SB4 Model Criteria for Groundwater Monitoring: "Seek the advice of experts"

Public Stakeholder Meeting to Develop Groundwater Monitoring Model Criteria for Oil and Gas Areas

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SB4 Pavley. Oil and gas: well simulation.

Section 7. Groundwater Monitor Plan

- **(a) Groundwater protection**
  - *The Legislature finds and declares that protecting the state's groundwater for beneficial use, particularly sources and potential sources of drinking water, is of paramount concern*.

- **(b) Scientifically-based groundwater monitoring**
  - *The Legislature further finds and declares that strategic, **scientifically based groundwater monitoring** of the state's oil and gas fields is critical to allaying the public's concerns regarding well stimulation treatments of oil and gas wells.*

SB4 explicitly discusses scientifically-based groundwater quality monitoring

Groundwater monitoring model criteria

- SB4 Legislative Counsel Digest

  —SB4 requires the SWRCB … to develop **groundwater monitoring model criteria… to be implemented either on a well-by-well basis or on a regional scale**, on how to conduct appropriate monitoring on individual oil and gas wells subject to a well stimulation treatment

SB4 identifies the Water Board as responsible for developing groundwater quality monitoring plan model criteria

“Shall seek the advice of experts”

Section 7. Groundwater Monitor Plan

- (d) Requirement for expert advice

  — *The state board … **shall seek the advice of experts** **on the design of the model groundwater monitoring criteria**. The experts shall assess and make recommendations to the state board on the model criteria.*

The Water Board is responsible for seeking expert advice.

SWRCB has contracted LLNL as an expert advisor

- **Lawrence Livermore National Laboratory**
  - Federal Research & Development Center
  - Helped State develop both Geotracker and the GAMA program
  - Expertise in aqueous, isotope & gas geochemistry; groundwater transport & contaminant attribution; seismology & rock mechanics; geothermal & carbon sequestration

Contract PI:	Bradley "Brad" K. Esser
Experience	LLNL staff scientist since 1991
Education	B.S., Geoscience (U Arizona) Ph.D., Geochemistry (Yale)
Roles	*Technical lead:* GAMA Special Studies *Lead:* LLNL Environmental Radiochemistry Group *Lead:* LLNL Environmental Monitoring Radioanalytical Laboratory
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The Water Board has a long relationship with LLNL for its technical expertise

LLNL will provide expert advice on both design criteria and conceptual models for groundwater monitoring

- **Model groundwater monitoring criteria:**
  — Recommendations for model criteria to be considered for groundwater monitoring of current and past oil and gas field related activities on spatial scales from individual well to regional groundwater basin.

- **Conceptual model evaluation:**
  —The report will also include Contractor's review the State Water Board's conceptual model for groundwater monitoring in areas of current and past oil and gas production.

LLNL will be responsible for the recommendations delivered to the Water Board.

LLNL will use both internal and external expertise

- **LLNL will subcontract external experts**
  - —Subcontracted experts will be chosen for technical expertise
  - —Subcontracted experts will not be stakeholders
  - —A list of subcontracted experts will be made publicly available
- **LLNL will be reaching out for relevant information**
  - — **We have access to information and data collected by the SB4 Well Stimulation Project**
    - — California Council on Science & Technology (under contract with the California Natural Resources Agency)
  - —**Agency meetings**
  - —**Stakeholder meetings**

LLNL will alone be responsible for recommendations and evaluations delivered to the Water Board.

Public meetings

Date & Location	Event	Description
August, 2014	**This meeting**	Presentations to public & stakeholders explaining process and presenting a conceptual monitoring plan. Input from public & stakeholders
October, 2014	**Input to experts**	Stakeholder, public presentations to LLNL. Preliminary deliberations.
January or February, 2015	**Presentation to Water Board of Directors**	Water Board Meeting Informational Item to allow presentation of recommendations to Directors.

The Water Board develops criteria by July 2015.

More than one plan required

- **(7c) Development of model groundwater monitoring criteria**
  - *The model criteria shall address a **range of spatial sampling scales** from methods for conducting appropriate monitoring on individual oil and gas wells subject to a well stimulation treatment, to methods for conducting a regional groundwater monitoring program.*

Scale	Responsibility	What
Well by well	Well Operator	Nearby water well
		An individual or small set of oil & gas wells
Regional	SWRCB	Groundwater basin
		Oil & gas field

The threshold for transitioning from well-by-well to regional monitoring is one of the criteria to be developed

Operator-Required Groundwater Monitoring

- **Groundwater analysis requirements**
  - —What laboratory analytical methods are required?
  - —How frequently and how long should samples be collected?
- **Groundwater monitor well design**
  - —How many wells are sufficient?
  - —What depth intervals should be monitored?
  - —How close should the monitor well(s) be to the stimulated well?
- **Limitations or exemptions?**
  - —Lack of protected water
  - —Significant separation between base of protected water and stimulation zone
  - —Presence of hydrocarbon zone
  - —Presence of UIC-exempted aquifer
  - —Presence of groundwater contamination not related to oil & gas activities

Operator-required groundwater monitoring targets an individual stimulation well or a small number of wells

Regional Scale Groundwater Monitoring

- **When and where should regional-scale monitoring be conducted**
  - —What are the criteria to transition from local to regional monitoring?
  - —In what areas should regional-scale monitoring be prioritized?
  - —What limitations or exemptions should apply?
- **What should a regional program look like**
  - —**Groundwater analysis**
    - — What analyses should be performed?
    - — How frequently and how long should samples be collected?
  - —**Groundwater monitor wells**
    - — How many wells are sufficient? What type of wells?
    - — What depth intervals should be monitored?
  - —**Data**
    - — What should the requirements be for reporting and data sharing?
    - — What other types of information should be required or requested?

Regional-scale groundwater monitoring targets an oil & gas field or a groundwater basin

“Shall take into consideration the recommendations received”

Section 7. Groundwater Monitor Plan

(c) Development of model groundwater monitoring criteria

The state board shall develop model groundwater monitoring criteria…

The state board shall take into consideration the recommendations received…

LLNL makes recommendations.
The Water Board develops criteria & plans.

THE END

Groundwater monitoring criteria (Sec 7f)

1. **An assessment of the areas to conduct groundwater quality monitoring** and their appropriate boundaries.
2. **A list of the constituents** to measure and assess water quality.
3. **The location, depth, and number of monitoring wells** necessary to detect groundwater contamination at spatial scales ranging from an individual oil and gas well to a regional groundwater basin including one or more oil and gas fields.
4. **The frequency and duration** of the monitoring.
5. **A threshold criteria** indicating a transition from well-by-well monitoring to a regional monitoring program.
6. **Data collection and reporting protocols.**
7. **Public access to the collected data**

These criteria will be developed over the coming year by the Water Board

Groundwater monitoring factors (Sec 7g)

1. **The existing quality and existing and potential use** of the groundwater.
2. **Groundwater that is not a source of drinking water** consistent with USEPA's definition of an Underground Source of Drinking Water as containing less than 10,000 mg/L TDS, including exempt aquifers
3. **Proximity to human population**, public water service wells, and private groundwater use, if known.
4. **The presence of existing oil and gas production fields**, including the distribution, physical attributes, and operational status of oil and gas wells therein.
5. **Events, including well stimulation treatments and oil and gas well failures,** among others, that have the potential to contaminate groundwater; appropriate monitoring to evaluate whether groundwater contamination can be attributable to a particular event, and any monitoring changes necessary if groundwater contamination is observed.

Section 7g requires "event" monitoring and monitoring "protected" water

Contaminant pathways

Contamination Source/Pathway	Shallow	Intermediate, Deep
Surface operations (e.g. sumps)	X	
Waste solids disposal	X	
Wastewater disposal	X	X
Oil/gas well casing failure	X	X
Abandoned wells	X	X
Natural fractures & faults		X
Hydrofracturing		X

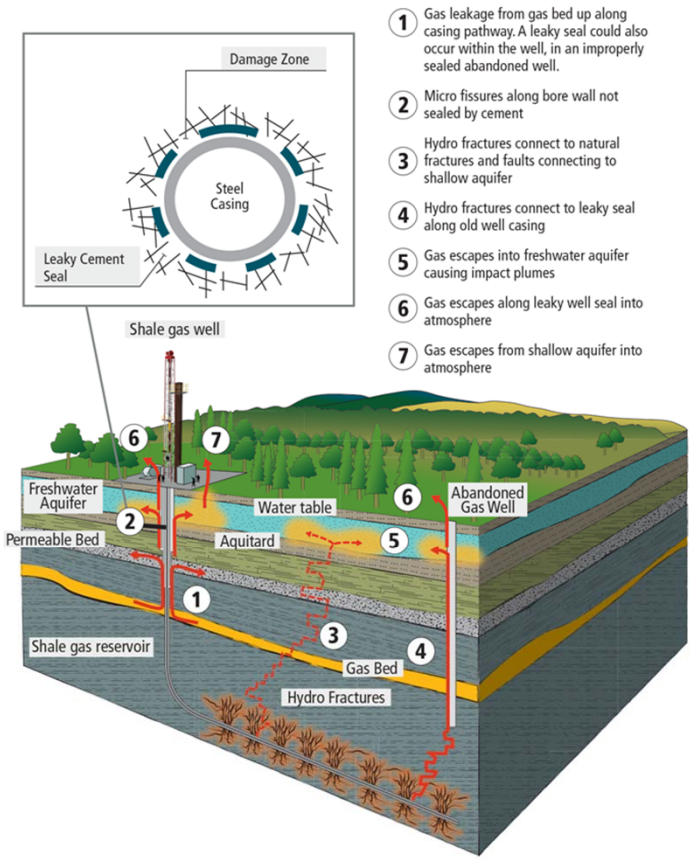

Figure 4.3

Conceptual Groundwater Contamination Pathways

CCA (2014) Environmental Impacts of Shale Gas Extraction in Canada., Council of Canadian Academies: The Expert Panel on Harnessing Science and Technology to Understand the Environmental Impacts of Shale Gas Extraction.

Contaminant sources & pathways will be considered in developing monitor plan criteria