DOCKETED

Docket Number:	17-AAER-08
Project Title:	Sprinkler Spray Bodies
TN #:	223112
Document Title:	Codes and Standards Enhancement (CASE) Initiative for PY 2017 Comments on Draft Staff Report
Description:	Codes and Standards Enhancement (CASE) Initiative for PY 2017 Staff Analysis of Water Efficiency Standards for Spray Sprinkler Bodies
Filer:	Patty Paul
Organization:	California Investor Owned Utilities
Submitter Role:	Public
Submission Date:	4/2/2018 4:28:19 PM
Docketed Date:	4/2/2018

Spray Sprinkler Bodies

Codes and Standards Enhancement (CASE) Initiative for PY 2017
Comments on Draft Staff Report: Staff Analysis of Water Efficiency Standards for Spray Sprinkler Bodies

Spray Sprinkler Bodies
Docket 17-AAER-08

April 2, 2018

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This report was prepared by the California Statewide Investor Owned Utilities Codes and Standards Program and funded by the California utility customers under the auspices of the California Public Utilities Commission.

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1. Purpose

The Codes and Standards Enhancement (CASE) initiative presents recommendations to support California Energy Commission's (Energy Commission) efforts to update California's Appliance Efficiency Regulations (Title 20) to include new requirements or to upgrade existing requirements for various technologies. The four California Investor Owned Utilities– Pacific Gas and Electric Company (PG&E), San Diego Gas and Electric (SDG&E), Southern California Edison (SCE), and SoCalGas® – sponsored this effort (herein referred to as the Statewide CASE Team). The program goal is to prepare and submit proposals that will result in cost-effective enhancements to improve the energy and water efficiency of various products sold in California.

The Statewide CASE Team appreciates the opportunity to offer comments addressing the Draft Staff Report: Staff Analysis of Water Efficiency Standards for Spray Sprinkler Bodies (Draft Staff Report) published by the Energy Commission in February 2018 (Steffensen 2018). The Statewide CASE Team commends Energy Commission staff on work done to advance this effort and strongly supports this proposal, which will avoid an estimated 80 billion gallons of water use and 290 gigawatt hours (GWh) of embedded electricity use per year. As noted by the Natural Resource Defense Council's (NRDC) comments at the Energy Commission's March 14, 2018, public workshop, "the estimated water savings at full stock turnover (ten years) in the staff analysis of 83,526 million gallons per year, or 256,000 acre-feet per year, is more than one and a half times greater than the entire annual water use of San Diego, the state's second largest city" (Quinn 2018). In this document, the Statewide CASE Team also provides recommended clarifications to the Draft Staff Report, and enhancements to the draft proposed standard (including an anti-burst requirement) and draft proposed test method as described in Section 3.

2. Product/Technology Description

The Statewide CASE Team agrees with the Draft Staff Report recommendation that the proposed standard should address spray sprinkler bodies. As noted in the Draft Staff Report, 1.1 trillion gallons of water are used annually to irrigate residential landscapes, and lawn sprinklers irrigate 50 to 78 percent of landscapes in California (Steffensen 2018, 10,11). Spray sprinklers are also among the most inefficient landscape irrigation emission devices.

The Statewide CASE Team offers two suggested clarifications to the product description in the Draft Staff Report. First, it states that "spray heads are interchangeable between bodies and are often marketed and sold separately" (Steffensen 2018, 15). The Statewide CASE Team suggests clarifying this language to state that *spray nozzles* are *often* interchangeable between *spray bodies*, but they are not universally interchangeable. Sometimes, slight differences in the thread of nozzles produced by different manufacturers can prevent spray nozzles from one manufacturer from being used on spray bodies produced by a different manufacturer. Additionally, although most manufacturers produce female-threaded nozzles, some manufacturers produce male-threaded nozzles, and nozzles with different thread patterns cannot be interchanged.

The Draft Staff Report also describes valve-in-head sprinklers (Steffensen 2018, 18). The Statewide CASE Team suggests clarifying that valve-in-head sprinklers are typically a subset of gear-drive rotor sprinklers that are used to irrigate larger areas of coverage than is typical for landscape rotor or spray sprinklers used in residential or light commercial applications. For example, the radius of throw for valve-in-head sprinklers can range from 30 to over 100 feet.

3. Proposed Standards and Recommendations

3.1 Proposed Changes to the Title 20 Code Language

Code language additions that are proposed in the Staff Draft Report are marked in underline. The Statewide CASE Team proposed changes to the Staff Draft Report proposed Title 20 Standard are provided below marked with double underlining (new language) and ~~strikethroughs~~ (deletions).

3.1.1 Proposed Definitions

The Statewide CASE Team recommends deleting two unused definitions and making several clarifying changes listed below, with explanations listed in brackets. Other proposed definitions that the Statewide CASE Team does not propose to change are listed for context.

"Basic model" of a spray sprinkler or spray sprinkler body means a group of spray sprinkler or spray sprinkler body models that are made by a single manufacturer, and ~~that have the same spray sprinkler body. A spray sprinkler body shall be considered the same as another if the~~ which have the same water use characteristics ~~are the same~~, regardless of any cosmetic differences among the bodies. Products with different devices in the flow path are not the same basic model. [This proposed clarification would address products with different flow paths due to different features, such as missing nozzle flow limitation devices, and explicitly address both spray sprinklers and spray sprinkler bodies].

"Landscape" means any and all areas that are planted or installed, and intended to receive irrigation, including turf grass, ground covers, shrubs, trees, flowers, and similar plant materials, as opposed to agricultural commodities as defined in California Government Code 51201(a). ~~agricultural crops grown for and harvested for monetary return~~. [The Statewide CASE Team proposes to add specificity to this definition, including the definition of agriculture.]

"Landscape Irrigation Equipment" means equipment that is used for irrigation excluding irrigation equipment (including sprinklers) for use exclusively within irrigation systems associated with agricultural commodities as defined in California Government Code 51201(a). [The Statewide CASE Team propose to add a definition for this term because it is used in Sections 1604(y), 1605.1(y), 1605.2(y), and 1605.3(y). The Statewide CASE Team suggested language regarding agricultural systems is based on ASABE/ICC-802-2014 Section 103.1, which reads in part "This standard shall not apply to sprinklers and emitters for use exclusively within agricultural irrigation systems…" The Statewide CASE Team suggested language is intended to clarify that products that are covered by a specific landscape irrigation equipment standard and are incidentally used for agricultural are not exempt from regulation unless the specific standard contains an exemption].

"Maximum operating pressure" means the highest spray sprinkler or spray sprinkler body inlet operational pressure specified by the manufacturer that will allow ~~recommended pressure to ensure~~ proper operation. [The Statewide CASE Team recommends this revision for clarity since spray sprinklers have both an inlet and outlet pressure. We also note that the United States Environmental Protection Agency's (U.S. EPA) WaterSense® Specification for Spray Sprinkler Bodies Version 1.0 (WaterSense Specification) uses the term "specified" rather than "recommended"].

"Nozzle" means the discharge opening or orifice of a sprinkler used to control the volume of discharge, distribution pattern, and droplet size.

"Orifice" means the emission point from a nozzle into the atmosphere.

"Regulation pressure" means the manufacturer rated outlet pressure of a pressure regulated spray sprinkler or spray sprinkler body ~~the product aims to achieve regardless of higher inlet pressure, as stated by the manufacturer~~. [The Statewide CASE Team recommends this revision for clarity].

"Rotor sprinkler" means a landscape irrigation system component consisting of a rotor sprinkler body with one or more orifices to convert irrigation water pressure to high-velocity water discharge through the air, discharging greater than 0.5 gallon per minute at the largest area of coverage available for the nozzle series, when operated at 30 pounds per square inch (psi) or more with a full-circle pattern.

"Rotor sprinkler body" means a sprinkler body that contains components to mechanically drive the rotation of the sprinkler ~~nozzle or orifice~~ during operation and lacks an integral control valve. [The Statewide CASE Team recommends this revision to clarify that non-rotating spray sprinkler bodies with multi-stream nozzles are not rotor sprinkler bodies].

"Spray sprinkler" means a landscape irrigation system component consisting of a spray sprinkler body with one or more orifices to convert irrigation water pressure to high-velocity water discharge through the air, discharging greater than 0.5 gallon per minute at the largest area of coverage available for the nozzle series, when operated at 30 psi or more with a full-circle pattern. This definition includes a spray sprinkler body sold with a nozzle such as a fixed spray type nozzle or a multi-stream, multi-trajectory type nozzle. [The Statewide CASE Team recommends this revision for clarity].

"Spray sprinkler body" means a sprinkler body that does not contain components to mechanically drive the rotation of the nozzle or orifice during operation and lacks an integral control valve.

"Sprinkler body" means the exterior case or shell of a sprinkler incorporating a means of connection to the piping system, designed to convey water to a nozzle or orifice.

~~"Valve-in-head sprinkler" means a landscape irrigation system component consisting of a valve in-head sprinkler body with one or more orifices to convert irrigation water pressure to high velocity water discharge through the air, discharging greater than 0.5 gallon per minute at the largest area of coverage available for the nozzle series, when operated at 30 psi or more with a full-circle pattern.~~ [Applicability is based on products that are defined as in scope; thus, defining products that are out of scope in the code is unnecessary. Products that are out of scope can be explained in the Draft Staff Report for informational purposes].

~~"Valve-in-head sprinkler body" means a sprinkler body that contains an integral control valve.~~ [Applicability is based on products that are defined as in scope; thus, defining products that are out of scope in the code is unnecessary. Products that are out of scope can be explained in the Draft Staff Report for informational purposes].

3.1.2 Proposed Test Procedure

Overall, the Statewide CASE Team agrees with the decision to align with the U.S. EPA WaterSense Specification test procedure. The Statewide CASE Team also recommends several enhancements that will

improve the reliability of the Title 20 test procedure and provide useful additional information while still generating data that can be used for WaterSense Specification certification.

3.1.2.1 Test Points

The Statewide CASE Team recommends that the Energy Commission require an additional test point at 50 psi inlet pressure, which is not required in the WaterSense Specification test procedure for spray sprinkler bodies rated at 30 psi regulation pressure (WaterSense 2017, B-1). Existing test data shows that product performance is non-linear, and thus the highest flow rate for a product could occur between 40 and 60 psi as noted in the CASE Report (Pike and Urigwe 2017). This additional test point will require minimal additional effort (i.e., two minutes at zero psi, followed by pressure stabilization at 50 psi and at least three minutes of measurement), and will help ensure that product test results are representative of pressure regulated spray sprinkler body performance.

3.1.2.2 Measurement Accuracy

The Statewide CASE Team notes that the WaterSense Specification requires that flow meters used in testing have a measurement resolution of at least 0.05 gallons per minute (gpm) and measurement accuracy of 1.5 percent of the full range of flow rates measured (U.S. EPA 2017, Appendix B "Test Equipment and Setup" 1c). These requirements result in an overall measurement accuracy of approximately plus or minus five percent. The WaterSense Specification appears to require pressure measurement accuracy of +/- 0.5 psi or better, or better than two percent accuracy across the typical range of pressures tested from 30 psi to 70 psi.[2]

The Statewide CASE Team recommends setting tighter flow measurement accuracy standards to match the procedures used by the University of Florida in its testing to support the development of the WaterSense Specification. The University of Florida procedures are designed to provide flow rate measurements within two percent of actual value. (This procedure would also achieve pressure measurement within one percent or better of the actual value at 30 psi and 1.5 gpm) (Dukes 2017). This level of flow measurement accuracy is highly desirable, especially for measuring relatively small differences in flow rate to determine compliance with the proposed standard, and is described below:

> "A Campbell Scientific (Logan, UT) CR1000 datalogger was used to record measurements from the flowmeter and the pressure transducers. The flowmeter was a Seametrics (Kent, WA) PE202-075 low flow magmeter…with resolution of at least 0.01 gpm and accuracy of +/- 1% plus 0.005 gpm of reading across rated range. The pressure transducers were Campbell Scientific model CS451…with a resolution of 0.0035% full scale and accuracy of +/- 0.1% full scale range."

The Statewide CASE Team recommends adding the following regulatory language:

"Section 1605.3
…
(y)(1)…The flow meter shall be capable of resolution of at least 0.01 gpm and accuracy of +/- 1% plus 0.005 gpm of reading across the rated range."

[2] When measuring a flow rate of 1.5 gpm, instrument resolution of 0.05 gpm results in about a 3.3% level of precision. Added to the measurement inaccuracy of 1.5%, this yields an overall measurement accuracy of approximately 4.8%, which rounds to 5%. We note that the WaterSense requirements include "pressure transducers capable of measuring pressure from 0 to at least 145 psi with at least 0.1 psi resolution. Accuracy (including linearity, hysteresis, and repeatability) shall be within 0.3% full scale output." An accuracy of +/- 0.5 psi (0.3% times 145 psi) and resolution of 0.1 psi would lead to an overall accuracy of +/- 0.5% psi, or two percent or better for a measurement range from 30 psi to 70 psi.

3.1.2.3 Instrument Calibration

The Statewide CASE Team recommends that the Energy Commission develop instrument calibration procedures that would apply to this standard to ensure that the equipment used in product testing adheres to the measurement accuracy recommendations above, and accurately reports results over time.

3.1.2.4 Anti-Burst Test

The Statewide CASE Team recommends adding the following anti-burst testing requirement to the Staff Draft Report proposed testing language (which is discussed further in section 3.1.3):

"Section 1605.3

…

(y) Landscape Irrigation Equipment.

(1) The test methods for a spray sprinkler body, and a spray sprinkler body within a spray sprinkler, manufactured on or after January 1, 2020, ~~is the~~ are in Appendix B of the WaterSense Specification for Spray Sprinkler Bodies Version 1.0, September 21, 2017, ANSI ASABE/ICC 802-2014 Section 303.5.5 (Burst pressure test method), and the Irrigation Association Pressure Regulating Spray Head Sprinkler Test Equipment Functionality Test Version 3.0, Stability Test (May 2012). A manufacturer shall cause tests to be performed for each of these methods, including testing per ~~the~~ Appendix B of the WaterSense Specification for Spray Sprinkler Bodies Version 1.0, September 21, 2017 with two flow rates, ~~test method~~ and as specified by the requirements of 1604 (y) (1) (A) and 1604 (y) (1) (B)."

3.1.2.5 Sample Selection

The Statewide CASE Team agrees with the IA Smart Water Application Technologies (SWAT) procedure of collecting multiple lots before selecting samples, given that a facility may have different production lines, and/or products may have differences over time (Irrigation Association 2012, 7). In addition, Kelsey Jacquard of Hunter has noted in public comments that "… variation in the plastic molding manufacturing process is normal, and these variations do have a slight effect on product performance. Detailed results can vary from test to test" (Jacquard 2018). Therefore, sampling different lots with different date codes would provide a more representative sample. The Statewide CASE Team suggests the following: "Five samples shall be selected at random from three different lots of ten with different date codes for each lot, resulting in a minimum of five samples to be tested." (This requirement is compatible with the WaterSense Specification Test Procedure Section 3, which requires selecting a minimum of five samples from a lot of 25 units or more without requiring different date codes).

3.1.2.6 Test and List

The Statewide CASE Team agrees with the proposed requirement to test products at 0.75 gpm for informational purposes, in addition to the requirement to test at 1.5 gpm for compliance purposes. The Statewide CASE Team believes that the 0.75 gpm flow rate is common in California due to the use of low-flow type nozzles, and that the proposed testing requirement will help fill the information gap noted by U.S. EPA regarding the performance of spray sprinkler bodies at 0.75 gpm compared to 1.5 gpm. The Statewide CASE Team also recommends clarifying the discussion of testing requirements in the Draft Staff Report as recommended by NRDC (Quinn 2018).[3]

[3] The current text of the Draft Staff Report (page 29, first paragraph, third line) suggests that an initial calibration flow rate of 0.75 gpm would be in lieu of the initial calibration flow rate 1.5 gpm. The intent could be clarified by striking all after "2017" and inserting "to be supplemented with an additional test run with a calibration flow rate of 0.75 +/-0.1 gpm."

The Statewide CASE Team also recommends requiring that manufacturers test products using the Irrigation Association (IA) Stability Test and provide this information to the Energy Commission.[4] The duration of the proposed Title 20 test method may be very short compared to longer run times in the field. A test and list requirement would enable the Energy Commission to determine whether future revisions to the regulatory compliance test method and/or standard are needed to accurately reflect performance in the field. The Statewide CASE Team does not believe that the test and list requirement would impose a significant burden on manufacturers. Proposed language is included with the proposed test and list language listed above.

3.1.3 Proposed Standard

The Statewide CASE Team agrees with the proposed spray sprinkler body pressure regulation requirement and recommends finalizing this requirement. The performance criteria set in the WaterSense Specification, as modified in the Draft Staff Report, provide adequate differentiation between compliant and non-compliant products. They are also technically reproducible in testing, as demonstrated by the testing completed by the University of Florida for the WaterSense Specification development. The Statewide CASE Team suggests minor clarifications to the pressure regulation section of the performance standards language as shown below.[5]

The Statewide CASE Team also recommends considering the anti-burst requirement in ANSI ASABE/ICC 802-2014 Section 302.6 (American Society of Agricultural and Biological Engineers/ International Code Council 2014). Section 302.6 requires that sprinklers withstand a hydrostatic test pressure of 1.5 times the maximum published operating pressure, but not less than 150 psi, without permanent distortion or leakage when tested in accordance with the test method in ANSI ASABE/ICC 802-2014 Section 303.5. Compliance with Section 302.6 is required by the WaterSense Specification (Section 3). Compliance with Section 302.6 is also required by the Department of Water Resources' (DWR) statewide Model Water Efficient Landscape Ordinance (MWELO) for all irrigation emission devices installed in landscapes subject to the MWELO (California Department of Water Resources 2015). Therefore, products sold in California are advertised as meeting Section 302.6 or should already meet this anti-burst requirement due to the MWELO, and the Energy Commission should harmonize with WaterSense and the MWELO.[6]

This requirement will also address or partially address a comment from the Contra Costa Water District (CCWD) suggesting that some sprinklers waste water due to poor quality construction (CCWD 2016). CCWD originally raised concerns to DWR's Independent Technical Panel, and also provided comments at the Energy Commission Title 20 workshop on March 14, 2018 that some products have a poorly-fitting cap or poor quality wiper seal (California Energy Commission 2018, 49) Adding the anti-burst requirement to the proposed Title 20 Standard could potentially prevent this issue by requiring a minimum level of structural integrity for spray sprinkler bodies.

Suggested regulatory language for the suggested minor clarification and additional of an anti-burst performance standard is shown below:

[4] This test can be found in the IA SWAT Pressure Regulating Spray Head Sprinklers Equipment Functionality Test Version 3.0, Section 6.4.3: Stability Test.

[5] The proposed code language refers to "selected samples", which is not defined. Thus, it is unclear if this language refers to all units selected for testing or a subset of products that are tested, and if the latter, it is unclear whether manufacturers could selectively report only the most favorable test results.

[6] Hunter and Rain Bird advertise that their spray sprinkler bodies comply with ASABE/ICC 802-2014 and Hunter is also certified by WaterSense as meeting the WaterSense Specification, which requires compliance with ASABE/ICC 802-2014. While other products not meeting the MWELO could be sold only for installation as replacement units for repairs that are not subject to the MWELO, the Statewide CASE Team has not found any evidence that this is a viable commercial strategy.

Section 1605.3

…

(y) Landscape Irrigation Equipment

(1) …

(A) … averaged for the ~~selected~~ tested samples

…

(B) … averaged for the ~~selected~~ tested samples

…

(C) … averaged for the ~~selected~~ tested samples

"(D) The spray sprinkler body (including a spray sprinkler body within a spray sprinkler) shall comply with ANSI ASABE/ICC 802-2014 Section 303.2.2 burst pressure requirements."

3.1.4 Proposed Reporting Requirements

The Statewide CASE Team recommends the following clarification to the proposed reporting requirements to remove any possibility that manufacturers will believe that they can choose the test pressure level for which to report data, and rather, to ensure that they report the maximum flow rate that occurs at any pressure level:

"Maximum flow rate ~~at any~~ across all tested pressure levels …"

The Statewide CASE Team also recommends adding the following reporting requirements to Table X (Data Submittal Requirements) consistent with our prior comments regarding standards and test methods:

Required Information	**Permissible Answers**
Permanent distortion or leakage exceeding ten milliliters /minute during burst pressure test.	Yes, no
SWAT Pressure Regulating Spray Head Sprinklers Test Equipment Functionality Test Version 3.0, Stability Test coefficient of variation (psi)	
SWAT Pressure Regulating Spray Head Sprinklers Test Equipment Functionality Test Version 3.0, Stability Test mean of deviations (gpm)	
SWAT Pressure Regulating Spray Head Sprinklers Test Equipment Functionality Test Version 3.0, Stability Test standard deviation (gpm)	
SWAT Pressure Regulating Spray Head Sprinklers Test Equipment Functionality Test Version 3.0, Stability Test coefficient of variability (gpm)	

3.1.5 Proposed Marking and Labeling Requirements

The Statewide CASE Team agrees with the Energy Commission's proposed marking and labeling requirements, including marking the presence of pressure regulation in a location visible after installation.

This requirement will also help local agencies that are implementing the MWELO and/or local water efficiency standards, and it will serve as a mechanism to ensure that compliant products are installed.

4. Analysis of Proposal

4.1 Scope/Framework

The Statewide CASE Team agrees that the Energy Commission should move forward with adoption of a standard requiring integral pressure regulation for spray sprinkler bodies. The Statewide CASE Team also agrees that a check valve requirement, and potentially a missing nozzle shut-off requirement, should be considered when sufficient information is available to verify the performance of these product features.

4.2 Technical Feasibility

During the staff proposal workshop, CCWD and EastBay MUD Water Conservation staff (California Energy Commission 2018, 48, 70) raised the question of whether pressure regulated spray sprinklers would cause operational issues for landscapes with low supply pressures. The Statewide CASE Team has reviewed three common models, and determined that manufacturers generally do not specify any difference in the allowable operating pressure range between pressure regulated and non-pressure regulated spray sprinkler bodies.

For example, in the technical specification sheet for the "1800" series of spray sprinkler bodies, Rain Bird lists an operating pressure range of 15 to 70 psi for both the 1800 model series (non-pressure regulated) and the 1800 PRS model series (pressure regulated) (Rain Bird 2009). Similarly, in their product operation specifications, Hunter Industries lists a recommended pressure range of 15 to 100 psi for both its non-pressure regulated Pro-Spray model (Hunter 2018b) and its pressure regulated Pro-Spray PRS40 model (Hunter 2018a). Their documentation notes that for the pressure regulated model, a dynamic pressure differential of ten psi is required for the pressure regulator to operate; however, this does not preclude the sprinkler from operating properly at the low end of the recommended operating pressure range without the engagement of the pressure regulator. In addition, the Toro 570 Z-series product specification sheet lists an operating pressure of 20 to 75 psi for their pressure regulated and non-pressure regulated products[7] (Toro 2016).

4.3 Per Unit and Statewide Water and Energy Savings

4.3.1 Summary of Per Unit Water and Energy Use Impacts

The Statewide CASE Team believes that the conservative water and energy use impacts in the Draft Staff Report are more than adequate to justify adoption of the standard. The Statewide CASE Team also notes that the Draft Staff Report estimate of water savings may understate savings for several reasons:

- As noted by NRDC, the Draft Staff Report estimate of water savings relies on several conservative assumptions (Quinn 2018). First, due to lack of data, no benefits are credited for spray sprinkler bodies used in commercial or multifamily residential landscapes, although these savings are likely

[7] The acceptable operating pressure of both units is the same in the manufacturer specification sheet, though the recommended use of the pressure regulated product listed on the Toro website is for higher pressures, which is reasonable given that the pressure regulated product provides additional benefits at higher pressures. The Statewide CASE Team notes that the Toro sheet lists a special product for operating pressure as low of 15 psi, which is outside the range of irrigation pressures reported in the PG&E-California Landscape Contractors Survey even after accounting for pressure losses between the curb and the sprinkler (Pike and Urigwe 2017).

substantial. Second, water savings were calculated based on a static supply pressure of 65 psi at the curb and 55 psi at the sprinkler inlet; however, NRDC found a population-weighted average of 81 psi (at the curb) based on recent reports by California urban water suppliers.[8]

- The CASE Report estimates that the change in flow rate at 55 psi for pressure regulated versus non-pressure regulated spray sprinkler bodies installed in single family homes is 20 to 29 percent, depending on assumptions, versus 14.7 percent calculated by the Energy Commission (Pike and Urigwe 2017, 34) (Steffensen 2018, A-7). In addition, the Statewide CASE Team agrees with CEC staff that users are unlikely to reduce flow rates to address overapplication that occurs with non-pressure regulated spray sprinklers in the base case (California Energy Commission 2018, 46) because residential users do not closely monitor and manage excessive sprinkler flow rates in their landscapes. Additionally, as noted in the CASE Report, most overapplication is not available to the landscape, and instead will be lost through misting, overspray, evaporation, and/or deep percolation; and water lost due to these pathways likely exceeds the percent savings estimated in the Draft Staff Report.
- The Draft Staff Report states that lawn sprinklers irrigate between 50 and 78 percent of landscapes, citing the CASE Report for the low end of this range (Steffensen 2018, 11). The Statewide CASE Team would like to clarify that while the Statewide CASE Team assumed that 50-80 percent of landscape irrigation water is emitted via *spray sprinklers*, "the Statewide CASE Team assumed the lower-end value for the analysis presented in [the CASE Report] to be conservative when calculating estimated savings from the proposed standard" (Pike and Urigwe 2017, 40). Therefore, actual savings are likely higher.

4.3.2 Shipments

The Statewide CASE Team agrees that the annual shipment estimate of 20.9 million units in the Draft Staff Report is reasonable (Steffensen 2018, A-3). While the CASE Report provided a somewhat lower estimate of 18.6 million units per year, the estimate in the Draft Staff Report is well documented.

4.4 Impact on California's Economy

4.4.1 Cost-Effectiveness

The Statewide CASE Team agrees with the Draft Staff Report that the standard is clearly very cost-effective (Steffensen 2018) even based on the overstated estimate of costs and understated estimate of benefits. As noted by NRDC, the Draft Staff Report estimate of the financial benefits of the proposed standard relies on some conservative assumptions (Quinn 2018):

- Estimates of financial benefits for consumers assume that the real cost of water will not increase, even though charges for water and sewer service have been increasing at more than twice the consumer price index for over ten years, and such increases are expected to continue further in the future.
- Financial benefits were further constrained by basing the cost of compliance with the standard upon the incremental cost of a six-inch pop-up stem rather than the four-inch pop-up stem, which is widely used. The incremental cost of a pressure regulated four-inch pop-up stem is nearly 30 percent less than a 6" pop-up stem.

[8] In a previous submission to this docket on June 15, 2017, NRDC provided an estimate of the population-weighted service water pressure for 2015, as reported by California urban water suppliers to the DWR as part of their 2015 urban water management plans.

5. Conclusion

In conclusion, the Statewide CASE Team strongly supports the adoption of the Energy Commission's proposed water efficiency standards for spray sprinkler bodies, which will provide significant and overwhelmingly cost-effective savings to California consumers. The Statewide CASE Team supports moving forward quickly on these standards, and provides suggested revisions to the Draft Staff Report to clarify and strengthen its provisions. These include the following:

- Clarifications to the proposed definitions and other report language;
- Changes to the test procedure, including:
    - An additional test point at 50 psi inlet pressure to account for the non-linear relationship between inlet water pressure and sprinkler flow rate,
    - A requirement of higher flow meter measurement accuracy to capture relatively small differences in flow rate,
    - The development of instrument calibration procedures to ensure that the equipment used in product testing accurately reports consistent results over time,
    - Testing in accordance with the anti-burst requirement test method in ANSI ASABE/ICC 802-2014,
    - Test and list requirements including: pressure regulation performance testing at 0.75 gpm, and results of the IA SWAT Stability Test; and
- Changes to the proposed standard, including the addition of the anti-burst requirement in ANSI ASABE/ICC 802-2014.

Additionally, the Statewide CASE Team offers the following additional information:

- The Statewide CASE Team agrees that a check valve requirement, and potentially, a missing nozzle shut-off requirement, should be considered when sufficient information is available to verify the performance of these product features;
- In response to a question on the potential impact of pressure regulated spray sprinkler bodies in landscapes with low water supply pressure, the Statewide CASE Team does not believe that pressure regulated models would perform worse than non-pressure regulated products at lower pressures, based on a review of commonly available products;
- Though the conservative water and energy use impacts in the Draft Staff Report are more than adequate to justify adoption of the standard, the Statewide CASE Team notes that the Draft Staff Report estimate of water savings may understate savings in several areas; and
- Similarly, the Draft Staff Report understates the financial benefits of the standards in several areas, and the Statewide CASE Team believes the actual financial benefits of the standard are likely greater than estimated.

The Statewide CASE Team appreciates the opportunity to offer comments and commends the work of the Energy Commission on this critical topic.

6. References

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