Identifying potential contaminants of concern and how to manage them

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Aims

- What are the potential contaminants in fracturing fluid, flowback water?
- How do we access these?
- Source – Pathways - Receptors
- Developing a framework to manage and reduce contamination
- Conclusions

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Hydraulic Fracturing Fluid

- Water and friction reducer - polyacrylamide.
- Gelling agents – Guar Gum
- Cross linkers – Borate
- Breakers -
- Biocides - gluteraldehyde.

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Hydraulic Fracturing Fluid

- In UK operators have to disclose the ingredient list and maximum concentrations to obtain a permit.

- The ingredients must be non-hazardous as defined by the Groundwater Directive 2006 (2006/118/EC)

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What is Hazardous?

- Hazardous substances are defined in the Directive as any substances or group of substances that are:
- Toxic
- Persistent
- Liable to bioaccumulate.

- Any substance previously class as List1

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What is Non-Hazardous?

- The EPR 2010 defines non-hazardous pollutants as any substance other than a hazardous substance.

- Any substance previously classed as List 2 but also lots of other pollutants, eg nitrate.

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What does this mean?

- The Water Framework Directive and EPR 2010 state that hazardous substances must be prevented from entering groundwater.

- The input to groundwater of non-hazardous pollutants must be limited to avoid pollution.

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Who is responsible for classification?

- In England the EA, the decision is reviewed by The Joint Agency Groundwater Advisory Group – JAGDAG
- JAGDAG = EA, SEPA, NIEA and EPA (Ireland) with DEFRA, WAG, HPA and industry representatives.
- Requests received for consideration undergo stakeholder consultation prior to final agreement.

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Interim determination

Substance	CAS	Interim
Acrylamide	76-06-1	Hazardous
Anionic Polyacrylamide	9003-05-8	Non-hazardous
Gluteraldehyde	111-30-8	Non-hazardous
Hydrotreated light distillate (StimLubeW)	64742-47-8	Non-hazardous

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Managing Fracturing Fluid

- Must be disclosed on the permit application
- Permitted to use only those agreed in writing
- Must be classed as non-hazardous to GW
- Stored appropriately on site –bunding etc
- Monitored in the flowback fluid where appropriate
- Monitored in the environmental monitoring.

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Contaminants in Flowback water

- Preese Hall, Lancashire:
- High salinity
  - Sodium – 28400 mg/l
  - Chloride – 75000 mg/l
- Metals
  - Iron – 112000 ug/l
  - Magnesium – 1350 mg/l
  - Mercury – 0.012 ug/l (1of 4)
- NORM

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Managing Flowback Fluid

- Contained at surface in closed systems
- Monitored to assess chemical composition and ensure fit for reuse where appropriate.
- When no longer useful removed from site by registered carriers to licensed waste facility for treatment and disposal.
- Substances included in environmental monitoring

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Drilling Additives

- Lots of additives to allow for the variety of geological conditions that may be encountered.
  - Brines
  - Glycol fluids
  - Silicate fluids
  - Barite (marble)
  - Bentonite
  - Xanthan gum
  - Gypsum
  - Cellulose

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Managing Drilling Additives

- Must be disclosed in the permit application.
- Do not require recipe just the ingredients list and maximum concentrations.
- May accept LTOBM below any sensitive receptors
- Operators notifications to HSE
- May consider a GW activity permit in very sensitive locations
- Appropriate waste management arrangements

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Managing Drilling Wastes

- Contained on site
- Transferred by registered carriers
- Treated and disposed of at licensened waste sites
- OBM returned to supplier for recycling.

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Managing Drilling Wastes

- Not this

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Managing Drilling Wastes

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Managing Drilling Wastes

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Understanding the Risks

- Conceptual understanding of the site is paramount.
- An assessment of all sources pathways and receptors is necessary
- A detailed risk assessment based on these will identify the mitigation measures required for any site.

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The EPR Permit

- Includes
  - conditions to ensure that indentified mitigation is in place
  - A site condition report to set out the quality of the environment prior to activity.
  - A waste management plan
  - A monitoring plan
  - Pre-operational conditions

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Baseline monitoring

- Expected as the default on any well to be fractured.
- Sets out the quality of the environment before any activity.
- Is important for operator
- Is important for the regulator
- Is important for the public

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Baseline monitoring

- Should be based on the conceptual understanding of the location
- Should include all potential receptors
- Should also take into account any possible existing contamination sources that could impact the site.
- Will provide a sound database for determining what needs to be monitored during operations.
- Will enable triggers to be set where necessary

Conclusions

- Protecting groundwater from contamination is not new.
- We have a tried and tested risk based approach.
- Many of the risks are not unique to the industry.
- Importance of a good conceptual understanding cannot be overestimated.
- Providing a comprehensive baseline data set is essential to prove mitigation measures are working.

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