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OFFICE OF
AIR AND RADIATION

**Summary of Rationale for ENERGY STAR® Commercial
Dishwasher Specification
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I. Introduction and Background

This memorandum provides a summary of the rationale and key inputs that culminated in the ENERGY STAR commercial dishwasher specification. It contains the following information:

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

II. Summary of ENERGY STAR Specification

The ENERGY STAR commercial dishwasher specification was finalized on July 25, 2007. Key elements of the new ENERGY STAR specification are provided below:

- The following machine types can qualify as ENERGY STAR: under counter; stationary rack, single tank, door type; single tank conveyor; and multiple tank conveyor machines. Both high and low temperature designs are eligible.
- Qualifying machines must meet maximum idle energy and water consumption levels. Separate requirements are presented for each machine type, high and low temperature. Rinse water consumption (gal/rack) must be measured and certified to the NSF/ANSI Standard 3-2007. The "gallons per rack" level is calculated using formulas provided by NSF and included in the specification. Idle energy (kW) is measured using ASTM Standards F1696 and F1920, depending on the machine type. Although ASTM Standards F1696 and F1920 are currently under revision to address previously identified flaws, the sections measuring idle energy that are cited in this specification were determined to be sound and without issue or need for revision.
- The new ENERGY STAR commercial dishwasher specification became effective October 11, 2007. Within two years of this effective date, EPA will review idle energy data to determine whether the limits required by the specification provide sufficient differentiation in

the marketplace. If revisions are needed, EPA will work closely with industry stakeholders to develop new levels.

- EPA plans to revisit the specification once the revision processes for ASTM F1696 and F1920 are complete in order to determine whether inclusion of these test procedures, in their entirety, will adequately address energy consumption in various modes of operation (beyond idle energy) as well as water consumption.

III. Key Milestones of Specification Development

EPA first announced its intention to develop a new specification for commercial dishwashers on February 17, 2005. This process spanned just over 2 years and included the following key milestones:

— Draft and Final Specifications

- Draft 1 released May 5, 2006 – The draft specification defined the type of machines covered and proposed maximum water efficiency levels (gal/rack) using calculations provided by NSF.
- Draft 2 released March 26, 2007 – Multiple tank conveyors were added to the list of qualifying products, along with proposed water consumption levels, and idle energy levels were proposed based on manufacturer submitted data. References to ASTM Standards F1696 and F1920 were added representing the test methods that must be used for measuring idle energy rate. A clarification was added that machines interchangeable in the field (high and low temperature) must meet both performance requirements for that product category. A comment summary was also posted for stakeholder review.
- Final Draft released June 15, 2007 – Water consumption and idle energy levels were adjusted as a result of revisions to the respective data sets. A requirement for certification to NSF/ANSI Standard 3-2007 was added to the specification. Guidance regarding rounding for gal/rack and idle energy rate reporting was added under the performance table.
- Final Specification released July 25, 2007 – An additional qualifier was added to the definition of under counter machines that excludes machines designed for cycles longer than 10 minutes. This statement was added to further differentiate between residential style models and machines specifically designed for a high workload, fast paced, foodservice environment, which is the application that EPA intended to address with this specification. A new 30-second load time was also added as an option in the gal/rack calculation for door-type machines designed for front loading. No additional changes were incorporated since the Final Draft version.

— Industry Stakeholder Meetings, Correspondence, and Events

- Industry stakeholder meeting held during the National Restaurant Association (NRA) Show on May 22, 2006 to discuss levels and requirements proposed in the Draft 1 specification.

- Memorandum sent to stakeholders on October 4, 2006 presenting EPA's intent of incorporating an idle energy rate requirement and asking manufacturers to review the applicable ASTM test procedures, sharing test results where feasible.
- Stakeholder conference call held on October 17, 2006 to answer any questions and/or address any concerns regarding the idle energy test procedures. Following the call, EPA distributed a final data collection sheet and manufacturers were given a deadline of January 5, 2007 to submit comments and/or data. EPA then decided to extend the deadline to January 31, 2007 to allow manufacturers additional time to test products.
- Industry stakeholder meeting held during the NRA Show on May 21, 2007 to discuss proposed levels and requirements proposed in the Final Draft specification, in particular idle energy levels based on manufacturer submitted data.
- Official launch of the new ENERGY STAR commercial dishwasher specification during the North American Association of Food Equipment Manufacturers (NAFEM) Show held in Atlanta, GA, October 11-13, 2007.

IV. Summary of Stakeholder Input

EPA received substantial stakeholder input over the course of the development of the new specification. Written comments were submitted by the following stakeholders: Insinger Machine Company, Auto-Chlor, Blakeslee, Miele Inc., Jackson MSC, Ecolab Inc., American Dish Service, Hobart Corporation, Champion Industries, Meiko USA, Green Restaurant Association, Steering Committee for Water Efficient Products, Consortium for Energy Efficiency (CEE), City of Austin, and East Bay Municipal Utility District.

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.

Definitions

- Comment: Several stakeholders provided input on proposed definitions for machine types covered by the specification to better reflect typical operation and design.

EPA Response: Where available, EPA used the definitions developed by NSF for the different types of machines, providing additional clarification as needed. However, NSF does not provide a definition for under counter machines within the NSF-3 Standard and Glossary. Given that under counter machines are allowed a higher water consumption limit, it was important that a clear line be drawn differentiating this machine type from others. EPA worked closely with manufacturers to identify characteristics, including a maximum height of 38 inches for under counter machines.

Product Types Eligible for ENERGY STAR Qualification

- Comment: Several stakeholders asked that flight type machines be included in the specification. These machines offer a wide variance in water consumption, which can be as much as 600 gallons of water per hour. EPA also received suggestions to include other

machine types in the specification including glassware; pot, pan, utensil; and multiple tank conveyor machines.

EPA Response: While EPA recognizes the impact that flight type machines have on total water consumption it also recognizes that they represent a small portion of the marketplace and are custom-built to each host site, making it difficult to develop an ENERGY STAR specification. EPA may consider flight type machines under subsequent versions of the specification based on continued industry interest, available performance data, and a clear methodology for addressing the custom-built nature of this machine type.

Glassware machines are not included in the specification largely because of the lack of available data in the NSF database. Stakeholders were asked to provide idle and water use data on these product types for EPA consideration but none was provided. EPA may consider adding glassware machines based on continued manufacturer interest and available performance data.

Pot, pan, and utensil machines are not specifically identified in the specification due to the realization that based on NSF data these machine types are inherently water and energy inefficient. However, to encourage further innovation EPA decided to allow these product types to qualify as ENERGY STAR as long as they meet the idle and water consumption levels provided for stationary single tank door type machines.

Multiple tank conveyors showed the most potential for ENERGY STAR labeling, offering a distinct functionality and robust dataset that includes low energy and water using designs. As such, EPA added a multiple tank conveyor category along with gal/rack and idle energy rate requirements based on performance data provided in the NSF database.

- Comment: EPA received conflicting feedback regarding whether to allow fill and dump machines to qualify for ENERGY STAR. These machines dump the water from the wash tank after every wash cycle. Many stakeholders felt that these types of machines are extremely wasteful while others argued that because of their large share of the low temperature market (90%), excluding them would essentially exclude the majority of available products within that category. Some manufacturers also suggested that separate performance levels be created for fill and dump machines.

EPA Response: The purpose of the ENERGY STAR specification is to recognize the most energy and water efficient machines available in the marketplace regardless of technology. The ENERGY STAR water consumption levels for low temperature, stationary door type machines (the subcategory in which fill and dump machines are prevalent) represents approximately 25% of models listed in the NSF database. This follows ENERGY STAR's practice of representing approximately the top quartile of available models when the specification is set, thereby serving as a target for manufacturers when redesigning their machines. Four manufacturers offer lo-temp models at this level, which indicates that there are several non-proprietary technology options (including fill and dump designs) available to reach this level of water efficiency performance.

- Comment: Stakeholders felt it was important to require listing to NSF/ANSI 3-2007, which will ensure that qualifying units will sanitize and remove soil properly while using less water.

EPA Response: This requirement supports one of EPA's guiding principles that performance is maintained or enhanced with improved efficiency. However, requiring listing to NSF would exclude other certification bodies capable of testing to NSF-3 and certifying machines. Instead,

EPA added a requirement that every ENERGY STAR qualifying machine be certified to the NSF-3 test standard, which allows other testing organizations to do the certifying.

- Comment: There was some concern that machines with designs similar to residential models, but intended for the commercial sector, aren't getting fair treatment under the specification.

EPA Response: EPA understands that these are niche products which are not necessarily targeted for the commercial foodservice sector. Therefore, EPA included a qualifier in the definition for under counter machines that excludes machines designed for wash cycles longer than 10 minutes. This requirement will further differentiate between residential style models and machines specifically designed for a high workload, fast paced foodservice environment, which is the application that EPA intended to address with this specification.

Test Procedures

- Comment: Many stakeholders were concerned about continued sanitation and cleaning performance under a water efficiency specification. EPA was asked to view current NSF-3 test standards as interim guidance, with the intent of supporting the pending formal request by industry to revise its cleaning and sanitation standard, taking into account real world conditions.

EPA Response: EPA discussed this concern with a NSF representative. Based on this discussion, EPA confirmed that rinse water consumption measurements are taken during the soil removal and sanitation tests, which means that the water consumption data verified and listed by NSF represents the rinse water amount needed to meet applicable NSF requirements. If and when the process to revise the NSF-3 test standard begins, EPA would be interested in reviewing and participating in these discussions. Again, maintaining product performance of ENERGY STAR qualified products is important to EPA and to the extent that these revisions can help ensure continued sanitation and performance in the field, EPA supports these efforts.

- Comment: Stakeholders supported EPA's proposal of using NSF-3 to measure water consumption and ASTM F1920 and F1696 to measure the idle energy, with the intention of measuring both performance criteria by the ASTM standards in the future.

EPA Response: In this specification, EPA cites the sections of ASTM F1696 and F1920 related to idle energy only. These sections were determined to be technically sound and without need for revision. EPA is monitoring the revision process for the rest of the sections of the ASTM test procedures for possible future incorporation into the specification, working closely with ENERGY STAR partners to revise the performance requirements, as needed.

Efficiency Performance Requirements

- Comment: One stakeholder was concerned that the specification criteria did not fully represent the many ways to minimize water and energy consumption during normal/peak energy consumption (e.g., washing cycle). There is some concern that efforts to minimize water consumption and idle energy for ENERGY STAR qualification could still result in equipment that is inefficient from a total energy consumption standpoint.

EPA Response: EPA would like to develop a commercial dishwasher specification that addresses energy use in all modes of operation. The revised ASTM F1920 and F1696 test procedures, as drafted, could serve this purpose. However, these test procedures are still under revision. EPA is

monitoring the test procedure revision process for possible future incorporation into the specification. Doing so will also require revisiting the performance requirements and collecting test data using the new test procedures. Until then, idle energy and the indirect energy savings due to lower water consumption represents the best available proxy for energy efficiency.

- Comment: Several stakeholders commented on proposed water consumption and/or idle energy levels for multiple tank conveyors, low temperature single tank door type machines, and low temperature single tank conveyors. Specifically, the idle levels for multiple tank and single tank conveyors should not be identical since multiple tank machines need to maintain heat for two or more tanks while idling. Theoretically, the limit for multiple tank machines should be higher than single tank machines. In addition, stakeholders felt that the proposed gal/rack levels for low temperature single tank door type and single tank conveyors did not accurately represent the top 25% of models actually available in the marketplace today.

EPA Response: In response to these comments, EPA revisited the datasets. For multiple tank conveyors, EPA found that some of the data point used to identify the idle energy level, derived from manufacturer submitted data, only represented wash tank idle energy use. Idle energy for multiple tank machines should indeed represent the collective energy used by all wash and final rinse tanks. A new analysis of the data supported an increase in the idle energy limit from 1.6 to 2.6 kW for high temperature models and 1.6 to 2.0 kW for low temperature models.

EPA revisited the dataset for low temperature single tank door type machines and single tank conveyors to confirm whether it represented models currently available in the marketplace. Through additional research and discussions with several manufacturers, EPA found that many of the models listed in the NSF database, and thus used in the initial analysis, are either discontinued or misrepresented (e.g., multiple tank machines listed as single tank). Once these models were removed from the dataset it became evident that the proposed water consumption levels were too restrictive in terms of product selection. Therefore, EPA adjusted the level for low temperature single tank door type machines from 1.16 to 1.18 gal/rack and adjusted the level for low temperature single tank conveyors from 0.62 to 0.79 gal/rack.

- Comment: It was brought to EPA's attention that there are some door type machines that are front loading and therefore, manufacturers should be able to use a 30 second load time in the gal/rack calculation instead of the current requirements of 5 or 7 seconds.

EPA Response: To the extent possible, the test procedures and calculations referenced in ENERGY STAR specification should represent the intended use of the product. Therefore, EPA added a 30-second load time for door type machines designed to be front loading.

Effective Date

- Comment: EPA received a request to delay the launch of the specification until the NRA Show in 2008, which would allow manufacturers to introduce more high efficiency models.

EPA Response: The primary goal of ENERGY STAR is to serve as a differentiator in the marketplace so that end users can identify the most energy and water efficient models. Typically, ENERGY STAR represents the top 25% of models when a specification is set, thus rewarding manufacturers who have already made investments in high efficiency and encouraging others to follow their lead. Delaying the effective date to allow more models to meet ENERGY STAR requirements does not support this goal. Furthermore, there was significant support to launch the

specification at the October NAFEM show. As such, EPA retained the October 11, 2007 effective date.

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 ENERGY STAR commercial dishwasher specification relative to each of these criteria:

- Expected Energy Savings and Environmental Benefits on a National Basis. The ENERGY STAR qualified commercial dishwasher specification is the first that offers end users both energy and water savings. Commercial dishwashers that have earned the ENERGY STAR are 25% more energy and water efficient than standard machines. Businesses can save about 90 Mbtus, and an average of \$850/year, on their energy bills. In addition, businesses can expect to save 52,000 gallons and more than \$200/year on their water bill.

Over the next five years, ENERGY STAR qualified commercial dishwashers are expected to save restaurants \$100 million in reduced energy and water costs.
- Technical Feasibility/Impact on Product Performance/Functionality. Prior to developing the commercial dishwasher specification, several manufacturers were already incorporating energy and water saving components into their product designs and promoting these benefits. The ENERGY STAR specification is simply rewarding those existing efforts and encouraging others to follow with improved product designs.

By using the NSF-3 standard to measure water consumption, EPA is ensuring that product performance (i.e., sanitation and soil removal) is maintained with improved water efficiency. Using NSF-3, measurements for water consumption are taken during the sanitation and soil removal tests. Therefore, end users are assured that the water consumption results listed on the ENERGY STAR Web site represent that which is needed to sufficiently sanitize and remove soil from dishes.
- Cost-Effectiveness to the Purchaser. Purchasing ENERGY STAR qualified commercial dishwashers offer end users significant energy and water savings resulting in a payback ranging from 1 – 4 years, depending on product type and fuel prices. High temperature machines offer the greatest energy savings compared to their low temperature counterparts.

- Achieve Efficiency With Several Technology Options. EPA designs its ENERGY STAR specifications to be performance-based. This means that it strives to recognize the better performing products on the market in terms of energy and water efficiency without differentiating based on technology. The ENERGY STAR specification for commercial dishwashers requires products to meet maximum idle energy and water consumption levels to qualify. Manufacturers have several options to reduce water and energy consumption, including improved rinse nozzle design and more efficient heating elements.

Separate efficiency criteria were created for under counter, single tank door type, single tank conveyor, and multiple tank conveyor machines in order to accommodate the functionality differences of each type. That is, an end-user that needs the washing capacity and speed of a conveyor machine will be able to find an ENERGY STAR qualified one. Similarly a facility that has limited dishwashing needs will be able to find an ENERGY STAR qualified under counter machine. In addition, each sub-category is divided up into lo- versus hi-temp levels in order to provide clear energy-efficient options for both end-users needing the functionality (cleaning power for glassware and finer dishware) of hi-temp machines and those needing the lower cost option of lo-temp machines.

- Testing Procedure. The ENERGY STAR specification references NSF/ANSI Standard 3-2007, which is the industry accepted test procedure for measuring water consumption. In addition, technical experts reviewed the ASTM F1920 and F1696 test procedures and agreed that the sections for measuring idle energy were reasonable and technically sound. Many of the commercial dishwasher manufacturers who participated in the development of the ENERGY STAR specification are actively participating in revisions to the remaining sections of the ASTM test standards for which issues were identified. EPA is monitoring the revision process for the rest of the sections of the ASTM test procedures for possible future incorporation into the specification and will working closely with ENERGY STAR partners to revise the performance requirements, as needed.
- Product Differentiation and Effectiveness of Labeling. EPA believes the ENERGY STAR mark serves an important role in the marketplace due to the absence of any other objective basis for end users to identify and manufacturers to promote highly efficient commercial dishwashers. All of the major commercial dishwasher manufacturers were actively involved in the development of the specification and eager to be able use ENERGY STAR to promote and sell their high efficiency machines. At the time of the launch, there were 10 partners signed onto the ENERGY STAR program and over 100 qualified models. Furthermore, several utilities and customers expressed interest in rebating and purchasing ENERGY STAR qualified commercial dishwashers. Lastly, the addition of commercial dishwashers helps to expand the number of energy and water saving opportunities in the growing suite of ENERGY STAR commercial foodservice equipment.