University of the West of England
BRISTOL

AIR QUALITY MANAGEMENT aqm RESOURCE CENTRE, BRISTOL

Fracking and the Environment: Implications for Air Pollution

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Lloyd's Register Foundation

Who are AQMRC?

Lessons from History

- Society chooses air pollution BUT our willingness to accept a particular amount of pollution changes over time.
- Air pollution is a consequence of political, economic and societal choices and the availability of technology.
- The link between air pollution and energy is historical:
  - 1257 Queen Eleanor leaves Nottingham *"to preserve her health from coal smoke."*
  - 1659 John Evelyn described the smoke of London as *"Such a cloud of sea coal as if there be a resemblance of hell upon earth… "*
  - 1839 Major General Sir Charles James Napier stated *"I ought to be at Manchester but unless under positive orders who can resolve to run up a chimney?*
  - 1952 London Smog – *4000 excess deaths in 5 days*
  - 2013 Local Air Quality Management - *approximately 60% of local authorities have declared an Air Quality Management Area for one or more pollutants*
  - *2013 UK GHG - UK's greenhouse gas emissions rose 3.5% in 2012 'primarily' due to the switch from gas to coal electricity generation*

The Impact of Air Pollution

- Poor ambient air quality is projected to be the world's leading environmental cause of mortality by 2050, ahead of dirty water and lack of sanitation (OECD, 2012) .

- Health effects include: respiratory illness, asthma, allergenic illnesses, diabetes, heart disease, cancer, adverse pregnancy and birth outcomes and lowering of male fertility (WHO, 2013) and air pollution now classed in the same category as tobacco smoke and UV radiation – Group 1: carcinogenic to humans (IARC, 2013).

- Costs to UK society from poor air quality are on a par with those from smoking and obesity, *reducing life expectancy on average by 6 months at an estimated cost of around £16 billion per annum* (House of Commons Environmental Audit Committee Report, 2011).

- Climate change affects the social and environmental determinants of health – clean air, safe drinking water, sufficient food and secure shelter (WHO, 2013)

Preliminary Risk Assessment (1)

Environmental aspect	Project phase						
	Site identification and preparation	Well design drilling, casing, cementing	Fracturing	Well completion	Production	Well abandonment and post-abandonment	Overall rating across all phases
	Individual site						
Groundwater contamination	Not applicable	Low	Moderate-**High**	**High**	Moderate-**High**	Not classifiable	**High**
Surface water contamination	Low	Moderate	Moderate-**High**	**High**	Low	Not applicable	**High**
Water resources	Not applicable	Not applicable	Moderate	Not applicable	Moderate	Not applicable	Moderate
Release to air	Low	Moderate	Moderate	Moderate	Moderate	Low	Moderate
Land take	Moderate	Not applicable	Not applicable	Not applicable	Moderate	Not classifiable	Moderate
Risk to biodiversity	Not classifiable	Low	Low	Low	Moderate	Not classifiable	Moderate
Noise impacts	Low	Moderate	Moderate	Not classifiable	Low	Not applicable	Moderate – **High**
Visual impact	Low	Low	Low	Not applicable	Low	Low-moderate	Low - Moderate
Seismicity	Not applicable	Not applicable	Low	Low	Not applicable	Not applicable	Low
Traffic	Low	Low	Moderate	Low	Low	Not applicable	Moderate

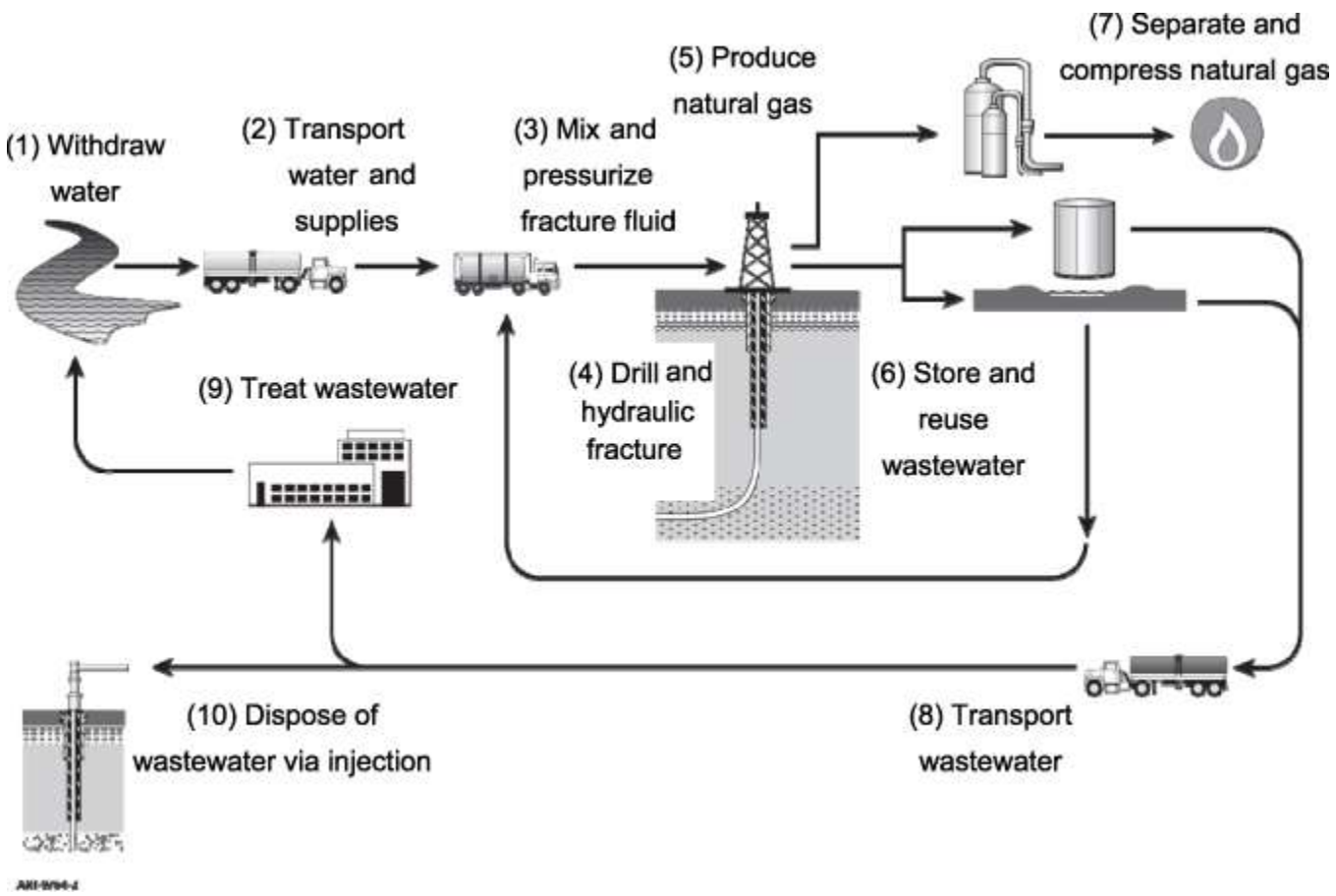
EU, 2013

Preliminary Risk Assessment (2)

Environmental aspect	Project phase						
	Site identification and preparation	Well design drilling, casing, cementing	Fracturing	Well completion	Production	Well abandonment and post-abandonment	Overall rating across all phases
	Cumulative						
Groundwater contamination	Not applicable	Low	Moderate-**High**	**High**	**High**	Not classifiable	**High**
Surface water contamination	Moderate	Moderate	Moderate-**High**	**High**	Moderate	Not applicable	**High**
Water resources	Not applicable	Not applicable	**High**	Not applicable	**High**	Not applicable	**High**
Release to air	Low	**High**	**High**	**High**	**High**	Moderate	**High**
Land take	**Very high**	Not applicable	Not applicable	Not applicable	**High**	Not classifiable	**High**
Risk to biodiversity	Not classifiable	Low	Moderate	Moderate	**High**	Not classifiable	**High**
Noise impacts	Low	**High**	Moderate	Not classifiable	Low	Not applicable	**High**
Visual impact	Moderate	Moderate	Moderate	Not applicable	Low	Low-moderate	Moderate
Seismicity	Not applicable	Not applicable	Low	Low	Not applicable	Not applicable	Low
Traffic	**High**	**High**	**High**	Moderate	Low	Not applicable	**High**

EU, 2013

Sources and Pollutants



Ozone Precursors
Odour
Methane
Carbon Dioxide
Hydrogen Sulphide
Particulates
NO_x/NO_2
nmVOC
Sulphur Dioxide
Carbon Monoxide
Benzene
and others…..

NO EMISSION CONSISTENCY

Image - Litovitz *et al* 2013

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Local Air Quality (UK and EU)

NO_2

- 40µg/m^3 annual mean and 200µg/m^3 1-hr mean no more than 18 times
- 40 out of 43 zones in the UK exceeding LV

PM_{10}

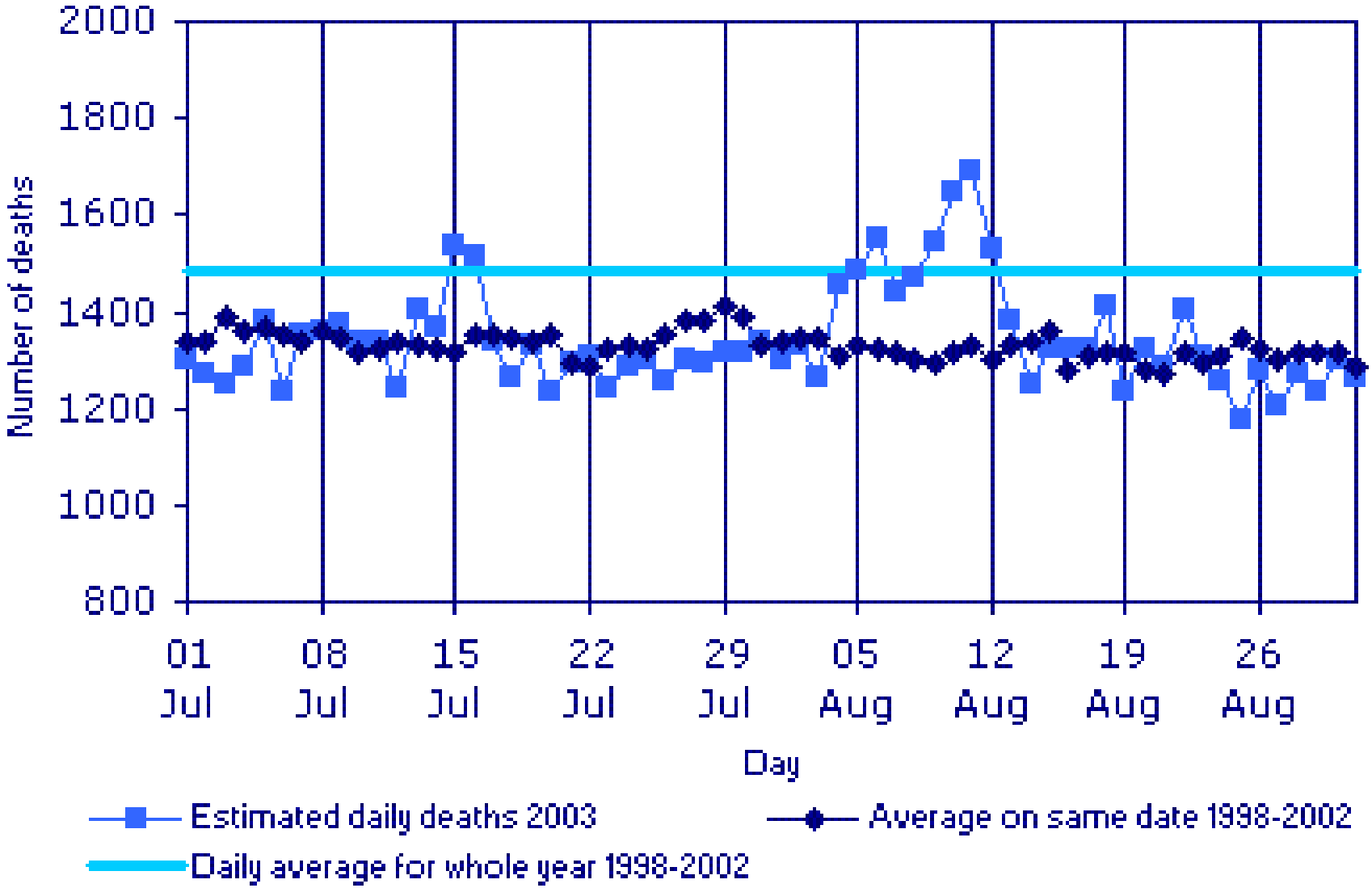
- 40µg/m^3 annual mean and 50µg/m^3 24-hr mean no more than 35 times
- Only London is exceeding LV

Fracking Concerns:

- Contribution to background concentrations
- Increased traffic movements
- Re-suspension of dust from unpaved work areas
- Contribution to public exposure and subsequent health impacts

A Typical AQMA

Regional – O_3 (and Methane)



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Air Pollution Management?

Need appropriate regulatory control in the UK

- Local Air Quality Management
- Environment Agency regulation
- Local Transport Plans

Data for emission inventories – source apportionment

Baseline monitoring – need to understand the background concentrations

Activity monitoring and modelling – need to understand the impact

BAT for emission reduction strategies

Compulsory ‘green completion’?

Need for direct methane legislation at EU and MS level? EU AAQD, NECD, IED?

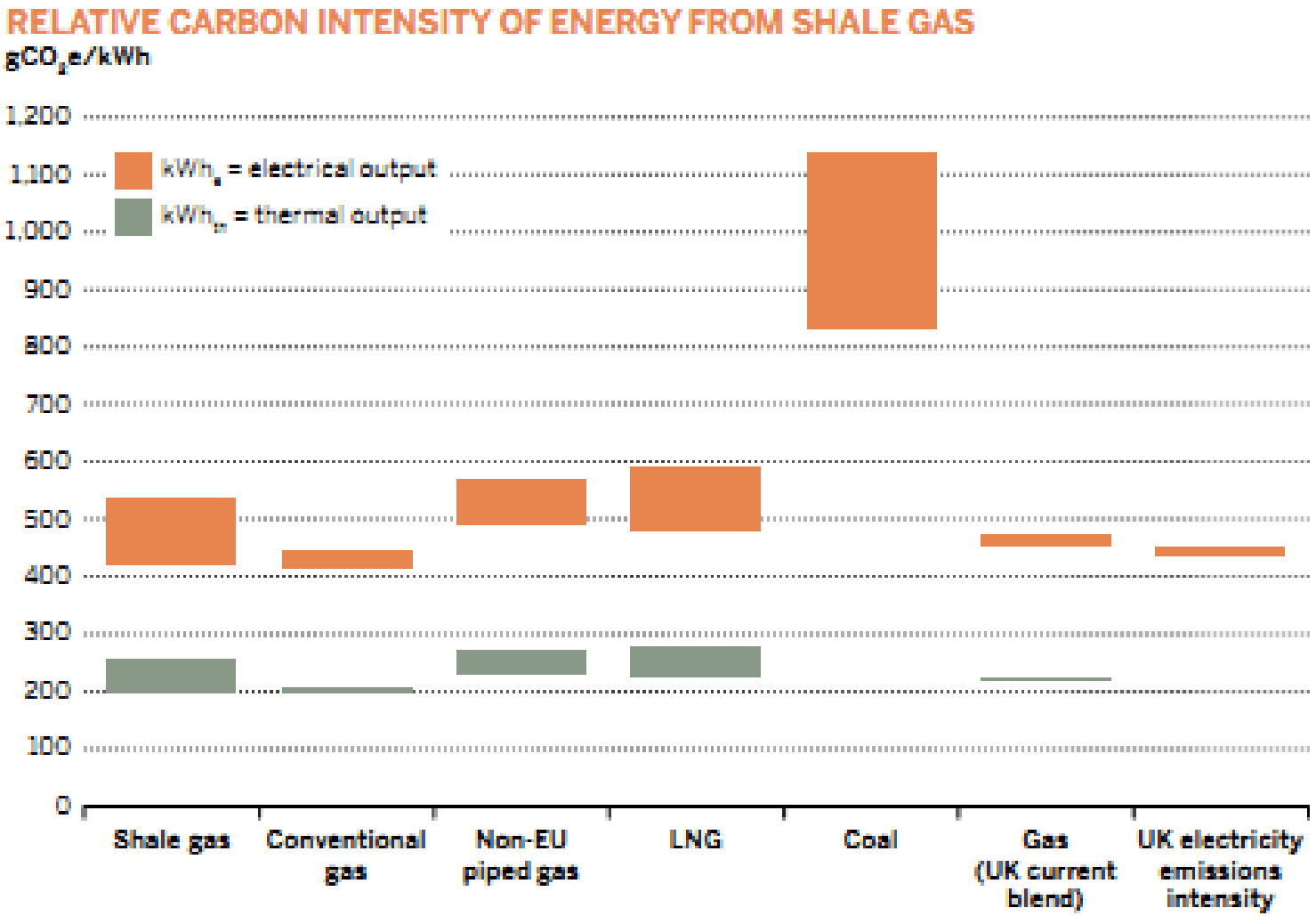
Global - The Elephant in the Room

- Shale Gas v Low Carbon Futures
- Is shale gas our transition solution?
- Evidence on total carbon is variable

DECC, 2013 (MacKay & Stone)

- Shale likely to impact on LNG imports
- Net effect on GHG is likely to be small
- Short-term and long-term effects.....…uncertain
- Production of shale gas could increase global cumulative GHG emissions if displace fossil fuels are used elsewhere

MacKay & Stone (2013)



Note: Units are in grams CO2 equivalent per kilowatt-hour delivered energy.
Assumes methane released during well completion is 90% captured and flared

Source: MacKay, DJ, Stone, TJ: Potential greenhouse gas emissions associated with shale gas extraction and use. DECC, 9 September 2013

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Conclusions

"Fracking for shale gas is not a "great evil" and can act as a bridge to a "green future" in the UK as long as it is properly regulated."
Ed Davey, Guardian - 9th September 2013

"Hundreds of thousands of words will be written about the latest report from the UN's Intergovernmental Panel on Climate Change. Here, in 10 words, is the bottom line: we have to leave most fossil fuels in the ground. It really is that simple."
New Scientist - 1st October 2013

"*The key to having a good understanding of the challenges and risks of shale gas extraction is reliable information"*
Ends - November 2013

"….without such data, it would be difficult to undertake a detailed assessment of the impact of emissions on human health."
Public Health England – October 2013

A Low Carbon Future?

Low carbon Bristol in 2050

Shale gas is not part of either scenario!!

If the research was repeated now would shale gas be included?

www.futurebristol.co.uk

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Thank You!!

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Air Quality Management Resource Centre
http://www1.uwe.ac.uk/et/research/aqmrc

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www.lrfoundation.org.uk

Some Useful Reading

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