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OFFICE OF
AIR AND RADIATION

**Summary of Rationale for ENERGY STAR® Roof Products
Version 2.0 Specification
January 2008**

I. Introduction and Background

This memorandum provides a summary of the rationale and key inputs that culminated in Version 2.0 of the roof products specification. It contains the following information:

- Summary of the Version 2.0 specification
- Summary of key milestones in the development of the Version 2.0 specification
- Summary of key comments provided by stakeholders
- EPA's rationale for deciding on key elements of the final Version 2.0 specification

II. Summary of Version 2.0 Specification

The Version 2.0 ENERGY STAR roof products specification was finalized on June 15, 2007. Key elements of the Version 2.0 Tier I ENERGY STAR specification are provided below:

- Manufacturers are required to test and report emissivity performance to qualify as ENERGY STAR. This is a reporting requirement only; there are no minimum emissivity requirements under Version 2.0.
- Data on newly submitted roof products must reflect that tested samples were not cleaned prior to testing for Maintenance of Solar Reflectance. EPA will allow roof products qualified prior to the Version 2.0 effective date, based on data on cleaned samples to remain on the Qualifying Product list.
- Partners are still allowed to self-test roof products for ENERGY STAR qualification. Test reports must be sent to EPA with the Qualifying Product Information (QPI) form in order for the product to qualify.
- The new Version 2.0 became effective December 31, 2007.

III. Key Milestones of Specification Development

EPA first announced its intention to reopen the roof products specification in February 2005. The primary purpose of initiating the specification development process was to determine the feasibility of including an emissivity requirement for roof products. This process spanned roughly two and half years and included the following key milestones:

— Draft and Final Specification and Framework Documents

- Draft 1 released December 15, 2005 – EPA proposed a new 0.75 emissivity requirement and supporting test procedures. Testing of cleaned samples for purposes of measuring and reporting aged reflectance would no longer be allowed for ENERGY STAR qualification. The minimum initial reflectance level is proposed to increase from 0.65 to 0.70.
- Draft 2 released April 28, 2006 – EPA retains the 0.75 emissivity proposal but reverts back to the existing 0.65 initial reflectance level, based on the realization that increasing to 0.70 would eliminate a significant number of products but yield only minimal savings to the consumer. The proposed effective date is pushed back to January 31, 2007 to allow manufacturers at least 9 months to qualify products.
- Final Draft released July 26, 2006 – the Solar Reflectance Index (SRI) is proposed as an alternative method of qualifying products for ENERGY STAR. SRI internalizes the emittance-reflectance trade-off into a single number that recognizes the benefits of a highly reflective roof product that otherwise wouldn't qualify under the 0.75 emissivity requirement. SRI levels, based on the proposed minimum emissivity and solar reflectance requirements, are included in this version. EPA also addresses concerns regarding self testing and reporting. The effective date is once again pushed back to May 1, 2007 to allow manufacturers additional time to qualify products.
- *Revised* Final Draft released February 23, 2007 – EPA determines that based on industry feedback and the absence of conclusive data, establishing an emissivity requirement for a national program is not yet feasible and removes it from the specification. Instead, EPA proposes to require manufacturers to report emissivity data for posting on the ENERGY STAR Qualified Product list. EPA also proposes educating the consumer of the benefits of emissivity via the ENERGY STAR Web site. All performance requirements for emissivity and references to SRI are removed. All other requirements remain unchanged compared to the previous Final Draft.
- Final specification released June 15, 2007 – no significant changes compared to the Revised Final Draft document with the exception of a new effective date of December 31, 2007.

— Industry Stakeholder Meetings and Events

- Meeting with the Roof Coatings Manufacturers Association representatives in Washington, DC on October 10, 2006 to discuss concerns regarding the proposed emissivity requirement.
- Meeting with Cool Metal Roof Coalition representatives in Washington, D.C. on October 16, 2006 to discuss concerns regarding proposed emissivity requirement.

IV. Summary of Stakeholder Input

EPA received substantial stakeholder input over the course of the development of the new specification. Key stakeholders that provided either written or oral comments included Roof Coatings Manufacturers Association, Cool Roof Rating Council, National Roofing Contractors Association (NRCA), Cool Metal Roofing Coalition, Lawrence Berkeley National Laboratory, Consortium for Energy Efficiency, the California Energy Commission, and several roof product manufacturers.

Provided below is a summary of key stakeholder comments and EPA responses. More detailed comments and responses are provided in note boxes included within the draft specifications available in the ENERGY STAR Product Development Archives located at:

www.energystar.gov/productdevelopment.

Alternative Roof Technologies

- **Comment:** Some stakeholders felt that the specification should consider including other roof product technologies, such as green roofs and cool ballasted systems, for ENERGY STAR qualification.

EPA Response: While EPA supports the efforts, it is unclear whether they could be included using the test procedures and performance levels provided in the ENERGY STAR specification. As the market grows for these technologies, and industry accepted test procedures are made available allowing these products to be compared to other ENERGY STAR roof products, EPA may revisit their inclusion in the specification. In the meantime, EPA will work to educate end users about these alternative technologies via the ENERGY STAR Web site and literature.

Reflectance

- **Comment:** EPA received several comments both supporting and opposing the increase of initial solar reflectance from 0.65 to 0.70. One stakeholder supported the revision because it would result in the ENERGY STAR specification being consistent with the requirements of ASHRAE 90.1. Others felt it would serve to differentiate products that achieve sizeable energy savings without significantly sacrificing the number of qualifying products. Even modest improvements in energy savings can have large cumulative benefits across the country and should be encouraged whenever possible. Raising the incremental energy savings of ENERGY STAR products will increase the likelihood that efficiency program administrators will actively promote labeled products, potentially with financial incentives, and will ensure that the ENERGY STAR continues to signify products with excellent performance.

Other stakeholders strongly opposed raising the initial solar reflectance to 0.70 because it would have a negative effect in the marketplace especially for metal products. Additionally, the minimal improvement in reflectivity would not be justified in light of the product prohibitions, market dislocation, potential confusion among customers, and minimal energy benefits that would follow. Some of these stakeholders felt that aged reflectance was more important than initial reflectance and did not see the utility of increasing the initial reflectance requirement.

EPA Response: EPA initially proposed the 0.70 level in the Draft 1 specification to maintain relevancy in the market by aligning with other state and regional initiatives, including California Title 24 requirements. However, upon further research EPA found that the savings that could be realized by raising this level by 0.05 would be minimal, and therefore not justify a revision for the sake of aligning with other programs. It was also determined, and confirmed by stakeholders, that ENERGY STAR has a strong presence in the market and is not in danger of becoming irrelevant. As a result, EPA removed this proposal from Draft 2 and subsequent versions of the specification.

Emissivity

- Comment: EPA received conflicting feedback regarding the proposed emissivity requirement. Several stakeholders supported the addition of the thermal emittance requirement of 0.75. One stakeholder added that while this requirement is particularly beneficial in heat-dominated climates, building owners in colder climate regions will also benefit due to reductions in the heat island effect in urban areas. Furthermore, aligning the ENERGY STAR definition with other CRRC program requirements will minimize confusion in the marketplace and eliminate barriers to promotion by efficiency program administrators.

Other stakeholders commented that a regional approach to the emissivity part of the specification is warranted. While high reflectance is desirable in all climates, variations in emissivity (lower in heat dominated climates and higher in cooling dominated climates) can result in much greater energy savings in some climates. This is shown in the government-developed energy calculators available on the Internet. These stakeholders recommended that EPA consider alternatives to a straight emissivity level requirement such as what has been done in California's Title 24 and the LEED program. Some of these stakeholders also expressed strong concern that an emissivity requirement as proposed would eliminate whole categories of products even though these perform well in reducing energy consumption and are cost effective.

EPA Response: To accommodate stakeholder requests to consider a trade-off equation alternative for roof products failing to initially meet the proposed emittance value, EPA reviewed several tradeoff options available in the marketplace including: (1) the proposed 2008 California Energy Commission Title 24 tradeoff equations; (2) the current Title 24 tradeoff equation in effect for low slope nonresidential roofs; and (3) the SRI formula referenced in ASTM E 1980-01. Based on a close review of these options and several discussions with industry experts, EPA proposed SRI as an alternative method of qualifying roof products that allows for a tradeoff between emittance and reflectance.

Using the SRI formula, and entering the proposed ENERGY STAR levels for emissivity (0.75) and reflectivity (0.65), EPA developed minimum levels for initial SRI and maintenance of SRI of 75 and 53. Since emittance tends to remain constant over the lifetime of a roof, initial emittance was allowable for purposes of determining both the aged and initial SRI values.

Instead of removing emissivity from the specification completely, EPA proposed this alternative in the interest of greater flexibility and in light of some of the challenges in meeting a strict emittance requirement. Roof products that did not initially meet the emissivity requirement, but also had a high reflectivity value, would have an opportunity to qualify for ENERGY STAR under the SRI alternative.

- Comment: EPA received mixed feedback regarding the proposed SRI alternative in addition to the new 0.75 emissivity requirement. Some commentors again stressed the need for a regional approach to this specification based on climate, as is currently done for ENERGY STAR Home Sealing and ENERGY STAR for Windows, Doors, and Skylights. Others supported the addition of an emissivity level greater than or equal to 0.40 and the removal of the SRI alternative. This would prevent the elimination of whole classes of products from ENERGY STAR qualification.

Still other stakeholders supported the inclusion of both reflectance and emissivity since it gives a more accurate and complete picture of a roof's ability to reduce energy consumption associated with air conditioning. They also agreed with the utility of SRI as a metric that combines both factors.

EPA Response: Based on a thorough review of current research and a series of meetings with industry representatives, EPA concluded that establishing a national emissivity requirement for ENERGY STAR qualified roof products is not appropriate at this time. EPA needs to better understand the impacts of emissivity on building energy use in various climates before attempting to include it within this specification; both for minimum requirements and alternative approaches (i.e., SRI). While buildings in warmer climates benefit from high emissivity levels, it is possible that buildings in colder climates would experience slightly increased energy use during the winter months and thus, a lower net energy savings as a result of using ENERGY STAR qualified [high emissivity] products. In the future, EPA may consider a regional approach based on available research and data, as well as the logistics of program implementation.

In lieu of a specification requirement, EPA addressed emissivity by requiring manufacturer reporting of results for inclusion on the ENERGY STAR qualified products list. This listing, as well as educational information regarding the benefits of emissivity, will help purchasers choose the ENERGY STAR qualified roof product that cost effectively saves the most energy for their individual climate needs. Manufacturers will need to report emissivity levels to remain ENERGY STAR qualified under the new Version 2.0 specification.

Self Certification and Publishing Results

- Comment: Some manufacturers felt that continuing to allow self certification and reporting of product performance data could lead to fraud and misrepresentation of the data. In addition, EPA received a few comments requesting that comparative test results not be published suggesting instead that the qualified product list only indicate ENERGY STAR qualification.

EPA Response: With few exceptions, ENERGY STAR specifications allow for self-testing with reporting to EPA to strike an appropriate balance between administrative costs and program oversight. EPA has in place a comprehensive program for assuring proper use of the ENERGY STAR label including that the products displaying the label must meet performance requirements. For roof products, EPA does require manufacturers to attach laboratory reports to all qualifying roof product QPI forms. This requirement was instituted in a previous version of this ENERGY STAR specification to help address issues of misrepresentation. In addition, as stated in the Partner Commitment section of the specification, "EPA may, at its discretion, conduct tests on products that are referred to as ENERGY STAR qualified," thereby stating EPA's authority to protect the integrity of the ENERGY STAR brand through spot checking product qualification or investigating claims that manufacturers have misrepresented their products' qualification.

EPA's intent in publishing qualified product information is to provide distributors and consumers a tool that they can use to identify not only those products that meet the specification levels but also those that meet their specific applications and needs. Individuals that use the ENERGY STAR qualified products list regularly request this type of information and use it for their purchasing decisions. Furthermore, utility partners use these lists to determine which products to include in their incentive programs. These lists serve as a one stop shop of information for many interested parties. For these reasons, EPA will continue to post this information on the ENERGY STAR qualified product list.

Testing: Cleaned vs. Uncleaned Samples

- Comment: EPA received several comments on the proposal to only accept performance data on roofs that have not been cleaned prior to testing. Several stakeholders supported the requirement that for newly qualified products, testing can only be performed on uncleaned samples, since this is more representative of actual field conditions. Others expressed concern that an advantage would be given to already listed products as they could have been tested using clean samples and their solar reflectance values would be more favorable. Further, these stakeholders were concerned about potential confusion that would result from having test results from both cleaned and uncleaned samples on the Qualifying Products list. Designating one with an asterisk and describing the difference between findings reported for clean versus uncleaned samples was said to be insufficient.

EPA Response: EPA proposed this new test requirement to ensure that testing of ENERGY STAR qualified roof products does its best to emulate real world conditions but also understood the burden on manufacturers to re-test existing ENERGY STAR products to remain qualified. In order to reduce the burden associated with this change, EPA also proposed that existing data for cleaned samples would be accepted for existing qualified products but products that were cleaned would be designated as such on the Web site. Newly qualified roof products would need to qualify using uncleaned samples under the new Version 2.0. In response to concerns about fairness of this approach, allowing certain products to re-qualify without retesting maintenance of solar reflectance on uncleaned samples is an accommodation by EPA. EPA feels that clearly identifying roof products that were cleaned during testing and providing additional explanation as to how that would affect performance is sufficient for end users to make informed purchasing decisions.

Accelerated Aging

- Comment: EPA received a number of comments from stakeholders opposing the use of an accelerated aging test procedure. Stakeholders stated that they were not aware of an accelerated aging process that mirrors field aging in its ability to replicate the dirt pick-up related discoloration experienced with aging under normal field conditions. Also, allowing accelerated aging appears to conflict with the intent to no longer allowing cleaning of samples prior to testing maintenance of solar reflectance values. For these reasons they support continuing the position of the program to only allow field aging.

Another stakeholder stated that while they agree with other stakeholder opinions that accelerated aging testing is unreliable, they still believe there is a need for providing the marketplace with a faster way of getting their roofing products registered with ENERGY STAR.

EPA Response: EPA initially considered an accelerated aging test procedure to help manufacturers qualify products more quickly. However, there continues to be strong opposition and distrust in this test method from stakeholders. Furthermore, EPA has not been presented with sufficient evidence that accelerated aging emulates the effects of in-field aging currently required in the specification. Over the next several years, EPA is willing to work with stakeholders who support an accelerated approach to determine if a test procedure can be identified that provides a strong correlation between results of solar reflectance testing after accelerated aging and those after in-field aging.

V. EPA Rationale for Specification

EPA uses a consistent set of criteria in the development and revision of specifications for ENERGY STAR qualified products. These criteria guide EPA in its decision making and help EPA ensure that the ENERGY STAR mark will continue to be a trustworthy symbol for consumers to rely upon as they purchase products for the home or business and their purchases will deliver substantial environmental protection. These criteria include:

- Significant energy savings and environmental protection potential on a national basis;
- Efficiency level is technically feasible while product performance is maintained or enhanced;
- Labeled products will be cost-effective to the buyer;
- Efficiency can be achieved with several technology options;
- Product differentiation and testing are feasible; and
- Labeling would be effective and recognizable in the market.

Below EPA addresses the Version 2.0 roof products specification relative to each of these criteria:

- Expected Energy Savings and Environmental Benefits on a National Basis. EPA decided not to go forward with an emissivity requirement due to the lack of conclusive evidence that energy savings would be realized in all regions of the U.S. In fact, there was evidence of increasing energy use during the winter months as a result of using highly emissive roof products in colder climates. Furthermore, several highly reflective roof products offering significant energy savings during peak periods would be eliminated from the specification due to low emissivity values. EPA will consider including an emissivity requirement at some point in the future when new data or research clearly supports emissivity, be it a regionally or nationally based metric that would routinely deliver cost-effective energy savings to end users.
- Technical Feasibility/Impact on Product Performance/Functionality. Although designing a roof product that meets high emissivity and reflectivity levels is technically feasible, in practice product performance could be degraded when installing under different climatic conditions. In this case, customers purchasing ENERGY STAR qualified roof products would not always be assured of desired product performance, or energy savings, which appears to be highly dependent on climate.
- Cost-Effectiveness to the Purchaser. As explained above, a single nationwide emissivity requirement does not appear to be cost effective to the purchaser. While buildings in warmer climates benefit from high emissivity levels, it is possible that buildings in colder climates

would actually experience lower net energy savings. In this case it would not be cost effective for a consumer to purchase a highly emissive roof product. EPA decided that more data and analysis is needed to assess whether an emissivity requirement in the ENERGY STAR specification would be appropriate and cost effective.

In lieu of performance levels, EPA included a requirement that all manufacturers report emissivity levels for purposes of posting the information to the ENERGY STAR Web site. This would allow customers in climates where highly emissive roof products would be beneficial to identify ENERGY STAR qualified roof products with this additional energy saving characteristic.

- Achieve Efficiency With Several Technology Options. The proposed emissivity requirement would have completely eliminated roof products representing a large market share and offering significant energy savings due to high reflectance values (e.g., bare metal products and aluminized asphalt-based roof coatings). The emissivity specification would have given cool roofs an unfair advantage even though in some applications they may result in a lower net energy savings.
- Testing Procedure. Testing uncleaned samples of roof products will provide end users with more realistic product performance information under a typical use scenario, since roofs are rarely cleaned after installation. Although there were some concerns regarding the current 3-year testing requirement, the majority of stakeholders felt that current accelerated aging test procedures fall short of accurately reflecting the conditions roofs are subject to in the field. EPA will continue to follow efforts in the industry to develop a more realistic accelerated aging test that might help to speed up the qualification process.
- Product Differentiation and Effectiveness of Labeling. While adding emissivity to the specification would further differentiate roof products available in the market today, labeling based on a single emissivity requirement would not be effective in all regions of the U.S. By including one national emissivity level, ENERGY STAR qualified products may either see reduced sales or be removed completely from Northern climates of the U.S., which would also impact overall program savings.