Inquiry into unconventional gas in Victoria: Public health considerations

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Role of the Chief Health Officer and the DHHS

The Chief Health Officer is a statutory office holder appointed by the Secretary of the Department of Health & Human Services (DHHS) under section 20 of the *Public Health and Wellbeing Act 2008*.

The Chief Health Officer has the following functions and powers:

- develops and implements strategies to promote and protect public health and wellbeing
- provides advice to the Minister for Health and DHHS Secretary on matters relating to public health and wellbeing
- exercises specific legislative roles.

The CHO also has an **advisory role** regarding investigations or inquiries relating to potential impacts on public health such as non-occupational or community-level exposures.

Public health risk assessment and management

A well-recognised and agreed set of steps is used:

1. Identify hazards of concern
2. Identify what doses of hazards are associated with what health effects
3. Determine how people might be exposed to the hazards
4. Characterise the potential for (and scale of) adverse health effects (i.e. risk characterisation)
5. Determine measures to reduce risk of adverse health effects (i.e. risk management)

Comprehensive health risk assessment and management requires strong scientific evidence.

Key hazards

- Chemicals (including chemical mixtures)
  - ***used*** in gas extraction (e.g. hydraulic fracturing chemicals)
  - ***produced*** in gas extraction (e.g. naturally occurring gases, chemicals and radioactive materials liberated by the process)
- Dust and particles
- Noise
- Other (e.g. climate change effects from greenhouse gas emissions)

Many potential hazards remain unknown.

Chemical hazards

- Many different chemicals may be used and produced due to unconventional gas operations. Available evidence indicates these may include:
  - Acids (e.g. hydrochloric acid, peroxydisulfuric acid)
  - Alcohols (e.g. methanol, isopropanol, ethanol)
  - Hydrocarbons (e.g. petroleum distillates, methane)
  - Metals (e.g. arsenic, mercury, cadmium)
  - Naturally occurring radioactive materials (e.g. radon)
  - Polycyclic aromatic hydrocarbons (e.g. naphthalene)
  - Surfactants (e.g. 2-butoxyethanol)
  - Volatile organic compounds (e.g. benzene, xylene, ethyl-benzene)

Many chemicals remain unknown.

Potential health effects?

- The potential for health effects depends on the **hazard**, how much people are exposed to (i.e. **the dose**) and the **duration of the exposure**.
- Potential health effects may include:
  - immune system effects
  - nervous system damage
  - liver and kidney toxicity
  - reproductive and developmental toxicity
  - cancers
  - respiratory and cardiovascular illness
  - psychological effects

How might people be exposed to hazards?

Contaminated land

- e.g. from chemical spills and inappropriate disposal of wastes including hydraulic fracturing fluids
    - potential impacts on land, including secondary contamination of primary produced products such as food crops and livestock

Contaminated surface and ground water supplies

- e.g. from chemical spills, injection of hydraulic fracturing fluids, inadequate treatment and disposal of wastewater
    - potential impacts on drinking water, water used for irrigation, recreational use of waterways, and stock and domestic use

Pollutants in the air

- e.g. due to fugitive gas emissions, dust from contaminated land and operation of machinery

Risk characterisation – key knowledge gaps

- There is significant uncertainty regarding several aspects of public health risk related to unconventional gas activities.
- Many potential hazards remain unknown.
- Knowledge is lacking regarding potential hazards and their:
  - physical and chemical properties
  - how they move in the environment
  - associated health effects
  - dose-response relationships (i.e. at what doses might you see which health effects)
- These **gaps prevent comprehensive health risk assessments** from being undertaken for the full range of potential hazards.
- Further there is limited understanding of the health impacts from exposure to chemical mixtures.

Risk characterisation – key knowledge gaps

- **Health guideline values are not available** for all known hazards, including those relevant to **different exposure routes** including:
  - Oral intake (ingestion) (e.g. drinking water guidelines)
  - Inhalation (e.g. air quality guidelines)
  - Topical (e.g. guidelines relevant to skin contact)
- **Limited evidence is available** in relation to short- and long-term health effects (due to limited scientific studies)
- Importantly, there is also **no evidence to rule out such health effects**.

Knowledge gaps - example

Hydraulic fracturing chemicals

- Many designated as proprietary (i.e. commercial-in-confidence) and not disclosed
- Of 1,076 chemicals compiled by the United States Environmental Protection Agency (US EPA):
  - physicochemical properties could only be obtained for 453 (42%)
  - levels that people can safely consume over a lifetime without health effects could only be determined for 90 (8%)

Source: Assessment of the potential impacts of hydraulic fracturing for oil and gas on drinking water resources (United States Environmental Protection Agency June 2015).

Risk management issues

- Preventive risk management is essential to reducing risks to an acceptable level. Key elements include risk mitigation measures, and operational procedures and process control.
- Published reports have examined the level of effectiveness of various elements such as risk mitigation measures. Despite mitigation measures, examples reported by the US EPA (2015) indicate:
  - 151 spills of hydraulic fracturing chemicals, where fluids reached surface water in 9% of cases and soil in 64% of cases
  - at least 3% of surveyed wells did not have cement across a portion of casing (which is aimed at preventing chemicals and gases entering groundwater)
- While such events may be of relatively low frequency or likelihood, potential consequences could be significant and potentially irreversible.

Key elements required to protect public health

- **Comprehensive assessment and management of potential risks** to human health, including:
  - a comprehensive understanding of the risks and potential impacts
  - the likelihood and consequences of key hazardous events
  - stringent risk mitigation measures
  - an understanding of the **effectiveness** of risk mitigation measures
- **Full disclosure of chemicals for proposed projects.**
- **Consideration of the potential health effects** from exposure to chemical mixtures (in addition to individual chemicals).
- **Strong and effective regulatory oversight.**
- **Engagement with national peak health bodies** (e.g. the National Health and Medical Research Council).

Summary

- There are a number of potential hazards associated with unconventional gas activities.
- The full range of hazards is currently unknown.
- For known hazards, scientific data is limited.
- Further research is required to fully assess potential risks to public health.
- Strong and effective regulatory oversight is a prerequisite for protecting public health.
- A precautionary approach should be taken where there is scientific uncertainty.

‘If a public health risk poses a serious threat, lack of full scientific certainty should not be used as a reason for postponing measures to prevent or control the public health risk’ (*Public Health and Wellbeing Act 2008*)

Recent reviews and useful references

- US EPA (2015) *Assessment of the potential impacts of hydraulic fracturing for oil and gas on drinking water resources.*
- New York State Department of Health (2014) *A public health review of high volume hydraulic fracturing for shale gas development.*
- Werner et al. (2015) *Environmental health impacts of unconventional natural gas development: A review of the current strength of evidence*. Science of the Total Environment. 505: 1127-1141.