

CFL-Color Roundtable

Date: 2-26-2004

Location: Lighting Research Center, Troy, NY

Attendees: Energy Star Lighting Manufacturers Partners (see attached file)

## Summary of minutes

Prepared by the Lighting Research Center

### **Part 1: Participants' perspective on CFL color issues - Opening comments**

The CFL-Color Roundtable held February 26, 2004 at the Lighting Research Center began with general comments and issues of concern to the participants. While the title of the roundtable helped in directing the comments towards the broad issue of color consistency, participants made opening remarks regarding a number of specific issues. These included:

- CCT consistency and potential effects on efficacy
- Chromaticity tolerances, and differences among manufacturers
- A systematic connection between lamp wattage and color consistency
- Education of the residential market vs. the commercial market, and the difference in communication tactics required to reach each respective market
- Identifying sources responsible for funding the education process
- Systems issues, and specific technical issues (e.g., new phosphors, the differences between screw-base and pin-base CFL lamps, and the impact that CFL covers have on light output).
- A concern, that the word, fluorescent, was in itself a barrier to market acceptance of CFLs.
- CFL market acceptance and the role it plays in the success of ENERGY STAR®

At the beginning of the roundtable Pam Horner, from OSRAM SYLVANIA, gave a brief demonstration on visual perception and CCT. Ms. Horner, using incandescent lamps of differing 'warm' color temperatures, demonstrated that a range of CCTs, with chromaticity coordinates varying along the x axis can appear very similar to the human eye.

### **Part 2: LRC Presentations**

#### **Presentation-1: Market Acceptance of Screwbase Compact Fluorescent Lamps**

Mariana Figueiro presented study findings which verified the issues/barriers associated with consumer acceptance of CFLs. Key barriers identified were: color, initial cost, size, warm-up time, and perception of fluorescent technology itself. The presentation is attached.

#### **Presentation-2: Color Tolerances for CFLs and Communication**

Presentation-2 served as the point of departure for the two Straw-person discussions outlined below. Chromaticity tolerance was the topic of the first Straw-person, while consumer package labeling was the topic for the second Straw-person.

Mark Rea presented a brief background of color terminology relevant to the roundtable, followed by a comparison of, the 4-step MacAdam ellipse used to define the chromaticity tolerance for linear fluorescent lamps under ANSI and IEC standards, with PEARL test results from CFLs of similar CCTs. The comparison showed that the CFLs tested represented a wide range of chromaticity falling outside current ANSI and IEC standards for linear fluorescent lamps, highlighting the need to address chromaticity tolerances associated with CFLs. The presentation concluded by suggesting a systematic approach for communicating color to scientists, specifiers, and consumers. A labeling system for consumers, consisting of 6 discs/circles (representing 2700K through 6500K), was proposed.

### **Part 3: Straw-person**

#### **Straw-person 1 Question(s):**

- A) Is there a problem with color consistency amongst CFLs?
- B) If there is a problem, can we come to agreement about how to resolve the problem within the restraints of the Energy-Star program? How do we then go about communicating within the industry?

#### **Straw-person 2 Question:**

- C) How do we communicate color information to the consumer market?

#### **Participant response:**

- A) The public consensus amongst all the participants was, 'yes', there is a problem with color consistency amongst CFLs.

Ed Yandek and Dale Work, from GE Lighting, and Philips Lighting respectively, each gave brief presentations. Mr. Yandek's and Dr. Work's presentations were given during the first Straw-person, which segued into the discussion of part **B**.

Mr. Yandek's presentation gave a brief background of the ANSI standards in regards to color tolerances, noting the original intention was to define central tendencies. The theme which Mr. Yandek focused on was the need to investigate the upper tolerance zone, and how far above the black-body is acceptable before the color becomes objectionable to the consumer. One of his concerns is that in a rush to redefine standards, future lamp efficacies run the potential of being limited.

Dr. Work's presentation emphasized the problem of market acceptance. He asked the question, what is tolerance, and how is it conveyed to the consumer? He also noted specific technical concerns (e.g., the two phosphors system, 'red and green', involved in the 2700K lamp, and how 2700K lamps with different wattages produce different

amounts of 'blue' as a function of discharge). Dr. Work stated cost-related issues regarding the production line, and how tightening tolerances 'too much' may not be beneficial in the long run. He cautioned that limiting the tolerance may result in lumen-loss. As with Mr. Yandek, Dr. Work emphasized the need to investigate the tolerance limits and consumer acceptability.

- B)** The answer to 'B', while not as definitive as the response to 'A', demonstrated a degree of solidarity. Variability in ANSI and IEC standards in regards to McAdam ellipse position with respect to the black-body (specifically 2700K) was identified as problematic. It was noted that the original intent of the standards was to establish an area of chromaticity similar to that associated with standard incandescent lamps, which Mr. Yandek referred to as a central tendency. Having said that, the consensus amongst the participants was that a standard for color tolerances of CFLs should be agreed upon. Industry needs to get together, 'pool' data, and address the issue in a practical way, thereby helping to encourage market acceptance of CFLs in the residential market.

While there was general agreement on the identification and overall resolution of the problem through addressing the color tolerance zones already used for linear fluorescent, there was active discussion on the means to mitigate the problem. The discussion began with the suggestion that we limit our attention to the range between 2700K and 3000K. For representation purposes a tolerance resembling a 'hot-dog' along the black-body was suggested. After participant input, for the sake of the roundtable discussion, the tolerance zone was transformed into a "hockey-stick", various permutations of the "hockey-stick", as well as modifications of the established ellipse system. The blade part of the "hockey-stick" was formulated by combining the ANSI and IEC standards for linear fluorescent lamps at 2700K. The handle part of the "hockey-stick" was simply a tolerance zone along the black-body.

No specific agreement was accepted on the specific dimensions (x, y coordinates) of the tolerance zone. It was agreed that a tolerance zone needs to be established, taking into account, the issue of uncertainty in measurements, as well as the overall concern to maintain current lamp efficacies, and not limit future lamp efficacies. Ed Yandek, on behalf of NEMA, will lead the proposal. Within the month (from the roundtable date of 2-26-2004) Mr. Yandek will propose a definite shape (height and length) for the "hockey-stick". This proposal will be given to EPA, DOE and lamp and luminaire manufacturers for comments. As a future step, the participants recommended that focus groups be conducted to determine the acceptability of the proposed tolerance zone to consumers, specifically further investigating the acceptability of the IEC and ANSI color tolerance zones at 2700 K.

- C)** Mark Rea began the discussion of how to bring the information to the consumer by illustrating a prototype for labeling CFL packaging. The label consisted of six

circles/discs representing 4-step MacAdam ellipses at 2700K through 6500K. A discussion about the labeling followed. It was generally agreed that a label of some sort was a good idea, worthwhile to pursue, and a potential tool for both consumers and designers. Specific comments regarding the labeling included:

- The need for focus groups
- The idea to include an incandescent reference point for comparison
- The anticipated problem when comparing labels amongst manufacturers (slight color differences as a function of the printing process)
- The general issue of 'good graphic design' and color contrast issues
- The need for simplicity in the labeling was noted
- The need for alpha/numeric redundancy in the labeling. Consumer color blindness dictates the inclusion of alpha/numeric information associated with each disc.
- The suggestion was made to associate a website with the label, thereby providing necessary information, while at the same time keeping the labeling simple
- Application specific labeling, as well as a coding system was suggested

Concluding comments focused on the success of the roundtable and for the process to continue in a 'real-time' fashion. The next step will be Ed Yandek's proposal for a definite shape of the "hockey-stick", to be submitted to EPA, DOE and manufacturers by 3-26-2004.