

# Jo McCubbin - Paediatrician

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Two Parts:

- Pictorial tour of personal involvement
- Population health in gas fields

# My involvement - slideshow

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- ◉ Beach Energy letter
- ◉ Pictorial tour of my neighbour's drill sites
- ◉ Site clean up
- ◉ Wombat field
- ◉ Community responses

# Health risks

- Modes of harm
- Types of damage caused
- Evidence for child health effects

**Having a gas neighbour!**

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31<sup>st</sup> July 2012

Ref: BE/3997/12

To: The Landowner

**RE: Operations at Boundary Creek-2**

Beach Energy Limited (Beach) as Operator for PRL2 wishes to advise nearby landowners of its planned workover and stimulation program for the Boundary Creek-2 well, situated on Merrick's Rd. We have identified that your property lies within 3km of the well site.

Beach plans to complete the well, which has been suspended since it was drilled by Lakes Oil in 2005, so that the well can be stimulated in an effort to produce gas at economic rates. Several intervals within thick gas saturated sandstone from 700-900m deep will be targeted to determine whether further work is warranted in the well and in the field as a whole.

The workover program will involve minor earthworks to upgrade the surface of the existing lease and modifications to the wellhead cellar, followed by the mobilizing of Superior Energy's rig to the site to re-establish the well and to run suitable high strength casing in the well. There will be an increase in traffic along Merrick's Rd during the rig move and occasional clanging of pipes and some diesel motor noise. The rig will be onsite for approximately 6 days with all work being conducted during daylight.

Soon after the rig has completed the well, the stimulation contractor will be mobilized; however the timing of this is subject to the contractor completing similar operations near Seaspray. There will be an increase in traffic along Merrick's Rd as the stimulation equipment is mobilized but following that, most associated traffic will be in the form of light vehicles. The stimulation treatment will involve up to 8 periods of high pressure pumping over a period of about 10-14 days. The duration of each pumping cycle will be approximately 1-2 hours during which time elevated noise levels will be experienced; all pumping will occur during daylight and there will be no significant night time activities. Following the stimulation activities there will be a period of testing which will involve flowing the well and burning off the produced gas. The testing is expected to take up to a fortnight and will be conducted continuously if the stimulation has been successful. It is not envisaged that there will be any disturbance to the

25 Conyngham St, Glenside South Australia 5065  
GPO Box 175 Adelaide 5001  
Telephone (61 8) 8338 2833  
Facsimile (61 8) 8338 2336  
Beach Energy Limited ABN 20 007 617 969  
Website: [www.beachenergy.com.au](http://www.beachenergy.com.au)

# Boundary Creek 1 & 2



IRISH OF GL  
CROWN ALLOT

TITLE REF: LP 142

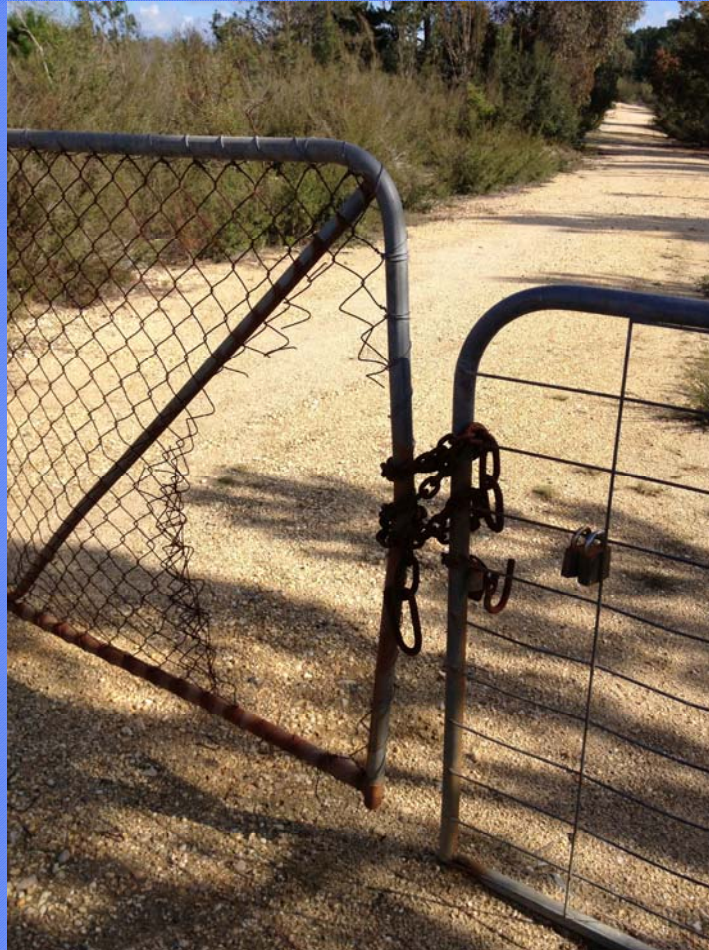
LAST PLAN REF: P

MAGNETIC  
MERIDIAN



# Lock the Gate??????

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# Tight (gas) security

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# Holding pond

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# Rusty pipedreams?

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# Iron oxides

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# July 2012 Gippsland Times



# Boundary Creek No 1

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# Crumpled concrete

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# BC 1 flare pit background

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# Boundary Creek No. 2



# Summertime Feb 2013





Autumn 2013 – good signage

Remnant blue paintwork











# Winter reflections

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# North towards BC No 1

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# Dampened enthusiasm??

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A photograph of a gravelly site with dense trees in the background and yellow text overlaid. The foreground is a wide, flat area covered in light-colored gravel and small stones, with sparse green vegetation. In the background, there is a thick line of trees, including several tall, dark green pine trees. The sky is blue with some white clouds. The text is overlaid in the center of the image.

**Pipes? - what PIPES?**  
**Site clean up – sort of....**

**Pond gone too!**



# Curious square hole



# Cover up???

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# Seaspray aerial view April 2013











# Melbourne Rally 2013

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# Gas concern boils down to fear for health

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# Human health in a gas field

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- ⦿ Threats to water
- ⦿ Threats to air quality
- ⦿ Threats to food chain and exports
- ⦿ Global warming contribution
- ⦿ Mental Health effects



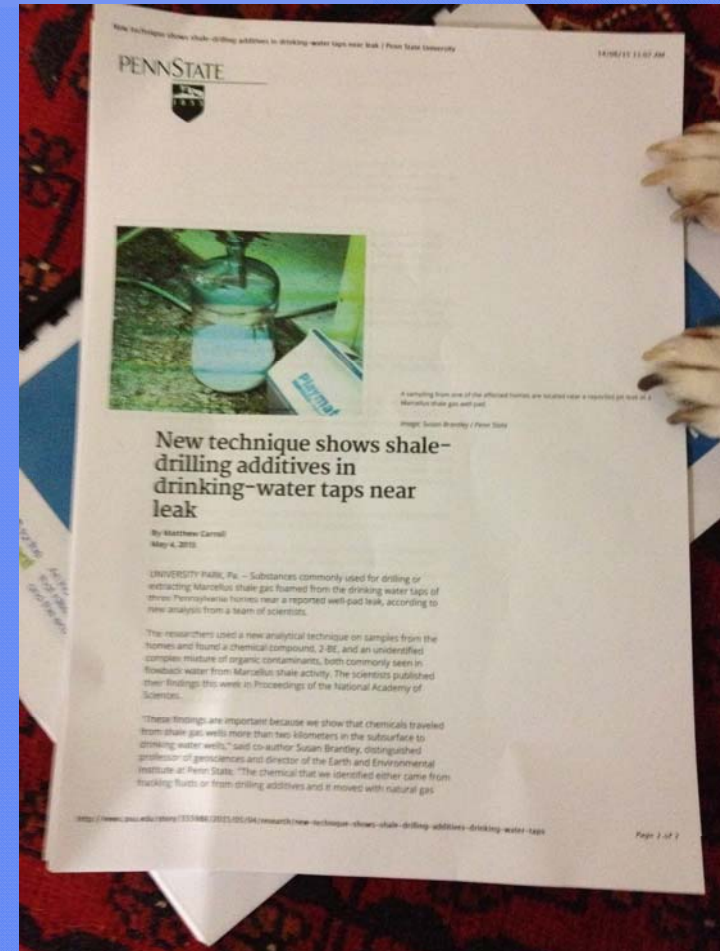
# **WATER**

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Obvious concern but the evidence is limited  
at this early stage..... incidents have been  
documented in Qld and NSW

# Water Contamination

- Via surface spills, floods
- Via faults, fracks, cracks or seismic activity affecting aquifers
- New technique shows contamination of drinking water. Sampled before homes sold to company under legal settlement



# Lakesoil



ACN: 004 247 214

Lakes Oil N.L.

## Quarterly Activities Report

For the three months ended  
31 March 2013

### Headlines:

- **Corporate – Capital Raising and changes to Board Composition**
- **PEP 166: Drilling Yallourn Power 1 corehole.**
- **PEP 169: Delays in Drilling Otway 1**

### Wombat 3: Flow testing of Strzelecki oil

Lakes Oil believes that the live oil (~10 barrels) previously encountered in Wombat 3 has migrated along natural fractures from oil bearing source rocks located significantly below the total depth of the well. Lakes have never fully tested this oil flow in isolation.

Lakes Oil plans to isolate the oil bearing zone in Wombat 3 in order to flow test the oil that was previously identified (2103-2105 m). It is proposed to seal off the gas/water producing zone at the top of the Strzelecki Group and run a pumping completion into the hole to test the productivity of the lower oil/gas zone.

The Company plans to install a downhole pump over the interval (2103-2105m), which will hopefully result in a substantially higher rate than achieved previously (refer to diagram below). The well will be tested for a period of at least one month to determine the productivity from the oil zone. The gas will be produced up the annulus and flared when necessary during testing. Depending on results, permanent surface equipment will be installed or the well shut-in.

It is planned to carry out this program as soon as possible, once all necessary approvals have been granted.

## Para 1 & 2 of the report states....

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- Oil previously encountered in Wombat 3 has migrated along *natural fractures* from oil bearing source rocks located *significantly below* the total depth of this well.
- ..plans to isolate the oil bearing zone in Wombat 3 in order to flow test oil that was previously identified (2103-2105 m)...It is proposed to seal off the gas/water producing zone....

## Air Quality

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Perhaps the most concerning, as the evidence from the US suggests this is an important cause of **documented** health effects in gas fields

# Air quality

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- ◎ Fine particles  $PM_{10}$  and especially  $PM_{2.5}$  are well recognised as damaging to health
- ◎ They get into the blood stream if small enough (think of ventolin)
- ◎ Tiny soot (carbon) particles adsorb heavy metals and organic compounds and smuggle them into the bloodstream




# Particulate pollution



# Air Quality

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- ◉ **WHO April 2015** [www.euro.who.int/en/media-centre/sections/press-releases/2015/air-pollution-costs-european-economies-us\\$-1.6-trillion-a-year-in-diseases-and-deaths,-new-who-study-says](http://www.euro.who.int/en/media-centre/sections/press-releases/2015/air-pollution-costs-european-economies-us$-1.6-trillion-a-year-in-diseases-and-deaths,-new-who-study-says)
- ◉ **Senate Inquiry 2013 Recommendation 43.67**
  - ◉ The committee recommends that pollution monitoring should accurately capture population exposure for communities and homes proximate to pollution point sources.
- ◉ **Hazelwood Inquiry 2014 - RECOMMENDATION 5**
  - ◉ The State equip itself to undertake rapid air quality monitoring in any location in Victoria, to: collect all relevant data, including data on PM<sub>2.5</sub>, carbon monoxide and ozone; and ensure this data is used to inform decision-making within 24 hours of the incident occurring.



Air Quality?

# Threats to food?

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- ◎ Particles may fall on grass, crops or water bodies
- ◎ toxics may be irrigated, flooded or leaked to soil contaminating crops and livestock
- ◎ Export reputation for clean green food?



# History of UCG in US

- Gas rush - mostly since 2005

Cancers often take decades to develop (eg. Asbestos, smoking)

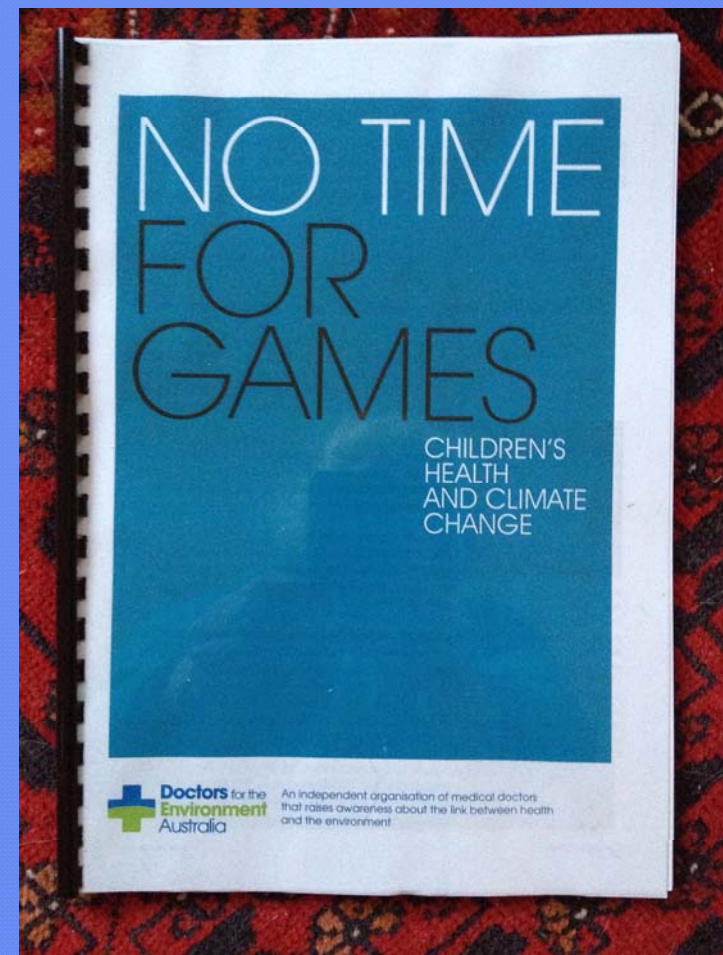
It will be 15 or more years before published, peer reviewed, studies will show cancer incidences etc.

We should wait and see!

# Managing the health effects of Climate Change – The Lancet - June 2015

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- ◉ Methane is 25 x more potent than CO<sup>2</sup>
- ◉ Casings do leak increasingly with age
- ◉ Seismic instability, and subsidence as well as fracking may contribute more leakage
- ◉ Several recent Gippsland earthquakes
- ◉ [www.thelancet.com/climate-change](http://www.thelancet.com/climate-change)



## Mental Health and Community resilience

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- ◉ Community Engagement against the shared enemy IS POSITIVE
- ◉ Watching your community and your lives work (real estate value) diminished is NEGATIVE
- ◉ Rurality increases suicide risk
- ◉ Rurality leads to reduced MH services
- ◉ Substance abuse in rural areas
- ◉ Possibility of neurotoxicity effects from gasfield too.

Would you like a gas well 100m  
from your home?

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If you have no rights  
to protect your land  
and your family, you  
may well feel like  
screaming!



# Mechanisms of injury

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◉ Immediate toxicity

◉ Long term

- heart and lung damage
- other organ systems
- Cancer Risk
- Endocrine disruption

Babies and young children

# Immediate Toxicity

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- ◉ Sore eyes, nose bleeds, cough
- ◉ asthma
- ◉ Vomiting
- ◉ Contact rashes
- ◉ Headaches
- ◉ Loss of consciousness
  
- ◉ Cause and effect seem obvious

# Longer term Effects

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## Heart and Lungs:

- Inhaled particles and gases
- For the foetus, heart malformation
- For low birth weight babies – Hypertension etc

## Other Effects:

- Immune system
- Endocrine Disruption
- Cancer
- Brain

# Immune system

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- Some cells fight bacteria , others viruses and still others attack allergens.
- They secrete factors which draw in other contributors
- Other cells detect and destroy cancer cells
- Some go rogue and attack the self.
- Knocking out one part of this complex interaction may upset the balance and lead to illness

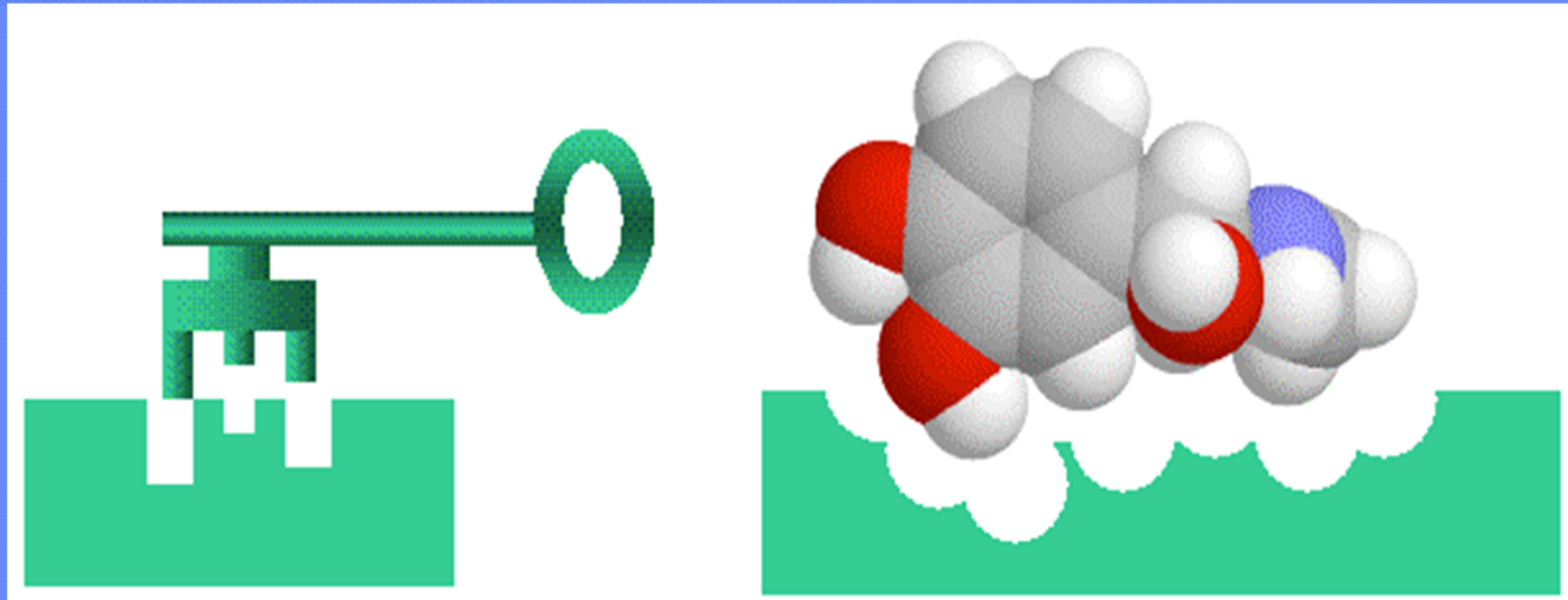
# Hydrocarbons and bone marrow

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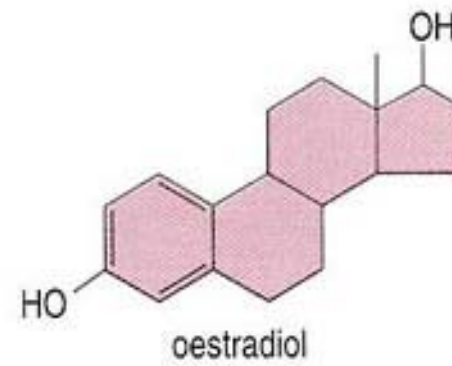
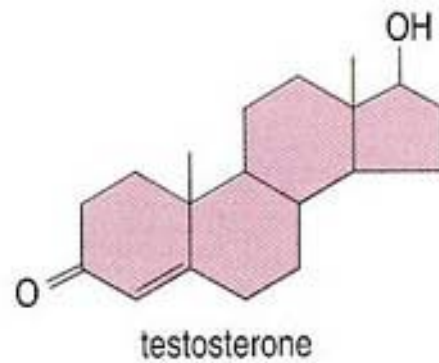
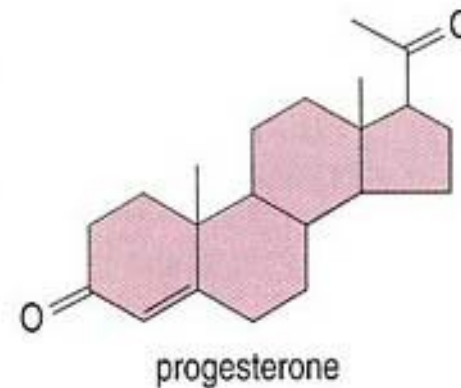
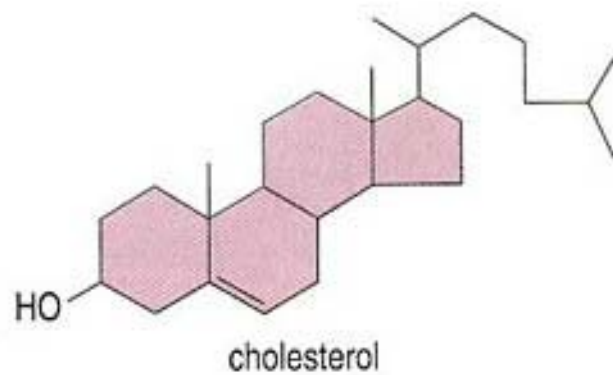
In the adult, the turn over of bone marrow cells is rapid and many hydrocarbons are known or suspected to reduce the rate of new cell formation, resulting in a shortage of cellular protection

# Endocrine – receptor fit

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# Endocrine disruptors



# IMPORTANT ISSUES IN ENDOCRINE DISRUPTION

- ◉ Age at exposure
- ◉ Latency from exposure
- ◉ Importance of mixtures
- ◉ Non traditional dose-response dynamics
- ◉ Transgenerational, epigenetic effects

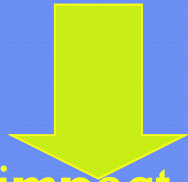
◉ [www.who.int/ceh](http://www.who.int/ceh)





# DIETHYLSTILBESTROL (DES) & ENDOCRINE CANCERS

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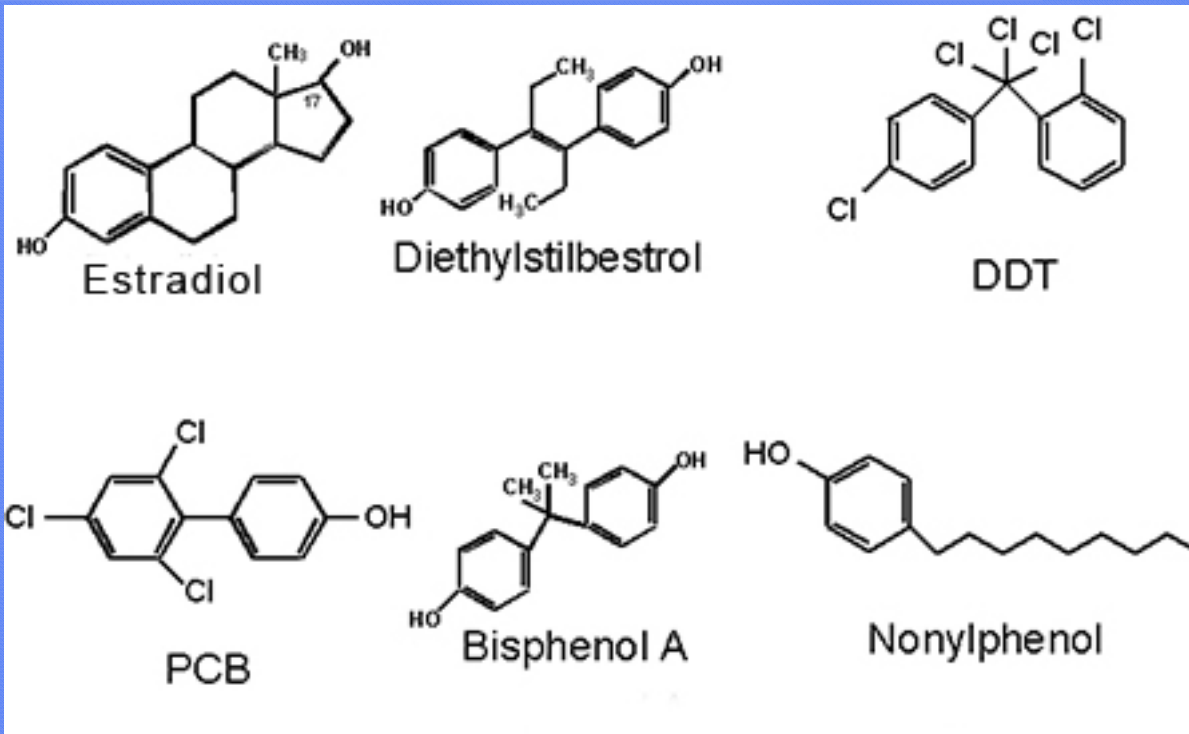
The first observation of the impact of endocrine disruptors in humans was done by Herbst and Bern in 1981:

8 cases of clear cell adenocarcinoma (CCA) of the vagina in young women who had been exposed *in utero* one to two decades earlier to DES, a synthetic estrogen prescribed to pregnant women in the 1950s and 1960s to prevent miscarriage

*Landrigan et al, 2003*

**[www.who.int/ceh](http://www.who.int/ceh)**

# Endocrine Disruption



# Endocrine Disruptors

Some endocrine receptors may trigger maleness in girls or femaleness in boys

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They may cause abnormal sexual development OR reduced fertility

Pesticides and alligator penises

# Cancer

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- ◉ diesel, BTEX and PM2.5 linked to cancers to name but a few
- ◉ Cancers caused through endocrine disruptors
- ◉ Fiskville example of a cluster years later
- ◉ Need to be aware of “The healthy worker effect”

# healthy worker effect.

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**Definitions: phenomenon observed initially in studies of occupational diseases; workers usually exhibit lower overall death rates than the general population because severely ill and disabled people are excluded from employment.**

# Cancer Risk

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**Benzene exposure and risk of lymphohaematopoietic cancers in 25 000 offshore oil industry workers.**

Suggest an association between cumulative and intensity metrics of low-level benzene exposure and risk for AML, MM, and suggestively for CLL.

[Br J Cancer. 2015 Apr 28;112\(9\):1603-12. doi: 10.1038/bjc.2015.108. Epub 2015 Mar 24.](#)

# Other organ systems

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- ◉ Kidneys – emerging links to air pollution
- ◉ Brain – now accepted

# Actual data from actual gas fields

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Where do you get that data and how reliable is it??

”no proven” cases - ? settled out of court ?



# An Exploratory Study of Air Quality Near Natural Gas Operations

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A Rural western Colorado area where  
residences and gas wells co-exist.

Data, before, during, and after drilling and hydraulic fracturing of a new  
natural gas well pad

Weekly air sampling for 1 year

Methylene chloride, a toxic solvent not reported in products used in drilling  
or hydraulic fracturing, was detected 73% of the time

Theo Colborn<sup>a</sup>, Kim Schultz<sup>a</sup>, Lucille Herrick<sup>a</sup> & Carol Kwiatkowski

<sup>a</sup>pages 86-105

[www.tandfonline.com/doi/abs/10.1080/10807039.2012.749447?src=recsys](http://www.tandfonline.com/doi/abs/10.1080/10807039.2012.749447?src=recsys)

# Colorado findings

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## ⦿ Review of the health effects :

- ⦿ Non-methane hydrocarbons: 30 that affect the endocrine system, which is susceptible to chemical impacts at very low concentrations ( far less than government safety standards).
- ⦿
- ⦿ Selected polycyclic aromatic hydrocarbons (PAHs) were at concentrations greater than those at which prenatally exposed children in urban studies had lower developmental and IQ scores.

## What the tabloids say....

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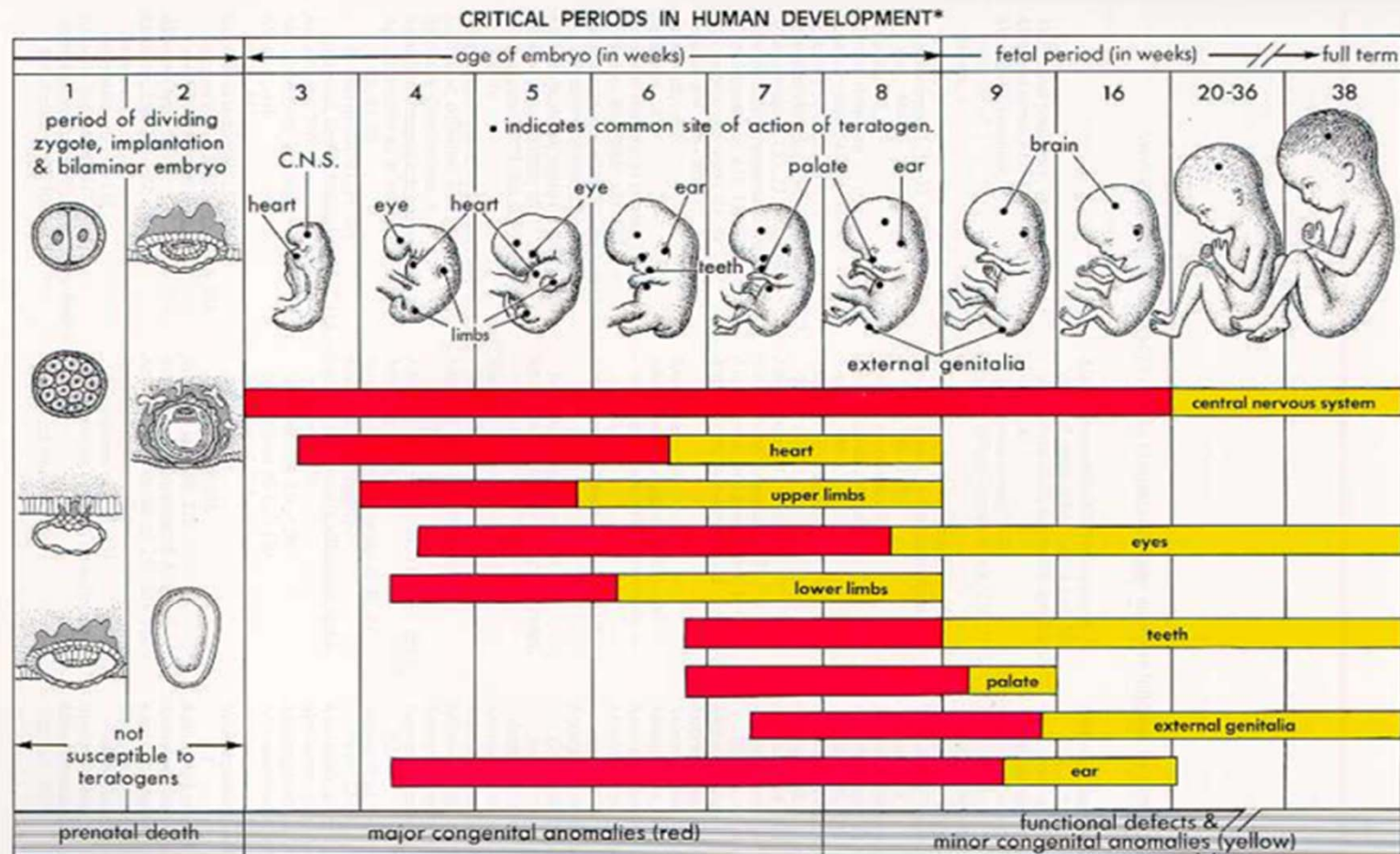
- ◎ **Emissions from diesel can damage children's brains and increase the risk of autism and schizophrenia, scientists warn**
- ◎ **Nitrogen dioxide, created by diesel causes damage to lungs and throat  
American scientists have warned that fumes also linked to autism**
- ◎ **Warning comes after research carried out on autistic babies in California : 05:21 EST, 7 April 2014 UK daily Mail.**

# Harvard Public Health Study

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- ◉ Women exposed to high levels of fine particulate matter specifically during pregnancy—particularly during the third trimester—may face up to twice the risk of having a child with autism than mothers living in areas with low particulate matter
- ◉ Using data from nurses health study
- ◉ Dec 2014

# Critical periods in human development



# Children's brains

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- Depending on:
- the pollutant component
- doses
- exposure
- age and gender
- health status, etc.,
- the detrimental effects range from:
- endothelial dysfunction, breakdown of the blood-brain-barrier (BBB; Levesque et al., [2011](#)),
- neuroinflammation (Fonken et al., [2011](#)),
- formation of free radicals and oxidative stress (Guo et al., [2012](#)),
- dopaminergic neuronal damage, RNA and DNA damage, to the identification of early hallmarks of Alzheimer and Parkinson's diseases (Brun et al., [2012](#)).
- <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4129915>

# Animal studies – the foetus

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- In spite of the complexity, the evidence conclusively showed in animals that prenatal exposure to either one or a combination of criteria pollutants caused permanent changes in neurotransmitters and altered brain development, most commonly resulting in long-term deficits.

# Birth weight – Pennsylvania

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- ◉ Births from 2003-2010
- ◉ Well or town water supply – no difference
- ◉ Air quality results in significant reduction
- ◉ Chinese data backs this too
- ◉ PAH's linked to LBW and IUGR
- ◉ Pennsylvania study lower Apgar too



# Colorado study – heart development

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- 12,842 live births 1996-2009 within 10 miles of a gas well or > 10 miles
- Congenital heart defects - statistically increased risk
- BW - not significant reduction
- Prematurity - not associated
- Cleft palate and lip - not associated

# How many doctors does it take to change a.....?



# Real economic assessment

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- ◉ The costs of health effects which will far out last the gas production, need to be factored in to the real cost benefit analysis of on-shore gas!

## Take home message ....

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- We should hasten slowly!
- Await rigorous scientific proof that there is NO HARM to health!