



State of Utah

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Department of
Environmental Quality

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DIVISION OF AIR QUALITY
Bryce C. Bird
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DAQ-043-15

MEMORANDUM

TO: Air Quality Board

THROUGH: Bryce C. Bird, Executive Secretary

FROM: Joel Karmazyn, Environmental Scientist

DATE: August 18, 2015

SUBJECT: FINAL ADOPTION: R307-230. NO_x Emission Limits for Natural Gas-Fired Water Heaters.

On May 6, 2015, the Board approved for public comment new rule R307-230. The intent of the rule is to reduce NO_x emissions from natural gas-fired water heaters. The public comment period was held from June 1 to July 1, 2015.

Advanced notice of rulemaking was sent to the Air-Conditioning, Heating, and Refrigeration Institute (ACHRI) and to the Association of General Contractors for distribution to their membership, and to Sears, Home Depot, and Lowe's corporate offices.

Public Comment Summaries

1. Air-Conditioning, Heating, and Refrigeration Institute (ACHRI).

Comment: The ACHRI and Bradford White recommended the removal of the power assist water heater category since it would be covered under the 75,000 BTU/hr category.

DAQ response: We concur. The power assist category has been removed.

Comment: The NO_x limit for residential storage models with input rates less than 75,000 Btu/h is specified only in terms of ng/J. For all the other categories of water heating equipment the NO_x emission limits in the regulations of both the California South Coast and Bay Area Air Quality Management Districts are in terms of ng/J and ppm. We recommend that the same be done in this proposed rule. The equivalent ppm limits should be added to the requirements proposed for larger input storage water heaters, mobile home water heaters, and pool heaters.

DAQ response: Testing for the NO_x level in the larger appliances is an easier test method. Therefore, we concur with the request.

Comment: ACHRI and A.O. Smith made the same comment. - The proposed rule should specify the procedure for determining NO_x emissions. We recommended that a provision be added to reference the South Coast Air Quality Management District (SCAQMD) Method 100-1. We understand that it is not the intent of this proposed rule to establish burdensome and redundant certification and compliance requirements. Therefore, we recommend that existing programs be recognized and the proposal rule be amended to state that a listing of compliance to the SCAQMD, or comparable NO_x rule of some other jurisdiction, is an acceptable means of establishing compliance with this rule.

DAQ response: SCAQMD Method 100-1 has been added to the rule. DAQ will recognize appliances certified by SCAQMD as meeting this rule.

Comment: ACHRI and A.O. Smith made the same comment. - The proposed requirement that the manufacturer display the NO_x emission rate of the water heater on the shipping carton and rating plate can be misinterpreted to require the display of the precise emission rate of the model. The marking requirements of existing NO_x rules such as the Bay Area Air Quality Management District (BAAQMD) require that the manufacturer display the certification status of the model, e.g. the model complies with a NO_x emission limit. To avoid requiring a special marking for units sold in Utah, we recommend that the marking requirement be modified to parallel the marking requirement of the BAAQMD or SCAQMD.

DAQ response: The proposed rule has been amended by removing the box labeling requirement.

The labeling requirement on the appliance is intended to confirm that the appliance complies with the appropriate standard. The current commonly used labeling statement, "complies with the 10 ng/Joule rule" is sufficient. The rule wording has been amended for clarity that we do not wish to have the actual rating printed.

Comment: ACHRI, A.O. Smith, and Bradford White Corporation made similar comments. - Although the NO_x rules in many California jurisdictions address the "sale, installation or offer for sale" of water heaters covered by the rule, the actual result is that these rules are applied based on the date of manufacture. This is the most practical and effective way to implement these NO_x emission rules with minimum disruption to the marketplace and to the wholesalers, distributors, retailers, and plumbers who all are involved in some aspect of providing these units to consumers. This recognizes that some units which were produced and shipped prior to the effective date will remain in the distribution chain until they have been depleted from distributor and wholesaler stocks. But this is a relatively short period. To do otherwise forces wholesalers, distributors, and retailers to somehow guess their needs for stocking water heaters and risk either having significant units that they can no longer sell or running out of units and not having product to sell. This task of maintaining an adequate stock is complicated for these businesses by the fact that most water heater purchases are for replacement installations where the need is immediate but unpredictable.

DAQ response: All appliances manufactured before the implementation date may be sold in Utah. The rule has been amended to explicitly state this fact.

2. A. O. Smith.

Comment: We support Utah's decision to base its proposed rule on SCAQMD Rule 1121 and Rule 1146.2, depending on the water heater and pool heater types and sizes. However, there are slight differences between the proposed Utah rule and the SCAQMD rules that conflict and would cause Utah to manage their own certification program and impose testing on manufacturers. To avoid this, we recommend that Utah align its proposed water heater size ranges and NOx limits to reflect the applicable SCAQMD rules currently in place.

DAQ response: Our rule is modeled after the Bay Area Regulation 9 Rule 6 and not SCAQMD Rule 1121. The BAAQMD Regulation 9 Rule 6 requires the lowest available NOx burners for water heaters, and it draws its requirements from the SCAQMD product testing. The SCAQMD has a certification process for approved water heaters and has certified many water heaters at the ultra-low NOx level of 10 ng/Joule. The differences between SCAQMD and the Bay Area rules are the way the heater ranges are described. For example, one range is stated as "up to 75,000 BTU/hr." versus "less than 75,000 BTU/hr." However, we did change the range for pool/spa heaters to include heaters that are equal to 400,000 BTU/hr by adding "less than or equal to 400,000 BTU/hr." Both rules have been in place for some time, so we do not foresee that this minor wording would require us to create our own certification program. UDAQ has communicated with A.O. Smith that appliances approved in the Bay Area will be acceptable in Utah.

Comment: Although the scope of SCAQMD Rule 1146.2 includes pool/spa heaters having inputs less than 400,000 kBtuh, currently SCAQMD excludes these products from their certification requirements (Rule 1146.2 c.8.). As a result, manufacturers have discontinued testing their products for certification, although the SCAQMD directory still contains some pool/spa heaters in that size range. We recommend that Utah delete this category from its proposed rule to be consistent.

DAQ response: We have confirmed with SCAQMD that A.O. Smith has misinterpreted the rule requirement, and we have relayed that information to A.O. Smith. A.O. Smith has verified that they have misunderstood the issue based on a policy memo and are now aware that their comment is moot.

3. Bradford White Corporation (BWC).

Bradford White supports "the use of higher efficiency products, as well as those that produce lower NOx emissions." Bradford White submitted the following specific comments.

Comment: Regarding the recommended implementation dates, as shown in Table 1 of the proposed rule, BWC recommends that all counties transition to these new requirements at the same time. This would alleviate confusion in the distribution channels where a distributor may operate in one or more counties that do not have to meet the new requirements, as well as in one or more counties that do have to meet the new requirements.

DAQ response: We agree with Bradford White. The proposed rule has been amended to become effective state-wide in two years.

Comment: In the memorandum summarizing the new rule, the following was stated: "The costs of these limited units are currently comparable to conventional units." BWC strongly disagrees with this statement. We estimate that pricing can differ by 18-20 percent, to the homeowner, when comparing low versus ultra-low NOx products in California, and we believe this difference would be similar in Utah. While performing some pricing research on the internet (at a big box store) on these products in California, we found two similar residential products, except their NOx emissions, to vary in price by

approximately 19 percent. Even though this is only one example, this is far closer to the norm that their pricing is not comparable. Price difference must be further considered when contemplating this proposed rule.

DAQ response: On February 12, 2015, we issued a letter to the major box stores and plumbing supply houses and the major Utah home and industrial construction companies to request prospective costing information for ultra-low NOx water heaters. No one responded to our request; consequently, our cost assessment for these water heaters is based on data we were able to retrieve from box store web sites. In all, we compared the price of 100 models across varied manufacturers that are available for purchase in Utah. Of these 100 units, 36 met ultra-low NOx specifications. On average, ultra-low NOx units were \$9.89 (1.6%) more than conventional units. However, when other factors such as capacity in gallons, length of warranty, and thermal efficiency were held constant, ultra-low NOx capability had no statistically significant impact on prices. Seventy-eight percent of ultra-low NOx units and 80% of conventional units were certified for operation at altitudes of 5,400 feet or higher, with several units being capable of operation up to 10,100 feet.

Type	Count	Average Price	Median Price	Min Price	Max Price	% High-altitude
Ultra-low NOx	36	\$ 626.64	\$ 598.25	\$ 477.00	\$ 1,169.00	78%
Conventional	64	\$ 616.75	\$ 582.00	\$ 389.00	\$ 1,044.99	80%

4. Questar Gas.

Comment: Potentially higher initial cost of water heaters may result in fuel switching to electric water heaters which would have the unintended consequences of higher emissions at the source of generation. Our initial research indicates a potential incremental cost of \$150 to \$400 compared to regular gas water heaters.

DAQ response: We inquired how the additional cost was derived and were told that the higher cost was quoted by a vendor Questar Gas uses to offer its employees appliance discounts. As explained in the response to comment 9, we are able to order an ultra-low NOx appliance today delivered to box stores in the valley at a comparable cost to conventional units. We question how the Questar Gas vendor has estimated such a high mark-up when the major manufacturers like A.O. Smith already have established channels of distribution in Utah. Further, the additional demand on these units will be small compared to the California market place, so we do not anticipate a need to increase manufacturing such that it would drive cost upwards.

Testing of Ultra-low NOx Products at High Altitude

Staff questioned early on whether high elevation would hamper the operation of ultra-low NOx burners. We requested insight on this matter from the ACHRI. Consequently, we received comments from Bradford White, Questar Gas, and the ACHRI encouraging the need for such testing. Questar Gas also questions whether these units will be more sensitive to gas quality changes. The following is the response from ACHRI:

We are aware that a question has been raised regarding the NOx emission rate of water heaters installed at high elevations. We are not aware of any specific studies that looked at this particular issue. However, with the exception of residential storage models with input rates less than 75,000 Btu/h, the burners used on the other types of water heating equipment which will be provided to

comply with the applicable proposed NO_x emission limits are not significantly different than the burners used on comparable models of those water heaters that do not meet the NO_x limits. There is significant field experience with these non-low NO_x models installed at high elevations. That experience does not indicate any particular issues with these models. Since the low NO_x models have similar burners and designs, we question whether there is an issue here that warrants further investigation.

In the case of residential storage models with input rates less than 75,000 Btu/h, the burners used on those 10 ng/J models are different than the burners used on other residential gas storage models. There is less field experience with these 10 ng/J models installed at high elevations. We are unaware of any issues that have been identified in the field regarding the operation of these models at high elevations. However, as noted above, we are not aware of any studies that have examined the operation of these models at high elevations. In view of this situation, it may be appropriate to conduct some testing before the proposed NO_x limit is put into effect.

Seventy-eight percent of the 36 ultra-low NO_x appliances we were able to price are suitable to 5,400 feet or higher. A. O. Smith has certified some of their units to 10,100 feet, yet they acknowledge that other manufactures may not have performed such testing and that there are certain types of burners that may not be suitable for high elevation.

Questar Gas has requested a delay on the decision of the rule to permit Questar Gas to conduct its research.

Staff has taken into consideration all of the comments and is recommending that the Board approve the following amendments to the rule:

1. Replace the phased-in implementation schedule for a fixed date state-wide implementation. This would relieve the need for the box cover labeling to assure proper water heater destination delivery within the state.
2. The state-wide implementation date would be November 1, 2017: two years from the anticipated rule effective date. This delayed implementation should provide the industry sufficient time to test or conduct the appropriate research.

Staff Recommendation: Staff recommends that the Board adopt new rule R307-230, NO_x Emissions Limits for Natural Gas-Fired Water Heaters, as amended.

1 **R307. Environmental Quality, Air Quality.**

2 **R307-230. NO_x Emission Limits for Natural Gas-Fired Water Heaters.**

3
4 **R307-230-1. Purpose.**

5 The purpose of R307-230 is to reduce emissions of nitrogen
6 oxides (NO_x) from natural gas-fired water heaters.

7
8 **R307-230-2. Applicability.**

9 R307-230 applies to the sale and installation of natural
10 gas-fired water heaters beginning November 1, 2017. [~~on the~~
11 ~~implementation schedule as outlined in Table 1.~~

12
13 ~~Table 1~~

14 ~~Statewide Implementation Schedule of R307-230~~

Location	Rule Implementation Date
Box Elder, Cache, Davis, Salt Lake, Tooele, Utah and Weber Counties	January 1, 2017
Washington, Duchesne and Uintah Counties	January 1, 2018
Remaining portions of Utah	January 1, 2019]

24
25 **R307-230-3. Exemptions.**

26 The requirements of R307-230 shall not apply to:

27 (1) [~~units~~] water heaters using a fuel other than natural
28 gas;

29 (2) [~~units~~] water heaters used in recreational vehicles;
30 [and]

31 (3) [~~units~~] water heaters manufactured in Utah for shipment
32 and use outside of Utah[-]; and

33 (4) water heaters manufactured before November 1, 2017.

34
35 **R307-230-4. Definitions.**

36 The following additional definitions apply to R307-~~[370]~~230:

37 "Heat output" means the enthalpy of the working fluid
38 output of the unit.

39 [~~"Heat input" means the heat of combustion released by~~
40 ~~fuels burned in a unit based on the higher heating value of~~
41 ~~fuel. This does not include the enthalpy of incoming combustion~~
42 ~~air.]~~

43 "Recreational vehicle" means a motor home, travel trailer,
44 truck camper, or camping trailer, with or without motive power,
45 designed for human habitation for recreational, emergency, or
46 other occupancy.

1 "Natural gas-fired water heater" means a device that heats
 2 water by the combustion of natural gas to a thermostatically-
 3 controlled temperature not exceeding 210°F (99°C) for use external
 4 to the vessel at pressures not exceeding 160 psig.

5
 6 **R307-230-5. Standards.**

7 ~~(1) [Beginning on the rule implementation date specified in~~
 8 ~~Table 1 for each area of the state, n]No person shall sell or~~
 9 ~~install any natural gas-fired water heater with an emission rate~~
 10 ~~exceeding the limits [in Table 2]described in R307-230-5(1)(a).~~
 11 ~~[The NO_x limits are expressed in nanograms of nitrogen oxides~~
 12 ~~(calculated as NO₂) per Joule of heat output.]~~

13
 14 [TABLE {2}]

15 ~~NO_x Emission Rate for Natural Gas-Fired Water Heaters~~

17 Category	Limits (ng/Joule)
18 Water heater up to 75,000 BTU/hr,	
19 excluding those installed in mobile homes	10
20 Water heater 75,001 - 2,000,000 BTU/hr	14 or 20 ppm
21 Any tank with power assist	10
22 Mobile home water heater	40 or 55 ppm
23 Pool/spa heater less than 400,000 BTU/hr	40 or 55 ppm
24 Pool/spa heater 400,001 - 2,000,000 BTU/hr	14 or 20 ppm]

25
 26
 27 (a) Subsections R307-230-5(1)(i)-(v) provide the NO_x
 28 emission limits for natural gas-fired water heaters.

29 (i) Water heaters up to 75,000 BTU/hr, excluding those in
 30 mobile homes: 10 ng/Joule of heat output or 15 ppm at 3% O₂.

31 (ii) Water heaters 75,001-2,000,000 BTU/hr: 14 ng/Joule of
 32 heat output or 20 ppm at 3% O₂.

33 (iii) Mobile home water heaters: 40 ng/Joule of heat output
 34 or 55 ppm at 3% O₂.

35 (iv) Pool/spa heaters less than or equal to 400,000 BTU/hr:
 36 40 ng/Joule of heat output or 55 ppm at 3% O₂.

37 (v) Pool/spa heaters 400,001-2,000,000 BTU/hr: 14 ng/Joule
 38 of heat output or 20 ppm at 3% O₂.

39
 40
 41 (2) The water heater manufacturer shall display the model
 42 number and the appropriate NO_x emission rating~~[e of a water~~
 43 ~~heater complying with this rule on the shipping carton and]~~on
 44 the permanent rating plate of each unit.

45
 46 (3) Manufacturers shall use SCAQMD Method 100-1 to comply
 47 with the NO_x standards in R307-230-5(1)(a).

1 KEY: Water heaters, natural gas, NO_x, air quality
2 Date of Enactment or Last Substantive Amendment: 2015
3 Authorizing, and Implemented or Interpreted Law: 19-2-101; 19-
4 2-104