use, when estimating emissions of flared volumes using Method 1. As a result, reporters have to use gas density values from other sources, including API compendium, NPI manuals, etc. This means that, depending on the source of the density value, gas densities differ:

- 0.6728 kg/m^3 – API Compendium, 2009. No mention of temperature and pressure;
- 0.755 kg/m^3 – NPI manual. At 15°C and 1 atmospheres (atm) ;
- 0.7 – 0.9 kg/m^3 (assumed 0.8) – engineering toolbox. At 0°C and 1 atm;
- 0.818 kg/m^3 – royal mechanical engineers, UK. At 15°C and 1 atm;

Total tonnes of flared emissions reported using method 1 varies from 18 to 43% (estimated using energy content of fuel vs. fuel flared in tonnes) depending on the density value chosen.

APPEA suggests that the DCCEE could address this issue by allowing reporters to enter fuel flared volumes in standard cubic metres (Sm^3) and not tonnes using OSCAR. Alternatively, the DCCEE could provide reporters with a density value in the determination guidelines.

APPEA would welcome the opportunity to meet with you to discuss these comments. In the meantime, should you have any queries, please contact Adam Welch, APPEA's Senior Analyst – Economics & Operations via telephone on 08 9426 7205 or via e-mail at awelch@appea.com.au.

Yours sincerely

Damian Dwyer

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Issue Number	Relevant Sources	General Description of Issue	Comments	Determination Section Number	Determination Section Title
1	Fugitives - venting	No guidance is provided in the Determination for modifying API emission factors based on gas composition. A default gas composition for CSG is also not provided.	Reporters within the industry may be treating emissions estimated using the API Compendium differently. The lack of a default CSG composition means that facility gas composition estimates must be used to convert the API emission factors from their base gas content. If method 2 has not been used at the facility (if measurements do not meet the required standards), then it is unclear how a reporter should estimate these emissions.	Subdivision 3.3.9.1	Fugitive emissions that result from deliberate releases from process vents, system upsets and accidents
2	Fugitives - venting	No guidance is provided in the Determination or referenced sections of the API Compendium for estimating vent rates if not measured.	Engineering calculation approaches (material balances) are referenced that require measured flows, however these are not always practical to measure. Other approaches such as emission factors could be considered based on calculation of volume and pressure released.	Subdivision 3.3.9.1	Fugitive emissions that result from deliberate releases from process vents, system upsets and accidents
3	Fugitives - venting	The exact content of the API Compendium that should be used by reporters should be outlined rather than general sections.	Specific emission factors should be defined in order to allow consistency within the industry.	Subdivision 3.3.9.1	Fugitive emissions that result from deliberate releases from process vents, system upsets and accidents
4	Fugitives - venting	It should be made clear what constitutes gas production and gas processing within the API Compendium and the Determination.	It is not clear whether a facility should use both gas production and gas processing emission factors, such as for non-routine emissions. The Determination should outline a definition for each of these terms and whether a facility can be classified as both.	Subdivision 3.3.9.1	Fugitive emissions that result from deliberate releases from process vents, system upsets and accidents

5	Fugitives - venting	The Determination should explain venting in more detail and what kind of sources are covered by Subdivision 3.3.9.1 (deliberate venting) compared to Division 3.3.6 (general leaks). A threshold guideline for vented emissions as opposed to leaks would be valuable and would avoid confusion.	It is often not clear whether a small non-manual source is considered venting or leaks. These sources are difficult to measure, so it would be more practical if these were covered by a general emission factor such as what is provided in Division 3.3.6, rather than accounting for them individually. Examples of such sources include high point vents, low point drains and gas entrained in produced water.	Subdivision 3.3.9.1	Fugitive emissions that result from deliberate releases from process vents, system upsets and accidents
6	Fugitives - venting	High point vents, low point drains and gas associated with produced water are not dealt with specifically in the Determination or the API Compendium.	Due to the nature of these sources (large number, small, difficult to monitor), measurements are impractical. Suggest rolling into other emission factors (such as the general leaks emission factor provided in Division 3.3.6) or providing a simple emission factor approach.	Subdivision 3.3.9.1	Fugitive emissions that result from deliberate releases from process vents, system upsets and accidents
7	Fugitives - leaks	The general leaks emission factor provided in the Determination (Division 3.3.6) references several API sections, but not the specific sources and number of each source assumed.	It is not clear what is covered by the emission factor and whether it is representative of different facilities. It is recommended that background information is provided on the derivation of the general leaks emission factor that details the sources that are included and the number of each source that are assumed to be included in the general leaks emission factor is included. This would allow facilities to determine whether the general leaks emission factor is appropriate for estimating emissions and would also assist in ensuring double-counting of emissions are minimised/eliminated.	Division 3.3.6	Natural gas production or processing, other than emissions that are vented or flared

8	Fugitives - supply / transmission	With the addition of embodied emissions in Part 1.1A of the Determination, which assumes that all gas supplied is combusted, it is unclear what fugitive emissions should apply (to avoid double-counting emissions).	It is not clear whether the estimated fugitive emissions from natural gas transmission should be taken into consideration when reporting the embodied emissions in natural gas supply pipelines. In other words, if all of the gas that enters the pipeline is assumed to be combusted and fugitive emissions such as leaks are estimated, the emissions would be higher than possible. It should be made clear whether the reporter should deduct the amount of gas that is estimated to be lost as fugitive emissions from the amount that is used for calculating embodied emissions.	Division 3.3.7	Natural gas transmission
9	Fugitives	No facility-wide fugitive factors are available in the Determination for oil & gas, unlike Coal Mining.	Using facility-wide fugitive emission factors such as those provided in Section 6.1.1 of the 2009 API Compendium will allow for a higher degree of comparability within the industry. Those factors may not be appropriate, but several emission factors could be developed based on the gas compositions and technologies used in Australian operations to provide a straight forward approach.	Part 3.3	Oil and natural gas - fugitive emissions
10	Fugitives	No CSG specific emission factors are available in the Determination for fugitive emissions, only the natural gas industry in general. The API Compendium is based on traditional natural gas extraction.	The relevance of emission sources and accuracy or emission factors based on different gas compositions and technologies is not clear. This should be addressed when hydraulic fracturing and other sources are considered in the current review of the CSG industry referenced in Appendix C of the Departmental Commentary on the Draft Determination. The 2009 API Compendium also has an emission factor for well completions, which should be reviewed for accuracy in relation to CSG extraction.	Part 3.3	Oil and natural gas - fugitive emissions

11	Energy production	The energy production reporting requirements are not clear. The definition of energy production is focused on what is extracted rather than sold, which is confusing for many reporters. This also means that there is some debate over what constitutes extraction.	The definitions mean that the energy produced by a CSG extraction operation is not what is sold, which is not intuitive. It also means that energy balances across the facility are required to determine what is produced rather than invoices. The Determination should have a subsection that defines extraction, detailing whether gas immediately flared at a well is considered energy produced.	Chapter 6	Energy
12	Energy consumption	The energy consumption reporting requirements are not clear. The definition of energy consumption includes gas lost during extraction (i.e. fugitives); however OSCAR does not include energy content for such emissions.	The Determination should make it clear whether fugitive emissions are counted as energy consumption. If this is the case, OSCAR should be updated so that this is automatically calculated rather than manually creating an 'energy consumed without combustion' source.	Chapter 6	Energy
13	Energy consumption / production	The energy consumption and production reporting requirements for CSG should be explained in more detail. It is not initially clear how different CSG extraction is compared to traditional natural gas. Natural gas has two energy commodities (raw and compressed natural gas), while CSG has one. This means that some reporters may be double-counting energy consumption and production if they treat CSG extraction as natural gas extraction.	To make things clearer in the Determination, only one energy commodity could be included for natural gas and one for CSG. This would ensure that reporters are not confused by the reporting requirements.	Chapter 6	Energy

14	General	Sales meters are the most accurate and dependable measurement devices used throughout many facilities; however they cannot be used for most emission sources. There is a lack of alternative methods for measuring and estimating flows within facilities that are not metered. Often engineering calculations are used to estimate flows (such as mass or energy balances across a facility); however it is not made clear in the Determination if or when this is acceptable.	Most reporters will not be able to use an estimation method higher than Method 1 due to the lack of available resources. Provisions for estimating flows based on sales metering and large sources would be useful. Mass or energy balances are used in some cases to estimate flows and it would be useful to have these methods approved by the Regulator. Altering methods so that invoiced deliveries form the basis of emission estimates would also ensure consistency.		
15	General	Many emission sources (such as general leaks) are estimated based on the facility throughput. A reporter may also separate one potential facility if necessary (such as separating a gas field and compressor station into two facilities for JV requirements). This means that the throughput emissions would be counted twice, whereas if the facilities were combined there would be only one calculation.	Setting different facility boundaries will result in different emission estimates. Further guidance is needed for how throughput based emission factors are used for fugitive emissions calculations.		

16	General	The measurement requirements (standards) for Method 2 are often too high for use at many facilities, so default factors are used even though site-specific data are available.	It is often the case that the input data required for Method 2 are available, but the measurements have not been made under the standards outlined in the Determination. In these cases the reporter must use Method 1, as they cannot provide evidence that the requirements for the use of Method 2 have been met. Since Method 3 is similar to Method 2 but with higher measurement standards in place, the measurement standards for Method 2 could be relaxed (similar to BBB criterion for fuel combustion - industry practice). This would allow for a site-specific calculation that uses correct standards (Method 3) and a site-specific calculation that does not (Method 2).		
17	Fuel consumed without combustion	It is unclear whether the amount of oils or greases consumed without combustion is in relation to the amount contained in equipment, or the amount added in each reporting period.			