

Oil and Gas Monitoring



November 2, 2016 GRA Meeting

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Presentation Overview

- Background
- Well Stimulation Groundwater Monitoring (Model Criteria)
- Produced Water Ponds
- Underground Injection Control

Background

- DOGGR Draft Regulations released Jan 2013
- Public concern about water quality
- Senate Bill 4 (SB 4 Pavley, statutes of 2013)
 - Oil and Gas Well Stimulation – including hydraulic fracturing and acid well stimulation

Well Stimulation Groundwater Monitoring (SB4)

During Interim Period:

- 15 groundwater monitoring plans are being implemented
Groundwater information uploaded by operators to the
GeoTracker information system

Model Criteria for Groundwater Monitoring

Model Criteria

- Model Criteria for groundwater monitoring adopted July 7, 2015
 - Lawrence Livermore National Laboratory (LLNL) provided recommendations
 - Model criteria developed in consultation with:
 - DOGGR
 - Technical Experts
 - Public Stakeholders
 - U.S. Geological Survey collected and analyzed data to help develop model criteria

Model Criteria Overview

- Outlines groundwater monitoring methods to be used in assessing the potential effects of well stimulation treatments
- Prioritizes monitoring of groundwater that is or has the potential to be a source of drinking water, but will assess all beneficial uses
- Describes how groundwater will be sampled and tested



Model Criteria Components

1. Area-Specific Groundwater Monitoring (Operators); and Exclusion
2. Requirements for Designated Contractor Sampling and Testing (Property Owner Requested)
3. Regional Groundwater Monitoring (State Water Board)



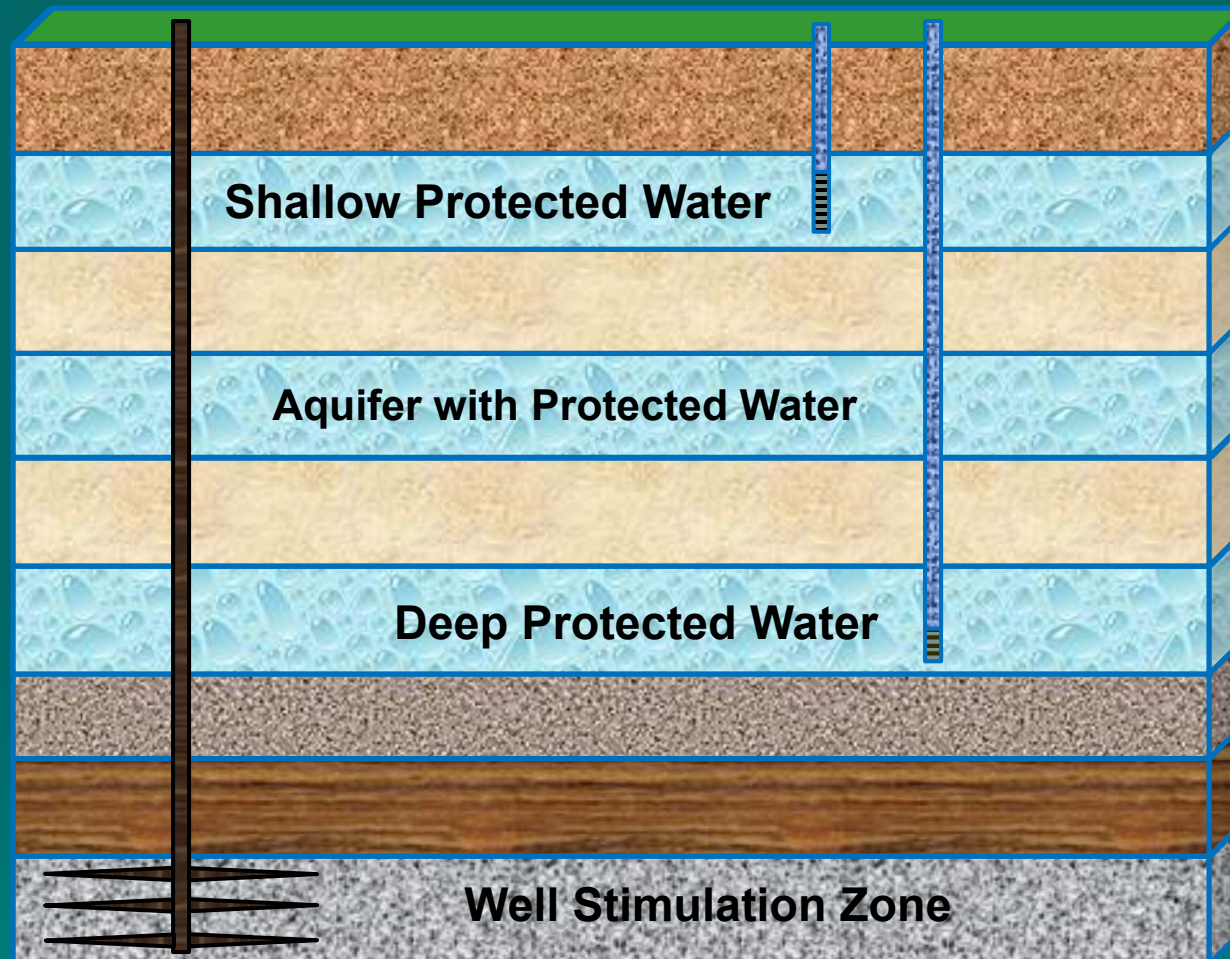
Area Specific Monitoring – Protected Water

- Protected Water is defined as:
 - Water with less than 10,000 milligrams per liter (mg/L) of total dissolved solids (TDS), and
 - Outside an exempt aquifer (meeting the criteria of Code of Federal Regulations, title 40, part 146.4).
- The requirement of a yield of more than 200 gallons per day was removed from the definition of protected water.

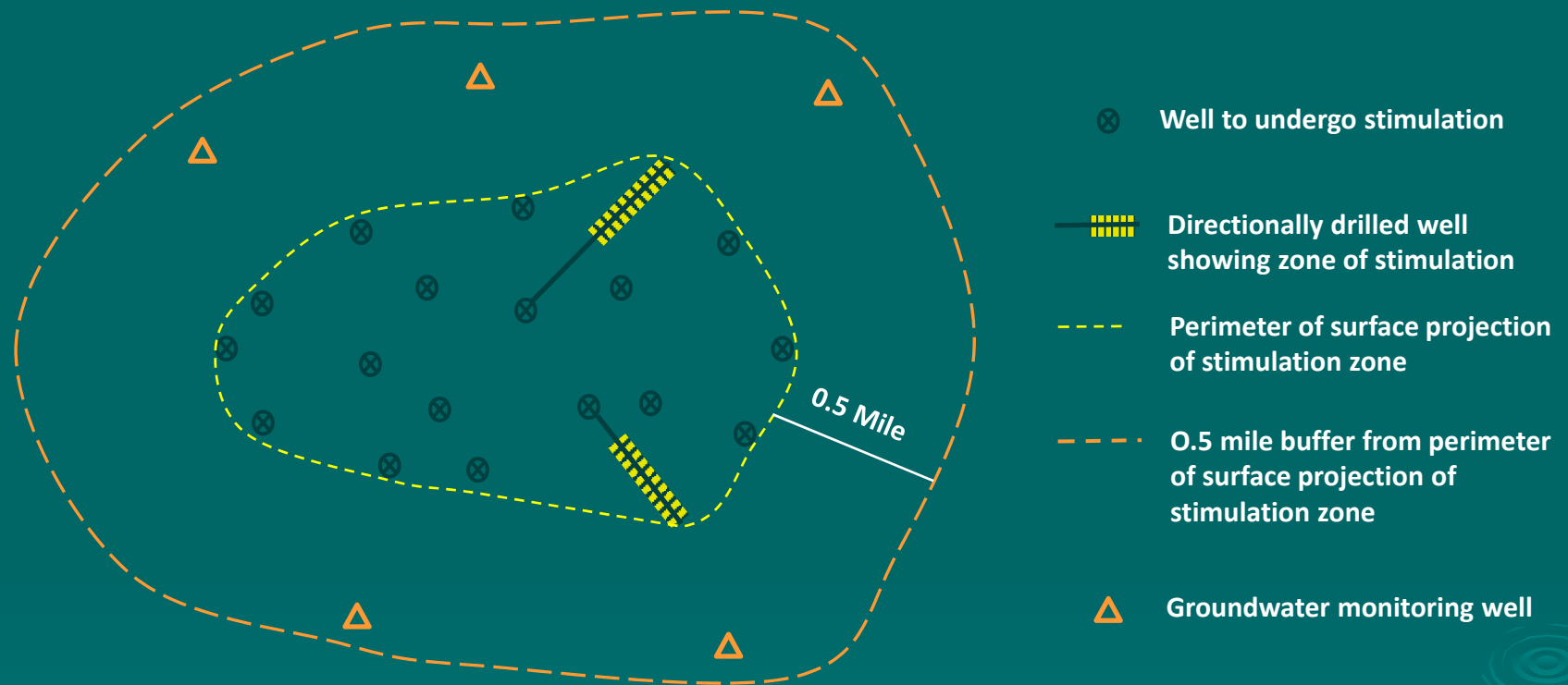
Area Specific Monitoring Design

- Requirement to monitor aquifer(s) containing protected water penetrated by the oil well to undergo stimulation:
 - When multiple aquifers are penetrated, a minimum of two aquifers shall be monitored separately:
 - ❖ Shallow protected water
 - ❖ Deep protected water
 - Additional aquifers may require monitoring based on site-specific conditions

Area Specific Monitoring: At least two aquifers to be monitored



Area Specific Monitoring Design



Monitoring wells are to be installed within 0.5 mile of the perimeter of the surface projection of the zone(s) of stimulation for a group of wells

Area Specific Monitoring Requirements

- Operators are required to install monitoring wells in groundwater zones where a well failure or breach has occurred.
- A contingency plan must be submitted that outlines the conceptual framework for monitoring well locations, depths, and well construction details to detect potential impacts of a well failure or breach

Area Specific Monitoring Requirements

- Axial Dimensional Stimulation Area (ADSA) must be approved by DOGGR
- Water Board's review of area-specific groundwater monitoring plans will occur in parallel with DOGGR's well stimulation permit review.
- Final Water Boards approval of a groundwater monitoring plan will not occur prior to DOGGR approving the ADSA.

Area Specific Monitoring: Request for Exclusion

Area-specific groundwater monitoring is required, unless an operator has received written concurrence from Water Boards staff for an exclusion from the monitoring requirement (written concurrence).

- Occurs where the operator can demonstrate the absence of protected water.
- Area-specific groundwater monitoring plans and requests for exclusion from groundwater monitoring must be submitted to GeoTracker for staff review.

Neighbor Requested Sampling

- Property owners within 1,500 feet can request their water to be sampled
- Designated samplers (third party) perform sampling
- One property owner has requested water to be sampled



Regional Monitoring Program

- State Board staff manage with technical experts from US Geological Survey
- Monitoring will leverage the use of wells from other groundwater monitoring programs, where available.
- Data, information and status reports will be made publicly available on a regular basis.
- Formal reports on the status and findings are anticipated to be prepared every two years starting January 2018.

Applicability of Model Criteria

- Model Criteria to be used to satisfy groundwater monitoring requirements for well stimulation permits.
- Does not apply to groundwater monitoring plans that were approved in connection with permits issued by DOGGR prior to the adoption of these Model Criteria



Applicability of Model Criteria

- Written concurrence for the exclusion of groundwater monitoring issued prior to the date of adoption of the Model Criteria will remain in effect unless future information indicates the presence of protected water.
- The development of threshold criteria on the transition from area-specific to Regional Monitoring Program is not included at this time.
 - Operators may use Regional Monitoring Program wells if approved by Water Boards staff

Status since Model Criteria was adopted

- Four proposed groundwater monitoring plans submitted by operators currently under review
- Three requests for exclusion from groundwater monitoring requested, one granted
- Regional Groundwater Monitoring Program is currently being conducted. U.S. Geological Survey characterizing groundwater risk zones, mapping salinity, produced water sampling

Underground Injection Control

Underground Injection Control

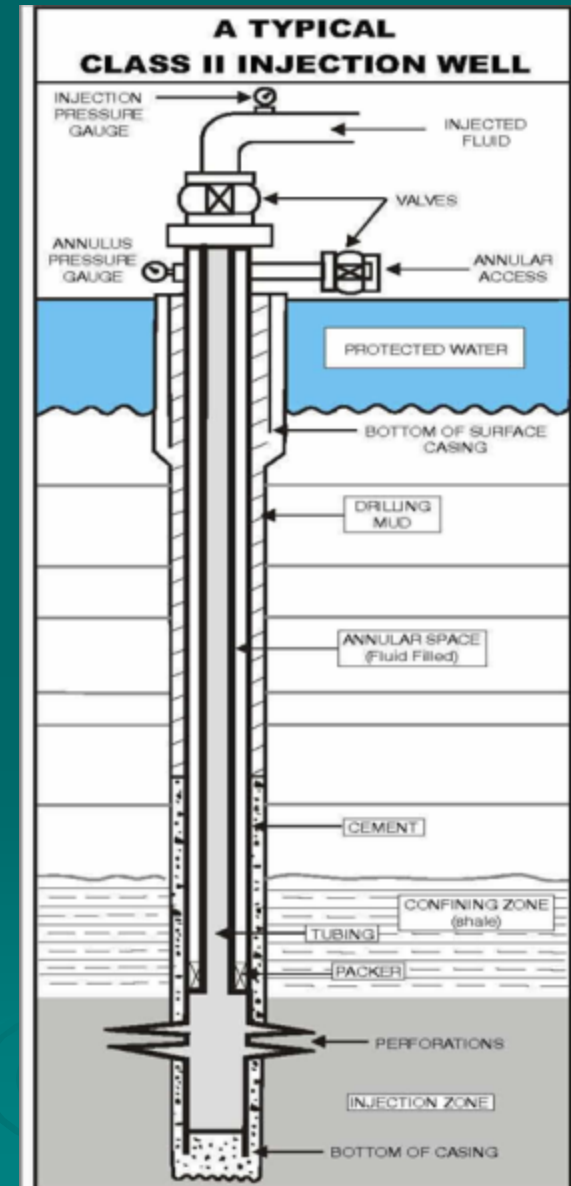
- 1982 Primacy Agreement between U.S. EPA and DOGGR established the Underground Injection Control Program for California
- 1988 Memorandum of Agreement (MOA) between DOGGR and SWRCB
 - DOGGR is the lead UIC Program oversight (enhanced oil recovery (EOR) wells, disposal wells, aquifer exemptions)
 - DOGGR to consult with the Water Boards during its consideration of UIC project permitting assistance with the protection of water resources.
 - Regional Water Boards lead agency for surface discharges (produced water disposal ponds)



Underground Injection Control

Class II Injection Well Types

- **Enhanced Oil Recovery** - water, steam, brine, polymers, or carbon dioxide into oil-bearing formations to assist recovery
- **Disposal** - fluids, including brines, associated with the production of oil and gas



Approach to Address UIC Issues

- Joint DOGGR and State Water Board plan to address UIC issues submitted to US EPA February 6, 2015
- Plan includes reviewing:
 - ✓ Aquifer Exemption Requests
 - ✓ New UIC Project Proposals
 - ✓ Existing UIC Injection Wells

Assess if injection wells are potentially impacting water supply wells or impacting groundwater of beneficial use

Review of Existing Injection Well Review

Over 30,000 Class II UIC wells reviewed; 6,100+ classified into three categories

- Category 1: disposal wells injecting into non-exempt, non-hydrocarbon-bearing aquifers
- Category 2: enhanced oil recovery (EOR) injecting into non-exempt, hydrocarbon-bearing aquifers
- Category 3: disposal and EOR inside surface boundaries of exempted aquifers, but may be injecting into a zone not exempted

UIC Well Review

Injection wells with potential risk to water resources evaluated -

- 176 disposal wells injecting into sub-3,000 TDS aquifers, then
- 356 disposal wells injecting into 3,000 to 10,000 TDS aquifers, and finally
- 5,625 enhanced oil recovery wells (Cat 2)

(<1500 feet bgs, within 500 vertical feet, 1 mile horizontally)

UIC Well Review

State Water Board staff screened:

- Water supply wells within a 1-mile radius of the injection wells
- Screened water disposal wells to identify which wells were “potentially impacting water supply wells”
- Screened EOR wells to identify if injection was impacting groundwater of beneficial use

UIC Well Review

Protocol for Injection wells potentially impacting water supply wells:

- Water Board issues information order to operator
- DOGGR issues cease injection order or operator voluntarily ceases injection
- Analytical results from samples have not indicated impacts to water supply wells from injection wells; orders have required operators to collect samples from water supply wells.

UIC Well Review

Non-exempt non-hydrocarbon aquifers:

- No new injection wells unless EPA approves aquifer exemption
- Cease injection immediately if potentially impacting water supply wells
- Cease injection by Oct 2015 if not potentially impacting water supply wells, and aquifer is sub-3,000 TDS
- Cease injection by Feb 15, 2017 if not impacting water supplies, and TDS between 3,000 and 10,000 mg/L

Non-exempt hydrocarbon producing zones:

- If groundwater has beneficial use, then no new injection wells, and existing wells cease injection by Feb 15, 2017
- If no beneficial use, new injection wells as part of an approved project may be permitted with the express condition that the permit expires on Feb 15, 2017, unless EPA approves exemption

11 aquifers historically treated as exempt

- No new injection wells unless EPA approves aquifer exemption
- Cease injection by December 31, 2016, unless EPA approves exemption

UIC Well Review results

- Water Board issued 72 information orders for 257 injection wells (as of October 2016) for Category 1 and Category 2 wells
- 23 injection wells were shut-in by DOGGR cease injection orders or the operators voluntarily relinquished their permits
- Category 3 wells will be covered in UIC Project by Project Review

Ongoing UIC Project Proposal Review Status

- 1988 MOA between DOGGR and SWRCB
 - *Currently under review for an update*
 - WBs review of project proposals includes:
 - Verifying that the UIC projects are protective of water quality
 - Address poorly constructed wells that may serve as conduits of contamination to groundwater
 - Collaborate with DOGGR to assess necessary modifications to the project such as additional monitoring or reporting requirements
 - Initiate appropriate action against discharges contaminating groundwater

Ongoing UIC Project Proposal Review Status

38 UIC project proposals have been forwarded to Water Boards for review since November 2014:

- 11 – concurrence without conditions
- 18 – concurrence with conditions (e.g. monitoring)
- 2 – Water Boards did not concur
- 7 – Currently under review

Produced Water Ponds



Produced Water Ponds

- An estimated 1.9 billion barrels of water were produced during oil extraction in the Central Valley in 2013.
- The majority of oilfield produced water is re-injected back via UIC well projects (EOR or disposal).
- According to 2009 Annual Report of the State Oil and Gas Supervisor, approximately 10% of oilfield produced water is disposed via either ponds or is recycled. (Approximately 12 billion gallons).
- The Water Boards are working to ensure that ponds have not negatively affected waters of beneficial use

Produced Water Ponds

➤ Current Activities:

- Reviewed waste discharge permits from oil well operators for ponds
- Reviewed associated groundwater monitoring plans related to ponds
- Performed field inspections
- Collected water samples, as necessary
- Taken enforcement actions, where necessary

Produced Water Ponds

- Hundreds of ponds in the Central Valley have been identified and inspected
- Enforcement Orders being drafted for active facilities not covered by permits (WDRs)
- Other Regional Boards are in various phases of produced water pond review and enforcement process

Current Status of Ponds (July 2016)

| Regional Water Board | Active Ponds | | Inactive Ponds | | Total Ponds | | Number of Ponds Under Enforcement Order |
|----------------------|--------------|-------------|----------------|-------------|-------------|-------------|---|
| | Permitted | Unpermitted | Permitted | Unpermitted | Permitted | Unpermitted | |
| Central Coast | 3 | 0 | 0 | 0 | 3 | 0 | 3 |
| Los Angeles | 0 | 0 | 0 | 1 | 0 | 1 | 1 |
| Central Valley | 535 | 144 | 119 | 263 | 654 | 437 | 1061 |

Continuing Work:

- SB 83 reports issued every 6 months (since January 2016)
- CV Regional Bd. working on 3 general orders for ponds
- Investigation and inspection of historical pond sites

Produced Water Ponds - DOGGR Prohibition

- Recommendation from California Council on Science and Technology (CCST) report commissioned as part of Senate Bill 4 (Statutes of 2013)
- DOGGR adopted recommendation as Regulation 14 CCR § 1786(a)(4) which states:
 - “(a) Operators shall adhere to the following requirements for the storage and handling of well stimulation treatment fluid, additives, and produced water from a well that has had a well stimulation treatment:
 - (4) Fluids shall be stored in containers and shall not be stored in sumps or pits.”



Aquifer Exemption Proposals



Aquifer Exemption Proposal Review Criteria

- **Code of Federal Regulations, Title 40, Section 146.4**
 - Aquifer does not currently serve as a source of drinking water, and
 - Cannot now or in the future serve as a source of drinking water (oil bearing, too contaminated, economically impractical), or
 - Total dissolved solids are between 3,000 and 10,000 milligrams per liter
- **Public Resources Code Section 3131**
 - Injection of fluids will not affect the quality of water that is, or may reasonably be, used for any beneficial use.
 - Injected fluid will remain in the aquifer or portion of the aquifer that would be exempted.

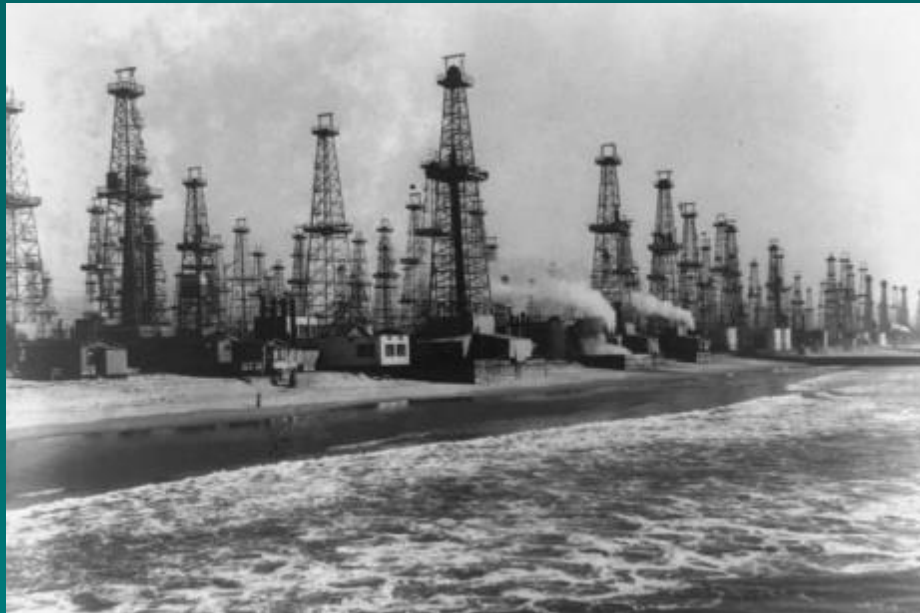
Aquifer Exemption Proposal Review

- **Primary goal is to ensure the protection of current and future beneficial use water...**
 - 40 proposals projected before February 15, 2017
 - Number received by Water Boards to date: 25
 - Water Board staff preliminarily concurred with 6
 - One proposal officially submitted to USEPA
 - Five public hearings conducted
 - Nineteen under technical review by Water Boards staff
 - Average 3 weeks to review; questions to DOGGR



Additional Information

- State Water Board Web Site <http://www.waterboards.ca.gov>
- DOGGR Web Site <http://www.conservation.ca.gov>



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