

ABRATECH[®] CORPORATION

FROM NEW TECHNIQUES TO NEW KNOWLEDGE[®]
475 GATE FIVE ROAD, SUITE 255, SAUSALITO, CALIFORNIA 94965
TELEPHONE 415.289.7455 FAX 415.331.6068
dlj@abratech.com

INFORMATION FOR BAAQMD EMPLOYEES INTERESTED IN PARTICIPATING IN OUR RESEARCH PROTOCOL: A field study of energy-saving, visually-efficient lighting.

After reading the executive summary and detailed descriptions given below, you may ask questions by calling Dr. Jewett at 415 289 7455, or you may email him at: dlj@abratech.com.

IF YOU KNOW OR DO NOT BELIEVE YOU ARE NOT COLOR BLIND, AND WANT TO VOLUNTEER TO PARTICIPATE:

Send an email to: BAAQMDstudy@abratech.com . In the body of the email put:

1. Your name,
2. Your phone number at BAAQMD,
3. Your room and floor number.

We will reply to your email. If for any reason you don't hear back from us within a day or two, contact Dr. Jewett, as described above.

Executive Summary of BAAQMD Project:

The Study:

Dr. Don Jewett of Abratech Corporation, and his research associates are studying the preferences that participants have to different types of fluorescent lamps in their offices. Lighting designers differ in their recommendations regarding different fluorescent lamps. All of the lamps to be tested are commercially-available lamps.

**INFORMATION FOR BAAQMD EMPLOYEES INTERESTED IN PARTICIPATING
IN OUR RESEARCH PROTOCOL: A field study of energy-saving, visually-efficient lighting**

ABRATECH[®] CORPORATION

FROM NEW TECHNIQUES TO NEW KNOWLEDGE[®]
475 GATE FIVE ROAD, SUITE 255, SAUSALITO, CALIFORNIA 94965
TELEPHONE 415.289.7455 FAX 415.331.6068
dlj@abratech.com

The Procedure:

For BAAQMD employees who volunteer to participate in the study, the following will occur:

Volunteers will be tested for visual acuity and color blindness. If there are more volunteers than are needed for the study, participants will be chosen by lottery.

Once a volunteer is chosen to be in the study, new fluorescent lighting fixtures will be installed in his or her office. The new fixtures will replace the existing lighting fixtures, which will be removed. The new fixtures will initially be controlled by a lighting-control box that will be placed on the participant's desk. After the new fixtures and control box are installed, the participant's vision will be again be tested, at different settings of the room lighting.

Over a period of several weeks participants will work under different fluorescent lamps of the same types encountered in offices, stores, or homes. For each different lamp, the participant will be asked to control the level of the lighting to the setting that is "best-for-me." The participants will also be asked to select between different lamps levels that are "best-for-me." At all times, the participant will be selecting the lighting that s/he likes best. Participants will also be asked to evaluate, on a simple scale, his or her views of the effects of the room lighting on their vision, on skin color, on room coloration, and on coloring of fabric swatches.

After the study is complete, the new fixtures will remain in place and the lighting will be controlled from a dimmer control that will be installed in the regular light switch for the room.

ABRATECH[®] CORPORATION

FROM NEW TECHNIQUES TO NEW KNOWLEDGE[®]
475 GATE FIVE ROAD, SUITE 255, SAUSALITO, CALIFORNIA 94965
TELEPHONE 415.289.7455 FAX 415.331.6068
dlj@abratech.com

Detailed Description of BAAQMD Project:

I. Nature and Purpose

For a period of about 10 years the U.S. Dept. of Energy has supported a research program examining the energy-efficiency effects of different fluorescent-light "colors" (technically "spectra"). We are now at the stage where we need to determine what types of lamps (and at what intensities) participants who work in windowless offices actually prefer? Our project is the first scientific study of lamp spectral choice based on long term use. We have designed a study that will allow participants to compare different fluorescent lamps, during prolonged usage, in a workplace office, during actual work. The lamps chosen for this study are all commercially-available.

Employees of BAAQMD can participate in the study because we have the cooperation of BAAQMD management, which is needed because the lighting fixtures (in the ceiling) of a participant's office will need to be changed. In order to conduct the study, the number of fluorescent tubes in each fixture will be increased. The extra space for fluorescent tubes makes it possible to install and then compare two separate sets of lamps. During the study, the participating employee will control the lighting intensities, and will rate the different lamps, according to their own preferences. Each participant will spend several weeks testing different lamps. The participant will choose the lighting by means of controls that are conveniently placed in a book-sized desk-top box. For each lamp, the participant will find the "best-for-me" intensity level, *i.e.*, the level that s/he prefers when the participant considers all variables: vision, room coloration, skin color, and fabric color. After that, the participant will choose which of the two lamps being tested s/he prefers to work under permanently.

This testing will be done for several different lamps. Ultimately, the participant chooses the lamp that s/he most prefers, at the intensity that is "best-for-me." We will then remove the desk-top control box, and put a dimmable control switch at the door, and leave the lamps the participant has chosen.

**INFORMATION FOR BAAQMD EMPLOYEES INTERESTED IN PARTICIPATING
IN OUR RESEARCH PROTOCOL: A field study of energy-saving, visually-efficient lighting**

ABRATECH[®] CORPORATION

FROM NEW TECHNIQUES TO NEW KNOWLEDGE[®]
475 GATE FIVE ROAD, SUITE 255, SAUSALITO, CALIFORNIA 94965
TELEPHONE 415.289.7455 FAX 415.331.6068
dlj@abratech.com

II. Work-time commitment:

BAAQMD participants must agree that any time taken during working hours on the study, including meetings and questionnaires, might need to be made up as compensatory work time. Any participant may cease participation in the study at any time, but might not be able to re-enter the study.

III. Procedures, in detail:

After giving informed consent, participants will have their office lighting modified with new upscale fixtures and light-level controls. A variety of commercially available lamps will be used in the new fixtures and the participants will be asked for their preferences.

Protocol components:

The testing protocol consists of the following eight principal components. These are first listed, and then described in more detail:

1. Selection for participation:
 - a. Office is suitable for retrofit, and
 - b. Participant's visual acuity affected by room illuminance;
2. Office fixture retrofit;
3. Visual acuity testing;
4. Light-level choices;
5. Lamp-type choice;
6. Interview and de-briefing;
7. Repeat cycle #'s 4-7 with new lamp-type;
8. End: Removing desk-top controls and installing dimming control at door.

ABRATECH[®] CORPORATION

FROM NEW TECHNIQUES TO NEW KNOWLEDGE[®]
475 GATE FIVE ROAD, SUITE 255, SAUSALITO, CALIFORNIA 94965
TELEPHONE 415.289.7455 FAX 415.331.6068
dlj@abratech.com

Details of each component:

1. Selection:

- a. Office configurations deemed suitable for replacing existing lighting fixtures with new fixtures will be identified by a "walk-around." If a room is suitable, then a notice will be left for the room's occupant, informing them of the possibility of participation in the program. Previous project participants already have offices that have been modified, and are therefore eligible to participate. A room that might otherwise be suitable may have wall-hanging pictures of a predominant color which could affect the outcome of the research. The Informed Consent will include mention that we may request that colorful pictures be taken down during the testing.
- b. Room occupants who wish to participate will first email Abratech, so an appointment can be set up for Dr. Jewett to come to your office for a visit. At that visit the potential participant will be able to ask Dr. Jewett questions, and then will be asked to give a verbal Informed Consent for visual acuity and color blindness testing. For the visual acuity test procedure the prospective participant will look down a black tube (about 5" wide and 36" long) that has a backlit acuity eye chart at its far end. Prospective participants will read the chart with the room lights off, and again with the room lights on. The acuity must be measurably better with the room lights on. Color blindness will be determined using a standard Ishihara color blindness test. When the prospective participant passes these tests, if the participant wishes to continue, s/he will then give written

ABRATECH[®] CORPORATION

FROM NEW TECHNIQUES TO NEW KNOWLEDGE[®]
475 GATE FIVE ROAD, SUITE 255, SAUSALITO, CALIFORNIA 94965
TELEPHONE 415.289.7455 FAX 415.331.6068
dlj@abratech.com

Informed Consent (via the written form) for participation in the rest of the study.

2. Office Fixture Retrofit:

- a. Lighting Testing. Before installing new lighting fixtures, the lighting of the room will be measured in the same way as the room will be measured after the new fixtures are installed, in the center of the room and on any desk surfaces, and at eye level from the participant's seating positions.
- b. Lighting Fixtures: The office of the new participant will be retrofitted with four lamp fixtures with each fixture containing two pairs of lamps; each of the lamps in a pair will be identical. The number of fixtures chosen for the retrofit will be such that with only one pair of the lamps in all fixtures empowered, the light-level at maximum is 50% more than originally present in the participant's office.
- c. Lamps: Within each fixture, the pairs of a given type of lamp are controlled together. The two lamp pairs will be differentiated by having two different standard "color temperatures." The test lamps are all commercially available, having been installed previously in many buildings. Initially, one of the pairs will be the same lamp-type as was originally installed in the participant's office.
- d. Lighting Control: The light-level of each pair in a fixture set with a given color temperature is variable and will be controlled by the participant via a small control box on the desk. The control will allow the participant to

ABRATECH[®] CORPORATION

FROM NEW TECHNIQUES TO NEW KNOWLEDGE[®]
475 GATE FIVE ROAD, SUITE 255, SAUSALITO, CALIFORNIA 94965
TELEPHONE 415.289.7455 FAX 415.331.6068
dlj@abratech.com

switch between either of the two lamp types, and to adjust the intensity level of each independently.

3. Visual Acuity and Other Effects:

After installation of the new fixtures in the participant's office, the participant will be instructed how to control the room lighting. At the same meeting, participants will be tested for their visual acuity under each lamp-type over a range of light-levels. The acuity test will be comprised of a quasi Snellen letters of continuously diminishing size. The experimenter will record the acuity as a function of light-level setting on the controls, up to the maximum obtainable with each fixture/lamp combination. The participants will be informed of their test results for both lamp-types.

The experimenter will also point out to the participant the effects on room color when switching from one lamp to another. The effects on skin color will be shown, as will the effects of the lamps on the color blends of fabric swatches containing multiple colors.

The fabric swatches and some visual acuity testing materials will be left with the participants, with the request that the participant observe all of the effects of lamp and intensity on these, and any other effects that they are aware of.

4. Light-Level Choice:

Participants are asked to pick a preferred choice of intensity for each of the two lamp-types, individually. Determining the preferred ("best-for-me") choice may take several days of exposure, and during the initial period to not switch from one to the other. Using the desk-top controller, the participant adjusts the intensity of one lamp-type, using the one lamp-type continuously for several days (or possibly longer if the participant wishes). Multiple choices of levels based on

ABRATECH[®] CORPORATION

FROM NEW TECHNIQUES TO NEW KNOWLEDGE[®]
475 GATE FIVE ROAD, SUITE 255, SAUSALITO, CALIFORNIA 94965
TELEPHONE 415.289.7455 FAX 415.331.6068
dlj@abratech.com

task or activity are permitted. When the participant is certain s/he has adjusted a lamp to the "best-for-me" level(s), the participant will notify the experimenter by phone, and will report the numerical setting(s) on the controller. The experimenter will then ask the participant to switch to the other lamp, and to repeat the process. When the "best-for-me" levels for both lamps have been found, the experimenter will ask the participant to move to #5.

5. Lamp-Type Choice:

Over a period of about a week or two (allowing for multiple tries), participants will be asked to compare the two lamp-types, each set to their "best-for-me" intensity choice, and then to choose which of the two types they prefer. They are asked to make this choice with the understanding that the lamp-type chosen was to remain in their office as their permanent lighting. During this evaluation period, they can change the "best-for-me" levels, should they find that their views about them have changed. When the participant is secure in their decision, s/he will phone the experimenter with the results, which include their subjective evaluations of the fabric swatches, skin color, and room coloration for each of the lamp-types at their "best-for-me" intensities.

6. Interview and de-briefing:

After the choice, the experimenter will interview the participant to obtain additional impressions, concerns, and observations about the lamp-types, and the testing procedures. The preferred lamps will be left in the room, and the non-preferred lamp-type will be replaced with a new lamp, for further testing.

ABRATECH[®] CORPORATION

FROM NEW TECHNIQUES TO NEW KNOWLEDGE[®]
475 GATE FIVE ROAD, SUITE 255, SAUSALITO, CALIFORNIA 94965
TELEPHONE 415.289.7455 FAX 415.331.6068
dlj@abratech.com

7. Repetitions with each new lamp-type:

Steps 3 through 6 will then repeated with a new lamp pair, one of which was the previously-chosen "preferred" type. It is expected that no more than three lamp-pairs will be tested.

8. After the testing is completed:

The participant will choose the lamp-type to be left in the room, and the desk-top controller will be removed. The participant's office will be left with a single lamp-type and a room light dimming control at the door switch.

IV. Risks

There are no risks to the participants. Participants must devote some of their time to making observations and filling out questionnaires. None of the published data will identify any specific participant.

V. Benefits

To the BAAQMD participants, there may be the following benefits:

1. Knowledge of lighting spectrum, intensity, and locations that are better than that presently available to that participant.
2. The lighting fixtures, and intensity control, will be donated to BAAQMD, and hence be left in the participant's office. There will be more light fixtures than presently installed, plus an intensity control at the door (not presently available in most offices).

VI. Confidentiality:

After filling out the personal information and light sensitivity questionnaires, the participant is given a numerical or alphabetic code. This code is used to identify the participant's data and other information. The code and the personal information on the

ABRATECH[®] CORPORATION

FROM NEW TECHNIQUES TO NEW KNOWLEDGE[®]
475 GATE FIVE ROAD, SUITE 255, SAUSALITO, CALIFORNIA 94965
TELEPHONE 415.289.7455 FAX 415.331.6068
dlj@abratech.com

participant are kept in a file folder in a locked desk in our office. Access to this desk is limited to senior Abratech researchers who work directly on the lighting project.

VII. Informed consent:

Prior to a participant's participation in the research, Dr. Jewett or one of his research associates will present and explain the consent form to the participant. The participant will then read and sign the consent form, after which s/he will receive a copy of the form.

IF YOU WISH TO PARTICIPATE, send an email to: BAAQMDstudy@abratech.com. In the body of the email put:

1. Your name,
2. Your phone number at BAAQMD,
3. Your room and floor number.

We will reply to your email. If for any reason you don't hear back from us within a day or two, contact Dr. Jewett, by calling Dr. Jewett at 415 289 7455, or you may email him at: dlj@abratech.com.

C:\a\vhmdata\ABRATECH\IRB\2004\IRB Approved 121404\BAAQMD\BAAQMD Web site, based on IRB approval 121404 DJL Arial.wpd

**INFORMATION FOR BAAQMD EMPLOYEES INTERESTED IN PARTICIPATING
IN OUR RESEARCH PROTOCOL: A field study of energy-saving, visually-efficient lighting**