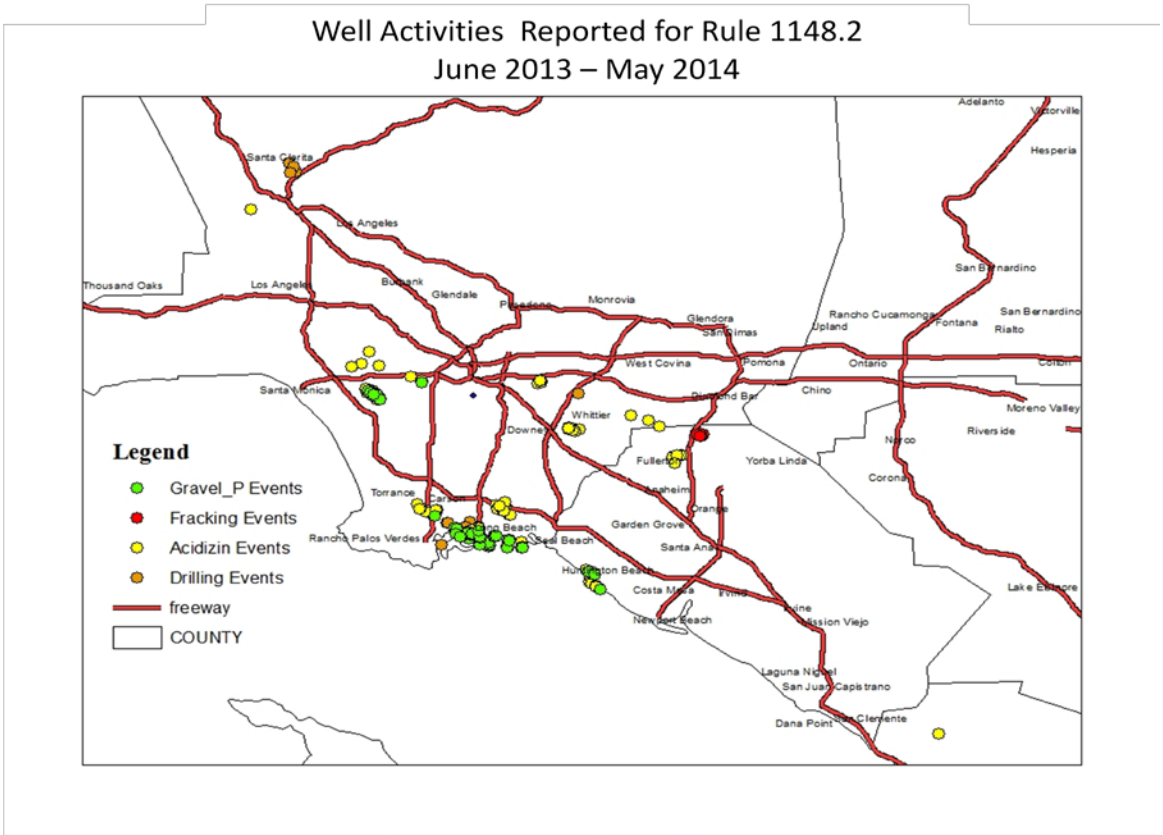
Summary of Implementation of Rule 1148.2
(June 2013 – May 2014)

Background

Rule 1148.2 – Notification and Reporting Requirements for Oil and Gas Wells and Chemical Suppliers was adopted on April 5, 2013. The purpose of Rule 1148.2 is to gather air quality-related information on oil and gas well drilling, well completion, and well reworks. This is a summary of information that has been collected between June 2013 to May 2014.

Summary of Well Activities (Notifications)

Rule 1148.2 requires facilities to notify the South Coast Air Quality Management District (SCAQMD) if they are conducting drilling, acidizing, gravel packing, or hydraulic fracturing operations. Between June 2013 and May 2014, the SCAQMD has received 602 notifications representing 679 drilling, acidizing, gravel packing or hydraulic fracturing activities (there can be multiple activities on a notification, for example one notification may cover well drilling and acidizing activities). 90 percent of the notifications are for wells located in LA County and the remaining activity is in Orange County. Map below shows geographical distribution of activities. Table on the next page provides summary of events reported between June 2013 and May 2014.

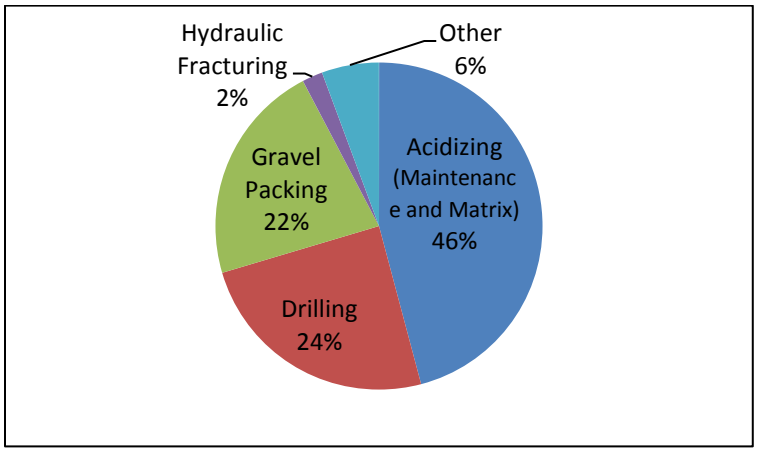


Summary of Notifications for Well Activity Events
June 2013 to May 2014

Well Activity	June 2013	July 2013	Aug 2013	Oct 2013	Nov 2013	Sep 2013	Dec 2013	Jan 2014	Feb 2014	Mar 2014	Apr 2014	May 2014	Total
WELL DRILLING													
Drilling – Vertical	2	14	13	6	9	11	11	7	5	10	11	11	110
Drilling - Horizontal	8	4	5	2	0	3	2	1	10	6	9	7	57
Drilling - Unspecified	0	1	0	0	1	0	0	0	0	0	0	0	2
WELL REWORK and WELL COMPLETION													
Acidizing*	15	24	41	37	34	26	33	24	20	16			270
Maintenance Acidizing*											23	17	40
Matrix Acidizing*											1	0	1
Gravel Packing	11	15	18	7	8	13	15	11	14	15	17	13	157
Hydraulic Fracturing	1	6	2	0	0	0	5	0	0	0	0	0	14
Other	2	3	0	1	1	0	1	3	2	6	7	2	28
Grand Total for all Activities													**679**

* Distinction between Matrix and Maintenance Acidizing began April 2, 2014

Distribution of Events



The Figure above shows relative distribution of the types of events. Some key points about well activity data:

- Most wells in the South Coast Air Basin are oil;
- Between June 2013 and May 2014 14 wells were hydraulically fractured (6 in LA and 8 in Orange County);
- 46% of the reported events were acidizing;
- 22% of the events were gravel packing (Gravel packing is akin to a mini hydraulic fracturing job);
- 24% of events were drilling operations;
- Sixteen operators submitted notifications:
    - Angus Petroleum
    - Berry Petroleum Company
    - Brea Canyon Oil Company, Inc.
    - Breitburn Operating
    - E&B Natural Resources
    - Freeport McMoran Oil and Gas (Formerly Plains Exploration and Production)
    - Geomechanics Technologies
    - Linn Operating, Inc
    - M & J Operators
    - Matrix Oil Corporation
    - Oxy USA
    - Signal Hill Petroleum, Inc.
    - Thums Long Beach Company
    - Tidelands Oil Production Company
    - Warren E&P, Inc. Drilling

Equipment

Rule 1148.2 requires facilities to report the combustion equipment used during drilling, acidizing, gravel packing and hydraulic fracturing. Since the beginning of reporting on Rule 1148.2 begun, operators reported 2250 diesel engines in use for various operations. Table below shows average hours of use of combustion equipment, average number of engines reported, and average engine size. Approximately 20% of engines used in hydraulic fracturing are over 1200 HP, and 50% are above 600 HP. For gravel packing, approximately 5% of engines are above 1200 HP, and such engines were not used for acidizing activities.

Equipment Use for Various Well Activities

Well Activity	Average Hours of Operation	Average Number of Engines	Average Engine Size (HP)
Horizontal Drilling	254	3	435
Vertical Drilling	105	20	500
Acidizing (Maintenance and Matrix)	14	11	500
Gravel Packing	57	9	515
Hydraulic Fracturing	15	8	780

Chemical Usage

Under Rule 1148.2 operators and suppliers are required to submit chemical use data. Based on an initial evaluation of the data submitted, there were approximately 40 of air toxics reported by the operators and approximately 5 additional air toxics reported by the suppliers as trade secret. The SCAQMD staff took a closer look at the following thirteen air toxics. Table below identifies chemicals used different well activities. Table on the next page provides quantities of chemicals used.

Well Activities that Used Key Air Toxics
(Based on Non-Trade Secret Chemical Reporting Only)

Air Toxics	Drilling	Acidizing	Gravel Packing	Hydraulic Fracturing
Crystalline Silica	X		X	X
Ethylbenzene		X		
Ethylene Glycol	X	X	X	X
Formaldehyde	X	X	X	
Glutural	X	X	X	
Hydrochloric Acid		X		
Hydroflouric Acid		X		
Methanol	X	X	X	X
Naphthalene	X	X	X	
Phosphoric Acid	X			
Sodium Hydroxide			X	X
Toluene		X		
Xylene		X		

Toxics Use Reported in Chemical Report for Rule 1148.2

Quantity	AQMD staff findings		Notes
Number of chemical reported as air toxics	40		Data Capture: June 4, 2013 May 29, 2014
Instances of toxics used	5249		Count of entries for chemicals identified in as toxic
Total mass of toxics used	39.5 million pounds		Sum of reported mass of chemicals identified as toxic
Air Toxics	**Instances of Use**	**Total (lbs)**	
Methanol	801	169,636	
Hydrochloric Acid	362	10,642,973	
Formaldehyde	227	32,124	
Hydrofluoric Acid	198	5,232,577	
Naphthalene	181	24,321	
2-Butoxy Ethanol	176	68,427	
Xylene	116	97,178	
Glutaral/Pentanedial	110	63,323	
Ethylbenzene	123	83,045	
Crystalline Silica	1578	25,991,840	Including CRISTOBALITE (SIO2); CRYSTALLINE SILICA; CRYSTALLINE SILICA (QUARTZ); CRYSTALLINE SILICA QUARTZ (SIO2); CRYSTALLINE SILICA, QUARTZ; CRYSTALLINE SILICA: CRISTOBALITE; CRYSTALLINE SILICA: QUARTZ (SI; CRYSTALLINE SILICA: QUARTZ (SI02); CRYSTALLINE SILICA; QUARTZ (SIO2); QUARTZ (SIO2)SILICA, CRYSTALLINE, QUARTZ; SILICA; TRIDYMITE; TRIDYMITE (SIO2)
Amorphous Silica	209	752,763	Including AMORPHOUS SILICA; AMORPHOUS SILICA FUME; SILICA FUMED; SILICA; FUMES, SILICA

Well Inspections

Following implementation of Rule 1148.2 in June 2013, SCAQMD staff conducted 90 inspections of various oil and gas well sites conducting drilling, well completion, and well rework operations. Site visits were prioritized by the well activity taking place and the presence of sensitive receptors located in close proximity to the well. Distances from the well to the sensitive receptor locations ranged from 50 feet to 1300 feet. SCAQMD staff performed inspections of the following well operations (in some cases multiple inspections of the same event were performed):

- 33 inspections of acidizing;
- 19 inspections of hydraulic fracturing;
- 10 inspections of gravel packing;
- 23 inspections of well drilling;
- 5 inspections of other operations such as cement job, perforations and redrill.

During the inspections, SCAQMD staff observed well operations, taking particular note of any visible dust emissions, smoke, or odors. Following is a summary of findings from SCAQMD staff's observations:

- During 13 inspections (14.4%) visible smoke was observed, primarily from internal combustion engines at the well site;
- During 13 inspections (14.4%) visible dust was observed, primarily from vehicle traffic and sand mixing operations;
- During 8 inspections (~9%) noticeable odors were observed by SCAQMD staff.

Monitoring and Sampling

In response to the Rule 1148.2 notifications, SCAQMD air monitoring staff conducted sampling and monitoring at a gravel packing, hydraulic fracturing, acidizing and drilling events. Handheld devices were used to measure PM and H_2S. Canister samples were also taken for all events (except one hydraulic fracturing job due to rain). Canister samples were collected near events. For all sampled activities, episodic (less than 5 minutes) elevated levels of PM10, PM2.5 and H_2S were observed. In some instances canister samples showed slightly elevated levels of some alkanes and aromatic hydrocarbons relative to the normal concentrations measured in the LA basin. The table below provides details of sampling activities and key findings.

Summary of Sampling Results for Rule 1148.2 Sources

Type of Activity Sampled	Number of Events Sampled	Results from handheld PM and H2S meters	Canister Samples Results for Organics
Hydraulic Fracturing	2	For the first event - Slightly elevated levels of PM10. H_2S not measured due to weather. For the second event - No elevated levels of PM10, except for one short-term period of elevated levels. No elevated levels of H_2S.	No canister samples were taken during the first event due to weather. Canister sampling from the second event showed slightly elevated levels of alkanes (ethane, propane, butane) and some aromatics such as benzene, toluene and xylenes
Drilling	9	Slightly elevated levels of PM10 and PM2.5 were observed. Slightly elevated levels of H2S. Elevated PM and H2S events were short in duration - 5 minutes or less	Canister sampling showed that in some cases levels of alkanes (such as ethane propane and butane) and aromatic hydrocarbons (such as benzene, toluene, ethylbenzene) were slightly higher than the ambient concentrations of these substances observed in the LA Basin.
Gravel Packing	5	Episodic elevated levels of PM10 and PM2.5 were observed. These increases were attributed to equipment startup	Majority of canister sampling did not show elevated levels of hydrocarbons. Only one sampling showed slightly elevated levels of aromatic hydrocarbons such as ethylbenzene, styrene and xylenes
Acidizing	1	No elevated levels of PM or H_2S	Canister samples showed elevated levels of aromatic hydrocarbons such as benzene and xylenes

Next Steps

SCAQMD staff will continue to evaluate the data. Staff plans to provide monthly updates and revise the data as necessary based on the review and audit of reported data.

Staff will continue to evaluate the chemical reports looking at volumes of reported chemicals.

Staff is continuing to conduct field inspections and sampling, including adding a capability of sampling flowback fluids.