Update on Implementation of Rule 1148.2
Stationary Source Committee
November 2014
R1148.2 Implementation

2005 R1148.2 Adopted

- April 2013: Operators and Chemical Suppliers Required to Submit Reports
- June 2013: Operators and Chemical Suppliers Required to Submit Reports
- Aug 2013: Operators and Chemical Suppliers Required to Submit Reports
- Feb 2014: First 6-Month Update to R1148.2 Working Group and Stationary Source Compliance
- Nov 2014: Findings and recommendations to Stationary Source Committee on implementation of R1148.2
- May 2015: Second 6-Month Update to R1148.2 Working Group and Stationary Source Compliance
Key Elements of Rule 1148.2

Event Notification
- Notify SCAQMD 10 days to 24 hours prior to:
  - Well drilling
  - Well completion
  - Well Rework
  - Identify nearest sensitive receptor within 1,500 feet

Emissions Reporting
- Report following emission sources:
  - Combustion sources
  - Dry materials usage/fugitive dust
  - Drilling and flowback fluids

Chemical Reporting
- Non-Trade Secret Chemical Information (Operators)
- Trade-Secret Chemical Information (Suppliers)

Emissions Reporting Sunsets April 2015
Summary of Event Notifications
Summary of Rule 1148.2 - Notification Data (June 2013 - Sep 2014)

- Approximately 821 Notifications representing 923 events (Some notifications have multiple events)
- >99% oil wells and <1% gas wells
Summary of Notifications

April 2014 began distinguishing between Matrix and Maintenance Acidizing.

14 Hydraulic Fracturing Events occurred in 2013. None in 2014.
93% of notifications in Los Angeles County
7% of notifications in Orange County
No notifications in Riverside or San Bernardino County
Distance to Sensitive Receptor

- ~50% of events ≤1,500 feet from sensitive receptor
- All 14 hydraulic fracturing events >1,500 from sensitive receptor
Distribution of Well Activities Near Sensitive Receptors by City

- Long Beach: 237
- Santa Fe Springs: 21
- Wilmington: 51
- Los Angeles: 61
- Cities With >=10 and < 20 Notices: 37
- Cities With < 10 Notices: 32
- Tidelands: 117
- Thums: 112
- Other: 8

469 Notices for Well Events <1,500 Feet from a Sensitive Receptor
Summary of Emissions Reporting
Emissions Reporting

- Calculated and analyzed combustion emissions
- Analyzed reports for amount of dry materials used
- Analyzed reports for flowback fluids
Average NOx and PM Emissions

**NOx Emissions Per Day**

- Acidizing
- Gravel Packing
- Hydraulic Fracturing
- Horizontal Drilling
- Vertical Drilling
- Drilling and Gravel Packing

**PM Emissions Per Day**

- Acidizing
- Gravel Packing
- Hydraulic Fracturing
- Horizontal Drilling
- Vertical Drilling
- Drilling and Gravel Packing
## Combustion Equipment Summary

<table>
<thead>
<tr>
<th>Activity</th>
<th>Average Engine Size (HP)</th>
<th>Average Operating Hours/Event</th>
<th>Average Maximum Operating Hours/Event*</th>
<th>Average Event Duration</th>
<th>Average Number of Engines</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vertical Drilling</td>
<td>566 HP</td>
<td>102 Hours</td>
<td>198 Hours</td>
<td>19 Days</td>
<td>11</td>
</tr>
<tr>
<td>Horizontal Drilling</td>
<td>451 HP</td>
<td>38 Hours</td>
<td>310 Hours</td>
<td>10 Days</td>
<td>7</td>
</tr>
<tr>
<td>Gravel Packing</td>
<td>495 HP</td>
<td>10 Hours</td>
<td>31 Hours</td>
<td>4 Days</td>
<td>6</td>
</tr>
<tr>
<td>Acidizing</td>
<td>460 HP</td>
<td>4 Hours</td>
<td>12 Hours</td>
<td>1 Day</td>
<td>2</td>
</tr>
<tr>
<td>Hydraulic Fracturing</td>
<td>960 HP</td>
<td>13 Hours</td>
<td>32 Hours</td>
<td>6 Days</td>
<td>8</td>
</tr>
</tbody>
</table>

* Individual engine maximum
# Estimated Cancer Risk from Single Drilling Event

## DRAFT Cancer Risk (Current Risk Assessment Methodology) (in a million)

<table>
<thead>
<tr>
<th></th>
<th>Distance to Receptor 100 Feet</th>
<th>Distance to Receptor 500 Feet</th>
<th>Distance to Receptor 1,500 Feet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cancer Risk (90 lbs/event)</td>
<td>0.07</td>
<td>0.04</td>
<td>0.02</td>
</tr>
<tr>
<td>Cancer Risk (423 lbs/event)</td>
<td>0.26</td>
<td>0.14</td>
<td>0.08</td>
</tr>
</tbody>
</table>

## DRAFT Cancer Risk (Revised Risk Assessment Methodology) (in a million)

<table>
<thead>
<tr>
<th></th>
<th>Distance to Receptor 100 Feet</th>
<th>Distance to Receptor 500 Feet</th>
<th>Distance to Receptor 1,500 Feet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>&lt;2 yrs</td>
<td>Adult</td>
<td>&lt;2 yrs</td>
</tr>
<tr>
<td>Cancer Risk (90 lbs/event)</td>
<td>1.65</td>
<td>0.03</td>
<td>0.82</td>
</tr>
<tr>
<td>Cancer Risk (423 lbs/event)</td>
<td>7.12</td>
<td>0.15</td>
<td>3.83</td>
</tr>
</tbody>
</table>
Flowback Fluids and Dry Materials Reporting

- Received 626 emission reports
- 9 events reported flowback fluid
  - Gravel packing and acidizing does not have flowback immediately after well treatments/stimulations
  - Low pressure in the formations found in the Basin
- 342 events reported dry materials
  - On average 140,000 lb of dry material
    - Alpine spotting beads
    - Bicarbonate of soda
    - Cement
    - Drilling Mud
    - Gravel Pack Sand
    - Magma Fiber
    - Potassium Chloride
    - Walnut Shells
    - Sawdust
Summary of Non-Trade Secret Chemical Reporting
## Non-Trade Secret Air Toxic Chemicals Used in Well Activities

<table>
<thead>
<tr>
<th>Chemical Ingredient</th>
<th>Acidizing</th>
<th>Drilling</th>
<th>Gravel Packing</th>
<th>Hydraulic Fracturing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crystalline Silica</td>
<td></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Ethylbenzene</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ethylene Glycol</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Formaldehyde</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Glutaral</td>
<td></td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Hydrochloric Acid</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hydrofluoric Acid</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Methanol</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Naphthalene</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phosphoric Acid</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Sodium Hydroxide</td>
<td></td>
<td></td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Toluene</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Xylene</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Drilling
(Top 9 Chemicals Used (lbs))

- Potassium Chloride: 124,442 lbs
- Calcium Salts: 56,486 lbs
- Calcium Chloride: 47,813 lbs
- Barite: 45,875 lbs
- Crystalline Silica: 20,661 lbs (Toxic Air Contaminant)
- Calcium Carbonate: 18,813 lbs
- Gypsum: 9,806 lbs
- Halides, Inorganic Salt: 9,412 lbs
- Amorphous Silica: 7,187 lbs

Average Non-Trade Secret Chemical Use
741,451 lbs of Water Used
Acidizing (Top 8 Chemicals Used (lbs))

- Hydrochloric Acid: 4051 lbs
- Ammonium Chloride: 2141 lbs
- Potassium Chloride: 1082 lbs
- Xylene: 292 lbs
- Hydrofluoric Acid: 289 lbs
- Methanol: 180 lbs
- Organic Acid: 245 lbs
- Citrus Terpenes: 167 lbs

Average Non-Trade Secret Chemical Use: 109,389 lbs of Water Used
Gravel Packing
(Top 8 Chemicals Used (lbs))

- Potassium Chloride: 13,528 lbs
- Halides, Inorganic Salt: 12,459 lbs
- Calcium Chloride: 5,336 lbs
- Barite: 2,752 lbs
- Calcium Salts: 2,501 lbs
- Calcium Carbonate: 1,415 lbs
- Amorphous Silica: 332 lbs
- Crystalline Silica: 7,427 lbs (Toxic Air Contaminant)

Average Non-Trade Secret Chemical Use: 62,582 lbs of Water Used
Hydraulic Fracturing
(Top 11 Chemicals Used (lbs))

- Crystalline Silica: 285681 lbs
- P/F Resin: 7578 lbs
- Guar Gum: 5202 lbs
- Potassium Chloride: 4387 lbs
- Distillates, Petroleum: 4190 lbs
- Methanol: 1792 lbs
- Monoethanolamine: 1399 lbs
- Carbonic Acid, Potassium Salt (1:2): 1167 lbs
- Toxic Air Contaminants: 287473 lbs
- Average Non-Trade Secret Chemical Use Reported: 2,044,054 lbs of Water Used
Summary of Observations, Monitoring, and Sampling
Since June 2013, SCAQMD staff conducted 104 inspections:
- 21 well drilling events
- 14 hydraulic fracturing events
- 44 acidizing events
- 11 gravel packing events
- 4 Misc. events

Observations:
- Visible smoke at 13 inspections (13%)
- Visible dust at 13 inspections (13%)
- Noticeable odors at 10 inspections (10%)
Sampling and Monitoring Equipment

- Jerome Monitor (H₂S)
- DustTrak Monitors (PM)
- Summa canisters used to measure hydrocarbons
- Sample vials and jars to test flowback fluids and drilling mud
Challenges

• Coordinating site visits is challenging due to rescheduling notifications
  – 48% of submitted notifications get rescheduled
  – 10% of submitted notifications get rescheduled multiple times
# Monitoring and Sampling Results (July – October 2014)

<table>
<thead>
<tr>
<th>Event</th>
<th>Event ID</th>
<th>Date</th>
<th>Handheld Results for PM and H$_2$S</th>
<th>Canister Results for Organics</th>
<th>Other Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maintenance Acidizing</td>
<td>1934</td>
<td>7/15/14</td>
<td>• No elevated levels of PM10.</td>
<td>No canister samples taken.</td>
<td>Diesel odors from engines used in well activities. Complaint reported to SCAQMD from the public.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• No elevated levels of H$_2$S.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Matrix Acidizing</td>
<td>2238</td>
<td>9/10/14</td>
<td>• No elevated levels of PM10.</td>
<td>No elevated levels (typical ambient air range of 100-700 ppbc) of NMOCs.</td>
<td>Petroleum hydrocarbon odors 75 feet from subject well.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• No elevated levels of H$_2$S.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gravel Packing</td>
<td>2329</td>
<td>9/25/14</td>
<td>• Slightly elevated levels of PM10 due to high wind speeds and dust from loose dirt roads.</td>
<td>No elevated levels (typical ambient air range) of NMOCs.</td>
<td>Strong petroleum hydrocarbon odors at catch basin for return fluid (open to atmosphere).</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• No elevated levels of H$_2$S.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gravel Packing</td>
<td>2329</td>
<td>9/26/14</td>
<td>• No elevated levels of PM10.</td>
<td>Elevated levels (900-2900 ppbc) of NMOC at catch basin.</td>
<td>Strong petroleum hydrocarbon odors at catch basin for return fluid (open to atmosphere).</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• No elevated levels of H$_2$S.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gravel Packing</td>
<td>2354</td>
<td>10/2/14</td>
<td>• No elevated levels of PM10, except for one short-term period of elevated levels due to road dust from vehicular traffic.</td>
<td>Elevated levels (20 – 13,000 ppmvc) of NMOCs at open hatch of Adler tank for return fluids. Above thresholds for SCAQMD Rules 1148.1, 1166, 1173, 1176, and 1178.</td>
<td>Strong hydrocarbon odors from Adler tank for return fluids.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• No elevated levels of H$_2$S.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drilling</td>
<td>2356</td>
<td>10/17/14</td>
<td>Pending</td>
<td>Pending</td>
<td>Pending</td>
</tr>
</tbody>
</table>
Sampling & Monitoring Return Fluids

• Sampled return fluids from two gravel packing events
  – Return fluid directly from well to Adler tank
  – Return fluid to interim open holding area prior to Adler tank

• Results:
  – Elevated levels of benzene, toluene, ethylbenzene, and xylene
  – Adler tank: NMOC 13,000 ppm
  – Interim holding area: NMOC 3,000 ppb

• Thresholds in SCAQMD Rules:
  – 500 ppm (R1148.1, R1176, R1178)
  – 1,000 ppm (R1166)
  – 50,000 ppm (R1173)
Observed Controls and Housekeeping Practices

- Carbon canister drums connected to Adler tanks storing return fluid can reduce VOC emissions
- Keeping hatches closed can reduce VOC emissions
- Plastic sheet ground cover to capture liquid leaks and spills of gravel packing fluids and dry materials
- Plastic tote instead of fabric tote for loading dry materials into hopper will minimize spillage of dry materials
Summary of Compliance Activities
Key Requirements for Operators and Chemical Suppliers

**Operators**
- Submit Emissions Reports within 60 days
- Submit **Non-Trade Secret Chemical Report** within 60 days
- Must provide specific non-trade secret chemical information

**Primary Chemical Suppliers**
- Submit **Trade-Secret Chemical Report** within 60 days
- Identified by Operator
- Must provide specific chemical information

**Secondary Chemical Suppliers**
- Submit **Trade Secret Chemical Report** within 60 days
- Identified by Primary Supplier
- Must provide specific chemical information
Overall Compliance Approach

Compliance Assistance
- **Description**: Clarification needed for isolated situations
- **Example**: Reports not completed correctly
- **Action**: Consulted Two with Primary Chemical Suppliers

Compliance Advisories
- **Description**: Clarification for system-wide problem
- **Example**: Missing or inaccurate reporting
- **Action**: Two Compliance Advisories Issued

Notices to Comply
- **Description**: Non-compliance with a specific provision
- **Example**: Failure to submit reports
- **Action**: 43 Notices to Comply Issued

Notices of Violation
- **Description**: Persistent non-compliance
- **Example**: Failure to respond to Notice to Comply
- **Action**: No Notices of Violation have been issued
Next Steps

• Continue to collect and analyze data
• Continue compliance efforts
• In six months
  – Provide update to Working Group
  – Provide update, and findings and recommendations for potential future rulemaking to the Stationary Source Committee