ARE EMISSIONS FROM THE GAS INDUSTRY ASSOCIATED WITH HOSPITALISATION IN THE DARLING DOWNS?
Asthma

- Rasmussen et al (2016) in a study of 35,000 medical records of people in Pennsylvania
- Those who lived beside a higher number of, or larger gas wells, were between 1.5 and 4 times more likely to have asthma attacks with those who lived closest having the highest risk.
- Exacerbations requiring oral steroid medication (mild), Emergency Department attendance (moderate) and hospitalization (severe) were all increased.
- **RISKS OF ASTHMA ATTACKS WERE RAISED THROUGH ALL STAGES OF WELL DEVELOPMENT FROM PAD PREPARATION, THROUGH DRILLING, STIMULATION AND PRODUCTION.**
ARE EMISSIONS FROM THE GAS INDUSTRY ASSOCIATED WITH HOSPITALISATION IN THE DARLING DOWNS?
5\textsuperscript{th} Jan 2015. The first LNG tanker sailed from Gladstone
The fully functioning gas field had been built involving massive

- Land clearing
- Soil disturbance
- Construction
- Industrialisation
APPEA

• total of 6543 active CSG wells

• 5010 production wells

• 1533 exploration wells.

• 427 wells had been fracked.
wells
5000 km of transmission pipelines
pipelines
pipes
hundreds of kilometers of high voltage overhead powerlines (which were for the sole and express use of the gas industry
pits
ponds
more ponds...
Reinjection wells

CONDABRI CENTRAL PERMEATE RE-INJECTION PILOT

This site contains a Hazardous Area.
No Unauthorised Entry.
All Visitors Please Report to Site Office.

EMERGENCY 1800 076 251
POLICE/FIRE/AMBULANCE 000

All Enquires
Walloons Operations
152 Dawson Street,
Miles, Qld 4415
Ph: (07) 4627 2840
flares
More flares
Lots of infrastructure
Processing plants
RUBY JO central processing plant
Compressor stations
QGC compressor station
Weeleavie Creek compressor stations
ARGYLE /BELLVUE field compressor station
water treatment plants
KENYA reverse osmosis plant
Origin Condabri reverse osmosis plant
associated water amendment facility.
CONDAMINE power station
BRAEMAR power station
Hundreds of kilometers of access roads
Massive truck movements
What infrastructure was missing?
air monitoring

Wells and air quality station at Hopeland, Queensland
Photo by CSIRO
The first government air monitoring station sited at Hopeland in February 2015

Five years after the LNG production licenses were issued

One month AFTER completion of the fully functioning gas field

The ship had literally sailed
Residents of Queensland gas fields have been reporting health impacts to Queensland Health since 2008.
Reported health impacts

- Eye irritation
- Skin irritation, rashes
- Nose bleeds
- Cough, chest tightness
- Muscles spasms
- Headaches,
- Numbness, pins and needles
- Severe fatigue, stress...
The Queensland Government claimed they had conducted a comprehensive study

• “In 2013, Queensland Health conducted a comprehensive study into the potential health effects of CSG in the Tara district.”
simply not true

• Claudio et al 2018 analysis of QH study:
  • *failed to meet HIA international best practice because 7 of 9 key steps were omitted.*
• Dr Jeanette Young QH 2018.
• Step 1: screening available data to determine if a HIA needed to be undertaken
• CSIRO/GISIRA study design framework 2018
• “An in-depth health impact study has yet to be conducted in an Australian CSG region”
In the absence of air monitors during gas field construction is there any publically available data?
NATIONAL POLLUTANT INVENTORY (NPI)

• Above a defined threshold polluting industries required

• Self report calculated, total annual estimates of emissions to air of 93 toxic substances (identified as important owing to their possible effect on human health and the environment).
Gas industry emission reporting sites (gas wells in yellow)
Compilation NPI data, self reported emissions (kilograms) QGC, Origin, Santos, Arrow facilities DDHHS Western Darling Downs catchment 2005/06 to 2015/16

<table>
<thead>
<tr>
<th>KG YEAR</th>
<th>Carbon monoxide</th>
<th>Oxides of nitrogen</th>
<th>Total VOCs</th>
<th>PM10</th>
<th>PM2.5</th>
<th>Formaldehyde</th>
<th>Sulphur dioxide</th>
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</thead>
<tbody>
<tr>
<td>2005/06</td>
<td>143,200</td>
<td>952,700</td>
<td>94,400</td>
<td>11,200</td>
<td>0</td>
<td>0</td>
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<td>2006/07</td>
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<td>1,704,000</td>
<td>153,400</td>
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<td>0</td>
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<td>1,143</td>
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<td>2007/08</td>
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<td>2008/09</td>
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<td>17,664.1</td>
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<td>2,877,000</td>
<td>632,420</td>
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<td>7,218,200</td>
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<td>116,105</td>
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<td>2011/12</td>
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<td>121,179</td>
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<td>2012/13</td>
<td>2,523,000</td>
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<td>11,584,000</td>
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<td>2015/16</td>
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<td>10,947,000</td>
<td>2,640,130</td>
<td>4,621,514</td>
<td>187,533.1</td>
<td>307,200</td>
<td>15,704</td>
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</table>
Air toxins acknowledged by the CSG industry known to cause respiratory and circulatory problems escalated
THE GAS INDUSTRY ACKNOWLEDGED THAT THEIR EMISSIONS OF **Oxides of Nitrogen** including NO2 increased 489% to 10,048 tonnes

- Irritant, dissolves on moist tissues to form nitric acid, irritates and burns
- Eye, throat and lung irritation
- Triggers asthma
- Deficits in children’s lung function
- Emergency visits, hospitalisation
Particulate matter **PM10** >6000% to 1926 tonnes
**PM 2.5** increased from **zero to 301 tonnes**.

- No safe level of particulate matter (WHO)
- Very small particles cross directly from the lungs into the blood stream
- PM2.5 is a cause of cardiovascular illness and death
- Linked to childhood respiratory disease, adverse birth outcomes, atherosclerosis,
- Increases risk of diabetes, dementia, parkinson’s disease (at very low levels eg 2.4 ug/m3)
- Coarse PM as bad as PM2.5 for respiratory health
- Air Quality Criteria PM2.5 annual average 8ug/m3, 24hr average 25ug/m3 (trending to 7 and 20 by 2025)
Particulate matter

- Repeated short-term exposures may result in the initiation and progression of chronic disease (WHO 2013), while an acute event such as a heart attack or stroke that results from exposure during a day of high ambient PM concentration may be a consequence of chronic disease progression associated with long-term exposure.
Carbon monoxide
increased by 801% to 6,800 tonnes

• Chemical asphixiant
• Patient with pre-existing heart disease most sensitive
• Significantly increases arrhythmias and angina
• Risks at near ambient levels
Volatile Organic Compounds (VOCs) increased by 337%, to 670 tonnes

- Irritation eyes, nose, throat
- Headaches, incoordination, nausea, liver, renal, central nervous system damage
- Some VOCs are known human carcinogens
Sulphur dioxide
increased by more than 1000% to 12.97 tonnes

• Irritation eyes, nose, throat, airways
• Positive association with respiratory hospital admissions
• Those with impaired heart or lung at increased risk
Formaldehyde
increased from 12 kg to 160.42 tonnes

• Sensory irritant, burning sensation in eyes, nose, throat, coughing, wheezing
• Implication in worsening of allergic and respiratory symptoms in children
• **Known human carcinogen** linked to nasopharyngeal cancer, sinonasal cancer and myeloid leukaemia
OZONE
Chemical reaction NO2/ VOCs in sunlight

• Airway inflammation
• Decreased lung function
• Asthma admissions
carbon monoxide, oxides of nitrogen, particulate matter 10, (Kilograms) Western Darling Downs, reported by CSG companies QGC, Origin, Arrow, Santos.
Particulate matter 2.5, formaldehyde (Kilograms) Western Darling Downs, reported by CSG companies QGC, Origin, Arrow, Santos
What data is available about the health of Darling Downs residents during construction of the gas field?
Between 2007 and 2014 the population of the Darling Downs increased by 9.4% while hospitalisation of residents

- For acute respiratory conditions increased by 142%
- For acute circulatory conditions increased by 133%

Darling Downs Hospital and Health Service statistics
<table>
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<tr>
<th>Circulatory</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
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<td>53</td>
<td>63</td>
<td>57</td>
<td>167</td>
<td>289</td>
<td>372</td>
<td>331</td>
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<tr>
<td>Dalby</td>
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<td>97</td>
<td>82</td>
<td>88</td>
<td>262</td>
<td>516</td>
<td>531</td>
<td>503</td>
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<tr>
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<td>23</td>
<td>32</td>
<td>27</td>
<td>102</td>
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<td>164</td>
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<td>16</td>
<td>6</td>
<td>11</td>
<td>21</td>
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<td>374</td>
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<td>35</td>
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<td>123</td>
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<td>11</td>
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<td>Toowoomba</td>
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<td>1691</td>
<td>1834</td>
<td>2023</td>
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<td>334</td>
<td>536</td>
<td>533</td>
<td>571</td>
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<td>641</td>
<td>614</td>
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<td>Total</td>
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<td>2700</td>
<td>2622</td>
<td>2817</td>
<td>3746</td>
<td>4773</td>
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<th>2009</th>
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<th>2011</th>
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<td>38</td>
<td>112</td>
<td>206</td>
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<td>Dalby</td>
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<td>4</td>
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<td>243</td>
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<tr>
<td>Miles</td>
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<td>12</td>
<td>47</td>
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<td>78</td>
<td>70</td>
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<tr>
<td>Millmerran</td>
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<td>13</td>
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<td>50</td>
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<td>5</td>
<td>12</td>
<td>31</td>
<td>22</td>
<td>26</td>
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<tr>
<td>Toowoomba</td>
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<tr>
<td>Warwick</td>
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<td>312</td>
<td>284</td>
<td>315</td>
<td>373</td>
<td>321</td>
<td>287</td>
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<tr>
<td>Total</td>
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<td>1564</td>
<td>1697</td>
<td>2410</td>
<td>2863</td>
<td>2781</td>
<td>3051</td>
</tr>
</tbody>
</table>

| DDHHS Catchment Population<sup>a</sup> | 252785 | 256824 | 261109 | 264185 | 267052 | 270851 | 274536 | 276723 |

<sup>a</sup> Population DDHHS catchment based on local government areas Toowoomba, Western Downs, Southern Downs, South Burnett, Cherbourg, Goondiwindi and the Taroom community of Banana Shire.
DDHHS acute circulatory and respiratory hospital admissions as a percentage of population from 2007 to 2014
Cardiopulmonary hospitalisations rose coincident with the rise in pollutants known to cause such symptoms
But maybe it is better now- or is it?

There are now 5 ambient air monitoring stations in the gas fields

• Now some ambient air monitoring data post construction
• Recent CSIRO report
An assessment of ambient air quality in the Surat Basin, Queensland

Interim data summary, September 2014 – December 2016

Sarah J. Lawson, Jennifer C. Powell, Julie Noonan, Erin Dunne, Min Cheng, Paul W. Selleck, James Harnwell and David Etheridge, 2018

Report for the Gas Industry Social and Environmental Research Alliance (GISERA), Project No G.3
Some significant spikes in air pollution
Particulate air pollution

Hopeland 3-8 Dec 2016 PM2.5 μg/m³
The first peak has been identified as smoke from vegetation fires for the following reasons:

- Landholders nearby reported smoke
- Figure 18 shows satellite images of fires on the 5th and 6th December which are 50 - 60 km N – NW of Hopeland, the direction of the wind during the first peak.
- The particles are predominantly fine fraction (PM$_{2.5}$) which is typical of smoke
- CO and PM$_{2.5}$ concentrations correlated (Figure 26), and the ratio of PM$_{2.5}$/CO is typical of smoke

An assessment of ambient air quality in the Surat Basin, Queensland | 73

- CO and CO$_2$ are correlated and the ratios are typical of smoke
Kowguran (north of Miles) – vegetation fire as at 3pm Tues 6 Dec

6th December 2016 2:59 PM

Multiple Queensland Fire and Emergency Services (QFES) crews are on scene at a large vegetation fire burning in the vicinity of L Tree Creek Road and Barakula State Forest, Kowguran.

Firefighters are working to contain the blaze which broke out on Sunday 4 December.

There is no threat to property at this time. Smoke may affect Kowguran and the surrounding area.

Residents are advised to close windows and doors and, if suffering from a respiratory condition, keep medications close by.

Motorists should drive with caution and to conditions. If residents are concerned their property is under threat they are advised call the Rural Fire Service.
L Tree Creek Road/ Barakula State forest
Origin APLNG Pipeline Hub
L Tree Creek Road/Barakula State Forest
CSIRO fail to even mention

- Major gas infrastructure
- vicinity of a bushfire
- Significant enough to cause major peak of PM2.5 more than fifty km away
11/08/16
24hr average PM2.5 was 55.8 with peak **360ug/m3**

- CSIRO attributed the cause to local bushfires and cited fires 10km SW and 50k N of Hopeland- Exactly the same attribution as on 6 Dec 2016
- But no reports of fires on government website, no reports in the media, no satellite images
- ???
One hour average data doesn’t show peak of 360
Something curious about the time frame—all happening in the middle of the night
PM 2.5 spikes in the middle of the night
3am

MILES 16th Sept 2015 PM2.5

The graph shows the PM2.5 levels at 3am on 16th September 2015.
All night

MILES 4th Nov 2015 PM2.5
PM spike at 4 am
CSIRO

• Failed to mention trends of night time air pollution
Ozone

• 22 Dec 2016. Regional ozone event (Miles Airport, Hopeland, Condamine and Burncluith sites (no O3 data at Tara Region) with 4-hour average concentrations >80% of air quality objective

• Ozone formation requires the presence of precursors VOCs, and nitrogen oxides, and sunlight

• CSIRO CONCLUSION – SOURCE UNKNOWN
Methane

• “Methane is considered non-toxic and only poses a risk to human health when at very high concentrations where it can act as an asphyxiant or explosive hazard.

• Consequently, there are no ambient air quality objectives for methane.”
However

a) Partial oxidation of methane in sunlight or by combustion = formaldehyde (potent toxin)

\[
\begin{align*}
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\text{H} & \quad \text{C} & \quad \text{H} \\
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CSIRO report-
Analysis of ambient air quality in a gas field

• No scrutiny of the activities of the industry coincident with exceedences.
• No discussion or analysis of possible industry related causes of impaired air quality

• Reminiscent of an episode of “Falwty Towers” – “Don’t mention the war.”
Ongoing serious data gaps

Still no exposure monitoring

• No account of spatial and temporal conditions
• No account of mixtures of toxins
• No monitoring cumulative load of low volume highly toxic pollutants (BETX, phenol, PAH, alkanes, heavy metals, radon etc)
• No one is considering the risk from silica
29 gas wells within a 2km radius

• The nearest air monitor is almost 7 km away

• At least 70 other emission sources within 2 km which are engineered to vent and emit gas
Emission sources

- **HIGH POINT VENTS**
  - ARG_HPV001; ARG_HPV002; ARG_HPV003; ARG_HPV4_; ARG_HPV005; ARG_HPV5_1; ARG_HPV5_2; ARG.HPV.004; ARG_HPV006; ARG_HPV007; ARG_HPV_011; ARG_HPV_012; ARG_HPV_013; ARG_HPV_014; ARG_HPV_015

- **HYDRAULIC POWER UNITS**
  - ARGYLE #13; ARGYLE #14; ARGYLE #15; ARGYLE #17; ARGYLE #18; ARGYLE #19; ARGYLE #20; ARGYLE #21; ARGYLE #22; ARGYLE #23; ARGYLE #24; ARGYLE #27; ARGYLE #28; ARGYLE #29; ARGYLE #31; ARGYLE #32; ARGYLE #35; ARGYLE #36; ARGYLE #37; ARGYLE #39; ARGYLE #48; ARGYLE #52; ARGYLE #53; ARGYLE #240; ARGYLE #242; KENYA #23

- **VENT ON WATER PIPE @ WELL**
  - ARGYLE #33; ARGYLE #41; ARGYLE #40; ARGYLE #48; ARGYLE #39; ARGYLE #32; ARGYLE #31; ARGYLE #24; ARGYLE #15; ARGYLE #13; KENYA #23; ARGYLE #14; ARGYLE #23; ARGYLE #16; ARGYLE #17; ARGYLE #19; ARGYLE #20; ARGYLE #22; ARGYLE #27; ARGYLE #18; ARGYLE #21; ARGYLE #29; ARGYLE #28; ARGYLE #35; ARGYLE #37; ARGYLE #34; ARGYLE #36; ARGYLE #43; ARGYLE #44; ARGYLE #52; ARGYLE #45; ARGYLE #53

- **VENT ON WATER OUTLET @ RISERS**
  - ARG_RIS006; ARG_RIS014; ARG_RIS015; ARG_RIS019
Conclusion

The burden of air pollution from the gas industry on the wellbeing of the Darling Downs population is a significant public health concern.
An in-depth health impact study has yet to be conducted in an Australian CSG region.

prospect for future health studies
GISERA planned health project 2 years

- “To determine whether there are hazards with viable causal pathways that may result in impacts on human health”.

- **Scoping, identification, screening**
- Not concentrating on final 2 stages
  - in-depth exposure and risk assessments, health outcome assessments.
- conclusions, future management
Looking for pathways but actively excluding

• gas fired power stations,
• underground coal gasification,
• coal mining
By 2020

still no health outcomes
Not in my brief... but

• Leave you with a couple of thoughts
Reverse osmosis outlet into the town water supply
Chinchilla weir
Thank you for listening
Food for thought

- Royalties from CSG since 2010
  - $400 million
    - Source: gasfield commission presentation, Dalby, May 2018

- Gaming machine tax 2015/2016
  - $577 million
    - Source: Qld gov budget papers
limitations

• Hospitalisation data
• No demographics (age/gender) times/ dates of admission
• No data on drive in/drive out workers
• Changes in cigarette smoking/obesity/prior health of residents moving in and moving out of the area
• Viral epidemics (eg swine flu 2009, but expected peak and return to baseline did not occur).

• NPI data
• Annual estimates of aggregate pollutant load
• ? Underestimated, ?how could estimates be audited
• Does not capture spatial or temporal conditions
GISERA- changing the results before the study even starts

“The literature review conducted as part of the health study design project highlighted that there is currently insufficient evidence to conclude that health impacts associated with CSG activities exist.”

What was actually said in the health design project literature review:

“The literature review conducted as part of the project highlighted a lack of robust studies around the stressors and health impacts associated with Australian CSG activities”.

And

“an indepth health impact study has yet to be conducted in an Australian CSG region.”
Long-term Affected Areas
As of 12\textsuperscript{th} July 2018 The Queensland Department of Environment and Science (DES) advises:

- 459 bores in the Surat Cumulative Management Area are predicted to have impaired capacity.
- 127 of these bores are in the Immediately Affected Area (IAA).
- To date, 73 bores have acknowledged impairment and are under make good agreements.
- DES advises that the number of bores in dispute or undergoing negotiations for make good agreements is not part of DES’s public register and this information is not publicly available.
- 555 business days to get a make good agreement (Helen Bender, Senate Inquiry Dalby)
CSIRO Characterisation of Regional Fluxes of Methane in the Surat Basin, Queensland Interim report March 2017

• **Methane** concentration roses for each monitoring site show *higher concentrations for wind directions emanating from the CSG area*.

• Differences in methane concentration between Ironbark and Burncluith, when the wind is in line with the two stations, provides the background - subtracted concentration differences due mainly to sources between the sites.

• These **differences** are typically less than 50 ppb but *occasionally 100-200 ppb*, compared to a background concentration of about 1800 ppb.
• If best practices are adhered to and the site is well regulated, then on-site sources are typically small compared to e.g. a large industrial installation, (PHE, 2013).
Percentage increase of UK’s 2012 national total emissions by 400 shale gas wells

- NOx : additional 1 - 4%
- NMVOC : additional 1 - 3%
- PM : additional 0.1 - 1%
- CH4 : additional 0.2 – 1% of the national total emission.

- Impacts on local and regional air quality have the potential to be substantially higher than the national level impacts, as extraction activities are likely to be highly clustered.
Site preparation- emissions

• mostly NOx and PM from large diesel-powered vehicles used during site preparation, construction, and the transport of water and sand to and from the sites.

• NOx, PM and NMVOCs are emitted from diesel powered site machinery; drill rigs, generator engines, pumps, and compressors (Moore et al., 2014, Field et al 2014a).
drilling

• extensive daily deliveries and removals to provide the essential materials (such as cement for sealing the well from the freshwater zone) and to remove the debris and waste.
• Results in emissions of NOx and PM from freight vehicles, diesel powered mobile machinery, and
• CH4, NMVOCs and sulphur compounds from the drilling activities.
Gas Extraction, Processing and Separation, construction pipelines, infrastructure

- NOx, PM, and NMVOCs can be emitted during the construction of infrastructure, and from mobile machinery and freight vehicles required during the operational lifetime of the well
NMVOCs

- combustion sources (including road vehicles),
- fugitive emissions from gas and
- fugitive emissions from condensate. (Field et al, 2014)
- water treatment and recycling facility (Warneke et al, 2014)
- gas well pads with collection and dehydration on the well pad clearly associated with higher emissions than other wells.
- The main NMVOC source categories from individual point sources were fugitive emissions from sources such as: dehydrators, condensate tank flashing (when condensate is pumped at high pressure into a tank) and pneumatic devices and pumps.
Most significant source categories for NOx in 2012 (US emissions data shale gas)

- drill rigs (67%)
- midstream compressor stations (CS) and gas processing plants (GP) (31%).

Most significant sources of NMVOCs in 2012

- Drill rigs (43%),
- pneumatic devices (8%),
- midstream compressor stations and gas processing plants (36%),
- and completion venting (11%)

- This study only included machinery or equipment concerned with drilling, fracturing and gas recovery activities. Freight vehicles making journeys to and from the site were not included.
Need

• Remedies for the exposed population
The hazardous substances associated with CSG water in Queensland include

• fluoride,
• boron,
• lead and
• benzene.

The exposure pathways for CSG water are

• (1) water used for municipal purposes;
• (2) recreational water activities in rivers;
• (3) occupational exposures;
• (4) water extracted from contaminated aquifers; and
• (5) indirect exposure through the food chain.
Although CSG water contaminants are well documented in the literature, there is little observational data available on the CSG water in Queensland that people are exposed to.

“It appears to be no centralised monitoring of CSG water to allow exposure pathway contaminant characteristic to be reliably estimated”.

Coal seam gas water: potential hazards and exposure pathways in Queensland 2015
Figure 5 Example of a hypothetical conceptual site model for the operational phase of CSG development. Letters correspond with a potential exposure pathway in Table 2. Graphic developed by Rachel Mackie (QAEHS)
Mental health impacts

- Farmers in the CSG- Stressed and Globally-Stressed profiles exhibited clinically significant levels of psychological morbidity.

- Dr Methuen Morgan

- Darling Downs hospital statistics
- Hospitalisation for attempted suicide
- 230 in 2007
- 471 in 2014
Concerns about cancer

- reviewed hospitalisation data up to 2011 for 3 areas in Queensland, with the finding that certain hospital admissions rates (neoplasms and blood/immune diseases) increased more quickly in the CSG area than the other study areas, after adjusting for key sociodemographic factors.
- Werner et al
Need health studies

• Independent, trustworthy, fully funded, comprehensive, transparent
• Exposure monitoring, including exposure to endocrine disruptors
• Assessment of cumulative health impacts from multiple exposure sources
• Short term and long term
• Residents and workers including those who have already left the district
The Australian Government has failed to respect and protect the human right to a safe, clean, healthy and sustainable environment.
Human rights impacts of unconventional gas
preliminary statement

- “...evidence which clearly established beyond any reasonable doubt the reality of violations of the rights of humans and of nature, and a significant contribution to climate change.”

- “...the violations of rights are generally planned and implemented intentionally, as well as being hidden when possible and denied when exposed.”
Need a complete change in policy

• Rapid transition away from fossil fuels
No baseline No monitoring

NO DATA

NO PROBLEM