Oil, Gas and Groundwater Production in the Los Angeles Basin

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Water Replenishment District of Southern California
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Central Basin and West Coast Basin (CBWCB)

Area = 420 mi$^2$, 43 Cities, 4 Million People

> 10% of the State’s Population

Over 400 Active Groundwater Wells
Pumping >240,000 acre feet/yr
(78 billion gallons/yr)
Severe Overdraft before 1960

- Plunging Water Levels
- Seawater Intrusion
- Wells Went Dry
- Resource being Depleted

Recovery Due to...

- Adjudication of Basins.
- Seawater Barrier Wells.
- Formation of WRD to provide Managed Aquifer Recharge using Imported and Recycled Water.
  “W.I.N.” program to replace imported water.
But There’s Oil & Gas in the Basins too

Signal Hill Then

Signal Hill Now
Over 30 Mapped Oil Fields and 9,700 Oil/Gas Wells Listed in WRD Service Area
N-S Cross-Section through WRD showing Hydrocarbon and Groundwater Target Zones

Recent, Pleistocene and late Pliocene. General area of Fresh Groundwater

Mid Pliocene to Mid Miocene. General Targets for Hydrocarbon Recovery

Mesozoic Schist, Granite, Slate, Metasediments, Bedrock – No Petroleum

Modified from Davis – Namson, 1998
Southern California Cross Section Study
Oil Wells & Water Wells in LA
Over 100 Years of Co-Existing
Potential Risks to Groundwater from Petroleum Operations and Well Stimulation

Threats: Chemicals, Metals, Saline Water, Natural Gas

http://www.epa.gov/hfstudy/hfwatercycle.html
Potential Risks to Groundwater from Petroleum Operations and Well Stimulation

1. Water Acquisition
2. Chemical Mixing
3. Well Injection
4. Flowback and Produced Water (Wastewaters)
5. Wastewater Treatment and Waste Disposal

Threats: Chemicals, Metals, Saline Water, Natural Gas

http://www.epa.gov/hfstudy/hfwatercycle.html

Old Gas/Oil Well – Not Abandoned Properly

Casing or Cement Failure or not Deep Enough

Groundwater

Oil/Gas Target Zone

Natural gas flows from fissures into well
Potential Risks to Groundwater from Petroleum Operations and Well Stimulation

Faults may act as a conduit

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HYDRAULIC FRACTURING:
When 2 wells meet, spills can often follow
Gayathri Vaidyanathan, E&E reporter
EnergyWire: Monday, August 5, 2013

When a geyser of oil and fracking fluid spewed out of an oil well on a farmer’s field in Innistall, Alberta, it coated 100 trees with a fine mist. About 20,000 gallons of oil and fluid collected on a snow-covered field and had to be cleaned up.

The spill was caused by hydraulic fracturing – not the activities surrounding drilling. A series of similar incidents are being reported across the United States and Canada.

Drillers call it a “frack hit” or “downhole communication,” and it could also contaminate groundwater aquifers.

Threats: Chemicals, Metals, Saline Water, Natural Gas
Some Ways to Minimize Risk to Groundwater

- Baseline Monitoring.
- Review well design to prevent leaks or fix old wells.
- Identify artificial pathways and seal off or avoid.
- Proper collection and disposal of wastes.
- Know where fractures are and avoid “Frack Hits”
- Monitor injection pressures, buffer zones, flowback ponds, fresh groundwater, seismic monitoring, groundwater basin and reservoir characterization.
>300 Monitoring Wells at 55 Locations
Minimum Depth 60 ft
Maximum Depth 3,000 ft
WRD Field Crew Samples Wells 2x/yr
Groundwater Quality Results near Oil Fields

- Generally Good Water Quality.

- A few wells have elevated concentrations of some chemicals, such as:
  - Arsenic, Barium, Boron
  - Methane, Surfactants
  - Tert-Butyl Alcohol (TBA)
  - TDS/Chloride
  - Color/Odor

- These can be found in groundwater in non-oil production areas too.

- Either naturally occurring, or from surface releases, or from oil field operations, or from other sources. Difficult to determine.

- Additional testing / analyses may be useful to confirm results and help identify natural or human sources.
Summary

- Fresh groundwater, oil and natural gas have been successfully produced in the CBWCB for over 100 years.

- The two reservoirs are separated by thick layers of low permeability strata (buffer zone), so that with appropriate precaution, construction, regulation and monitoring, the activities in one should not affect the other.

- Responsible model groundwater monitoring criteria developed under SB4 will help ensure well stimulation practices are protective of fresh groundwater resources.

- WRD looks forward to continue participating in the process and assisting in any way possible.
THANK YOU!

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