San Joaquin Valley
AIR POLLUTION CONTROL DISTRICT

HEALTHY AIR LIVING™

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DATE: May 2, 2013

TO: SJVUAPCD Governing Board

FROM: Seyed Sadredin, Executive Director/APCO
Project Coordinators: Dave Warner/Tom Jordan

RE: **ITEM NUMBER 9: HYDRAULIC FRACTURING IN SAN JOAQUIN VALLEY PETROLEUM PRODUCTION**

RECOMMENDATIONS:

1. Review and consider information relating to the environmental and economic impacts of Hydraulic Fracturing in San Joaquin Valley.

2. Assess the District's current approach to oversight and regulation of Hydraulic Fracturing in San Joaquin Valley and provide direction for ongoing responsibilities and oversight by the District.

BACKGROUND:

Hydraulic fracturing has been in the news recently in connection with natural gas production in parts of the Northeast and Intermountain West regions of the United States. In California, however, hydraulic fracturing is typically used to produce liquid oil rather than natural gas. Hydraulic fracturing has been used in the Valley for liquid oil production for decades without any reported air quality hazards.

With recent discoveries relating to the Monterey Shale formation, we may see a significant increase in fracturing activities in the Valley. Recent reports of estimates of the oil contained in the Monterey Shale have concluded that it may meet more than 60 percent of the U.S. consumption needs and result in creation of tens of thousands of jobs and billions of dollars in revenues in San Joaquin Valley. It is estimated that more than 80 percent of the oil reserves from the Monterey Shale are located in San Joaquin Valley.

HYDRAULIC FRACTURING:

Hydraulic fracturing, or “fracking”, is a method to enhance the recovery of oil or natural gas from the rock layer in which the oil or gas resides, known as the producing formation. A production well is drilled vertically down through the various strata and lined with several layers of steel casing and cement. In a non-fractured well, the producing formation is sufficiently porous to allow the oil or gas to flow freely into the well. In a hydraulic fracturing job, "fracturing fluids" or "pumping fluids" consisting primarily of water and sand, with small amounts of other chemicals, are injected under high pressure into the producing formation, creating fissures that allow the oil or gas to move more freely from rock pores where it is trapped. The water and other fluids are extracted from the fissures, but the sand “proppant” stays behind, propping the fissures open so that the oil or gas can flow freely. See Attachment A for drawing of a typical natural gas fracking operation.

Fracking has been occurring in the oil production operations of the southern San Joaquin Valley for about three decades, with no known environmental impact, according to the state’s Division of Oil, Gas and Geothermal Resources (DOGGR). Of the approximately 800 fracking jobs in the state in 2011, approximately 500 were in the San Joaquin Valley. As far as the District is aware, there has been no natural gas well fracturing in the San Joaquin Valley.

There are important and significant differences in the natural gas hydraulic fracturing in states in the Midwest and East that has resulted in widespread news coverage, and the oil well fracking that has been occurring in the San Joaquin Valley. For instance, the oil reserves in the Monterey Shale are at an average of 11,000 feet below the surface, and are capped by a significant layer of less permeable “cap rock”. This cap rock has trapped the oil and gas for millennia and keeps these petroleum reservoirs isolated from the water table and earth’s surface. In California, hydraulic fracturing is principally a means of ensuring that individual, conventional wells attain maximum production, often, according to DOGGR, a preferable alternative to drilling additional wells to produce the same resources.

In some other parts of the United States, such as the Marcellus Shale gas deposits in New York, Pennsylvania, Ohio, Maryland, Virginia and West Virginia, natural gas is trapped not in a reservoir protected by cap rock, but inside uncapped rock formations much closer to the earth’s surface and the water table. In these “unconventional” cases, hydraulic fracturing is necessary to free the resource for production, but doing so in the absence of a rock cap introduces a risk of fracturing the producing formation to such an extent that the surface or water table is compromised.

According to DOGGR, there are other differences between the typical use of hydraulic fracturing in California and elsewhere. For instance, in other states the extraction of unconventional natural gas resources requires lengthy fracturing periods along long stretches of horizontally-drilled production wells. Millions of gallons of water are injected

under constant pressure, a process that may take days or weeks in order to effectively open the reservoir rock. In California, much less water is used and the period of pressurizing the reservoir rock is much shorter. In other states, the extent of fracturing in unconventional rock stretches for hundreds of yards along the horizontal well and the fractures stretch farther away from the well. In California, fracturing projects tend to use far less fluid to fracture within a narrow vertical band along a well, generally starting at a point several thousand feet underground, with the fractures extending only tens to hundreds of feet away from the well.

Finally, most oil production in the San Joaquin Valley is relatively isolated from human habitation, while in more populous areas of the nation, production wells exist in backyards and high school football fields.

POTENTIAL ENVIRONMENTAL CONCERNS:

Although water contamination has been the most significant and frequently expressed concern with respect to hydraulic fracturing, a number of other potential environmental concerns have been raised, including potential climate change and air quality impacts, and even the long term effects of prolonging the world's reliance on petroleum based fuels.

While other potential environmental impacts may deserve attention, the Air District's focus has been naturally aimed at air quality impacts. There are a number of potential sources of emissions of various pollutants, beginning with the emissions from large numbers of diesel engines that are associated with oil well drilling and fracturing operations. While fracturing a well in the San Joaquin Valley is a short term operation, it may have taken weeks or even months of drilling to prepare the down-hole environment for fracturing. Various diesel engines will have been operating drilling and pumping equipment during this period. Diesel exhaust is recognized by the State of California as containing potent carcinogenic particulate matter, responsible for the largest portion of air-borne cancer risk in the ambient air in much of California, including the San Joaquin Valley.

As noted above, in hydraulic fracturing, sand is mixed with water and injected at high pressure into the production rock layer. The handling and mixing of the sand can create silica dust emissions, resulting in a potential health risk situation for on-site workers. Silica is known to cause or contribute to serious respiratory illnesses, including silicosis and cancer.

Hydraulic fracturing also utilizes small amounts of chemicals, some of which are known air toxic compounds. These chemicals make up less than one percent of the materials pumped into the typical fracking well, with the water and sand comprising about 99.5% of the total materials injected. A portion of these chemicals can be expected to be brought back to the surface, either during the final "flow-back" portion of the fracking

process after the high-pressure fluid injection is completed, or through produced fluids after the fractured well is placed into oil production mode.

Oil and gas production companies have historically claimed that identification of these chemicals is a trade secret, disclosure of which would provide significant benefit to competitors. However, significant public and regulatory attention is being placed on the use of these chemicals, and their eventual fate in the environment.

Finally, there has been some concern expressed that hydraulic fracturing can be responsible for seismic events, such as earthquakes. Some earthquakes in the Midwest have been associated in with local fracking operations. However, DOGGR is on record as saying that the reports of induced seismicity are incorrectly associated with hydraulic fracturing, and are actually related to long-duration, high-volume injection of waste fluids in disposal wells. Hydraulic fracturing is a short-duration production well stimulation treatment. In California, existing Underground Injection Control regulations already address sustained injection pressures in waste fluid disposal wells that would exceed the natural fracture limit of the formation. Therefore, induced seismicity has not been an issue in California.

DISTRICT'S CURRENT APPROACH TO OVERSIGHT AND REGULATION:

Hydraulic fracturing is currently regulated by the District under a variety of regulations (see below) that cover virtually all potential sources of air pollution and the resulting air quality impacts. Given the potential for significant increase in fracking and heightened level of public attention and concern, enhanced requirements for reporting and impact quantification are warranted. However, the District staff believes that separate and duplicative reporting regulations by multiple government agencies are not warranted. Instead, the District has been working with DOGGR to help craft effective regulations at the state level.

Until recently, there were no specific regulations in California pertaining to hydraulically fractured wells. "Fracked" oil wells were regulated like any other well. Recently, DOGGR began "pre-draft" discussions of a regulation pertaining to hydraulic fracturing (CCR Title 14, Division 2, Chapter 4, Subchapter 2, new article 4-Hydraulic Fracturing). A formal rulemaking will begin this year. The pre-draft DOGGR rule is focused on protection of groundwater. It requires the proper design and testing of the wells to be hydraulically fractured, monitoring during and after hydraulic fracturing operations, and proper storage of hydraulic fracturing fluids. Additionally, the pre-draft rule requires extensive notification for wells to be hydraulically fractured, and disclosure on the web-based Fracfocus "Chemical Disclosure Registry" of the wells to be hydraulically fractured, chemicals used, etc.

South Coast Air Quality Management District recently adopted Rule 1148.2 which requires notification of well drilling, well completion activities (including hydraulic fracturing) and well re-work activities, and reporting of chemicals used, equipment used

and associated IC engine emissions, dray materials used and quantity of fluids used. SCAQMD then plans to utilize this information to determine if they should develop additional control requirements to close any "regulatory gaps".

There is significant overlap between the "pre-draft" DOGGR regulation and SCAQMD Rule 1148.2. In terms of air quality, both regulations are "notification" oriented and contain no emission control requirements.

There are also a number of legislative proposals at the state level that pertain to hydraulic fracturing. District staff will be watching these efforts and providing comments consistent with our intent to avoid duplicative or unnecessary regulatory actions and requirements.

Applicable District Regulations: Hydraulic fracturing is regulated by the District under a number of District rules and regulations that apply to a broad range of air pollution source.

In general, permits are required by District Rule 2010 for most sources of air pollution in the San Joaquin Valley, including for oil and gas production operations. New sources are required under Rule 2201 to implement the Best Available Control Technology (BACT) to reduce emissions the maximum extent possible, and significant emissions increases are required to be mitigated with reductions in emissions from other sources.

Much of the portable equipment used in short-term hydraulic fracturing operations, such as tanks used to capture fluids and the engines used for drilling and pumping, is exempt for permitting requirements, specifically because of the short term nature of the operations. However, such equipment would lose its permit exemption if it were found to create a potential health risk due to emissions of air toxics. At least one study has found that there is some potential for acute and chronic health risk from fracking chemicals and engine exhaust for residents near hydraulic fracturing operations in the "unconventional" natural gas fields in the east. Given the comparatively shorter term fracturing operations in the San Joaquin Valley, the significantly reduced amount of fracking fluid used in a given operation, and the relative remoteness of such operations, our analysis of this report provides little concern of a similar risk occurring in the San Joaquin Valley. However, specific information regarding the quantity and nature of such chemicals used in the San Joaquin Valley could provide greater certainty.

In addition, even when exempt from permits, emissions from such portable equipment remain heavily regulated, including under the District's own Rule 4702 for internal combustion engines and portable equipment registration requirements, the state's Air Toxic Control Measures (ATCMs) for diesel particulate and alternative Portable Equipment Registration Program (PERP), and the federal government's National Emissions Standards for Hazardous Air Pollutants (NESHAPs).

These regulations jointly reduce health impacts from diesel emissions by requiring newer and cleaner engines to be used over time, and require registration, record-keeping and reporting of the use of such portable equipment.

The District also has multiple regulations that regulate VOC emissions from oil and gas operations that are generally applicable to the permanent equipment associated with oil and gas production:

Rule 4401 –Steam Enhanced Crude Oil Production Wells – requires the capture and control of VOC emissions from of existing and new steam enhanced wells.

Rule 4402 – Crude Oil Production Sumps – requires the capture and control or replacement with tanks of sumps used store certain produced fluids.

Rule 4409 – Components at Light Crude Oil Production Facilities, Natural Gas Production Facilities, and Natural Gas Processing Facilities – requires the inspection and maintenance of fugitive components associated with the light oil and gas production and gas processing facilities.

Rule 4623 – Storage of Organic Liquids – requires the capture and control of VOC emissions from certain tanks storing produced fluids, i.e. crude oil and produced water.

US EPA 40 CFR 60 Subpart OOOO - Standards of Performance for Crude Oil and Natural Gas Production, Transmission and Distribution (constructed, reconstructed, or modified after 8/23/11). This new regulation has requirements for the collection and control of gasses from hydraulically fractured natural gas wells, and other requirements. This regulation does not apply to wells that are hydraulically fractured that produce both oil and associated gas – as is common in the District. Again, while the northern part of the District has some natural gas wells, these wells are not in a producing from a formation that is susceptible to hydraulic fracturing. As such, this regulation has no impact on hydraulic fracturing operations in the District.

The District also regulates fugitive dust emissions such as the dust from sand handling and mixing operations. Regulation VIII regulates fugitive dust and contains several applicable rules that require control of dust emissions and limit exposure to silica dust.

Attachment: DIAGRAM OF TYPICAL NATURAL GAS PRODUCTION HYDRAULIC FRACTURING OPERATION (1 page)

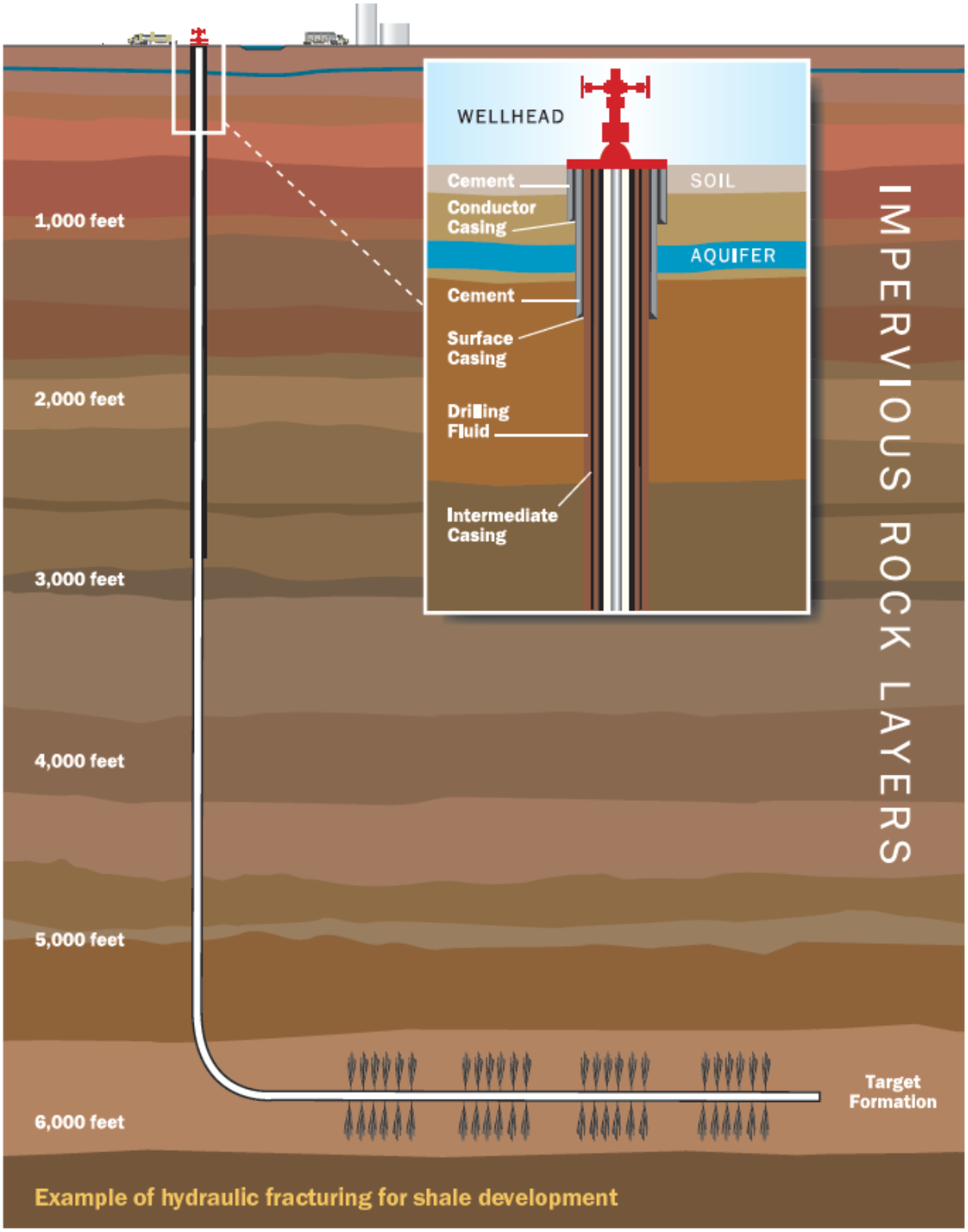
San Joaquin Valley Unified Air Pollution Control District
Meeting of the Governing Board
May 2, 2013

HYDRAULIC FRACTURING IN SAN JOAQUIN VALLEY PETROLEUM PRODUCTION

Attachment:

DIAGRAM OF TYPICAL NATURAL GAS PRODUCTION
HYDRAULIC FRACTURING OPERATION
(1 PAGE)

DIAGRAM OF TYPICAL NATURAL GAS PRODUCTION HYDRAULIC FRACTURING OPERATION



Source: API, Hydraulic Fracturing; Unlocking America's Natural Gas Resources July 19, 2010