

## Summary and Response to Stakeholder Comments

### ENERGY STAR Program September 19, 2011 Webinar for the Residential Dishwasher Cleaning Performance Test Method

## I. TEST GOALS

<u>Key</u>	<u>Comment Summary</u>	<u>Response</u>
1	Energy and performance measurement must be linked, that is, the same test procedure should be used to measure both energy and water use and cleaning performance.	DOE proposes to use the DOE test procedure at 10 CFR 430, Subpart B, Appendix C (Appendix C) to measure the cleaning performance and energy and water use of residential dishwashers.
2	To meet the requirement of using the same test procedure for energy and water use and cleaning performance, DOE's test procedure should be used.	DOE proposes to use Appendix C.
3	With all the work that may be required to make some version of the AHAM / DOE test procedure reproducible, resources may not be available to work on both the procedures, and the work on a new IEC based AHAM procedure may be delayed. It should be noted that if we continue down the road of developing a special US AHAM / DOE test procedure, it will become much more difficult to change to IEC based procedure in the future.	DOE proposes to use Appendix C to ensure cleaning performance is tied to energy and water consumption. DOE concluded this should be a priority of the cleanability test method. Additionally, conducting the performance test using Appendix C will minimize test burden for manufacturers and third party labs.
4	In the long term, switching toward the IEC cleanability procedure will enable use of the IEC infrastructure, reduce procedural maintenance cost by avoiding involvement in multiple cleanability test procedures, improve utilization of experts in the field, reduce test burden due to a common procedure, improve customer satisfaction, reduce pre-rinsing and offer a true reduction in overall dish washing energy consumption.	DOE does not propose utilizing the IEC method at this time because a majority of stakeholders are interested in linking dishwasher cleanability performance to the energy and water use tests. Additionally, DOE's data suggest that the IEC method is not repeatable with US-based dishwashers and it poses a significant test burden for small manufacturers.
5	The cleanability test procedure must be repeatable and reproducible, which is particularly challenging with a cleanability test procedure that involves subjective scoring. DOE could address these issues through uniform training materials on soiling, grading, and reading use and care guides. Stakeholders are willing to work with DOE to develop these materials, such as preparing a guidance video to capture critical test procedure elements, and to train technicians.	DOE agrees that technicians should be trained for the cleanability test method to maintain repeatability and reproducibility. DOE welcomes input from AHAM and other stakeholders on what information should be included in training materials. Dependent upon stakeholder feedback, DOE may conduct additional testing after publishing the Draft 1 Test Method for Determining Residential Dishwasher Cleaning Performance to assess the repeatability and reproducibility of the proposed test method.
6	Round robin testing is needed to address reproducibility once a cleanability test procedure is developed.	See response to comment 5.

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7	A correlation workshop hosted by DOE would help minimize variation in the interpretation of the test procedures including DOE's residential dishwasher test procedure.	This issue has been brought forward in the past; DOE is working to schedule such a meeting.
8	Manufacturers should be completely involved throughout the entire process. DOE should set up a schedule of phone conferences and face to face meetings, starting with the Energy Summit. The Energy Summit should be setup in a manner that allows product specific discussions, instead of a mass meeting and discussion of all ENERGY STAR products at the same time.	Manufacturers have been involved in the process of developing the ENERGY STAR cleanability test method, starting with the Sept. 19 webinar, and continuing with the latest draft release for review and comment. DOE and EPA intend to involve stakeholders throughout the process.
9	The amount of detergent required for the prewash cycle should be discussed at the DOE energy test summit.	DOE is aware that detergent formulation and dosing stipulated in Appendix C is open to different interpretations and will address this issue in a future rulemaking or through guidance issued on its website.
10	Further work on the cleanability test procedure should continue after the correlation work because several issues raised during the webinar would be addressed at the workshop and could impact the outcome of the testing (e.g. which detergent to use).	DOE will continue developing the cleanability test method and will address the issues raised during the webinar in the Draft 1 Test Method for Determining Residential Dishwasher Cleaning Performance.
11	In the future, eight soiled place settings should be considered for cleaning performance, either as an additional test or as a replacement for four soiled place settings.	Currently, DOE proposes to use Appendix C for cleanability testing, which does not include testing with eight soiled place settings. DOE may consider eight soiled place settings in the future if consumer use data indicates that eight soiled place settings is representative or if stakeholders feel that testing eight soiled place settings could provide a more consumer-relevant measure of dishwasher cleaning performance.
12	Using eight soiled place settings or the IEC soils would impact the energy and water standards.	See response to comment 1.
13	Monitor the energy and water use with 12 place settings?	DOE proposes to use eight place settings for standard dishwashers and four place settings for compact dishwashers in the cleanability test method as required in Appendix C.
14	The IEC test load is not independent of the size of the test unit.	See response to comment 13.

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15	The air dry scores should be higher than thermal dry scores for IEC scoring.	DOE did not use the thermal dry method for the IEC test method and therefore does not have comparative scores. DOE is proposing to use Appendix C, including soil load preparation, which stipulates an air-drying preparation method.
16	The test procedure cannot be overly aggressive because that would lead to energy and water consumptions that are higher than the real-world values.	See response to comment 1.
17	The cleaning performance test procedure should focus on the DOE soil loads instead of the IEC or AHAM loads because the DOE soils are consumer-relevant.	DOE proposes to use the soil loads from Appendix C in the cleaning performance test method.
18	This might be a good time to move over to the IEC test because all companies are global.	DOE recognizes that many companies sell dishwashers into international markets with standards that differ from those in the United States (US); however, majority of stakeholders expressed support for harmonizing the cleanability test method with Appendix C.
19	This test procedure should consider the light and medium DOE soil loads to ensure there is no drop off in performance because these cycles are weighted the most in the energy and water consumption calculations.	DOE agrees that the light and medium soil loads should be covered in the cleanability test method, and is basing the cleanability method on Appendix C with heavy, medium, and light soil loads for all dishwashers.
20	Switching toward an IEC-based procedure will result in a robust and cost effective solution that is better than any current USA-based proposal; resulting in a test procedure with proven reproducibility and consumer satisfaction.	DOE believes implementing the IEC test method would force manufacturers and test labs to incur significant costs and test burden. DOE's testing indicates that the proposed test method, based on Appendix C, is robust, repeatable, and reproducible.

## II. TEST SETUP

<u>Key</u>	<u>Comment Summary</u>	<u>Response</u>
21	In the test setup, it appears that the drain hose is too high, which could cause some issue for particular dishwashers.	DOE reviewed published manufacturer guidelines for installing dishwasher drains and determined that testing was performed in accordance with the supplied guidelines.
22	It appears that the water connection, water bleed off, temperature thermocouple, and pressure measurement are mounted above the dishwasher. In manufacturers' labs, these instruments are installed at the bottom, as near the fill valve as possible. The supply hose from these instruments to the dishwasher is as short as possible.	DOE requested information from third party test labs, and found that the setup used for DOE testing was reasonable based on the third party setups. DOE notes that Appendix C does not specify locations for the test equipment, and as a result each test lab's setup varies. DOE also does not expect using a supply hose that is as short as possible to be standard practice, as most test labs would likely use the hoses supplied by the manufacturer.
23	Lab setups vary; with some variations being critical to certain dishwasher designs while other's designs are unaffected. Many lab setup issues were noted when a stakeholder visited labs and witnessed energy testing. What became apparent is that none of the labs conducting energy testing are setup in exactly the same way. This is one of the base reasons for requesting the energy summit. It would be suggested to have the DOE/NETL ATEC Lab setup reviewed by industry experts to ensure lab setup is consistent with common industry practice. It would be a waste of resources to find issues with lab setup after extensive testing has been completed.	DOE requested information from third party test labs, and found the laboratory where DOE tested used a setup that was reasonable based on the feedback received regarding third party setups. DOE notes that Appendix C does not specify locations for the test equipment, and as a result each test lab's setup varies.

### III. TEST METHOD

<u>Key</u>	<u>Comment Summary</u>	<u>Response</u>
24	<p>The IEC test was not done according to the exact specification of the IEC standard:</p> <ul style="list-style-type: none"> <li>• Proper reference machine was not used.</li> <li>• Proper food soils were not (and could not be) used and a study of replacement soils was not performed.</li> <li>• Different test conditions were used.</li> <li>• Different test load was used.</li> <li>• Different detergent and rinse-aid was used.</li> <li>• Different cleaning evaluation calculation was used.</li> </ul>	DOE acknowledges that the preliminary IEC testing was not performed according to the exact specifications of that standard; in the few instances where test equipment or materials were unavailable or obsolete, the most reasonable equivalents were substituted. Given the preliminary test results using the IEC method, and general support in the preliminary webinar and submitted comments, DOE is not pursuing the IEC standard as the cleanability test method. DOE instead proposes a test method based on Appendix C. DOE is proposing to include a scoring method based on the IEC approach, which is independent of the test methodology.
25	<p>For the DOE test procedure, AHAM DW-1-2009 soil load was used instead of AHAM DW-1-1992 as specified in the current DOE test procedure.</p> <ul style="list-style-type: none"> <li>• AHAM DW-1-1992 uses cooked egg yolks but AHAM DW-1-2009 uses raw egg yolks.</li> <li>• The order of soil application is different in the two versions.</li> </ul> <p>These changes add significant burden.</p>	For investigative purposes, DOE used the soil load from AHAM DW-1-2009, since that initially appeared to represent a worse-case cleaning scenario than the soil load from AHAM DW-1-1992. Based on these tests, DOE concluded that the differences in the 2009 and 1992 soil loads would not lead to measurable differences in cleaning performance. In the interest of harmonizing with Appendix C that references AHAM DW-1-1992, DOE proposes to use the soil load, soil preparation, and soil application according to AHAM DW-1-1992 for determining the cleaning performance of dishwashers.
26	If DOE does not want to use the AHAM DW-1-1992 soil load, it should update its test procedure to reference to ANSI/AHAM DW-1-2009, which is the most current version of AHAM DW-1.	DOE proposes to use the soil load specified in Appendix C, which references AHAM DW-1-1992.
27	For the DOE tests, soil substitutions were made without assessing the effect the replacement would have on the test.	DOE substituted certain soil loads because the specified soils were not available or have been discontinued. Appropriate substitutions were made based on the available products. DOE welcomes feedback on substitutions used by manufacturers and any data that illustrates the impact these substitutions have on the test results.

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28	Same ambient conditions were used for all tests regardless of what the test procedure specified.	Same ambient conditions were used for all tests so that the cleaning performance of the different test methods could be compared while keeping other variables constant. While ambient conditions may affect the energy use of a unit under test, DOE does not expect that slight changes in ambient conditions would significantly impact cleanability results.
29	An alternate food soil application method was used for AHAM DW-1 in some cases. The alternate soil application leads to different wash performance depending on where the dish is placed in the dishwasher. The grid and half soiling patterns in AHAM DW-1 are meant to mimic the different placements in a machine, and thus, minimize that variation. Changes in soil application also could require changes to the specified drying times.	DOE proposes to use the grid and half soiling patterns, as specified in Appendix C, to determine the cleaning performance of dishwashers.
30	Filter was cleaned for the DOE test procedure even though filter cleaning is not specified in the DOE test procedure.	The filter was cleaned for Phase 1 testing to minimize the variables for each test; in addition, only the sensor heavy response tests were performed. Filter cleaning allowed the comparison of scores from each test. During Phase 2 testing, DOE did not perform filter cleaning between the heavy, medium, and light cycles in accordance with Appendix C.
31	No clean-up runs or filter cleaning should be performed between test cycles.	DOE is not proposing clean up cycles or filter cleaning between test cycles.
32	Cleaning filters might lead to better DOE scores on the light and medium tests.	See response to comment 31.
33	Do consumers actually clean filters in between cycles? The test should reflect consumer behaviors. Also, there are concerns with running a clean-up cycle in between test cycles. If the filter degradation is excessive, the test procedure should capture it.	See response to comment 31.

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34	The DOE procedure uses heavy, then medium, then light loads with no clean-up in between because consumers would not clean up after each cycle. The AHAM procedure includes clean-up cycles because its soil loads stress the performance of the unit.	DOE agrees that consumers likely do not clean the dishwasher filters between each cycle, and proposes a cleanability test based on Appendix C, which does not include a clean-up cycle or cleaning of the filter between cycles.
35	The IEC standard does not allow filter cleaning to observe filter degradation over the entire test run.	DOE appreciates the comment but does not propose to use the IEC test method for testing the cleaning performance of dishwashers.
36	There is little confidence in the results and conclusions cannot be made because the test procedure was changed from the specifications in each standard.	Due to support from stakeholders in the preliminary webinar, DOE is not proposing a cleanability test method based on the AHAM or IEC standards. DOE proposes a cleaning performance test based on Appendix C.
37	The results cannot be compared with manufacturers' results in their laboratories because of the above mentioned changes.	DOE used the preliminary tests to compare results internally between the initial set of test units, not to compare with manufacturers' test results.
38	The comparison of results presented by DOE and EPA may not be meaningful because of the above mentioned changes. Variation across test results appeared substantial.	The investigative test results provided useful comparative data despite the necessary substitutions and changes to the test methods. DOE used the preliminary testing to gain an understanding of the test methods, and to gauge the viability of the test methods.
39	Insufficient data was presented during the webinar for manufacturers to effectively evaluate if any variation that occurred was due to the test procedure itself or other factors. Additional data, such as water and energy use, cycle path, wash temperatures among other detailed data, would be useful.	DOE conducted Phase 2 testing based on Appendix C. In the next webinar to address the proposed cleanability test method, DOE will provide more in-depth data including water and energy use.
40	It is problematic to mix and match tests and scoring techniques.	Scoring techniques are independent of the test methodology for soil application and dishwasher operation. DOE analyzed the IEC and AHAM scoring techniques for each test method and determined that IEC scoring produced the most repeatable results while differentiating between the performances of different units.

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41	It is also problematic to combine scoring techniques and apply a combined scoring method to a different test.	DOE developed the hybrid scoring method to address certain limitations of the IEC and AHAM scoring methods. However, test results indicated that the hybrid scoring method did not provide a benefit in terms of measuring relative cleaning performance as compared to the AHAM and IEC scoring methods.
42	Since the DOE test procedure does not have an associated performance scoring procedure, it may be acceptable to apply another scoring technique.	DOE proposes to use the IEC scoring technique because it provided higher consistency in scoring compared to the AHAM scoring method.
43	AHAM DW-1 may be the best scoring procedure to use because technicians in the US have most experience with it.	DOE is aware that most US technicians have experience with the AHAM scoring technique. However, DOE believes technicians can transition to the IEC scoring method with training; in fact, many technicians are likely already familiar with this method.
44	Clarify the IEC scoring method used. IEC scoring drops below 2 when the combined area of soiled particles is more than 50 mm <sup>2</sup> .	DOE agrees that IEC scoring drops below 2 when the combined area of soiled particles is more than 50 mm <sup>2</sup> . However, often a large number of very tiny particles were observed on items that did not exceed a combined area of 50 mm <sup>2</sup> and therefore received a score of 2. The hybrid scoring method was developed to avoid such items from getting a lowest possible score of 2. However, the hybrid scoring method did not provide a benefit in terms of measuring relative cleaning performance and therefore, DOE is proposing the IEC scoring method.
45	If DOE develops a measurement tool for scoring, it should not be hand drawn; it must be exact, clearly labeled, and calibrated. If developed, every laboratory conducting tests would need to use the tool in the future.	The grading tool shown in the first webinar was created for DOE's internal use and was presented at the webinar for illustrative purposes only. If DOE provides a public tool, it will be exact and clearly labeled. Test labs may develop their own internal tools to simplify the grading process.



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46	Multiple graders must be able to grade in the same way to ensure repeatability and/or reproducibility.	DOE agrees that consistent grading is necessary for repeatability and reproducibility of the cleanability test method. DOE believes the scoring method included in the IEC test method has been appropriately developed to ensure repeatability and reproducibility. DOE believes multiple graders will be able to grade consistently after appropriate training with the IEC method.
47	The webinar did not show evidence that graders were able to achieve consistent results. DOE must ensure that multiple graders can achieve consistent results before proceeding with a performance test procedure.	Webinar data were based on Phase 1 testing. Phase 2 test data indicate that the variability from test-to-test corresponds more to variability in the cycle response triggered by the soil sensor than variability between graders.
48	Extensive training is necessary to have repeatable results with the subjective grading of a dishwasher cleanability test procedure. Improper methods can have big impacts on test results.	DOE agrees that graders should be trained for evaluating the cleaning performance, and that improper grading could have a significant impact on test results.
49	DOE should focus only on the DOE test procedure with four (eight), two and ½ place settings soiled for Phase 2. The IEC and AHAM test procedures with 10 or 12 place settings soiled do not add enough value.	Based on comments received, DOE focused on Appendix C with four, two, and ½ place settings soiled for Phase 2 and proposes this test method for performance testing of dishwashers.
50	The IEC method has significant costs and testing burden. The equipment, dish loads, and reference dishwasher required for the IEC procedure carry significant cost which may be difficult for small labs to support. The air drying method requires 16-18 hours of dry time which is not feasible for larger labs because it occupies a significant amount of table space.	DOE does not intend to propose the IEC test method, keeping in mind the significant burden as well as stakeholder's request for linking energy and performance tests. DOE is also not proposing to include the reference dishwasher required for the IEC test method, based on data showing it provides no benefit on the test-to-test repeatability. DOE also recognizes the significant burdens associated with the reference unit. DOE will consider including the reference dishwasher if supported by stakeholders.

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51	We disagree that the “IEC method does not provide consistent results or adequate differentiation among units tested.” The IEC method is the only methodology around the world which has proven to provide repeatable and reproducible results. Two round robin tests in 2003 and 2009 were conducted with 20 laboratories that showed the results were reproducible within expected limits. This methodology also allows differentiating dishwashers on a reasonable level of performance.	The IEC test method is not being pursued for performance testing of dishwashers because stakeholders are interested in linking the energy and performance tests. Round robin test results indicate that the IEC method provides repeatable and reproducible results among most test labs; however, for US-based dishwashers, and with the substitutions made for soils, test load, detergent, rinse-aid, and reference dishwasher, the results did not show the desired level of repeatability.
52	Off the shelf dishwashing detergents vary from batch to batch with formulation changes taking place without notification. Therefore a specially formulated test detergent with consistent results is recommended.	DOE is aware that detergent formulations may vary; however, to maintain harmonization with the energy and water consumption tests, DOE proposes that the detergent specified in Appendix C should also be used for cleaning performance tests.
53	The procedure should address differences in detergent and rinse aid formulations.	In order to link cleaning performance to energy and water use, DOE proposes the cleanability test method be conducted based on Appendix C, including the same detergent requirements. No rinse aid is to be used, in accordance with Appendix C.

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54	<p>In response to the above comment:</p> <ul style="list-style-type: none"> <li>• For the IEC method, Detergent B is available, Detergent C was never available, Detergent D will be in Edition 4.0</li> <li>• For the AHAM method, Cascade had highest market share at the time the standard was written.</li> <li>• Recent data shows that tablets have the highest market share.</li> <li>• IEC thinks it would be harder to control dosing with tablets.</li> <li>• How the dishes are loaded is just as important to the results.</li> <li>• Non-phosphate Cascade is being used as of the last twelve months.</li> <li>• In the US, detergent could have variation by region.</li> </ul>	DOE appreciates the input on the market trends for detergent use and will consider this information when Appendix C is due for revision.
55	If the test load is 12 place settings, all units might not be able to handle that.	See response to comment 13.
56	Should the tests use a smaller amount of fixed soils to represent consumer use?	In Phase 1 testing, DOE used the IEC, AHAM, and DOE heavy soil loads for investigative purposes. DOE proposes testing based on Appendix C, which are lighter soil loads than in the IEC and AHAM methods.
57	US dishwashers will most likely need modification to the dishwasher cycle structure and/or sensor decision set points in order to have good and repeatable performance with the IEC procedure. Without these changes performance may not be optimal and sensor decisions may not be repeatable. At this point, testing U.S. dishwashers with the IEC dishwasher test procedure could lead to incorrect conclusions.	Phase 1 testing indeed indicated that the IEC method did not provide the desired level of repeatability for U.S.-based dishwashers. DOE is not proposing the IEC method to determine the cleaning performance of dishwashers.

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58	Substitutions of food soils, dishes and reference machines, cannot be considered without round robin testing showing that the changes do not have impacts. Changes to scoring methods should be considered after establishing a clear basic direction. Changes to the soil application (soiling entire plates with a single soil) will certainly impact the rate the food soil falls off the dishes, and this may influence the sensor decisions.	Data presented during the webinar were from Phase 1 investigative testing. DOE proposes performing the cleanability test on the cycles required in Appendix C, with no soil substitutions or changes to the soil application methods.
59	At this point it is unknown how difficult, costly and time consuming it will be to make some form of the AHAM / DOE test procedure reproducible. It will be a major undertaking to develop a specific reference machine and determine relevant test scores and tolerances. Extensive training would need to take place to ensure consistent methods and setups. After these accomplishments, round robin testing would need to occur to determine if reproducibility has been achieved.	Data collected using Appendix C indicates that the proposed cleanability test method is repeatable. DOE plans to conduct a round robin test program after publishing the Draft 1 Test Method for Determining Residential Dishwashers Cleaning Performance to ensure the methodology is reproducible from lab-to-lab.

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60	The soil load and degree of soil attachment in the IEC procedure is representative of how we would like consumers in the US to use their dishwasher, avoiding pre-rinsing which will result in substantial energy savings when compared to current US consumer use habits. On the other hand, the DOE procedure was developed based on current consumer use habits of pre-rinsing, which has been proven to use more energy. The IEC procedure is a more realistic approach, which will allow more aggressive use of the dishwasher while improving ease of use, and offering energy savings at the same time. It will also reduce the need to develop different cycle structures for different countries, with an ultimate goal to have identical cycle structures.	The soil loads required in Appendix C best represent consumer use in the U.S. as is currently known. If DOE receives data indicating that consumer habits are significantly different, DOE may consider different soil loads for the cleanability test method.

#### IV. TEST BURDEN

<u>Key</u>	<u>Comment Summary</u>	<u>Response</u>
61	Labs should not be required to run energy and water tests differently from cleaning performance tests. The cleaning performance tests should use the existing energy runs. Hence, we would not want quarter plate soiling used for the energy and water tests but single plate soiling is used for the performance test. Single plate soiling would be of interest if the DOE test is changed as well.	See response to comment 1.
62	Using the existing DOE soil loads would only require the additional burden of grading.	DOE agrees that a cleanability test method that can be performed using Appendix C would minimize the test burden. DOE proposes a cleaning performance test method for all dishwashers using the cycles in Appendix C that are currently required for soil-sensing dishwashers.
63	A stakeholder disagreed with the test burden evaluation presented in the webinar. The soiling and grading portion of the test procedure are only a fraction of the time required to obtain and investigate results. In addition, we do not feel that the opinion presented in the webinar considers the bigger topic of managing multiple test procedures. The US AHAM IEC Technical Advisory Group plans to be involved with the continual development of the IEC dishwasher test procedure even if a different cleanability test procedure is selected by DOE.	To minimize test burden, including the burden of managing multiple test methods, DOE proposes a cleanability test method that can be run simultaneously with the energy and water use test procedure in Appendix C.
64	There would be a tremendous amount of work and expense to manage the process of having a repeatable and reproducible test procedure. Continuous discussions and revisions must occur to keep the procedure updated to current designs and to prevent circumvention; basically, creating a living process of continual improvement involving the experts in the field.	DOE agrees that the test method must be relevant to current dishwasher designs and prevent circumvention; however, the test method must be amended incrementally rather than continually to ensure test results are comparable from unit-to-unit. Additionally, continual changes to the test method would require continual evaluation or amending of the ENERGY STAR specification levels. DOE must ensure that any test method changes are made at intervals consistent with the process of updating the specifications, which would provide manufacturers sufficient lead time to meet any changes to the ENERGY STAR program.

## V. CONSUMER BEHAVIOR / PREFERENCES

<u>Key</u>	<u>Comment Summary</u>	<u>Response</u>
65	Did ENERGY STAR conduct any consumer or focus groups to rank scoring preferences? Need to determine what consumers consider acceptable cleaning performance.	DOE considered two scoring methods for the cleanability test method based on those included in IEC Standard 60436 and AHAM DW-1-2009, as well as a hybrid version of both. DOE evaluated the results from each, and determined on a quantitative basis that the IEC scoring method produced the most consistent results.
66	DOE used consumer studies when the test procedure shifted to soil sensor testing. The studies were conducted by Arthur D. Little.	DOE is aware of these studies; the soil loads used in Appendix C are the most common based on consumer usage patterns.
67	The values used in the sensor test procedure are conservative; the ADL studies showed that only one in 6,000 loads actually had four soiled place settings.	DOE is aware of the infrequent use of the heavy soil load, but is proposing to include it in the cleanability test method to determine how units perform with the heaviest consumer soil loads, since this is the most stringent condition for measuring cleaning performance.
68	Some of the soils are outdated, such as coffee grounds in the AHAM procedure. Also the preparation of the soils is important to the results, for example the spinach grinding in the IEC procedure.	The soils in Appendix C are relevant to consumer use. Although some of the soils are outdated, they still provide a meaningful basis for determining a dishwasher's cleanability. Further, it is important to maintain the same soils in order to harmonize with the energy and water use measurements.
69	More relevant soils could be determined by discussions with detergent manufacturers about the most typical consumer complaints	See response to comment 68.
70	It is important to harmonize IEC and AHAM. Need to determine which soils are relevant and repeatable. There is an extensive survey for the IEC soils to show they are representative but the soil volume may be high.	The soil loads in Appendix C represent the soil loads most relevant to consumer use in the U.S. Both the AHAM and IEC soil loads are likely to be heavier than typical consumer use. DOE recognized this in developing its test procedure, by weighting the heavy soil load by 5 percent.
71	Has the consumer changed habits to get the same cleaning performance? Don't know. The medium and low sensor tests were intended to accommodate rinsing of soiled dishes by the consumer and still use less water and energy.	DOE is not aware of any available information indicating consumer habits regarding pre-rinsing dishware have changed since its previous energy and water use test procedure rulemaking. However, DOE would be interested if stakeholders have more current information on consumer pre-rinsing habits.

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72	AHAM soils are not representative of consumer use. The soils are loosely attached and fall-off quickly in the dishwasher. The IEC test procedure has soils that are harder to remove from the dishes. The AHAM test procedure has more loosely-attached soils.	DOE is not aware of any information to indicate that the soils in Appendix C based on the AHAM test method should be updated to be more representative of consumer use. However, DOE would be interested if stakeholders have data on representative consumer soils.
73	Is it more representative for the amount of soil on the four place settings (DOE heavy load) to be spread over 10 or 12 place settings? Also it may be more representative to dry the soils over a longer period.	Stakeholders commented in support of using the Appendix C soil loads for measuring cleaning performance, which include clean place settings. Based on observations during Phase 1 testing, the total amount of soil in the dishwasher is most important to cleaning, energy, and water performance, regardless of the soil location. DOE believes the draft test method, including the clean place settings, will provide a representative measure of cleaning performance because the soil quantities reflect typical consumer use.
74	Twelve soiled place settings using the IEC soils are similar to the amount of soil on four place settings using the AHAM soils.	DOE appreciates this comment but does not propose to use the 12 soiled place settings with IEC soils for the cleanability test method. DOE proposes to use the four, two, and ½, soiled place settings in accordance with Appendix C.



## VI. TEST VARIABILITY

<u>Key</u>	<u>Comment Summary</u>	<u>Response</u>
75	US dishwashers are not designed for an IEC test load, so variation in those test results is not surprising.	DOE agrees that the preliminary IEC tests showed more variation, and proposes to use the existing test procedure in Appendix C.
76	Tolerances need to be reasonable given the variability in test results. (May have some data on cleaning performance repeatability)	The draft test method does not include tolerances on the final result stemming from the single unit, cleanability test. For non-DOE regulatory metrics, EPA typically uses a single test, no tolerance approach to generating ratings. EPA and DOE are welcome feedback on whether tolerances should be considered for the cleanability test and what those tolerances may look like.
77	Did the dishwashers that were tested meet the current ENERGY STAR rating and cleanability?	All units tested in DOE's sample met the prior ENERGY STAR specifications. Every unit except two units also met the new ENERGY STAR requirements that took effect on January 20, 2012.
78	It is necessary to have reproducibility but not repeatability within a lab.	DOE's goal is to propose a test method that is both repeatable and reproducible within reasonable limits. DOE found that the proposed test method meets this requirement.
79	There is a massive amount of data showing that the IEC test procedure is the most repeatable and reproducible dishwasher test procedure available. When the IEC dishwasher test procedure is conducted using correct methods and with dishwashers designed for the procedure, repeatability and reproducibility have been proven.	DOE agrees that the IEC method likely produces repeatable and reproducible results when tested using the correct methods on dishwashers designed for the test. However, DOE recognizes that certain test equipment and materials for the IEC method are not readily available in the US, US dishwashers may not be designed for the IEC test, and the soil loads may not represent actual consumer use. DOE proposes to base the cleanability test method on Appendix C, but to incorporate the IEC scoring method.
80	Food soils vary due to many reasons such as: genetics, soil type, season grown, temperature, rain fall, region grown, variations in processing.	The soils specified in Appendix C limit the amount of variation due to these factors, and will provide consistent cleanability test results.

## VII. REFERENCE DISHWASHER

DOE requested AHAM to ask its members if they had the IEC reference dishwasher and received the following comments. DOE also asked labs that are recognized by EPA for dishwasher testing if they had the reference dishwasher and received the following responses from six out of seven labs.

<u>Key</u>	<u>Comment Summary</u>	<u>Response</u>
81	A reference machine is necessary for reproducibility because it normalizes any minor testing inconsistencies.	DOE recognizes that the use of a reference dishwasher may help to normalize variations in soils and graders from test-to-test and lab-to-lab for certain test methods; however, DOE is not including a reference dishwasher in the proposed test method. In internal testing, DOE conducted tests with and without a reference dishwasher. DOE observed that the use of a reference dishwasher did not impact the differentiation in results for the units under test, increased the variation in results from test-to-test, and significantly increased test burden. If stakeholders express concerns about not using a reference unit, DOE may consider including this requirement in the cleanability test method.
82	In order to have reproducible results it is critical to have a specially defined reference machine that has the cycle structure tuned to the test procedure being evaluated. In order for the reference machine to be effective, the cleanability score, water usage, energy usage and related allowable tolerances must be established prior to verification testing and checked with an established calibration procedure.	DOE is aware that a verified reference unit is defined in the IEC test method and considered the use of this reference dishwasher for the cleanability test method. The draft test method does not require the use of the reference dishwasher, but DOE may include the reference unit requirement if stakeholders support its use.
83	There is not currently a reference machine that is developed for the US test procedures. Development and production of such a reference machine is a complex and involved process, as reflected in the cost of the Miele reference machine.	DOE is not aware of any manufacturer willing to develop and produce a reference machine designed for testing in the US. DOE therefore considered the use of the IEC reference machine.

## Summary and Response to Stakeholder Comments

### ENERGY STAR Program September 19, 2011 Webinar for the Residential Dishwasher Cleaning Performance Test Method

<u>Key</u>	<u>Comment Summary</u>	<u>Response</u>
84	<p>AHAM asked 14 manufacturers if they had a reference dishwasher and received responses from six manufacturers. Of these six manufacturers:</p> <ul style="list-style-type: none"> <li>• Four have the IEC reference unit.</li> <li>• Three of the four manufacturers have the reference machine in the US.</li> <li>• Three of the four manufacturers have the G595SC unit and two have the G1222SC unit (one manufacturer has both the old and new unit).</li> </ul>	DOE appreciates the feedback received from stakeholders regarding the availability of the IEC reference dishwasher.
85	A third party test lab commented that it does not have the IEC reference unit. Additionally, since these models are referenced in a European standard, it is most likely they are designed for the European market, which means their electrical systems would not be adaptable to North America.	DOE appreciates the feedback regarding the availability of the reference dishwasher at EPA-recognized labs for dishwasher testing.
86	A third party test lab commented that it does not have the room to keep tested appliances for a lengthy period of time and does not have the reference dishwasher. This lab will not consider purchasing the IEC reference dishwasher at this time.	See response to comment 85.
87	A third party test lab commented that it does not have the IEC reference dishwashers but would not hesitate to consider purchasing the unit if this metric were adopted. The lab's European facilities also do not have the IEC reference dishwasher but would purchase it if the new standard would require its use.	See response to comment 85.
88	A third party test lab commented that it does not have the reference dishwasher but would consider it if it was required for additional performance testing requirements.	See response to comment 85.
89	A third party test lab commented that it does not have the IEC reference dishwasher currently but would be willing to purchase at least one unit if the cleaning performance metric goes into effect. The price of the unit is a concern.	See response to comment 85.

## VIII. QUALIFICATION CRITERIA

<u>Key</u>	<u>Comment Summary</u>	<u>Response</u>
90	DOE and ENERGY STAR are driving down energy and water consumption too far. There is a limit to how low these can get while maintaining cleaning performance.	DOE and EPA may consider this when amending the energy conservation standards or setting new ENERGY STAR performance specifications. The purpose of this test method is to develop a method to objectively measure residential dishwasher cleaning performance.
91	A key point of the IEC standard is that the energy and water use is reported only if a machine meets the wash performance.	DOE appreciates the comment but notes that the energy and water use are regulated metrics that must be measured; cleaning performance is proposed to be additionally measured during the same cycles for the purposes of potential ENERGY STAR qualification, which is voluntary.
92	In Europe, there is a minimum performance threshold instead of a rating scale.	EPA will consider and propose qualification criteria that address cleaning performance once the test method has been finalized.
93	AHAM scores from 75 to 80 wouldn't be considered acceptable by consumers.	See response to comment 92.
94	Each test of soiled four, two, and ½ place settings should meet a minimum performance threshold value and scores should not be weighted according to the respective 5%, 33%, and 62% soil distribution levels.	DOE investigated different weighting options to account for cleaning performance at each of the soil levels. During internal testing, equal weighting of the cycles provided the best combination between maintaining repeatability of results and differentiation between the units. Additionally, to reduce the potential for test method circumvention, DOE proposes to equally weight the cleaning performance at each soil level.
95	There is a potential for test procedure circumvention if the heavy cycle only accounts for 5% of the DOE energy and water consumption.	DOE agrees that weighting the heavy cycle cleaning performance by 5 percent may present an opportunity to circumvent the test method. DOE proposes equal weighting for the cleaning performance on the heavy, medium, and light soil loads to limit the opportunity to circumvent the test method.
96	Do we need a wash performance score or should we just say a dishwasher cleans/does not clean based on a threshold number? Do the scores from these test procedures align with what a consumer would find to be clean or dirty?	EPA welcomes stakeholders to submit any consumer tests or surveys performed to understand consumer preference. Additionally, EPA will propose qualification criteria after the test method is finalized.

## Summary and Response to Stakeholder Comments

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## IX. OTHER

<u>Key</u>	<u>Comment Summary</u>	<u>Response</u>
97	The same number of tests should be required for performance testing as required for the DOE energy test procedure (i.e. test a minimum of two machines, with one test on each machine)	DOE proposes to use the sampling plan specified in the current ENERGY STAR specification for residential dishwashers version 5.0, which references Appendix C.
98	There is more performance testing history out of Europe with the IEC oven dry method.	DOE does not propose using the IEC method for testing the cleaning performance of dishwashers, and believes that the soil loads and preparation from Appendix C are most representative of U.S. consumer usage.
99	Differentiation between test units shouldn't be the priority when choosing the test procedure. The performance delivered to the consumer should be the primary goal.	DOE agrees that performance delivered to the consumer is the primary goal; however, the purpose of this test method is to establish a method that will quantitatively identify and differentiate cleanability between dishwashers.
100	The preliminary testing did not generate enough data to draw a conclusion on the best test method.	Based on comments received during and in response to the initial webinar, DOE conducted further testing. DOE will present data generated during Phase 2 testing at the next webinar. DOE has generated enough data and received enough stakeholder feedback to make an informed decision on its proposal.