SAN JOAQUIN VALLEY UNIFIED AIR POLLUTION CONTROL DISTRICT

FINAL DRAFT STAFF REPORT

Proposed Amendments to Rule 4308 (Boilers, Steam Generators, and Process Heaters – 0.075 MMBtu/hr to less than 2.0 MMBtu/hr)

October 15, 2013

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I. SUMMARY

The purpose of this rule amending project is to fulfill a commitment from the San Joaquin Valley Air Pollution Control District's (District's) *2012 PM2.5 Plan* by making the requirements of Rule 4308 (Boilers, Steam Generators, and Process Heaters – 0.075 MMBtu/hr to less than 2.0 MMBtu/hr) more stringent and to improve rule clarity. Rule 4308 is the District's point-of-sale rule that reduces oxides of nitrogen (NOx) and carbon monoxide (CO) emissions from boilers, steam generators, and process heaters with a rated heat input capacity of 0.075 to less than 2.0 million British thermal units per hour (MMBtu/hr).

During plan development, the District identified an opportunity to lower the NOx emission limit for natural gas-fired instantaneous water heaters with a rated heat input of 0.075-0.4 MMBtu/hr (instantaneous units) from 55 parts per million by volume (ppmv) to 20 ppmv. The 20 ppmv compliant instantaneous units are readily available throughout California (including the San Joaquin Valley (Valley)) and are cost effective; as such, the District is proposing to lower the NOx emission limit for these units through this rule amendment project. The District is also proposing to clarify the applicability of Rule 4308 by adding specific exemption language for hot water pressure washers that are currently exempt from the rule.

This proposed rule amendment project will contribute to the Valley's progress towards attainment of federal air quality standards for particulate matter that is 2.5 microns or less in diameter (PM2.5) and ozone by reducing NOx, which is a precursor for both PM2.5 and ozone. If adopted, amendments to Rule 4308 will reduce 1.82 tons per year

(tpy) of NOx emissions from instantaneous units upon full rule implementation. In addition, this proposed rule amendment will ensure that Rule 4308 is as stringent as similar rules in other California air districts and satisfies Reasonably Available Control Technology (RACT) requirements.

II. PROJECT BACKGROUND

A. Source Category

As a point-of-sale rule, Rule 4308 applies to any person who supplies, sells, offers for sale, installs, or solicits the installation of boilers, steam generators, and process heaters with a rated heat input of 0.075 MMBtu/hr to less than 2.0 MMBtu/hr. Affected persons include water heater manufacturers, plumbing wholesalers, supply stores, plumbers, and contractors. This point-of-sale approach allows the District to achieve NOx emission reductions without forcing immediate replacement of existing units to comply with rule requirements and thus placing an undo financial burden on the consumer.

The most significant proposed rule amendment applies specifically to instantaneous units. Instantaneous units, also known as tankless water heaters, generate hot water only as it is needed. They do not produce the standby energy losses associated with storage, or tank-style, water heaters since they only heat water when it flows through a heat exchanger, and are thus promoted as energy efficient devices.[1] Instantaneous units of this size range are used in settings including, but not limited to, apartment buildings, large homes, small businesses, commercial buildings, manufacturing facilities, government facilities, restaurants, hotels, hospitals, educational institutions, and religious organizations.

Instantaneous units have an estimated lifetime of 20 years.[2] Therefore, the emissions reduced from these units will occur over 20 years, from 2015 through 2034, as existing instantaneous units are replaced with newer instantaneous units, new instantaneous units are purchased for new developments, and some end-users switch from tank-style to instantaneous units.

B. Number of Units Affected by Proposed Rule Amendments

Since rule implementation will occur from 2015 through 2034, the District projected the number of instantaneous units in the Valley in 2034. The District estimates that there will be 1,678 instantaneous units in 2034. To determine the number of units in the Valley affected by the proposed rule amendments, the District calculated an average

[1] Rinnai Tankless Water Heaters. (2013). Retrieved April 17, 2013 from http://www.rinnai.us/tankless-water-heater/how-tankless-works

[2] United States Department of Energy [DOE]: Tankless or Demand-Type Water Heaters. (2012). Retrieved June 11, 2013 from http://energy.gov/energysaver/articles/tankless-or-demand-type-water-heaters

population-to-unit ratio of 1 natural gas-fired unit with a rated heat input of 0.075-0.4 MMBtu/hr for every 385 people, using population data from the South Coast Air Quality Management District (SCAQMD)[3] and their estimate for the total number of units in this size category.[4] Using this ratio and a population estimate of 4.33 million people in the Valley in 2015,[5] the District estimates that there will be 11,247 natural gas-fired units with a rated heat input of 0.075-0.4 MMBtu/hr in the Valley in 2015.

Only a fraction of the 11,247 natural gas-fired water heaters are instantaneous units, as most of the natural gas units sold are storage water heaters. The Department of Energy's *2009 Water Heater Market Profile* estimated that of water heaters sold 3% are natural gas-fired instantaneous units, 48% are natural gas-fired storage units, and the remaining 49% are electric units.[6] Therefore, natural gas-fired instantaneous units make up 5.9% of the natural gas-fired water heater market. As such, the District estimates that there will be 664 instantaneous units in the Valley in 2015.

An increasing number of commercial developments and large residences are being built with instantaneous water heaters due to the increased fuel and energy efficiency that these units provide over typical tank-style water heaters. Similarly, some existing commercial businesses and residents are replacing tank-style units with instantaneous units because of the added efficiency benefits. Various sources estimate that in future years, instantaneous water heaters will have an annual growth rate of 4-10%.[7,8] To remain conservative, the District assumes an annual 5% growth rate for the inventory of instantaneous units in the Valley. Using the annual growth rate and 2015 inventory of instantaneous units, the District projects that the total number of instantaneous units in the Valley in 2034 will be 1,678 units.

As these sources are not permitted or registered, the estimated number of units subject to these proposed rule amendments has been determined using the best available data.

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[3] SCAQMD: About South Coast AQMD. (2012, October 9). Retrieved May 7, 2013 from http://www.aqmd.gov/aqmd/index.html

[4] SCAQMD. (2006, May 5). *Staff Report for Proposed Amended Rule 1146.2- Emissions of Oxides of Nitrogen from Large Water Heaters and Small Boilers and Process Heaters.* Diamond Bar, CA. Retrieved from http://www.aqmd.gov/hb/2006/may/060535a.html

[5] The Planning Center. (2012, March 27). *San Joaquin Valley Demographic Forecasts 2010 to 2050.* http://www.valleyblueprint.org/files/San%20Joaquin%20Valley%20Demographic%20Forecasts%20-%20Final%2027%20Mar%202012_0.pdf

[6] Department of Energy [DOE]. (September 2009). *Water Heater Market Profile.* Retrieved from http://www.energystar.gov/ia/partners/prod_development/new_specs/downloads/water_heaters/Water_Heater_Market_Profile_Sept2009.pdf

[7] California Utilities Statewide Codes and Standards Team. (October 2011). *2013 California Building Energy Efficiency Standards.* http://www.energy.ca.gov/title24/2013standards/prerulemaking/documents/current/Reports/Residential/Water_Heating/2013_CASE_WH2.WH5_WaterHeaterReady-10.28.2011.pdf

[8] CenterPoint Energy. (2009). *Vertical Subdivision Workshop: Tankless Water Heaters.* *http://www.centerpointenergy.com/staticfiles/CNP/Common/SiteAssets/doc/Tankless%20Water%20Heaters-Rheem.pdf*

C. Current Rule

The purpose of Rule 4308 is to limit NOx and CO emissions from large water heaters and small boilers with a rated heat input of 0.075 MMBtu/hr to less than 2.0 MMBtu/hr. The rule currently requires that no person supply, sell, offer for sale, install, or solicit the installation of any natural gas-fired unit within the Valley that exceeds a NOx emission limit of 20 ppmv, except instantaneous water heaters and pool heaters with a rated heat input of 0.075-0.4 MMBtu/hr that currently have a NOx emission limit of 55 ppmv.

Rule 4308 also requires that manufacturers of units subject to this rule certify their units through either the District's certification program, the SCAQMD certification process for SCAQMD Rule 1146.2, or another emission certification program approved by the United States Environmental Protection Agency (EPA) and District's Air Pollution Control Officer. Both the SCAQMD and District certification processes require that the manufacturer obtain a certification source test from an independent testing laboratory for each unit, in order to verify compliance with the applicable emission limits. The manufacturer is then required to submit the certification source test as part of a compliance report that identifies the manufacturer, brand name, model number, and description of the unit being certified. SCAQMD has worked extensively with manufacturers subject to SCAQMD Rule 1146.2 to certify thousands of units and provides the complete list of certified units on their website for reference.[9]

The District's Governing Board adopted amendments to Rule 4308 on December 17, 2009 to incorporate the 20 ppmv NOx emission limits mentioned above. The District submitted the amended rule to the California Air Resources Board (ARB) for forwarding to the EPA as an amendment to the State Implementation Plan (SIP) in 2010. EPA finalized approval of Rule 4308 on January 31, 2011 and found it to be at least as stringent as established RACT requirements.[10]

D. Similar Rules in Other Air Districts

The District compared Rule 4308 to the following analogous rules in other air districts:

- Bay Area Air Quality Management District (BAAQMD) Regulation 9, Rule 6 (Rule 09-06) (Nitrogen Oxides Emissions from Natural Gas-Fired Boilers and Water Heaters)[11]

[9] SCAQMD. (2013, July 9). *List of Certified Units Pursuant to Rule 1146.2*. Diamond Bar, CA. Retrieved from http://www.aqmd.gov/rules/doc/r1146/r1146_2table.pdf

[10] Revisions to the California State Implementation Plan, San Joaquin Valley Unified Air Pollution Control District, 76 Fed. Reg. 20, pp. 5276-5277. (2011, January 31). (to be codified at 40 C.F.R. pt. 52) http://www.gpo.gov/fdsys/pkg/FR-2011-01-31/pdf/2011-1927.pdf

[11] Bay Area Air Quality Management District [BAAQMD]. (2007, November 7). *Regulation 9 Inorganic Gaseous Pollutants, Rule 6 Nitrogen Oxides Emissions from Natural Gas-Fired Boilers and Water Heaters*. Retrieved from http://www.baaqmd.gov/~/media/Files/Planning%20and%20Research/Rules%20and%20Regs/reg%2009/rg0906.ashx?la=en

- Sacramento Metropolitan Air Quality Management District (SMAQMD) Rule 411 (NOx from Boilers, Process Heaters and Steam Generators)[12]
- SMAQMD Rule 414 (Water Heaters, Boilers and Process Heaters Rated Less Than 1,000,000 BTU Per Hour)[13]
- SCAQMD Rule 1146.2 (Emissions of Oxides of Nitrogen From Large Water Heaters and Small Boilers and Process Heaters)[14]
- Ventura County Air Pollution Control District (VCAPCD) Rule 74.11.1 (Large Water Heaters and Small Boilers)[15]

Units subject to Rule 4308 and these aforementioned rules in other air districts have emission limits based on two size categories: units with a rated heat input of 0.075 to 0.4 MMBtu/hr and units with a rated heat input greater than 0.4 but less than 2.0 MMBtu/hr. Rule 4308 currently enforces a 20 ppmv NOx emission limit for all natural gas-fired water heaters with a rated heat input greater than 0.4 but less than 2.0 MMBtu/hr, which is equivalent to the limits in these other California air districts' rules.

However, BAAQMD Rule 09-06, SCAQMD Rule 1146.2, and VCAPCD Rule 74.11.1 have a 20 ppmv NOx emission limit for instantaneous units with a rated heat input of 0.075-0.4 MMBtu/hr, whereas Rule 4308 contains a NOx emission limit of 55 ppmv for these units. The lower limit was implemented in SCAQMD in 2012 and BAAQMD in 2013, and will be implemented in VCAPCD in 2014.

The District also compared the CO emission limit in Rule 4308 to the aforementioned air districts' rules. The District's emission limit of 400 ppm is equivalent to the CO emission limits in these other air districts' rules and it applies to the same size category of units specified within those rules. Therefore, aside from the NOx emission limit for instantaneous units, current Rule 4308 is as stringent as or more stringent than other air districts' rules.

E. Control Technologies

Instantaneous units are designed and manufactured with low NOx burner systems in order to meet specific NOx emission limits, such as the existing Rule 4308 NOx emission limit of 55 ppmv. The instantaneous units that meet a 20 ppmv NOx emission limit are equipped with ultra-low NOx burners. As this rule is a point-of-sale rule, retrofit of currently installed instantaneous units would not be required.

[12] Sacramento Metropolitan Air Quality Management District [SMAQMD]. (2007, August 23). *Rule 411, NOx from Boilers, Process Heaters, and Steam Generators.* Retrieved from http://airquality.org/rules/rule411.pdf
[13] SMAQMD. (2010, March 25). *Rule 414, Water Heaters, Boilers and Process Heaters Rated Less Than 1,000,000 BTU Per Hour.* Retrieved from http://airquality.org/rules/rule414.pdf
[14] SCAQMD. (2006, May 5). *Rule 1146.2 (Emissions of Oxides of Nitrogen from Large Water Heaters and Small Boilers and Process Heaters).* Retrieved from http://www.aqmd.gov/rules/reg/reg11/r1146-2.pdf
[15] Ventura County Air Pollution Control District [VCAPCD]. (2012, September 11). *Rule 74.11.1—Large Water Heaters and Small Boilers.* Retrieved from http://vcapcd.org/Rulebook/Reg4/RULE%2074.11.1.pdf

The District researched whether pool heater technology has also advanced to achieve a 20 ppmv NOx emission limit. Water heater manufacturers and staff at SCAQMD indicated that there are no known pool heaters with a rated heat input of 0.075-0.4 MMBtu/hr that are capable of meeting a 20 ppmv NOx emission limit. All pool heaters certified through SCAQMD are certified to meet a 55 ppmv NOx emission limit. The District recommends upholding the current NOx emission limit for pool heaters in this size range to maintain the lowest feasible limit and stay consistent with other air districts' rules.

The District is not proposing the addition of any PM2.5 or sulfur dioxide (SO2) emission limits or requirements, as found in other District combustion rules, because there are no known units with a rated heat input of 0.075-2.0 MMBtu/hr that operate with PM2.5 or SO2 emission control devices (such as baghouses, electrostatic precipitators, and scrubbers). These technologies have not been demonstrated or achieved-in-practice for units smaller than 5 MMBtu/hr.[16] Units this small are fired on natural gas, propane, liquefied petroleum gas, or low sulfur diesel fuel and already emit very low levels of PM2.5 and SO2.

III. PROPOSED AMENDMENTS TO RULE 4308

A. Overview of Proposed Amendments

The District is proposing the following amendments to Rule 4308:

- Lowering the NOx emission limit for instantaneous units from 55 ppmv to 20 ppmv
- Addition of an exemption for hot water pressure washers
- Removal of redundant and expired language
- Clarifications to existing rule language in Sections 1.0, 3.0, and 6.0

B. Proposed Rule 4308

The following discussion details the proposed amendments to Rule 4308. See Proposed Rule 4308 for exact language.

Section 1.0 Purpose

Language would be added to this section to clarify that this rule also limits CO emissions.

[16] SJVAPCD. (2012, December 20). *Appendix D (Stationary and Area Source Control Strategy Evaluation), 2012 PM2.5 Plan.* Fresno: CA. Retrieved from http://www.valleyair.org/Workshops/postings/2012/12-20-12PM25/FinalVersion/14AppendixDStationaryandArea.pdf

Section 3.0 Definitions

To improve rule clarity, the definitions of "EPA," "SCAQMD," and "hot water pressure washer" would be added to rule language, and the definition of "PUC Quality Natural Gas" would be moved.

Section 4.0 Exemptions

To clarify current rule applicability, an exemption for hot water pressure washers would be added. In 2011, a pressure washer manufacturer notified the District that per the current definition of an instantaneous water heater, hot water pressure washers could be misinterpreted as being classified under this source category.

Similar to instantaneous units, the water for hot water pressure washers is only heated when it flows through the heat exchanger. These units are used in various industries, including food processing, construction, and transportation industries. The pressure washers are used to clean and degrease machinery, vehicles, work surfaces, and floors. As such, most units are portable and are fired on diesel fuel since it is more readily available and practical for portable uses than natural gas.

Since most hot water pressure washers are portable, it is not possible to incorporate add-on NOx controls. For the few stationary units that may be in operation, the rated heat input capacity is so small that add-on controls are not feasible. Without the use of add-on controls, hot water pressure washers are unable to meet the emission limits of Rule 4308. In addition, these units are generally only used for a couple of hours a day. Pressure washers are equipped with trigger guns, which stop the flow of water when not needed and limit heating and fuel burning processes. The NOx emissions from hot water pressure washers are very small. There is currently one 0.166 MMBtu/hr hot water pressure washer permitted in the Valley, and based on the current NOx emission limit within that permit, the unit would emit at most 0.13 pounds of NOx per day, assuming an unrealistic worst case scenario that the unit runs for 24 hours a day.

Diesel fuel-fired water heaters of all sizes are required to obtain a permit for their units per District Rule 2201 (New and Modified Stationary Source Review Rule) and implement Best Available Control Technology (BACT) requirements. An exemption from Rule 4308 does not remove the requirement for diesel-fired hot water pressure washers to obtain a permit and implement the most stringent controls possible via Rule 2201.

The District examined whether other air districts regulate hot water pressure washers through their analogous rules and found that none of the rules identified in Section II.D specifically address these units. The SCAQMD, BAAQMD, and VCAPCD rules only apply to natural gas-fired units, and since hot water pressure washers are generally diesel-fired, these units would be exempt.

Pressure washers were previously addressed in SCAQMD Rule 1147 (NOx Reductions from Miscellaneous Sources); they were recently removed from this rule and transitioned into Rule 219 (Equipment Not Requiring a Written Permit Pursuant to Regulation II). In the staff report for the 2013 amendment of Rule 219, SCAQMD notes that due to the mobile nature of power pressure washers, emission controls for these units are challenging, if not impossible.[17] As a result, Rule 219 exempts all diesel-fired pressure washers with a maximum heat input capacity of 0.55 MMBtu/hr or less; 96% of the permitted pressure washers in SCAQMD had rated maximum heat input capacities less than 0.55 MMBtu/hr.

Section 5.0 Requirements

The District proposes amending the NOx emission limit for instantaneous units with a rated heat input of 0.075 to 0.4 MMBtu/hr from 55 ppmv to 20 ppmv. Emission limits in Table 1 of Rule 4308 would remain in effect until December 31, 2014. On and after January 1, 2015, Table 2 emission limits would be implemented. Table 2 of Rule 4308 reflects the new NOx emission limit for these instantaneous units; see below.

[17] SCAQMD. (2013, May 3). *Staff Report for Proposed Amended Rule 219- Equipment Not Requiring a Written Permit Pursuant to Regulation II.* Diamond Bar, CA. Retrieved from http://www.aqmd.gov/hb/attachments/2011-2015/2013May/2013-May3-028.pdf

Table 2 for Rule 4308 NOx Emission Limits

Table 2 Emission Limits (Effective on and after January 1, 2015)		
Type and Size of Unit, in MMBtu/hr	NOx Limit (at 3% stack gas oxygen by volume on a dry basis)	
	PUC Gas	Non PUC Gas or Liquid
	lb/MMBtu of heat input (ppmv)	lb/MMBtu of heat input (ppmv)
Units greater than or equal to 0.075 but less than or equal to 0.4, except as specified below	0.024 (20)	0.093 (77)
Units greater than 0.4 but less than 2.0, except as specified below	0.024 (20)	0.036 (30)
Instantaneous water heaters greater than or equal to 0.075 but less than or equal to 0.4	0.024 (20)	0.093 (77)
Instantaneous water heaters greater than 0.4 but less than 2.0	0.024 (20)	0.036 (30)
Pool heaters greater than or equal to 0.075 but less than or equal to 0.4	0.068 (55)	0.093 (77)
Pool heaters greater than 0.4 but less than 2.0	0.024 (20)	0.036 (30)

This amendment would require that instantaneous units supplied, sold, or installed in the Valley after January 1, 2015 be certified to meet a 20 ppmv NOx emission limit. The District examined whether low NOx instantaneous units are available in the Valley. SCAQMD maintains a list of natural gas-fired water heater manufacturers certified to produce units that meet SCAQMD Rule 1146.2 emission limits.[18] There are six water heater manufacturers that produce instantaneous units. Five of the six manufacturers produce 55 ppmv and 20 ppmv compliant instantaneous units, while one of the manufacturers no longer produces 55 ppmv compliant units and now only produces 20 ppmv compliant instantaneous units. All six instantaneous water heater manufacturers confirmed to District staff that they sell 20 ppmv compliant instantaneous units to Valley wholesalers or water heater suppliers. These Valley wholesalers and suppliers generally only sell units to licensed contractors or parties qualified to correctly install the units.

[18] SCAQMD. (2013, July 9). *List of Certified Units Pursuant to Rule 1146.2*. Diamond Bar, CA. Retrieved from http://www.aqmd.gov/rules/doc/r1146/r1146_2table.pdf

Section 6.0 Administrative Requirements

Language would be added to Section 6.2.3 to clarify that the SCAQMD protocol, "Nitrogen Oxides Emissions Compliance Testing for Natural Gas-Fired Water Heaters and Small Boilers," is only applicable to natural gas-fired units. Redundant language would also be removed from Section 6.0.

Section 7.0 Compliance Schedule

To improve rule clarity and simplify rule language, Section 7.0 would be deleted from Rule 4308. The compliance dates listed in this section are outdated and the new compliance dates are listed in Section 5.0 of the rule.

IV. SUPPORTING ANALYSES

A. Global Climate Change and Greenhouse Gases

The California Global Warming Solutions Act of 2006 (AB 32) created a comprehensive, multi-year program to reduce greenhouse gas (GHG) emissions in California, with the overall goal of restoring emissions to 1990 levels by the year 2020. ARB and the State Legislature are developing policies and programs to implement AB 32. The District believes that the evidence and the rationale that climate change is occurring is compelling and convincing. In addition to the long-term consequences of climate change, the District is concerned with the potential ramifications of more moderate but imminent changes in weather patterns. The Valley depends heavily on agriculture for its economy and has developed agricultural practices based on the last several decades of weather patterns. Unanticipated and large fluctuations in these patterns could have a devastating effect on the Valley's economy.

While there are many win-win strategies that can reduce both GHG and criteria/toxic pollutant emissions, when faced with situations that involve tradeoffs between the two, the District believes that the more immediate public health concerns that may arise from an increase in criteria or toxic pollutant emissions should take precedence. The District Governing Board adopted the Climate Change Action Plan (CCAP) in August 2008. For California Environmental Quality Act (CEQA) requirements, one of the goals of the CCAP is to establish District processes for assessing the significance of greenhouse gas impacts. The District has developed a policy and guidance for addressing greenhouse gases under CEQA.

B. Health Benefits

The District is a public health agency whose mission is to improve the health and quality of life for all Valley residents through efficient, effective and entrepreneurial air quality management strategies. The District periodically compiles attainment plans to identify

individual regulations and other strategies that will achieve the emissions reductions needed for the Valley to meet federal health-based air quality standards (National Ambient Air Quality Standards, or NAAQS). Guided by its Health-Risk Reduction Strategy, the District develops and implements both attainment plans and regulations to attain the NAAQS in the quickest, most health-protective, and most cost-effective manner. The control strategy as a whole, then, has important public health benefits and health costs savings. This amendment to Rule 4308 is one component of this overall control strategy. Since this rule amendment reduces NOx emissions, it benefits public health by contributing to improved ozone and PM2.5 air quality.

C. Emission Reduction Analysis

As presented in the *2012 PM2.5 Plan*, the annual NOx emissions from this source category subject to Rule 4308 were 0.71 tpd (259 tpy) in 2012. The District did not specify an emission reduction commitment for this proposed rule amendment in that plan in lieu of conducting a more thorough emission reduction analysis in this rule amendment project.

Proposed rule amendments would only affect a portion of the total source category; as such, the baseline NOx emissions from instantaneous units are 2.92 tpy. Proposed rule amendments would result in approximately 1.82 tpy of NOx emission reductions after all units are replaced and new units are purchased within the next 20 years, reflecting a 62.3% reduction from this baseline. The complete Emission Reduction Analysis is presented in Appendix B of this Final Draft Staff Report.

D. Cost Effectiveness Analysis

Pursuant to California Health & Safety Code (CH&SC) Section 40920.6(a), the District is required to analyze the cost effectiveness of new rules or rule amendments. The District has prepared a Cost Effectiveness Analysis to analyze the economic feasibility of the proposed rule amendments. The estimated cost effectiveness of implementing a 20 ppmv NOx emission limit for instantaneous units is approximately $19,961-$52,746 per ton of NOx emission reductions. The complete analysis is presented in Appendix C of this Final Draft Staff Report.

E. Socioeconomic Analysis

Pursuant to CH&SC Section 40728.5(a), “Whenever a district intends to propose the adoption, amendment, or repeal of a rule or regulation that will significantly affect air quality or emissions limitations, that agency shall, to the extent data are available, perform an assessment of the socioeconomic impacts of the adoption, amendment, or repeal of the rule or regulation.” No significant socioeconomic impacts are expected from these proposed rule amendments. The complete Socioeconomic Analysis is presented in Appendix D of this Final Draft Staff Report.

F. Rule Consistency Analysis

Pursuant to CH&SC Section 40727.2, the District prepared a Rule Consistency Analysis that compares the elements of the amendments with the corresponding elements of other District rules and federal regulations. Proposed amendments would not conflict with other District rules, or federal rules, regulations, or policies covering similar stationary sources. This Rule Consistency Analysis is presented in Appendix E of this Final Draft Staff Report.

G. CEQA

Pursuant to Section 15061 of the Guidelines for Implementation of the CEQA, the District investigated the possible environmental impacts of the proposed amendments to Rule 4308. Based on the lack of evidence to the contrary, the District has concluded that the proposed rule amendments will not have any significant adverse effects on the environment. Staff recommends filing a Notice of Exemption under the provisions of Public Resource Code 15061(b)(3).

V. RULE DEVELOPMENT PROCESS

A. Public Workshop for Rule 4308

The District held a public workshop to present, discuss, and hear comments on the draft rule and draft staff report on August 22, 2013. The draft rule and draft staff report were made available on the District's website prior to the public workshop, and a two week comment period followed the public workshop. Comments received during the workshop and during the commenting period following the workshop were considered and incorporated into the proposed amendments to Rule 4308 and Final Draft Staff Report, as appropriate.

Per the District's socioeconomic policy, adopted by the Governing Board in October 2011, District staff solicited information from stakeholders at the August 22nd workshop about trade organizations that represent industries affected by the rule amendment. Through this process, the Cleaning Equipment Trade Association was identified as an affected trade organization. The District also solicited feedback from affected sources to determine if any new Department of Transportation (DOT), Occupational Safety and Health Administration (OSHA), or other requirements would result from the draft amendments. Stakeholders did not identify any DOT, OSHA, or other requirements that would result from the draft rule amendments.

B. Public Hearing for Rule 4308

In accordance with CH&SC Section 40725, the proposed amendments to Rule 4308 and Final Draft Staff Report were publicly noticed and made available on the District's

website prior to the Governing Board public hearing to consider adoption of the proposed rule amendments. The proposed amendments to Rule 4308, Final Draft Staff Report, and other supporting documents were made available for public comment on October 15, 2013. The public is also invited to provide comments during the public hearing for the adoption of the proposed rule amendments.

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APPENDIX A

Summary of Significant Comments and Responses For Proposed Amendments to Rule 4308

October 15, 2013

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SUMMARY OF SIGNIFICANT COMMENTS FOR DRAFT AMENDMENTS TO RULE 4308 (BOILERS, STEAM GENERATORS, AND PROCESS HEATERS — 0.075 MMBTU/HR TO LESS THAN 2.0 MMBTU/HR)

VERBAL COMMENTS, AUGUST 22, 2013 WORKSHOP

EPA REGION IX STAFF COMMENTS

No comments were received from EPA.

ARB STAFF COMMENTS

No comments were received from ARB.

STAKEHOLDER COMMENTS

R.F. MacDonald Company (MacDonald)
Cargill Beef Packers (Cargill)

1. **COMMENT:** There are some boilers and water heaters in the 0.075-2.0 million British thermal units per hour (MMBtu/hr) size range installed in the San Joaquin Valley (Valley) with a South Coast Air Quality Management District (SCAQMD) certification sticker for meeting a 30 parts per million by volume (ppmv) NOx emission limit; however, the current NOx emission limit for these units in Rule 4308 is 20 ppmv. We are concerned the District's Compliance department is not noticing these units because they have a SCAQMD certification sticker. (MacDonald)

   RESPONSE: The 20 ppmv NOx emission limit for most units subject to Rule 4308 went into effect on January 1, 2011. Prior to that date, units supplied, sold, or installed in the Valley were required to meet either a 30 ppmv or 77 ppmv NOx emission limit. Since Rule 4308 is a point-of-sale rule and does not require replacement of existing units to meet rule limits, these units may have been purchased prior to the January 1, 2011 compliance date.

2. **COMMENT:** Since the District is lowering the NOx emission limit for instantaneous units with a rated heat input of 0.075-0.4 MMBtu/hr from 55 ppmv to 20 ppmv, will a 20 ppmv NOx emission limit also apply to instantaneous units with a rated heat input greater than 0.4 to less than 2.0 MMBtu/hr? (Cargill)

   RESPONSE: The current version of Rule 4308 already contains a 20 ppmv NOx emission limit for instantaneous units with a rated heat input greater than 0.4 to less than 2.0 MMBtu/hr.

WRITTEN COMMENTS, AUGUST 22, 2013 WORKSHOP

EPA REGION IX STAFF COMMENTS

The District did not receive a comment letter from EPA.

ARB STAFF COMMENTS

The District did not receive a comment letter from ARB.

STAKEHOLDER COMMENTS

One comment was received during the commenting period following the August 22nd public workshop from the Cleaning Equipment Trade Association (CETA).

1. **COMMENT:** Pressure washers differ in application and design from the boilers, steam generators, and process heaters that Rule 4308 is intended to regulate. Pressure washers have limited use and most units are portable. As a result, CETA supports the draft amendment to Rule 4308 to include an exemption for pressure washers.

   RESPONSE: Comment noted.

APPENDIX B

Emission Reduction Analysis
For Proposed Amendments to Rule 4308

October 15, 2013

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EMISSION REDUCTION ANALYSIS FOR PROPOSED AMENDMENTS TO RULE 4308

I. SUMMARY

Proposed rule amendments reduce NOx emissions by lowering the NOx emission limit from 55 parts per million by volume (ppmv) to 20 ppmv for instantaneous water heaters with a rated heat input of 0.075-0.4 million British thermal units per hour (MMBtu/hr) (instantaneous units), as committed to in the *2012 PM2.5 Plan*. Instantaneous units have an estimated lifetime of 20 years.[1] Therefore, as a point-of-sale rule, emission reductions will occur over 20 years, from 2015 through 2034.

The *2012 PM2.5 Plan* did not specify an emission reduction commitment for this proposed rule amendment; therefore, there is no comparison between a plan emission reduction commitment and the proposed rule emission reductions. The estimated NOx emission reductions upon full rule implementation in 2034 are summarized in Table B-1.

Table B-1: Emissions Reduced Upon Full Rule Implementation in 2034

Number of Units in the Valley	Baseline NOx Emissions Inventory (tons per year, or tpy)	NOx Emission Reductions (tpy)	Percent Reduction from Baseline
1,678	2.92	1.82	62.3%

II. BACKGROUND

Rule 4308 applies to any person who supplies, sells, offer for sale, installs, or solicits the installation of boilers, steam generators, or process heaters with a rated heat input of 0.075 MMBtu/hr to less than 2.0 MMBtu/hr. The proposed rule amendment would reduce NOx emissions by requiring instantaneous units to meet a 20 ppmv NOx emission limit compared to the current limit of 55 ppmv. These types of units in this size range are used primarily in a variety of commercial settings.

Since this proposed rule amendment is affecting a small subcategory of units subject to Rule 4308, the baseline NOx emissions inventory for these instantaneous units is considerably smaller than the total NOx emissions inventory for the overall source category. Table B-2 illustrates the NOx emissions inventory for all units subject to Rule 4308. As demonstrated in this appendix, the 2034 baseline emissions inventory for instantaneous units affected by the proposed rule amendments is 2.92 tpy.

[1] United States Department of Energy [DOE]: Tankless or Demand-Type Water Heaters. (2012). Retrieved June 11, 2013 from http://energy.gov/energysaver/articles/tankless-or-demand-type-water-heaters

Table B-2: Annual Average NOx Emissions Inventory for All Units Subject to Rule 4308*

Year	2012	2014	2015	2016	2017	2018	2019
NOx Emissions (tpy)	259.2	233.6	219.0	211.7	204.4	197.1	193.5

**2012 PM2.5 Plan* data converted to tpy.

III. EMISSION REDUCTION ANALYSIS

A. Assumptions for the Emission Reduction Analysis

District staff gathered data from manufacturers, previous District staff reports, Department of Energy (DOE) data, and the 2006 South Coast Air Quality Management District (SCAQMD) Rule 1146.2 staff report to determine emission capacity factors, average usage rates, emission rates, and average unit size.

The District sent out a survey to gather information on the number of units in this size category in 2009. Only 50% of surveys were returned, and most of them did not contain any information on the number of units for this size category. Therefore, the results of that survey are not included in this analysis.

For purposes of this emission reduction analysis, the following assumptions are made:

1. **Population-to-Unit Ratio:** District staff calculated an average population-to-unit ratio, using SCAQMD population data[2] and an estimate for the total number of units with a rated heat input of 0.075-0.4 MMBtu/hr in the SCAQMD.[3] For every 385 people, there is one unit in the size range of 0.075 MMBtu/hr to 0.4 MMBtu/hr.

2. **Valley Population:** A Valley population of 4,330,000 people is assumed for 2015, based on data from Valley Metropolitan Planning Organizations (MPOs).[4]

[2] SCAQMD: About South Coast AQMD. (2012, October 9). Retrieved May 7, 2013 from http://www.aqmd.gov/aqmd/index.html

[3] SCAQMD. (2006, May 5). *Staff Report for Proposed Amended Rule 1146.2- Emissions of Oxides of Nitrogen from Large Water Heaters and Small Boilers and Process Heaters.* Diamond Bar, CA. Retrieved from http://www.aqmd.gov/hb/2006/may/060535a.html

[4] The Planning Center. (2012, March 27). *San Joaquin Valley Demographic Forecasts 2010 to 2050.* http://www.valleyblueprint.org/files/San%20Joaquin%20Valley%20Demographic%20Forecasts%20-%20Final%2027%20Mar%202012_0.pdf

3. **% Instantaneous:** The DOE estimates that 3% of water heaters sold are natural gas-fired tankless (instantaneous) units, 48% sold are natural gas-fired storage units, and the remaining 49% sold are electric units.[5] The District assumes that instantaneous units make up 5.9% of the natural gas-fired water heater inventory in 2015, which is the year that the 20 ppmv NOx emission limit would be implemented for instantaneous units.

   $$\% \text{ of gas units that are instantaneous} = \frac{(\% \text{ of gas instantaneous})}{(\% \text{ of gas instantaneous} + \% \text{ gas storage})} \times 100$$

   $$\% \text{ of gas units that are instantaneous} = \frac{(0.03)}{(0.03+0.48)} \times 100$$

   % of gas units that are instantaneous = 5.9%

4. **Growth Rate:** An increasing number of new large residential and commercial developments are being built with instantaneous water heaters, due to the increased fuel and energy efficiency that these units provide over typical tank-style water heaters. Similarly, some existing commercial businesses and residents are replacing tank-style units with instantaneous units because of the added efficiency benefits. Various sources estimate that in future years, instantaneous water heaters will have an annual growth rate of 4-10%.[6,7] To remain conservative, the District will assume an annual 5% growth rate for the inventory of instantaneous units in the Valley.

5. **# of Years Projected Forward**: The District is projecting forward the inventory of instantaneous units in the Valley through 2034, the year of full rule implementation. Therefore, the District is projecting the inventory of instantaneous units forward 19 years.

6. **Capacity Factor:** A 0.22 capacity factor will be used to calculate the baseline emissions from a 55 ppmv NOx emission limit and potential emissions from a 20 ppmv NOx emission limit.[8] The capacity factor represents the fraction of fuel

[5] United States Department of Energy [DOE]. (2009). *2009 Water Heater Market Profile.* http://www.energystar.gov/ia/partners/prod_development/new_specs/downloads/water_heaters/Water_Heater_Market_Profile_Sept2009.pdf

[6] California Utilities Statewide Codes and Standards Team. (October 2011). *2013 California Building Energy Efficiency Standards.* http://www.energy.ca.gov/title24/2013standards/prerulemaking/documents/current/Reports/Residential/Water_Heating/2013_CASE_WH2.WH5_WaterHeaterReady-10.28.2011.pdf

[7] CenterPoint Energy. (2009). *Vertical Subdivision Workshop: Tankless Water Heaters.* *http://www.centerpointenergy.com/staticfiles/CNP/Common/SiteAssets/doc/Tankless%20Water%20Heaters-Rheem.pdf*

[8] SCAQMD. (2006, May 5). *Staff Report for Proposed Amended Rule 1146.2- Emissions of Oxides of Nitrogen from Large Water Heaters and Small Boilers and Process Heaters.* Diamond Bar, CA. Retrieved from http://www.aqmd.gov/hb/2006/may/060535a.html

actually burned or consumed by the unit in a year compared to the theoretical maximum amount of fuel that a unit could use in a year.

7. **Average Rating:** An average rating is applied to the 0.075 MMBtu/hr and 0.4 MMBtu/hr size categories since the number of instantaneous units is assumed to be distributed evenly within this size range. The average rating is 0.238 MMBtu/hr. Based on the instantaneous water heaters listed in the *SCAQMD List of Certified Units Pursuant to Rule 1146.2,* [9] the most commonly available instantaneous units have a rated heat input of 0.2 MMBtu/hr, further supporting the assumption.

8. **Baseline Emission Rate:** The baseline emission rate assumes 100% of instantaneous units in 2034 comply with the current NOx emission limit and operate with a NOx emission rate of 55 ppmv (0.068 lb NOx/MMBtu).

9. **Proposed Emission Rate:** The proposed emission rate assumes 100% of instantaneous units would comply with the proposed NOx emission limit, upon full rule implementation in 2034, and operate with a NOx emission rate of 20 ppmv (0.024 lb NOx/MMBtu).

10. **Commercial Average Daily Use ($ADU_{commercial}$):** Average usage is 1,000 gallons/day (gal/day) for commercial and industrial water heaters.[10]

11. **Residential Average Daily Use ($ADU_{residential}$):** Average residential water heater usage is 27-135 gal/day. District staff averaged this range and assumes that average residential water heater usage is 81 gal/day.[11]

12. **Average Water Output Rate:** The average water output rate range for instantaneous water heaters is 2-5 gallons/minute (gal/min).[12] District staff assumes the average water output rate is 3.5 gal/min.

B. Total Number of Instantaneous Units in the Valley in 2034

Using the population-to-unit ratio and percentage of units that are instantaneous, the District calculated the total number of instantaneous units in the Valley in 2015 (first year of rule implementation). Using this figure and the annual growth

[9] SCAQMD. (2013, July 9). *List of Certified Units Pursuant to Rule 1146.2*. Diamond Bar, CA. Retrieved from http://www.aqmd.gov/rules/doc/r1146/r1146_2table.pdf

[10] United States Department of Energy [DOE]: Office FEMP Designated Product: Commercial Gas Water Heaters. (2012). Retrieved June 11, 2013 from http://www1.eere.energy.gov/femp/technologies/m/eep_com_gaswaterheaters.html#foot4

[11] Energy Center of Wisconsin. (2010). *Energy Use by Residential Gas Water Heaters.* Retrieved from http://www.ecw.org/ecwresults/254-1.pdf

[12] United States Department of Energy [DOE]: Tankless or Demand-Type Water Heaters. (2012). Retrieved June 11, 2013 from http://energy.gov/energysaver/articles/tankless-or-demand-type-water-heaters

rate of instantaneous units, the District calculated the total number of units in the Valley in 2034.

$Units_{(in\ 2015)}$ = (Population-to-Unit Ratio) x (Valley Population) x (% Instantaneous)
$Units_{(in\ 2015)}$ = (1 unit/385 people) x (4,330,000 people) x (0.059)
$Units_{(in\ 2015)}$ = 664 instantaneous units

Total $Units_{(in\ 2034)}$ = [$Units_{(in\ 2015)}$] x [(Growth Rate)^(# of Years Projected Forward)]
Total $Units_{(in\ 2034)}$ = (664) x [1.05^19]
Total $Units_{(in\ 2034)}$ = 1,678 instantaneous units

C. Average Daily Usage (ADU)

Most of the instantaneous units of this size range are used for commercial purposes; however, to conduct a conservative analysis the District averaged the $ADU_{residential}$ and $ADU_{commercial}$ figures in order to calculate the ADU for all units.

$ADU_{gallons}$ = ($ADU_{residential}$ + $ADU_{commercial}$) / 2
$ADU_{gallons}$ = (81 gal/day + 1,000 gal/day) / 2
$ADU_{gallons}$ = 540.5 gal/day

ADU_{hours}= ($ADU_{gallons}$) / (Average Water Output Rate x 60 min/hr)
ADU_{hours} = (540.5 gal/day) / (3.5 gal/min x 60 min/hr)
ADU_{hours} = 2.6 hours/day

D. Baseline NOx Emissions Based on Current NOx Emission Limit of 55 ppmv ($Emissions_1$)

$Emissions_{1\ (tpd)}$ = (Total Units) x (Average Rating) x (Baseline Emission Rate) x (Capacity Factor) x (ADU_{hours}) x (ton/lb)
$Emissions_{1\ (tpd)}$ = (1,678) x (0.238 MMBtu/hr) x (0.068 lb NOx/MMBtu) x (0.22) x (2.6 hours/day) x (1 ton/2,000 lb)
$Emissions_{1\ (tpd)}$ = 0.008 tpd

$Emissions_{1\ (tpy)}$ = ($Emissions_{1\ (tpd)}$) x (365 days/year)
$Emissions_{1\ (tpy)}$ = (0.008 tons/day) x (365 days/year)
$Emissions_{1\ (tpy)}$ = **2.92 tpy**

E. NOx Emissions Based on Proposed NOx Emission Limit of 20 ppmv (Emissions$_2$)

$Emissions_{2\ (tpd)}$ = (Total Units) x (Average Rating) x (Proposed Emission Rate) x (Capacity Factor) x (ADU_{hours}) x (ton/lb)
$Emissions_{2\ (tpd)}$ = (1,678) x (0.238 MMBtu/hr) x (0.024 lb NOx/MMBtu) x (0.22) x (2.6 hr/day) x (1 ton/2,000 lb)
$Emissions_{2\ (tpd)}$ = 0.003 tpd

$Emissions_{2\ (tpy)}$ = ($Emissions_{2\ (tpd)}$) x (365 days/year)
$Emissions_{2\ (tpy)}$ = (0.003 tons/day) x (365 days/year)
$Emissions_{2\ (tpy)}$ = **1.10 tpy**

F. Total Emission Reductions (TER)

TER = ($Emissions_{1(tpy)}$) - ($Emissions_{2(tpy)}$)
TER = (2.92 tpy) - (1.10 tpy)
TER = 1.82 tpy

G. % of Baseline Emissions Reduced

% of Baseline Emissions Reduced = [(TER) / (Baseline Emissions)] x 100
% of Baseline Emissions Reduced = [(1.82 tpy) / (2.92 tpy)] x 100
% of Baseline Emissions Reduced = 62.3%

IV. CONCLUSION

Since this is a point-of-sale rule, the NOx emission reductions from this proposed rule amendment will occur gradually as instantaneous units are replaced with newer instantaneous units, new units are purchased for new developments, and as people switch from tank-style to instantaneous units between 2015 and 2034. The total NOx emission reductions of 1.82 tpy will occur upon full rule implementation in 2034. Table B-3 illustrates the cumulative NOx emission reductions over this 20 year period.

Table B-3: Cumulative NOx Emission Reductions from Proposed Rule 4308[13]

Year	2019	2024	2029	2034
NOx Emission Reductions (tpy)	0.34	0.76	1.25	1.82

[13] District staff assumed that each year for 20 years 5% of the inventory of the existing instantaneous units in 2015 would be replaced. To calculate the cumulative emission reductions for each year, the District added the emission reductions from the replacement of the existing instantaneous units to the emission reductions from the purchase of new instantaneous units for either new developments or people switching from tank-style to instantaneous units.

APPENDIX C

Cost Effectiveness Analysis
For Proposed Amendments to Rule 4308

October 15, 2013

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COST EFFECTIVENESS ANALYSIS FOR PROPOSED AMENDMENTS TO RULE 4308

I. SUMMARY

Per California Health and Safety Code (CH&SC) Section 40920.6(a), the District conducts absolute and incremental cost effectiveness analyses of available emission control options to evaluate the economic reasonableness of a new rule or rule amendment prior to adoption. A cost effectiveness analysis examines the added cost (in dollars per year) of the control technology or technique, divided by the emission reductions achieved (in tons per year (tpy)).

$$\text{Cost Effectiveness } (\$/ton) = \frac{\text{Compliance Cost } (\$/year)}{\text{Emission Reductions } (ton/year)}$$

This rule amendment project would lower the NOx emission limit for natural gas-fired instantaneous water heaters with a rated heat input of 0.075-0.4 million British thermal units per hour (MMBtu/hr) (instantaneous units) from 55 parts per million by volume (ppmv) to 20 ppmv. As a point-of-sale rule, this proposed rule amendment would mandate that any instantaneous units supplied, sold, or installed in the San Joaquin Valley (Valley) meet a 20 ppmv NOx emission limit effective on and after January 1, 2015.

Based on the analysis in this appendix, the absolute cost effectiveness is summarized in Table C-1. Incremental cost effectiveness is not applicable to this project.

Table C-1: Cost Effectiveness Analysis Findings for Proposed Rule 4308

Number of Units Affected	Differential Cost for a 20 ppmv Compliant Unit (Low-End Estimate)	Differential Cost for a 20 ppmv Compliant Unit (High-End Estimate)	Absolute Cost Effectiveness
1,678	$3.00 to $185.00	-$45.00 to $489.00	$19,961 to $52,746/ton of NOx reductions

II. ESTIMATED COMPLIANCE COSTS

Estimated compliance costs for a rule project can include, but are not limited to, capital equipment costs, engineering design costs, additional labor or fuel costs, installation costs, and costs incurred from implementing new safety requirements. There are no additional engineering costs, labor costs, or costs from new safety requirements resulting from this proposed rule amendment. Installation costs are not expected to

vary for 20 ppmv and 55 ppmv compliant units. Therefore, compliance costs for this proposed rule amendment consist solely of the price differential between 20 ppmv and 55 ppmv compliant instantaneous units.

South Coast Air Quality Management District (SCAQMD) currently maintains a list of natural gas-fired water heaters certified to meet SCAQMD Rule 1146.2 emission limits.[1] This list is organized by the respective manufacturer, the size of the models, and the NOx emission limit achievable by that model (either 20 or 55 ppmv). The following six water heater manufacturers produce instantaneous units:

1. Bosch
2. Navien America, Inc.
3. Noritz America Corp.
4. Paloma Industries, Inc.
5. Rinnai
6. Takagi Industrial Co. USA, Inc.

All six manufacturers confirmed that they sell their units to Valley suppliers, wholesalers, and/or contractors for distribution to Valley businesses and residents. Five of the manufacturers produce both 20 ppmv and 55 ppmv compliant instantaneous units, while Navien America only produces 20 ppmv compliant units due to the rules in place in the SCAQMD and Bay Area Air Quality Management District. Many of the manufacturers that still produce 55 ppmv compliant units have discontinued several of their 55 ppmv models and replaced them with instantaneous units capable of meeting a NOx emission limit of 20 ppmv.

Using the model numbers provided in the SCAQMD list of certified units, District staff conducted research and collected data on the prices of the various 20 ppmv and 55 ppmv compliant units through a variety of water heater retailers, suppliers, and wholesalers; this list is available in Section VI (References).

Cost data for luxury units, such as condensing gas combination boilers, is not included in this cost effectiveness analysis. Condensing gas combination boilers are water heaters in which a high efficiency (typically greater than 90%) is achieved by using the waste heat to preheat the cold water entering the boiler. These units are generally three to five times more expensive than a typical instantaneous unit and are not representative of the price range for the majority of instantaneous units.

Most of the instantaneous units sold in the 0.075-0.4 MMBtu/hr size range have a rated heat input capacity of 0.12-0.2 MMBtu/hr. In addition, the majority of cost data available is for instantaneous units with a rated heat input capacity of 0.12-0.2 MMBtu/hr. Table C-2 summarizes cost information for instantaneous units in two size categories: 0.12-

[1] South Coast Air Quality Management District [SCAQMD]. (2013, July 9). *List of Certified Units Pursuant to Rule 1146.2*. Diamond Bar, CA. Retrieved from http://www.aqmd.gov/rules/doc/r1146/r1146_2table.pdf

0.16 MMBtu/hr and 0.161-0.20 MMBtu/hr. The table includes low-end and high-end cost estimates of 20 ppmv and 55 ppmv compliant units, as well as the price differential between 20 ppmv and 55 ppmv compliant units.

Table C-2: Compliance Costs for 55 ppmv Compliant Units vs. 20 ppmv Compliant Units

Unit Size (MMBtu/hr)	20 ppmv Compliant Unit Cost	55 ppmv Compliant Unit Cost	Price Differential Between 20 ppmv and 55 ppmv Compliant Units
Low-End Estimates			
0.12 to 0.16	$549.00	$546.00	$3.00
0.161 to 0.20	$744.00	$559.00	$185.00
High-End Estimates			
0.12 to 0.16	$1,554.00	$1,065.00	$489.00
0.161 to 0.20	$2,234.00	$2,279.00	-$45.00

III. ABSOLUTE COST EFFECTIVENESS ANALYSIS

Absolute cost effectiveness of a control option is the additional annual compliance cost, in dollars per year, to meet the proposed rule's requirements divided by the emission reductions achieved in tons of pollutant reduced per year. This absolute cost effectiveness analysis examines the differential cost of a 20 ppmv compliant instantaneous unit and a 55 ppmv compliant instantaneous unit and the emission reductions anticipated from lowering the NOx emission limit to 20 ppmv for these units.

A. Assumptions and Formulas

The following assumptions and formulas were used for calculating the absolute cost effectiveness of lowering the NOx emission limit for instantaneous units to 20 ppmv:

1. **Price Differential**: A $185 price differential (highest price differential for the low-end cost estimates) and $489 price differential (highest price differential for the high-end cost estimates) are used for these calculations in order to conduct a conservative absolute cost effectiveness analysis (see Table C-2).

2. **Annualized Compliance Cost (ACC) Formula**:

   ACC = Price Differential x Capital Recovery Factor (CRF)

The CRF converts the price differential into equal annual payments over a specified time, at a specified interest rate. The "equipment life" variable in the CRF equation is 20 years because this is the estimated lifetime of an instantaneous unit.[2]

$$\text{CRF} = \frac{i(1+i)^n}{(1+i)^n - 1} = \frac{0.1(1+0.1)^{20}}{(1+0.1)^{20} - 1} = 0.117$$

Where:

i = Interest rate (10%)
n = Equipment life (20 years)

3. **Total Number of Units:** Based on information from Appendix B (Emission Reduction Analysis), there are 1,678 instantaneous units in the Valley that will be affected by these rule amendments upon full rule implementation in 2034.

4. **Total Annualized Cost (TAC) Formula:**

   TAC = (ACC) x (Total Number of Units)

5. **Total Emission Reductions**: Based on the analysis in Appendix B (Emission Reduction Analysis), this rule amendment will result in a total of 1.82 tpy of NOx emission reductions from instantaneous units.

6. **Absolute Cost Effectiveness (ACE) Formula**:

   ACE = (TAC) / (Total Emission Reductions)

B. Annualized Compliance Cost

ACC = Price Differential x CRF

$ACC_{(\text{low-end estimate})}$ = ($185) x (0.117)
$ACC_{(\text{low-end estimate})}$ = $21.65 per unit

$ACC_{(\text{high-end estimate})}$ = ($489) x (0.117)
$ACC_{(\text{high-end estimate})}$ = $57.21 per unit

[2] Department of Energy [DOE]: Tankless or Demand-Type Water Heaters. (2012). Retrieved June 11, 2013 from http://energy.gov/energysaver/articles/tankless-or-demand-type-water-heaters

C. Total Annualized Cost (TAC)

TAC = (ACC) x (Total Number of Units)

$TAC_{(low\text{-}end\ estimate)}$ = ($21.65) x (1,678)
$TAC_{(low\text{-}end\ estimate)}$ = $36,329

$TAC_{(high\text{-}end\ estimate)}$ = ($57.21) x (1,678)
$TAC_{(high\text{-}end\ estimate)}$ = $95,998

D. Absolute Cost Effectiveness (ACE)

ACE = (TAC) / (Annual NOx Emission Reductions)

$ACE_{(low\text{-}end\ estimate)}$ = ($36,329/year) / (1.82 tpy of NOx)
$ACE_{(low\text{-}end\ estimate)}$ = $19,961/ton of NOx reduced

$ACE_{(high\text{-}end\ estimate)}$ = ($95,998/year) / (1.82 tpy of NOx)
$ACE_{(high\text{-}end\ estimate)}$ = $52,746/ton of NOx reduced

IV. INCREMENTAL COST EFFECTIVENESS

The incremental cost effectiveness is the difference in cost between two successively more effective controls, divided by the additional emission reductions achieved. For this rule-amending project, the proposed NOx emission limit is considered the lowest achievable NOx emission limit in practice. An incremental cost effectiveness analysis is not applicable to this project.

V. CONCLUSION

The additional cost for a 20 ppmv compliant instantaneous unit is $3.00 to $185.00 for the low-end cost estimates and -$45.00 to $489.00 for the high-end cost estimates. This differential cost is distributed over the 20 year lifetime of the unit, which reduces the financial impact for stakeholders. The absolute cost effectiveness ranges from $19,961 per ton of NOx emissions reduced (low-end cost estimate) to $52,746 per ton of NOx emissions reduced (high-end cost estimate). Lowering the NOx emission limit to 20 ppmv for instantaneous units is a cost effective and economically reasonable proposed rule amendment.

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APPENDIX D

Socioeconomic Analysis
For Proposed Amendments to Rule 4308

October 15, 2013

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SOCIOECONOMIC ANALYSIS FOR PROPOSED AMENDMENTS TO RULE 4308

I. INTRODUCTION

Pursuant to California Health and Safety Code (CH&SC) Section 40728.5 as well as the District's *2011 Economic Analysis Process Recommendations*,[1] the District conducts a socioeconomic analysis of a proposed rule or rule amendment that will significantly affect air quality or emission limitations prior to rule adoption. A socioeconomic analysis examines how a rule project may impact industries, businesses, employment rates, and the economy in the San Joaquin Valley (Valley).

This rule amendment project would achieve emission reductions by lowering the NOx emission limit for natural gas-fired instantaneous water heaters with a rated heat input of 0.075-0.4 million British thermal units per hour (MMBtu/hr) (instantaneous units) from 55 parts per million by volume (ppmv) to 20 ppmv. As a point-of-sale rule, this proposed rule amendment would mandate that any instantaneous units supplied, sold, or installed in the Valley meet a 20 ppmv NOx emission limit effective on and after January 1, 2015.

The CH&SC requires discussion of the necessity of adopting, amending, or repealing a rule to attain state and federal ambient air quality standards; this requirement is met through the discussion in the body of the final draft staff report. The other five CH&SC requirements for a socioeconomic analysis are satisfied through this appendix, which examines the following items:

- Type of industries or businesses affected by the rule amendments (Section II of this appendix)
- Range of probable costs for the rule amendments (Section IV of this appendix)
- Emission reduction potential of the rule amendments (Section IV of this appendix)
- Availability and cost effectiveness of alternatives to the rule amendments (Section V of this appendix)
- How the rule amendments impact the Valley's employment and economy (Section VI of this appendix)

The District also evaluated two additional items in this socioeconomic analysis, per the District's *2011 Economic Analysis Process Recommendations*:

[1] San Joaquin Valley Air Pollution Control District [SJVAPCD]. (2011, October 20). *Enhancements to District Economic Analysis of Regulations.* Fresno, CA. Retrieved from http://www.valleyair.org/Board_meetings/GB/agenda_minutes/Agenda/2011/October/GB_Agenda_Item_13_Oct_20_2011.pdf

- Costs and socioeconomic impacts from previous versions of the rule (Section III of this appendix)
- Impacts of rule amendments to small businesses, municipalities, and at-risk communities (Section VII of this appendix)

II. AFFECTED INDUSTRIES AND BUSINESSES

Instantaneous units are utilized in a variety of settings, including, but not limited to, the following areas:

- Apartment buildings
- Large homes
- Small businesses
- Commercial/office buildings
- Small manufacturing facilities
- Government facilities
- Hotels
- Restaurants
- Hospitals
- Educational institutions
- Religious organizations

End-users of instantaneous units are affected by the proposed rule amendments, as they would not be allowed to purchase 55 ppmv compliant instantaneous units and could potentially pay more for a 20 ppmv compliant instantaneous unit. The incremental cost for purchasing a 20 ppmv compliant unit instead of a 55 ppmv compliant unit is minimal or nonexistent for certain instantaneous water heaters brands.

Manufacturers of instantaneous units would be affected by the proposed rule amendments, but there are currently no instantaneous water heater manufacturers in the Valley. There are Valley wholesalers, suppliers, and contractors who purchase instantaneous units from manufacturers to sell in the Valley that would be affected by the proposed rule amendments. These businesses would no longer be allowed to sell, distribute, or install instantaneous units meeting a NOx emission limit of 55 ppmv.

III. COSTS AND SOCIOECONOMIC IMPACTS FROM PREVIOUS VERSIONS OF RULE 4308

Rule 4308 was adopted in October 2005 and subsequently amended in December 2009. These 2013 proposed amendments represent the third generation of this rule. In order to account for the cumulative impact of multiple generations of rules on this source category, the *2011 Economic Analysis Process Recommendations* advises that staff reports include descriptions and cost estimates for previous generations of air

pollution controls and reference previous socioeconomic analyses as each rule is amended.

Previous staff reports for Rule 4308 did not specifically address cost estimates for instantaneous units; as such, there is no previous cost data to compare to the cost estimates for this final draft staff report. Previous socioeconomic analyses concluded that there were no significant economic or employment impacts associated with the adoption or amendment of Rule 4308 since it is a point-of-sale rule and did not require forced replacement of units.

IV. COSTS AND EMISSION REDUCTION POTENTIAL FROM PROPOSED RULE 4308

Compliance costs for this proposed rule amendment consist of the price differential between 20 ppmv and 55 ppmv compliant instantaneous units. There are no additional engineering costs, labor costs, or costs from new safety requirements resulting from this proposed rule amendment. Installation costs are not expected to vary for 20 ppmv and 55 ppmv compliant units. Table D-1 below presents the compliance costs for 55 ppmv compliant instantaneous units versus 20 ppmv compliant instantaneous units, as examined in Appendix C (Cost Effectiveness Analysis).

Table D-1: Compliance Costs for 55 ppmv Compliant Units vs. 20 ppmv Compliant Units

Unit Size (MMBtu/hr)	20 ppmv Compliant Unit Cost	55 ppmv Compliant Unit Cost	Price Differential Between 20 ppmv and 55 ppmv Compliant Units
Low-End Estimates			
0.12 to 0.16	$549.00	$546.00	$3.00
0.161 to 0.20	$744.00	$559.00	$185.00
High-End Estimates			
0.12 to 0.16	$1,554.00	$1,065.00	$489.00
0.161 to 0.20	$2,234.00	$2,279.00	-$45.00

The price differentials listed in Table D-1 would be distributed over the 20 year lifetime of the unit.[2] Assuming the most conservative price differential for the low-end estimates ($185) and high-end estimates ($489), the average annual cost of a 20 ppmv compliant instantaneous unit would be $21.65-$57.21 per year (see Appendix C, Cost Effectiveness Analysis).

[2] Department of Energy [DOE]: Tankless or Demand-Type Water Heaters. (2012). Retrieved June 11, 2013 from http://energy.gov/energysaver/articles/tankless-or-demand-type-water-heaters

As discussed in Appendix B (Emission Reduction Analysis), the proposed amendments to Rule 4308 are expected to result in 1.82 tons per year (tpy) of NOx emission reductions upon full rule implementation. Given the 20 year lifetime of instantaneous units, emission reductions will occur over a 20 year period (2015 through 2034) as existing instantaneous units are replaced with newer instantaneous units, new instantaneous units are purchased for new developments, and some end-users switch from tank-style to instantaneous units. These emission reductions represent a 62.3% reduction from the estimated baseline of 2.92 tpy of NOx emissions from instantaneous units.

V. ALTERNATIVES TO PROPOSED RULE AMENDMENT

Given the extent of the Valley's attainment challenges, the District evaluates all potential opportunities to reduce emissions during the attainment planning process, and commits to pursue all reasonable emission reduction opportunities identified during this planning process. This amendment to Rule 4308 was identified as a reasonable opportunity to reduce emissions during the development of the *2012 PM2.5 Plan* and there is no alternative to pursuing these emission reductions.

The proposed NOx emission limit is considered the lowest achievable NOx emission limit in practice. Although the District confirmed that the NOx emission limit is achievable and has been put into practice in other air districts, the rule does not specify how manufacturers are to achieve this limit. As such, there are no technological alternatives to compare for this proposed rule amendment, so evaluation of the cost effectiveness of alternatives is not applicable to this rule project.

VI. SOCIOECONOMIC IMPACTS

A socioeconomic impact is any effect on the Valley's employment or economy due to a regulatory action. There are no socioeconomic impacts anticipated for the proposed rule amendments because there are no significant impacts to the following three groups that could potentially be affected by this rule-amending project:

- The end-users of instantaneous units;
- Manufacturers of instantaneous units; and
- Wholesalers, suppliers, and/or contractors who supply or install instantaneous units.

End-Users

Rule 4308 does not require end-users to replace existing instantaneous units within a certain time frame; rather, as instantaneous units meeting the 55 ppmv NOx emission limit reach the end of their life and the users replace them, they will purchase a unit that meets a 20 ppmv NOx emission limit, thus ensuring that end-users are not forced to

incur additional costs when their current units are still operable. Also, the price differential between 20 ppmv and 55 ppmv compliant units is minimal in terms of the overall cost of the unit, and some 20 ppmv compliant units are identical in price to their 55 ppmv counterparts. The price range for instantaneous units is more closely related to the fuel efficiency, energy efficiency, or luxury features (such as stainless steel build and touch screen capabilities) of an instantaneous unit, rather than the low-NOx capability of the unit.

The District anticipates that owners of tank-style water heaters will continue the trend of replacing their current water heaters with instantaneous (tankless) water heaters because of the increased fuel, water, and energy efficiencies of instantaneous units (see Section II of the Final Draft Staff Report). For those owners switching from tank-style to instantaneous units, any potential price differential between a 55 ppmv compliant instantaneous unit and a 20 ppmv compliant instantaneous unit will be largely offset by fuel and energy savings.

Manufacturers

There are six instantaneous water heater manufacturers identified by the South Coast Air Quality Management District (SCAQMD) in their *List of Certified Units Pursuant to Rule 1146.2* (see Appendix C of this Final Draft Staff Report). These manufacturers build instantaneous units and sell them to wholesalers, suppliers, or contractors for distribution to the end-users.

As a result of the proposed rule amendments, manufacturers would no longer be able to sell 55 ppmv compliant instantaneous units to Valley retailers or contractors. However, all of the manufacturers identified who produce 55 ppmv compliant instantaneous units also produce the 20 ppmv compliant units. Five of the six manufacturers produce 55 ppmv and 20 ppmv compliant instantaneous units, while one of the manufacturers no longer produces 55 ppmv compliant units and now only produces 20 ppmv compliant instantaneous units. The proposed rule amendments would have a minimal impact to instantaneous unit manufacturers.

District staff also verified that none of the six instantaneous water heater manufacturers have manufacturing facilities located in the Valley.

Wholesalers, Suppliers, and/or Contractors

Wholesalers, suppliers, and contractors are the medium between the manufacturing facilities and the end-users, as these parties purchase units from the manufacturers to sell and distribute to users. These businesses would no longer be allowed to sell, distribute, or install instantaneous units meeting a NOx emission limit of 55 ppmv. The January 1, 2015 compliance deadline in the proposed rule provides these wholesalers and suppliers with over 12 months to sell through existing stock before the new emission limit becomes effective. The availability and number of instantaneous units meeting a NOx emission limit of 20 ppmv has grown substantially within the last few years. Each of the six instantaneous water heater manufacturers are already producing

several models in various sizes within the 0.075 to 0.4 MMBtu/hr rated heat input size range that meet a 20 ppmv NOx emission limit and are currently selling these units in the Valley.

Also, as discussed in Appendix C (Cost Effectiveness Analysis), the price differential between a 55 ppmv and 20 ppmv compliant instantaneous unit is minimal, ranging from $3.00 to $185.00 for the low-end cost estimates to a cost savings of $45.00 to an increased cost of $489.00 for the high-end cost estimates. Contractors, suppliers, and wholesalers sales volumes would not be adversely impacted. Profit margins would remain the same as the cost would be passed onto the consumer.

VII. IMPACTS TO SMALL BUSINESSES, MUNICIPALITIES, AND AT-RISK COMMUNITIES

Per the *2011 Economic Analysis Process Recommendations* document, District staff is advised to evaluate how new rules or rule amendments may impact small businesses, municipalities, and at-risk communities where the major employer may respond to additional compliance costs by laying off workers. As discussed in Section VI above, the proposed rule amendments are not expected to result in any significant economic impacts, nor any decreased employment for small businesses and industries in the Valley. As such, municipalities and at-risk communities are not expected to incur any economic or employment effects from these proposed rule amendments.

APPENDIX E

Rule Consistency Analysis
For Proposed Amendments to Rule 4308

October 15, 2013

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RULE CONSISTENCY ANALYSIS FOR PROPOSED AMENDMENTS TO RULE 4308

I. REQUIREMENTS FOR RULE CONSISTENCY ANALYSIS

Pursuant to Section 40727.2 of the California Health and Safety Code, prior to adopting, amending, or repealing a rule or regulation, the District performs a written analysis that identifies and compares the air pollution control elements of the rule or regulation with corresponding elements of existing or proposed District and United States Environmental Protection Agency (EPA) rules, regulations, and guidelines that apply to the same source category. The rule elements analyzed are emission limits; monitoring and testing requirements; recordkeeping and reporting requirements; and operating parameters and work practice requirements.

II. ANALYSIS

A. District Rules

There is no other District prohibitory rule or regulation tailored specifically for boilers, steam generators, and process heaters with a rated heat input of 0.075 million British thermal units per hour (MMBtu/hr) to less than 2.0 MMBtu/hr. Sources would be subject to District Rule 1081 (Source Sampling). The requirements of Rule 1081 are not in conflict with, nor are they inconsistent with the requirements of the proposed amendments to Rule 4308.

B. Federal Rules, Regulations, and Policies

1. EPA Alternative Control Techniques (ACT) Document

   EPA 453/R-94-022 ("ACT Document – NOx Emissions from Industrial/ Commercial/Institutional Boilers," dated March 1994)[1] discusses the different control techniques for controlling NOx emissions from boilers with heat input capacities from 0.4 to 1,500 MMBtu/hr. The ACT also presents the achievable emission levels of several control techniques based on the type of boiler and the type of fuel used and contains cost effectiveness estimates for the control techniques; however, the ACT does not recommend specific emission limits. As confirmed by the July 2010 EPA technical support document (TSD) for the approval of Rule 4308, the District rule is already as stringent as the ACT.

[1] Environmental Protection Agency [EPA]: SIP Planning Information Toolkit: Control Techniques Guidelines and Alternative Control Techniques Documents. (2012). Retrieved April 10, 2013 from http://www.epa.gov/glo/SIPToolkit/ctgs.html

2. EPA Control Techniques Guideline (CTG) Document

Based on the EPA CTG list[2], there is no CTG for boilers, steam generators, and process heaters with a rated heat input capacity greater than or equal to 0.075 MMBtu/hr to less than 2.0 MMBtu/hr.

3. EPA New Source Performance Standard (NSPS)

Based on the NSPS list in 40 CFR 60[3], there is no NSPS for boilers, steam generators, and process heaters of this size.

4. National Emission Standard for Hazardous Air Pollutants (NESHAP) and Maximum Achievable Control Technology (MACT)

Based on the NESHAP and MACT lists in 40 CFR 61 (NESHAP)[4] and 40 CFR 63 (MACT)[5], there is no NESHAP or MACT for boilers, steam generators, and process heaters of this size.

5. EPA Best Available Control Technology (BACT) Requirements

There are no BACT requirements listed for boilers, steam generators, and process heaters of this size range. BACT requirements are applicable to units greater than 5.0 MMBtu/hr.

6. EPA Policy on Recordkeeping

EPA has a policy that mandates stationary sources keep and maintain records for at least five years; however, as a point-of-sale rule, boilers, steam, generators, and process heaters 0.075 to less than 2.0 MMBtu/hr are not permitted sources and are thus not required to follow specific recordkeeping guidelines. Therefore, units subject to Rule 4308 are not subject to EPA's Policy on Recordkeeping.

[2] Environmental Protection Agency [EPA]: SIP Planning Information Toolkit: Control Techniques Guidelines and Alternative Control Techniques Documents. (2012). Retrieved April 10, 2013 from http://www.epa.gov/glo/SIPToolkit/ctgs.html

[3] Environmental Protection Agency [EPA]: 40 CFR 60-Standards of Performance for New Stationary Sources (NSPS). (2013). Retrieved April 10, 2013 from http://www.tceq.state.tx.us/permitting/air/rules/federal/60/60hmpg.html

[4] Environmental Protection Agency [EPA]: 40 CFR 61-National Emission Standards for Hazardous Air Pollutants (NESHAPS). (2012). Retrieved April 10, 2013 from http://www.tceq.state.tx.us/permitting/air/rules/federal/61/61hmpg.html

[5] Environmental Protection Agency [EPA]: 40 CFR 63-National Emission Standards for Hazardous Air Pollutants for Source Categories (a.k.a. Maximum Achievable Control Technology (MACT)). (2013). Retrieved April 10, 2013 from http://www.tceq.state.tx.us/permitting/air/rules/federal/63/63hmpg.html

III. CONCLUSION

Based on the above analysis, District staff found that the proposed amendments to Rule 4308 would not conflict with any District or federal rules, regulations, or policies covering similar stationary sources.

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