



## How the Division of Oil, Gas, and Geothermal Resources Regulates, Prevents, and Responds to Surface Expressions in California Oilfields

### What is Surface Expression?

The term surface expression refers to the flow of water and/or oil to the surface during the oil extraction process. The condition typically is associated with extractions using high-energy steam injection in brittle geologic formations such as those found in northern Santa Barbara County near Santa Maria and on the southwest end of the San Joaquin Valley, west of Bakersfield.

Most surface expressions occur in oilfields that are far from communities and homes and do not pose threats to the public. Although most surface expressions are quite small, in 2011, an oilfield worker was killed when a large surface expression occurred in an Kern County oilfield where an extraction technique called cyclic steaming was in use.

The Division of Oil, Gas, and Geothermal Resources (Division) has adopted safeguards to prevent surface expressions from occurring. The Division requires operators to monitor for early indications of surface expressions and quickly take steps to protect public health safety and the environment should one occur. Division field inspectors respond quickly when surface expressions are reported to assess the situation. Response actions are tailored to the size of the expression and can include orders to halt or modify operations and remediate any incidents.

As with any other type of oil spill, operators are required to contain and clean up oil arising from the surface expression.

### How are Surface Expressions Reported?

California has a [robust system](#) for reporting and responding to all oil spills, including surface expressions. Any oil spilled in or near a source of water, or a stream that leads to the ocean, must be immediately reported to the California [Governor's Office of Emergency Services' Warning Center](#) (CalOES).

Land-based oil discharges greater than one barrel (42 gallons) – or smaller discharges that cause harm or threaten to cause harm – must be reported by the facility owner as a spill to CalOES. In certain San Joaquin Valley oilfields, operators must report all spills of five barrels or more, unless the spill is contained and is less than 10 barrels.

Operators that have received permits to use cyclic steaming are required to report any surface expression to the Division, regardless of spill volume. New Underground Injection Control regulations due later this year will specify that all surface expressions be reported, regardless of size.

### How does the Division of Oil, Gas, and Geothermal Resources Currently Regulate Surface Expressions?

- ✓ Prior to receiving a permit for any injection activity, operators must provide the Division an Area of Review study to demonstrate the safety and geological characteristics of the area in which steam injections will occur. The study must include:
  1. Maps of all wells (active, idle, plugged and abandoned)
  2. Geological maps for the area of injection

3. Reservoir characteristics (to predict risk of surface expression)
4. Casing diagrams of all wells (to ensure integrity of wells under pressure)
5. Flood pattern map showing all injection, underground flow and production patterns of the area.

- ✓ Operators must report spills meeting state thresholds to the Office of Emergency Services (CalOES) and to the Division. The agencies are authorized to order a halt to operations and require clean-up and mitigation measures.
- ✓ Division staff inspect reported surface expressions. They verify the energy and volume of steam, mud, oil, and produced water released, and determine whether operations should cease or whether mitigation measures should be taken.
- ✓ Mitigation measures may include shutting in steam injectors near the expression, lowering injection pressures, re-abandoning plugged wells (re-drilling and filling with fresh cement), remediating active wells within the project area, or requiring seep receptacles.
- ✓ Many operators are now using tilt meters and satellite sensors to detect and monitor surface deformations. Surface deformations are frequently a precursor to a surface expression. If an operator notes precursor indicators of a surface expressions, the operator is required to modify or cease operations to prevent a surface expression.

### Current Division Practices and Safeguards to Prevent Surface Expressions:

- Injection projects with the potential for surface expressions have additional safety requirements.
- Heat-resistant cement may be required.
- Enhanced well construction techniques are required.
- Monitoring of injection vs. withdrawal volume to manage reservoir pressure and prevent over-pressuring incidents.
- Lower injection volumes of steam may be required.
- Monitoring systems are required. This way systems can be immediately and automatically shut in if abnormal readings are observed.

### Proposed Underground Injection Control Regulations Specifically Address Surface Expressions:

The Department is in the process of [revising regulations](#) for all underground injection control practices. To better understand the causes and reduce the intensity and frequency of surface expressions, the Division has enlisted the help of scientific researchers from Stanford University and the Lawrence Livermore National Laboratory to inform the new regulations. Extensive research and public comment was gathered during pre-rulemaking discussion drafts and public meetings in 2017. The Division is incorporating comments into formal draft regulations, which are expected in late spring, 2018.

### Additional Resources

To report a release or spill, call the California Office of Emergency Services' Warning Center at 1-800-852-7550.

Reported petroleum discharges are tracked in CalOES' [Spill Release Archive Files](#).

The [California State Oil Spill Contingency Plan](#) regarding oil discharges to marine or inland surface waterways is maintained by the Department of Fish and Wildlife and the Office of Oil Spill Prevention and Response.



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