THE BEHAVIORAL BENEFITS OF PROPER AMBIENT LUMINAIRE LAYOUTS IN ALZHEIMER'S HOMES AND SUPPLEMENTAL LIGHT THERAPY ADMINISTRATION

by

LAURA GEIGER

B.S., Kansas State University, 2011

A REPORT

submitted in partial fulfillment of the requirements for the degree

MASTER OF SCIENCE

Department of Architectural Engineering and Construction Science
College of Engineering

KANSAS STATE UNIVERSITY
Manhattan, Kansas

2011

Approved by:

Major Professor
Fred Hasler

Abstract

Over 26.6 million people suffer from Alzheimer's Disease in the United States, and while no cure exists, how their built environment is illuminated - lamp type, color selection, wavelengths emitted, luminaire specifications, and luminaire layout - may enhance the lives of Alzheimer's patients (APs), their relatives, and caretakers. Research has found mixed results when it comes to selecting the correct lamp, but most researchers agree illumination levels benefit APs quality of life. Achieving higher illumination levels can be achieved by adding more luminaires to the ambient lighting layout, placing additional task lighting in specific locations, or using light therapy. Exposing APs to higher illumination levels can have positive behavioral benefits and help shift the circadian rhythm. Common problems such as aggression, sleepiness, and agitation can be reduced if proper lighting layouts or light therapy is used on a consistent basis. Adding to research, several Alzheimer’s facilities in Kansas and Colorado were contacted to complete questionnaires about their lighting and resident’s behaviors. Upon analysis, these facilities concurred with research about lamp types, daylight, and luminaire layouts showing higher levels of illumination were preferred by APs and also where they displayed their best behaviors. Ninety perfect of facilities agreed that APs enjoyed sitting by the windows, and over half agreed APs exhibited better behavior while seated here. Homes with CLFs documented APs were typically more calm and happy than those with tubular fluorescents, but the conclusions made need additional research to support the findings.

Table of Contents

List of Figures

List of Tables

Acknowledgements

Thank you to my committee members, Fred Hasler, P.E, Kimberly Kramer, P.E., S. E., and Raphael A. Yunk, P.E., LEED A.P. for their guidance throughout this report. Jane Cox and Cathleen Stotts were helpful during the collection of questionnaires, and Dr. Donita Whitney - Bammerlin assisted in editing the report.

A special thanks to my parents Larry and Nancy Geiger for always supporting my educational endeavors.

Thank you to the following Alzheimer's facility participants:
Amberwood Court Care Center – Denver, CO
Brookshire House – Denver, CO
Clare Bridge of Leawood – Overland Park, KS
Garden Terrace at Overland Park – Overland Park, KS
Julia Temple Healthcare Center – Englewood, CO
New Dawn – Aurora, CO
Senior Care Homes Midwest – Overland Park, KS
Stratford Commons Memory Care – Overland Park, KS
Stoneybrook Retirement Community – Manhattan, KS
Sunrise of Leawood – Overland Park, KS
The Heritage of Overland Park – Overland Park, KS
The Good Shepherd Hospice House – Manhattan, KS
The Sweet Life at Grand Court – Overland Park, KS
The Sweet Life at Shawnee – Overland Park, KS

Dedication

Dedicated to Grandpa Jim, whom my mother said "I never really knew" because of Alzheimer's.

Chapter 1 - Background

A German psychiatrist and neuropathologist, Alois Alzheimer, first discovered *Alzheimer's disease (AD)* in 1906. (Refer to Appendix A for definitions of italicized words). The disease was named after him, and since then AD has become the sixth leading cause of death in the United States. The cause of AD is unknown, but some evidence points to genes and environmental exposure.

AD is unlike many other diseases, because those with the disease can live anywhere from three to twenty years after their symptoms have been recognized ("Alzheimer's Association - Myths" 2009). Unlike many other causes of death, AD has no available treatments, prevention, or means of stopping its progression ("Alzheimer's Disease" 1989). A new case is diagnosed every 33 seconds, and the Alzheimer's Association documented that AD deaths have increased by 66%, while other causes of death decreased between 2000 and 2008. AD affects not only the individuals who have the disease but also their *nursing home* caregivers. *Light* can help both groups enjoy their time with each other.

Alzheimer's Behaviors

Generally speaking, AD affects memory, thinking, and behavior. More specifically, typical AD behaviors are: "gradual memory loss, decreased ability to perform routine tasks, disorientation, problems with language skills, poor judgment and personality changes" ("Acute Hospitalization" 2009). As the disease advances, the Alzheimer's Association quotes "symptoms include confusion, irritability and aggression, mood swings, language breakdown, long-term memory loss, and the general withdrawal of the sufferer as their senses decline. Gradually, bodily functions are lost, ultimately leading to death."

In addition to all of these symptoms, Alzheimer's patients' (APs) sleep is also adversely affected. Noell-Waggoner, Dupuy, and Godfrey have reported 73% of older adults have sleeping problems. APs have similar sleep patterns as people without *dementia*, but their sleep disturbances are more frequent and severe (ANSI/IESNA 2011). Figueiro, Bullough, and Rea documented APs have more restless nights, waking up more frequently, resulting in daytime napping. These problems can be reduced, by correcting the circadian rhythm system. (See Appendix I for further information about the circadian rhythm.) The circadian system is the

master clock in the body, and shifting, or correcting, this clock can be done with the help of light. Caregivers would benefit from this shift so they could get a better night's sleep as well.

Correcting sleep patterns in APs is just one way lighting can improve their behaviors. Light *intensity* and color also have an effect on APs. Designing ambient *luminaires* to reduce glare, allow control, and produce even distribution can all positively impact all patients. If *ambient light* does not sufficiently lessen agitation or restlessness, light therapy is an alternate solution.

Who Alzheimer's Effects

AD typically affects those over the age of 60. Projections show that by 2030 more people over 65 than under 17will exist in the US (ANSI/IESNA 2011). The risk for developing AD in adults at age 65 is about 1-2%; however, this percentage increases by age 80, where high risk is 1 in 5 (20%) (Mace and Rabins 2006). Since the risk for developing AD increases with age and medicine is helping people live longer, understanding how to properly illuminate nursing homes is gaining importance.

Another study, by Figueiro, Bullough, and Rea, found four million Americans suffered from AD in 1993.

> One in 10 persons over the age of 65 and nearly half of those over age 85 currently have AD. The Alzheimer’s Association predicts that more than 14 million Americans will have AD by the middle of this century. More than seven out of 10 people with this disease live at home. Family members and friends provide almost 75% of the home care and a person with AD lives an average of 8 years after the onset of symptoms—some living as many as 20 years or more. (Mariana, Figueiro G., Mark S. Rea, and Gregory Eggleston 2003)

In 1993, the Alzheimer's Association reported 4,000,000 Alzheimer's patients (APs). By 2006, the number had risen to 26.6 million people, an increase of 665%. It is projected that globally AD will affect 1 in 85 people by 2050. Until a cure is found, it is important to find ways to improve the quality of life, by reducing the impact of AD for both patients and caregivers. A solution may be found by researching the affects of light on AD.

Everyone, not just relatives and caretakers, could benefit from additional research because there are 5.3 million people with AD in 2011, costing Americans $172 billion dollars annually to care for them (Alzheimer's Association 2011). The more severe the Alzheimer's, the more it costs to take care of them, and every working citizen pays a FICA tax to help pay for

APs medical bills, unless the AP has private insurance. Medication is expensive, so further research using light to assist APs is imperative.

When it becomes too difficult for a loved one to care for their relative in the home, they often send them to *assisted living* or nursing home facilities where caretakers take on the responsibility for looking out for AP's health. Caretakers receive the same amount of light as APs while on duty and APs might only be exposed to *illuminance* greater than 1,000 *lux* for no more than a half an hour each day ("Research Recap." *LD+A* June 2003). People who live in assisted living facilities receive about 58 minutes of *bright light* per day. (For the remainder of this report, bright light is defined as receiving 10,000 lux of light. Anything less than 10,000 lux is called light therapy). Those living in nursing homes only experience approximately two minutes of bright light a day. Most APs are placed in nursing homes due to the level of attention needed, so providing sufficient lighting in these facilities is important for both APs and caretakers.

While many APs are placed in nursing homes once their symptoms of AD become too difficult for their loved ones, some elders develop dementia. AD accounts for 50-70% of all dementia cases; regardless of the age dementia is recognized. AD is also the most common form of dementia (Alzheimer's Association - Myths" 2011). Using techniques described in this report, light can potentially slow this digression. Light is able to trigger memories or illuminate objects that bring back memories, which enhance an AP's personality. Improving the quality of life for APs and caretakers is the goal of this report.

Chapter 2 - Lamps

One step in improving the quality of lives involves *lamps*. There are many different lamps types, shapes, sizes, *CRI*, *CCT*, intensity, *efficiency*, etc. Each of them behaves slightly differently and choosing the correct lamp for ambient lighting or light therapy is important. According to the Unified Facilities Criteria (UFC), light therapy depends more on the quantity of light rather than the light source, but selecting the correct lamp is still important for ambient lighting.

Efficacy

Many times lamps selected for ambient lighting take into consideration *efficacy*, not efficiency. Efficiency is not a measurable quantity for lamps, but efficacy can provide information on how well the lamp converts energy into light output. The higher the efficacy, the more light the lamp puts out with less energy consumed. Table 1 compares several standard lamps and their efficacies. (Figure 1 illustrates table 1 in a bar chart format). As seen from the table and graph, cool white *LED*s have the best efficacy rating, followed by *HID*s and linear fluorescent lamps, which is why the industry is starting to shift towards LEDs. This shift is also occurring in light therapy. Smaller luminaires and light boxes are using LEDs, which could lead to ambient bright light therapy treatment possibilities.

Table 1: Lamp Efficacies

Table adapted from "Solid-State Lighting," 2011.

Typical LED Efficacy Compared to Conventional Lighitng Technologies in 2010	
Product Type	**Typical Luminous Efficacy (lm/W)**
LED Cool White Package	130
LED Warm White Package	93
LED A19 Lamp (Warm White)	64
LED APAR 38 Lamp (Warm White)	52.5
HID (High Watt)	120
Linear Fluorescent	118
HID (Low Watt)	104
CFL	63
Halogen	20
Incandescnet	15

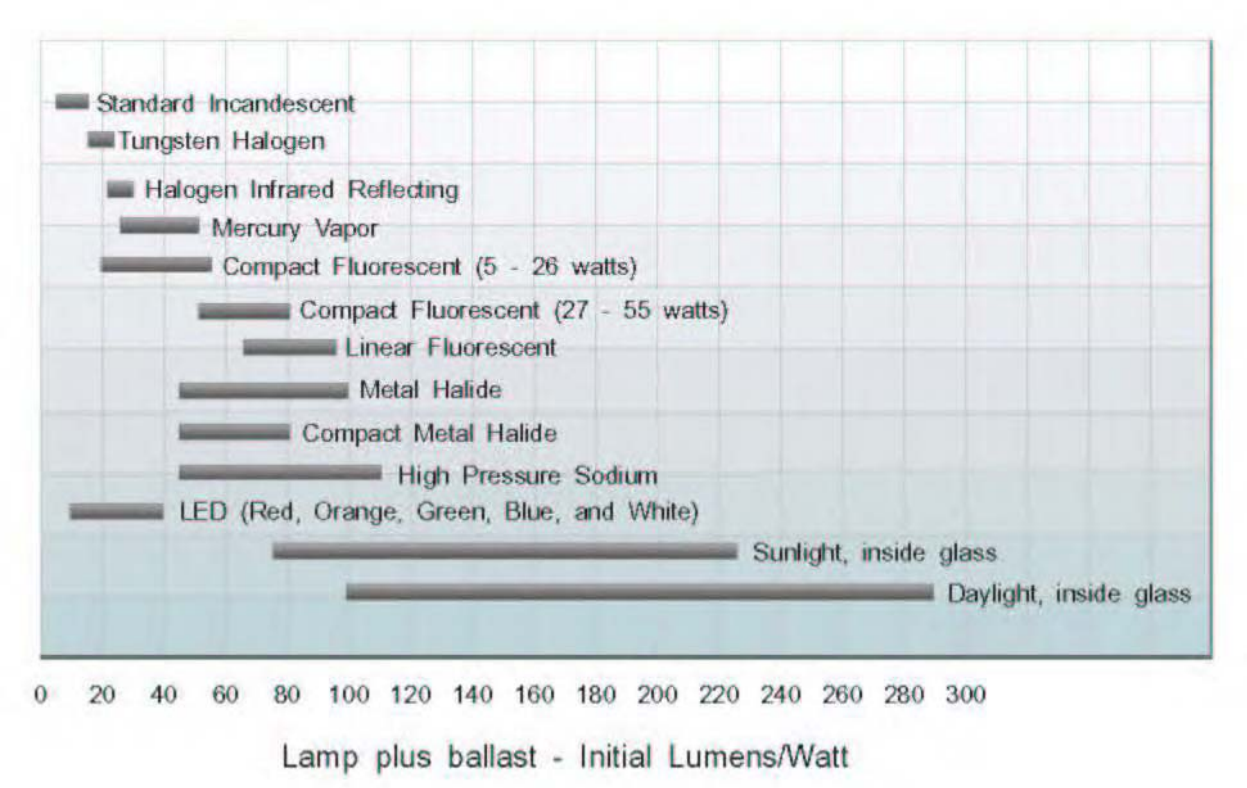


Figure 1: Lamp Efficiency Graph

Reproduced with permission from John Peltz on behalf of United States Department of Defense, 2010, p. 163.

Efficiency varies with CCT and CRI, which will be briefly explained. As seen in figure 2, higher CCT ratings are bluer in color. CRI ratings are based off incandescent lamps, which have a CRI of 100. Table 2 combines efficiency, CCT, and CRI to show how efficiency varies. A CCT of more than 5,000°K with a CRI of 80-89 has a low efficacy rating, 38 lm/W. The same CCT with a lower CRI is more efficient. It is up to the AD facilities how important CRI is compared to lamp efficiency when purchasing replacement lamps.

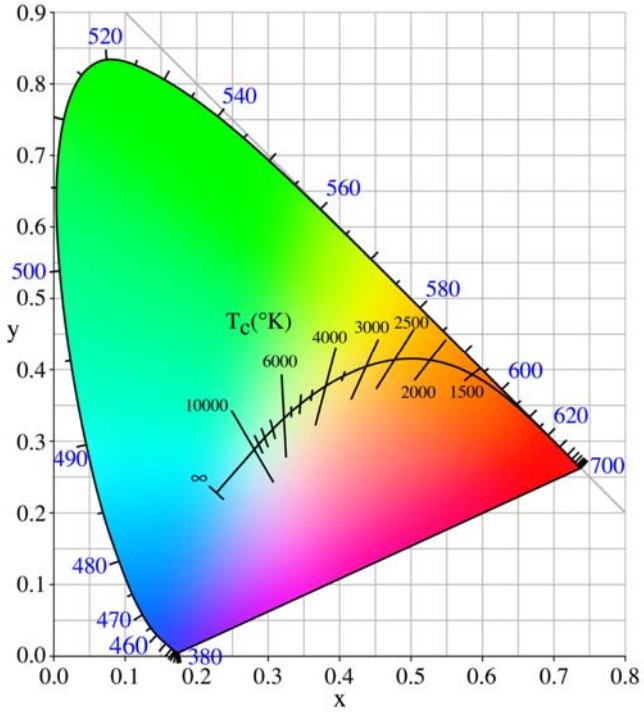


Figure 2: Comparing nm of Wavelengths and CCT

Table 2: CCT, CRI, and Efficacy Comparison

Table adapted from "Color Quality of White LEDs," 2008.

CCT vs CRI Efficiency			
	CRI		
CCT	70-79	80-89	90+
2,600-3,500	23-43 (lm/W)		25 (lm/W)
3,500-5,000	36-73 (lm/W)	36-54 (lm/W)	
5,000+	54-87 (lm/W)	38 (lm/W)	

CRI is important to see colors correctly, so if the goal of the AD home is to mimic a traditional home, lamps with 2,600-3,500 CCT and 90+ CRI are the best choice (see figure 3 below). If incorporating blue wavelengths is important, then 5,000°K CCT and 80-89 CRI lamps are ideal. Lamps may be selected based on the room they will be installed, especially if the facility has a light therapy room. Blue wavelengths are the most efficient at stimulating the circadian rhythm and thus could be beneficial for light therapy. Blue wavelengths, 5,000°K CCT, are also generally more efficient than warmer lights, so cooler lamps might also be installed throughout the facility.

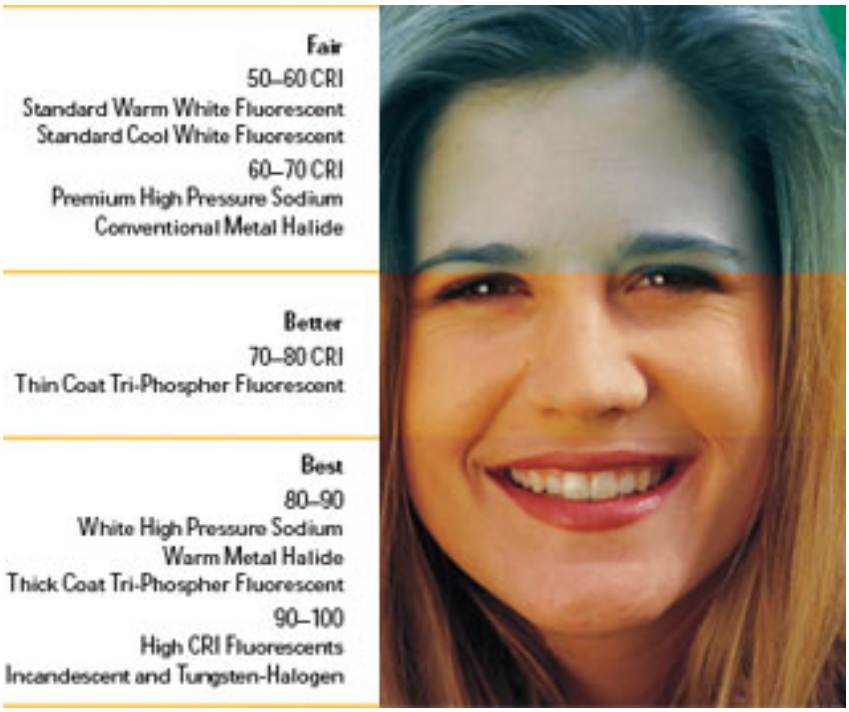


Figure 3: CRI Comparison

Reproduced with permission from Energy Star.

Lamp Types

Efficiency also affects lamp type and illumination levels, so table 3 relates these variables. In order to achieve higher illumination levels, more power is required. While more power means higher energy bills, the benefits of increased illumination levels could outweigh the extra expense. The table also illustrates the lack of illumination levels achieved by standard

ambient lamps. A standard 13W *compact fluorescent lamp (CFL)* only produces 40 lux, while bright light therapy typically uses 10,000 lux. This table proves traditional lamps are not sufficient in proving enough light to shift the circadian rhythm, decrease agitation, or provide other behavior benefits.

Table 3: Lamp and Footcandle Comparison

Table adapted from "How Do I Choose Light Sources?" 1995-2011.

Illuminance of a 5" Recessed Downlight (6-3/4" Deep)					
	Incandescent				CFL
	Common		PAR 30		Quad Tube
	75W	100W	50W	75W	13W
Illuminance (fc)	5	7	58	65	4
Illuminance (lux)	54	75	624	700	43

The approximate conversion between *fc* and lux is shown in equation 1because many researcher is in lux, but the English equivalent is a footcandle. Professors at Kansas State University typically speak in terms of footcandles and not lux, so knowing the conversion between these units will prevent confusion throughout this report.

Lux= 10.764 * Footcandle

Equation 1: Footcandle to Lux Conversion

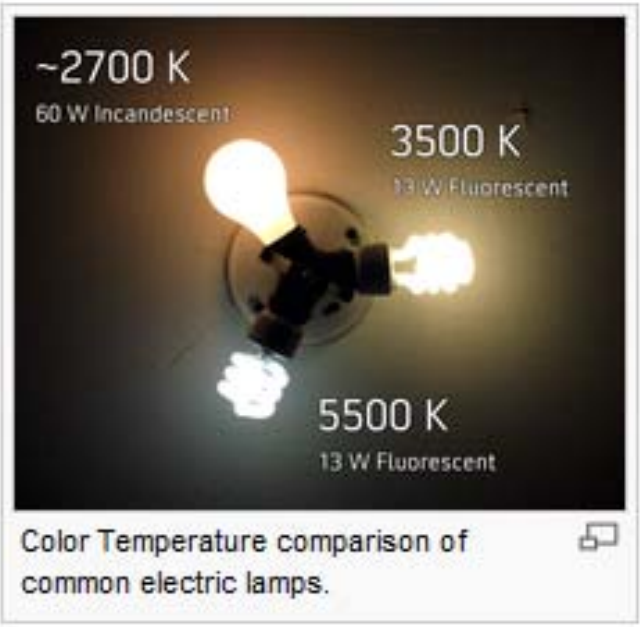
Similar to the table above, the following table illustrates the amount of light received by someone who is sitting at a desk or table, which would be the typical setup if an AP was using bright light therapy. The lamp would be between 12 inches and 24 inches away from their cornea. Maximum lamp levels on this table are less than 200 fc (translated to approximately 2,150 lux). These levels are higher than ambient illumination levels, but not necessarily enough to have an impact on APs to improve their behavior or shift their circadian rhythm. Due to the less intense lamps, the patient would have to sit in front of the luminaire for an extended period of time to make up for the lack of intensity.

Table 4: Distance, Lamp, and Footcandles

Table adapted from "The Aging How ," 1995-2011.

Illuminance From a Desk Lamp					
Task-Desk Lamp Adjustable Arm	CFL			Incandescent	
Distance From Task	13W	18W	2x9W	50W	75W
(Inches)	Illuminance (fc)				
25	36	66	56	42	75
20	55	112	80	56	120
15	93	178	135	97	200
(Inches)	Illuminance (lux)				
25	388	710	603	452	807
20	592	1206	861	603	1292
15	1001	1916	1453	1044	2153

While tables, charts, and graphs explain concepts in numerical terms, figure 4 shows the differences between three different lamp types: 60W incandescent, 13W warm fluorescent, and 13W cool fluorescent.



Color Temperature comparison of common electric lamps.

Figure 4: Lamp Comparison

There are several similarities in the lamps above, even though the 5,500°K fluorescent lamp is slightly bluer in color than the other two lamps. This is because its CCT is closer to the blue range. Another comparison can be made between the lamp intensity, the incandescent is a 60W compared to both of the 13W fluorescent lamps. Although this is a picture, the 13W lamps look like they produce the same amount of light, and referring back to efficacy; this means the 3,500°K fluorescent has a better efficacy rating than the 60W, while still giving the same feel.

Another way to illustrate different sources and their relative color temperatures can be found in table 5, because it shows what commons sources produce these color temperatures. Using table 5 below and figure 4 above, AD facilities can have a better understanding of the relationship between CCT, color, and efficiency.

Table 5: Sources CCT

Sources and Their Relative Color Temperatures	
Temperature (°K)	**Source**
1,700	Match flame
1,850	Candle flame, sunrise, sunset
2,700-3,300	Incandescent lamp
3,350	Studio "CP" light
3,400	Studio lamps, photofloods
4,100	Moonlight, xenon arc lamp
5,000	Horizon daylight
5,500-6,000	Vertical daylight, electronic flash
6,500	Daylight, overcast
9,300	CRT screen

Figure 5 is a visual representation with colors of the above table.

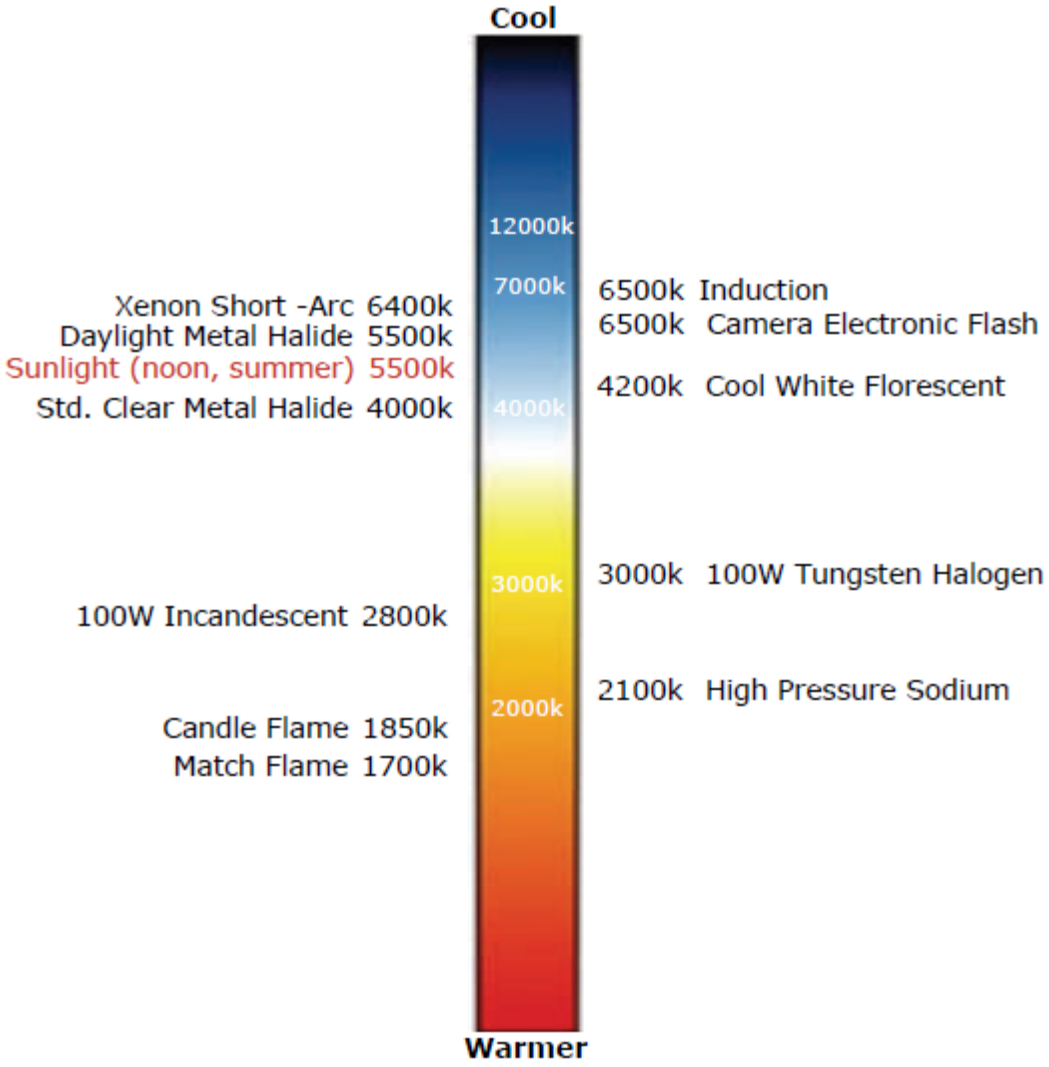


Figure 5: Lamp Scale

Reproduced with permission from LED Industries ("Understanding Color").

The following table, table 6, is more comprehensive than previous tables because it includes cost and lumen maintenance in addition to CRI, CCT, etc. This table also shows how inconsistent LEDs can be when it comes to CRI, efficacy, and other characteristics.

Table 6: Lamp Comparisons

Table adapted from United States Department of Defense, 2010, p. 51.

Comparison of Lamps										
	Efficacy (lm/W)	Lamp Life (hrs)	Color Temperature (°K)	CRI	Start Time	Restrike Time	Lumen Maintenance (%)	Dimmable	Effects of Temperature	Initial Cost
Incandescent	15-18	1,000-3,000	2,700-3,000	100	0	0	83-87	yes	none longer start and	low
CFL	60-75	10,000	2,700-4,100	82	0	0	83-87	with ballast	warm up time in low temperatures	med
Linear Fluorescent T8	80-95	20,000	2,700-4,100	75-85	0	0	83-87	with ballast	longer start and warm up time in low temperatures	low
Linear Fluorescent T5HO	80-95	20,000	2,700-4,100	75-85	0	0	90-95	with ballast	full output only at 35°C (95°F). Lower temperatures increase start time and light output	med
Induction	60-75	100,000	3,000-4,000	80+	0	0	80	coming soon	low temperatures decrease light output	very high
Metal Halide	80-90	10,000-20,000	3,000-4,200	65-90	5-10	15+	80-85	yes	none	high
HPS	90-105	24,000+	1,900-2,100	21-85	<5	1	88-92	no	none	high
LPS	100-160	16,000	1,800	poor	7-15	7-15	100	no	none	med
Mercury Vapor	35-55	24,000	4,000-5,900	20-45	<10	<10	60-66	no	none	med
LED	50+	50,000	3,000-6,500	70+	0	0	70% at 50,000 hrs	with variable power supply	high ambient temperatures may	high
Tungsten Halogen	18-22	2,000-4,000	2,800-3,100	100	0	0	93-97	yes	none	low

This information reinforces changing incandescent lamps to fluorescent lamps because it will make the space resemble daylight more and potentially save money since CFLs use less energy to produce the same amount of light. Less energy means a lower energy bill. CFLs have a longer lamp life than incandescent lamps, so additional money will be saved over the course of a lifetime in lamp replacements.

Atmosphere

More specific recommendations for lamps, CCT, and locations can be seen in table 7. The associated affects on mood are included, so AD homes can make informed decisions when replacing lamps. Different lamps and color temperatures illicit different feelings of a space. Warm incandescent lamps, used on coffee shops, produce a warm and cozy feeling, which is great for reading, while tubular fluorescents have a higher CCT and give off a harsher light that keeps people awake, but are potentially irritable. These lights are typically found in hospitals and classrooms; therefore, different lamps are used in different applications. Table 7 illustrates typical color temperatures and appropriate lamp applications based on the atmosphere trying to be created.

Table 7: Location and Feel from Lamps

Table adapted from Philips Lighting.

The Influence fo Color Temperature on Mood and Lighting Applications				
Color Temperature	**Warm**	**Neutral**	**Cool**	**Daylight**
Kelvin Range (°K)	**3,000**	**3,500**	**4,100**	**5,000**
Appropriate Applications	Restaurants	Public reception areas	Office Areas	Galleries
	Hotel Lobbies	Showrooms	Conference Rooms	Museums
	Boutiques	Bookstores	Classrooms	Jewellery Stores
	Libraries	Office Area	Mass Merchandisers	Medical Exam Areas
	Office Areas		Hospitals	Printing Companies
	Retail Stores			
Associated Effects and Moods	Friendly	Friendly	Neat	Bright
	Intimate	Inviting	Clean	Alert
	Personal	Non-Threatening	Efficient	Exacting Coloration
	Exclusive			

Chapter 3 - Lamps, Fixtures, and Locations

Once the correct lamp is selected, the fixture needs to be specified along with appropriate mounting type (surface, recessed, suspended, etc.). Merely selecting the correct lamp will not provided the desired benefits, the whole system needs to be properly designed. This section discusses luminaire arrangements and lamp types, due to a request from Jerry Pullin's, President of SeniorCare Homes, request for improved illuminance levels. These examples can serve as a reference for designers looking to improve APs' behavior.

Recommendations by the UFC are most likely already being used by designers if the AD home is included in a government contract; however, Figueiro also has recommendations that apply to spaces. The UFC, healthcare facilities promotes using lamps with 3,000°K and 80 CRI for general illumination and not specifically for light therapy. Another general rule to follow comes from Figueiro. She says to use fluorescent lamps with a CCT between 2,700°K and 3,000°K if incandescent lamps are also present in the space ("How Do I Choose" 1995-2011), this way the warm color of the incandescent lamp is matched and not distracting to the occupants. Another tip is to recess lamps at least 2-1/2" inside a downlight to "shield the direct view of the lamp. The inside surface of the fixture could have a matte finish to minimize reflected images of the lamp." Most luminaires have some kind of shielding on them so the occupant cannot see the bare lamp, which causes glare.

Glare is typically the number one concern when designing a luminaire layout for AD homes, but enhancing contrast is also important. Enhancing contrast can benefit multiple spaces, especially entrances to AD facilities and dining rooms, because contrast helps illuminate signs, aiding loved ones who are unfamiliar with the building (ANSI/IESNA 2011). Contrast can also be used in the dining room to accentuate colors of food and place settings. Elders do not always have the best eyesight, so distinguishing the difference between their plates and the table can be helpful to the caretakers. Most people do not like to depend on others, especially for common tasks like eating; therefore, the more independent the AP is, the better they feel about themselves and the easier they are to assist.

Related to increasing the contrast between objects, the ANSI/IESNA mentions surface textures. They indicate incandescent lamps enhance the surface textures of objects, while diffuse

light can mask form and texture. Both indirect and direct fluorescents provide diffuse lighting, which another reason it is suggested AD homes use CFLs instead of tubular fluorescent lamps. Couches, beds, and dining room tables all benefit from having enhanced textures, because this is another way to differentiate between objects.

Brightness of a space is yet another considering to factor into the lighting design. It is recommended that adjoining spaces not have extremely different *brightness* levels because it takes elder eyes an extended amount of time to adjust. (It takes elders approximately 15 minutes to adjust between light and dark spaces). The *luminance* levels should be uniform, or close, so APs do not strain their eyes when looking up from reading a book or glancing from the TV to a caretaker. The recommended luminance ratio between ceilings and walls is 3:1; however, spaces with uniform brightness lack visual interest. This can be overcome by providing lamps or dimmable luminaires.

An additional concern when lighting an AD home, is maintenance and safety. Lamp life, ease of changing the lamp, and number and size of pieces in the lamp can impact luminaire selection. Some lamps get too hot, some have long cords that are easily tripped on, while others are easily knocked over, and still others have many parts that are easily lost (ANSI/IESNA 2011). If luminaire are selected that do not cause injuries, proper lighting is a great way of "reducing health care costs and maintaining and independent life style" (ANSI/IESNA 2011).

Some of the factors that should be considered when designing a lighting layout for an AD have been discussed above and table 8 suggests tactical ways to improve common problems.

Table 8: How to Improve Visibility for Elders

Reprinted with permission the Illuminating Engineering Society of North America. (Table adapted from ANSI/IESNA, 2011, p. 16).

Task and Environment Factor Changes that Improve Visibility Making it Easier for Older People to See	
Factor	**How to Improve**
Disability Glare	Use matte finish floor polish on floors, use anti-reflective lenses for glasses and antiglare screens on computers. Avoid clear glass luminaires and use opaque or translucent shades. Light filtering window coverings and matte finish blinds or curtains are important for diminishing glare from windows. Avoid bright sources in the field of view.
Discomfort Glare	Eliminate bright, large sources in the line of sight, especially when viewed against a dark background. Avoid specular surfaces and choose indirect lighting.
Flicker	Check age, operating characteristics of lamps and luminaires. Consider use of high frequency electronic ballasts.
Light Dark Adaptation	Provide transititional spaces and balance light levels in adjacent spaces. Make general lighting uniform.
Contrast Sensitivity	Improve contrast with paint or other techniques. Paint the doorframe dark and the walls a contrasting light value. A white cup for coffee on a dark table and light dishes will increase contrast. At least three times more light will be required in task areas to see fine details.
Need for Increased Light Levels	Increase task light but avoid enhanced light levels directed to the eye. Use light colors on floors, walls, and ceilings to increase the cumulative effects of light.
Decreased Ability to Distinguish Between Colors and Intensities of Color	Increase light levels and use high color rendering (CRI>80) lamps.
Lowered Acuity	Increase task magnificaion and illumination.
Shadows and Facial Modeling	Provide uniform light distribution. High-reflectance matte finishes diffuse light to wash out harsh shadows.

These generalizations, like reducing glare, flicker, and shadows, can be applied to most spaces in an AD facility, and Figueiro and the Department of Defense (DOD) have documented additional lighting recommendations for individual spaces. For the most part, their recommendations are synonymous. These typical spaces found in an Alzheimer's facility are provided below.

Restrooms

Jerry Pullins, who specializes in Alzheimer's care and the President and Operator of SeniorCare Homes in Kansas City, mentioned restrooms are a location in need of attention. He compared the restroom to going to the dentist, no one likes to go, but everyone must. Restrooms are also where "a lot of care takes place," so using colors to differentiate between the *water closet*, lavatory, and walls can assist and ease the AP. Lamps with high CRI ratings will improve contrast between objects making it easier for an AP to independently use the facility. Lamps can benefit this space, but Pullins wanted to know if there was a luminaire that could promote a soothing atmosphere to encourage better behavior. Implementing the suggestions below could help improve the restrooms ambiance and aide in the usage frequency.

One way to improve the restroom is to make it bright with no shadows or glare, granted part of creating a bright space is related to the color palate and materials, but designers can encourage others to select certain materials. A "non-shiny vanity countertop" that is light in color will reflect light back up to the underside of the users chin, documents Figueiro, eliminating the shadowing that normally occurs with top lighting. The lamp selected can impact the way the materials look due to the lamps CCT and CRI. A high CRI is also important so APs do not look washed out or sick. Figueiro even goes so far to describe and sketch her ideal restroom lighting concept (see figure 6).

Figure 6: Restroom Lighting

Reprinted with permission from Mariana G. Figueiro ("Lighting Rooms," 1995-2011).

Figueiro mentioned lavatory illumination is important for APs to continue grooming routines, so she placed a 4'-0" wall mounted vanity luminaire, with an opaque front and open top aperture above the lavatory and water closet to aid their grooming habits. This luminaire also has acrylic lenses on the bottom to scatter the light and prevent harsh shadows. The location of the two 32W, T8 fluorescents 6’-6” above the floor, allow it to bounce light off the ceiling and counter top so "all sides of the face are lighted at the mirror." This allows men to continue to shave on their own. She also recommends two separate luminaires on either side of the lavatory if there is room and using two 2'-0", 17W, T8 lamps in smaller restrooms, which ANSI/IESNA also endorses. Side luminaires reduce harsh shadows under the chin, and when luminaires are placed at eye level, occupants can get closer to the mirror without reflection or glare from the luminaire.

Above the bathtub, Figueiro placed a 52W recessed, wet location, halogen lamp to conserve energy. Bathtub illumination could be handled separately from lavatories to save on energy consumption. This luminaire is switched separately because it adds additional brightness for assisting APs in the shower, which could prevent falls. Additionally, at night, when high levels of light might not be necessary, or cause a stark contrast to the bedroom, this luminaire may be turned on to provide adequate illumination levels.

The DOD also has recommendations for restroom lighting, which do not necessarily pertain to APs' restrooms, but still serve as a first-class reference. Figure 7 depicts their interpretation of a quality restroom layout, and the picture and table 9 contains additional information about the lamps in the restroom.

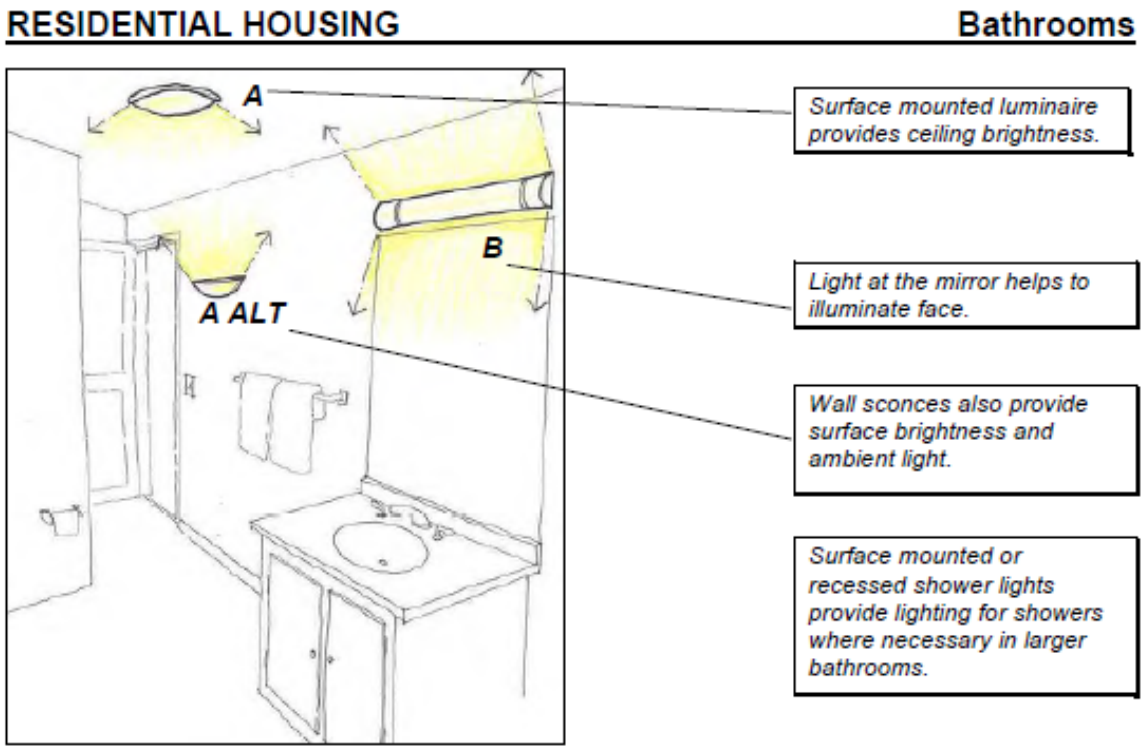


Figure 7: Restroom Lighting 2

Reproduced with permission from John Peltz on behalf of United States Department of Defense, 2010, p. 163.

The following recommendation from the DOD mirror several of Figueiro 's recommendations. The DOD believes restrooms should have bright lights while minimizing glare. They also set the target footcandle level for a typical residential restroom at 30 fc (322 lux) due to the potential detailed grooming habits. Their reasoning for this level of illumination is for quality grooming and make-up application. Making sure there are no shadows is also very important to the DOD, and to ensure faces do not have shadows, they recommend not using downlights. Instead, AD homes could install wall mounted luminaires or wall sconces. Also, reinforcing Figueiro's ideas, they mention eliminating direct glare and discuss using bright colored surfaces to reflect light also recommend using a linear fluorescent vanity luminaire that can prove both direct and indirect light to the space. A simple way to avoid glare is to install low glare luminairies. Making sure the lamp is not bare is also important, in case the user looks up into the luminaire. More information about the lamp types is found in table 9. Surface mounted fluorescents, or wall sconces are encouraged to be installed near the lavatory, and their

corresponding lamps to have a CRI over 80 and a color temperature of 3,000°K. Again, this warm lamp helps give occupants color and not look washed out.

Table 9: Restroom Lamps

Reproduced with permission from John Peltz on behalf of United States Department of Defense , 2010, p. 163.

EQUIPMENT REQUIREMENTS:

	LUMINAIRE	LAMP	CONTROLS
A	*Surface mounted luminaire.*	*Compact fluorescent lamps, 3000K color temperature, 80 CRI+*	*Control ambient lighting separately from task (vanity) lighting*
A ALT	*Wall mounted sconce*	*Compact fluorescent lamps, 3000K color temperature, 80 CRI+*	*Control ambient lighting separately from task (vanity) lighting*
B	*Wall mounted linear vanity light.*	*4' linear fluorescent T8 lamps, 3000K color temperature, 80 CRI+*	*Control ambient lighting separately from task (vanity) lighting*
C	*Surface mounted or recessed shower light.*	*Compact fluorescent lamps, 3000K color temperature, 80 CRI+*	*Control shower luminaire separately.*

Proper restroom illumination is important for APs to feel at ease, which helps them have proper bowel movements (Mace and Rabins 2006). This can also prevent accidents, which are sometimes caused by stress (Powell and Courtice 1983). By providing fluorescent lamps in the restrooms and throughout the rest of the facility that do not flicker or hum, this potential stress, can be eliminated.

Corridors

Additional research is recommended so optimal lamp types and luminaire layouts can be achieved to aide APs. Based on conversations with maintenance people, uniform illumination levels and non-glossy finishes prevent confusion for APs navigating corridors, so fluorescent lamps would be a good choice for these areas, including stairs and elevators. The Health Care Facility Lighting mention HIDs can cause glare, as well as create "strong facial shadows," so these lamps are not recommended for corridors. More information about these recommendations can be found in the IESNA guidelines.

The IESNA has three different examples showing different luminaires, and some are more desirable. The first photo illustrates why scalloped lighting is not recommended for

corridors. Uneven lighting levels are not pleasing to the eye, nor is it conducive to reading signs on doors so APs can find their room.

Figure 41. The scalloped light patterns (shown) on hallway walls should be avoided. Luminaire light distributions should be selected to light walls evenly. This is particularly important in corridors where visitors need to find apartment numbers and residents need to see faces clearly through doorway peepholes. (photographer: Eunice Noell-Waggoner)

Figure 8: Scalloped Hallway Lighting

Reproduced with permission from Eunice Noell-Waggoner (ANSI/IESNA, 2011, p. 35).

The following corridor represents good lighting design. Indirect/direct luminaires provide uniform lighting without glare, and wall sconces provide an added touch of light. These two types of luminaires could be controlled separately if desired, saving the AD facility energy.

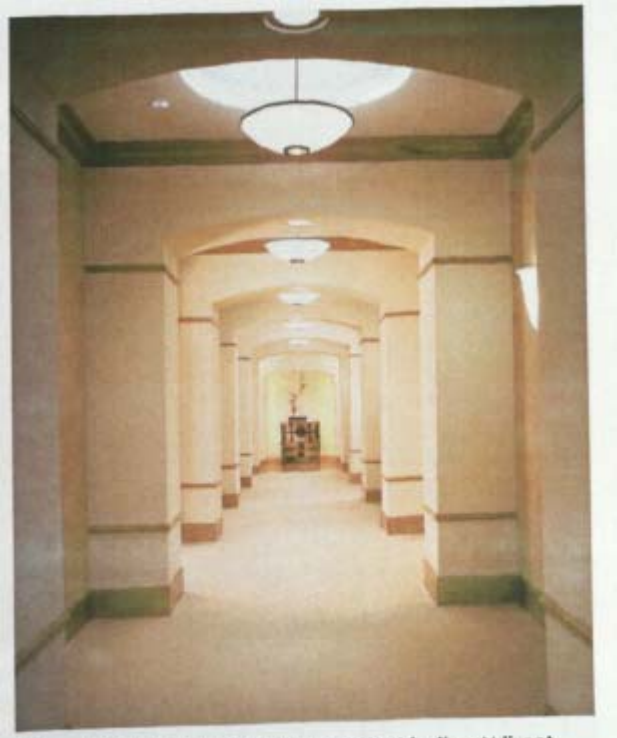


Figure 43. High ceilings allow pendant indirect/direct luminaires to provide uniform lighting throughout the corridors, with wall sconces adding a residential quality. Wood paneling along the wall base clearly defines the wall/floor juncture. (photographer: Charles McGrath)

Figure 9: Uniform Hallway Lighting

Reprinted with permission from Chas McGrath (ANSI/IESNA, 2010, p. 35).

Limitation in ceiling height might not allow the above luminaires to be installed. For these instances, the next photo gives an alternate lighting design, which is also done well. Again, direct/indirect luminaires are used for distributing even lighting levels without glare. Additionally, this photo also represents the typical reflectances used for lighting ceiling, walls, and floors. These reflectances, 80/50/20 respectively, assist in properly illuminating the space. A third detail this picture depicts is handrails. Handrails lead and guide APs, so where handrails stop, so might the AP, deterring them from wandering down corridors where they do not belong.

Figure 42. Surface mounted direct/indirect fluorescent luminaires spread light out onto the ceiling and wall areas. The light values of the ceiling and wall finishes reflect the light into the space. (© Jeffrey Totaro)

Figure 10: Surface Mounted Hallway Luminaires

Reproduced with permission from Jeffrey Totaro (ANSI/IESNA, 2010, p. 35).

Additional strategies could be implemented to guide APs through facilities like dimming corridors leading to the exterior of the building, as see in the first photo in the above series. This deters APs from wandering down the halls and either escaping , becoming frustrated that they cannot leave, or setting off alarms. People are naturally drawn to brighter spaces, so controlling illumination levels can reduce stress on caretakers who constantly have to listen to alarms or reset them. Dimming corridor luminaires at night could also aide the nighttime routine, as well as keeping APs in their rooms after they are in bed.

Bedrooms

Multiple levels of light is one of the characteristics, and Figueiro incorporated this into her design in bedrooms. She used a 22" diameter ceiling mounted luminar with a translucent acrylic diffuser with two 24W twin tube fluorescents inside. A second level of lighting is used to illuminate the floor, which is beneficial for both APs and caretakers. Turning on all the luminaires in the middle of the night to use the restroom can be startling, so using a lower level

of light, directed at the ground, and leading the AP to their destination would be beneficial. ASNI/IESNA reiterates this point by recommending nightlights located low on the wall to illuminate the pathway to the restroom.

Two separate task lights exist in the space to aide in detailed tasks such as reading. One lamp is located next to the dresser and the other is next to the bed. ASNI/IESNA suggests these lamps have a CRI of at least 80 to aid with sorting pills, coordinating clothing, puzzles, etc. The floor lamp in figure 11 is an Energy Star torchiere that uses three 36W CFLs. Three levels of lighting can be achieved with this individual luminar due to the three lamps inside, but an alternative is a luminar that has a swinging arm. (For additional information about bedside lamps see figure 14 below).

The bedside lamp uses a 39W CFL that has the ability to be switched to produce three different levels of lighting so turning on either of these luminaires can provide additional ambient light to the bedroom. The adjustable lamp above the bed, which houses an 18W CLF, allows the occupant to read in bed or see to drink water.

Figure 11: Bedroom Lighting

Reprinted with permission from Mariana G. Figueiro ("Lighting Rooms," 1995-2011).

The DOD's recommendations for bedroom lighting are provided below, and it focuses on average illumination levels while trying to minimize glare. Making sure the luminaires on the wall do not point out into the room, leaving a bare lamp exposed, is an easy way to minimize glare. Task lighting could be used next to the bed so occupants can read in bed or find objects

easier, and another benefit of task lighting is that it is user controlled. Depending on how often this luminaire is used, the facility could conserve energy.

An average of 5 fc (54 lux) is the appropriate lighting level for the bedroom, according to the DOD. This minimum is for residential housing, not for AD bedrooms, and it is also an average, meaning every inch of the space does not need to have this amount of light. Typically, corners will have less than 5 fc, and the middle of the room will have more, which is fine because most activity occurs in the middle of the room. Again, table 10 provides additional information about the lamps in figure 12.

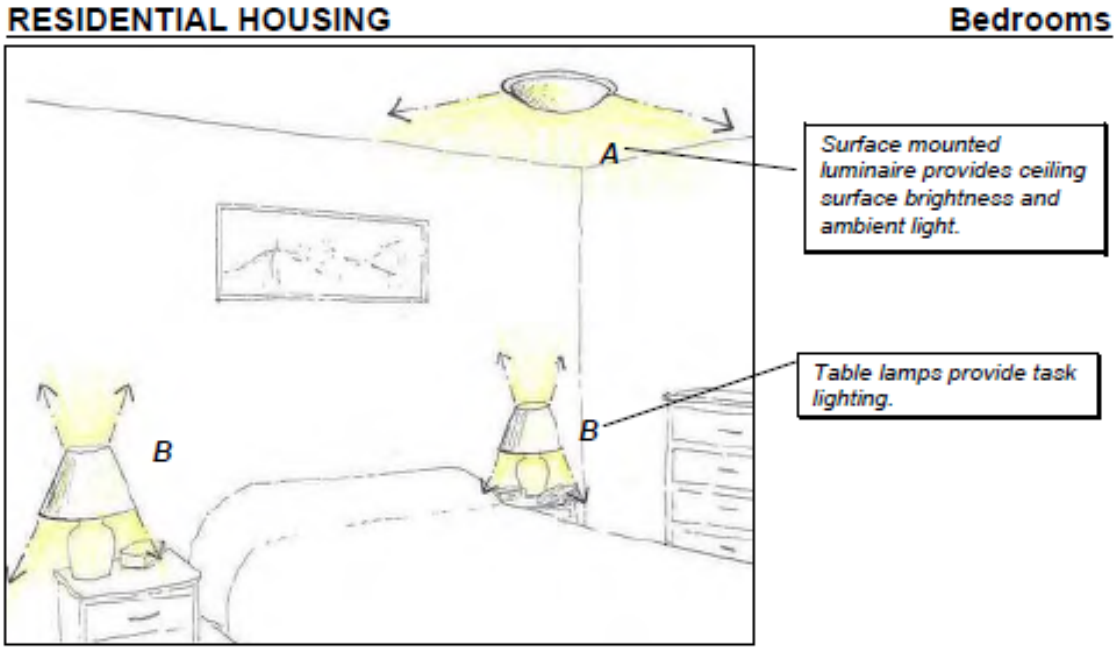


Figure 12: Bedroom Lighting 2

Reproduced with permission from John Peltz on behalf of United States Department of Defense, 2010, p. 150.

Table 10: Bedroom Lamps

Reproduced with permission from John Peltz on behalf of United States Department of Defense, 2010, p. 150.

EQUIPMENT REQUIREMENTS:

	LUMINAIRE	LAMP	CONTROLS
A	*Surface mounted luminaire*	*Compact fluorescent lamps, 3000K color temperature, 80 CRI+*	*Manual on/off.*
A ALT	*Wall mounted sconce*	*Compact fluorescent lamps, 3000K color temperature, 80 CRI+*	*Manual on/off.*
B	*Table lamp*	*Compact fluorescent lamps, 3000K color temperature, 80 CRI+*	*Manual on/off.*

CFLs are used throughout the bedroom because they are more energy efficient and still resemble an incandescent (as seen in figure 4) by emitting warm wavelengths. Making sure the CFL has a CRI of at least 80 and a color temperature of 3,000°K, helps make the room warm and friendly. If the AD facility's goal is to make the space feel like home, having lamps that resemble incandescent lamps should be a priority.

Since bedrooms are such an important room in an AD facility, ANSI/IESNA provides a third option for lighting it, as seen in figure 13. All three examples have tableside lamps and ambient lighting in common; however, it is unclear from the picture whether there is an addition luminaire used for ambient lighting aside from the one near the window. The valance could provide sufficient illumination to read a book while sitting in bed, but probably not enough to meet ambient illumination requirements.

Figure 50. The light valance provides an even wash of light along the headboard wall. General ambient light is provided by the indirect light from the valance. The bedside table lamp provides additional task light for reading. The surface mounted ceiling light balances the luminance ratios between daylight and interior surfaces adjacent to the window. (© Jeffrey Totaro)

Figure 13: Bedroom Lighting

Reproduced with permission from Jeffrey Totaro (ANSI/IESNA, 2011, p. 39).

ANSI/IESNA has detailed pictures and descriptions of lamp types that could be used for bedside reading. Lamp shades are expected to be used so wavelengths do not illuminate the readers eyes, thus reducing the strain of AP's eyes caused by glare. These luminaires and principals can be applied to any task light.

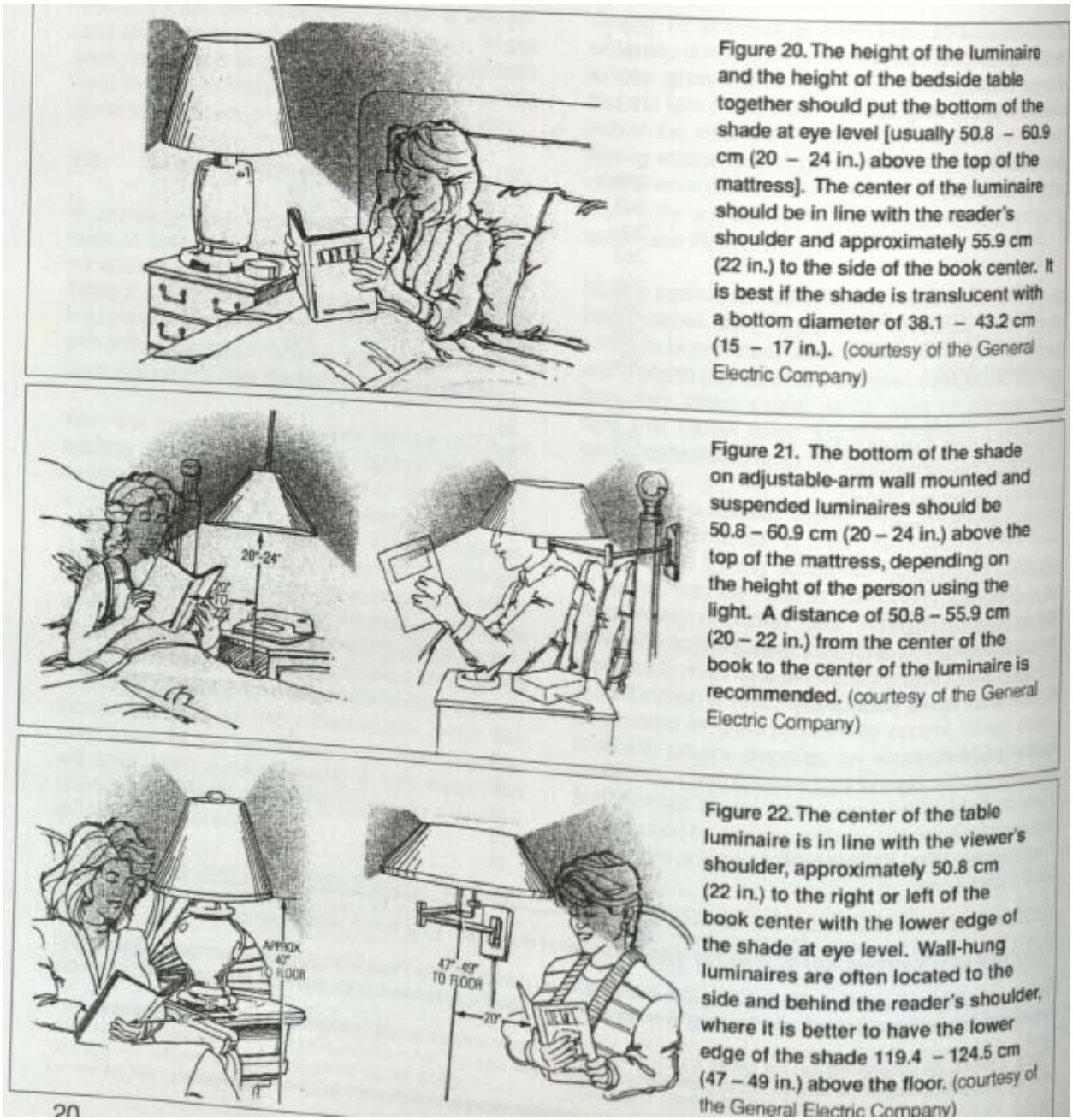


Figure 14: Bedside Lamps

(ANSI/IESNA, 2011, p. 20).

As mentioned above, these concepts can be applied to reading chairs. Lamp shades conceal lamps to reduce glare, and positioning the lamp slightly behind the person reduces eye strain.

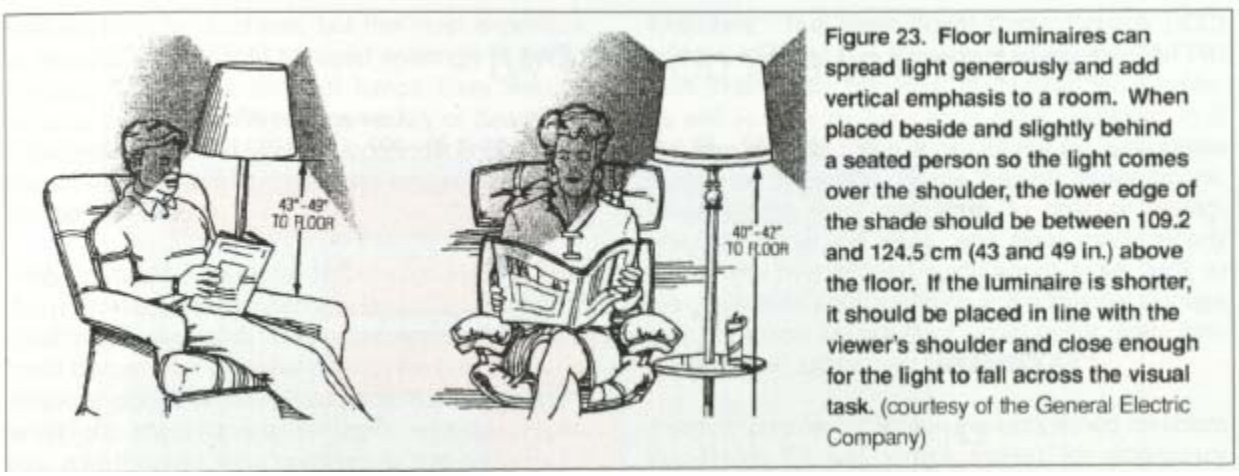


Figure 23. Floor luminaires can spread light generously and add vertical emphasis to a room. When placed beside and slightly behind a seated person so the light comes over the shoulder, the lower edge of the shade should be between 109.2 and 124.5 cm (43 and 49 in.) above the floor. If the luminaire is shorter, it should be placed in line with the viewer's shoulder and close enough for the light to fall across the visual task. (courtesy of the General Electric Company)

Figure 15: Chair Lamp

(ANSI/IESNA, 2011, p. 21).

AGi 32, a lighting program used to calculate illumination levels and render rooms, renderings, and floor plans are found below that model the current luminaire type and location in the bedroom. The main, glass, incandescent, luminaire is modeled as a CFL equivalent because once the current incandescent lamps burn out, they will be replaced by 13W CFLs, because incandescent lamps are being phased out. Lighting cut sheets can be found in Appendix F. When brining the luminaires into AGi 32, they come in as standard shapes, sometimes representative of the actual luminaire, and sometimes a box or circle. The rendering , figure 17, shows two circles and one rectangle above the bed to represent luminaires.

This luminaire layout only emits an average of 11.89 fc in the bedroom, 46.71 fc on the pillow top, and 24.18 fc in the restroom. Even though there are technically three levels of illumination in this room, there are no night lights, which means the main luminaire must be switched on to see at night. The main bowl luminaire provides minimal illumination, as seen in figure 16 and 17, while the valance provides two additional levels of control. Up light illumination from the valance could improve ambient illumination levels while the lower lamp

could assist reading in bed. A valence with two levels of illumination is the best option because it gives optimum level of control to the user.

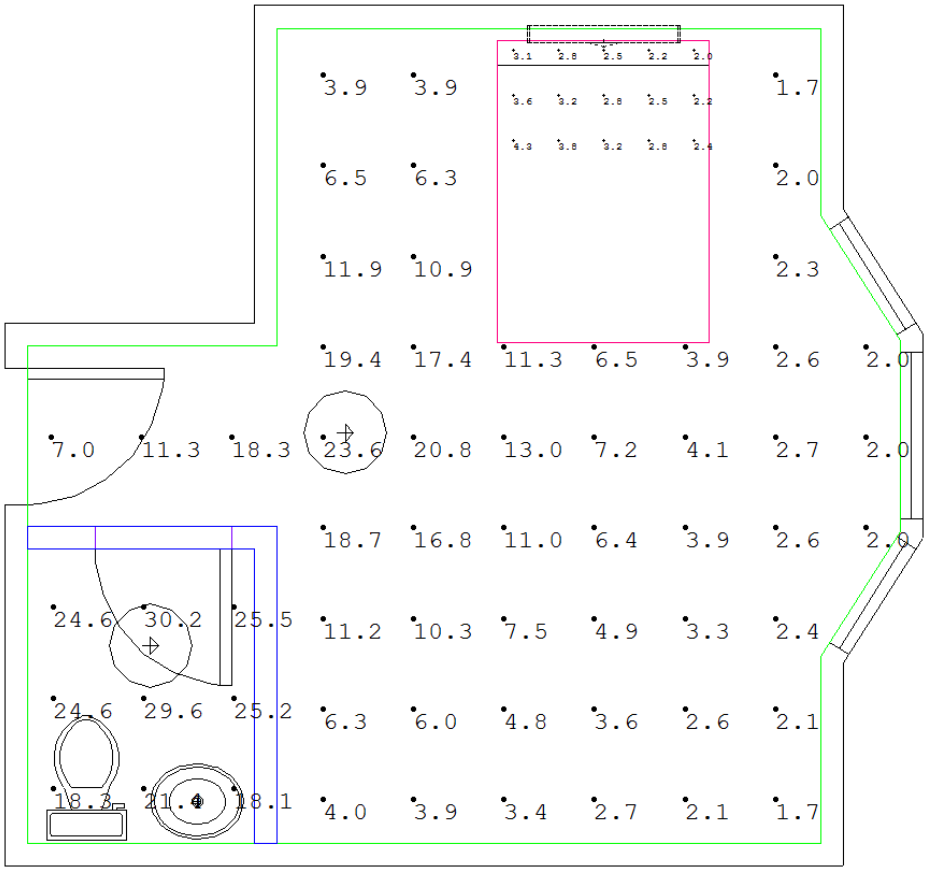


Figure 16:Footcandle Levels with Main Two Luminaires "On"

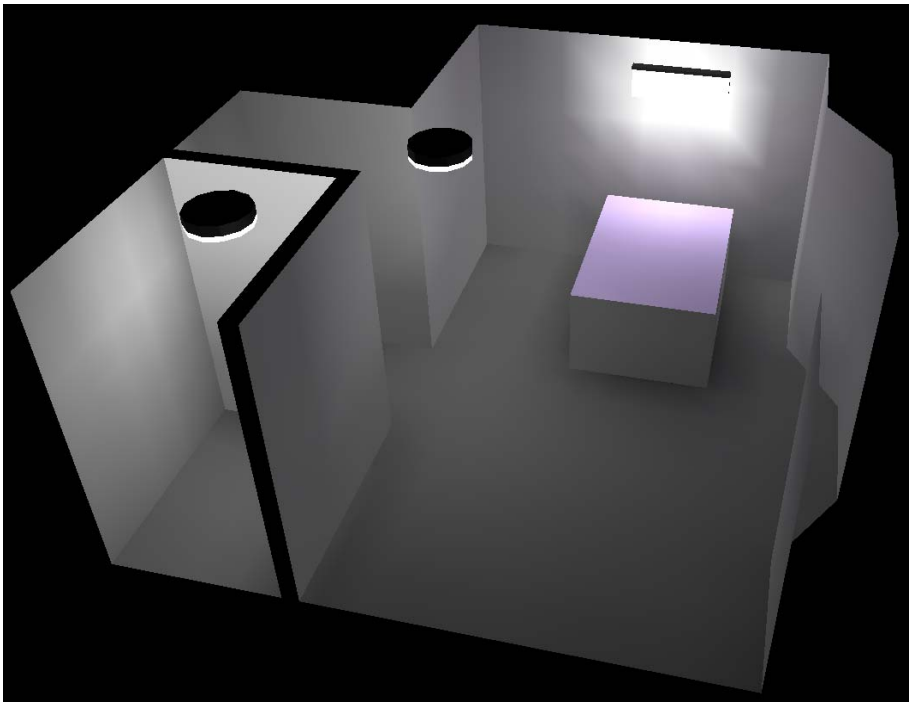


Figure 17: Rendering of Existing Layout with All Luminaires "On"

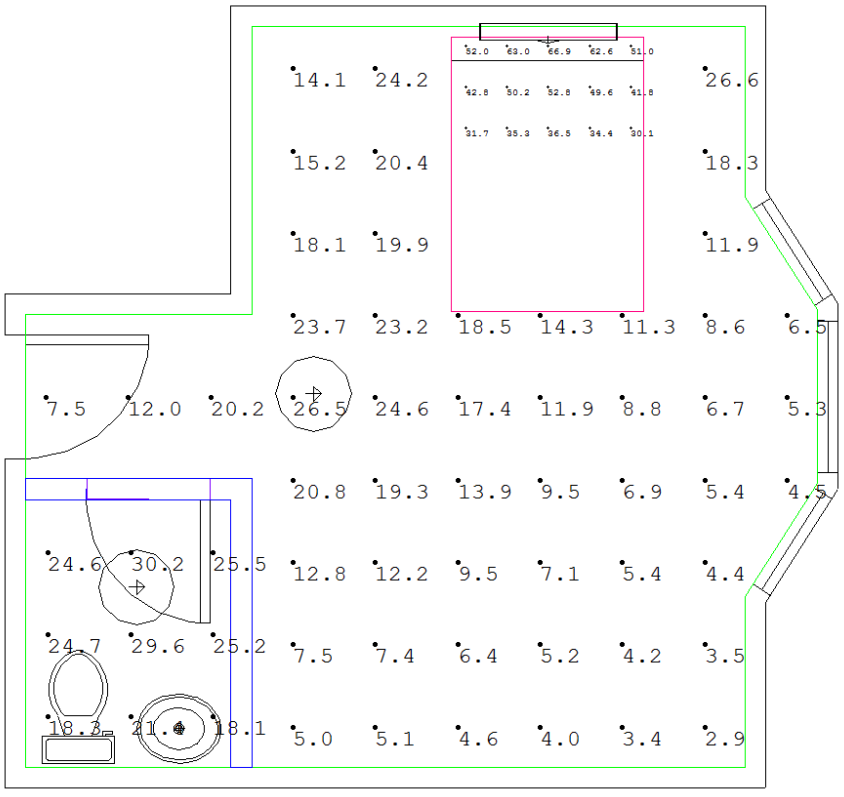


Figure 18: Footcandle Levels with All Luminaires "On"

Controls in this room consist of three separate switches (see Appendix F). The one controlling the restroom is located outside the restroom, and the switch for the main luminaire is next to this switch. The door leading to the corridor houses both of these switches. The switch for the valance above the bed is on a cord hanging down behind the pillow, which is perfect positioning for the AP to use while in bed. Circuiting is simple in this room, with only one point of control for each luminaire. If APs wanted to control the main luminaire, they must walk to the door, which is inconvenient and increases the potential for falls.

Dining Rooms

Mr. Pullin's also wanted further research in the dining area because meals are very important to keeping Alzheimer's residents well fed and their immune systems and energy levels high. He hopes to find luminaires that will stimulate patients' appetite; therefore, taking some of the pressure off the caretakers to make sure the residents are well fed without forcing them to eat.

Having the proper illumination where APs eat can improve their nutrition, and light can effects the way food looks by making it more or less appealing. In Spring 2009, students at Kansas State University experimented with different lamps and recorded their observations of fruit. In table 11, it is clear that certain lamps can affect one's view of food. Following the table is a visual representation of a similar experiment by Paul Picone from PI Corporation.

Table 11: Lamps Effect on Fruits

Lights Effect on Fruit								
Object	**Warm White**	**Soft White**	**Cold White Exposed**	**Cold White**	**Rite White**	**Soft White**	**Daylight**	**Natural Light**
Orange	yellowed so we wouldn't eat it	bright orange, yum!	more bleached out color	natural color that makes it look normal but no better, we'd eat it	fake and plastic	more subdued colors than rite white	pale, not appealing	vibrant!
Red Apple	not as bright as usal but decent	bright red, and we'd eat it	more bleached out color	natural color that makes it look normal but no better, we'd eat it	plastic because it was so red	more subdued colors than rite white	purple, definitely not eat	juicy red color
Green Apple	fine	not so tastey looking	more bleached out color	looks the best out of the first 4 lights	shiny green but tasty	more subdued colors than rite white	not appetizing pale green	looked yummy to eat
Meat	ok, nothing special, maybe we'd eat it	julicy and good looking	dull and brown so not too appealing	looks normal, we'd eat it	looked better than normal because it was bright	duller, but still edible	no color/red in it, looked bad	almost bloody red, would have to think twice if too red
Grapefruit	pale and watery, not our 1st choice	looked the best because had the most color	pale white, looked bad	normal, we'd eat it	-	-	-	-
Person	yellowish	red undertones	pale and white	normal	yellowed	fine	pale white	red undertones
Would you eat it?	no	depends	ok	yes	yes	ok	no	yes!

Figure 19: Fruit Under Warm and Cool Lamps

Reprinted with permission from Paul Kevin Picone/PI Corporation (ANSI/IESNA, 2011, p. 20).

Different lamps enhance certain colors of food and the same principals apply to clothing. GE Lighting has an interactive cite where anyone can see how clothes look under different kinds of lamps. Several different scenarios are pictured in figure 20-22 where it is clear incandescent lamps bring out the color red while fluorescent make the blue shirt a more defined blue.

Figure 20: Incandescents

Figure 21: Cool White Fluorescents

Figure 22: HPSs

Figures from GE Lighting.

Illuminating meals is not the entire focus for the dining room. Other factors can improve AP's behaviors like being able to see friends and family members sitting across the table. Figueiro recommends avoiding clear-glass luminaires, and instead use pendants. In figure 23, the pendant is translucent to minimize glare, which encourages socialization. The pendant uses two 75W halogen incandescent lamps, but an alternative could be a CFL. Regardless of the lamp type, it should not be visible to the occupants when seated. Additional lighting in the form of two wall scones, located on the back wall, add brightness to the walls and ceilings and could also

illuminate a piece of art. These particular scones have a translucent shield so the lamp is not directly visible and contains an 18W CFL.

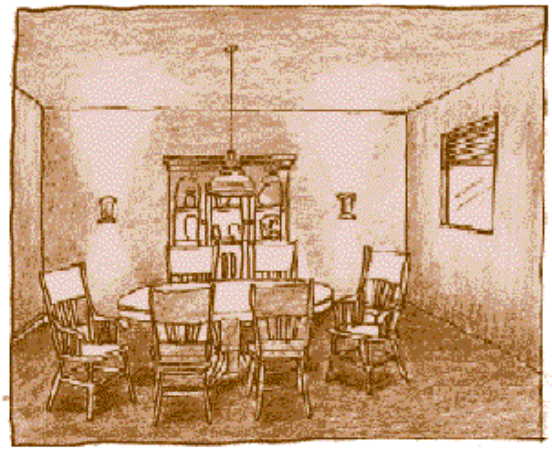


Figure 23: Dining Room Lighting

Reprinted with permission from Mariana G. Figueiro ("Lighting Rooms," 1995-2011).

Depending on the facility, officer dining rooms, cafeterias, or residential dining rooms, laid out by the DOD may apply.

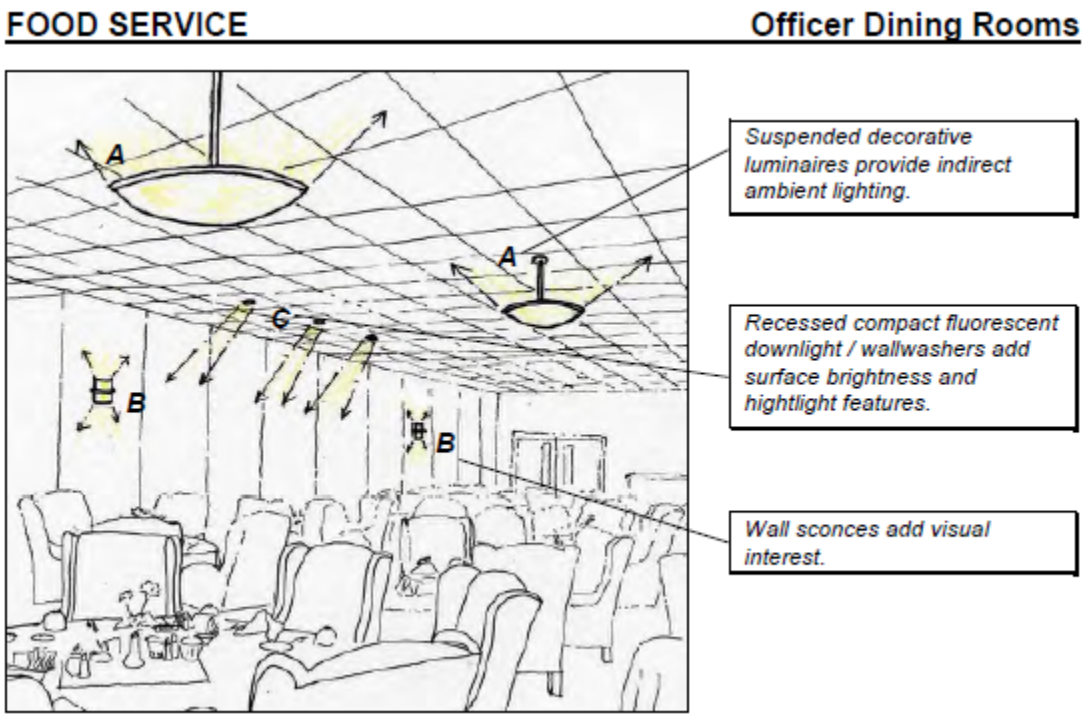


Figure 24: Dining Room Lighting 2

Reproduced with permission from John Peltz on behalf of United States Department of Defense, 2010, p. 133.

Officer dining rooms are typically more decorative, like an upscale dining room in a home or restaurant. If this is the image the facility is trying to exude, they could use lamps with a high CRI. Fluorescent lamps are typically used for general illumination whereas halogens are used for accenting because the DOD recommends lamps that can accentuate textures and colors. Avoiding direct glare and proper modeling of faces is important to the lighting design along with meeting the recommended lighting levels: 100 lux average ambient and 500 lux average on the food. Having this contrast between ambient illumination and illumination of the food has proved to improve food intake for people with dementia (ANSI/IESNA 2011) while soft ambient lighting promotes a comfortable environment. Accent lighting also adds visual interest. In order to successfully add visual interest, accent lighting needs to be three to five times brighter to be perceived as being brighter. The lamps used in this scenario are shown in table 12.

Table 12: Dining Room Lamps

Reproduced with permission from John Peltz on behalf of United States Department of Defense, 2010, p. 133.

EQUIPMENT REQUIREMENTS:

	LUMINAIRE	LAMP	CONTROLS
A	*Suspended decorative uplight.*	*Compact fluorescent lamps, 3000K color temperature, 80 CRI+*	*Control ambient and accent lighting separately. Provide dimming.*
B	*Wall mounted sconce.*	*Compact fluorescent lamps; 3000K color temperature, 80 CRI+*	*Control ambient and accent lighting separately.*
C	*Recessed downlight wallwasher.*	*Compact fluorescent lamps, 3000K color temperature, 80 CRI+*	*Control ambient and accent lighting separately. Provide dimming.*
C ALT	*Recessed linear downlight / wallwashers*	*Linear fluorescent lamp 3500K color temperature, 80+ CRI*	*Control ambient and accent lighting separately. Provide dimming.*

Separate lighting controls are useful in this application, but might not be necessary for an AD facility. Different moods can be achieved with different luminaires turned on in a fancy dining setting, whereas, AD homes are more about function. Being able to dim the lights during the day to create a coffee shop atmosphere could benefit a facility, but if diming is not an option, placing half the luminaires on a separate circuit allows them to conserve energy, but still have adequate illuminance levels when the space is not being used for a specific task.

Another possible layout for an AD facility is a cafeteria. Halogen lamps are used to illuminate the food where it is served, while fluorescent lamps, with a high CRI, are used for ambient lighting. Lamps could provide light that makes the food appealing and gives it proper shape. T5HO lamps emit a lot of light and could be used to create brightly lit spaces; however, when using these luminaires, it is hard to use accent luminaires because they must be so much brighter in order for people to visually see a difference in the intensity. Type "B" luminaires, in figure 25, were placed to help move the occupants through the line, as well as give visual interest to the space. Cafeterias could also be designed to minimize glare and have the same recommended lamp levels as the officer dining room. If daylight is incorporated into the space, it could be controlled to minimize glare, and the luminaires could be dimmable or on occupancy sensors to conserve energy.

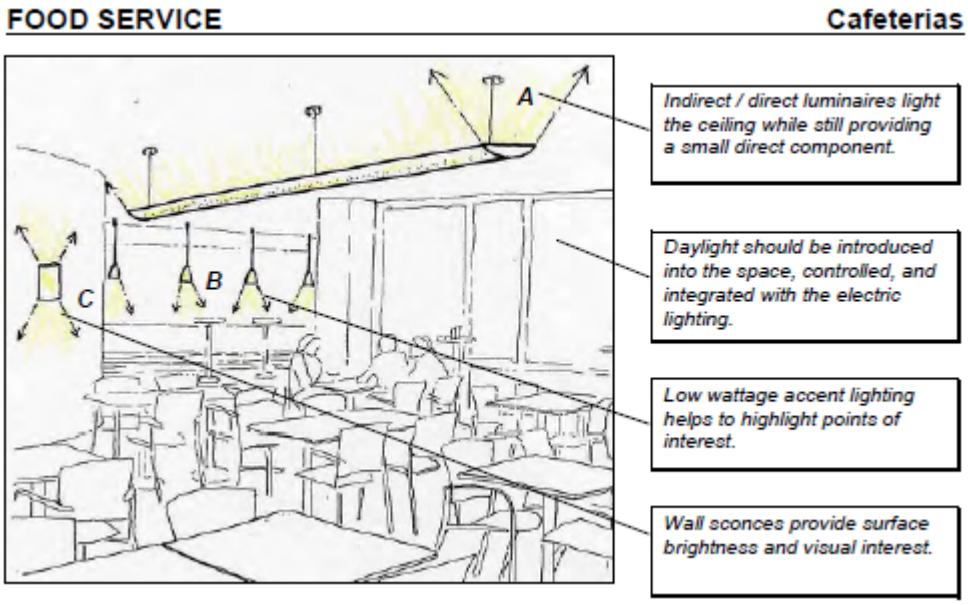


Figure 25: Dining Room Lighting 2

Reproduced with permission from John Peltz on behalf of United States Department of Defense, 2010, p. 129.

Table 13: Dining Room Lamps 2

Reproduced with permission from John Peltz on behalf of United States Department of Defense, 2010, p. 129.

EQUIPMENT REQUIREMENTS:

	LUMINAIRE	LAMP	CONTROLS
A	*Suspended linear indirect / direct luminaire.*	*4' linear fluorescent T8 or T5HO lamps, 3000K color temperature, 75 CRI+*	*Control with daylight sensors.*
B	*Suspended low voltage decorative accent light.*	*Low voltage, directional lamps.*	*Control ambient and accent lighting separately. Consider the use of occupancy sensors.*
C	*Wall mounted sconce.*	*Compact fluorescent lamp; 3000K color temperature, 80 CRI+*	*Control ambient and accent lighting separately. Consider the use of occupancy sensors.*

A third possible lighting layout resembles a home dining room. These recommendations could be applied to facilities trying to recreate a home so APs feel more at ease and comfortable in the space, perhaps promoting better eating. Color appearance and contrast are important in this application, and a high CRI helps with promoting healthy eating. Glare could be avoided, and

referencing figure 26, this is accomplished by aiming the accent lighting away from the seating area. Glare is irritating, especially when trying to hold a conversation with others at the table. Shadowing can be used to create depth to both objects and people, but it should not be distracting. Illuminating objects and people from multiple angles with similar intensities reduces harsh shadows, and while a single downlight directly above a person will create deep, unflattering shadows this promotes socialization because people have dimensions and achieving the average target illumination level of 50 lux ensures elders can see both their food and friends.

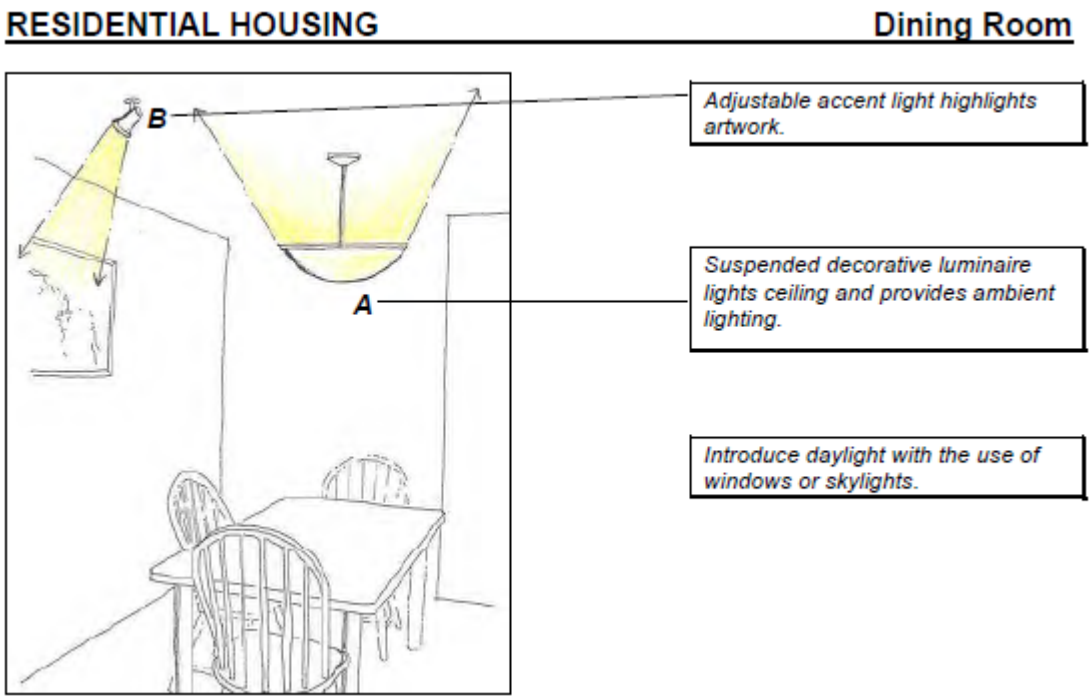


Figure 26: Dining Room Lighting 3

Reproduced with permission from John Peltz on behalf of United States Department of Defense, 2010, p. 157.

Table 14: Dining Room Lamps 3

Reproduced with permission from John Peltz on behalf of United States Department of Defense, 2010, p. 157.

EQUIPMENT REQUIREMENTS:

	LUMINAIRE	LAMP	CONTROLS
A	*Suspended luminaire*	*Compact fluorescent lamps, 3000K color temperature, 80 CRI+*	*Control ambient and accent lighting separately. Provide dimming.*
A ALT	*Ceiling mounted luminaire*	*Compact fluorescent lamps, 3000K color temperature, 80 CRI+*	*Control ambient and accent lighting separately. Provide dimming.*
B	*Recessed or monopoint mounted adjustable accent light.*	*Tungsten halogen directional lamp*	*Control ambient and accent lighting separately. Consider dimming to extend lamp life.*

Figures 27 and 28 provide different ambiances, partly due to the luminaires and partially due to the furniture. Chandeliers are not out of the question for dining rooms in AD facilities because many family dining rooms in 1920's had chandeliers. This representation of a 1920's home could help put the APs at ease and relaxed APs are more willing to eat.

Figure 47. In this formal dining area, architectural cove lighting provides ambient light for the central space and wall wash luminaires light the perimeter. Chandeliers and wall sconces provide a formal residential elegance. (photographer: Fred Golden)

Figure 27: Formal Dining Room Lighting

Reproduced with permission from Fred Golden (ANSI/IESNA, 2011, p. 38).

Figure 28 has both similarities and differences to the photo above. One similarity is daylight. Integrating daylight into the dining room, as seen in figure 28, could help with bright light therapy (discussed in greater detail later), depending on the time of day and season, as well as promote a healing environment. This daylight comes from incorporating windows into the dining room which resembles most homes, making the APs more comfortable with their environment and surroundings. A difference between the two photos is the patterns. The photo below has less patterns to distract APs, which also allows for better contrast between table settings and furniture.

Figure 49. This dining area successfully integrates daylighting from the adjacent space with interior lighting provided by pendant indirect luminaires and cove lighting to provide diffused ambient light. Good contrast is provided by dark chairs against a medium value carpet and eating utensils against a white tablecloth. (© Jeffrey Totaro)

Figure 28: Daylight Dining Room

Reproduced with permission from Jeffrey Totaro (ANSI/IESNA, 2011, p. 39).

Living Rooms

APs gather in living rooms to chat, sleep, read, watch TV, or do an activity, so ensuring the lighting does not encourage sleep or discomfort is very important for this space. Like the spaces mentioned above, direct glare should be avoided, and this can be achieved by using indirect luminaires. Unlike previous spaces, a 30 lux average is the recommended horizontal illuminance for a residential living room. The DOD recommends controlling the luminaires to conserve energy because a living room can be used for so many different activities. Controlling luminaires can be done by diming lights or by circuiting rows of luminaires separately.

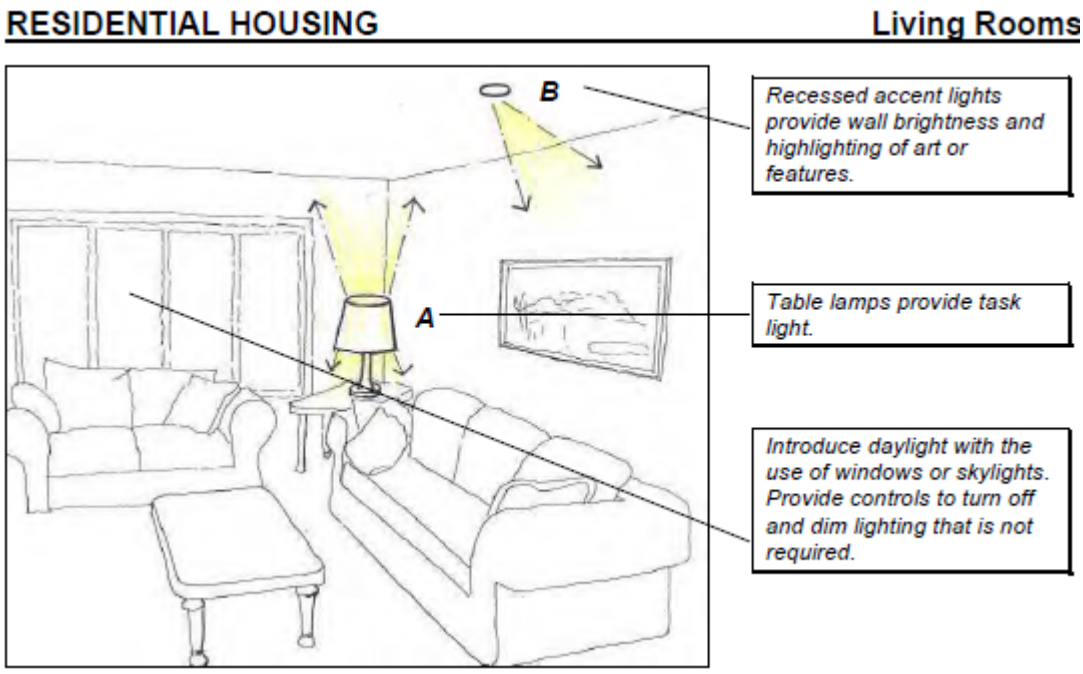


Figure 29: Living Room Lighting

Reproduced with permission from John Peltz on behalf of United States Department of Defense, 2010, p. 159.

Table 15: Living Room Lamps

Reproduced with permission from John Peltz on behalf of United States Department of Defense, 2010, p. 159.

EQUIPMENT REQUIREMENTS: /1/

	LUMINAIRE	LAMP	CONTROLS
A	*Table lamp*	*Compact fluorescent lamps, 3000K color temperature, 80 CRI+*	*Manual on/off.*
A ALT	*Floor lamp or torchiere*	*Compact fluorescent lamps, 3000K color temperature, 80 CRI+*	*Manual on/off.*
A ALT	*Wall mounted uplight*	*Compact fluorescent lamps, 3000K color temperature, 80 CRI+*	*Include the use of dimmers.*
B	*Recessed wall washer or adjustable accent light*	*Compact fluorescent lamps, 3000K color temperature, 80 CRI+ or tungsten halogen directional lamp*	*Include the use of dimmers. Control ambient and accent lighting separately.*

Additional task lighting in the living room might assist elders working cross words puzzles or reading the paper who used to sit by windows while doing these activities at their

home. An easy and non-invasive way to add additional lighting is with tubular fluorescents mounted on the underside of a bookshelf or on upper cabinets.

Another option has been drawn below, figure 30, by the ANSI/IESNA. This situation is specific for working puzzles or other detailed tasks. Puzzles keep the mind active and potentially prevent the AD from progressing as quickly, so there should be enough light to entice APs to work on puzzles. Enhancing colors on puzzle pieces, contrast between pieces, and contrast between the puzzle and the table are important factors to consider.

Figure 24. The best locations for a desk or work table are against a plain, light colored wall with a matte finish, or placed at a right angle to a window to utilize daylight. The top surface of the desk should be non-glossy and light in value. A portable luminaire can be moved by the user for glare control. The bottom of the shade should be approximately 38.1 cm (15 in.) above the work surface and tall enough that the light source is not visible from a seated or a standing position. Lighting in the area surrounding the desk or work table will create a comfortable environment without harsh contrasts. (courtesy of the General Electric Company)

Figure 30: Detailed Task Lighting
(ANSI/IESNA, 2011, p. 21).

A photograph of a quality living room lighting design is provided in figure 31. The photo depicts quality lighting design because multiple lamp types can be seen to create a layering of illumination levels. These layers can all be controlled separately to conserve energy. The photo also reemphasis correct wall and ceiling reflectances and properly uses indirect/direct luminaires to reduce glare.

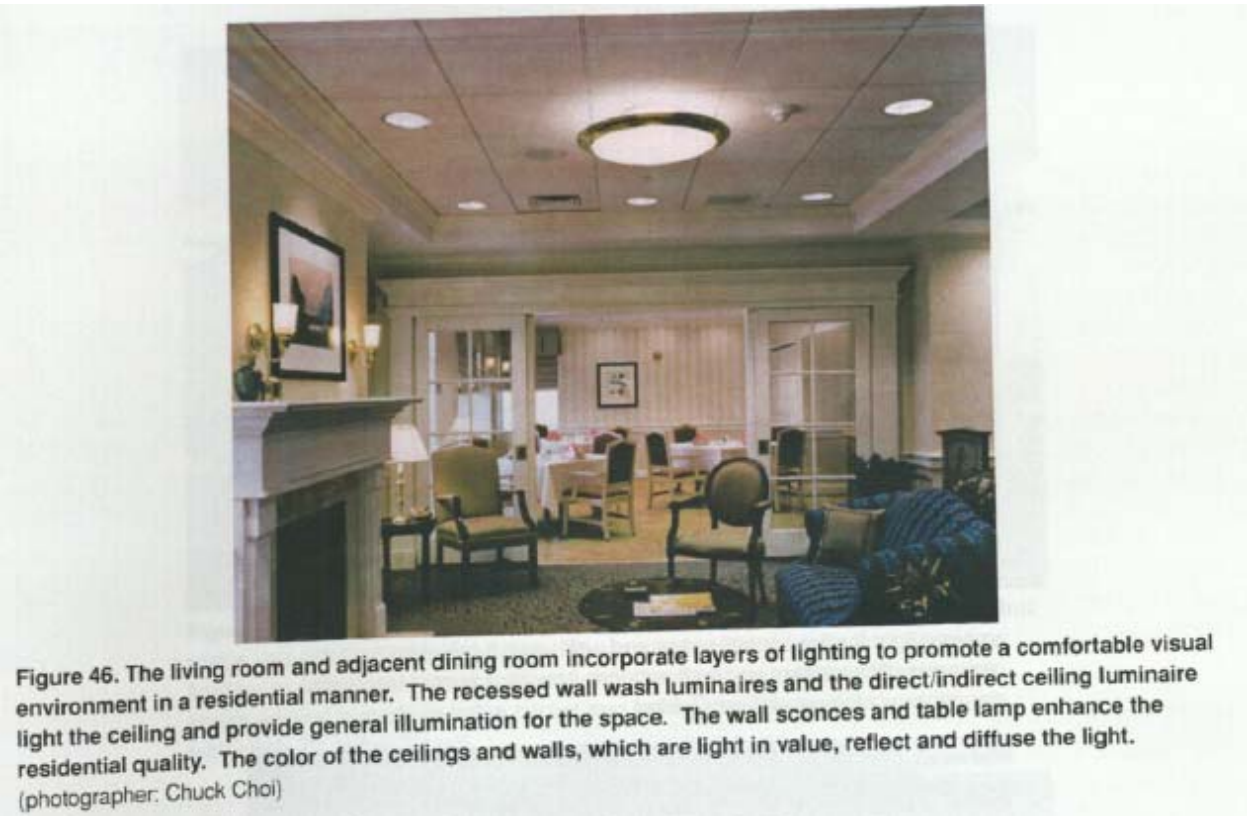


Figure 46. The living room and adjacent dining room incorporate layers of lighting to promote a comfortable visual environment in a residential manner. The recessed wall wash luminaires and the direct/indirect ceiling luminaire light the ceiling and provide general illumination for the space. The wall sconces and table lamp enhance the residential quality. The color of the ceilings and walls, which are light in value, reflect and diffuse the light. (photographer: Chuck Choi)

Figure 31: Layered Living Room Lights

Reproduced with permission from Chuck Choi (ANSI/IESNA, 2011, p. 37).

Chapter 4 - Therapy

Bright light therapy can be used if proper illumination levels and lamp layouts do not enhance an AP's life to their maximum potential. Bright light therapy is the name for using lamps capable of producing 10,000 lux, to enhance an AP's life, and a Danish physician, Nils Finsen, who is credited with being the father of phototherapy ("Light Therapy 2011), discovered it. The UFC states, "Light quality and quantity can have profound physical and psychological effects." These effects include SAD, sleep disorders, and jet lag, and it is believed that light therapy can help all of these situations.

Typically, it is believed only medication can combat AD, but some researchers have used light therapy. Deciding which method to use to slow the severity of Alzheimer's depends on the amount and frequency of medication verses the level of supervision the therapy needs. While medication can take weeks before any behavioral changes are noticed, therapy can benefit the AP within days (Sloane, Figuerio, and Cohen 2008). Therapy could be a more efficient cost alternative, or supplement, to medication.

Light therapy might not seem more efficient because additional luminaires will be installed in the facility because ambient illumination levels are not sufficient. Table 16 shows the relative illumination levels for different spaces, and these illuminance recommendations are based off typical surface reflectances, need for accuracy of task, and amount of detail. Smaller more detailed tasks need more illumination to make sure the task is accurate. The levels in table 16 are general recommendations, which mean every inch of the space does not need to have the assigned illumination level; however, all these levels are much lower than the 10,000 lux required for bright light therapy, as mentioned above.

Table 16: IESNA Recommendations for Lighting Levels

Table adapted from ANSI/IESNA, 2011, p. 19.

IESNA Recommendations for Lighting Levels		
Acitvity	**Illumination (fc)**	**Illumination (lux)**
Standard Classroom	50	538
Science Labs	50-75	538-807
Cafeteria Eating Area	20	215
Cateteria Food Preparation	75	807
General Gymnasium	30	323
Library Reading Area	50	538
Library Stacks	35	377
Private Offices without Task Lighting	50	538
Open Offices with Task Lighting	35	377

As seen from the above table, 10,000 lux is above any of the listed areas. Simply by recognizing a bright room and trying to replicate the luminaires in a facility does not mean there is enough light for therapy. Typical spacing of luminaires and choices in lamps does not make it possible to provide 10,000 lux of ambient illumination in a facility, so specific lamps could be installed for therapy or portable devices implemented into the AP's daily routine.

Some might wonder why so much light is required for light therapy, it is due to the degradation of elders' eyesight. As people age, their pupils become smaller (senile miosis) and the crystalline lens becomes thicker and more absorptive and their lenses yellow, which means they need more light to have the same perceived brightness as they did when they were younger. "A typical 60-year old receives about one-third the retinal illuminance of a 20-year old" ("The Aging Eye" 1995-2011), and the graph below, figure 32, illustrate this concept. This also means the illumination levels in standard living areas could be at least two to three times brighter than what younger people find comfortable ("The Aging" 2010).

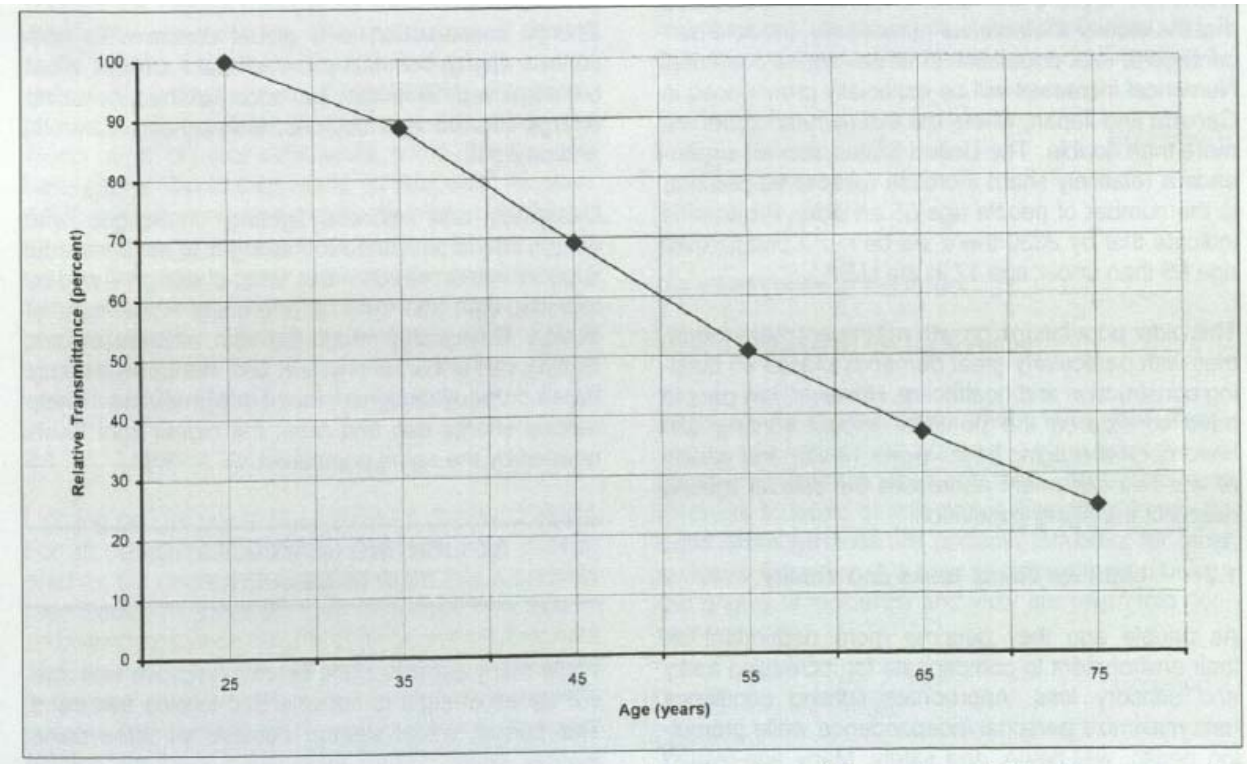


Figure 1. The transmittance of the human eye plotted as a function of age.[9] As people get older, they may require greater illuminance to offset the reduction in the amount of light reaching the retinas of their eyes.

Figure 32: Transmittance of Light Related to Age

Reprinted with permission from Illuminating Engineering Society of North America (ANSI/IESNA, 2011, p. 1).

The amount of light entering the eye influences the amount of time needed to benefit from the light. Tests by Sloane, Figueiro, and Cohen show 2,500 lux of white, broadband light for two hours is approximately equivalent to 10,000 lux for 30 minutes. These measures of illuminance (2,500 and 10,000 lux) are equivalent to being outside on a cloudy day and outside on a sunny day respectively.

Surprisingly, more intense luminaires are not always the answer in light therapy, even though Noell-Waggoner, Dupuy, and Godfrey state as long as there is no glare, "it is almost impossible to have too much light." High levels can cause squinting, limiting the amount of light entering the eye, as well as causing discomfort. While more light might benefit the circadian rhythm or theoretically lessen agitation, the angle of the light might cause discomfort than the benefits received, so while maximum illumination levels are ideal, there is a limit where it becomes discomforting instead of beneficial.

Time of Day for Administering Light Therapy

One of the benefits of light therapy over medication is light therapy can be provided at a time that is convenient for the caretaker and patient. While it can be administered any time of day, consistency can help bring maximum benefit to the AP and keep them on a daily pattern with other regular activities. Figueiro, Rea, and Eggleston have documented that finding the optimal time to administer light is a factor in light therapy, "the optimal timing of light therapy remains controversial," but regardless if consistence is adhered to, administering light therapy can potentially be easier than remembering to give APs medication at a specific time of day. Even though caretakers might become irritated if they have to repeat themselves while administering light therapy, telling APs to sit still in front of the light during therapy APs will be in a better mood and easier to work with throughout the day.

While the optimal time of day to administer light therapy is controversial, table 17 shows typical exterior illuminance levels throughout the day. For APs to receive 10,000 lux or more of light, the optimum time to go outdoors is between 7am and 5pm, which is not difficult to achieve. The more daylight they receive, the shorter amount of time they need to be outdoors. The illuminance values in table 17 were probably taken in direct sunlight, but APs can sit in the shade and still receive ample illuminance levels (see table 27 in Chapter 8).

Table 17: Time of Day and Lux Comparison

Illuminance Levels During the Day		
Springtime Lighting on a Clear Day	Illuminance (lux)	Illuminance (fc)
5:55 Sunrise	750	70
6:10 AM	2,500	232
6:20 AM	5,000	465
6:40 AM	10,000	929
12:00 Noon	81,000	7525
5:10 PM	10,000	929
5:30 PM	5,000	465
5:40 PM	2,500	232
5:55 Sunset	750	70

If outdoor activity cannot be achieved between 7am and 5pm, bright light therapy in the form of supplemental electric lighting can be administered. Figueiro has done clinical research since 1992 that proves bright white wavelength, administered in the morning or evening, improves sleep, increases daytime wakefulness, and reduces agitation for AD. She recommends at least 1,000 lux shown at the eye (for an hour (Kohsaka et al.) 2002) for the affects to occur.

Figueiro, Rea, and Eggleston sum up the delicate dance between the variables well with the statement: "Tailoring intensity, spectrum, timing, duration, and distribution light might be a clinically effective treatment for consolidating rest/activity rhythms of APs, which can also benefit caregivers in institutions and at home." Depending on the patient's wants and needs, and the caregivers' wants and needs, a compromise can be made to fit the needs of any AP.

Morning

Morning therapy sessions are typically cited as being more effective than evening as seen in Bright Light Therapy with Day-Light 's quote "Significant clinical improvement in about 80% of cases when bright light was scheduled at the optimum early hour. If the bright light was scheduled later, the response rate dropped to about 40%." Thorpe, Middleton, Russell, and Stewart also found similar results with their research when they found morning light had a positive effect on behavior, reducing the agitation and disruptive behaviors in patients. Having light therapy distributed in the morning can wake up patients and set their mood the rest of the day.

Not all researchers agree morning light has positives impacts on APs. In Colenda et. al's study, no correlation existed between morning light therapy and sleep. The experiment consisted of providing four patients with 2,000 lux via visor for two hours in the morning (Thorpe, et al. 2000), which is not enough participants to make conclusions. Failure to find a correlation could have been due to faulty light visors, timing, or duration of administration.

Evening

While some research shows morning light to be the most effective, others have found evening light to have better results. Ancoli-Israel S, Kripke D, Jones D, et al. noted evening dim light, or increased daytime activity, improved sleep (Thorpe, et al. 2000), and improved sleep resulted in them being more awake during the day. People in general benefit from improved sleep because it results in a more pleasant demeanor. While typical adults might be more aware

of the reasoning behind their ill feelings toward others and try to control their moods, APs act the way they feel, without regard to others. This research also mentions dim red light, and as discussed earlier, the improved the APs sleep could be due to color, time of day administered, or light/dark pattern that.

Figueiro found studies supporting administering light therapy in the evening because evening light therapy delayed the circadian clock and helped adults sleep better at night, which, in turn, this helped APs be more awake during the day. This might be in part because evening light phase advances the circadian rhythm, while morning light causes a phase delay. Even though these shifts are similar, phase advancing the system helps APs reach deep sleep sooner, while phase advancing helps APs wake up. Researchers disagree on whether administering light during the morning or evening has a greater effect on the patient, the studies agree that luminaires can have a positive impact.

Duration

Duration of light exposure is one of the variables during treatment. While longer periods may be better, it is difficult to keep APs in a room for much longer than two hours (Figueiro, Rea, and Eggleston 2003). Different experiments have been conducted to test different outcomes relating the amount of light and the duration of exposure.

Sloane, Figueiro, and Cohen conducted a few tests and came to the conclusion that a minimum of 2,500 lux of white, broadband light aimed at the cornea could be used for two hours, and if two hours is too much, they said 10,000 lux could be used for 30 minutes. The more the intense the luminaire output, more attention needs to be spent on reducing glare. Higher lamp levels can to have higher levels of discomfort, making people squint and thus less light actually enters the eye.

The same researchers also learned that 100 lux shown at the cornea for 6.5 hours can phase shift the circadian system. This test was completed in a controlled lab environment and there is no evidence this low level of light can have this effect on the circadian system in the real world, but Rea also hypothesizes that even lower levels of light, 3.5 lux, can affect the circadian system. This is only a hypothesis and no additional information was given like the amount of time it would take for this phase shift to happen.

Affecting the circadian system requires more light than for visual stimulation or boosting one's mood because according to Sloane, Figueiro, and Cohen, the visual system can respond in milliseconds, whereas the circadian system might take several minutes or days to respond to bright light. Table 18 illustrates the amount of light, time of day, duration of exposure, and intensity needed to affect both vision and the circadian rhythm.

Table 18: Comparison Between Light Needed to Effect Circadian and Vision

Table adapted from "Research Recap," *LD+A* June, 2003, p. 17-18.

Lighting Characteristics (Broad-Band Light)			
	Application		
	Circadian - Day work shift	Circadian - Night work shift	Vision
Quantity	Low	High	High
	300-500 lux on task	~1,000 lux at eye	~1,000 lux at eye
Spectrum	Photopic	Short wavelength	Short wavelength
	Peak sensitivity 555nm	Peak sensitivity 420-480nm	Peak sensitivity 420-480nm
Spatial distribution	Distribution important	Independent of distribution	Independent of distribution
	Task luminance, contrast and size determine visibility	Illuminance at eye	Illuminance at eye
Timing	Anytime	subjective morning	Perodically throughout shift
Duration	Very short	Long	Short
	Less than 1 second	1-2 hours	15 min pulses

Types of Therapy

Once the time of day has been decided, caretakers need to determine which method of distribution to use. There are multiple methods of distributing artificial light to a patient: visors, light boxes, *high-intensity lights*, dawn simulators, and ambient luminaires. Different techniques of distributing mean varying the amounts of wavelengths to the eye at dissimilar angles; therefore, affecting the impact of the therapy. The severity and type of dementia the person has might affect how well a particular treatment is received or the impact the it has on the AP.

Knowing which type of dementia one has also affects the type of light therapy distributed. Van Someren et al. found APs were more sensitive to the whole-day indirect luminaries, whereas Mishima et al. found those with *multi-infarct dementia*, were most sensitive to the traditional light box (Thorpe et al. 2000).

The position of the light and the angle it reaches the eye changes the effectiveness of the therapy, as well as the circadian rhythm. Sloane, Figueiro, and Cohen have found that light, which reaches the lower retina, has more of an effect on the circadian system than light reaching

the upper retina. For this reason, all the therapy types discussed could aim to be distributed from above.

Knowing light is more effective when coming from above a person, APs could situate themselves at a table or in a chair where the luminaire can be above them. This is part of the reason several methods, light box in particular, are done during meal times when the patients sit still and have something else to keep them occupied. Another option to engage the AP is reading; however, they must not tilt their head down too far or the wavelengths will not be able to enter their eyes.

Positives

Light therapy has many potential benefits by itself, and when compared to other methods of helping APs, light therapy is a viable option. Sometimes caretakers give APs sleeping pills to help them successfully sleep through the night, which this allows them to care for other patients not on sleeping pills, have a more peaceful shift, or sleep through the night themselves without worrying about their loved ones. “Sleep Issues in Persons with Dementia” states sleeping pills become ineffective after about a month on the medication, and as the AD progresses, so do sleep issues. They also note, "medications can often increase confusion and lead to more falls," which as people age, falling becomes more dangerous and potentially deadly. For APs, it can cause additional problems, because they do not understand what happened or why they cannot do certain activities, they used to enjoy like caring for a baby doll. If they have a broken arm, this soothing activity becomes difficult if not impossible.

Medications always have warning labels on them, while light therapy is relatively free of serious adverse effects according to Sloane, Figueiro, and Cohen. "Theoretically plausible potential risks include retinal damage, the induction of mania and/or agitation, heightened photosensitivity, and general somatic and psychosomatic complaints (headache, nausea, jitteriness, anxiety). The available randomized trials indicate; however, that the prevalence of major adverse effects are virtually nil." Another study by Nowak and Davis reported light therapy had less frequent adverse effects, and were typically milder than pharmacological treatment. Having less serious and frequent side effects for the patients is a great advantage to both the caretaker and the AP.

Sloane, Figueiro, and Cohen sought out more experiments relating, sleep, mood, and light, and found 21 additional studies. Although many of the studies involved smaller groups of people (six of them included ten or fewer participants), the majority of them dealt with people with dementia, and three of the studies included people with depression. Of these 21 test groups, 14 of them reported "significant improvement in one or more clinical outcomes." While this is a small pool of subjects, the majority showed improvements, but conclusions drawn from this research only needs additional research to confirm the findings due to the small number of participants.

Being able to improve recognition and recollection are invaluable assets to family members of APs. Nowak and Davis noted such benefits as "improved cognition with themes of awake and alert, verbal competence, recognition and recollection, and motor coordination, as well as psychosocial improvements with themes of recaptured personality, environmental engagement, and improved mood." Recapturing an APs personality and their identity, can make the AP feel more human, and caring for a loved one who acts like themselves is more enjoyable than caring for a loved one that has severe AD.

Since behaviors affect each other, once APs have improved cognition, improved mood, etc., they also improve their circadian rhythm and nutrition. One of the outcomes of shifting the circadian system is the reduction in daytime sleepiness. Another affect of shifting the circadian rhythm is when APs do sleep, their sleep is less disruptive, and as mentioned earlier, having a better nights rest improves the mood of most people and makes them more enjoyable to be around. A further domino effect of increased lighting levels and affecting the circadian rhythm is having patients be more awake during the day, including meal times. According to an interview with Jerry Pullins President of Senior Care Homes Midwest, convincing APs to eat can be one of the biggest challenges. From personal experience, APs are sleeping all the time, but if they are awake, the chances to keep them nourished increases. Being well nourished has obvious benefits.

Nowak and Davis also noticed increased psychological tendencies like "decreased risk for mood disorders due to sleep loss" after APs received light therapy. A more pleasant demeanor aided in socialization, which in turn might have increased their desire to do things on their own because their friends were doing things independently. This independence reduces the level of care or attentiveness from the caretakers.

Visor

Light visors are a great method to use if the patient wants to move around and be independent during treatment. Wandering is a common characteristic of, so the more active patients would benefit from a device that can be worn instead of sitting still to get the allotted dosage of light. The visor is worn just like a tennis visor and is powered by batteries. It gives a maximum of 3,000 lux, but since it is worn so close to the eyes, treatment sessions do not necessarily take longer than other forms of therapy according to WholeHealthMD. Another benefit of the visor is ease of portability. If APs are traveling to see loved ones, this device can easily be worn in a car or packed in a bag.

Light Box

Light boxes, see figure 33, are the most common form of light therapy, and one manufacturer is DayLight Technologies, Inc. who manufactures a product capable of delivering 10,000 lux. Typically, this form of therapy is administered during a mealtime so patients are more likely to be still. In one experiment, cited by Thorpe et al., light boxes were used by patients for half an hour each morning Monday through Friday because caretakers did not think additional time was probable due to their patients' tendency to wander or fall asleep. Caretakers also believed the full 10,000 lux was appropriate because the patients were only receiving the light for 30 minutes. There is a correlation, to an extent, between light intensity and time. The more intense the light, the less time the light needs to be administered. For this reason, the 10,000 lux of light box is the preferred amount of light to use during therapy.

There are three main variables, which are all related, involving light boxes: intensity of the lamp, distance from the luminaire, and length of exposure. Users are typically exposed to light for 30 minutes if the person is 12 to 14 inches from the luminaire with a light intensity of 10,000 lux. However, the Mayo Clinic claims a box producing 2,500 lux at the same distance may take two or more hours to achieve the same effect. The Mayo Clinic also mentions most light boxes need to be at least within two feet of the person regardless of intensity or duration to benefit the AP.

Light therapy, especially therapy using light boxes, is recommended for people with SAD. It is important to note this fact because many elders are often depressed so sometimes people think their loved ones have SAD instead of AD. Either way, combining a positive change

in mood along with shifting the circadian rhythm, has the potential to benefit both SADs and APs.

Light boxes are both efficient and affordable, selling for $100-$500, and this makes it easier to recommend light therapy to a caretaker or an AD home. To save even more energy, the AD home might only need to purchase a few light boxes to help multiple residents.

Bright Light (High-Intensity)

Bright light therapy has been clinically tested to be safe and effective ("Bright Light Therapy" 2007); however, some precautions need to be taken. For the best results, it is suggested luminaires project downwards, filter out *ultra violet* (UV) rays, and have a wide range of illumination because luminaires that project from below the eye can cause the viewer discomfort. UV rays can be damaging to the eye, so a screen or filter could be placed over the luminaire to eliminate these waves, and a wide illumination allows the patient to move slightly while still attaining the effects of the light therapy. Another precaution caretakers could take when selecting lamps is choosing white wavelengths over blue wavelengths because blue wavelengths have been known to damage the eye because these wavelengths are closer to UV wavelengths.

Light boxes and visors could both potentially be considered bright light treatments if they emit 10,000 lux, and especially if they help with *sundowning*. Bright light therapy has been targeted specifically for helping sundowning according to Kumar and Eisdorfer, which occurs in 45% of APs, but when patients were exposed to two hours of bright light using 1,500-2,000 lux, sundowning was reduced in 8 out of 10 patients. The cause of sundowning is unknown, but symptoms such as confusion, wanting to be with family, and then become angered when such desires are not fulfilled, occur in the late afternoon. In some Alzheimer's facilities, they bring in additional caretakers for the late afternoon to keep track and calm the residents.

Sundowning is related to the circadian rhythm because in Glen Smith's article "Sundowning: Late-day Confusion" for the Mayo Clinic, he specifically cites low lighting and disruptions to the internal clock as aggravating sundowning symptoms. Using bright lights in addition to typical AD home lighting can reduce the number of caretakers needed between the hours of 3pm and 5pm. These bright lights can affect the circadian rhythm and make APs happier.

Research has been done specifically on the benefits of *bright white light* related to consolidating their rest/activity patterns. Bright white light administered to elders living in nursing homes for at least two hours a day in the morning resulted in substantial sleep improvements (ANSI/IESNA 2011), and by exposing APs to 1,500-2,000 lux, the severity of sundowning decreased, as well as their nighttime activity. Another experiment shows exposing 22 people with AD to bright white light (averaging 1,136 lux) for four weeks consolidated their rest/activity rhythms. Even exposing APs to 2,500 lux for one hour every morning improved their sleep, increased daytime wakefulness, reduced evening agitation, and improved their rest/activity patterns.

Philips BriteLITE 6

Philips lighting has capitalized on this market by manufacturing luminaires specifically for sundowning. "BriteLITE 6," pictured in figure 33, is similar to a light box, but allows the user to be further from the luminaire, up to 30 inches away. This luminaire still uses 10,000 lux with a *soft white light*.

Figure 33: Philips BriteLITE 6
("Philips - BriteLITE 6," 2011).

The brochure and user instructions, which reiterate the three variables: intensity, distance from luminaire, and length of exposure, are in Appendix B. An example of how these three

variables interact is shown in table 19. It illustrate the closer the user is to the lamp, the shorter the duration of exposure required.

Table 19: Philips BriteLITE 6 Instructions

Table adapted from "Philips - BriteLITE 6," 2011.

Duration vs Distance	
Duration (min)	Distance (in)
15	13
30	20
45	30
60	40

Uplift Technologies

Uplift Technologies Inc. makes "Day-Light," "Day-Light Classic," and "Day-Light Sky" to help people with AD, and additional information about these products can also be found in the Appendix C. Uplift Technologies Inc. includes specifics of their luminaire including UV filters, downward projection of light, and glare-free diffusion screens. UV filters are important to make the light reaching the eye safe for the user's eyes and skin, and glare-free screens make the therapy session more comfortable since direct light can be harsh on the eyes and potentially cause headaches. Uplift Technologies Inc. also suggests 4,000-5,000°K lamps for therapy along with high efficiency ballasts. High efficiency ballasts do not flicker like typical fluorescent ballasts, and being situated so close to the lamp source and reducing this flicker will make the therapy session more enjoyable for the patient.

Benefits

One of the most beneficial outcomes of bright light therapy is an improved mood in patients. Kumar and Eisdorfer found moods improved and Thorp et al. documented a decrease in agitation during the week of treatment as opposed to the week after treatment. Along with fewer agitated patients, they also observed less disruptive behaviors during treatment and an increase in positive behavior.

Another benefit of bright light therapy is improved rest/activity rhythms. Thorpe et al. studied demented patients in a psychogeriatric ward where bright lights were installed in the

living rooms of several patients and using an actimetry sensor, they monitored their sleep/wake cycles. Data was collected at several different intervals: two weeks before the baseline (436 lux), three weeks after the luminaires were installed (1,136 lux), and finally four weeks after uninstalling the luminaires (372 lux). Making sure to test both before and after allows data to be verified and see any comparisons to the before behaviors, as well as how long the luminaire effects patients. The data collected showed elders with good vision had increased rest/activity rhythms, while those with impaired vision were not affected by the increased lamp levels. This could be because the lamps were not intense enough to overcome the yellowing of the eye to affect the circadian rhythm, but their findings did show those with AD and other cases of dementia had the most improvement.

Dawn Simulator

Philips sells a "Wake-Up Light" that simulates the sunrise and also affects the circadian rhythm. Although this product was designed for people with SAD, the light can also be used for phase advancing the circadian system. The "Wake-Up Light" uses an incandescent lamp, which is programmed to "gradually increase the illumination levels in the morning hours, simulating the sunrise" (Sloane, Figueiro, and Cohen 2008). The lamp levels achieved by a dawn simulator are typically less than those of a visor or light box, but they have had an impact in Longyearbyen.

Philips tested their "Wake-Up Light" in Longyearbyen, the most northern town on Earth, and boasts that 86% of the people felt a positive impact on their mood after using the luminaire, and 81% had more energy. If APs have a better mood, they are easier to care for, making the caretakers' mood better, as well. Once a caretaker's shift is over, they leave the confines of the Alzheimer's facility with a certain mood that potentially rubs off on anyone the caretaker comes in contact with. This dawn simulator had a major impact on a regular town, it is intriguing to postulate what affect this luminaire could have on an AP specifically.

Negatives / No Real Improvements

While there are several positive outcomes of light therapy, there are still potential consequences to be considered. The three most common behaviors were agitation/aggression, apathy/indifference, and nighttime behavior after being exposed to light therapy according to Dowling et al. The next most common behaviors were aberrant motor behavior, irritability, and

appetite/eating disorders; however, "there were no significant post hoc findings for appetite/eating disorders." (Eating disorders are a common symptom of APs). Caretakers might find some of these behaviors more bearable than others, like agitation and aggression, because they can try to control or teach their loved ones how to act unlike apathy which might just frustrate the caretaker.

Another study done by Kogan and Guildford also found negative aspects for both AP and caretaker. They exposed 32 subjects to 2,500 lux for two to six hours daily. Several caretakers thought it was a hassle to administer the light for such extended periods, while the low levels of light, 2,500-3,500 lux, caused headaches for APs. Headaches went away after the third day, depending on their severity; headaches could have other negative impacts on people. A headache could make the person more irritable or moody, but this study did not document any of these additional negative behaviors. Instead, they found other side effects such as strain, excessive glare, seeing spots, blurring, and irritation. Yet another side effect, nausea, was reported mostly occurring on the first day along with agitation. Hypomania was the only serious side effect, and it occurred after the fifth day.

Sloane, Figueiro, and Cohen did a study of their own and found common side effects were: eyestrain, blurred vision, seeing spots, glare, and eye burning/irritation. Most patients reporting these symptoms said they went away in a few days. Other symptoms, not eye related, were also reported: headache, nausea, dizziness, agitation, and jumpiness/jitteriness/anxiety. Most of these negative side effects occurred in light therapy treatments where the lamp is located very close to the users' eye such as a visor.

Sloane Figueiro, and Cohen conducted another random sampling of two, long-term care facilities and "identified no significant increase in the prevalence of seeing spots, problems with glare, eye burning or irritation, eye redness, jitteriness, severe agitation, skin rash on the face or arms, headache, dizziness, or nausea when bright light (2,500 lux) was compared to standard lamp (500 lux). This low level of light was the same amount used by Kogan and Guildford above.

These three separate experiments have proven there are potential negative side effects to light therapy; however, they are mostly temporary while the body adjusts. Only a few participant reported serious adverse effects. Table 20 illustrates the most common side effects when light therapy was used on people with SAD disease, and the table is still valid for APs because many

of them also have a form of depression. In addition, characteristics of SAD include daytime sleepiness, social withdrawal, and irritability, which are also found in APs. People with SAD are better able to report symptoms and be aware of other factors that might affect their bodies.

Table 20: Side Effects of Light Therapy

Table adapted from Kogan, Alan O., and Patricia M. Guildford, 1998.

Side Effects of SAD Patients Receiving 10,000 lux Light Therapy		
	Subjects with Symptom(s)	
Symptoms	N	%
Tightness in chest	1	1.4
Irritability	1	1.4
Anxiety or feeling "weird"	2	2.9
Dizziness	3	4.3
Sedation	4	5.7
Hypomania or agitation	4	5.7
Nausea or vomiting	5	7.1
Eye or vision problems	13	18.6
Heacache	15	21.4

As mentioned above, some APs also exhibit characteristics of depression. According to Sloane, Figueiro, and Cohen, hypomania, "wiredness," and agitation, along with suicidal thoughts were recorded in some patients treated for depression. Depression increases in nursing homes according to Thorpe et al., but geriatric psychiatrists find it hard to diagnosis nursing home patients. Since it is hard to diagnosis depression, it is suggested additional monitoring occur the first few days to make sure no negative effects occur.

While some research suggests there is potential for light therapy to benefit elders and their sleep, not all research has led to favorable conclusions. Sloane, Figueiro, and Cohen conducted an experiment where there was no correlation with improved dementia, depression, and the timing of light therapy. While previous research results have pointed towards the benefits of evening light, because it phase advances the circadian rhythm, these findings are not always supported.

Another study, conducted by researchers Thorpe et al., also found there were no significant effects from light treatment. They observed 14 people with dementia, behavioral, and sleep disorders, along with a control group of 10 elder participants. The experiment lasted for two months, where between 9am and 11am, participants were exposed to 3,000-5,000 lux. Sleep time, behavioral problems, and melatonin levels were recorded for both groups. Total sleep time improved, along with a reduction in daytime sleepiness, and behavior problems in the experimental group. Another benefit the test group received was lower levels of melatonin, but in general, "no significant light treatment effect was found in this study." This statement could be made due to the limited number of participants or the fact that the improvements were minor, which could be unrelated to light therapy.

Sloane, Figueiro, and Cohen have summarized addition published studies and their inconclusive conclusions. Out of seven published studies, three recorded significant improvements with light therapy, while four did not, and again, most of these studies involved very few participants, so conclusions could not be confirmed. The conclusions from four of the studies supported there was no association "with the total amount of light exposure or the timing of the therapy in the diurnal cycle." The diurnal cycle is another term describing the circadian rhythm. Interestingly, three of the four negative studies had people with dementia and all three of the positive studies had people without dementia. Dementia is hard to diagnose and measure since it varies person to person. Therefore, the conclusion from this data could be due to extraneous situations, ineffectiveness, or insensitive measurements.

Visor

The potential for headaches from wearing a light visor will be discussed in Chapter 5 - Dim Red Wavelengths, but another downside of the visor is the intensity of the light. Some people complain the visor is so close to their eyes, it is uncomfortable. In Sloane, Figueiro, and Cohen's research, even though a visor only give 3,000 lux, instead of the typical 10,000 lux from a light box, the wearer could still feel discomfort. This is because visors can reach the lower portion of the retina, which is more sensitive, and why lower illumination levels are used in visors.

Light Box

Lamp intensity does not determine if studies have no correlation between light and behaviors, because light boxes have also documented minimal changes that could be unrelated to light therapy. One study used a DayLight Technologies Day-Light Box, for one hour, everyday, during mealtime. Patients with dementia sat in front of this 10,000 lux light box while eating breakfast, and while the actual timing of the light varied, due to differing eating schedules, the light was administered in the morning Monday through Friday. The results of their experiment are in table 21.

Table 21: Positive and Disruptive Changes with Phototherapy

Table adapted from Thorpe, Lilian, Joan Middleton, Gqen Russell, and Norma Stewart, 2000, p. 179.

EBIC Positive and Disruptive Changes with Phototherapy					
	t*	Mean	Standard Deviation	Mean Change	Standard Deviation
Total Positive Behavior					
Baseline		21.1	14.7	0.0	-
Treatment		25.4	13.0	4.3	11.6
Post-treatment	1.4**	21.1	15.3	-0.03	12.1
Dissruptive Behavior					
Baseline		9.8	12.4	0.0	-
Treatment		5.9	5.8	-3.8	10.1
Post-treatment	1.7***	3.3	2.9	-6.5	12.5
*t= Ratio of the mean of the differences between each set of pairs divided by the standard effor of the differences					
*p= 0.08 on one tailed t-test					
**p= 0.05 on one tailed t-test					

A one-tail paired t-test was used to record their research because the researchers predicted the light would only have positive results. To verify the results, both pre and post therapy measurements were documented. If the results were similar, the test was effective. While the numbers in the table might seem small, they show that positive behaviors increased during treatment and disruptive behaviors lessened post-treatment. Thorpe et al. concluded these changes were minimal and not of "statistical significance," so even more intense light therapy treatments do not always have positive outcomes. For further information about this test and others Thorpe et al. conducted, please reference the Appendix D.

Bright Light

Dowling et al. would agree with the above study, because they also found that bright light therapy did not clinically affect neuropsychiatric behaviors. (Neuropsychiatric behaviors include mental disorders and diseases related to the nervous system). They compared morning bright light, afternoon bright light, and typical indoor light to the effect on the "presence, frequency, severity, and occupational disruptiveness of neuropsychiatric behaviors in nursing home residents with AD." For 10 weeks, the APs received one hour of light Monday through Friday, and the nursing home caretakers observed "significant differences between groups on agitation/aggression, depression/dysphoria, aberrant motor behavior, and appetite/eating disorders." However, the magnitude of change was small no significant conclusions could be drawn. Further experimentation is necessary to have a solid basis for conclusions.

They also found bright light did not improve agitation in people without sleep disturbances (Dowling et. al. 2007). For people without disruptive sleep patterns, therapy might not prove as beneficial as designing rooms with proper luminaire placement.

Ambient Light

Using *ambient light* for therapeutic treatment has not been discussed yet, because no positive outcomes document. Sloane, Figueiro, and Cohen have tested this possibility, but could not prove any benefits. They mention the cost of installing luminaires with such a high output would be very expensive and the intensity of the luminaire could be uncomfortable to some individuals. While skylights or LEDs with *monochromatic* blue wavelengths might reduce these problems, another difficulty in designing high levels of ambient light is to make sure it is evenly distributed throughout the room. Due to all these factors, even if this method of therapy provided the best results, the time and money involved do not make it a feasible solution for AD homes.

A larger study, conducted by Barrick et al., reiterates the ineffectiveness of ambient fright light. Their study included 66 elders from a state psychiatric hospital in North Carolina and a dementia-specific residential care facility in Oregon. The object was to test the effect of agitation due to ambient bright light therapy, and four different conditions were tested: morning bright light, evening bright light, all day bright light, and standard light. Caretakers observed the patients' behaviors and found those with mild/moderate dementia were more agitated with bright light administered at any time of day, compared to standard light. Patients with more severe

dementia were more agitated with morning light than standard light as well, and morning and evening light caused more agitation in North Carolina compared to all day light in Oregon. Even though the states had unique outcomes, both locations came to the same conclusion that ambient bright light was not effective in reducing agitation in dementia patients. They even went so far to say ambient bright light might actually make agitation worse.

Increased agitation could be an outcome of bright light therapy used in AD homes with tile flooring. The maintenance man at an AD facility mentioned bright lights can make the floors seem wet because they are extra shiny, so APs walk around the "puddles" or avoid the area completely because they are afraid of falling. APs could become agitated or frustrated if they cannot walk around the puddle and the puddle is always present. Additionally, shiny floors could potentially desensitize APs to actual wet floors, which could in turn cause falls. In order to avoid these problems, if bright ambient lights are use, carpeted flooring is encouraged.

Chapter 5 - Blue, White and Red Wavelengths

Lamps can emit different wavelengths, which correlate to colors, and different colors affect AD behaviors. CFLs come in both warm and cool lamp options, and some people have a strong preference. Knowing what wavelength emits a specific color, which can also promote a certain type of atmosphere, is important when AD homes select lamps.

Referring to figure 34, colors and wavelengths are relative to each other, and one can see red wavelengths have a longer wavelength, about 700nm, while blue wavelengths are shorter, around 400-500nm. The visual system is activated at 555nm, while the peak sensitivity of the circadian rhythm is between 420nm and 480nm. Although this may not seem like a big difference, figure 34shows the colors of the rainbow only vary between 700nm and 400nm.

Figure 4. Spectral power distributions of several types of LEDs.

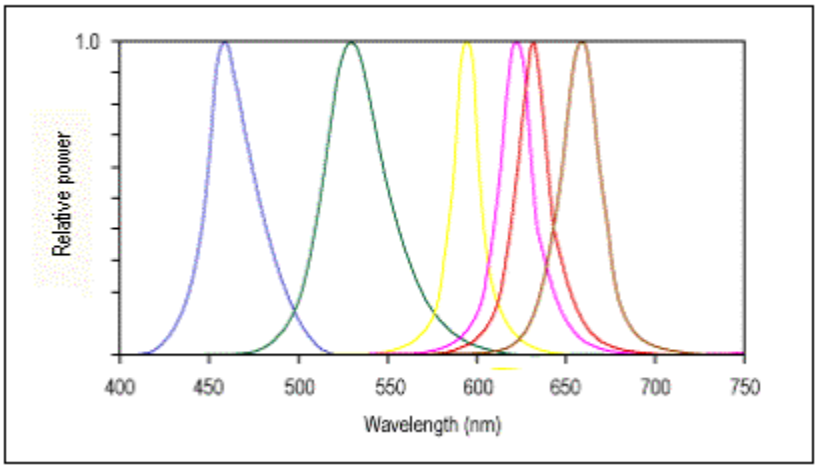


Figure 34: LED Spectral Power Distribution Curve

Reproduced with permission from Mary Cimo on behalf of John Bullough, 2003.

There is some difference of opinion whether red or blue wavelengths are best for light therapy and some of this discrepancy stems from when the light is administered, be that in the morning or evening. The results are inconclusive, so potentially either time of day could be beneficial. Figueiro found that 67% of APs were asleep at 10pm after blue wavelength exposure (see figure 35), while 54% were asleep after red wavelength exposure ("The Bright Side" 2005).

There was no documentation if the patients' sleep was less restless or even how long they slept, but it is certain that the circadian system is more easily activated by shorter wavelengths than longer ones. Figueiro also noted APs slept better between 12am and 4am after blue light exposure than red light, so based on this data, blue wavelength therapy administered closer to bedtime could assist both the AP and the caregiver get a better nights rest.

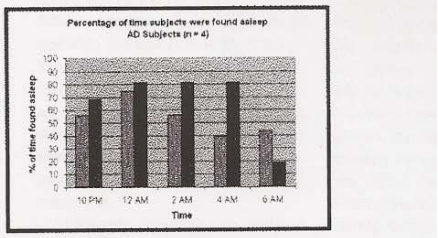


Figure 1A: Percentage of time the AD subjects were found asleep following either red or blue light exposures (approximately 30 photopic lux at the eye). Subjects consistently slept better between midnight and 4:00 am following blue-light exposure than after red-light exposure.[3]

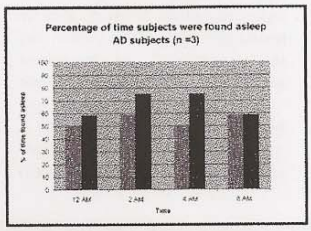


Figure 1B: Percentage of time the AD subjects were found asleep following either red or blue light exposures (30 photopic lux at the eye). Subjects consistently slept better between midnight and 4:00 am following blue-light exposure than after red-light exposure. Note: one AD resident was not able to complete the study for medical reasons.

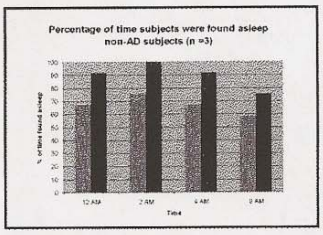


Figure 1C: Percentage of time the non-AD subjects were found asleep following either red or blue light exposures (30 photopic lux at the eye). Subjects consistently slept better between midnight and 6:00 am following blue-light exposure than after red-light exposure. Note: one non-AD resident was not able to complete the study for medical reasons.

Figure 35: Red vs. Blue Wavelength Exposure Before Bed

Reproduced with permission from Mariana G. Figueiro ("The Bright Side of Blue Light," *LD+A* May, 2005, p. 16-18).

Blue wavelengths have not been universally agreed upon as the best wavelength for therapy. Figure 36 shows how daylight is the ideal source for light therapy since it has broadband light covering the *full-spectrum* of wavelengths, almost uniformly. Incandescent lamps tend to

stay on the warmer side of the spectrum, while T12 fluorescents have cooler properties. The cool T12 has a shorter wavelength (like blue light), whereas the warmer incandescent wavelength is longer (like red light). Many people find it advantageous to install full-spectrum luminaires in their facilities, because it increases happiness and decreases headaches among employees.

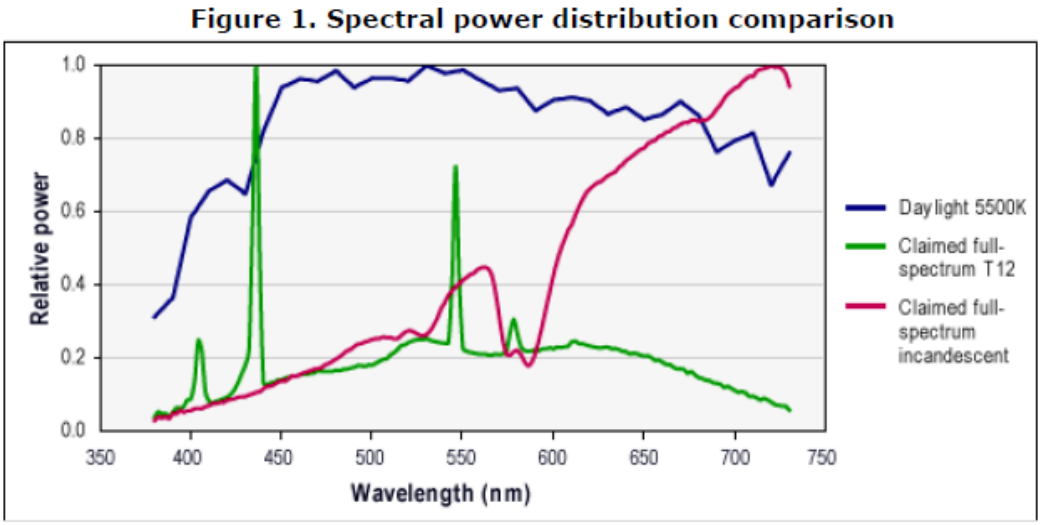


Figure 36: Spectral Power Distribution Curve Comparison

Reproduced with permission from Mary Cimo on behalf of Lei Deng, and Robert Wolsey, 2005.

Viewing the *color correlated temperature (CCT)* graph of different lamps can help associate wavelengths with a particular color, so graphic 37 compares multiple different lamp types. The peaks in the CCT scale represent colors the type of lamp can really enhance, while slumps in the scale are colors the lamp is unable to enhance.

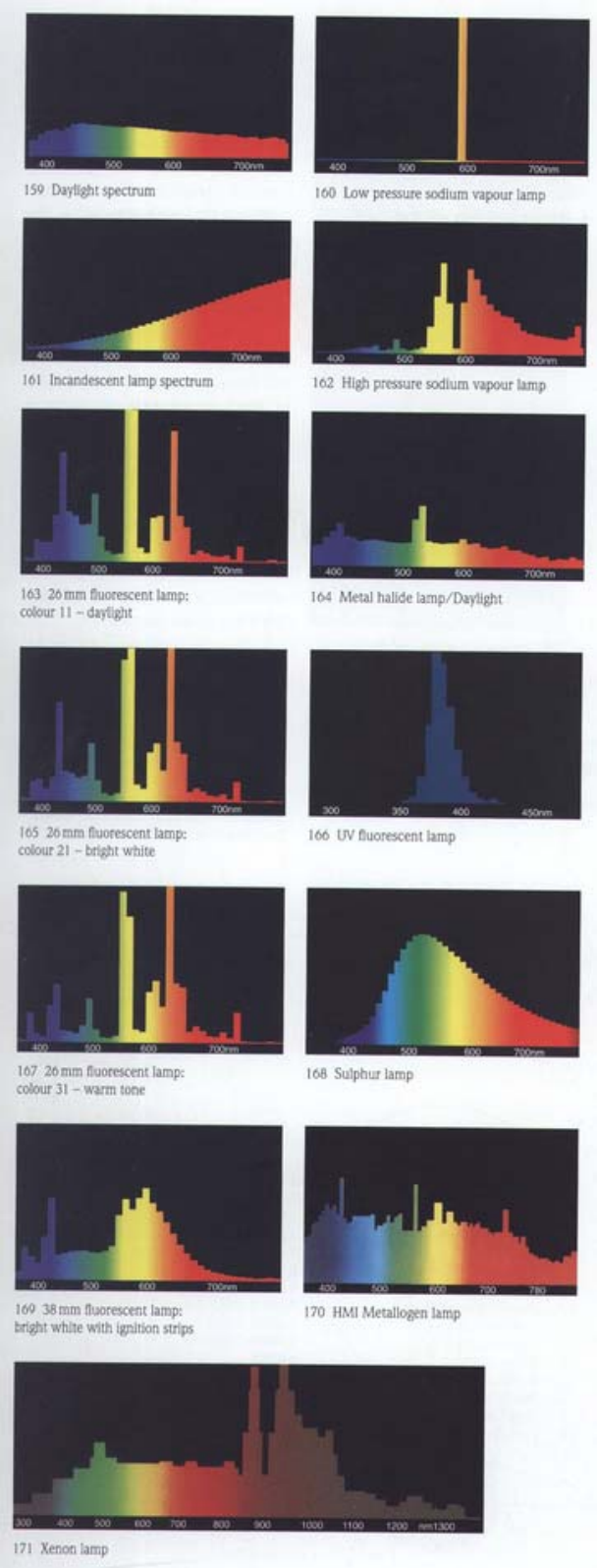


Figure 37: CCT Lamp Scale

(Keller, Max, 1999, p. 78).

It has been noted that colored wavelengths affect sleep; however, this report is not interested so much in how it works or why, but in the fact that if APs can successfully sleep through the night, they will be better rested. This means their caretaker will also receive a better night's sleep, leaving both parties in a better mood. The AP might also have more energy to interact with other residents or just act more like themselves; the person their family used to know.

Blue Wavelength

Different colors of light affect sleep, but the exact wavelength that affects the circadian system is still debatable. Some researchers believe blue wavelengths, between 420-440nm, have more of an effect on the circadian system, while other researchers have reported that 470-485nm are more effective. Although these ranges differ, they are both still in the green/blue color spectrum. The lens on their eye becoming yellowed causes the increased sensitivity to blue wavelengths in elders ("The Aging Eye 1995-2011).

Blue wavelengths are found in almost all lamps, and to get rid of them a special filter must be applied to the luminaire. Sometimes blue wavelengths are desired; however, they are also potentially harmful to the eye. Filtering some of the blue wavelengths might be the desired balance to only have positive benefits.

Conclusions from research can only be implemented if caretakers find the therapy easy to administer and lamps are comfortable for APs and affordable for the facility. For example, Figueiro, Rea, and Eggleston found people do not like blue LEDs when other room luminaires are on. While most research and conclusions favor using blue wavelengths to help people with AD, more research is needed. This additional research needs to include a larger AD population.

Benefits

One team of researchers, Nowak and Davis, found 450-500nm wavelengths have the greatest impact on the circadian rhythm, and ANSI/IESNA also with this wavelength. Nowak and Davis were trying to phase advance patients sleep habits to "increase sleep efficiency, decrease levels of sleep fragmentation, decreases levels of excessive daytime sleepiness, and improve global function." ANSI/IESNA reported exposing APs to 30 lux of blue wavelength (470nm) in the evening, for two hours, consolidated rest/activity rhythms and increased sleep

efficiency. Not only does a good night's sleep typically put a person in a better mood, it also keeps them awake and functioning throughout the day. APs can be found sleeping in any position at any time of day in retirement facilities, which makes it difficult to stimulate their minds and keep them healthy. Daytime alertness lasted four to six weeks after the study ended as well, but the study did not say if they completely reverted after four to six weeks or if they were not as alert.

In addition to Nowak and Davis finding APs slept less through the day, they also showed improved recognition and recollection, which helped recapture their personalities. Improved recognition is a desired trait for APs, because when a family member walks into the room and their loved one knows their name, it makes that family member's day. This duo also documented APs seemed to regain some of their personality, interact more with their environment, have improved motor skills, and an improved moods after exposure to blue wavelengths. They even found one AP being less resistive to care. There was no information on the duration or intensity of lamp exposure in this research; however, they found two hours of morning light at 3,000 lux for 4-27 weeks had significant improvements to APs.

Light Boxes and Visors

Relating to the different methods of distributing bright light therapy (see Chapter 6 - LEDs), light boxes, visors, lamps, etc., typically use full-spectrum lamps, but recently, some products have been manufactured to use monochromatic light with blue LEDs. Since blue wavelengths are "close to the maximum sensitivity of the circadian system, much lower illumination levels can be used" (Sloane, Figueiro, and Cohen 2008). Therefore, light boxes using this technology can distribute 400 lux at the cornea, while light visors using the blue/green LED can provide 500-12,000 lux to the patient.

Glasses Provide Mixed Results

Lighting Research Center researchers, Figueiro et al., conducted their own experiment that consisted of 11 participants between the ages of 51 and 80 years old who were exposed to 90 minutes of light. Each volunteer wore glasses (see figure 38) that administered two levels, 50 lux and 10 lux, of blue wavelengths on two different nights. After one hour of exposure, the personal light glasses were able to suppress melatonin 35% with the low lamp level and 60%

with 50 lux. Additionally, the more intense blue wavelengths suppressed melatonin quicker and were maintained one hour after the glasses were removed.

Figure 38: Personal Administering Glasses

Reprinted with permission from Mariana G. Figueiro (Figueiro, Marianna, Andrew Bierman, John Bullough, and Mark Rea.

Another study conducted by Sloane, Figueiro, and Cohen, showed that more light also yielded positive results. Of the 19 volunteers they recruited, 7 of 9 (78%) who received over 6,000 lux had positive results. When lower levels of light were administered, only 5 of 10 (50%) had positive results.

This method of splitting a group in two smaller groups is different from the experiment above dealing with the glasses, but both have potential errors. Having all the participants receive both levels of light could result in improved benefits during the second light administration due to "leftover" benefits from the first light. If the group is split, there is no control group to compare the results. Light affects people differently, and outlying variables could factor into the experiment.

White Wavelengths

White wavelengths have blue wavelengths in them, so it is recommended that lamps with bright white wavelengths be installed in AD homes because this way APs will receive the both the benefits of the blue wavelengths and bright light. If energy codes prevent these intense

luminaires from being installed, portable blue wavelengths are a good supplement. White wavelengths administered in the morning or evening have similar effects of blue wavelengths, meaning they can improve sleep, increase awareness during the day, reduce evening agitation, and "consolidate rest/activity patterns of people with AD ("The Bright Side of Blue Light." *LD+A* 2005)." These finding, on the benefits of white wavelengths, have been published since 1992, and the recommended amount of white wavelengths administered to get these results is 1,000 lux at the eye.

Whole Health MD reports white wavelengths have benefits beyond those associated with blue wavelengths, like increased serotonin levels, which is also known as the "happiness hormone." Happy patients are typically more pleasant to not only work with, but simply more enjoyable for friends, family, and caretakers to be around. Sometimes happiness can even rub off onto others. Loved ones are more apt to visit their family member with AD if they are pleasant to be around, and this increased frequency of visits can help APs remember the names and faces of relatives. Increased interaction with their families can help decrease confusion when grandchildren grow up and physically change. Interacting with their grandchildren at a young age and then seeing them again five years later is large span of time where many physical attributes might change. Processing these changes and recognizing them is hard for anyone.

Another reputable health website, the Mayo Clinic, also agrees white wavelengths are better, and this why light boxes typically contain white wavelengths. Light boxes have and have proven the benefits of light boxes with seasonal affective disorder (SAD) people. The Mayo Clinic also advises against using blue wavelengths due to the increased potential of blue wavelengths damaging the eye. An easy solution is not to look directly at the lamp, but this "simple solution" might not be as simple as one might anticipate working with APs. Making sure their eyes are open is a challenge and another challenge is trying to have them not look directly at the lamp. Most likely, they do not understand the lamp is bad for them and the caretakers of an AD wing do not have enough employees to sit with individual APs as they receive light therapy.

If caretakers can overcome challenges associated with APs looking at the lamps, Bright Light Therapy with Day-Light recommends 10,000 lux of white wavelength over colored wavelengths, saying blue wavelengths might damage the user’s eyes. They also state there are no known benefits of blue wavelengths that white wavelengths do not also provide; however, benefits of white wavelengths are not stated nor the purpose of their tests. Blue wavelengths have

proven to decrease aggressive APs, helping them sleep better through the night, and other invaluable benefits to APs and caretakers.

Dim Red Wavelengths

If blue wavelengths stimulate the circadian rhythm, then why are dim red wavelengths, still on the market? Nowak, LuAnn, and Davis found dim red wavelengths make patients calmer and less resistive to care. Dim red wavelengths administered through a light visor had the same effect as bright light in a light box for people with SAD.

In a separate study done by Figueiro, she found red wavelengths, particularly at night, stimulated the brain, improved cognitive performance and alertness ("Research Recap." *LD+A* 2003). Therefore, red wavelengths could be beneficial to use in the morning to assist patients in waking up and functioning.

While some studies have proven dim red wavelengths beneficial, it might not come highly recommended. While using dim red wavelengths at night to calm APs prior to bed agrees with earlier research that recommended patterns of light/dark, this information could make one wonder if the red wavelengths or the dimness of the lamp is providing the behavioral benefits. Nowak, LuAnn, and Davis were also aware behavior improvements might not have been from the light but from pressure points. APs might have been calmer when wearing a light visor due to the pressure points around the head where the visor could have been pressing. Additional, there is a warning accompanying the use of red wavelengths from Epidemiologists who hypothesize that any light at night might increase certain types of cancer ("Research Recap." *LD+A* 2003). Dim red wavelengths require more research to prove their benefits.

White Wavelengths with A "Bluish" Tint

Sloane, Figueiro, and Cohen offer a solution that combines both white and blue wavelengths. They suggest AD homes have white lamps with a "bluish" tint, delivering 1,000 lux to the eye. A fluorescent lamp with 7,500°K will suffice, and if this lamp intensity is uncomfortable for the patient, a less intense lamp can be used, but the duration of exposure might have to be extended for the same effect. Figure 39 shows a fluorescent lamp is preferred for light therapy due to the peak wavelengths falling in the green and blue range.

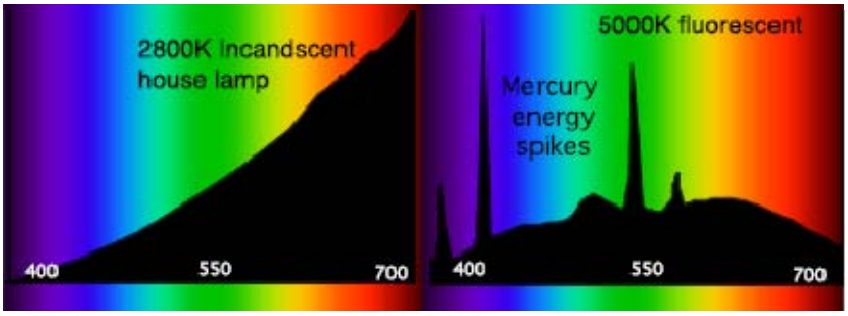


Figure 39: Incandescent and Fluorescent Lamp Output

The fluorescent lamp has four to five peaks, all occurring in the cooler color temperature range (green-purple), whereas the incandescent slowly ascends to its highest level in the red zone. These colors correlate to wavelengths in the background of the figure. Shorter wavelengths are towards the left, blue side, and longer wavelengths toward the right. The spikes in different wavelengths also vary with the CCT.

Some argue that incandescent lamps have a smooth, continuous light distribution similar to daylight, which is the ideal source for light therapy. Morning light would be classified as warm because it is less than 4,000°K. However, typically daylight has a cooler CCT than incandescent lamps; thus, fluorescent lamps are more suited for light therapy. Below, figure 40, is a daylight scale detailing CCTs compared to different times of the day.

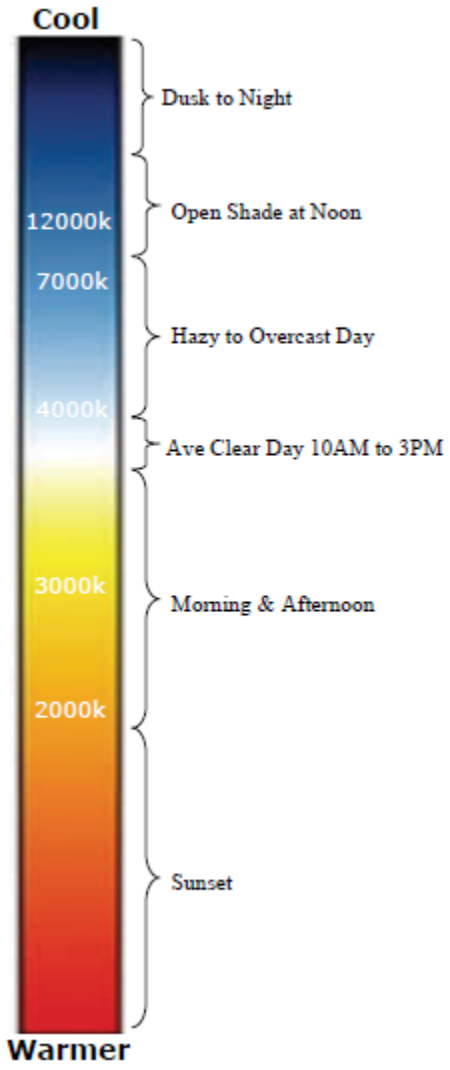


Figure 40: Daylight CCT Scale

Reproduced with permission from LED Industries ("Understanding Color").

Chapter 6 - LEDs

LEDs are the latest technology when it comes to colored lamps because they can come in many specific colors as seen in Christmas lights. Currently, there are two different methods of creating *white light* with LEDs: mixed color and phosphor-converted (see figure 41). While there are two different ways to create white wavelength, they have the same effect in light therapy patients. Red, white, and blue LEDs mirror the results found from fluorescent lamps.

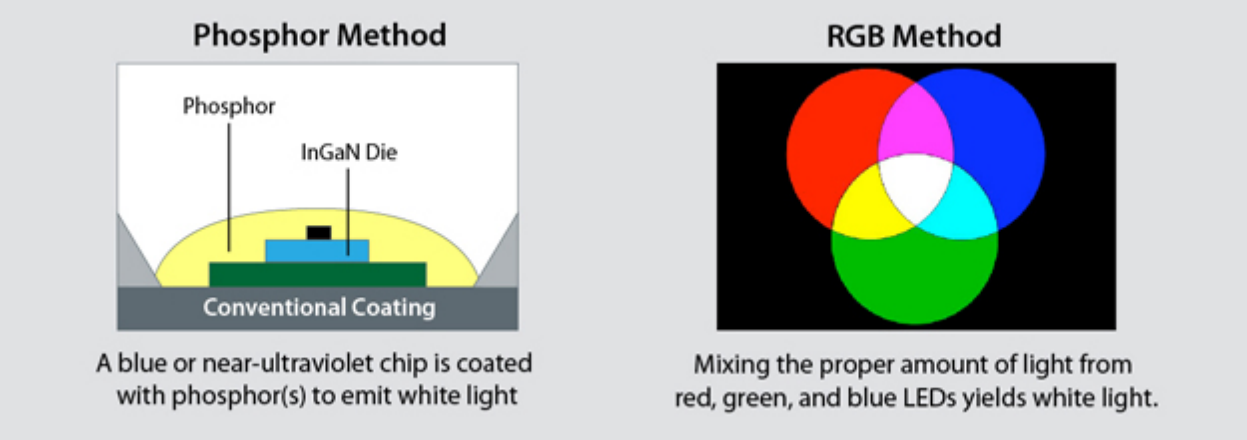


Figure 41: Phosphor and RGB LED Methods

There is also discussion about lamp types used for therapy, especially with the introduction of LEDs. *Full-spectrum lighting* used to be thought of as the best and was primarily used in therapy; however, more recently, LEDs emitting *monochromatic light* are being used. Being monochromatic allows these LEDS to peak at different levels/colors. Some use blue LEDs, peaking at 470nm, while others use blue/green LEDs, peaking at 500 nm. Reference figure 42 and figure 2 in Chapter 2 - Lamp Types for a better understanding of the full electromagnetic spectrum and the color difference between blue and blue/green wavelengths in the following graphic.

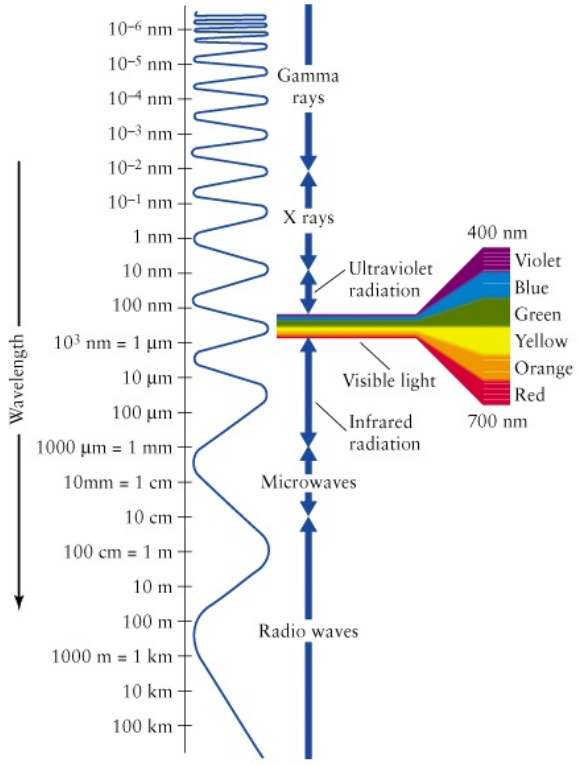


Figure 42: Electromagnetic Spectrum

White LEDs

Mixed white wavelengths are created by combining several colored LEDs, similar to how white wavelengths have been created in the past in the theater. This method entails mixing red, green, and blue wavelengths from tri-phosphor fluorescent lamps to make white wavelengths, and the other method is using a phosphor-converted LED. When a yellow phosphor has blue wavelengths pass through it, it gives off yellow light. This yellow light has a "fairly broad spectral power distribution" according to Bullough. By using the phosphor of a blue LED, "some of the blue wavelength will be converted to yellow light by the phosphor. The remaining blue wavelength, when mixed with the yellow light, results in white wavelength." This technology is still being improved to make higher saturated colors.

Newer technology has made it possible to vary the red and blue wavelengths to produce higher intensity outputs between 600-650nm, as seen in figure 43, which could increase the impact of blue wavelength therapy.

Figure 5. Spectral power distributions of early phosphor-based white LEDs (left), and white LEDs using more recently developed phosphors (right) with increased output between 600 and 650 nanometers.

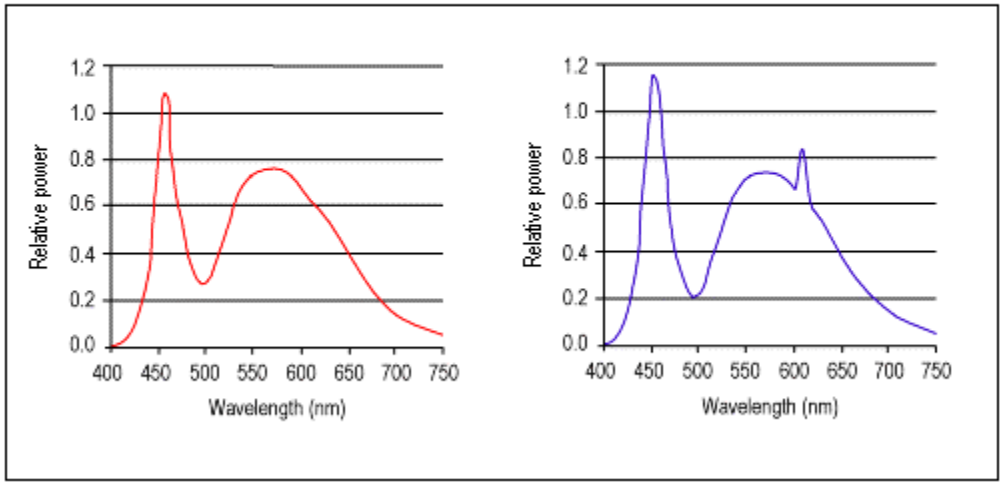


Figure 43: Red and Blue LED Wavelengths

Reproduced with permission from Mary Cimo on behalf of John Bullough, 2003.

The figure above achieved higher intensities using phosphor-converted LEDs, but this method of creating *white light* has some disadvantages (as does mixed LEDs). Tables 22 and 23 provide more details on the advantages and disadvantages of phosphor LEDs compared to traditional mixed color LEDs. For example, mixed color LEDs have been on the market longer so they can achieve any color desired, but they are harder to dim, and from Chapter 3 - Lamps, Fixtures, and Locations, diming is important to facilities to conserve energy. The other option is phosphor-converted LEDs, which look like white light, but have a lower *luminous efficacy*. If used at full power, phosphor-converted LEDs consume more energy, but provide more full-spectrum lighting. Phosphor-converted LEDs are improving, so eventually one diode will be able to emit any color of light instead of having to mix three different LEDs together, taking up more space in a luminaire.

Table 22: Advantages and Disadvantages of White LEDs

Table adapted from Bullough, John., 2003, p. 1-23.

Mixed-Color White LEDs vs Phosphor-Converted White LEDs		
Type	**Advantages**	**Disadvantages**
Mixed-Color	Higher overall luminous efficacy	Difficult to completely mix light
	Good color rendering properties	Difficult to maintain color stability over life and at different operating conditions, including dimming
	Complete flexibilty for achieving any desired color property	
Phosphor-Converted	Results in a single, compact, white light source	Lower overall luminous efficacy
		Uniform application of phosphor in manufacturing process is more difficult to control
		Limited range of available color properties based on phosphor availability

Table 23: Advantages and Disadvantages of White LEDs 2

Table adapted from "Color Quality of White LEDs," 2008.

Advantages and Disadvantages of LEDs		
Technology	**Advantages**	**Disadvantages**
RBG	Color flexibility, both in multicolor displays and different shades of white	Individual colored LEDs respond differently to drive current, operating temperature, dimming, and operating time
		Controls needed for color consistancy add expense
		Often have low CRI score, in spite of good color rendering
Phosphor Conversion	Most mature technology	High CCT (cool/blue/appearance)
	High-volume manufacturing processes	Warmer CCT may be less available or more expensive
	Relatively high luminous flux	May have color variability in beam
	Relatively high efficacy	
	Comparatively lower cost	

Full-spectrum

One of the advantages of phosphor-converted LEDs, is they emit more full-spectrum light, but what is full-spectrum. The definition of full-spectrum lighting is not technical, meaning it cannot be measured (Full-spectrum Light). If measurements cannot be documented, then no scientific data can be collected proving one lamp or LED is better or worse than monochromatic light. Full-spectrum Light cites the National Research Council of Canada Institute for Research in Construction (NRC-IRC), a Canadian government research and development agency, not finding any benefits in performance, mood, or health, of full-spectrum lighting. They define full-spectrum light as about 5,000°K with a CRI of at least 90. These qualifiers defend labeling the lamps in table 24 as full-spectrum lamps.

Marketing

Several lamps are being marketed as full-spectrum. Table 24 compares the CCT, CRI, and full-spectrum index (FSI).

Table 24: Full-spectrum Lamp Comparisons

Table adapted from Lei Deng, and Robert Wolsey, 2005.

Performance Characteristics of Popular Light Sources				
Light	CCT	CRI	FSI	Efficacy (lm/W)
Equal Energy Spectrum	5457	95	0	N/A
Daylight				
5,500°K	5500	100	0.35	N/A
11,000°K	11000	100	2	N/A
Xenon				
1,000°K	5900	96	1.2	22
Incandescent				
60-100W A-lamp	2800	100	5.3	17
60W GE Reveal A-lamp	2789	78	5.6	11
LED				
White	5000	78	5.2	13
RGB (615nm/525nm/470nm)*	4400	56	9.8	22
RGB (640nm/525nm/470nm)*	4200	26	8.2	22
CFL				
15-20W (2,700°K-3,000°K)	2800	82	11	61**
15-20W 5,000°K	5000	85	5.9	47**
15W Verilux CFS15VLX	5777	78	5.6	60**
T8 Fluorescent				
32W (3,500°K)	3300	84	8.3	92
32W (5,000°K)	4800	87	6.4	88
32W Lumiram Lumichrome 1XX	5960	93	4.7	73
32W Verilux F32T8VLX	6369	85	6.2	88
T12 Fluorescent				
40W (5,000°K)	4900	91	1.8	56
40W Duro-Test Daylight 65	6588	93	1.8	53
40W Duro-Test Vita-Lite 5500	5159	88	1.4	55
40W Lumiram Lumichrome 1XC	5207	92	1.6	59
40W Verilux F40T12VLX	5833	94	1.4	53
Metal Halide				
320-400W (Warm)	3600	68	5	92
175-400W (Cool)	4300	61	4.3	90
Ceramic Metal Halide				
35-60W (Warm	2900	84	6.5	79
100W (Warm)	3100	81	5.1	93
100-150W (Cool)	4100	93	1.5	90
Mercury Vapor				
175-400W (Coated lamp)	3900	43	5.5	54
100-150 (Clear lamp)	5900	15	9.6	53
HPS				
200-400W	2000	12	22	120
LPS				
180W	1800	0	52	180

Red text indicates claims of full-spectrum by their manufacturers. CCT, CRI, and FSI values for these light sources were calculated from SPD measurements performed at the Lighting Research Center; efficacy values were calculated from manufacturers' data.

*The values in parentheses represent the peak outputs of the respective red, green, and blue LEDs mixed to create this light source.

**Efficacy Values for CFLs include losses from integral ballasts.

As seen from the table above, the full-spectrum lamps typically have a higher CCT (cooler lamps), average or lower efficiency, and sufficient CRI ratings. Some lamps not being marketed as full-spectrum could be marketed as such because they have higher FSI values than others being marketed as full-spectrum. The table shows lamps being marketed as full-spectrum are equivalent in CRI, FSI, and efficiency, to regular lamps, so AD homes should be aware this label does not mean this lamp is better than another lamp of similar stature. Full-spectrum Light cites the National Lighting Product Information Program (NLPIP) when quoting "full-spectrum light does not provide any improved benefits over similar light systems." They do not mention what "similar light systems" are in particular, but consistent with other findings, more research needs to be done in this area to obtain conclusive results.

The products above can be marketed as full-spectrum, because it is not a technical term, according to Full-spectrum Light, but a marketing tool. The term is used to compare a lamp to daylight purely from a marketing perspective, so consumers must be aware the lamp does not actually emulate daylight. Some lamps are more accurate than others, but their *spectral power distribution curves* are not consistent throughout. Some might have peaks in various wavelength regions, which does not emulate the spectral power distribution curve of daylight.

Benefits

A test by Deng and Wolsey proved the benefits of full-spectrum LEDs, especially related to AD benefits like mood and mental awareness, and their results are depicted in figure 44. It is interesting Deng and Wolsey do not think full-spectrum light offers any benefits to sleep quality; however, they have documented white wavelengths are beneficial to improving moods, mental awareness, productivity, and helping those with SAD. Improving any or all of these for APs would be beneficial to their loved ones because these improvements would make APs seem more like themselves.

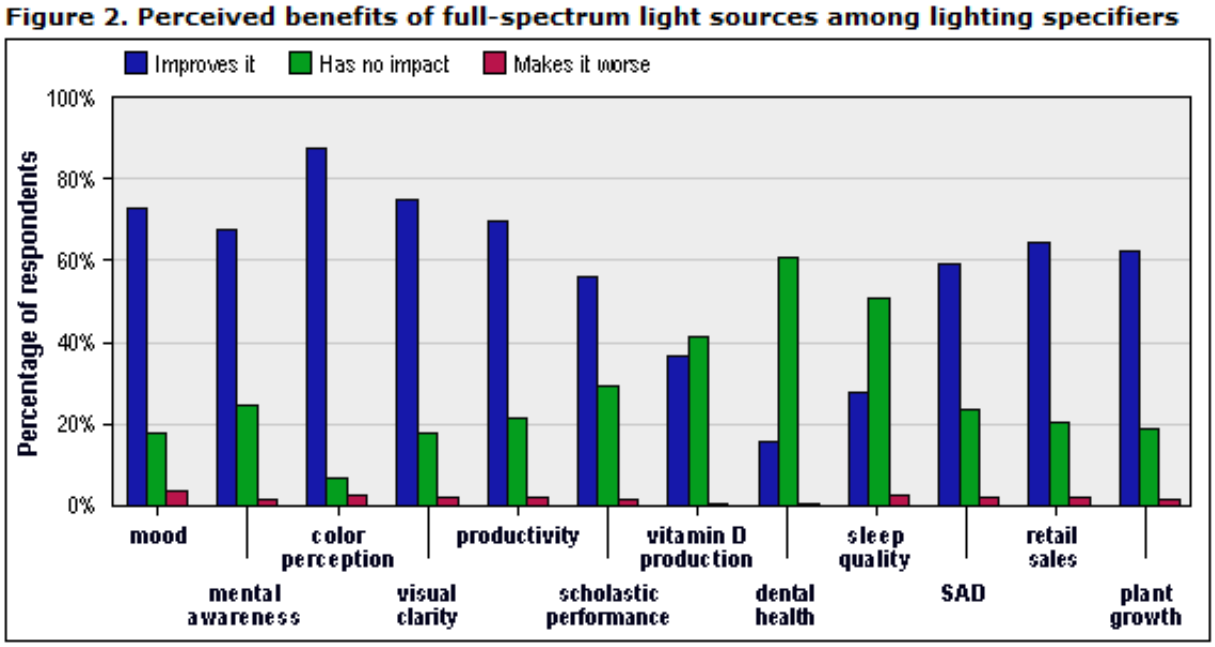


Figure 44: Benefits of Full-spectrum Light

Reproduced with permission from Mary Cimo on behalf of Lei Deng and Robert Wolsey, 2005.

Daylight

The best way to receive full-spectrum light is by going outdoors, because daylight is 10,000 lux, which is about 15 times brighter than normal home or office illumination levels. Going outside daily for at least 30 minutes is the most ideal situation, and even on a cloudy day, he sun provides adequate full-spectrum lighting (see Chapter 8 for further information).

Colored LEDs

Colored LEDs are another option when designing luminaire layouts or purchasing lamps for light therapy. New technology has brought LEDs into the architectural engineering industry because they are energy efficient, and more efficient lamps means the facility saves money on electric bills. (See figure 45). The lumen maintenance curve shows that high-power white LEDs continue to emit a higher percentage of light than T8s or T12s, which makes these LEDs competitive with T5 lamps.

Figure 11. Lumen maintenance curves for different light sources out to 10,000 hours.

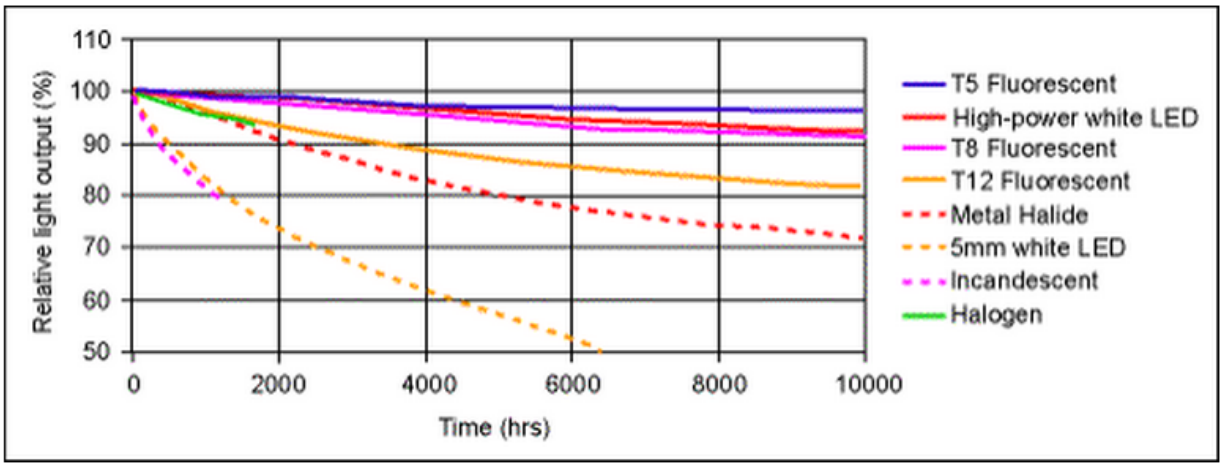


Figure 45: Luminaire Maintenance Curves

Reproduced with permission from Mary Cimo on behalf of John Bullough, 2003.

Another way LEDs compete with T5s deals with wavelengths. Red and blue LEDs can emit more red or blue wavelengths to emulate warm or cool fluorescent lamps. Figure 34 in Chapter 5 depicts the wavelengths of LEDs specifically. Blue and green lamps peak at distinctly different wavelengths, which is why their effects on light therapy are different from red wavelength therapy.

Table 25 answers why LEDs are not always implemented in facilities, because the table provides two pieces of information dealing with blue versus white LEDs and lumen output. First, researchers might recommend white LEDs (broadband light) over blue LEDs because white wavelengths emit more lumens than blue or red wavelengths, meaning it could take less time for the same effect. Second, it illustrates why LEDs are not quickly replacing typical lamps. LEDs do not always produce enough lumens. Many facilities require at least 30 fc for ambient lighting, in which case, none of these LEDs necessarily meet this requirement.

Table 25: LED Colored Lumen Outputs

Table adapted from Bullough, John, 2003, p. 1-23.

Color Lumens	
Color	**Light Output (lm)**
White	18-87
Red	25-55
Yellow	20-69
Green	25-120
Blue	7-30

There is another factor that deters LEDs from entering the market with full force, deciding which LED color, based on cost, should be installed. The first question most individuals or care facilities will have when presented with distributing light therapy to their loved ones, is how much will it cost? There are not only the initial cost and maintenance costs, but also the life cycle cost, how long the lamp will last before it needs to be replaced. While the table above recommends white wavelengths, figure 46 shows white wavelengths fades quicker than colored wavelengths, thus needing to be replaced more.

Figure 12. Lumen maintenance of several colors of indicator-type LEDs as a function of operating time.

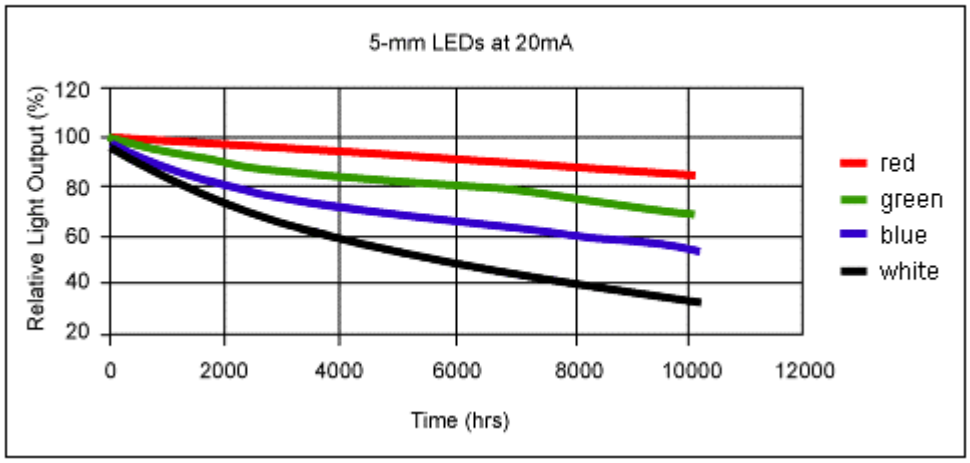


Figure 46: Correlation between LED Output and Maintenance

Reproduced with permission from Mary Cimo on behalf of John Bullough, 2003.

Chapter 7 - Related Studies

Additional tests have been conducted beyond the ones already mentioned, and this section is a compilation of those tests. Most have been conducted in laboratory settings with a small number of participants. The application and results of light therapy in the real world is less consistent than when conducted in a controlled environment (Sloane, Figueiro, and Cohen 2008).

Red and Blue Wavelengths

A very detailed experiment was documented by Figueiro, Rea, and Eggleston, whose research group was composed of four volunteers with AD whose symptoms ranged from very mild to severe.

"Patients followed their normal routine except they were brought to a common room for 2 hours between 6:00 pm and 8:00 pm. This 2-hour period was just prior to the time they were normally taken to their rooms to sleep for the night. The room was illuminated to approximately 300 lux on the table by ceiling fixtures containing fluorescent lamps. After 2 weeks of acclimation to the 2-hour sessions, patients were exposed to tabletop light fixtures containing red LEDs each evening for 10 days. These light fixtures produced approximately 30 lux at the cornea of the patients, but this illuminance could not be rigidly controlled due to random sleep periods, agitation, and absence from the room due to other unrelated, clinical conditions. The red-light exposure condition was introduced as a control because red wavelength at this illuminance should not be effective in activating the circadian system. The red-light exposure was followed by 10 days of blue-light exposure, again producing approximately 30 lux at the cornea of the patients from a tabletop light fixture. It was expected that this condition would be effective for activating the circadian system. The last 10 days was another control condition where the patients went back to their daily routine and data were collected after 6 days. Like the red-light exposure, this condition was not expected to be effective in activating the circadian system. These expectations concerning the different light exposures were based on calculations using the spectral sensitivity of the circadian system and the dose response curve for melatonin suppression at night."

Figure 47 illustrate the set up and results obtained from the above experiment. Four APs are sitting at a table receiving the light treatment in the first graphic and the photo on the fight is a closer look at the actual lamp apparatus.

Figures 1A and 1B. Experimental design and apparatus.

Figure 47: Lamp Set Up

Reprinted with permission from Mariana G. Figueiro (Mariana, Figueiro G., Mark S. Rea, and Gregory Eggleston).

Body temperate can be related to the circadian system and rest/activity patterns as seen in figure 48 where red wavelengths decreased the four APs body temperature. Lower internal body temperatures aide sleep, so this study promotes administering red wavelengths to APs before bed to help them get a full night's rest.

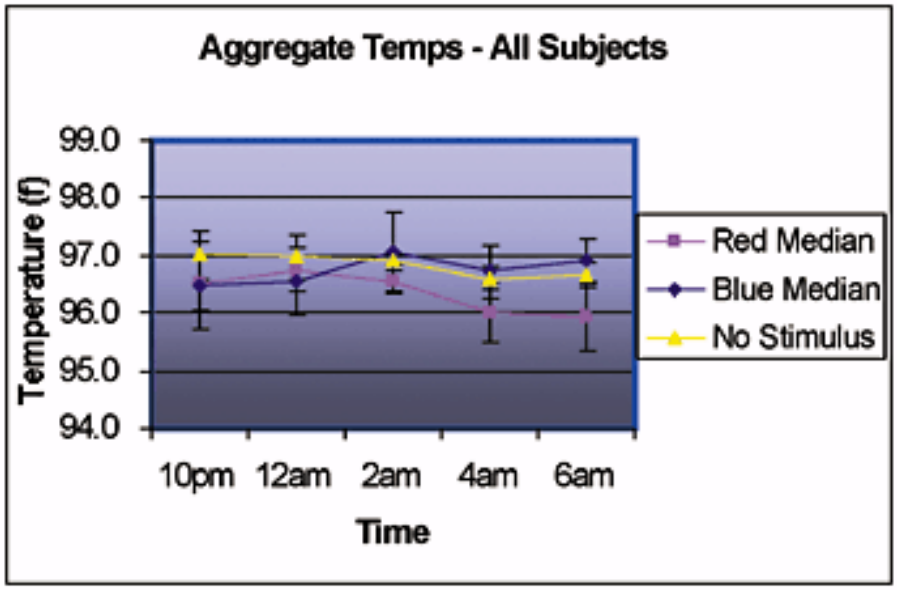


Figure 48: Aggregate Body Temperatures

Reprinted with permission from Mariana G. Figueiro (Mariana, Figueiro G., Mark S. Rea, and Gregory Eggleston).

Table 26 has ratios for two subjects and their exposure to both red and blue LEDs. A higher ratio signifies the patient had more activity during the day and less at night, which means their overall sleep/wake cycle was consolidated and more adjusted to the 24-hour clock. The cosine peak row recorded the time of day APs had the most amount of activity, and these times can be referenced with the figure 85 in Appendix I - Circadian Rhythm System. Blue LEDs proved to affect the circadian rhythm more than red LEDs, based on this research.

Table 26: Light to Dark Activity Ratios

Table adapted from Mariana, Figueiro G., Mark S. Rea, and Gregory Eggleston.

Light to Dark Ratios				
	Subject 1 Blue LED	**Subject 2 Blue LED**	**Subject 1 Red LED**	**Subject 2 Red LED**
Light/Dark Ratio	2.24	1.2	2.13	0.99
Cosine Peak	11:40	11:40	12:20	4:00

Light period from 6:00 to 20:00 hours and dark period from 20:00 to 6:00 hours. A higher ratio indicates relatively more activity during the day than during the night and better consolidation of rest/activity rhythms. Cosine peak time is the estimated time for peak activity during the 24 hour day.

The time of night determined which colored wavelength had a larger affect. Based on figure 49, the only time red wavelengths benefited sleep was 6am. If patients went to bed at 9pm or 10pm, they would receive the recommended eight hours of sleep. Continuing to sleep after 6am might interfere with breakfast and other planned activities, so while red light may seem beneficial at 6am, it really might inhibit APs from participating in social activities. Blue wavelengths are more beneficial because the most important time of night for APs to sleep is between 2am to 4am, since this means the caretaker can also sleep during this time. When APS cannot sleep, caretakers must assist the patient and then help them to go back to bed.

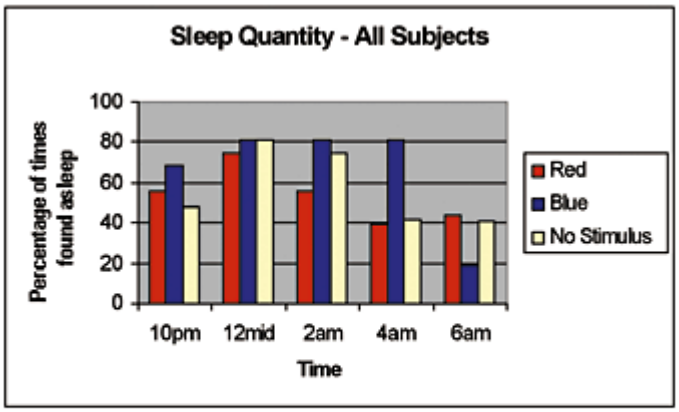


Figure 3. Sleep quantity for all subjects. Subjects slept better between 2:00 am and 4:00 am after blue-light exposure compared to red-light exposure.

Figure 49: Red and Blue LEDs Effect on Sleep

Reprinted with permission from Mariana G. Figueiro (Mariana, Figueiro G., Mark S. Rea, and Gregory Eggleston).

Low Illumination levels Can Affect Circadian Rhythm

Studies conducted in controlled laboratory conditions showed that much lower illumination levels (about 100 lux at the cornea of a 4,100°K fluorescent light) applied for 6.5 hours can phase shift the circadian system (Sloane, Figueiro, and Cohen 2008). This same test has not been conducted outside of lab conditions, and this therapy is not realistic because it is administered for 6.5 hours. Depending on the method of distributing the light, most people cannot sit still for this amount of time; however, most people receive 30 fc (300 lux) while working in an office, and typical home illuminance levels also range between 5 fc and 30 fc. This means, theoretically, AD homes shift AP's circadian rhythm without knowing it. Other research in this report would disagree with this statement.

No Difference Between Incandescent and CFL

Research is not always done by scientists in contained environments. Pullins conducted an experiment on his own by retrofitting one of his homes that houses four and six APs. He replaced all the incandescent lamps with CFLs, and after noticing no change in the residents' behavior he kept the more energy efficient CFL lamps.

Chapter 8 - Daylight

Along with conducting his own experiments, Pullins had researched the benefits of daylight so he strategically purchased homes for APs instead of working in a AD facility. He found "light is entertaining and comforting," and "residents function better with light," so he did not want to confine them to a hospital like atmosphere, which is was some AD facilities imitate. "There is such a disconnect without windows" that residents do not know if it is snowing, raining, or sunny outside. He has renovated traditional homes to include sunrooms, decks, and larger windows. This way the residents can "experience different amounts of light depending on the weather. He noticed that his APs are "at peace and ease while engaged with light," reinforcing his decision to modify homes instead of working for the traditional AD facility. Another benefit from the large windows is the residents are able to "connect with the outside. The light engages them, and residents can get nutrients from daylight and also heat from that daylight." The large windows have also helped decrease sundowning.

Light and Health agree that extended daylight hours have the biggest impact on people instead of luminaires. Daylight does not have to be received while in direct sunlight, although approximately 1,000 fc will be received if they are in direct sunlight. If an AP steps outside of a building, with the building shading the sun, an AP will receive about 300 fc as represented in measurements taken around an apartment and documented in table 27. While still in the shade, but further from the building, they will received around 400 fc. If they choose to sit on the edge of the shade, 550 fc could be expected. Combining this information with recommendations above, spending one to two hours outside, even in the shade, could help reduce sundowning, agitation, and realign the circadian rhythm.

A different way to look at the benefits of daylight concerns falls. Elders who do not receive adequate amounts of UV light, typically found from the sun but also present in artificial lighting, do not get the recommended amount of vitamin D, which help keep bones and muscles strong. Weak bones cause falls, which lead to fractures and medical bills. Depending on the APs insurance, other people will end up paying for their medical bills.

Vitamin D is so important, the US Surgeon General stated "Optimum light exposure ought to be as uncontroversial as an aim of future health policy as best possible nutrition" in the

2004 report (qtd. in ANSI/IESNA 2011). This probably came about after realizing 30-40% of elders with hip fractures had a vitamin D deficiency. To reduce this number, elders could go outside for five to ten minutes at least three times a week. Being outside is important because vitamin D cannot transcend windows, because glass windows absorb most of the UV, which carries the vitamin D.

Apartment

Illumination levels at several different times of day were tested in an apartment in Manhattan, KS to see the impact of daylight in September. The table shows one is exposed to over 900 fc outside if in direct sunlight, and even on a cloudy day, someone sitting in the living room, which has no luminaires, can receive 55 fc. While this is not enough illumination to shift the circadian rhythm, it is enough to not need luminaries, thus saving energy. At 6pm on a cloudy day, the light meter recorded 19 fc at a bedroom windowsill, which exceeds the required 10 fc for general illumination in a nursing home. While this amount will not carry throughout the room, it can add to luminaire levels or reduce the number of luminaries needed in a space.

Table 27: Apartment Illumination Levels

Apartment Illumination Levels				
Space	Time of Day	Weather	Fc	Lux
Kitchen	5:30pm	No light on, just in ray of sunlight	2.6	28
Rec fields	9pm	Night	5	54
My bedroom - on desk top	8am	Night	6.55	71
My bedroom - on desk top	8pm	Night	6.9	74
My bedroom - on desk top	6pm	Cloudy	9	97
My bedroom with lights on	12pm	Sunny	12.3	132
My bedroom - at bottom of window	8pm	Night	13.4	144
Megan's bedroom with lights on	12pm	Sunny	13.5	145
My bedroom - under light	8am	Night	13.8	149
My bedroom window sill without lights	11:15am	Sunny	14.5	156
My bedroom - in the middle	5:30pm	Sunny	17	183
My bedroom - at window sill	6:15pm	Cloudy	19	205
My bedroom - without lights by window sill	6pm	Mostly sunny	20	215
My bedroom - at window sill with lights	11:15am	Sunny	26	280
My bedroom - on desk top with daylight	5:30pm	Sunny	27	291
Megan's bedroom - no lights,	12:30pm	Sunny	30	323
Megan's bedroom - with lights at window	12:30pm	Sunny	36	388
Living room at eye level and distance away from window	11:15am	Sunny	50	538
My bedroom - at window sill with lights	12:30pm	Sunny	54	581
Living room window sill	6:15pm	Cloudy	55	592
ARE hallway	9am	Sunny	64.5	694
Living room window sill	11:15am	Sunny	95	1023
Outside away from building	6:15pm	Cloudy	200	2153
Outside under awning	6:15pm	Cloudy	250	2691
Outside under awning	5:30pm	Sunny	300	3229
Outside in shade away from building	5:30pm	Sunny	400	4306
Outside under awning	11:15am	Sunny	460	4951
At edge of shade	5:30pm	Middle of room	550	5920
Outside in shade but away from awning	11:15am	Sunny	680	7320
No clouds outside	12pm	Sunny	900	9688
*All measurements taken at the window sill arre approximately 5 inches from the sill				

One day in particular, multiple measurements were recorded to see how the illuminance waxed and waned throughout the day. A floor plan has been provided (figure 50) to show where windows are located and the orientation of the apartment. At 8am on a sunny day, the top of a desk received 6.55 fc, and after raising the light meter to the bottom of the window sill (about 7 inches), the meter read 13.4 fc. Illumination levels on the desk are from indirect sunlight because the window (3'-0" x 3'-9") faces south. There is also a tree at the southwest corner of the

apartment and a smaller apartment building located 20 feet south of my bedroom. Another reading was taken at 12:30pm with the luminaire on, and this time, 54 fc was recorded. At 6pm that night, without ambient luminaires on, there was 20 fc of illumination at the windowsill. These illumination levels are adequate for a bedroom, but would not be sufficient for an AD home. As mentioned before, daylight makes a great supplement to ambient luminaires to conserve energy, but not to use it as the sole source of light for a room.

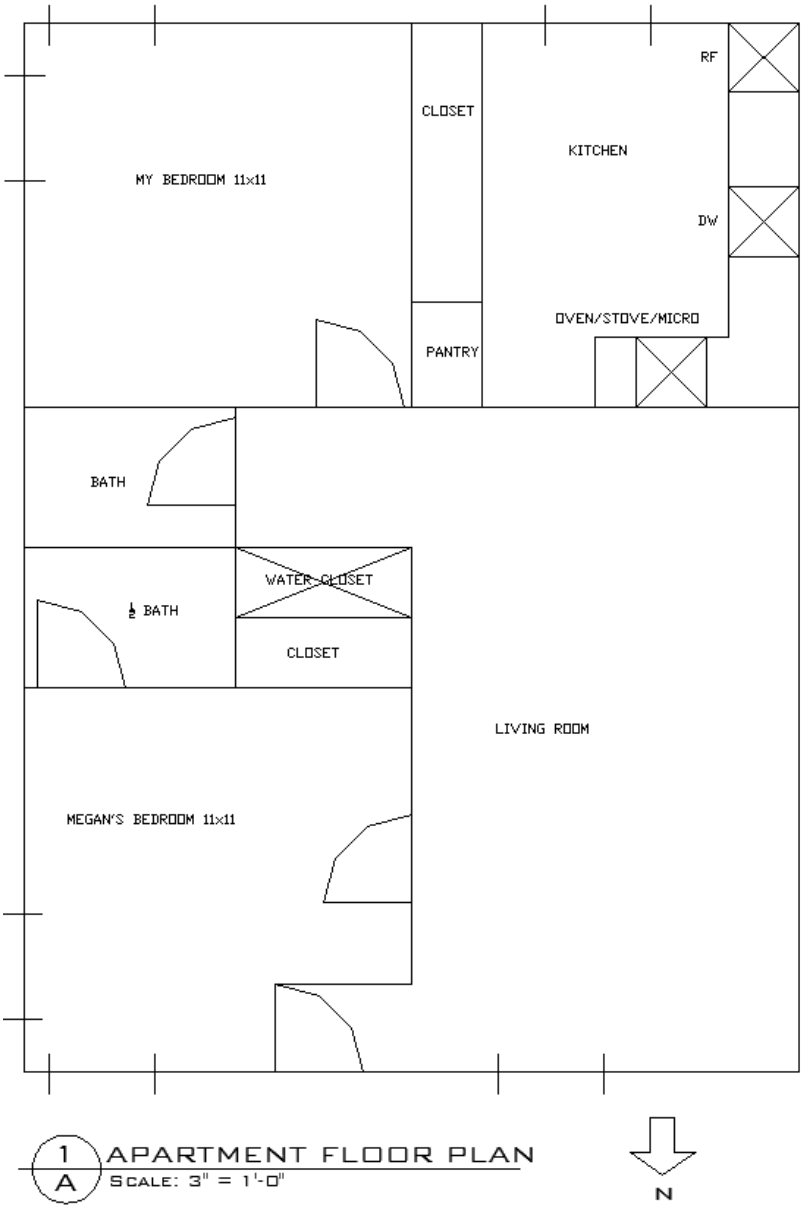


Figure 50: Apartment Floor Plan

This experiment shows that daylight does not penetrate well into interior spaces, as one might believe, and so it is ideally used as supplemental lighting. Daylight only increased the illumination levels by a maximum of 40 fc, which is not sufficient to use for shifting the circadian rhythm. Windows should not replace luminaires, but have daylighting be supplemental since it is so dependent on external factors like weather and objects outside could increase interior illuminance levels certain times of the year. This additional illumination, anywhere between 1 fc and 40 fc could assist APs in activities. Different seasons deliver different intensities of light at varying angles through the day as well. Towards nighttime, there was only 2.6 fc in the kitchen, and this is not enough illuminance for AP to perform tasks.

Learning 20 fc penetrates a window on a sunny day could encourage AD homes to install more windows because it could save them energy over time (if proper controls were installed). More windows means energy savings in lighting; however, additional glazing probably means increased mechanical loads. If the building is striving for *LEED* certification, then determining if the benefits of daylight outweigh the increased mechanical loads could be considered.

Studies Abroad

Studies have been conducted proving the benefits of daylight outside of the United States, too. In 2008, APs in the Netherlands were exposed to 92 fc daylight. These APs, whose average age was 85.5, showed improvements in depression, agitation, and sleep (Noell-Waggoner, Dupuy, and Godfrey 2011).

In Sweden, Sorensen and Brunnstrom studied the correlation between "good" illumination and quality of life. Elders had healthier appetites and improved self-confidence when using, correct angles of illuminance, appropriate contrast ratios, and avoiding glare. Additionally, loneliness, anxiety, and bad tempers lessoned (ANSI/IESNA 2011).

Chapter 9 - Guidelines

Foreign countries might not have specifications for designing AD facilities, but there are guidelines like the UFC and Figueiro's (as mentioned above), for designing luminaire layouts in the United States. Additional sources exist for different parts of the country as well. Kansas has specific regulations to follow and lighting must comply with state energy codes. There is a national energy code which many times has been adopted at the state level.

ASHRAE 90.1

ASHRAE Standard 90.1 is the national energy standard for buildings. There are two different methods to calculate allotted energy for facilities: whole building method, or space-by-space. The space-by-space method was chosen for this report because only a bedroom is evaluated. Depending on which classification is selected, different lighting power densities (LPD), which are measured in *W/sf*, are allowed for the space. Table 28 displays examples of allowable lighting power densities (LPD) to get an idea of the different ranges. Dormitories do not allow much energy consumption because a lot of additional luminaires are brought in by the occupants, while medical research laboratories allow more illumination due to detailed and precise work. The bedroom was dividing into a hotel guest room and restroom because of the dividing walls between the two spaces. Hotel guest room was chosen to account for the increase illumination levels needed for elders, and their loved ones might not bring in additional luminaires to meet their needs. Even though these restrooms might be considered private, APs have been known to wonder into others rooms and use restrooms that are not theirs. The space-by-space method allows for greater flexibility by permitting spaces that do not exceed the allowable levels to transfer the LPDs left to other spaces.

Table 28: Lighting Power Densities

Table adapted from ASHRAE Standards Committee, 2009-2010, p. 83.

Lighting Power Densities Using the Space-by-Space Method	
Space Type	**LPD (W/sf)**
Dormitory	0.38
Gymnasium Audience Seating	0.43
Hospital Patient Room	0.62
Stairway	0.69
Family Dining	0.89
Restroom	0.98
Enclosed Office	1.11
Conference/Meeting	1.23
Classroom/Lecture	1.24
Leisure Dining	1.31
Medical Research Laboratory	1.81
Highway Lodging Guest Room	0.75
Hotel Guest Room	1.11

Bedrooms could be classified as either a dormitory or hospital patient room, and based on the allowed W/sf for each of these, "hospital patient room" was selected to help achieve proper illumination levels. Many of the luminaires selected for the AP's room are exempt from 90.1 in accordance with 9.2.2.3.g because APs fall under the special lighting needs category due to visual impairments and other medical and age-related issues. This exemption only applies to additional lighting and not general lighting. A caveat of additional lighting is it must be controlled by an independent control device such as a light switch or occupancy sensor. This is easy to comply with, if using the above recommendations.

Controlling both general and additional luminaires is another aspect ASHRAE 90.1 specifies. Occupancy sensors are typically installed in buildings to reduce energy usage; however, they are not required in AD homes because patient care is needed (9.4.1.1 exception b). AD homes could potentially be considered 24-hour care environments as well, which would also fall under this exception. It is suggested general illumination have at least one control device with two different lighting levels. One level could have intensity between 30-70% and the other at full power. A benefit of dimming luminaires is saving energy, which saves money. There are two exceptions to this dimming rule: spaces with one luminaire rated less than 100W and spaces

with LPDs less than 0.6 W/sf. If AP's rooms use the dormitory classification, this exception applies, which is another reason to select the hospital patient room classification.

Luminaire control applies to all spaces, not just bedrooms. If skylights are integrated into living room spaces, dining rooms, or gathering areas, it is recommended they be equipped with photocontrol. According to section 9.4.1.5, if the space illuminated by a skylight is more than 90sf, general lighting should be separately controlled by at least one multilevel photocontrol. Benefits of photocontrols include being able to reduce electric luminaires to appropriate levels during the day to provide sufficient lighting levels, but still conserve energy.

Another energy saving feature that is not required, but encouraged, in Aps' restrooms is occupancy sensors, because many times people forget to turn off the luminaire after exiting the restroom, thus wasting energy. Personal restroom are typically small so no regardless of the type of occupancy selected, it will stay on for the duration of the visit.

Pilot lights are also not required, but could be useful in AD homes because it could ensure the AP could locate the switch in the middle of the night or when transitioning from the corridor to a dark room. Pilot lights provide contrast between walls and switches regardless of wall or switch plate color.

ComCheck

ComCheck was developed by the Department of Energy, and utilizes the energy code to check for energy compliance on a state by state basis. Version 3.8.2.0 was used for calculations in this report, and the standard for compliance was ASHRAE 90.1 (2010). ComCheck verified energy code compliance with the existing bedroom layout from earlier in this chapter when only the main glass luminaires were input (see figure 51). Only these luminaires were calculated to serve as a comparison with these same luminaires evaluated later.

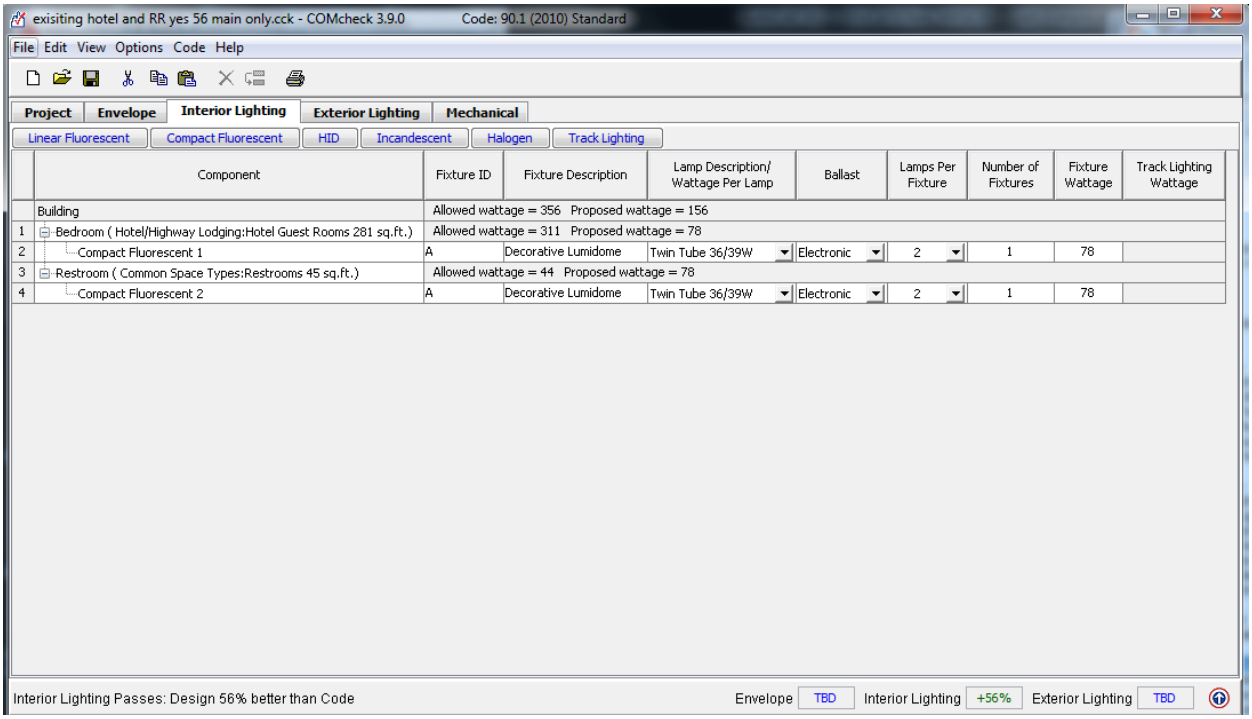


Figure 51: ComCheck for Existing Bedroom with Main Luminaires

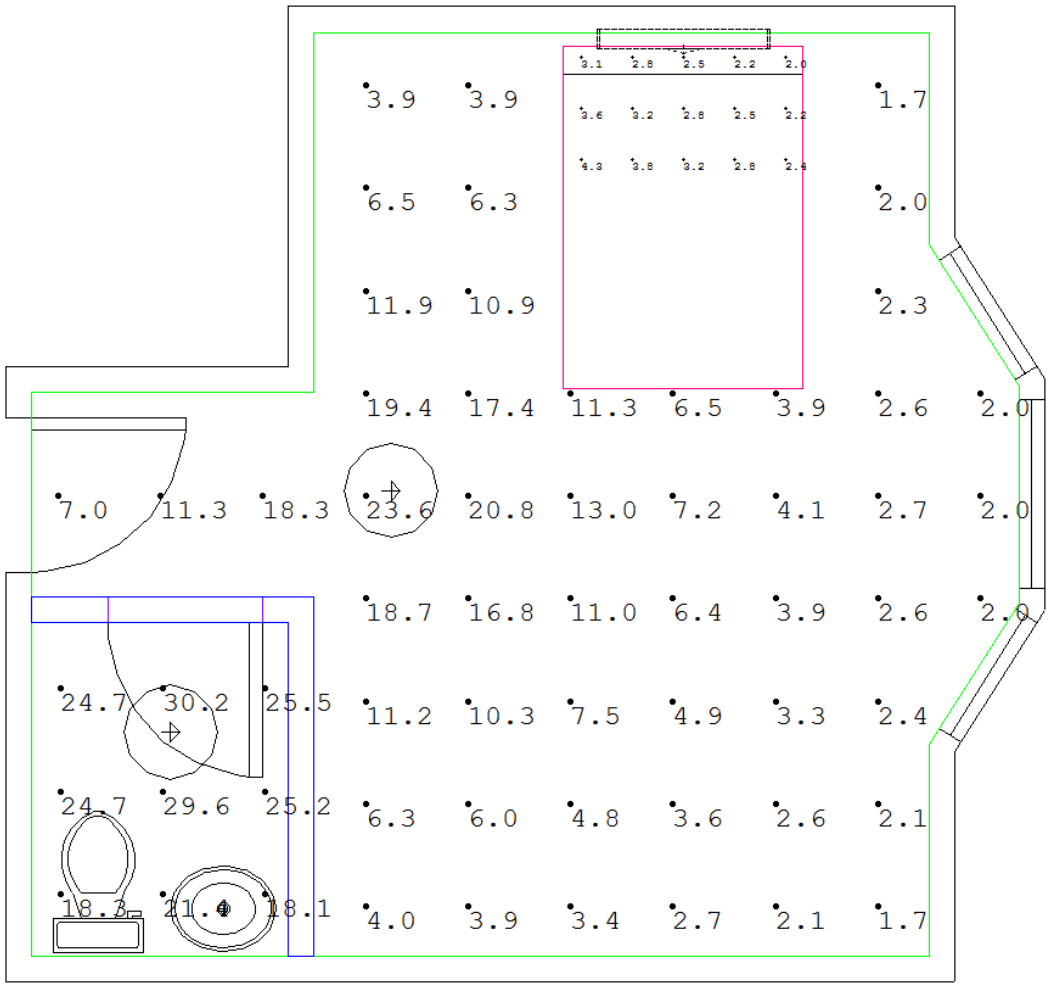


Figure 52: Main Two Luminaires "On"

While this layout complied with ASHRAE 90.1, it lacked control and adequate illumination levels. Kansas Licensure and Certification requires 30 fc of ambient light in the bedroom, but this luminaire layout only produced an average of 11.89 fc (see figure54).

To achieve proper illumination levels in the bedroom, the next ComCheck includes the valance above the bed, but not the restroom luminaire above the lavatory. This lavatory lumianre was unable to be modeled because manufacturers do not upload test files for residential luminaires, but it was a decorative luminar with three bare lamps screwed into a glass parabolic housing.

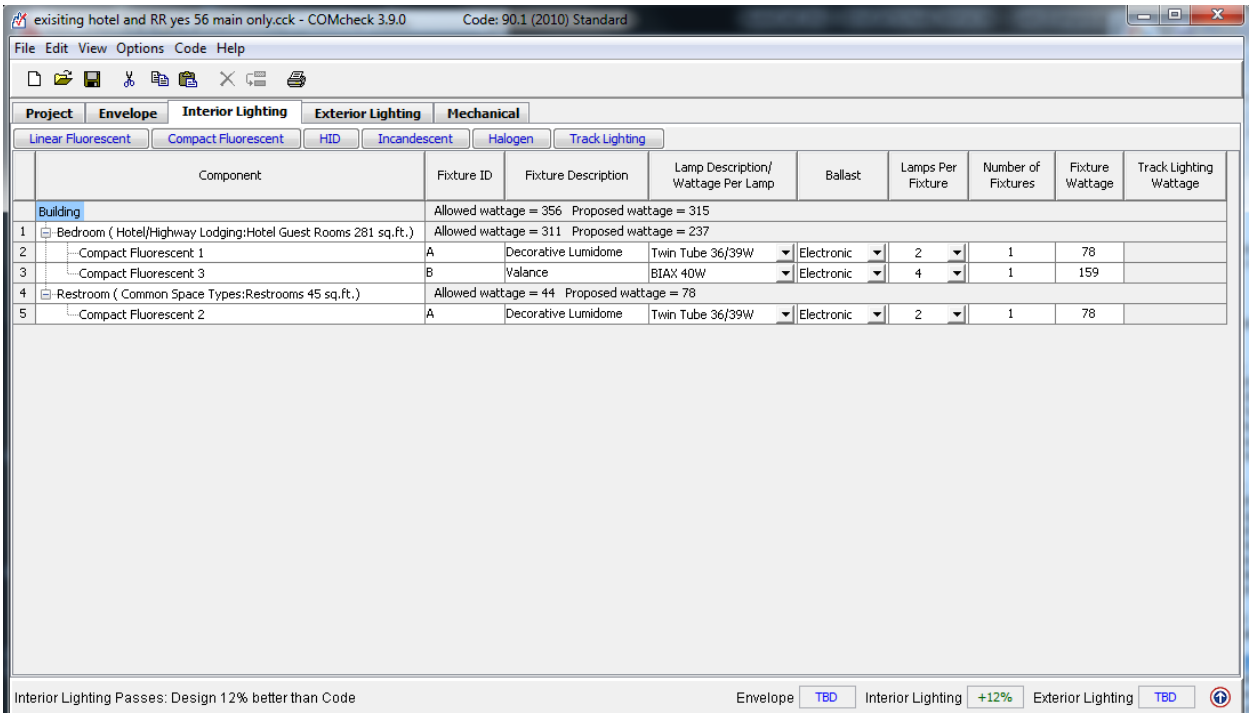


Figure 53: ComCheck for Existing Bedroom with Main Luminaires and Valance

Even when the valance was added to the ComCheck, it passed by 12% and provided the required average bedroom illumination level of 10 fc (see figure 54), but this design still did not include the luminaire above the lavatory. This luminaire housed three 60W incandescent lamps, which would not pass ComCheck; however, when these lamps burn out, they will be replaced with 13W CFLs, which would comply (see figure 55 and 56). While these layouts comply with energy codes, an improved luminaire layout could be designed to comply with ASHRAE, have proper illumination levels, and allow multiple levels of control. The layout and compliance for the improved bedroom can be found towards the end of Chapter 12 - Recommendations.

Main Two Luminaries "On"	All Luminaires "On"
Calc Pts	Calc Pts
bedroom	bedroom
Illuminance (Fc)	Illuminance (Fc)
Average=7.19	Average=11.89
Maximum=23.6	Maximum=26.6
Minimum=1.7	Minimum=2.9
Avg/Min=4.23	Avg/Min=4.10
Max/Min=13.88	Max/Min=9.17
pillowtop	pillowtop
Illuminance (Fc)	Illuminance (Fc)
Average=2.89	Average=46.71
Maximum=4.3	Maximum=66.9
Minimum=2.0	Minimum=30.1
Avg/Min=1.45	Avg/Min=1.55
Max/Min=2.15	Max/Min=2.22
restroom	restroom
Illuminance (Fc)	Illuminance (Fc)
Average=24.17	Average=24.17
Maximum=30.2	Maximum=30.2
Minimum=18.1	Minimum=18.1
Avg/Min=1.34	Avg/Min=1.34
Max/Min=1.67	Max/Min=1.67

Figure 54: Comparison of Footcandles with Different Luminaires "On"

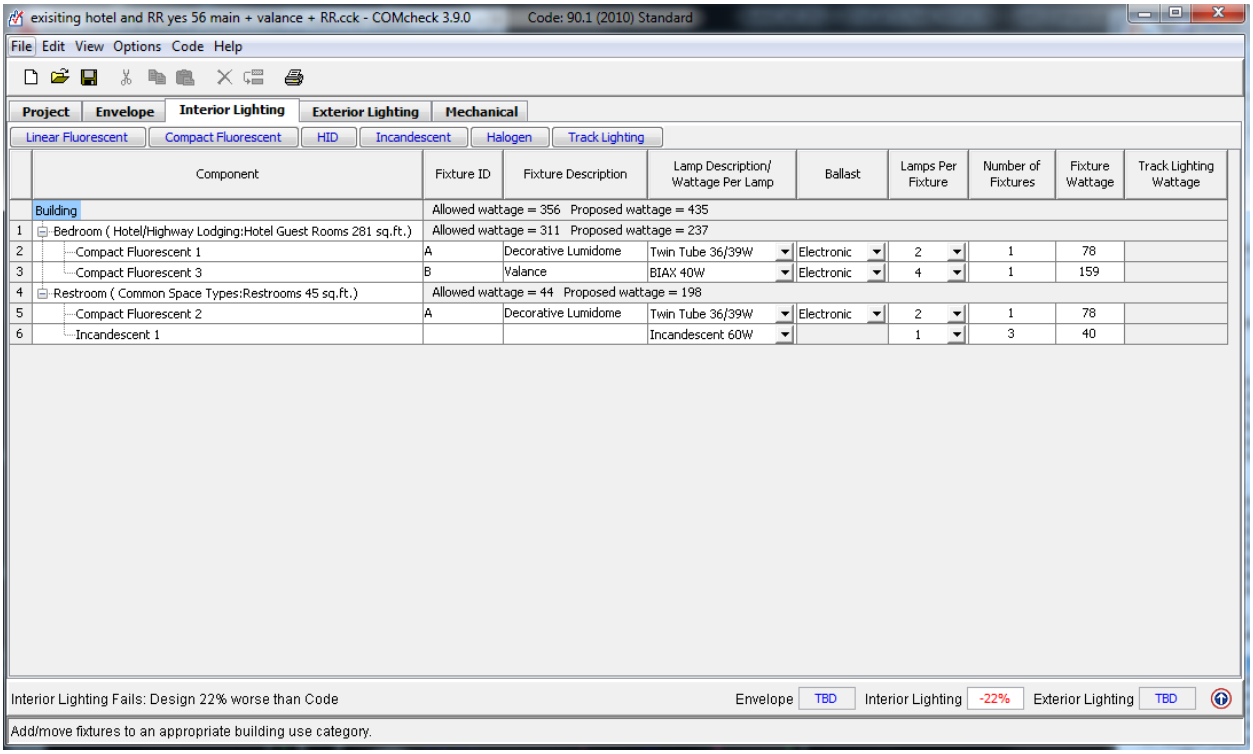


Figure 55: ComCheck for Existing Bedroom with Main Luminaires, Valance, and Lavatory Incandescent

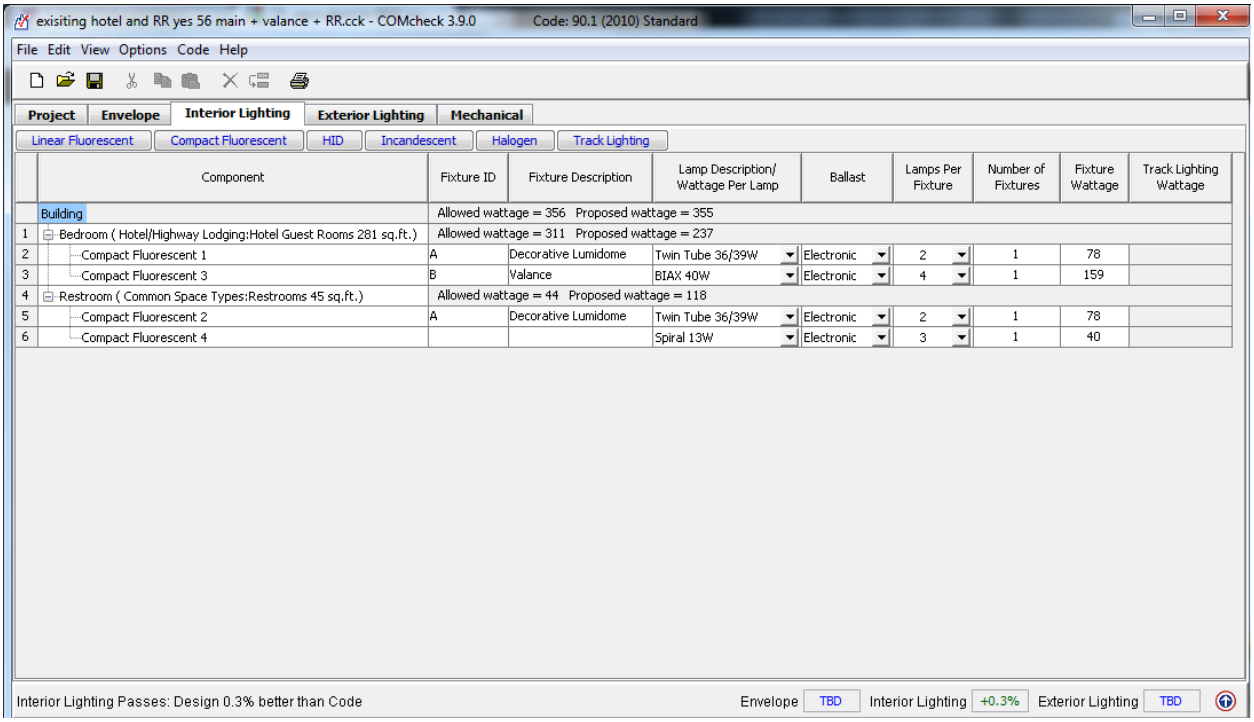


Figure 56: ComCheck for Existing Bedroom with Main Luminaires, Valance, and Lavatory CFL

Other Guidelines for Health Care Facilities

ASHRAE 90.1 is the main energy code to abide by, but there are other design guides produced by The Facilities Institute, American Institute of Architects, and U.S. Department of Health and Human Services. They collaborated on specific guidelines for the design and construction of health care facilities. Under section 10.3.5.2 they require hospital patient rooms to have both general lighting and night lighting, and they require a reading light accessible to the patient while still in bed.

This same set of guidelines has different lighting recommendations for nursing homes. The guideline references the IESNA and their recommendations and considerations for lighting, where it is suggested that nursing homes have general illumination, task lighting, and night lighting. In accordance with the guidelines for hospital patient rooms, easily accessible task lighting is also recommended for nursing homes. This means nursing home bedrooms have similar designs to hospital patient room.

The state of Kansas has their own rendition of guidelines for nursing homes and assisted living facilities, which are comparable to the ones previously noted, but must be met prior to occupancy to meet licensure. For nursing facilities, rooms shall have general, task, and night lighting with minimum illumination levels per table 57. Designers need to verify their luminaire layouts comply with local and state codes.

Minimum Artifical Light Requirements According to the State of Kansas		
Place	**Light Measured in Foot-Candles**	**Where Measured**
Dining Room	25	Table level
Living Room - General Illumination	15	Three feet above floor
Living Room - Reading	50	Chair or table level
Nurses' Station and Office	20	Three feet above floor
Resident's Room - General	10	Three feet above floor
Resident's Room - Bed	30	Mattress top level, at bed wall to 3'-0" out from bed wall
Corridors	10	Floor level

Figure 57: Kansas Lighting Levels

Table adapted from KAR 26-40-305, 2011.

Chapter 10 - Difficulties and Errors from Research

Besides the challenges faced by researchers already mentioned, such as not enough participants, studies not conducted over extended periods, and slight changes not allowing for conclusions, there are additional difficulties with conducting research with APs. For instance, many APs also have other medical problems that could affect everything from their vision to behavior (Alzheimer's Disease 1989), and other underlying mood disorders could affect their reaction to light therapy, both positively and negatively. Additional factors are discussed below, including both difficulties in research and in personal experience when surveying AD facilities.

Research Difficulties

Research has focused on bright light for aiding APs, and part of the reason for using bright light therapy with APs is because their pupils become smaller as they age ("The Aging How" 1995-2011). It takes three times as much light for a 60 year old person to see the same illuminance level as a 20 year old, and making sure these illumination levels are met can be challenging. Caretakers might think lamps are bright enough, or too bright, and decrease the intensity, when in reality, the lamp was providing correct illumination levels.

Lamps lose intensity over time due to dirt, ballasts factors, and other factors, so eventually they will emit illumination levels caretakers expect to find in rooms. Caretakers could end up using the same lamp for years thinking it is giving the same luminance level it did in the beginning, because they are unaware of lamp depreciation. Most researchers probably had a light meter to record the actual illuminance levels to ensure lamp depreciation did not occur during the experiments, but individuals or AD homes most likely not have access to this piece of equipment.

Another problem elders have is thickened lenses, meaning the light seen is less clear and less vibrant. It scatters the light more, reducing contrast and saturation, meaning reds look like pinks. This could steer some researchers to believe blue wavelength has more of an effect on APs. However, some elders lose the ability to discriminate blue colors. The yellowing of their lens does not allow them to see shorter wavelengths as well.

Hard data is only part of the challenge with making correlations between lamps and behaviors. The other challenge is dealing with quantitative and not qualitative data when individuals come from different backgrounds, have different standards, and expectations. Moods and behaviors rely on others' observations, and research dealing with night shift caretakers could have not received information from the daytime workers. An AP could have incurred another ailment during the day that left them in a rotten mood. If no communication occurs between day and night employees, night employees could record increased aggressions after a certain therapy treatment, when the therapy did not induce this behavior.

Different people also have different biases and scales then they observe the patients. Caretaker "A" might think an AP is extremely cheerful while caretaker "B" thinks the same AP is just having an above average day. Happiness or ease of working with the AP could be relative to other APs.

Caretakers could have also given the patients extra attention during the study. In any situation, some people tend to go above and beyond if they think it will improve their patients' behaviors to reflect admirably on their facility. This could be done subconsciously; however, Nowak and Davis were aware of this during their research noting more attentive caretakers could have seen a wider range of behaviors or intensities. Both of these could affect their observations which were later used to make conclusions. The caretakers could have been looking for changes or differences between the test group and the control group so much so that they might have convinced themselves there were changes when there really were none.

Thorpe et al. also recognized potential errors in their research, specifically when administering light via a light box. The caretakers might have viewed restraining patients from getting to close the lamp as bad behavior, when it was done due to lack of understanding. Light boxes were not the only method of administering light that had errors.

Administering light with a visor might have caused irritation or disruptive behaviors simply because the AP was not used to wearing the visor. It could have been too tight around their head, or resting on a pressure point, causing headaches. Headaches could be recorded as a negative effect even though it was not caused by the light. Pressure points could also relax the AP, making them more favorable to assist, and these behaviors would seem related to the light, but in reality, other external factors affected their behaviors.

Typically, during an assessment or questionnaire, people tend to write down negative comments more than positive ones because negatives are more noticeable. An interesting detail Thorpe et al. noted was "interventions that may improve certain positive and adaptive behaviors, but not decrease negative ones, may appear to be ineffective, in spite of an overall gain in quality of life for the individual." If light increases the alertness of an AP during the day, they might be more active and disruptive. These behaviors could be seen as negatives if they are out of character for that person. The AP's alertness could also stimulate others around them to have positive (or negative) activity interactions. To reduce this bias, caretakers are encouraged to either document all behaviors or make sure to not focus on the negative behaviors.

Lastly, Thorpe et al. mentioned not all the volunteers that participated in the research necessarily had Alzheimer's, since it is difficult for even the most experienced psychiatrists to differentiate between dementia and Alzheimer's. If psychiatrists cannot tell the difference between those with AD and those with dementia, their loved ones probably cannot tell the difference either. Regardless of the diagnosis, improving APs lives is the goal.

Questionnaire Difficulties

To add to research, questionnaires were distributed to several AD homes, and after evaluating the questionnaires, several improvements could be made, if the process be repeated in the future. (Theses questionnaires can be found in Appendix H). Recording illuminance levels at multiple AD homes involves multiple variables like cloud cover, time of day, age of lamps, and if the bedroom was furnished. Time of day and window orientation has a major impact on illumination levels and this was observed when one AD home allowed readings in both an east room and west room on a sunny day at 4:30pm. The east room recorded 22.9 fc while the west room registered 124 fc. This proved depending on the time of day, exterior foliage, and room orientation, illumination levels could be drastically different.

Room orientations were not recorded for other facilities because AD homes were not visited at the same time and the above factors like foliage could also affect the data. In rooms with windows, the exact distance from the windows was not documented either because each room had a different layout with different window and wall reflectances. Also, some AD homes had skylights, while others did not. Skylights allowed multiple different illumination levels to be

recorded within the room, depending on the location of the light meter. These rooms could record a variety of illumination levels depending on the time of day and cloud coverage.

The questionnaire distribution and collection process could be handled differently in the future. Lamp data could have been recorded while illuminance measurements were taken; however, many times the maintenance person was not available during this time. Because caretakers were taking time out of their busy schedules, questionnaires were sometimes hastily explained to whomever was giving the tour so not to impede on their time. Several AD facilities had other programs or accreditations occurring around the same time measurements and questionnaires were handed out, so sometimes receptionists were instructed to deliver the questionnaire to the head caretaker. Sometimes the caretakers would say they would only be able to fill out part, and the maintenance staff would fill complete the other part. It is unknown if communication between these two people occurred so poor instructions or miscommunication could have rendered non-uniform results.

Poorly structured questions yielded confusion for some along with not leaving enough room for explanations. Had more detailed questions been asked about multiple lamp sources in bedrooms and sitting rooms, guessing which lamps, circled previously, were installed in these task luminaires would have been eliminated. Pictures could have accompanied the questionnaires so room layouts, lamp locations, and types, could have assisted in deciphering the questionnaire responses. Photos would have also aided multiple AGi 32 renderings, which have already been illustrated previously. Another change in the wording of the questionnaire would be improving the question, "What behavior would you like to see improved the most" to ensure it was understood to mean which behavior was the worst.

Taking more time to review the questions and interacting with the caretakers who had relationships with the APs could have aided in drawing conclusions from the questionnaires. Many times the caretakers said they did not have any questions, which could have been true, since we discussed the basis of this report while touring their facility, but when they finally found time to complete the questionnaire, they might not have understood the questions as well. Contact information was provided, but none of the facilities used this resource.

Along these lines, human error could have played a role in the responses to behavioral questions. The moods of other APs or caretakers could have affected answers. Different people also have different perceptions of light, and if other luminaires were on in conjoining rooms then

the room being evaluated might have appeared brighter. Brighter adjacent rooms could have influenced their answer to "Compare the Brightness of the Rooms to Each."

Chapter 11 - Questionnaires

While there were challenges with surveying AD facilities, there were many responses that can add to research on how light affects APs. In order to add to the research on light and AD, questionnaires were given to 15 AD facilities between Kansas and Colorado. The facilities were selected based on proximity to the researcher's location in Overland Park, KS and the Denver, Colorado. Out of the 14 questionnaires distributed, 10 were completed and are located in Appendix H, with a table summarizing the results of the questionnaires found below. While visiting these AD homes, a light meter recorded footcandle values in rooms matching the rooms on the questionnaire. These recorded illuminance levels are in Appendix E, and the first column of target footcandle levels was obtained from the Kansas Licensure and Certification for nursing homes (KAR 26-40-305 1999).

Summary of Facility Questionnaire Answers											
		Facility*									
Question	Options	A	B	C	D	E	F	G	H	I	J
Type of Luminaire	Incandescant	X									
	CFL			X	X	X		X	X	X	X
	Tubular Fluorescent	X	X				X		X		
Number of Lamps per Luminaire	1		X						X	X	
	2	X	X	X		X		X			X
	3				X			X			X
	4		X	X							X
	5				X						
	6				X						
Lamp Wattage	15						X				
	26					X					
	30										X
	32	X				X					X
	42		X								
	60		X	X					X	X	
	75							X			
Typical Behaviors	Agitated										
	Happy		X			X		X			
	Sad										
	Mad										
	Calm					X		X		X	
	Angry										
	Restless					X					
	Aggressive							X			
	Sleepy		X					X			
	Anxious							X	X		
	Talkative		X				X			X	
	No Difference From Other Spaces	X		X			X				X
What Behavior Would You Like Most Improved	Agitated	X					X	X			
	Happy		X								X
	Sad										
	Mad										
	Calm										
	Angry										
	Restless	X		X				X	X		
	Aggressive					X		X			
	Sleepy						X				
	Anxious									X	
	Talkative	X									
Age of Luminaires	Original	X		X				X	X	X	
	Retrofit	X	X			X					X
Year of Luminaires			2011	2011		2011	2009		2010	2009	2011
Why Retrofit the Luminaires	Better for Residents	X	X					X			
	N/A			X		X	X		X	X	
Do Residents Like Sitting Next to the Windows	Yes		X	X		X	X	X	X	X	X
	No	X									X
Do They Have Better Behavior By Windows	Yes		X			X	X	X	X		
	No										X
	No Difference From Other Spaces	X		X						X	

* Grayed out columns delineate facilties that behavioral information is not being used from.

		Facility* (cont.)									
Question	Options	A	B	C	D	E	F	G	H	I	J
When Do They Sit By Windows	Breakfast		X	X		X			X	X	X
	Breakfast-Lunch			X				X	X		
	Lunch		X	X					X	X	X
	Lunch-Dinner			X		X		X	X		X
	Dinner		X	X					X	X	
	After Dinner								X		
	Any Time		X				X	X	X	X	
	No Particular Time	X		X			X			X	
Do Residents Like Rooms with Windows More than those Without Windows	Yes	X	X	X		X		X	X	X	
	No						X				
Ever Tried Different Luminaires	Yes		X			X		X	X		
	No	X		X			X			X	X
What Lamp Type was Tried	Incandescant								X		
	CFL		X						X	X	
	Fluorescent Strip					X					
How Did Resident's Behavior Change	Agitated										
	Happy		X								
	Sad										
	Mad										
	Calm		X					X	X		
	Angry										
	Restless										
	Aggressive										
	Sleepy										
	Anxious										
	Talkative		X								
	No Change					X					
Room Where Resident's Have Their Best Behavior		Common	Outside	Dining		Bedroom	Sunroom	Dining and Common	Bedroom	Bedroom and Common	
Resident's Favorite Room		Common	Dining and Bedroom	Dining		Dining	Sunroom	Dining and Common	Bedroom and Common	Bedroom, Common, and Dining	Bedroom
Is the Illumination Level Highest in the Favored Room	Yes	X	X	X			X		X		
	No					X		X		X	X
Resident's Least Favorite Room		Dining	Restroom	Restroom		Restroom	Restroom	Restroom	Hallway		
Do You Think Anything Could Be Done to Improve Residents' Comfort	Yes		X						X		
	No	X		X		X	X	X		X	X

* Grayed out columns delineate facilties that behavioral information is not being used from.

General Questionnaire Observations

There are two assumptions that cannot be made about these questionnaires: AD homes can be compared and CFLs are warm lamps. It is unfair to compare different AD homes' questionnaires because of all the variables like time of day visited, empty or occupied room, and cloud cover. Assuming CFLs are warm lamps is not valid either, because stores sell warm and cool CFLs, and questionnaire responses did not provide enough information to tell which lamp type was installed.

While comparing questionnaires is not recommended, there were two consensus items: restrooms are the most disliked space in facilities, they also bring out the worst behaviors in APs, and restlessness is the behavior caretakers would like to see improved the most. AD facilities with exterior spaces or sunrooms documented both exhibited good behavior and preferred these rooms. Having APs prefer spaces with daylight is concurrent with the research above. The subheadings below continue to compare data across different AD homes, but still keeping in mind the other variables that could have factored into their responses.

CFLs vs. Tubular Fluorescent Lamps

There was no correlation between illumination levels and lamp types, but there was a relationship between lamp types and behaviors. Out of the eight questionnaires returned with sufficient information, five used CFLs and three had tubular fluorescent. Facilities with CFLs want to see improvements in aggressive and restless behaviors. Calm and happy were common positive characteristics among CFL facilities, while common behavioral traits in tubular fluorescent facilities were: talkative, anxious, sleepy, agitated, and no different from other rooms. Based on this, when renovating, facilities could install warm fluorescents to promote better behaviors.

When asked what behavior AD homes would like most improved, those using CLFs responded with restless and aggressive behaviors, while tubular fluorescent facilities noted agitation and restless needing improved. Based on these finding, neither lamp does an adequate job of keeping APs still, and the other two qualities are equally frustrating to deal with for caretakers.

Excel questionnaire summary table

Excel questionnaire summary table

General Questionnaire Observations

There are two assumptions that cannot be made about these questionnaires: AD homes can be compared and CFLs are warm lamps. It is unfair to compare different AD homes' questionnaires because of all the variables like time of day visited, empty or occupied room, and cloud cover. Assuming CFLs are warm lamps is not valid either, because stores sell warm and cool CFLs, and questionnaire responses did not provide enough information to tell which lamp type was installed.

While comparing questionnaires is not recommended, there were two consensus items: restrooms are the most disliked space in facilities, they also bring out the worst behaviors in APs, and restlessness is the behavior caretakers would like to see improved the most. AD facilities with exterior spaces or sunrooms documented both exhibited good behavior and preferred these rooms. Having APs prefer spaces with daylight is concurrent with the research above. The subheadings below continue to compare data across different AD homes, but still keeping in mind the other variables that could have factored into their responses.

CFLs vs. Tubular Fluorescent Lamps

There was no correlation between illumination levels and lamp types, but there was a relationship between lamp types and behaviors. Out of the eight questionnaires returned with sufficient information, five used CFLs and three had tubular fluorescent. Facilities with CFLs want to see improvements in aggressive and restless behaviors. Calm and happy were common positive characteristics among CFL facilities, while common behavioral traits in tubular fluorescent facilities were: talkative, anxious, sleepy, agitated, and no different from other rooms. Based on this, when renovating, facilities could install warm fluorescents to promote better behaviors.

When asked what behavior AD homes would like most improved, those using CLFs responded with restless and aggressive behaviors, while tubular fluorescent facilities noted agitation and restless needing improved. Based on these finding, neither lamp does an adequate job of keeping APs still, and the other two qualities are equally frustrating to deal with for caretakers.

If the assumption is made that CFLs provide warmer wavelengths than tubular fluorescents (which is not necessary accurate), than the correlation between CFLs and behavior could be due to making the facility feel more like home. Homey atmospheres typically have a calming effect; however, this assumption comes with many precautions. Purchased CFLs can have a warm or cool CCT, but and warmer CCT lamps are typically less expensive. Warmer wavelengths do not have as much blue wavelengths, which supposedly improves the circadian rhythm, so this inference leaves one curious if blue wavelengths has a greater impact on APs or trying to replicate a home environment.

The questionnaire did not ask about sleep wake cycles to make a comparison between lamp types and sleep because this report was not supposed to focus on the correlation between light and sleep. This data could potentially be difficult and stressful for caretakers to accurately record. Generalizations might not be able to be made about APs, and tracking one individual would be cumbersome and take constant observation.

Three facilities, B, E, and H had mixed results when they tried different types of lamps in their facilities. When facility E replaced CLFs with tubular fluorescents, they observed no changes in the AP's behaviors, but when the other two facilities replaced tubular fluorescents with CLFs and incandescent lamps, they saw improved behaviors in APs. Facility H recorded APs were calmer after the switch and facility B circled "happy," "calm," and talkative" for how APs' behaviors changed. All three behaviors circled are beneficial for APs, including talkative, because talking keeps them engaged and socializing, which in turn increases their happiness and makes them easier to assist.

Number of Lamps and Wattage

Expectations of correlations between the number of lamps in a room, wattages of those lamps, and behaviors, were destroyed when no relationship was found. Facilities G and E both had two 75W CLFs in each luminaire, and both circled restlessness and agitation as areas needing improved the most. The most common characteristics were calm, restless, and happy. Facilities H and C typically had two or more 60W lamps in their luminaires. Illumination levels do not vary significantly between these two wattages, with restlessness as the main behavior recorded in both facilities. Facility I only used one 60W CFL per luminaire, and they commented most APs were calm and talkative. Some facilities noted similar characteristics in rooms, but

there are not enough commonalities between all of them to formulate a correlation between quantity of lamps, wattage, and behaviors.

Luminaires used in facilities A, F, and J draw less wattage. Facilities A and J used, on average, two 32W lamps and both facilities documented no spaces with specific behaviors, as interpreted from "no difference from other" being circled. Facility A has tubular fluorescents and J installed CFLs, so it is interesting both of these facilities responded that APs did not act any different in any of their rooms.

Lastly, facility F used the least amount of power in by using 15W lamps. This was achievable because skylights were in both the dining room and sitting room, so illumination levels were still sufficient. Talkative, agitated, and sleepy were the three most common comments documented, and surprisingly, caretakers wanted sleepiness improved in rooms with skylights. Facility F is probably the most energy efficient facility with lamps drawing low wattages and utilizing daylight; however, their lamps and use of daylight did not seem to have a dramatic affect on the AP's behavior.

Original vs. Retrofit Luminaires

Out of the 10 facilities, about half of them had original luminaires and the other half had retrofitted them, but all of them had luminaires less than two years old. This was surprising since several of the facilities did not look that new, but this shows they have maintained their lamps properly and replaced them when necessary. It was also surprising to learn several of the AD homes did not know the reasoning behind the luminaires installed or why they were retrofitted. This means they could have changed luminaires to save energy or could not purchase T12 lamps anymore, not necessarily to benefit APs.

Windows

All but one AD home agreed that APs enjoy sitting near window, and 5 of 9 mentioned they had better behavior while near windows. Almost all facilities noted APs preferred rooms with windows, but there is no specific time when they sit by windows. This could be because APs tend to wander and they might not be consciously aware of the windows, or there could be windows in certain rooms and so APs use these rooms for specific purposes like meals or activities, which may or may not have a set time during the day.

Favorite and Least Favorite Rooms

APs typically displayed their best behaviors in the rooms that were their favorite, and restrooms were universally disliked. Some AD homes wrote down why they thought certain rooms were the favorite, like the bedroom was theirs or the living room was where activities took place, which are unrelated to lighting. It was interesting to see such a smattering of favorite spaces, and then no relation between illumination levels. Room preference might have more to do with other factors like activities or feelings associated with the space, which could be enhanced by lighting, because there was a correlation between illumination level and room preference. Half the APs preferred the room that also had the highest illuminance level.

Built for Alzheimer's Patients

Three questionnaires, C, H, and I, denoted they have catered to APs needs differently than the rest of the nursing home, but only one mentioned light. The other two questionnaires wrote they had more specialized programming, a life skills area, and high ceilings. High ceilings can impact luminaires because they have a farther distance to throw the light, while still maintaining adequate illumination levels on the working plane. The third questionnaire, which solely houses APs, based their entire design around AD by including lots of windows, an open floor plan and accessible outdoors. The most common behavior these facilities wished to see improved is restlessness, which is a common characteristic among other facilities. Surprisingly, only one facility, H, believes more could be changed to improve AP's behavior.

Room for Improvement

Facility H was one of two facilities that believed something could be done to improve the APs comfort, which is shocking. They all documented behaviors they wished would improved, but do not have any ideas how to resolve or improve these behaviors. Did those facilities that tried different luminaires not notice changes enough to try and implement additional changes or share their finding with other AD homes? Referencing back to research, the improvements might have been so minor they were not worth the time and effort from the AD home's perspective, which would be unfortunate if they put time and money ahead of the health and happiness of their residents.

Individual Questionnaire Evaluations

Since comparing facilities involved several variables, individual facilities can be evaluated based on information gathered about individual rooms. Some correlations can be made between brightness of luminaires, windows, rooms preferred by APs, and where APs exhibited their best and worst behaviors. Questionnaire A showed the common room was the most liked space and where APs exhibited their best behavior, so it is no surprise this space has the highest illumination level and incorporates daylight. Facility A's dining room had a much lower illumination level and therefore APs did not enjoy this space.

Facility B had interesting responses, and the correspondent actually stated they were not sure the person completing the questionnaire completely understood some of the questions. Upon review of the answers, this is quite possible because the behavior they wanted to see most improved was happiness. They almost certainly meant to say they would like to see the APs exhibit more happiness and not that being overly happy was their worst trait. Surprisingly, they also marked that APs were happy in the restroom, but it is also their least favorite room. Due to this contradicting information, as well as window information (particularly about the restroom), this questionnaire was determined invalid. Additional data collected makes this questionnaire difficult to make any comparisons with because the light meter recorded high illuminance levels in the bedroom and dining room. These rooms did not have daylight to provide these levels, so these errors also detract from the usefulness of this facility.

Windows did not encourage better behavior or entice APs to sit near them in facility C. This facility agrees with most other responses when stating the restroom is the least favorite room, and APs exhibited their best behavior in their favorite room, which happened to be the dining room in this AD home. Their good behavior is probably due to the high illumination level, which the caretaker correctly identified the dining room as being the brightest.

Another facility, D, also will not be used due to the quick turnover rate of patients. They are an end of life facility where the average stay is only six days. Due to the poor health status of patients and quick decline upon entering the facility, no behavioral data was collected.

The next questionnaire tried tubular fluorescent lamps instead of CFLs, and found no change in AP's behavior. They found APs best behavior was in the bedroom, but their favorite room was the dining room. Both rooms the APs were calm, as opposed to the restroom where

they were restless. Facility E observed better behaviors from APs when they sat by windows in the bedroom, but caretakers still wanted to see aggressive behavior improved all around.

The facility with a sunroom, F, documented this space as AP's favorite room. They demonstrate their best behavior here, which might include being calm and talkative. Overall, this facility did not have many windows, but they had skylights in both their common room and dining room. Surprisingly, in both these rooms, APs were sleepy, and in rooms without skylights, they were agitated. Contrary to this information, caretakers marked APs were talkative in the rooms with skylights. It is confusing how the same space promotes dialogue and sleepiness as the same time.

Illumination levels were completed, at facility G at 10am, on a cloudy day. The caretakers' interpretations of brightness did not correspond to actual footcandle levels, but this could have been due to the cloudy day. It also may seem invalid that APs best behavior is in the two rooms with the lowest illuminance levels, but again, this is probably due to the cloudy morning when measurements were taken. Sunny days could increase the numbers two fold since there were numerous windows throughout. APs exhibited better behavior while sitting next to windows, and this was taken into consideration when designing this facility. The top three behaviors caretakers would like to see improved are restlessness, agitation, and aggressiveness. This facility actually tried replacing lamps to brighten the bedrooms and restrooms, and after replacing these lamps, they found APs were calmer, even in the restrooms. Perception versus recorded illumination levels was difficult for facility H. They thought several rooms were brighter than others while recorded footcandle levels did not support this perception. Even though APs typically sat by windows when they had the opportunity, they still were anxious. Facility H wants to see restlessness improved the most in the common room

The last page of facility H's questionnaire gave some insightful responses to why APs might enjoy certain rooms more than others. They marked the bedroom as APs favorite because it was their own and the corridor the least favorite because APs thought they were going somewhere, but potentially unsure of where exactly. These annotative responses do not favor the impact of luminaires on behaviors so much as the task associated with the space. This facility has also tried replacing CFLs and tubular fluorescents with incandescent lamps and CFLs. APs appeared calmer after this change, and based on research, incandescent lamps would have this effect. Bedrooms with incandescent lamps were also the APs favorite, partially because this

space is theirs and partially because this room had the highest illumination level. Most rooms in facility H had two types of lamps, both tubular fluorescents and CFLs. If the CLFs installed were warm CFLs, this could defend that warm lamps have a calming affect.

Installing the same lamp in every single room could promote similar illumination levels, if the rooms are also similar in size and shape, but this is not the case for questionnaire I. Varied illumination levels occurred because some rooms had higher ceilings than others. Another interesting concept in this facility was caretakers marked APs enjoyed sitting next to windows, but their behaviors did not change. This is intriguing because better behavior is expected near windows. Replacing CFLs in this facility showed no behavioral improvements either, which was also surprising. However, outside of the restrooms, APs best behavior was documented in the rooms with the highest illumination levels.

The last facility, J, did not propose any similarity between lamps or windows and behaviors. It is interesting that all the rooms have similar illumination levels, only varying by approximately 18 fc. Potentially due to uniform illumination levels, the APs had no behaviors that stood out in any rooms so caretakers wanted to improve patient's overall happiness. Similar to facility I, rooms with windows were not preferred by APs, and did not improve their behaviors either.

Chapter 12 - Recommendations

Even though there were challenges with questionnaires, and researchers may dispute conclusions, recommendations for AD homes are attainable. If AD facilities are designed so the designer would not mind residing there, then most recommendations will be implemented. Examples of these recommendations are accenting walls to illuminate artwork and plants, increasing daylight levels, making sure there are multiple levels of control, and conveniently placing controls for ease of use. One additional consideration for designers is making sure higher illumination levels are met while still avoiding glare, which makes fluorescent lamps a good choice. Avoiding glare can be achieved by making sure lamp shades are used and ambient luminaires are indirect/direct luminaires. It is suggested abrupt changes in lighting levels be avoided, which is achievable with task lighting. These basic suggestions can be implemented in any AD facility to improve the atmosphere.

Warm lamps (those with long, red wavelengths and low CCT) are encouraged to be used throughout AD facilities with a mobile lamp to deliver light therapy treatments. Short, blue wavelengths with high CCTs are comforting and calming to APs, and resemble a home environment more so than harsh fluorescent lamps. Lamps with short wavelengths could be used for light therapy, while warm CFLs are recommended for AD homes because they satisfy the want for lamps emitting short wavelengths and facilities responded positively to CFLs on the questionnaires. Adding light therapy to their daily routine might help APs keep track of the day, time of day, or encourage them to interact with others.

Another method to help APs know what time of day it is can be achieved by alternating light and dark patterns of light. Since light has such an effect on the circadian rhythm, two different luminaire layouts are ideal in AD homes. During the day, bright lights (electric or daylight) that can activate the circadian system could be used, and at night, a separate or dimmable system is encouraged. This system could use dim red light if requested.

Additional Research

First and foremost, based on research completed by others and myself, additional research is needed to confirm current findings. This includes repeating experiments already

mentioned and collecting more questionnaires from AD homes. Beyond gaining more data, there are several other directions that could benefit from further research, and color is a prime example. Some researchers believe blue wavelengths have a greater affect on the circadian rhythm, but additional investigations needs to be done to determine the optimal wavelength. Is the ideal color more blue or green? A different direction, related to the color of light, suggested by Nowak and Davis, would be to research if dim red wavelengths can "reduce agitation, resistiveness, or repetitive behaviors such as wandering." More research is needed for both red and blue wavelengths.

Almost all of the researchers agreed that additional studies need to be completed with a larger number of participants and over longer periods to come to any conclusions about how light affects APs. Figueiro, Rea, and Eggleston want the studies to last longer because side effects might carry over from one lamp source to the next. These carry over benefits could affect the baseline test or benefits thought to be from another color lamp or brighter luminaire. Thorpe et al. would like to see studies last multiple weeks and include weekends so more information could be gathered and consistency between tests could be achieved. Both of these ideas to include more participants and complete tests for longer durations are valid.

Restrooms

Restrooms need to be the focus of more research since it is the least enjoyable room as concluded from the questionnaires. APs exhibit their worst behavior here and caretakers provide support more in this space than one might expect. To improve this room, restrooms could use three walls and a curtain instead of the traditional four walls to promote restroom usage and give it a softer, more comforting feel. A warm incandescent or CFL could also aide in comforting the AP. The curtain would provide privacy, but also help remind them where to find the restroom. The luminaire layout should take into consideration the location of this curtain, making sure there is adequate illumination on both the water closet and lavatory side. Curtain reflectance is important to consider, as well when running lighting calculations for this space.

Pushing the limits beyond curtains for walls, restrooms could be designed to resemble a spa. Most people enjoy visiting spas because they are relaxing, which could help relax APs and make them easier to assist. If the bathtub is a problem, then placing lights inside or on the walls (see figure 58) could entice them to enter the water and cleanse themselves. Making bath time

fun with lights might bring back childhood memories of splashing around with boats and ducks, and not make this time such a hassle for caretakers.

Figure 58: Lighted Bathtub

Posted by Danielle at gadgets.elliottback.com/spa-lights on April 9, 2006.

If cleansing is not the main problem, then a physical rearrangement of the space could encourage water closet usage and prevent falls. Constructing restrooms on the same side of the bedroom as the bed headboard allows the APs to quickly locate and navigate to them. Locating the door or curtain so it is open and the restroom is visible to the AP in bed could promote restroom usage, and the luminaire in this space can spill into the bedroom. Reducing the distance between the bed and restroom also reduces potential falls and the area needing to be illuminated by night lights. Another alternative to nighttime floor luminaries is locating lamps under a railing on the wall from the bed to the restroom. The rail would then double as a support mechanism, as well as safely illuminating their path.

Controlling both general illumination and night lighting needs to accessible to the AP from their bed. Placing a rocker switch to control the restroom luminaire next to the AP's bed would be ideal, so the luminaire could be on prior to arriving in the space, allowing time for their eyes to adjust. It would also help guide them to this brighter room, especially in the middle of the night. Upon returning to bed, the AP has the option to leave the luminaire on to serve as a nightlight, or turn it off once situated comfortably in bed.

Brighter restrooms could be attained if daylight was brought into the space. None of the AD homes visited had windows in this space, and there is no reason not to have windows. Many times AD homes are built several feet away from other structures or on upper floors so no one could look in on the restroom. Textured glass could be installed or curtains could be added so increase privacy, but still allowing daylight. Daylight could lessen APs worst behaviors like restlessness, aggressiveness, and anxiousness. In order to achieve daylight in this space, the facility would have to renovate their building to position the restrooms on the exterior of their building or use solar tubes, which are discussed in more detail later.

Daylight also provides warmth to a space both physically and psychologically. If restrooms are chilly in the winter, adding a heat lamp could promote restroom usage. The thought of walking on linoleum or tile flooring without foot protection in winter could be enough to deter APs from using the water closet or bathtub.

The next section, Bedrooms, models the improvements that could be made to the original layout modeled earlier. This room contains a restroom, and there were several changes to the improved lighting layout due to questionnaire results. The luminaires selected in the restroom are placed vertically next to the mirror so APs can get close the mirror without blocking the light. Lamps with 3,000°K provide warm illumination so the AP does not appear ghostly, but these lamps did not provide enough illumination to meet ambient requirements, so additional downlights were provided.

Bedrooms

Some facilities visited had acceptable luminaire layouts and controls, while others need improvement. To show these improvements, an existing luminaire layout from an AD home is modeled in figure 59 illustrating the improved bedroom layout. (The rendering of the original layout is located in Chapter 3). These are the same models and layouts used at the end of the report when discussing ASHRAE 90.1 criteria.

The improved layout, figure 59, has different luminaires, lamps, and locations, as well as bed positioning. The bed is located on the same wall as the restroom to enable fewer night lights to illuminate the pathway to the restroom. (Cut sheets for the improved luminaires can be found in the Appendix G).The original luminaire was kept so APs are not confused after their room is renovated. These luminaires also represent a time period with which they are more familiar. The

valance is kept similar in control style, too, because this particular model has both top and bottom illumination, allowing two levels of light within a single luminaire, which is great for task lighting. Amber nightlights are used because blue and white light might stimulate the circadian rhythm. Nightlights can be used so AP's eyes do not have to adjust to harsh luminaires.

Additional luminaires provide greater controllability for APs and caretakers, and lamps provide damnability. Being able to dim lamps provide another level of lighting control for APs who might not have progressed enough to require such high illuminance levels. Depending on the severity of the AD, nightlights could be a transition from a nice feature to a necessity. Implementing night lights into AP's bedrooms should be at the top of the priority list when the facility renovates.

Using the luminaires described, an improved layout was designed and rendered. Three glass bowl luminaires and valance will typically be on during the day, and this is shown in both the rendering and the floor plan (see figure 60). Illumination levels are more than adequate with this layout, and multiple levels of control allow APs to turn on main luminaires, reading luminaires, nightlights, and bright luminaires for therapy. Of the luminaires, the four main circles representing the main luminaires and valance are turned on, while the five smaller circles near the window for light therapy and eight nightlights turned off. For consistency of comparing the two bedrooms, the same luminaires that were "on" in the original layout, found in Chapter 3, are also "on" in the improved bedroom layout.

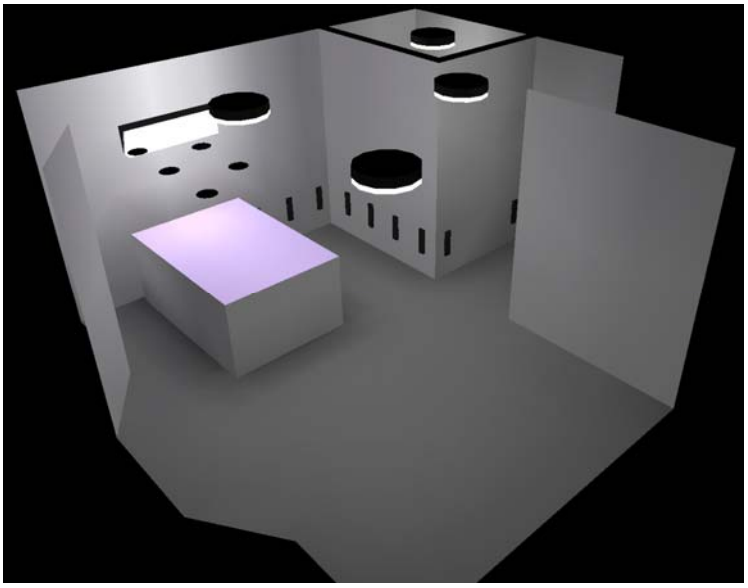


Figure 59: Improved Layout with Main Three Luminaires and Bed Luminaire "On"

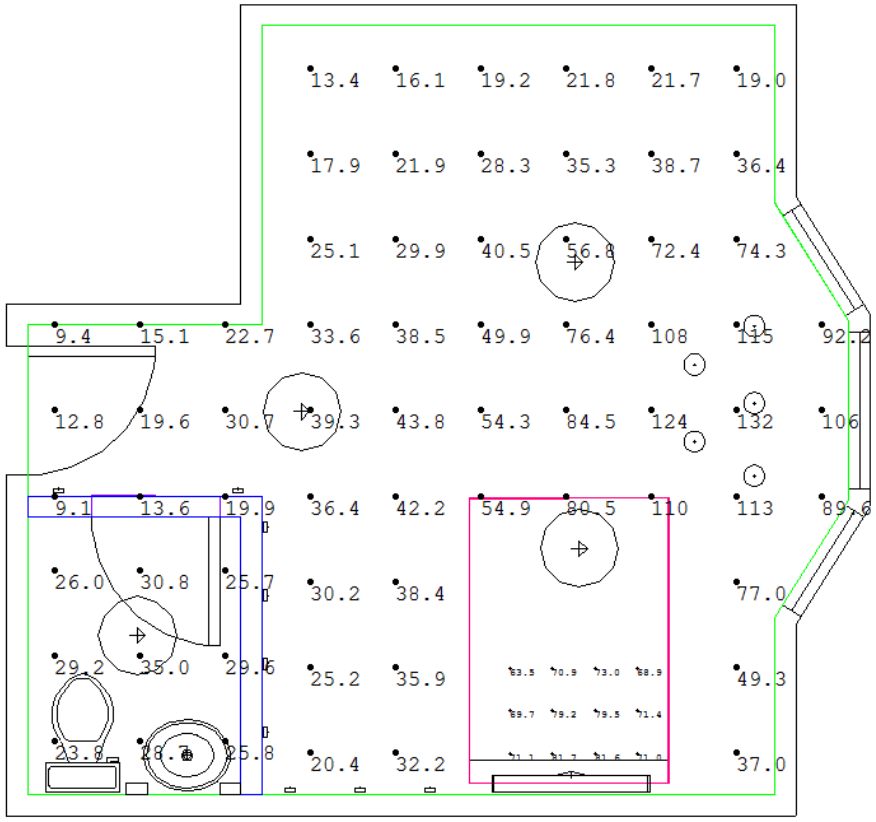


Figure 60: Improved Layout Illumination Levels with Three General Luminaires and All Restroom Luminaires "On"

The two round luminaires added to the space allow it to meet the required 10 fc average illuminance and provide the required 30 fc on the pillow top. The original layout needed the valence turned on to even provide an average of 10 fc, and it also gave 66 fc at the head of the bed but steeply dropping to 34 fc on the far pillow edge. The two footcandle layouts below, figure 61 and 62, illustrate the before and after levels with only the main luminaires "on" to compare the illumination levels and realize the need to the valance to be turned on the existing layout.

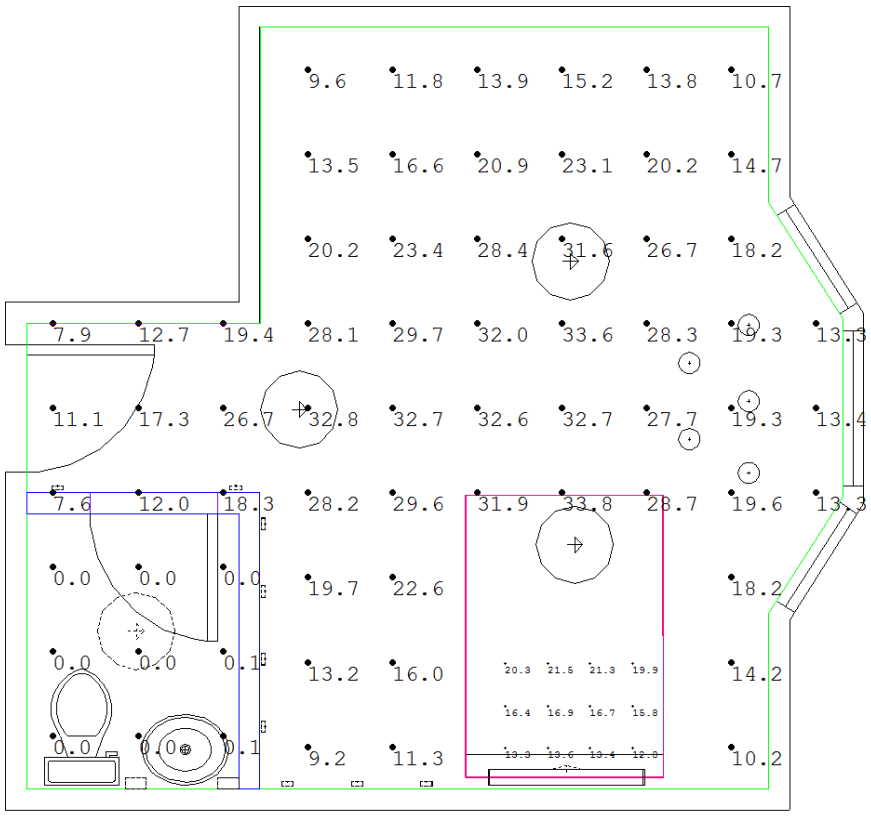


Figure 61: Improved Bedroom with Only Main Luminaires "On"

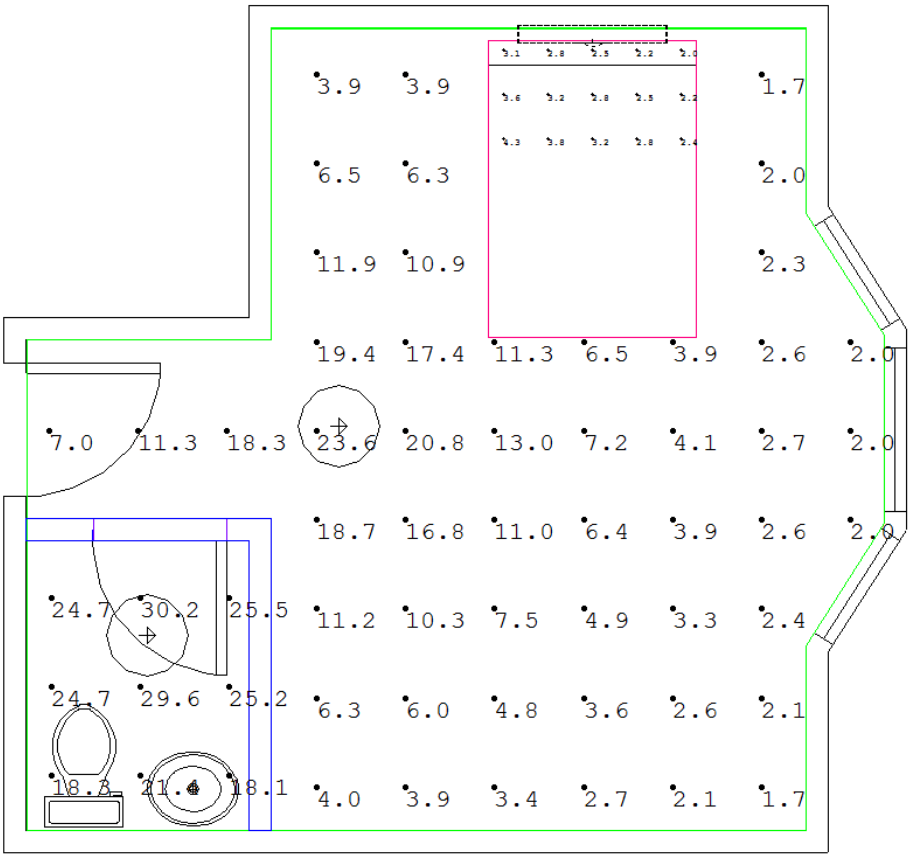


Figure 62: Original Bedroom with Only Main Luminaires "On"

Circuiting for this room is more elaborate than the original design allowing for more control (see Appendix G). The restroom switch is located outside the restroom along with the switch for the main luminaires. Another set of switches is next to the bed to allow the AP to control the overhead luminaires from their bed. Nightlight and valance switches are also located by the bed for ease of access, and daylight luminaires have a switch positioned away from other switches so not to confuse the AP.

Five downlights located near the window, in figure 63, are to be used in conjunction with daylight. While research does not favor ambient bright light therapy, additional research needs to be conducted, so this facility could provide a research environment to confirm or deny research conclusions. The selected luminaires produce over 100 fc of illumination under the downlights, which probably correlates to spending over two hours under these five downlights for the desired benefits.

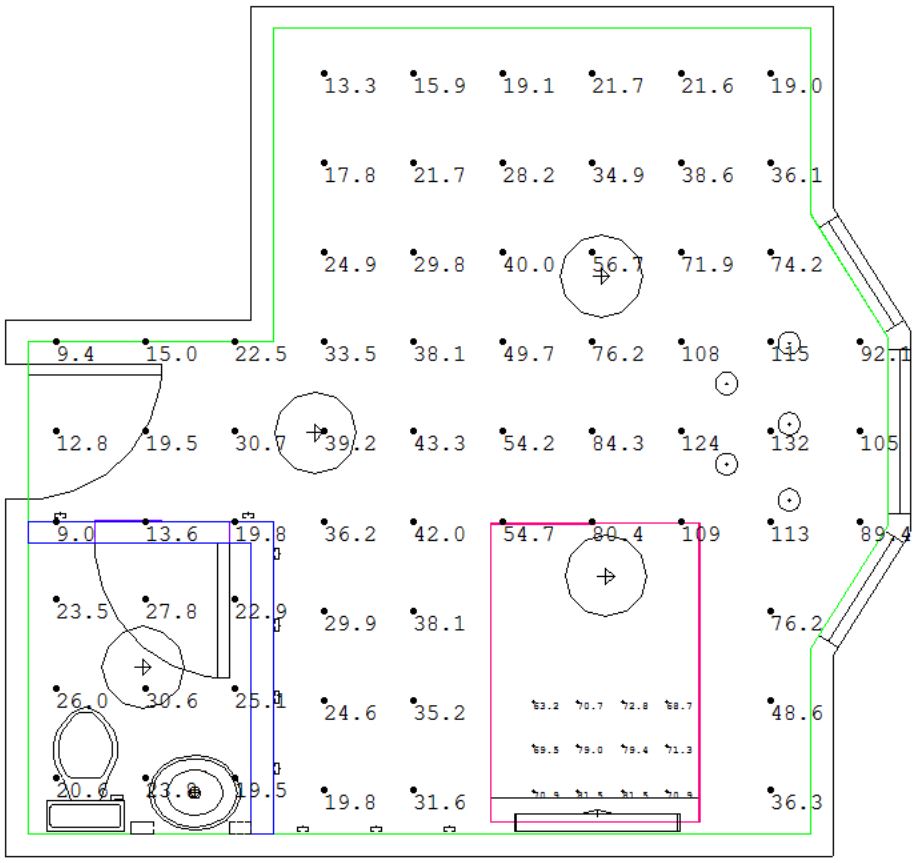


Figure 63: Main Three Luminaires and Five Light Therapy Luminaires "On"

Healing Environments

The affects of light on APs does not have to be limited to light therapy, colored wavelengths, or the circadian system. Lighting can be expanded to a more general sense. If AD homes have plants, either inside or out, illuminating them is encouraged. Nature is healing, so if there is a courtyard in the middle of the AD facility, the patients ought to be able use it at any time day or night. Courtyard paths should be lit for the safety and security of APs and luminaires could be strategically placed so plants are illuminated at night.

More issues related to healing environments frequently discussed are standard 2x4 fluorescent troffers, because hospital patients who lay in bed are irritated by the glare and starkness from the lamps. If adding a lens to this luminar or changing the reflectance from direct to indirect/direct luminaires does not improve the situation, replacing troffers with downlights is another alternative. While APs do not spend all their time on their backs looking into the

luminaires, using warm CCT lamps can make their stay more pleasant. Warm lamps make a facility seem more like home, giving a warm feel instead of a chilling institution, prison, or hospital feel, and this could aide in the transition from a home to an AD home.

Socialization is also encouraged when home lighting is used, because it is reminiscent of a family room. Residents spend up to three times as much time socializing with other residents in a home like atmosphere than those in a traditional nursing home (Gesler 2003). Social APs are more pleasant to visit instead of ones who are always sleeping or off by themselves. Watching APs interact with others gives family members hope and happiness to see their loved ones being themselves. Gesler also noticed APs in home like atmospheres "progressed more slowly in their disease, stayed physically active longer, and their care costs are lower than their counterparts." All of these outcomes benefit AP and everyone around them, so AD facilities could strive to recreate this ambiance. This homey atmosphere can be achieved by using warm CFLs when incandescent lamps have been completely phased out, and making sure there are adequate table and floor lamps for additional task lighting.

Making sure the display cases outside AP's rooms are illuminated is important to potentially spur conversation outside of the sitting are or living room. Memory boxes break up the wall space, provide APs with a small stimulant, and encourage others to stop and talk about objects inside. If the box is poorly lit with inadequate light due to intensity or wavelengths emitted, the objects will not be as enticing.

While socialization can occur anywhere, a typical location is around a fireplace. Building a fireplace, real or fake, could foster conversation or contemplation. Real fires have some stimuli from flickering, and APs need some stimulus, but not too much. Artificial fires could create the ideal balance and artificial fire could be created with lamps and a color coating for safety purposes. Flickering could be introduced for a more realistic effect as well.

Colors

Colored lamps could also be used in a unique way throughout AD facilities. Colored wall sconces could delineate different wings or neighborhoods. Children learn colors, so depending on the severity and type of Alzheimer's, the ability to recognize colors could be one of the last proficiencies to be forgotten. If caretakers could get APs to remember a specific color, or have a luminaire outside their door that is their favorite, maybe they could remember which room is

theirs and not wander into other's. Bursts of wall color could take away from an institutional feel, aide in directing APs to their rooms, as well as families navigating the facility. This could be accomplished with colored LEDs or tinted glass to produce red, blue, purple, green, etc. on the walls. APs need stimulation, just not too much, so splashes of color could be just the right amount. The renderings in figures 64-66 better illustrate this concept, but could be toned down if desired.

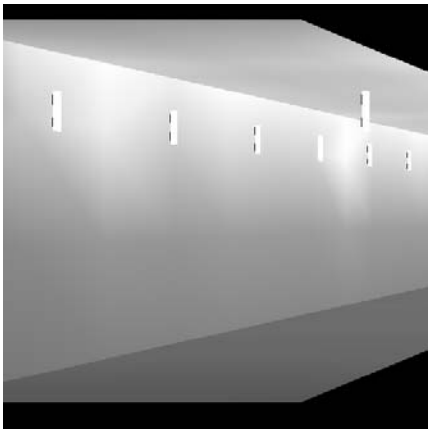


Figure 64: Typical Corridor

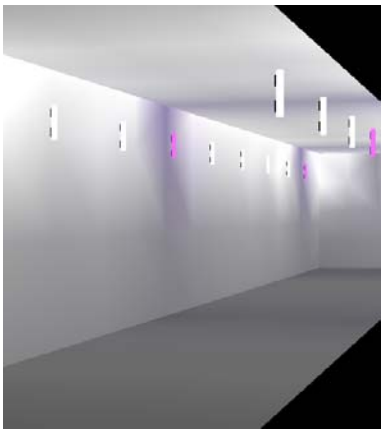


Figure 65: Sparse Color

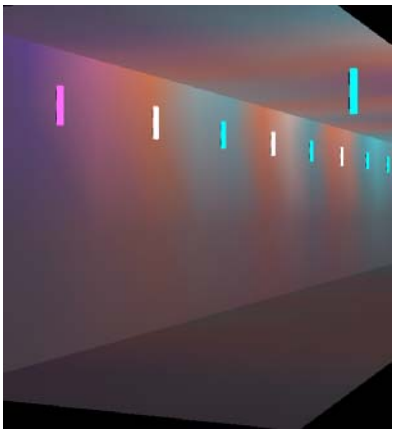


Figure 66: Multicolored

Daylight

A potentially easier way to add color to a room is by bringing in daylight. Pullins has done a fine job renovating old homes and increasing the size of the windows. Skylights are another option for homes, as well as single story facilities. The picture below, figure 67, shows an example of renovating an existing home to add a skylight. For facilities wanting to use full-spectrum luminaires, daylight is the only source that can truly bring in all the wavelengths at approximately the same intensities.

Figure 31. Skylights were added to the living room of this 1920's style bungalow. Similar skylights were added to other areas of the home. Energy efficient fluorescent wall-wash lighting highlights the artwork and lights the wall near the fireplace. (photographer: Eunice Noell-Waggoner)

Figure 67: Living Room Improvements

Reproduced with permission from Eunice Noell-Waggoner (ANSI/IESNA, 2011, p. 30).

Another way to encourage APs to sit by windows is arranging furniture nearby, as the figure above demonstrates. Furniture placed both inside and outside on a patio or porch could provide additional footcandles, but also a view to the outdoors, which is said to be healing. Some APs might need encouraging or told to sit by the windows instead of letting them wander wherever they chose, and if other APs are already there, socialization could occur.

Having a porch, awning, or sunroom attached to the facility could be beneficial to persuading APs to sit outdoors because they could be protected from harsh weather elements like wind and rain, while receiving the benefits of daylight. Sitting outside, APs receive full benefits from daylight including vitamin D, while inside they observe increased illumination levels. These physical additions to the facility could also help reduce the heating and cooling load by lessoning direct daylight during part of the day, and if these additions are not possible, then as the above figure depicts, adding blinds can reduce the mechanical load, decrease glare, and give control to the AP.

Solar Tubes

If the facility is multiple stories, then transmitting daylight becomes more challenging; but not impossible with solar tubes. Solar tubes can distribute daylight into any story of a building. As seen in figure 68, solar tubes bounce daylight back and forth in a tube down to the correct floor, and still allow daylight to be brought into a space. While skylights provide excellent color rending to objects and connectivity to the outside world, they do not always provide visual stimulation.

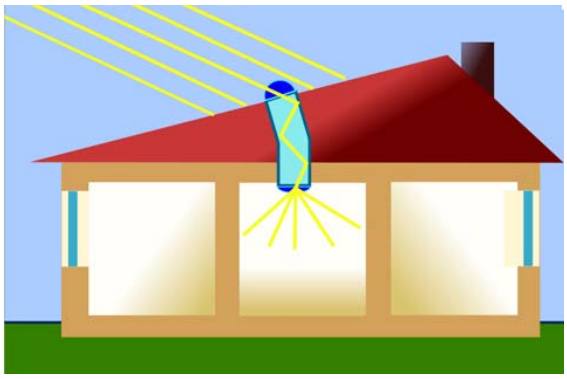


Figure 68: Solar Tube

("Solar Tube," 2011).

Nature Panels

For spaces unable to use skylights, or solar tubes, panels can be installed over fluorescent luminaires that look like nature (see figure 69). Clouds or trees could enhance the space; however, designers need to make sure this does not confuse the APs or stimulate the AP too much.

Figure 69: Skylight Fluorescents

("DECORATIVE LIGHT DIFFUSER PANELS," 2011).

Orientation

Increasing daylight requires proper orientation of the facility, like locating the dining room and activity room in the southeast part of the building to allow optimum daylight into the rooms used most frequently. If these rooms are positioned on the west side then glare, heat, and visibility become issues. Harsh daylight will enter the space during dinner, potentially making the space uncomfortably warm and difficult to hold conversations. To reduce both the direct sunlight and warmth, blinds might be closed, but this does not allow the APs to visually connect with the outside environment. Window blinds are encouraged so individuals could be allowed to decide if they want to enjoy the view or close the blinds to enhance conversation.

Improved Bedroom Compliance with ASHRAE 90.1 (2010)

As mentioned in Chapter 9, ComCheck is a tool to check for energy compliance, and the improved luminaire layout passes ComCheck by 12% (see figure 70), even though there are several more luminaires than in the original layout. Nightlights were not included in ComCheck because of exception 9.2.2.3, and the five luminaires by the windows, restroom mirror luminaires, and headboard luminaire were also not included because they will have separate controls and used sparingly. Appropriate illumination levels were achieved with this design, as seen in figure 71, and renditions on this design can apply to most AD homes. Further renderings, circuiting, and light fixture cut sheets, can be found in Appendix G.

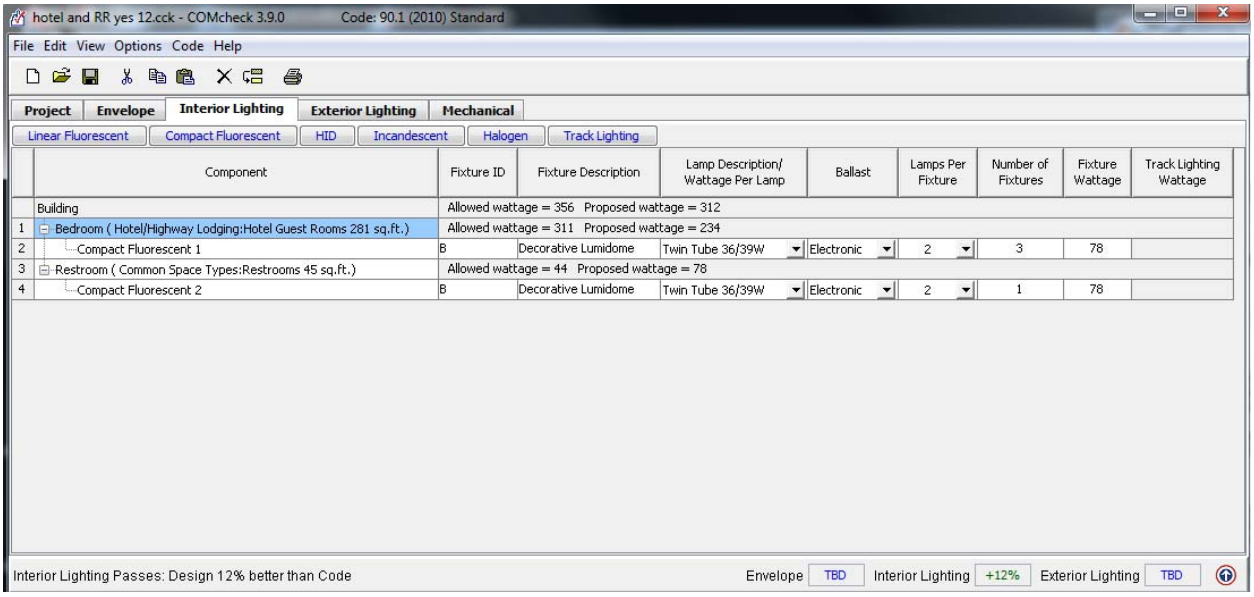


Figure 70: ComCheck for Improved Bedroom Design

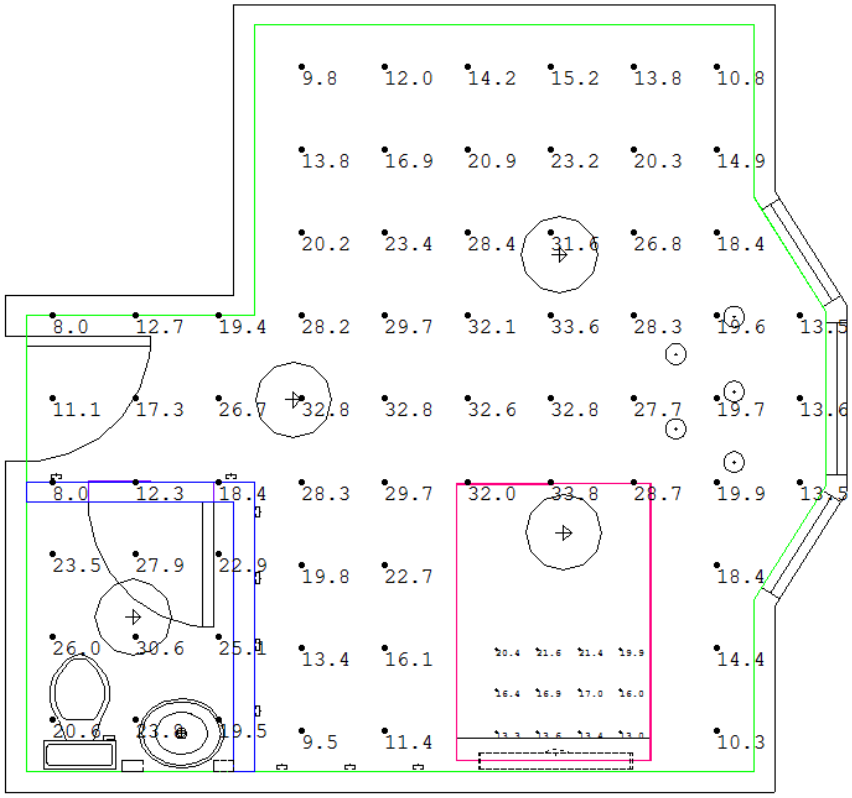


Figure 71: Main Three Luminaires and One Restroom Luminaire "On"

Facilities Visited

Depending on the location of the facility in the world, a different building orientation might be recommended to allow for increase daylight, but the other recommendations can still be applied. Some facilities need more improvements than others, like when it comes to lamp types, facilities B, F, and H could benefit from renovations. (The letter designation refers to the questionnaires in Appendix H). Two other facilities B and H replaced tubular fluorescents with CFLs because tubular fluorescents did not promote behaviors such as happiness, calmness, or talking amongst APs as much as CFLs. Therefore, facilities B, F, and H could follow suit and exchange their tubular fluorescent lamps for CFLs to promote the home environment. Since CFLs come in both warm and cool CCTs, the homes could ask their APs which lamp they prefer for their bedroom allowing them to participate in the decision making process. Including the AP in this process and tailoring their bedroom makes them feel important, useful, and loved. If their bedroom has lamps they prefer, they probably will be in a better mood.

Bedrooms are private areas that can be tailored to fit individual APs preferences, but common areas like dining rooms and sitting rooms need to provide benefits for groups of APs. An easy way to achieve positive benefits is by arranging the furniture so it is near windows and then encouraging APs to sit by windows. Questionnaire responses almost universally agreed APs display better behavior when sitting near windows, but also noted that they do not sit there at any time in particular. Suggesting they look out the window or socialize with their friend near the window could provide visual stimulation, full-spectrum light, and socialization all at the same time.

Daylight is an ideal way to increase illumination levels, but it is not controllable. A suggestion that applies to all AD homes, except facility I, is increasing the number of controllable lighting levels. Facility I has three separate levels of lighting, which is the recommended level of control, enabling APs to dim luminaires prior to sleeping or if they have a headache. Facilities with one or two levels of control must have all the luminaires on or off. Having multiple levels of lighting is different way to provide dimming in rooms, and while some APs may not use this feature, having the option typically makes people feel more in control.

In addition to multiple levels of control, switch locations can also be improved. Three-way switching is circuiting the luminaires so there is a switch at the entrance and another switch somewhere else in the room, like next to the bed. Incorporating three-way switches in bedrooms

could decrease the probability of falls, because APs could turn the luminaire on and off without leaving the comfort of their bed and tripping on something in the dark. If multiple switches are located next to each other, labels could help an AP remember which switch controls which luminaire. If labels are too cumbersome or confusing, color coding the switch to the luminaire is another suggestion to help both the AP and their family members, who might not visit their loved on a regular basis.

Relatives visit AD homes because they are concerned for their health, want to learn more about AD, and potentially bring trinkets to cheer up their loved ones. Similarly, AD facilities need to addend conferences about how to improve the lives of their residents and share knowledge with one another, since the questionnaire responses showed many facilities do not think there is anything that could be done to improve the lives of APs. There are ways to improve their lives, but the AD homes might just be uninformed so this report could give them some ideas of areas they can improve.

Chapter 13 - Conclusion

Many different aspects of light have been analyzed throughout this report from optimum luminaire layouts, wavelengths, colors, to therapy. All of these qualities can work together to aid an AP's memory, behavior, and way of thinking. Using light to enhance APs' lives will also affect their families and caretakers' lives, so facilities designed for a typical inhabitant would probably produce the best design as long as increased illumination levels are met.

Appropriate luminaire layouts can ease the transition between a loved one's home and an AD facility, and warm lamps aide this shift, especially in table and floor lamps. Cool, tubular fluorescents are not recommended because they give the home a sterile, hospital feel, but if they must be installed, direct/indirect or indirect luminaires that have a lens are best. These luminaires would focus on reducing glare and unwanted shadows, because those are two of the main concerns when illuminating an AD home.

Another way for an AD facility to resemble a residential home is by incorporating task lighting to ensure adequate footcandle levels are met while also providing additional control. These lamps can have shades that cover the exposed lamp to reduce glare. AD facilities can also improve the home ambience by adding multiple levels of lighting control, especially with nightlights in the bedroom.

A unique way to illuminate a facility could be with colored lamps, adding visual interest and a sense of fun to the home. Since APs connect with childhood due to their memory loss, if designers appeal to childhood ideals, the behavior of the APs could improve. Color luminaires also contradict the feelings and emotions associated with stark white hospital walls, which could be how an AP views an AD home.

If designing correct ambient lighting layouts does not improve the APs behaviors, light therapy has many viable options: visors, light boxes, high intensity, dawn simulators, or ambient light. Typically, light therapy uses 10,000 lux for 30 minutes, which is equivalent to daylight on a sunny day. If less light, 2,000-3,000 lux is used, light therapy could be administered for two hours to obtain similar benefits. Duration of therapy depends on lamp intensity. While daylight is the best option of these three, the others are also valid ways to try and shift the circadian rhythm.

Daylight is the best light therapy because it provides 10,000 lux and vitamin D, and best of all, it is free. About 50% of the questionnaires returned confirm research stating APs exhibit better behavior when exposed to daylight. Facilities B, E, G, H all denoted APs also enjoyed rooms with windows more and tried to sit by these windows anytime they could. Since APs were small children, they have been taught not to look directly at the sun, so additional supervision typically required to make sure APs do not stare into therapeutic lamps does not apply to daylight. Simply sitting inside by a window is not sufficient even though increased illumination levels are achieved because vitamin D does not transmit well through glass. If APs do not want to be completely exposed to the sun, they can still obtain the health benefits of sunlight by standing in the shade as seen from table 27 in Chapter 8 - Daylight.

Daylight, along with the other solutions, benefit both the caretakers and APs, which leads one to believe AD homes should be designed for everyone, the designer themselves, their friends, etc. APs have a disease, but should not be treated like they are sick necessarily. Lighting layouts should be designed to attract everyone. Helpful additions for APs include increase lighting levels, which many times are State mandated, increasing levels and location of controllability, and labeling switches and luminaries appropriately.

More research needs to be conducted to solidify current conclusions about light affecting APs. Researchers suggest including larger participant groups and longer periods to confirm the impact of light on APs. For now, benefits are likely from improved lighting, but the extent of such benefits is difficult to determine. Ambient lighting and light therapy could be used in AD homes and try to and improve AP's behaviors and help solidify research conclusions.

References

"Acute Hospitalization and Alzheimer's Disease: A Special Kind of Care." *National Institute on Aging*. 5 Feb. 2009. Web. 06 Mar. 2011. <http://www.nia.nih.gov/Alzheimers/Publications/acute.htm>.

"Alzheimer's Association - Myths." *Alzheimer's Association*. Alzheimer's Association, 4 Jan. 2011. Web. 26 Jan. 2011. <http://www.alz.org/alzheimers_disease_myths_about_alzheimers.asp>.

Alzheimer's Disease. Topeka, Kan.: Department, 1989. Print.

ANSI/IESNA. *Lighting and the Visual Environment for Senior Living*. Feb. 2011. Recommended Practice. New York.

ASHRAE Standards Committee 2009-2010. "Lighting." *ASHRAE Standard: Energy Standard for Buildings except Low-rise Residential Buildings.* Atlanta, GA: ASHRAE, 2010. 75-84. Print.

Barrick, Sloane, Williams, Mitchell, Connell, Wood, Hickman, Preisser, and Zimmerman. "Impact of Ambient Bright Light on Agitation in Dementia." *EBSCO Host*. 14 Jan. 2011. Web. 10 Mar. 2011. <http://web.ebscohost.com.er.lib.k-state.edu/ehost/detail?hid=122&sid=9b1156f7-f267-4a6f-b792-abfff1d4834a@sessionmgr111&vid=1&bdata=JnNpdGU9ZWhvc3QtbGl2ZQ==#db=c8h&AN=2010799805>.

Bullough, John. "LED Lighting Systems." *National Lighting Product Information Program* 7.3 (2003): 1-23. *Lighting Research Center*. Web. 24 Jan. 2011. <http://www.lrc.rpi.edu/programs/nlpip/lightingAnswers/led/abstract.asp>.

"Bright Light Therapy with Day-Light." *Day-Light*. 2007. Web. 22 Jan. 2011. <http://www.day-lights.com/us/usindex.html>.

"Circadian Rhythm." *Wikipedia, the Free Encyclopedia*. 11 Jan. 2011. Web. 23 Jan. 2011. <http://en.wikipedia.org/wiki/Circadian_rhythm#Human_health>.

"Correlated Color Temperature." *LED-Industries*. LED-Industries. Web. 26 July 2011. <http://www.led-industries.com/Understanding_Color.pdf>.

Clark, Denise. "Alzheimer's Patients in the Restroom." *Caring for Aging Parents | Dealing with*

Aging Parents. Web. 06 Mar. 2011. <http://www.agingcare.com/Featured-Stories/114872/Alzheimers-Patients-in-the-Restroom-Safety.htm>.

"Color Quality of White LEDs." *EERE*. Department of Energy, Jan. 2008. Web. 13 July 2011. <http://apps1.eere.energy.gov/buildings/publications/pdfs/ssl/color_quality_of_white_leds.pdf>.

Danielle. "Spa Lights by Cute & Adorable Gadgets." *Cute & Adorable Gadgets*. Cute & Adorable Gadgets, 9 Apr. 2006. Web. 16 Nov. 2011. <http://gadgets.elliottback.com/spa-lights/>.

"DECORATIVE LIGHT DIFFUSER PANELS AND FLUORESCENT LIGHT DIFFUSER PANELS." *Decorative Fluorescent Light Diffuser Panels - Decorative Light Diffusers For A Modern Interior Lighting Decor*. Greek Panels. 2011. Web. 20 Sept. 2011. <http://www.greekpanels.com/>.

Dowling, Glenna, Carla Graf, Erin Hubbard, and Jay Luxenbert. "Western Journal of Nursing Research." *Light Treatment for Neuropsychiatric Behaviors in Alzheimer's* (2007).*Sage*. Web. 10 Mar. 2011. < http://wjn.sagepub.com.er.lib.k-state.edu/content/29/8/961.full.pdf+html >.

"ENERGY STAR Fixtures Guide - Light Quality : ENERGY STAR." *ENERGY STAR*. ENERGY STAR. Web. 10 Nov. 2011. <http://www.energystar.gov/index.cfm?c=fixture_guide.pr_fixtures_guide_lightquality>.

Figueiro, Mariana G. "Lighting Rooms." *Lighting Research Center*. 1995-2011. Web. 06 Mar. 2011. <http://www.lrc.rpi.edu/programs/lightHealth/AARP/senior/lightingRooms/index.asp>.

---. "How Do I Choose Light Sources?" *Lighting Research Center*. 1995-2011. Web. 06 Mar. 2011. <http://www.lrc.rpi.edu/programs/lightHealth/AARP/designers/lightingOlderAdults/choosingSources.asp>.

---. "Research Recap." *LD+A* Feb. 2003: 17-18. Web. 24 Jan. 2011.

---. "Research Recap." *LD+A* June 2003: 8-11. Web. 24 Jan. 2011. <http://www.lrc.rpi.edu/programs/lightHealth/pdf/circadian.pdf>.

---. "Research Recap." *LD+A* June 2003: 17-18. Web. 24 Jan. 2011. <http://www.lrc.rpi.edu/programs/lightHealth/pdf/researchrecap.pdf>.

---. "The Aging Eye - How Does Vision Change as One Grows Older." *Lighting Research*

Center. 1995-2011. Web. 06 Mar. 2011. <http://www.lrc.rpi.edu/programs/lightHealth/AARP/healthcare/lightingOlderAdults/agingEye.asp>.

---. "The Bright Side of Blue Light." *LD+A* May. 2005: 16-18. Web. 24 Jan. 2011.

Figueiro, Marianna, Andrew Bierman, John Bullough, and Mark Rea. "Light and Health." *Lighting Research Center*. National Institute on Aging. Web. 06 Mar. 2011. <http://www.lrc.rpi.edu/programs/lightHealth/projects/Elders.asp?id=167>.

Figueiro, Mariana G.; Bullough, John D.; Rea, Mark S.;l Spectral Sensitivity of the Circadian System. Lighting Research Center. <http://www.lrc.rpi.edu/programs/lightHealth/pdf/spectralSensitivity.pdf>.

Figueiro, Mariana G.; Rea, Mark S.; Eggleston, Gregory. "Light Therapy and Alzheimer's Disease | January-February 2003." *Sleep Review*. Jan.-Feb. 2003. Web. 24 Jan. 2011. <http://www.sleepreviewmag.com/issues/articles/2003-01_01.asp>.

---. "Spectral Sensitivity of the Circadian System." *Lighting Research Center*. Web. 24 Jan. 2011. < http://www.lrc.rpi.edu/programs/lightHealth/pdf/spectralSensitivity.pdf>.

"Full-spectrum Light." *Wikipedia, the Free Encyclopedia*. 18 Jan. 2011. Web. 23 Jan. 2011. <http://en.wikipedia.org/wiki/Full-spectrum_light>.

GE Lighting. "Selecting the Best Color Lamp: Virtual Color Booth." *GE Consumer & Industrial Lighting: Redirect to NA Splash Page*. GE Lighting. Web. 25 July 2011. <http://www.gelighting.com/na/business_lighting/education_resources/learn_about_light/pop_color_booth.htm>.

Gesler, Wilbert M. "Therapeutic Hospital Environments." *Healing Places*. Lanham, MD: Rowman & Littlefield, 2003. 97-98. Print.

Guidelines for Design and Construction of Health Care Facilities. Comp. The Facility Guidelines Institute, The American Institute of Architects Academy of Architecture for Health, and U.S. Departmetn of Health and Human Services. Washington, DC: American Institute of Architects, 2006. 125+. Print.

"Health Care Facility Lighting." *IESNA*. 16-6-6-7. Print.

"Is Alzheimer's Disease Genetic? Hereditary Risk Factors." *WebMD - Better Information. Better Health.* WebMD, 16 July 2009. Web. 29 May 2011. <http://www.webmd.com/alzheimers/guide/alzheimers-genetic>.

Kantor, Daniel, and David Zieve. "Alzheimer's Disease - PubMed Health." *PubMed Health*. 4 Oct. 2010. Web. 07 Mar. 2011. <http://www.ncbi.nlm.nih.gov/pubmedhealth/PMH0001767/>.

"KAR 26-40-305 - Nursing Facility Physical Environment - Mechanical, Electrical, and Plumbing Systems." *Licensure and Certification Division*. Kansas Department on Aging, 27 Apr. 2011. Web. 16 Oct. 2011. <http://www.agingkansas.org/LongTermCare/LCE/Licensure_Certification.html>.

Keller, Max. *Light Fantastic: the Art and Design of Stage Lighting*. Munich: Prestel, 1999. Print.

Kogan, Alan O., and Patricia M. Guildford. "Side Effects of Short-Term 10,000-Lux Light Therapy -- Kogan and Guilford 155 (2): 293 -- Am J Psychiatry." *The American Journal of Psychiatry*. American Psychiatric Association, Feb. 1998. Web. 22 Jan. 2011. <http://ajp.psychiatryonline.org/cgi/content/full/155/2/293>.

Kohsaka, Masako, Noriko Fukuda, Hiroshi Honma, Riko Kobayashi, Satoshi Sakakibara, Emi Koyama, Toshio Nakano, and Hozumi Matsubara. "Effects of Moderately Bright Light on Subjective Evaluations in Healthy Elders Women." *Wiley Online Library*. Psychiatry and Clinical Neurosciences, 12 Feb. 2002. Web. 4 Oct. 2011. <http://onlinelibrary.wiley.com/doi/10.1046/j.1440-1819.1999.00539.x/full>.

Kumar, Vinod, and Carl Eisdorfer. *Advances in the Diagnosis and Treatment of Alzheimer's Disease*. New York: Springer Pub., 1998. 259. Print.

Lei Deng, and Robert Wolsey. "Full-spectrum Light Sources." *National Lighting Product Information Program-Lighting Answers* 7.5 (2005). Web. 6 Mar. 2011. <http://www.lrc.rpi.edu/programs/nlpip/lightingAnswers/fullSpectrum/lightSources.asp>.

"Light and Health." *Lighting Research Center*. U.S. Green Building Council (USGBC) and (in Part) Trans-National Institutes of Health Genes, Environment and Health Initiative (NIH-GEI). Web. 06 Mar. 2011. <http://www.lrc.rpi.edu/programs/lightHealth /projects/SeasonalLight.asp>.

"Light Therapy." *Wikipedia, the Free Encyclopedia*. 21 Jan. 2011. Web. 23 Jan. 2011. <http://en.wikipedia.org/wiki/Phototherapy>.

Lyndsley, Gila. "Bright Light Therapy for Seasonal Affective Disorder (SAD), Depression &

Melatonin." *SAD Light Boxes, Seasonal Affective Disorder (S.A.D) Light Therapy Box, Winter Depression & Sleep Disorders Treatment*. New Technology Publishing, Inc. Web. 23 Jan. 2011. <http://www.alaskanorthernlights.com/light_therapy.php>.

Mace, Nancy L., and Peter V. Rabins. *The 36-hour Day: a Family Guide to Caring for People with Alzheimer Disease, Other Dementias, and Memory Loss in Later Life*. Baltimore: Johns Hopkins UP, 2006. Print.

Noell-Waggoner, Eunice, Robert Dupuy, and Mark Godfrey. "Daylighting as a Personal Energizer." *LD+A* July 2011: 30-32.

Nowak, LuAnn, and Jean Davis. "Qualitative Analysis of Therapeutic Light Effects on Global Function in Alzheimer's Diseas." *Western Journal of Nursing Research* (2010). *Sage*. Web. 10 Mar. 2011. <http://wjn.sagepub.com.er.lib.k-state.edu/content/early/2010/11/16/0193945910386248.full.pdf+html>.

"Phase Response Curve." *Wikipedia, the Free Encyclopedia*. 7 Dec. 2010. Web. 23 Jan. 2011. <http://en.wikipedia.org/wiki/Phase_response_curve>.

"Philips - BriteLITE 6 Energy Light HF3310/60 - Energy Light - Light Therapy - Personal Care." *BriteLITE 6 Energy Light*. Philips Lighting, 2011. Web. 25 Nov. 2011. <http://www.usa.philips.com/c/light-therapy/hf3310_60/prd/en/>.

"Philips - Circadian." *Home - Royal Philips*. 2011. Web. 23 Jan. 2011. <http://www.usa.philips.com/c/circadian/178345/cat/;jsessionid=4CAB20D1AEAE621749F6D11FE39DC3C1.app102-drp4?show=results&external=false&language=en&country=us&catalogType=consumer&_requestid=372332>.

Philips Lighting. "Color Temperature." *Brite-Lite Lighting and Electrical Distributors - Home Page*. Philips Lighting. Web. 19 July 2011. <http://www.brite-lite.com/Products/Technical/Color_Temp.html>.

"The Photoperiod Effect." *The Photoperiod Effect - Natural Darkness for Natural Health, with More Melatonin Etc.* 9 Aug. 2006. Web. 23 Jan. 2011. <http://photoperiodeffect.com/photoperiod_diabetes_hypertension/the_unknown_eye_iprgcs.html>.

"Planning and Design Guide for Community-based Day Care Centers." *Alzheimer's*

Disease International. Alzheimer's Disease International, Aug. 1999. Web. 20 Oct. 2011. <http://www.alz.co.uk/adi/pdf/daycarecentre.pdf>.

Powell, Lenore S., and Katie Courtice. "The Physical Challenges of Alzheimer's Disease."*Alzheimer's Diesase A Guide for Familes*. Reading: Addison-Wesley, 1983. 119-24. Print.Pullins, Jerry. "Alzheimer's Care." Telephone interview. 1 Feb. 2011.

Pullins, Jerry. "Alzheimer's Care." Telephone interview. 1 Feb. 2011.

Rea, Mark S. *Light-Much More than Vision*. Tech. Troy: Lighting Research Center. Web. <http://www.lrc.rpi.edu/programs/lightHealth/pdf/moreThanVision.pdf>.

Rea, Mark S., Mariana G. Figueiro, Andrew Bierman, and John D. Bullough. "Circadian Light."*Journal of Circadian Rhythms* (2010). Web. 26 Jan. 2011.

"Reference Library." *WholeHealthMD*. 20 Apr. 2005. Web. 22 Jan. 2011. <http://www.wholehealthmd.com/ME2/dirmod.asp?sid=17E09E7CFFF640448FFB0B4FC1B7FEF0&nm=Reference Library&type=AWHN_Therapies&mod=Therapies&mid=&id=5ACB0BAA23384F3197BA0DAA6EBA40DA&tier=2>.

"Reference Library." *WholeHealthMD*. 20 Apr. 2005. Web. 23 Jan. 2011. <http://www.wholehealthmd.com/ME2/dirmod.asp?sid=17E09E7CFFF640448FFB0B4FC1B7FEF0&nm=Reference Library&type=AWHN_Therapies&mod=Therapies&mid=&id=4350211BC6F94C13BC9BD903B4BD423C&tier=2>.

"Sleep Issues in Persons with Dementia." *Alzheimer's Association* May 2009. Web. 26 Jan. 2011. http://www.alz.org/texascapital/documents/Sleep_Issues_in_Persons_with_Dementia.pdf.

Sloane, Philip D., Mariana Figueiro, and Lauren Cohen. "Light as Therapy for Sleep Disorders and Depression in Older Adults | Clinical Geriatrics." *Clinical Journal of the American Geriatrics Society*: 25-31. *Clinical Geriatrics | A Clinical Journal of the American Geriatrics Society*. 3 Mar. 2008. Web. 23 Jan. 2011. <http://www.clinicalgeriatrics.com/articles/Light-Therapy-Sleep-Disorders-and-Depression-Older-Adults?page=0,0>.

"Solar Tube - How To Light A Room With Solar Tubes - Solar Panels." *Solar Energy - Information about Solar Power & Renewable Energy*. Solar Contact. Web. 16 Nov. 2011. <http://www.solarcontact.com/solar-panels/solar-tube>.

"Solid-State Lighting: LED Basics." *EERE: EERE Server Maintenance*. Department of Energy, 24 May 2011. Web. 13 July 2011. <http://www1.eere.energy.gov/buildings/ssl/sslbasics_ledbasics.html>.

Caretakers , Mayo Clinic. "Seasonal Affective Disorder Treatment: Choosing a Light Box - MayoClinic.com." *Mayo Clinic*. 1 Oct. 2010. Web. 23 Jan. 2011. <http://www.mayoclinic.com/health/seasonal-affective-disorder-treatment/DN00013>.

---. "Sundowning: Late-day Confusion - MayoClinic.com." *Mayo Clinic*. Mayo Clinic. Web. 12 June 2011. <http://www.mayoclinic.com/health/sundowning/HQ01463>.

"The Aging Eye - How Does Vision Change as One Grows Older?" *Lighting Research Center*. 2010. Web. 24 Jan. 2011. <http://www.lrc.rpi.edu/programs/lightHealth/AARP/healthcare/lightingOlderAdults/agingEye.asp>.

The Facilities Institute, and U.S. Department of Health and Human Services. "Nursing Facilities." *Guidelines for Design and Construction of Health Care Facilities*. Comp. American Institute of Architects. Washington, DC: American Institute of Architects, 2006. *Facility Guidelines Institut*. Facility Guidelines Institute. Web. 3 Nov. 2011. <http://openpub.realread.com/rrserver/browser?title=/FGI/2006guidelines>.

Thorpe, Lilian, Joan Middleton, Gqen Russell, and Norma Stewart. "Bright Light Therapy for Demented Nursing Home Patients with Behavioral Disturbance." *American Journal of Alzheimer's Disease* 15.1 (2000). Jan.-Feb. 2000. Web. 10 Mar. 2011. <http://aja.sagepub.com.er.lib.k-state.edu/content/15/1/18.full.pdf+html>.

"Understanding Color." *LED Industries: Your Exterior Lighting Experts*. LED Industries. Web. 25 Nov. 2011. <http://led-industries.com/Understanding_Color.pdf>.

United States. Department of Defense. *UNIFIED FACILITIES CRITERIA-Design: Interior, Exterior Lighting and Controls*. By NAVAL FACILITIES ENGINEERING COMMAND, U.S. ARMY CORPS OF ENGINEERS, and AIR FORCE CIVIL ENGINEER SUPPORT AGENCY. 2010. Print.

Appendix A - Definitions

AD (Alzheimer's Disease) - The most common form of dementia that gradually gets worse over time. It affects memory, thinking, and behavior more severely than generic dementia.

Ambient Light - General illumination of a space with no directional luminaires.

Assisted Living - Facilities that provide meals and housekeeping for elders who are typically younger and physically stable.

Brightness - The visual perception of light.

Bright Light - Light output of at least 10,000 lux.

Bright White Light - Lamps that emits cooler wavelengths of light similar to tubular fluorescents. Sometimes also referred to as daylight.

CCT (Color Correlated Temperature) - Describes the visual warmth or coolness of light. A lower color temperature (3,000°K and lower) describe a warm source, like an incandescent. A higher color temperature (4,000°K and above) describes a cool source, like a cool white fluorescent.

CFL - Compact Fluorescent Lamp

CRI (Color Rendering Index) - A technique to indicate how accurately a source renders color compared to daylight. A CRI of 100 is the reference condition, and those lamps with a CRI less than 100 might make objects appear unnatural.

Dementia - The loss of brain function that affects memory, thinking, language, judgment, and behavior.

Spectral Power Distribution Curves- Visual "feel" or profile of color from a specific light sources.

Efficacy (lm/W) - The ratio between the amount of light (luminous *flux*) produced by a lamp to the amount of power consumed to produce it.

Flux (lumen, lm) - Total light production power of light *source.*

Fc (Footcandle lm/ft^2) - The English unit of illumination, one lumen per square foot. It is the non-SI unit of illuminance.

Full-spectrum Light - Light that covers the electromagnetic spectrum from infrared through near-ultraviolet.

HID - High intensity discharge

Intensity (candela) - Strength of light in a *particular direction.*

Illuminance (foot candle) - Amount of light *arriving at a surface.*

Lamp - Also known as a light bulb

LED - Light emitting diode

LEED - Stands for Leadership in Energy and Environmental Design, and is a government sponsored program with four levels of compliance that promote sustainable buildings and development practices.

Light - In this report, "light" refers to both daylight and artificial luminaires.

Luminance - The photometric measurement of luminous intensity of a surface in a give direction per unit of project area.

Luminaire (Light Fixture) - Completely integrated lighting unity which includes a housing and reflector to hold the lamps, and all necessary hardware to operate the lamp.

Luminous Efficacy of a Source of Light (lm/W) - The quotient of the total luminous flux emitted to the total lamp power input.

Lux (lm/m^2) - The international unit of illumination, one lumen per square meter. It is the SI unit of illuminance and *luminous emittance* measuring luminous power per area.

Monochromatic Light - One shade or one color of light.

Nursing Home - Facilities providing around-the-clock nursing for elders who are more dependent on others for everyday tasks. (See *assisted living* for optional long term care).

Soft White Light - CFL replacement for incandescent lamps. Emitting warm wavelengths of light.

Sundowning - A state of confusion happening in late afternoon. Some APs may also exhibit mood swings or a desire to be with loved ones who have passed.

Ultra Violet (UV) - Electromagnetic radiation with wavelengths shorter than visible light.

W/sf (Watt per Square Foot) - Unit of power in the SI system divided by the area.

Water closet - Also known as a toilet.

White Light - Combination of all wavelengths of light. Perceived as having high brightness compared to surroundings.

Appendix B - Philips briteLite 6 Information

Additional Philips briteLite 6 lamp information can be found on their website, but specifications, user manual, and leaflet are provided below for the briteLite 6 product.

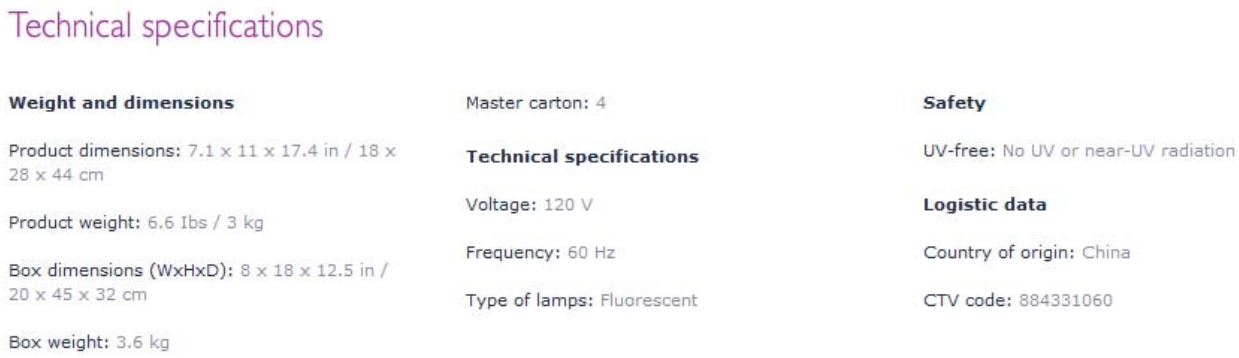


Figure 72: Philips Bright Light Specifications

("Philips - BriteLITE 6," 2011).

Philips
briteLITE 6 energy light

HF3310

Get an energy boost naturally

with full-spectrum 10,000 lux light intensity

Research shows that our mood and energy levels are regulated by light. The briteLITE 6 energy light provides full spectrum 10,000 lux light that naturally restores the essential light signals needed to feel happy and energetic.

Boost mood and energy
- Clinically proven to treat winter blues
- Provides the natural benefits of sunlight

Full-spectrum light
- 10,000 lux light intensity
- The light our bodies respond to

Easy to use
- Four timer settings ranging from 15 to 60 minutes
- Automatically shuts off when session time is up

Comfortable light
- Produces no harmful UV or near-UV light

PHILIPS
sense and simplicity

Specifications

Weight and dimensions
- Product dimensions: 7.1 x 11 x 17.4 in / 18 x 28 x 44 cm
- Product weight: 6.6 lbs / 3 kg
- Box dimensions (WxHxD): 8 x 18 x 12.5 in / 20 x 45 x 32 cm
- Box weight: 3.6 kg
- Master carton: 4

Technical specifications
- Voltage: 120 V
- Frequency: 60 Hz
- Type of lamps: Fluorescent

Safety
- UV-free: No UV or near-UV radiation

Logistic data
- Country of origin: China
- CTV code: 884331060

Highlights

10,000 lux light intensity
The briteLITE combines 10,000 lux light with boosted blue spectrum.

Clinically proven
Our bodies use sunlight to regulate a variety of functions that affect our mood and energy level. Without enough sunlight, we often feel down and lack energy. In the winter months this can be especially noticeable, leading to what many refer to as the "winter blues". Light therapy is a simple and natural way to help you restore your mood and energy levels and beat winter blues -without the use of drugs or artificial stimulants. Best of all, most people feel the benefits of light within just a few days.

Natural solution
Our modern lifestyles often add to the problem because we may spend most of our time under artificial lights that simply do not replicate sunlight. By using the briteLITE energy light, you can boost your mood and energy by replenishing the light you may be missing.

Easily adjustable setting
With four convenient settings, you can choose the one that's right for you. Plus, the briteLITE remembers your last session length and shuts down automatically when your time is finished, making it easy to use.

Issue date 2009-11-06

Version: 1.5.1

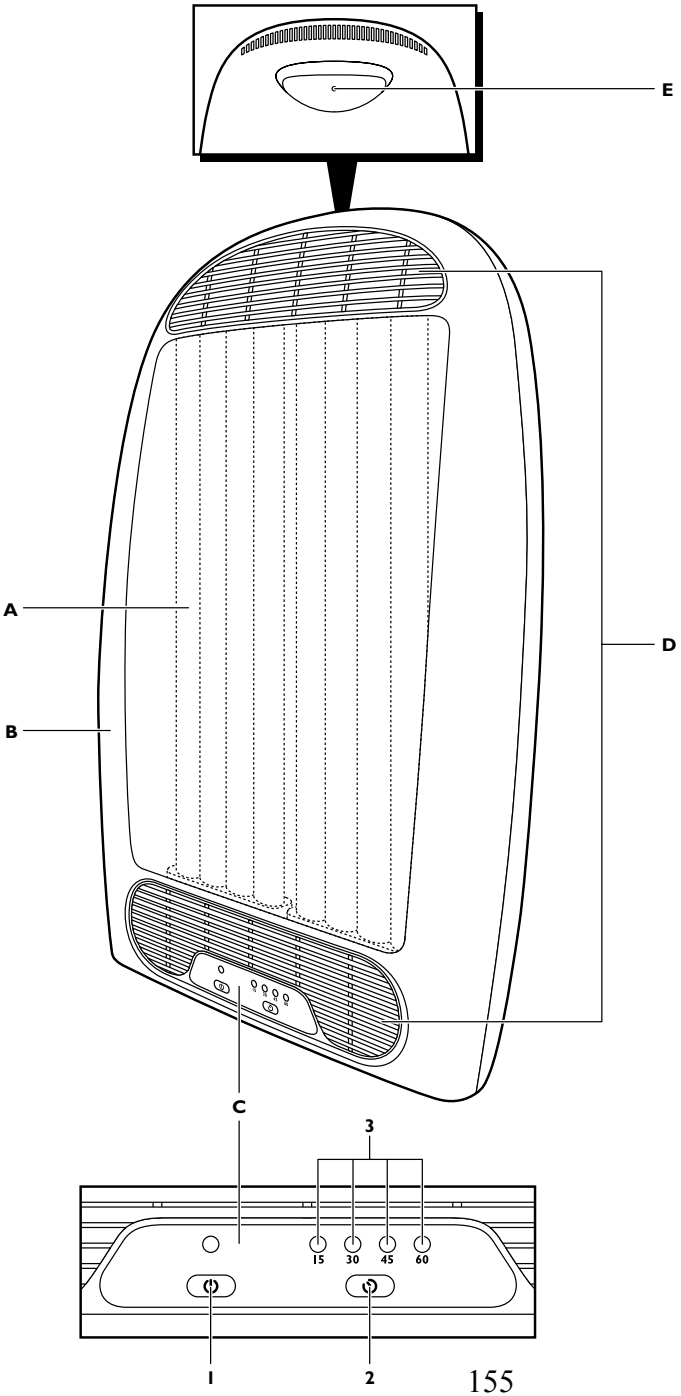
www.philips.com

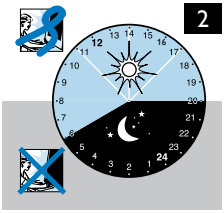
Register your product and get support at
www.philips.com/welcome

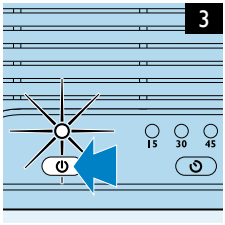
HF3310

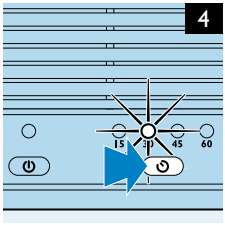
PHILIPS

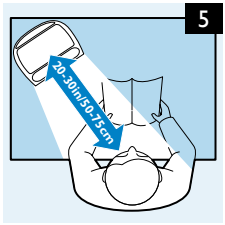
Fig. 1




2


3
15
30
45


4
15
30
45
60


5
20-30m/50-75cm

Important

Read this user manual carefully before you use the appliance and save it for future reference.

Danger

- Water and electricity are a dangerous combination. Do not use this appliance in wet surroundings (e.g. in the bathroom or near a shower or swimming pool).

Warning

- Check if the voltage indicated on the appliance corresponds to the local voltage before you connect the appliance.
- If the power cord is damaged, do not use the appliance. Call 1-866-832-4361 for assistance.
- Close supervision is necessary when this appliance is used by, or near children or invalids.
- Children should be supervised to ensure that they do not play with the appliance.

Caution

- Always unplug the appliance after use.
- Place the appliance on a stable, level and non-slippery surface.
- Do not place any object on top of appliance.
- Never use the appliance if the lamp housing or cover is damaged, broken or missing.
- To prevent possible damage to the cord, do not wrap cord around the appliance.
- Make sure the vents in the top and in the bottom of the appliance remain open during use.
- Do not use the appliance in a room that is not illuminated by any other lamp, as this may cause eyestrain. Use the light of this appliance as an addition to the normal light (sunlight, electric light) in your home.
- Do not look straight into the light too long, as this may be uncomfortable for your eyes.
- Consult your doctor before you start using the Philips briteLITE energy light if:
  1 you suffer or have suffered from severe depression;
  2 you are hypersensitive to light (e.g. due to diabetes or epilepsy);
  3 you have an eye complaint;
  4 you are on specific medication (i.e. certain antidepressants, psychotropic drugs or malaria tablets);
  5 you have high blood pressure.
- If use of the appliance causes you to become too active, we advise you to reduce the exposure to bright light. If there is no improvement, consult your doctor.
- If you feel exhausted, distressed or restless and/or suffer from sleeping problems (e.g. insomnia) after you have used the appliance, we advise you to consult your doctor.
- Use this appliance for its intended household use as described in this manual. Do not use attachments not recommended by Philips Electronics North America Corporation.

General

- The duration of the light exposure depends on the distance at which the appliance is used. See chapter 'Using the appliance' for the appropriate distance and duration.
- After the first few light exposures, you may experience some eye strain and/or a light headache. These side effects tend to disappear quickly.
- Learn more about your briteLITE energy light at www.philips.com/briteLITE

SAVE THESE INSTRUCTIONS

Introduction

Congratulations on your purchase and welcome to Philips! To fully benefit from the support that Philips offers, register your product at www.philips.com/welcome.
This appliance helps to counteract the tiredness, low spirits and lack of energy that many people experience in fall and winter, when the days are darker and shorter. These symptoms are often referred to as the winter blues.

briteLITE energy light and the winter blues

The winter blues are characterized by a combination of the following symptoms: tiredness, lack of energy and trouble getting out of bed in the morning. The winter blues occur during the darker period of the year, i.e. from September until March. More than 60% of the population is troubled by the winter blues. Many health experts agree that the winter blues can be counteracted by exposure to bright light. 'Bright light' means daylight with a certain intensity. In winter, the outdoor light intensity is often much lower than in summer: on a gloomy winter day the light intensity varies between 2,500 and 10,000 lux, whereas this may be as much as 100,000 lux on a bright summer day. Moreover, in winter most people spend a lot of time indoors, either at home or at work, where artificial light often has an intensity of as little as 500 lux and sometimes even less. Philips has developed this special lighting appliance for winter blues. This appliance allows you to safely get the amount of light you need to combat the winter blues. Exposure to a personal energy light is generally accepted as one of the safest and most effective ways of fighting the winter blues.

General description (Fig. 1)

A Lamp
B Lamp housing
C Control panel
1 On/off button with power-on light
2 Timer button
3 Timed lights
D Vents
E Handle

Using the appliance

- It is advisable to start using the briteLITE energy light as soon as you feel the winter blues coming on or when you feel like you need extra light.
- Preferably take your light exposures between 6 o'clock in the morning and 8 o'clock in the evening. (Fig. 2)
- Visit www.lighttherapy.com for a free assessment and to customize a light exposure time schedule just for you.

1 Place the appliance on a level surface such as a counter, table or desk.

2 Put the plug in the electrical outlet.

3 Press the on/off button to turn on the appliance (Fig. 3).
◗ The lamp goes on.
◗ The power-on light and the 45-minute timed light indicator go on.

4 Press the timer button repeatedly to select the light exposure time of your preference (Fig. 4).
◗ The timed lights stay on to the selected light time.

Note: You can select a light time of 15, 30, 45 or 60 minutes.

Note: The default light time is 45 minutes.
◗ When the selected light time has elapsed, the lamp switches off automatically.

Duration

The advisable duration of the light exposure depends on the distance at which the appliance is used:
- approx. 15 minutes at a distance of 13in/33cm
- approx. 30 minutes at a distance of 20in/50cm
- approx. 45 minutes at a distance of 30in/75cm
- approx. 60 minutes at a distance of 40in/100cm

Note: Usage duration varies depending on your needs. Most people obtain best results using the briteLITE energy light about 30 minutes per session at a distance of about 20-30in/50-75cm.

5 Position yourself near the appliance and place the lamp at a 45° angle so you can comfortably look in the direction of the light (Fig. 5).

Make sure there is a distance of at least 13in/33cm between your face and the briteLITE energy light.
- You do not need to sit right in front of the appliance.
- For the best results, place the briteLITE energy light on a surface at the same level as your midriff (stomach area), e.g. place it on the table at which you are sitting.
- You do not have to take the whole light exposure without interruption. If it suits your schedule better, you can interrupt your light exposure and continue later.
- You can read, eat, work at the computer, watch TV, exercise or perform other tasks while you use your briteLITE energy light.

Note: Do not stare into the light. It is sufficient that the light reaches your eyes indirectly from the side.
- Use your briteLITE energy light in a well-lit room to minimize eye strain.

6 Look into the light every now and then.

Do not look into the light continuously. You can simply engage in other activities such as reading, writing, or handicraft while taking a light exposure and look into the light every now and then.

7 Repeat the light exposures until you feel better.

Generally, improvements occur within 1 week. After then, you can reduce your light time to maintain your desired results.

8 You may repeat the light exposure as often as you like during the dark period of the year. Take a light exposure for at least 5 successive days.

9 After use, remove the plug from the electrical outlet.

Cleaning

Clean the appliance and inside the lens at least once a year.

Do not attempt to remove the reflector and lamps.

Never immerse the appliance in water or any other liquid, nor rinse it under the faucet.

Never use scouring pads, abrasive cleaning agents or aggressive liquids such as petrol or acetone to clean the appliance.

1 Switch off the appliance and unplug it.

2 Clean the outside of the appliance with a dry cloth.

3 To clean the inside of the appliance, remove the four screws at the back of the appliance that are marked with a (+) with a screwdriver.

4 Remove the front lens.

5 Tilt the appliance forward (1) and wipe away any dust from the lamps and the reflector with a damp cloth (2).

6 Wipe the front lens with a damp cloth.

7 Reassemble the front lens and reattach the screws with a screwdriver.

Note: Make sure the lamps, the reflector and the front lens are completely dry before you reassemble the front lens.

This appliance has no other user-serviceable parts. For assistance call 1-866-832-4361.

Storage

- If the appliance will not be used for an extended period of time, remove cord from outlet and store in a safe, dry location where it will not be crushed, banged, or subject to damage.
- Do not wrap cord around the appliance when storing.

Disposal

- Dispose of the device in accordance with local regulations.
- Your local or national recycling organizations may also have disposal information.
- For assistance call 1-866-832-4361.

Assistance

For assistance call toll free: 1-866-832-4361 or visit our website:
www. philips.com/briteLITE

45-Day Money-Back Guarantee

If you are not fully satisfied with your Philips briteLITE energy light, send the product back along with the original dated sales receipt and we will refund you the full purchase price.
The briteLITE energy light must be shipped prepaid by insured mail, insurance prepaid, and have the original sales receipt, indicating purchase price and the date of purchase, enclosed. We cannot be responsible for lost mail. The briteLITE energy light must be postmarked no later than 45 days after the date of purchase. Philips reserves the right to verify the purchase price of the briteLITE energy light and limit refunds not to exceed suggested retail price.
To obtain Money-Back Guarantee Return Authorization Form, call 1-866-832-4361. Please allow 4-6 weeks for delivery of the check.

Full Two-Year Warranty

Philips Electronics North America Corporation (USA) and Philips Electronics Ltd (CANADA) warrant each new Philips product, model HF3310 against defects in materials or workmanship for a period of two years from the date of purchase, and agree to repair or replace any defective product without charge. IMPORTANT: This warranty does not cover damage resulting from accident, misuse or abuse, lack of reasonable care, or the affixing of any attachment not provided with the product. NO RESPONSIBILITY IS ASSUMED FOR ANY SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES. In order to obtain warranty service, simply call toll-free 1-866-832-4361.

In US Manufactured for: Philips Consumer Lifestyle, A Division of Philips Electronics North America Corporation, 1600 Summer Street – 5th Floor, Stamford, CT 06905-5125

In Canada Imported for: Philips Electronics LTD, 281 Hillmount Road, Markham, Ontario L6C 2S3

Frequently asked questions

This chapter lists the questions most frequently asked about the appliance. If you cannot find the answer to your question, call 1-866-832-4361 for assistance.

Question	Answer
Can I look directly at the appliance when it is switched on?	Yes, you can look into the light every now and then, but we advise you not to look into the light continuously. It is sufficient to sit close to the lamp.
Are there any side effects to using the briteLITE energy light?	During the first few days of use, some people may experience minor headaches or strained or watery eyes. These symptoms generally disappear within a few days. If not, consult your doctor before you proceed with your light exposure.
How often should I use the briteLITE energy light?	We recommend that you start taking daily light exposures for 5 to 7 days in a row, preferably in the morning. Most people start to feel more energetic within 5 days. If you do not notice any improvement within that time, continue using the briteLITE energy light for another 7 to 14 days and make the sessions longer. Do not give up too soon, since it may take up to 2 weeks before you notice any significant improvement. However, if using the briteLITE energy light causes you to become too active, we advise you to reduce the light exposure.
Can I use the briteLITE energy light if I am on medication?	If you are on prescribed medication, we advise you to consult your doctor first before you use the briteLITE energy light or use any other form of light. Certain medicines cannot be used in combination with light exposure. Anti-depressants combined with light exposure may result in eye damage.
Can I use the briteLITE energy light if I have eye problems?	If you have eye problems, you should consult your doctor or ophthalmologist before you use the briteLITE energy light or undergo any other form of light. There are certain eye and eye-related conditions that may respond unfavorably to light.

Question	Answer
Can I use the briteLITE energy light if I have a skin allergy?	If you are allergic to light or have a diagnosed chronic skin disease, it is safest to consult your doctor before you use the briteLITE energy light or undergo any other form of light.
Can I use the briteLITE energy light during pregnancy?	Yes, there are no known side effects from using the briteLITE energy light during pregnancy.
Can I use the briteLITE energy light if I am allergic to light?	If you are allergic to light, we recommend that you consult your doctor before you use the briteLITE energy light or use any other form of light.
Is it harmful to sit in front of a switched-on briteLITE energy light for a prolonged period of time?	No, using the briteLITE energy light longer than the recommended time is not harmful. However, do not use the light after 8 p.m.
Do I have to wear any sunscreen lotion?	No, the briteLITE energy light is not a tanning device. It has a special screen that filters out all UV rays; it is therefore safe for your skin and does not give you a tan. If you use the briteLITE energy light in accordance with the instructions in the user manual, you do not have to worry about tanning or other skin reactions.

Appendix C - Day-Light Information

The products in figures 73 and 74 are manufactured by Uplift Technoligies, and these are just two additional lamp alternatives to Philips lamps.

Day-Light Classic

Home ▸ Product ▸ Specifications

Where can I buy mine?
Click to Find Out

Day-Light Classic DL930 Specifications:

Day-Light	
Model No. DL 930	**Description** Day-Light Classic
Description	**Details**
UL & C-UL Listed	
Enclosure Size	13.25" x 16" x 3" (33.7 cm x 40.6 cm x 7.6 cm)
Height on Legs	Max: 28" (71.1 cm), Mid: 26.5" (67cm), Min: 25" (63.5cm)
Weight of Light	6.5 lbs (3.0 kg)
Electronic Ballasts	Instant on, no flicker
Lens Material	High-impact polycarbonate
UV Diffusing Filter	99.3% UV filter
Two-Way Switch a) 3 light setting b) 2 light setting	 10,000 lux 7,000 lux
Light Tubes:	
Compact fluorescent	3 x 36 watt compact fluorescent
4,000 Kelvin color temperature	
Warranty:	
Five-year limited warranty	

Figure 73: Day - Light Classic Specifications

("Bright Light Therapy with Day-Light," 2007).

Day-Light Sky

Home ▸ Product ▸ Specifications

Day-Light Sky DL2000 Specifications:

Where can I buy mine?
Click to Find Out

Day-Light	
Model No. DL 2000	**Description** Day-Light Sky
Description	**Details**
UL & C-UL Listed	
Enclosure Size	13.69" x 10.38" x 2.75" (26.2 cm x 35.2 cm x 7.2 cm)
Height on Legs	Max: 27.25" (69.2 cm), Mid: 26.25" (66.6cm), Min: 25" (63.5cm)
Weight of Light	8.2 lbs (3.7 kg)
Electronic Ballasts	Instant on, no flicker
Lens Material	High-impact polycarbonate
UV Diffusing Filter	99.3% UV filter
Two-Way Switch a) 2 light setting b) 1 light setting	 10,000 lux 5,000 lux
Light Tubes:	
Compact fluorescent	2 x 55 watt compact fluorescent
4,000 Kelvin color temperature	
Warranty:	
Five-year limited warranty	

Figure 74: Day - Light Sky Specifications

("Bright Light Therapy with Day-Light," 2007).

Appendix D - Thorpe et al.'s Research on Bright Light Therapy for Demented Nursing Home Patients with Behavioral Disturbances

Below is the full documented experiment conducted by Thorpe et all.

Bright light therapy for demented nursing home patients with behavioral disturbance

Lilian Thorpe, Joan Middleton, Gwen Russell and Norma Stewart

AM J ALZHEIMERS DIS OTHER DEMEN 2000 15: 18
DOI: 10.1177/153331750001500109

Bright light therapy for demented nursing home patients with behavioral disturbance

Lilian Thorpe, BSc, MSc, MD, FRCP
Joan Middleton, RN, MN
Gwen Russell, BA
Norma Stewart, RN, PhD

Abstract

The objective of this study was to examine the effects of morning bright light on behavioral disturbances in dementia using a repeated measures ABA design. We hypothesized that morning bright light in demented patients reduces the agitation rating and directly observed disruptive behavior, but increases observed positive behavior.

The study was done in a special care unit of a long term care facility, with 16 demented residents ages 60 to 89, 13 female and three male. Morning bright light (Day-Light Box 10000, produced by DayLight Technologies, Inc, providing 10,000 lux) was administered Monday to Friday during the treatment week. The Global Deterioration Scale rating at baseline, followed by baseline, treatment and post-treatment ratings in the Cohen-Mansfield Agitation Inventory (CMAI) and Environment-Behavior Interaction Code (EBIC) were used as measurements

Compared to baseline, the mean total Cohen-Mansfield score decreased more during the phototherapy week than during the post-treatment week ($p < 0.05$ on one-tailed paired t-test). Regardless of phototherapy, Cohen-Mansfield scores decreased significantly in summer versus fall-spring ($p < .005$). Although the direct behavioral measures [EBIC] showed no statistically significant change compared to baseline, there was a pattern of greater mean increase in positive behaviors ($p = .08$) during phototherapy than in the post-treatment week, and a mean decrease of total disruptive behaviors most pronounced in the post-treatment week ($p = .05$).

Bright light therapy has modest efficacy in reducing agitation, with possible concurrent improvement in positive behaviors. Disruptive behaviors may also become less frequent during phototherapy with evidence of even greater delayed optimal effect. Further research should focus on subgroups of patients demonstrating a particularly robust response, enhance power through a larger sample, provide for longer light exposure, and control for seasonal variables.

Introduction

Behavioral disturbance in demented patients is commonly seen in special care units (SCUs) of nursing homes, largely due to selection factors, and possibly also due to factors intrinsic to the nursing home environment. Many treatment interventions have been investigated, including environmental manipulation, behavioral intervention, and pharmacotherapy. In spite of considerable attention by many researchers to this problem, many of the behaviors remain highly refractory to any intervention, and the pharmacologic interventions particularly, although showing some success, are accompanied by significant adverse effects. Therefore, continued exploration of exacerbating factors and novel treatment modalities are necessary.

One area of interest is the association between diurnal rhythm disturbance and behavioral change. Bliwise,[1] has reviewed sleep in normal aging. In summary though, aging itself is associated with a rise in sleep-related complaints,

Lilian Thorpe, BSc, MSc, MD, FRCP, Associate Professor, Department of Psychiatry, University of Saskatchewan, Saskatoon, Saskatchewan, Canada.

Joan Middleton, RN, MN, Clinical Nurse Specialist, Parkridge Centre, Saskatoon District Health, Saskatoon, Saskatchewan, Canada.

Gwen Russell, BA, Research Coordinator, Parkridge Centre, Saskatoon District Health, Saskatoon, Saskatchewan, Canada.

Norma Stewart, RN, PhD, Professor, College of Nursing, and Medical Research Council (MRC) Scientist, Saskatoon, Saskatchewan, Canada.

Table 1. Patient summaries

ID	Sex	Age*	GDS	Vision**	Diagnosis***	Qualitative comments
1	f	77	6	1	3	More sociable and cheerier in phototherapy week, fewer aggressive episodes.
2	f	87	5	1	1	More sociable, less hoarding behavior during light week.
3	f	89	6	2	1	Less spitting and cursing during light week, more social, but more afternoon sleep.
4	m	80	7	1	1	No change during light week.
5	f	91	5	1	1	More sociable during light week.
6	m	74	6	1	2	No change.
7	f	84	6	1	1	More day sleep and less agitated during light week.
8	f	75	6	1	1	No change during light week.
9	f	76	6	1	1	More repetitive movement of arm, nonsensical questions, some improvement in positive behavior.
10	f	82	7	1	1	More alert during light week, but at end of week daughter visiting.
11	m	60	6	1	1	More active during light week, less sitting or watching TV.
12	f	76	6	1	1	Slept less during the day and was more mobile during light week.
13	f	83	6	1	1	Happier during light week, interacted slightly more with other residents, less combative.
14	f	73	6	1	1	Much busier and less sleeping during light week, more laughing and interacting, even if it made no sense.
15	f	89	5	2	1	Slightly more positive behaviors during light week, does not do much of anything.
16	f	89	6	1	2	Did not notice much change during the light week, few negative behaviors to start with.
Average	N/A	80.3	5.9	1.1	N/A	

* Age at the beginning of the baseline week
** Vision was scored: 1 - none to mild impairment, 2 - moderate impairment, 3 - totally blind
*** Diagnosis: 1 - Alzheimer's disease, 2 - Vascular dementia, 3 - Mixed dementia, 4 - Unknown or other dementia

Table 2. Cohen-Mansfield total scores and score changes with phototherapy

Assessment	Mean score	SD	Mean change from baseline	SD	t
Baseline	47.6	17.85	-		
Treatment	43.3	20.61	-4.31	11.79	
Post-treatment	48.5	22.01	+0.88	12.27	-1.9*

* p = 0.04 on one tailed t-test

which arise from not only intrinsic aging changes, but also from medical and psychiatric co-morbidity. Although the total sleep time is reduced only modestly with increasing age, there is a more significant increase in slow wave sleep and an increase in awakenings during the night. There may also be a reduction of total REM sleep and possibly a shifting of REM sleep to become more evenly distributed throughout the night. These abnormalities appear to be even more pronounced in elderly people with dementia, who have even lower sleep efficiency, a higher percentage of stage one sleep, more arousals and awakenings, decreased stage three and four sleep, and, in more severe dementia, further changes in REM sleep. Applying this clinically, Ancoli-Israel *et al*,[2] studied 24-hour circadian rhythm patterns of activity and sleep-wake activity in the nursing home population specifically, and found significant disturbance, greatest in the most demented patients.

Diurnal rhythm disturbance might be related etiologically to behavioral disturbance—many reports describe diurnal patterns in behavior problems, the most frequently discussed being 'sundowning' or transient nocturnal delirium. This clinical entity is generally understood to mean significant exacerbation of disruptive behaviors and agitation in the evening. Supporting the idea that behavioral disturbance in dementia is related to disruption of diurnal patterns, is the finding that with age there appears to be an accelerated deterioration of the suprachiasmatic nucleus (thought to serve as a biological clock in regulating diurnal rhythms), which is most apparent in Alzheimer's disease.[3] As well as this internal regulatory loss, demented patients appear also to have reduced Zeitgeber's, or triggers to stimulate normal brain diurnal patterns. There are likely many such Zeitgebers, including light, social, physical activity and eating behaviors.

Beyond diurnal variation, one also needs to consider seasonal effects. The literature suggests that there are seasonal fluctuations in agitation—possibly reflecting changes in the length of daylight. Bliwise,[5] found that transient nocturnal delirium is more common in winter than in summer, and van Someren *et al*,[6] found a time-of-year effect in the rhythm disturbances of Alzheimer patients.

Light is of particular interest in the study of behavioral problems, as healthy elderly, and particularly demented elderly, are exposed to reduced amounts of bright light compared to healthy young people,[7] likely due to their restricted environment. A logical progression from this finding is the development of studies addressing the effect of increased bright light on behavioral and sleep disturbance in demented elderly. In contrast to studies of sleep in non demented patients, though, the methodology has generally not included EEG confirmation of sleep. In addition to the difficulties of keeping EEG equipment on agitated patients, the slowing in the EEGs of demented patients makes the differentiation of sleep from wakefulness more difficult.[1] Accordingly, nursing observations of behavioral sleep patterns, sometimes augmented by motion actigraphy, are the mainstay of sleep assessment. Diurnal rhythms may be further documented by means of laboratory measures such as melatonin or by temperature measurement, although the successful use of rectal temperature probes in demented agitated patients is unlikely.

Literature review

Okawa *et al*,[8] gave morning bright light (3,000 lux, 9 to

Table 3. Seasonal pattern in Cohen-Mansfield total scores			
Season	**Mean total score**	**f**	**t**
Fall-Spring	54.5	16.06	
Summer	38.5	20.52	3.0*
* p = .002 on one tailed t-test			

11 am) for one to two months to 24-patients with moderate to severe dementia as well as sleep and behavioral abnormalities. Twelve of these 24 improved on this regimen, but relapsed during a subsequent placebo phase i.e. sitting in front of lights that were turned off. Satlin *et al*,[9] gave 10 inpatients with AD evening bright light (1,500 to 2,000 lux) from 7 to 9 pm for one week, rating pretreatment agitation, sleep-wake patterns, use of restraints, and use of prn medications. Activity monitors were worn on the last two days of each week. Results showed that sleep-wakefulness improved with light treatment in eight of 10 patients, and circadian locomotor rhythm increased also in this week. The authors further found that more severe sundowning at baseline predicted greater improvement in this area with light treatment by the post-treatment week.

Mishima *et al*,[10] observed 14-inpatients with dementia, behavioral and sleep disorders and 10 elderly controls for two months. The authors gave four weeks of morning light (9 to 11 am, 3,000-5,000 lux) and recorded sleep time, behavioral problems, and melatonin. Results showed an improvement of total nocturnal sleep time, a reduction of daytime sleep time, and a reduction of problem behaviors in the demented group. Melatonin levels were lower in the demented group in general, although no significant light treatment effect was found in this study.

Van Someren *et al*,[11] described bright light treatment in 22-demented patients (probable Alzheimer disease, multi-infarct dementia, alcohol related dementia, or normal pressure hydrocephalus) that took into account the difficulties of patient compliance with traditional light sources, as well as staff requirements for constant attendance on these patients. The authors installed bright lights into the living rooms of severely demented patients on a psychogeriatric ward and assessed rest-activity rhythm (using actigraphy) two weeks before baseline (average light intensity 436 lux), three weeks after installation of the light (average light intensity 1136 lux), and then four weeks after the removal of the light (average light intensity 372 lux). Results showed that during increased illumination the rest-activity rhythm increased in patients with intact vision, but not in significantly visually impaired patients. Improvement was most robust in those with Alzheimer's disease and other causes of dementia.

The timing and method of light administration may affect the results in demented patients with sleep and behavioral disturbance. Although Mishima *et al*,[10] cited above, found efficacy with morning light, Anconi-Israel *et al*,[12] found that evening bright light was more effective than morning bright light, evening dim light, or increased daytime activity in improving sleep, and Satlin *et al*'s,[11] study noted above also successfully used evening light. Colenda *et al*,[13] using an activity monitor, also did not find a consistent biological affect of morning light (2,000 lux given by light visor two hours in the morning after waking) on sleep in the four protocol completers with Alzheimer's disease. This negative finding could have been due to ineffectiveness of the light visor, timing or length of administration, or other factors, such as severe destruction of the suprachiasmatic nucleus, making it insensitive to the effects of light administration. Most recently the single subject design study (on, off, on, off) by Okumoto *et al*,[14] showed significant beneficial effect of two hours of morning bright light in an 87-year-old woman with multi-infarct dementia.

The type of dementia may affect the bright light impact on sleep and difficult behaviors. As noted above, van Someren *et al*,[11] found that those with Alzheimer's disease were more sensitive to the whole-day indirect light increase, whereas Mishima *et al*,[15] found that those with multi-infarct dementia were most sensitive to the traditional light box.

Methodological problems of bright light studies

It is difficult to remove many sources of methodological error in studies of bright light in dementia. Studies are invariably not double-blind, as nurses and other staff must be involved in rating behaviors, and light sources

are a noticeable addition to the nursing home environment. In the studies with typical light boxes, a potential source of error is the increase in nursing attention associated with the administration of bright light, or even possible increased restraint use to keep the patient appropriately close to the light source. There is also a lot of intra-individual variability in behaviors in dementia, with confounders appearing due to difficult to diagnose medical changes, staff variability in interactional style with patients, and even changing interactions with other patients. Weekends may be particularly different environments from weekdays due to the absence of regular recreational and social activities, as well as a greater proportion of casual staff. There may be seasonal patterns to agitation, so, unless all the patients are treated simultaneously, differences between patients may not be solely due to fixed patient variables. The collection of sleep data is also difficult. Hourly observations of sleep may disturb patients, and are time-intensive activities for staff that may already be overburdened. Furthermore, behavioral observations of sleep may or may not correlate well with EEG changes, which themselves are hard to evaluate.

The assessment of problem behaviors tends also to vary with the assessor, the clinical staff providing the information, and the instrument used to collect the data. Generally behavioral assessment instruments document negative behaviors, and interventions that may improve certain positive and adaptive behaviors, but not decrease negative ones, may appear to be ineffective, in spite of an overall gain in quality of life for the individual. For example, the increase in alertness during the day may actually increase the frequency of minor disruptive events, yet result also in the increase of positive ones and rewarding interactions with the environment.

To address the last concern we chose to use not only a weekly standard behavioral problem rating scale [Cohen-Mansfield Agitation Inventory (CMAI),[16] completed with input from direct care staff], but also a systematic coding of behavior by a trained, non-participant observer (not involved in caregiving) using the interval version of the Environment-Behavior Interaction Code [EBIC].[17] The EBIC taxonomy classifies all behavior into positive, neutral and negative categories based on a priori environmental impact. A disruptive score may be constructed by summating the negative scores (aversive and harmful) with the high intensity neutral (agitation) scores. Stewart *et al* found that the interrater agreement with the interval EBIC was 96 percent (kappa 0.80) on average. The computerized event version of the EBIC uses the same taxonomy as the checklist interval format. Using the known-groups method of construct validity with the event format, the disruptive behavior construct discriminated between residents with dementia according to risk of disruptive behavior (F [1,80] =5.33; $p < .05$). Stability results varied across samples for disruptive behavior (r -.56-.85) and for positive behavior (r = .50-.92). Of particular interest to us was the ability to code positive behaviors, including the expression of affection, helping, caregiving, accepting help, pleasurable activities and pro-social and therapeutic behaviors, rather than just problem behaviors.

Hypotheses

On the basis of the published literature as summarized earlier, we hypothesized that, compared to baseline ratings, morning bright light would result in:

- Greater decrease in agitation (Cohen-Mansfield ratings) in the treatment week than the post-treatment week;
- Greater decrease in disruptive behavior (EBIC) in the treatment week than the post-treatment week; and
- Greater increase in positive behavior EBIC) in the treatment week than the post-treatment week.

Methodology

Setting

The SCUs of a long term care facility in a mid-western Canadian city.

Participants

Patients with chart documentation of dementia and difficult behaviors were identified by the research coordinator in consultation with unit staff. Consent from next of kin was obtained on 16 patients, none of whom suffered from a current depressive episode using DSM-IV criteria, or had known significant retinopathy. A DSM-IV diagnosis of dementia (Alzheimer's disease, vascular dementia, mixed dementia, unknown or other dementia) was made by one author (geriatric psychiatrist) reviewing all available data including family information, charted behavior, cognitive assessments and radiological imaging (when available) supplemented by direct patient assessment. Concomitant illnesses and medications were charted by the research coordinator, noting visual problems (mild, moderately severe, and totally blind). No patients were entered that were undergoing active changes in their psychotropic medications.

Table 4. EBIC positive and disruptive changes with phototherapy					
	Mean	**SD**	**Mean change**	**SD**	**t**
Total positive behavior					
Baseline	21.1	14.7	0	-	
Treatment	25.4	13.0	4.3	11.6	
Post-treatment	21.1	15.3	-.03	12.1	1.4*
Disruptive behavior					
Baseline	9.8	12.4	0	-	
Treatment	5.9	5.8	-3.8	10.1	
Post-treatment	3.3	2.9	-6.5	12.5	1.7**

* p = 0.08 on one tailed t-test
** p = 0.05 on one tailed t-test

Intervention

Light was administered by use of the Day-Light Box 10000 (produced by DayLight Technologies, Inc, providing 10,000 lux) for half an hour each morning while sitting at the table having breakfast, from Monday to Friday during the active treatment week. The exact time of administration varied with the patient's breakfast time, but always occurred in the morning. Nursing staff felt that half an hour was realistically as much time as they could manage to keep patients near the light, and the administration during breakfast ensured that patients would not be undergoing additional restraint. As the light source provided a much higher lux rating than those in other published reports, the authors felt that this would be an acceptable compromise.

Measurements

The Global Deterioration Scale Reisberg *et al*,[18] scores were assigned by the research coordinator at baseline for each patient on the basis of observed behaviors and caregiver information. The CMAI was scored by the research assistant (using all available staff and chart information as well as direct observations) at baseline, the end of the light treatment week, and the end of the post-treatment week. These three time intervals represented the repeated measures in the ABA design (A-baseline with no treatment, B-treatment, A-return to baseline with no treatment). The summated total problem score for each patient was used for statistical analysis, coding 'not applicable' on individual categories as '0.' During Monday to Friday during the three observation weeks each patient was observed in the afternoon for two 10-minute periods (as much as our limited budget would allow) by a trained, non-participant observer, assigning EBIC scores (disruptive as well as positive behaviors, as discussed earlier). The total weekly EBIC score from these 10 assessments in each EBIC subcategory was used for subsequent analysis, replacing missing values with the average value that week. Nightly 12-hour sleep charts were filled out by attending nurses,

Table 5. Sleep changes with phototherapy: Within subjects effects			
	Mean	**SD**	**F**
Average Monday - Friday sleep score			
Baseline	8.18	1.33	
Treatment	8.28	0.96	
Post-treatment	8.48	1.21	1.13*
* p = 0.35 on within subjects repeated measures statistic			

marking sleep as positive if the patient was assessed to be sleeping at the beginning of each hourly check. Daily use of all psychotropic medications as well as any restraint use was charted.

Data analysis

We used the paired t-test to compare the Cohen-Mansfield score change at treatment (compared to baseline) to the change in score in the post-treatment week (compared to baseline) in the 16-patient group. All raw total data points were also reviewed on scatter plots. Due to obvious seasonality on the scatter plot including all Cohen-Mansfield scores (baseline, treatment and post-treatment), these data points were evenly divided into two groups suggested by the plot; Spring-Fall versus Summer, and then compared using the independent t-test. EBIC score (disruptive and positive) changes from baseline during phototherapy compared to post-phototherapy were analyzed using a paired t-test.

Results

Table 1 represents basic information on all 16-patients in the study. There were 13 women and three men in the sample, with ages ranging from 60 to 89 (mean 80.3) and GDS scores ranging from 5 to 7 (mean 6.0). No patients were completely blind, but two had moderate visual impairment. Thirteen had a diagnosis of Alzheimer's disease, two had vascular dementia, and one mixed dementia. No patients appeared uncomfortable or distressed by the light therapy, but staff felt some increase in their effort due to the need to protect the light equipment from the study as well as other patients. The small number of patients in our group, and unavailable neuroimaging diagnostic confirmation in some patients, made it impossible to draw any valid conclusions involving diagnostic or age comparisons in the data to follow. Restraint use showed no pattern of change during the study, and prn medications were almost never given.

Cohen Mansfield ratings

CMAI scores and changes with phototherapy are shown in Table 2. Using the one-tailed paired t-test, the treatment change from baseline (*i.e.*, drop in the CMAI score) compared to the post-treatment change from baseline, was significantly different (p=.038, df=15); *i.e.*, agitation scores decreased more during phototherapy than during the post-treatment phase.

Based on the (unexpected) observed seasonality of all 48 CMAI total scores (baseline, treatment week, and post-treatment week) on scatter plot representation, we divided the raw scores into two even groups of 24 observations—Fall-Spring (September 18 to April 17, inclusive), and summer, regardless of light treatments. The mean scores are presented in Table 3. These seasonal scores were significantly different on one-tailed t-test (p=0.002, df = 46,). This strongly suggests that the time of year has significant impact on patient agitation, with the summer months showing much lower ratings.

Environment-Behavior Interaction Code (EBIC) results

Table 4 summarizes the mean weekly EBIC subscores and changes from baseline during the phototherapy week, and in the post-phototherapy week. Figure 1 shows this schematically. As is apparent from the table and graph, mean positive behavior score increase (compared to the baseline) during the phototherapy week showed a trend to be larger (p=.08) than the mean positive behavior score increase in the post-treatment week. On the other hand, the drop of negative behaviors (compared to the baseline) showed a trend (p = .05) to be lowest in the post-treatment week. Unfortunately, due to very high variances related to inter-individual differences and the sporadic nature of many coded events, these did not reach statistical significance.

Discussion

In our limited study of 16-patients who were given phototherapy for only half an hour for five working days, we showed a pattern of both increasing positive behaviors and decreasing negative behaviors, although statistical significance was only achieved with the CMAI measures. Unexpected to us was the large seasonal effect on reducing total Cohen-Mansfield scores.

Our findings were limited by many factors, most related to the small, open design. As raters were non-blinded, the prior expectation of improvement with light might have caused staff to rate more highly than warranted. However, care aides giving the most information about problem incidents, had the least knowledge or expectations about lights, and furthermore, due to high patient load, by evening when many of the incidents occurred, would usually not remember which patient had the phototherapy in the morning (often a different shift). It is theoretically also possible that there were secondary effects on the caregiver perception of problems caused by the mood elevating effects of light on the caregivers themselves. This was not possible to rule out, as the caregivers did indeed get a lot of extra light while they fed residents under the lights (and some staff, in fact, chose to use the lights while doing their charting). As light administration continued for some time with varying groups of patients though, the effect would have been spread out over the three week assessment, when, although a particular patient might no longer be receiving the light, the caregiver would be still caring for others now receiving the light. The research coordinator herself (who did the EBIC coding and coordinated all the data for the Cohen-Mansfield ratings) was not likely affected by the light as she was not present during the morning phototherapy.

There is also a potential effect on patient behavior of increased attention during the three weeks that behavior was being observed, causing all scores to improve. Fortunately, there was minimal increase in attention beyond this during the phototherapy, as the light source was fixed, and patients were eating at the same time as usual, in the same place. As most of the analysis was performed comparing ratings across those three weeks, we felt that fairly valid comparisons should be possible. Alternate methods could include using indirect light, such as in van Someren *et al*'s study.[13]

Major visual loss can be expected to reduce the effects of phototherapy. Unfortunately, we did not have objective recent measurements of vision in this very demented group, and could not totally ensure that very demented patients would keep their eyes open continuously throughout the breakfast (or glance at the light as suggested for the standard phototherapy protocols in seasonal affective disorder), which may have affected our findings adversely.

The incidence of depression increases in nursing home patients, and it is notoriously difficult, even for experienced geriatric psychiatrists, to make this diagnosis in the most demented group, such as in our study patients. If some patients had an underlying mood disorder this may have accounted for the larger effect phototherapy on behavior. Furthermore, although some studies have found light responsiveness varying with different causes of dementia, we were unable to obtain recent neuroimaging data on all patients, and therefore could not draw any conclusions about the role of diagnosis in light efficacy.

We had initially planned to collect sleep data, but these were unable to be collected reliably in our study, due to inconsistency in night-time sleep charting (especially on weekends) related to staff workload and changes. Alternate assessments of sleep-wake behavior such as motion actigraphy for the full 24-hour day might be more successful to establish the effects of phototherapy.

Reasons for the seasonal variation could relate to increases in summertime activity, changes in the number of visitors, changes in staffing patterns or other undetermined factors. Natural light exposure may have been a factor also, as some of the residents were able to sit out on the patio or enclosed court-yard in the summer, but of course never in early Spring, fall or winter.

The episodic pattern of specific behaviors, especially disruptive behaviors, makes it hard to 'catch' behaviors of interest in short selected observation periods, and the high variability reduces the likelihood of finding statistical significance. Therefore the EBIC observations should be increased in future research.

Conclusions

Direct, non-participant sampling of behaviors during bright light therapy shows a trend to increasing positive behaviors and decreasing disruptive behaviors in very demented nursing home patients with behavioral problems. Caregiver information (CMAI) shows a statistically significant drop in agitation scores during the phototherapy compared to the post-therapy week. There are minimal adverse effects to patients receiving this treatment, but staff may find it more cumbersome than the administration of medications. Other factors may also have a significant role in diurnally related pathology, such as social interaction, daily routines, and seasonality. Further work should include a longer administration period of the light: ideally daily over a few weeks, including weekends. More detailed diagnostic information should be available, the sampling time increased for problem behaviors, and a 24-hour assessment made of diurnal patterns with the use of motion actigraphy. More systematic information on the seasonal patterns of sleep and behavior should be sought.

Acknowledgments

The authors would like to acknowledge the financial support of the Saskatoon and District Health Research Development Fund, as well as staff and patients of Parkridge Centre who were instrumental in the data collection of the study.

References

1. Bliwise DL: Dementia. In: Kryger, Roth & Dement, eds. *Principles and practice of sleep medicine*, 2nd Ed. Philadelphia: Saunders, 1994: 783-800.
2. Ancoli-Israel S, Klauber MR, Williams Jones D, *et al*: Variations in circadian rhythms of activity, sleep, and light exposure related to dementia in nursing-home patients. *Sleep*. 1997; 20(1): 18-23.
3. Swaab DF, Fliers E, Partiman TS: The suprachiasmatic nucleus of the human brain in relation to sex, age and senile dementia. *Brain Res*. 1985; 342: 37-44.
4. Swaab DF, Grundke-Iqbal I, Iqbal K, *et al*: Tau and ubiquitin in the human hypothalamus in aging and Alzheimer's Disease. *Brain Res*. 1992; 590: 239-249.
5. Bliwise DL: Sleep in normal aging and dementia. *Sleep*. 1993; 16: 40-81.
6. Van Someren EJW, Hagebeuk EEO, Lijzenga C, *et al*: Circadian rest-activity rhythm disturbances in Alzheimer's disease. *Biol Psychiatry*. 1996; 40: 259-270.
7. Campbell SS, Kripke DF, Gillin JC, *et al*: Exposure to light in healthy elderly subjects and Alzheimer's patients. *Physiol Behav*. 1988; 42(2): 141-144.
8. Okawa M, Hishima Y, Hozumi S, *et al*: Sleep-wake rhythm disorder and phototherapy in elderly patients with dementia. In: Racagri G, Fukuda, T, eds. *Biological Psychiatry*. New York: Elsevier Science Publishers, 1991: 837-840.
9. Satlin A, Volicer L, Ross V, *et al*: Bright light treatment of behavioral and sleep disturbances in patients with Alzheimer's disease. *Am J Psychiatry*. 1992; 149(8): 1028-1032.
10. Mishima MK, Okawa M, Hishikawa Y, *et al*: Morning bright light therapy for sleep and behavior disorders in elderly patients with dementia. *Acta Psychiatr Scand*. 1994; 89: 1-7.
11. Van Someren EJ, Kessler A, Mirmiran M, *et al*: Indirect bright light improves circadian rest-activity rhythm disturbances in demented patients. *Biol Psychiatry*. 1997; 41(9): 955-963.
12. Ancoli-Israel S, Kripke D, Jones D, *et al*: Light exposure and sleep in nursing home patients. *Soc Light Treatment Biol Rhythms*. 1991; Abst 3: 18.
13. Colenda CC, Cohen W, McCall WV, *et al*: Phototherapy for patients with Alzheimer disease with disturbed sleep patterns: results from a community based pilot study. *Alzheimer Dis Assoc Disord*. 1997; 11(3): 175-178.
14. Okumoto Y, Koyama E, Matsubara H, *et al*: Sleep improvement by light in a demented aged individual. *Psychiatry Clin Neurosci*. 1998; 52(2): 194-196.
15. Mishima K, Okawa M, Satoh K, *et al*: Bright light as a regulator of biological rhythms in elderly patients with dementia. *Sleep Res*. 1995; 24A: 530.
16. Cohen-Mansfield J, Marx MS, Rosenthal AS: A description of agitation in the nursing home. *J Gerontology*. 1989; 44(3): M77-M84.
17. Stewart NJ, Hiscock M, Morgan DG, *et al*: Development and psychometric evaluation of the Environment-Behavior Interaction Code (EBIC). *Nursing Research*. 1999; 48(5): 260-268.
18. Reisberg B, Ferris SA, DeLeon MJ, *et al*: The global deterioration scale for assessment of primary degenerative dementia. *Am J Psychiatry*. 1982; 139: 1136-1139.

Appendix E - AD Homes Footcandle Levels

Attached is the excel spreadsheet completed in various AD homes. It contains information about the facility, time of day measurements were taken, and weather. Additional information like lamp types, number of lamps, etc. was taken from the questionnaires. The first column, "Target Footcandles," has numbers from the Kansas KAR 26-40-305 for full nursing homes.

Data Collected From Local Alzheimer's Facilities							
	Target Footcandles	Facility Designation*					
		A	B	C	D	E	F
Type of Residence	--	combo (few AD actually)	all AD	All AD	neither	all AD	all AD
Time of Day	--	11am	10:30	10	11	10:30 AM	10:30
Weather	--	sunny	cloudy	sunny	Cloudy	sunny	sunny
Bedroom Footcandles	10	10	115	54.2	6.93	32.2	35.8
Type of Lamp		Circle Fluorescent	Incandescent, Incandescent Flood, CFL, Tubular Fluorescent	CFL	CFL	CFL	Tubular Fluorescent
Watts		32	40-60	60		32	15
Total Number of Lamps in Space		2	1, 2, 3	2	3	3	
Manufacturer			Philips and GE	Philips		Minka	TCP
Model Number							EOXO-14
Bedroom Pillow Footcandles	30	4.4	22	N/a-unoccupied	7.73	58.1	35.8
Type of Lamp							
Watts							
Total Number of Lamps in Space							
Manufacturer							
Model Number							
Levels of Lighting		1	2	2	1+ dimming	2	1
Bathroom Footcandles	30	29	24	20	125	71.6	10.6
Type of Lamp		Incandescent and CFL	CFL	CFL	Incandescent	CFL	Tubular Fluorescent
Watts		25	40	60		32	15
Total Number of Lamps in Space		3		4	6	1	
Manufacturer			Philips and GE	Philips		Minka	TCP
Model Number							EOXO-14
Sitting Room Footcandles	15	144.7 - daylight	7	27	9.4	64.7	182.6
Type of Lamp		Tubular Fluorescent	Fluorescent Strip	CFL	CFL	CFL	Tubular Fluorescent
Watts		32	40-50	60		26	15
Total Number of Lamps in Space		2		(1) in 4 cans, (2) in 1 fixture		2	
Manufacturer			Philips and GE	Philips		Minka	Ecolab
Model Number							ESL15BR30/ECO16
Sitting Room-Reading Footcandles	50	171	5	50.6	136	51.8	173.2
Type of Lamp							
Watts							
Total Number of Lamps in Space							
Manufacturer							
Model Number							
Dining Room Footcandles	25	16.5	133	80	20	49.1	200-skylight
Type of Lamp		Incandescent and Tubular Fluorescent	Tubular Fluorescent	CFL	CFL	CFL	Tubular Fluorescent
Watts		32	40-60	60		26	15
Total Number of Lamps in Space		2		(3) in 5 fixtures, (5) in 1 fixtures	5	2	
Manufacturer			Philips and GE	Philips		Minka	Ecolab
Model Number							ESL15BR30/ECO16
Corridors Footcandles	10	30	30	13	20	52.9	3.5
Type of Lamp			Tubular Fluorescent				
Watts			40-60				
Total Number of Lamps in Space							
Manufacturer			Philips and GE				
Model Number							
Notes			invalid measurements for bedroom and dining room		sitting room comprised of all windows		skylights in sitting room

* Facilities that returned questionnaires have been assigned a letter, and this letter coresponds to the completed questionnaires found in Appendix H. Facilities that did not return questionnaires, but had tests completed, have been assigned letters K-N and do not have completed questionnaires in the Appendix.

Data Collected From Local Alzheimer's Facilities (cont.)										
	Target Footcandles	Facility Designation* (cont.)								
		G	H		I	J	K	L	M	N
Type of Residence	--	All AD/dementia	All AD	All AD	all AD	all AD	all AD	all AD	Combo	All AD
Time of Day	--	10am	4:30pm East side	4:30pm West side	11am	3:30	11am	9:30	11am	12
Weather	--	Cloudy	Sunny	Sunny	Sunny	Sunny	Sunny	Sunny	Sunny	Sunny
Bedroom Footcandles	10	15.3	32.2-"living room" and 22.9-bedroom	124	28.5	19.9	29.5	32.9	15	4
Type of Lamp		CFL		CFL and Tubular Fluorsecent	CFL		CFL			T12
Watts		75		60	60		32			40
Total Number of Lamps in Space		3		1 of each	1		2			3
Manufacturer		Sylvania		Phillips and TCP	Energy Star		Sylvania			Lithonia
Model Number										
Bedroom Pillow Footcandles	30	7.22	21.4	16.3	N/a- unoccupied	N/a-unoccupied	43.5	15.2	10	7
Type of Lamp										T12
Watts										
Total Number of Lamps in Space										3
Manufacturer										Lithonia
Model Number										
Levels of Lighting		1	2	2	3	1	2	1	1	2
Bathroom Footcandles	30	103	11.4	12.1	54.4	36.2	15.2	24	16	51.1
Type of Lamp		CFL		Tubular Fluorescent	CFL		CFL			T12
Watts		75		60	60		15			
Total Number of Lamps in Space		2		1	1		4			3
Manufacturer		Sylvania		Philips	Energy Star		Sylvania			Lithonia
Model Number										
Sitting Room Footcandles	15	12.9	10.9-main		39.2	38.6	670	30.8	9.28	39
Type of Lamp		Incandescant Flood		CFL and Tubular Fluorsecent	CFL		CFL			T12
Watts		75		60	60		32			
Total Number of Lamps in Space		3		6 CFL and 2 Tubular Fluorescent	1		3			3
Manufacturer		Sylvania		TCP	Energy Star		Sylvania			Lithonia
Model Number										
Sitting Room-Reading Footcandles	50	12.5	14.1-AD, 37.9-general residents		62.2	26.9	151	36.5	45	44
Type of Lamp				CFL						T12
Watts				60						
Total Number of Lamps in Space				2						3
Manufacturer				TCP						Lithonia
Model Number										
Dining Room Footcandles	25	10	11.7AD, 21.4-general residents		41.4	31.3	31.6	49.2	26.6	39
Type of Lamp		CFL		CFL	CFL		CFL			T12
Watts		75		60	60		32			
Total Number of Lamps in Space		3		12	1		3			3
Manufacturer		Sylvania		TCP	Energy Star		Sylvania			Lithonia
Model Number										
Corridors Footcandles	10	8	36.6		26.8	20	9.45	11.6	15.6	37.7
Type of Lamp		CFL		Tubular Fluorescent			Tubular Fluorescent			T12
Watts		75		34			30			
Total Number of Lamps in Space		2		2			4			3
Manufacturer		Sylvania		Philips			Philips			Lithonia
Model Number							Advantage T8: F17T8ADV830ALTO			
Notes			bedroom lamp "on"	bedroom lamp "off"		another sitting room had 73.3	skylights in sitting room			soon replacing all (3) T12 lamps to (4) T8 lamps

* Facilities that returned questionnaires have been assigned a letter, and this letter coresponds to the completed questionnaires found in Appendix H. Facilities that did not return questionnaires, but had tests completed, have been assigned letters K-N and do not have completed questionnaires in the Appendix.

Appendix F - Existing Bedroom Information

Below are more renderings of the existing bedroom along with switching and light fixture cut sheets. Depending on the circuiting, different luminaires can be turned on and off, but the circuiting shown represents the current connections between luminaires. The luminaries selected are close replications of the luminaires currently in use.

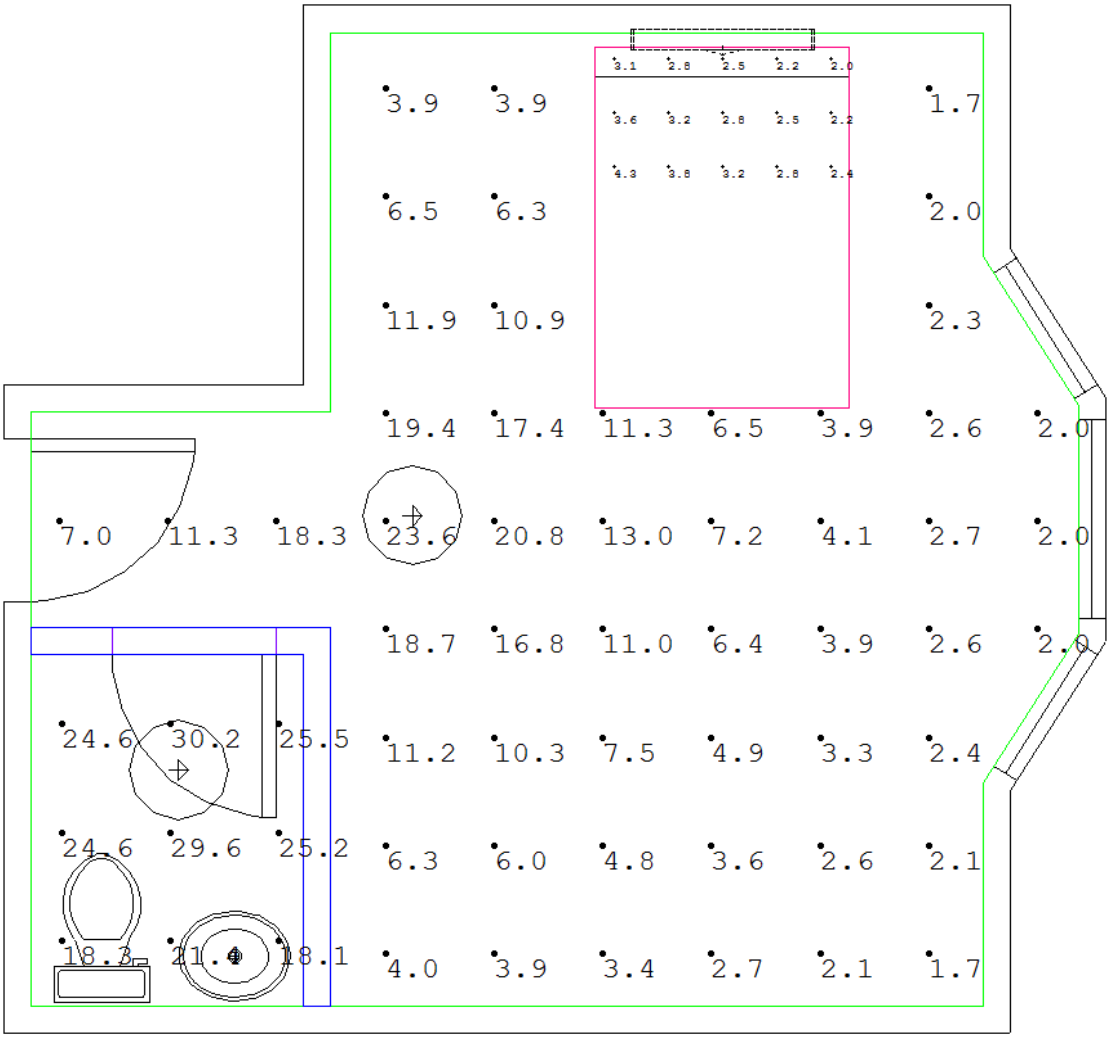


Figure 75: Footcandle Levels with Main Two Luminaires "On"

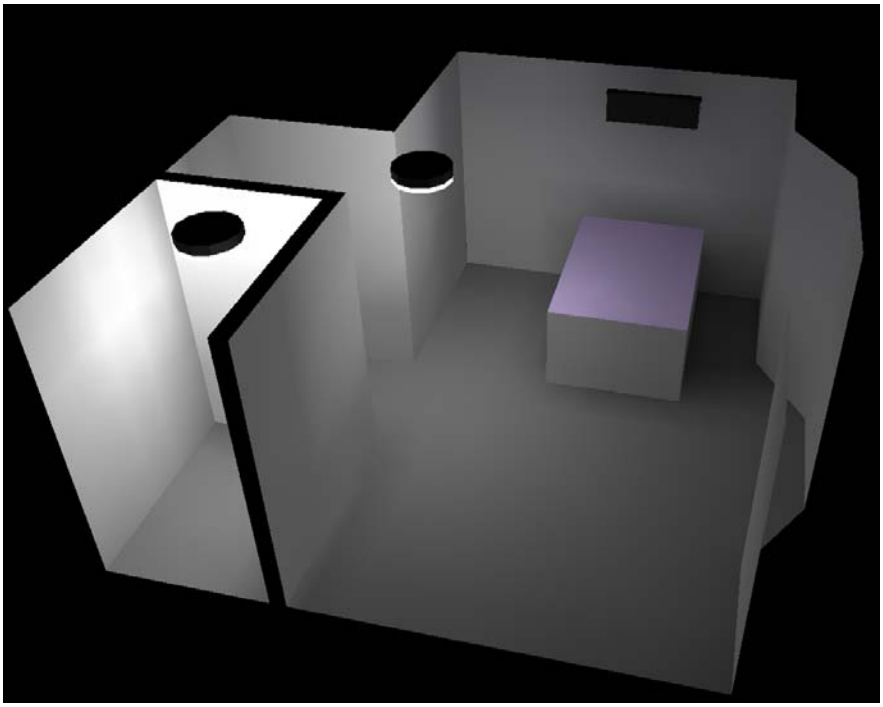


Figure 76: Rendering of Main Two Luminaires Rending

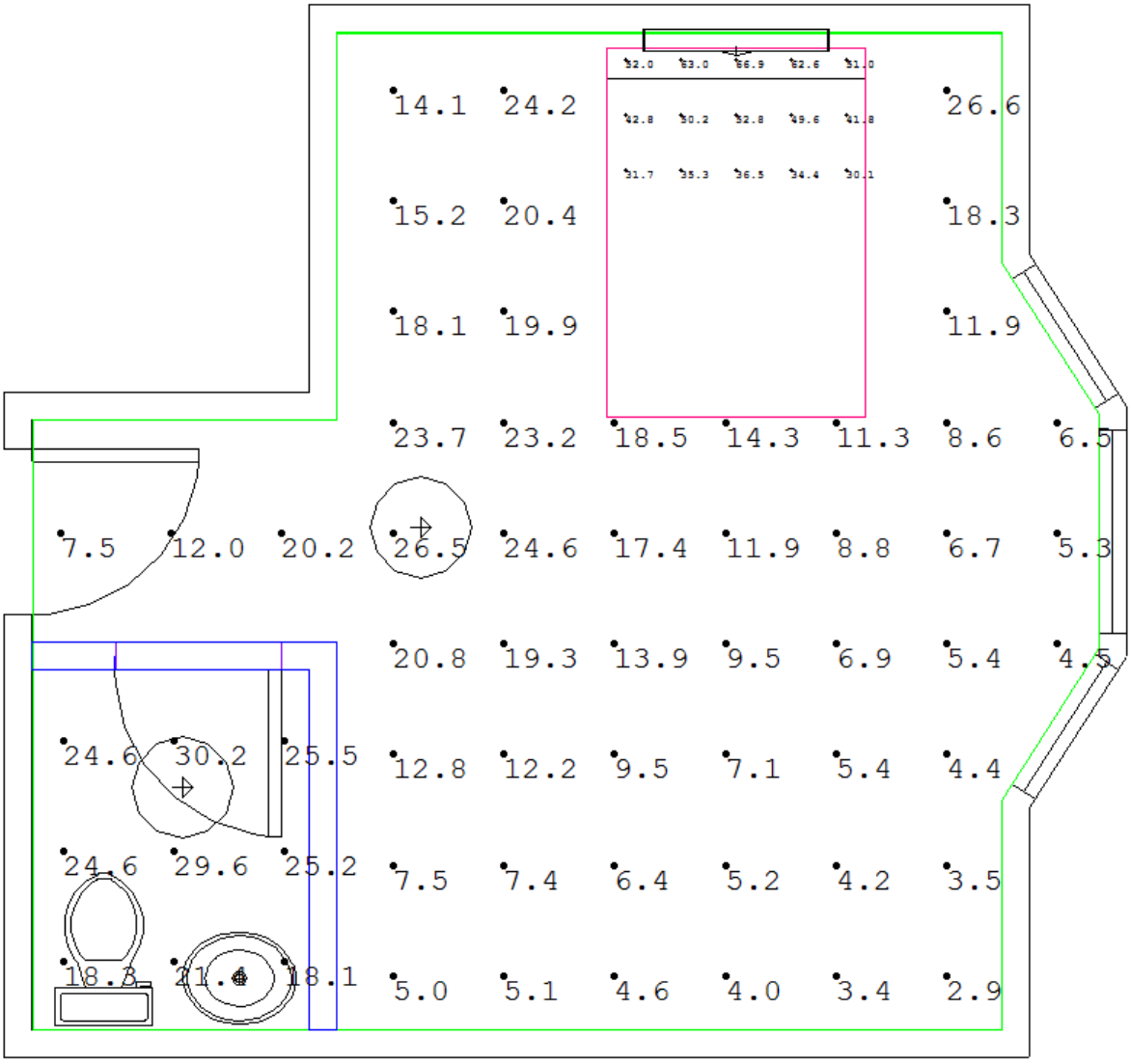


Figure 77: Footcandle Levels with All Luminaires "On"

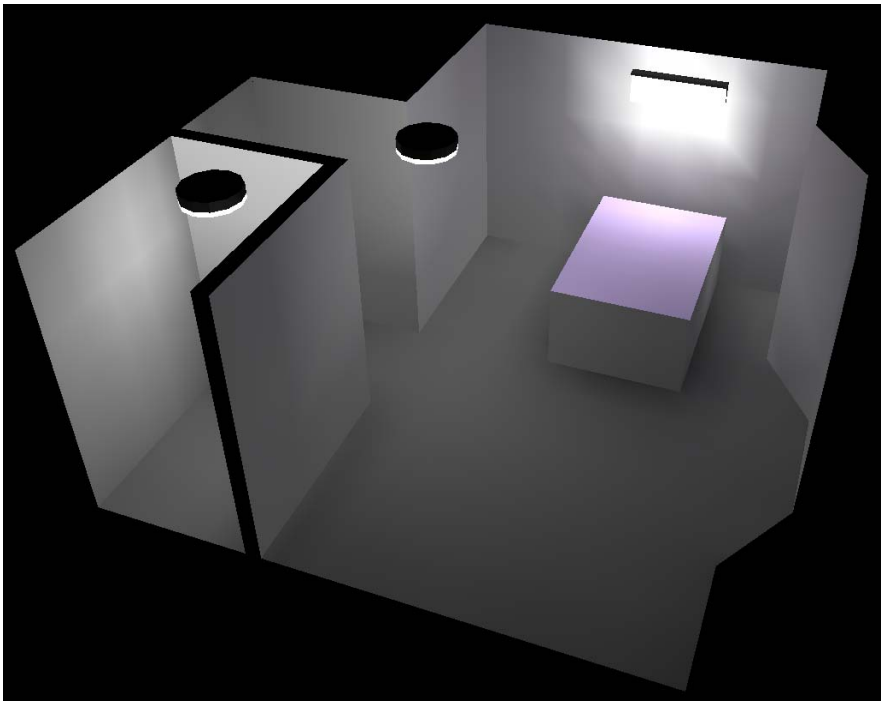
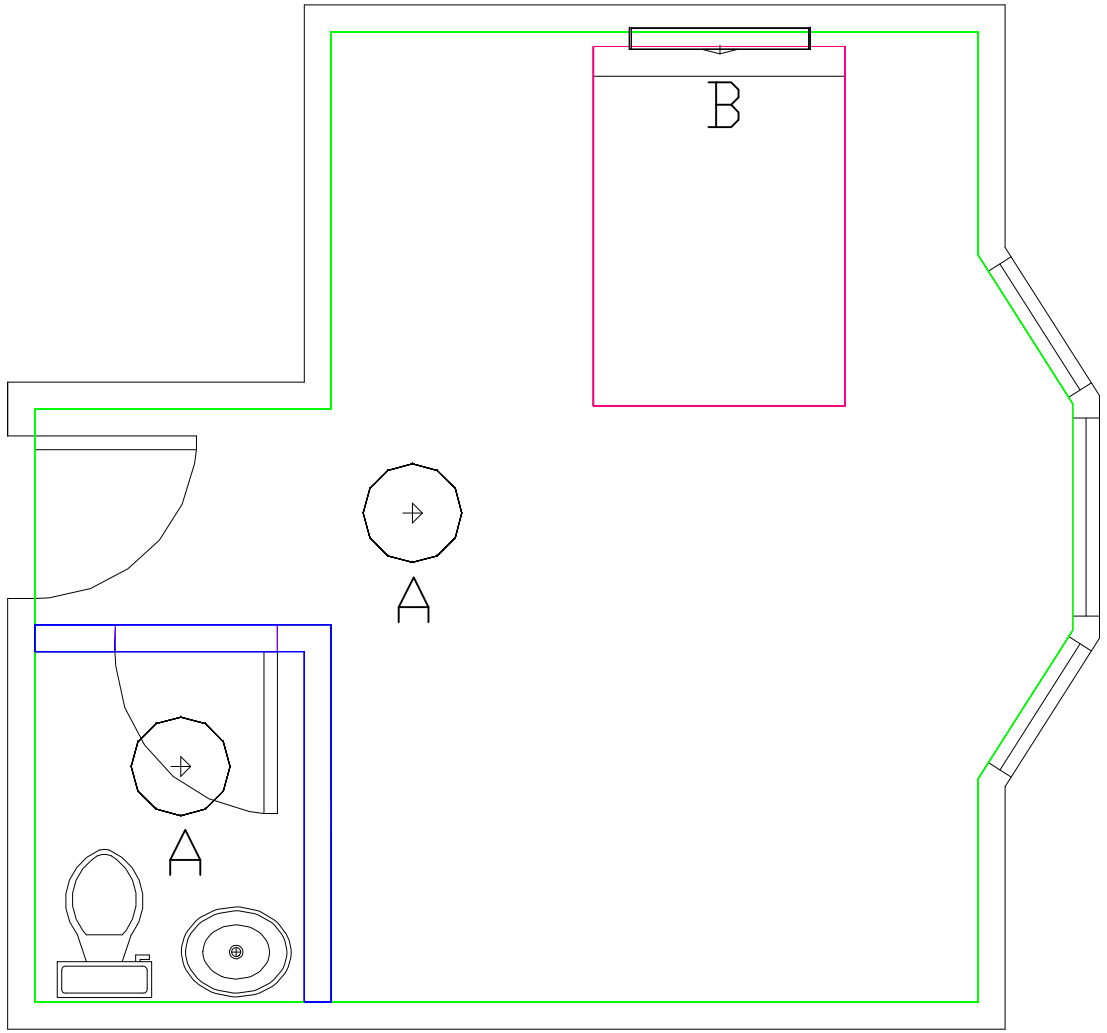


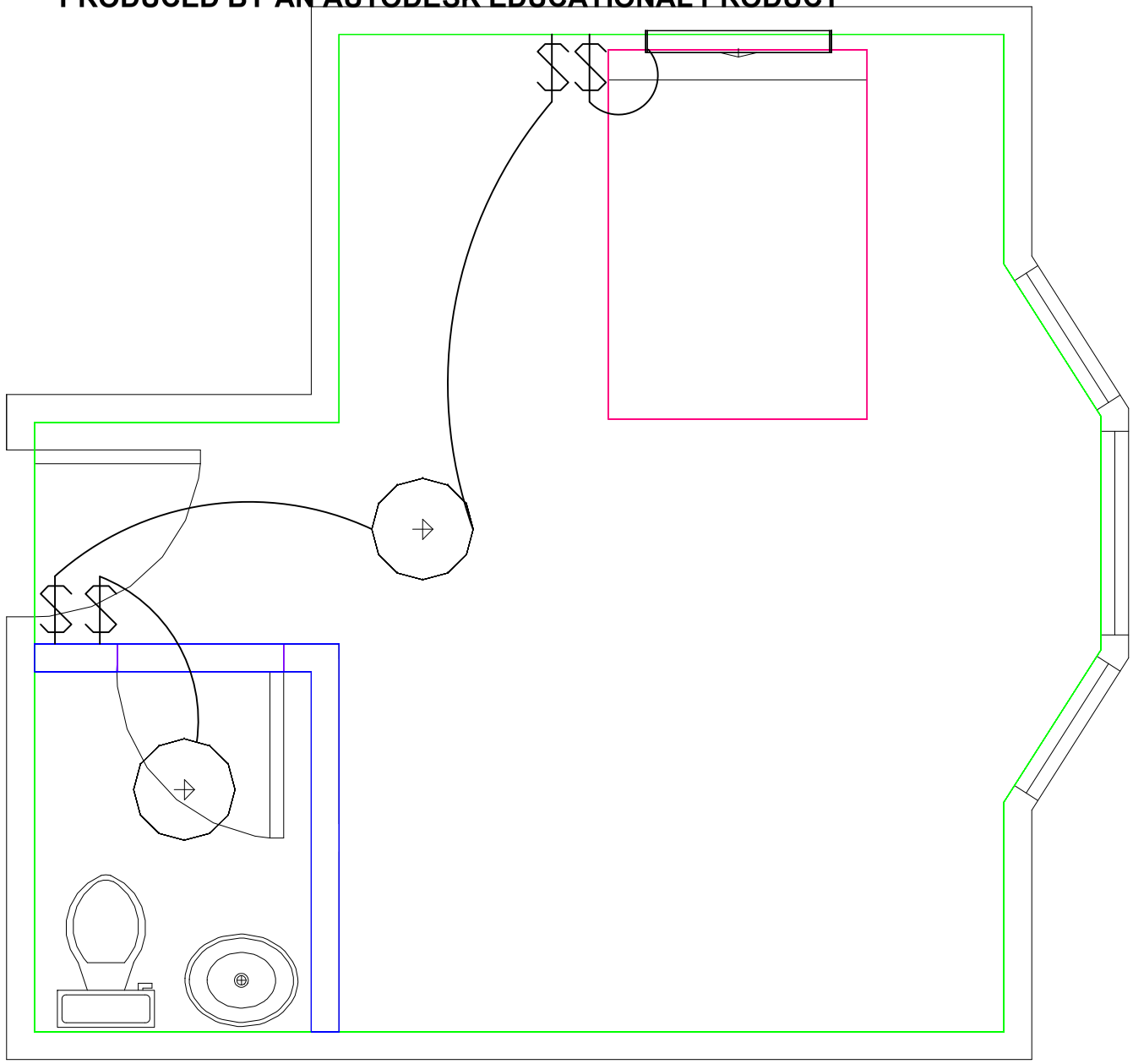
Figure 78: Rending of All Luminaires "On"



A/1 EXISITING BEDROOM LUMINAIRE LAYOUT
SCALE: NTS

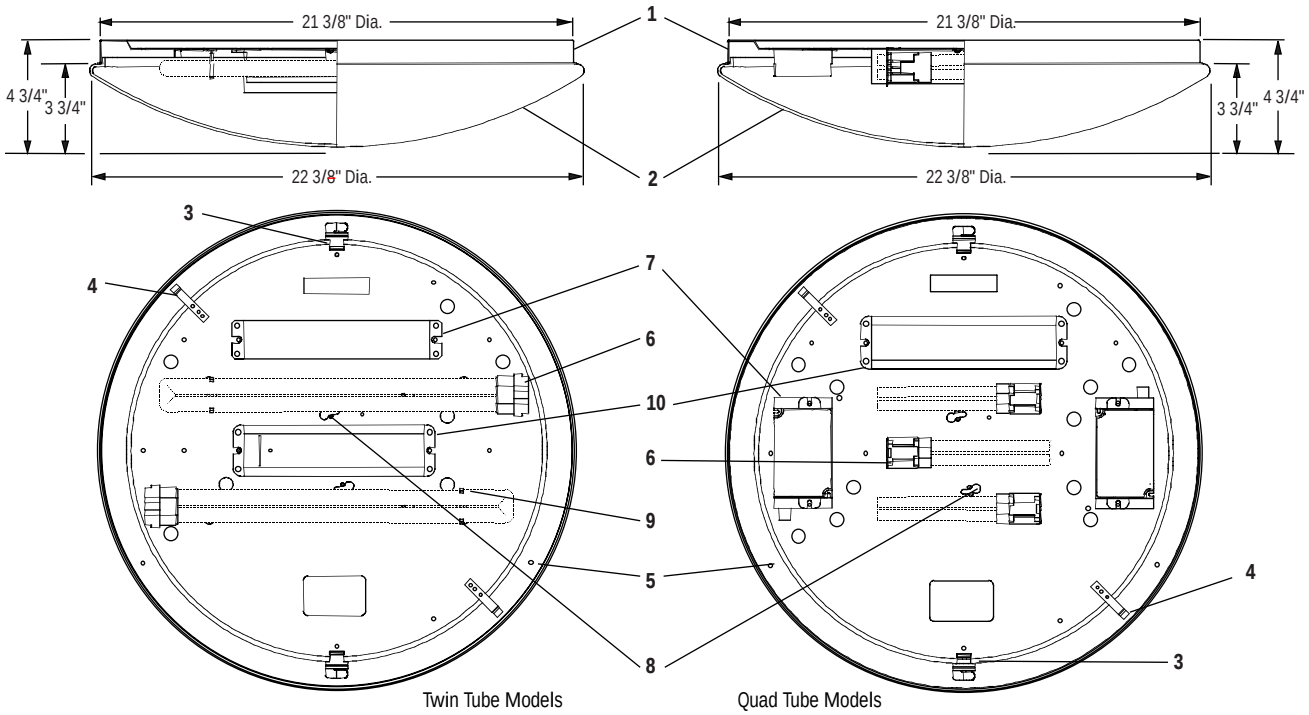
Luminaire Schedule										
Symbol	Qty	Label	Total Lamp Lumens	LLF	Lum. Watts	Arr. Watts	Total Watts	Symbol-Iso	No. Lamps	Lumens/Lamp
	1	valance impression IB644	11600	0.800	159	159	159		4	2900
	2	main glass bowl lightoli	5800	0.800	78	78	156		2	2900

PRODUCED BY AN AUTODESK EDUCATIONAL PRODUCT



B/1 EXISITING BEDROOM CIRCUITING

SCALE: NTS



Ordering Information:

Cat. No.	Diameter	Depth	Finish	Voltage	Lamps (by others)
5241WH239U	22-3/8"	4-3/4"	Gloss White	**120/277V**	(2) 36/39W Twin Tube 4-Pin Compact Fluorescent (2G11 base) 36W – / FT36DL / * / PL-L36W /* 39W F39/36BX/SPX * / – / – *Manufacturers' color temperature designation.
5241WH326U	22-3/8"	4-3/4"	Gloss White	**120/277V**	(3) 26W Quad Tube 4-Pin (G24q-3 base) General Electric F26DBXT4/SPX */4P Osram/Sylvania CF26DD/E/* Philips PL-C26W/ * /4P

Features

1. **Ceiling Pan:** Die-formed 16 ga. aluminum.
2. **Diffuser:** Formed white translucent acrylic.
3. **Bracket:** (2) Twist-lock fastener.
4. **Stop:** Formed 18 ga. galvanized steel.
5. **Mounting Holes:** (3) 3/16" Dia., 120° apart on a 20 1/4" Dia. Bolt circle.
6. **Lamp Socket:** See Lamps.
7. **Ballast:** See Electrical/Ballast
8. **Keyhole Mounting Slots:** (2) for direct mounting to 4" octagonal outlet box.
9. **Lamp Support Clip:** (2) on Twin Tube Series only.

†**10.Emergency Lighting:** Add suffix **E** (See Specification Sheet SU-EM)

Electrical/Ballast

	36/39W Electronic 120V	36/39W Electronic 277V	26W Electronic 120/277V
Total Input Watts	65	75	85
Max. Line Current (Amps)	.51	.27	.73 / .34
Power Factor	> .98	> .98	> .98
Ballast Factor	1.12	1.09	1.0
THD	< 10%	< 10%	< 10%
Min. Starting Temps.	-20°C (-4°F)	-20°C (-4°F)	-20°C (-4°F)

Labels

UL Listed, suitable for Damp Locations.
†UL Listed, (for Indoor Dry Locations only).

Job Information Type: A

Job Name: EXISTING BEDROOM

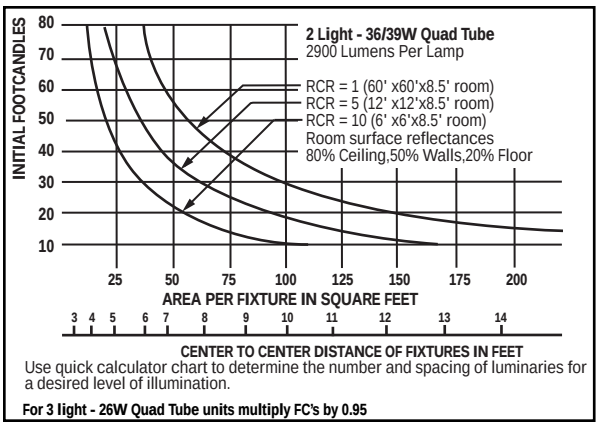
Cat. No.: 5241WH239U

Lamp(s): 2 (39W)

Notes: MAIN, GLASS LUMINAIRE

Lightolier a Genlyte company www.lightolier.com
631 Airport Road, Fall River, MA 02720 • (508) 679-8131 • Fax (508) 674-4710

LIGHTOLIER®



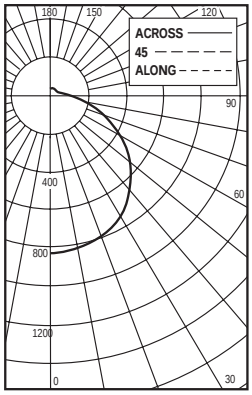
Use quick calculator chart to determine the number and spacing of luminaries for a desired level of illumination.

For 3 light - 26W Quad Tube units multiply FC's by 0.95

SPACING RATIO = 1.3

CERTIFIED TEST REPORT NO. 1045FR
COMPUTED BY LSI PROGRAM **TEST-LITE**

LIGHTOLIER SURFACE UTILITY FLOURESCENT LUMIDOME
CAT. 5241WH239F1 WITH TWIST LOCK ACRYLIC DIFFUSER
2-39W DULUX L SYL.LAMPS. LUMEN RATING = 2900 LMS.
ROBERTSON BALLAST #RER2LT8-120H,120VAC



CANDLEPOWER DATA

ANGLE	CANDLEPOWER	LUMENS	ANGLE	CANDLEPOWER	LUMENS
0	850		95	83	92
5	846	81	100	62	
10	836		105	49	54
15	819	232	110	41	
20	795		115	39	39
25	766	354	120	38	
30	730		125	38	35
35	688	432	130	39	
40	640		135	39	30
45	589	456	140	38	
50	532		145	38	25
55	472	423	150	38	
60	410		155	38	18
65	349	348	160	37	
70	291		165	35	10
75	237	253	170	31	
80	189		175	32	4
85	147	162	180	33	
90	108				

ZONAL LUMENS AND PERCENTAGES

ZONE	LUMENS	% LAMP	%LUMINAIRE
0-30	666	11.48	21.92
0-40	1097	18.92	36.11
0-60	1975	34.05	65.01
0-90	2735	47.17	90.04
40-90	1638	28.25	53.93
60-90	760	13.12	25.03
90-180	302	5.22	9.96
0-180	3038	52.39	100.00

** EFFICIENCY = 52.4% **

TESTED ACCORDING TO IES PROCEDURES. TEST DISTANCE EXCEEDS FIVE TIMES THE GREATEST LUMINOUS OPENING OF LUMINAIRE.

COEFFICIENTS OF UTILIZATION ZONAL CAVITY METHOD
%EFFECTIVE FLOOR CAVITY REFLECTANCE = .20

ROOM CAVITY RATIO	80			70			50			30			10			
	50	30	10	50	30	10	50	30	10	50	30	10	50	30	10	0
1	.53	.50	.48	.51	.49	.47	.48	.46	.44	.45	.43	.42	.42	.41	.40	.38
2	.46	.42	.39	.44	.41	.38	.42	.39	.37	.39	.37	.35	.37	.35	.33	.32
3	.40	.36	.33	.39	.35	.32	.37	.33	.31	.35	.32	.29	.33	.30	.28	.27
4	.36	.31	.28	.35	.31	.27	.33	.29	.26	.31	.28	.26	.29	.27	.25	.23
5	.32	.27	.24	.31	.27	.23	.29	.26	.23	.28	.24	.22	.26	.24	.21	.20
6	.29	.24	.21	.28	.23	.20	.26	.23	.20	.25	.22	.19	.24	.21	.18	.17
7	.26	.21	.18	.25	.21	.17	.24	.20	.17	.22	.19	.16	.21	.18	.16	.15
8	.23	.19	.16	.22	.18	.15	.21	.18	.15	.20	.17	.15	.19	.16	.14	.13
9	.21	.17	.14	.21	.16	.14	.19	.16	.13	.19	.15	.13	.18	.15	.12	.11
10	.19	.15	.12	.19	.15	.12	.18	.14	.12	.17	.14	.11	.16	.13	.11	.10

DETERMINED IN ACCORDANCE WITH CURRENT IES PUBLISHED PROCEDURES
For 3 light - 26W Quad Tube units multiply CU's by 0.95

Job Information	Type: A

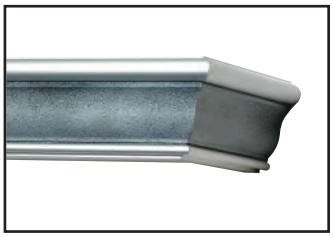
Lightolier a Genlyte company www.lightolier.com
631 Airport Road, Fall River, MA 02720 • (508) 679-8131 • Fax (508) 674-4710

LIGHTOLIER®

IMPRESSION™
TRADITIONALLY STYLED PATIENT ROOM BEDLIGHT IB5000/6000 SERIES

- Traditional design reinforces a residential ambiance.
- Choose standard semi-gloss off-white or specify a custom finish. Insert may be a different finish from trim.
- Independently switched indirect lighting for general room illumination and direct lighting for patient reading/tasks.
- Standard switching: downlight controlled from on/off pull chain switch; indirect lighting controlled from remotely located switch(s).
- Optional low voltage relay installed in fixture provides interface with industry standard pillow switch and bed control systems for separate or sequential control up and down lighting.
- Optional night light provides low-level illumination to facilitate night observation/room circulation.
- modular lift out electrical chasis w/ quick electrical disconnect facilitates easy installation and out of room repairs.
- Choose T8 or higher lumen bi-axial fluorescents.

Impressions provides the functional and practical needs of a patient overbed light in a sturdy, extruded aluminum enclosure which has the appearance of custom architectural millwork.

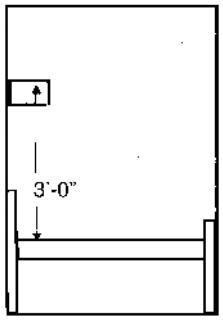


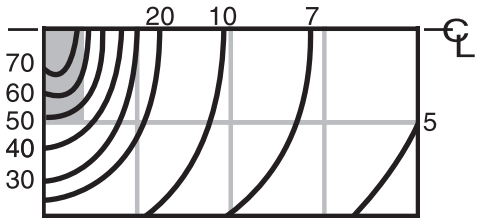
Optional Two-Tone Paint Finish

Modular Electrical Chasis

IMPRESSION™ TRADITIONALLY STYLED PATIENT ROOM BEDLIGHT IB5000/6000 SERIES

PHOTOMETRIC DATA





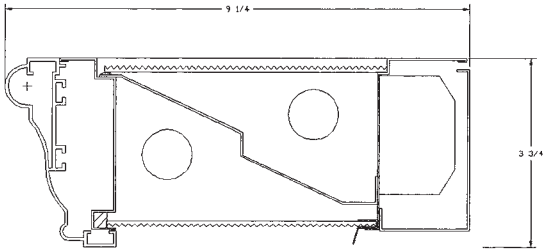
Footcandles at 36" from floor with fixture mounted 6' from floor using (2) F32 T8 lamps (for FT40 biaxial lamps, multiply by 2)

Based on 12' x 12' x 9' room with 80%/ 50%/ 20% reflectances

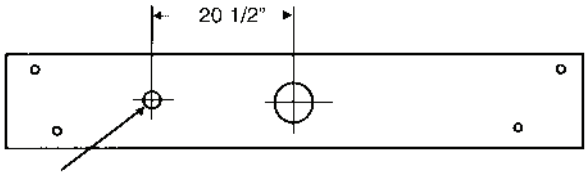
From ITL Report number ITL 46046A

Complete ITL photometric data available on request

CROSS SECTION



MOUNTING HOLES & KNOCKOUTS (view from front of fixture)



7/8" KO for low voltage wiring to optional LVR relay

SPECIFICATIONS

CONSTRUCTION
Extruded aluminum mitered frame is secured to a 20 gauge cold rolled steel back plate. A drop-inchasis, which contains all electrical components, is die-formed from 20 gauge cold rolled steel and is secured to the frame with 2 screws.

DIFFUSER
Clear acryic prismatic diffuser is standard for both indirect and downlight lamp compartments. Downlight diffuser is held securely into position to avoid accidental unlodging and is easily removed without tools via a finger tab installed onto the diffuser.

ELECTRICAL
(2) premium grade high power factor class "P" CBM magnetic rapid start/ballast are standard. Optional electronic ballast may be specified. Available for 120, 277 or 347 Volt applications.

SWITCHING
Standard switch configuration is an on-off pull chain switch for the downlight, with the uplight controlled from a remote switch(s) (by others). Optional 4-position pull chain switch for sequential control of up & down lights. Optional low voltage relay (installed in fixture) is compatible with industry standard bed control systems.(by others) & can be field wired for either separate or sequential switching up and downlights. Fixture may also be specified "less switch" for use with remotely located low voltage relay & control system (by others).

INSTALLATION
Electrical chasis w/quick disconnect is removeable from frame for ease of installation and maintenance by a single person. Luminaire should be secured to wall stud or wall reinforcement.

FINISH
Standard finish on extruded frame is semi-gloss off white (ref#RAL9010). Custom painted finishes can be specified, including 2 different colors; 1 for top/bottom trim and 1 for the inset section. Finish on electrical chasis and backplate is white polyester resin powder coat minimum 87% reflectivity.

LAMPS
3500K (2) F17, F25, or F32 T8 Fluorescents or (4) FT40W/2G11/RS bi-axial fluorescents included.

LABELS/COMPLIANCE
UL, CSA & IBEW

ORDERING INFORMATION

CAT.#	DESCRIPTION/LAMPS	L	W	D
For T8 Lamps				
IB5217	(2) F17T8	28 3/4"	3 3/4"	9 1/2"
IB5225	(2) F25T8	40 3/4"	3 3/4"	9 1/2"
IB5232	(2) F3T8	52 3/4"	3 3/4"	9 1/2"
For Bi-axial Lamps				
IB6440	(4) FT40W/2G11/RS	52 3/4"	3 3/4"	9 1/2"

OPTIONAL SWITCHING (add as suffix to catalog number)	
/HDS	4 position pull chain switch for sequential control of uplight and downlight
/LVC	Low voltage controller installed in IB5232 or IB6440 for use with remotely located bed control system supplied by others–no pull chain switch provided. (not available on IB5225 or IB5217)
/LessSwitch	Less switch for use with remotely located low voltage relay & control system (by others)
OPTIONAL EQUIPMENT (add as suffix to catalog number)	
/277	277 Volt Electronic Ballast (Pull chain switch not available)
/347	347 Volt Electronic Ballast (Pull chain switch not available)
/CO-W	white grounded convenience outlet (120V) (left location as you face fixture)
/ECB	Electronic Ballast
/NL-7	7 watt incandescent nite light (supplied standard w/fixture mounted rocker switch, lamp by others)
/RSP	Radio Suppresor
/Slo-Blo	GMF Slow Blow fuse and fuse holder
OPTIONAL FINISHES (standard finish is semi-gloss off white)	
/2Tone	Insert section and trims finished separate colors (please provide RAL or Pantone color & ref.#, or paint chip for custom finishes)

Appendix G - Improved Bedroom Information

Below are several renderings, luminaire layouts, graphic comparing different footcandle levels when specific luminaires are on, and light fixture cut sheets for an ideal AP bedroom. These graphics show brighter rooms with multiple different luminaires on.

Appropriate illumination levels were achieved by using the same main glass luminaire from the original layout because it represents the time period when APs were younger so it gives the room a nostalgic feel. The original valance is more aesthetically appealing, but the Horizon valance produces a more even distribution of light than the Impression. Within three feet of the wall, the footcandle levels drop from 95 to 48 when using the Impression, but these levels stay between 77 and 63 footcandles with the Horizon. As mentioned before, amber nightlights are used because blue and white light might stimulate the circadian rhythm, and luminaires are placed on the walls of the restroom to enable grooming habits. The daylight luminaires have a clear glass covering so all the light is received and not scattered from a secular lens.

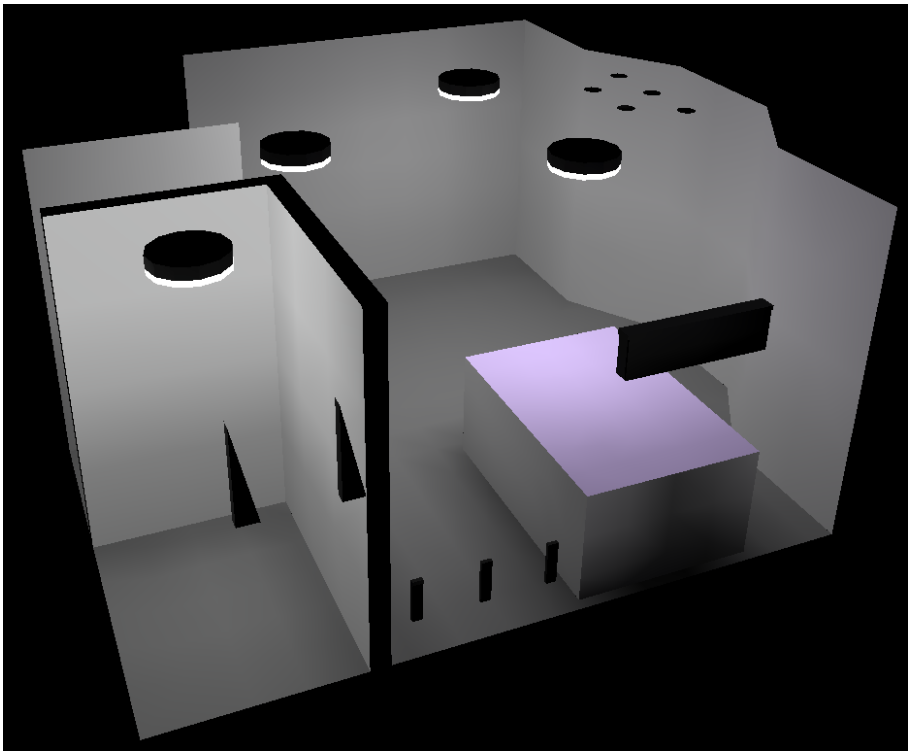


Figure 79: Rendering with Three General Luminaires and All Restroom Luminaires "On"

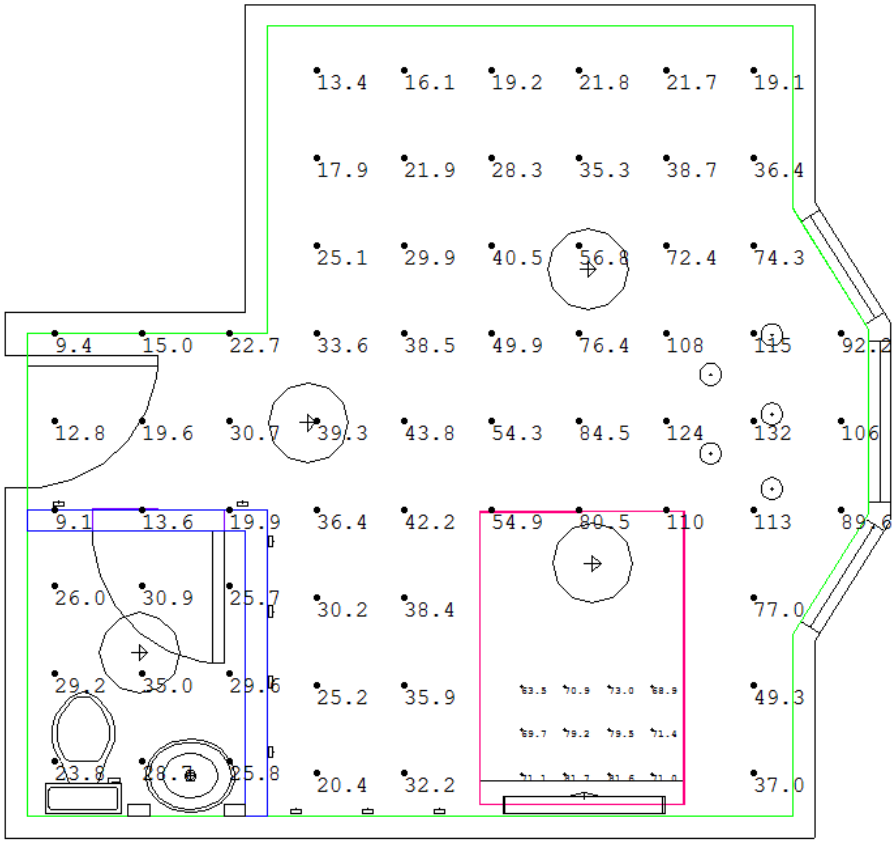


Figure 80: Footcandle Levels of All Luminaires Turned "On"

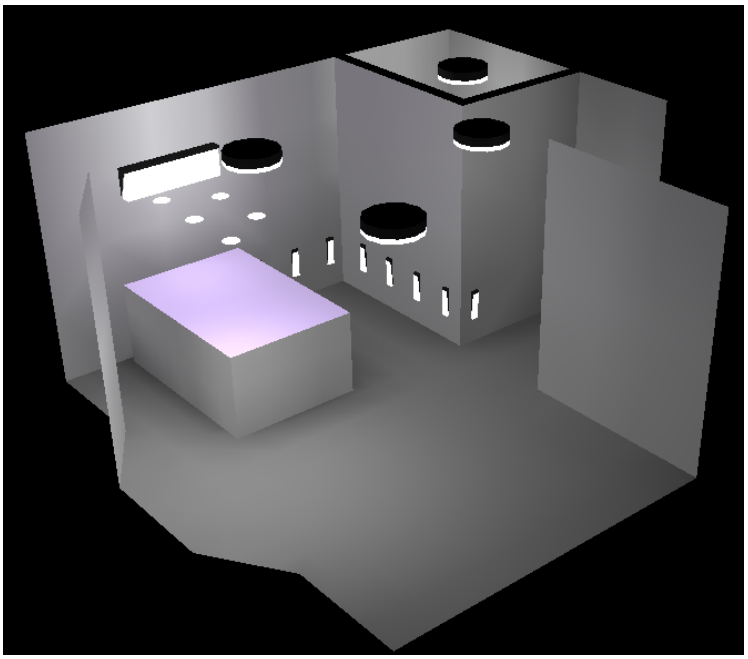


Figure 81: Rendering of All Luminaires Turned "On"

4 Main Luminaires "On" Calc Pts	4 Main Luminaires and Valance "On" Calc Pts	All Luminaires "On" Calc Pts	All Luminaires Except 5 Daylights "On" Calc Pts
bedroom	bedroom	bedroom	bedroom
Illuminance (Fc)	Illuminance (Fc)	Illuminance (Fc)	Illuminance (Fc)
Average=20.48	Average=25.67	Average=47.57	Average=25.86
Maximum=33.8	Maximum=44.6	Maximum=132	Maximum=44.8
Minimum=8.0	Minimum=8.5	Minimum=9.1	Minimum=8.6
Avg/Min=2.56	Avg/Min=3.02	Avg/Min=5.23	Avg/Min=3.01
Max/Min=4.23	Max/Min=5.25	Max/Min=14.51	Max/Min=5.21
pillow top	pillow top	pillow top	pillow top
Illuminance (Fc)	Illuminance (Fc)	Illuminance (Fc)	Illuminance (Fc)
Average=16.91	Average=67.34	Average=73.46	Average=67.50
Maximum=21.6	Maximum=78.1	Maximum=81.7	Maximum=78.2
Minimum=13.0	Minimum=56.7	Minimum=63.5	Minimum=56.8
Avg/Min=1.30	Avg/Min=1.19	Avg/Min=1.16	Avg/Min=1.19
Max/Min=1.66	Max/Min=1.38	Max/Min=1.29	Max/Min=1.38
restroom	restroom	restroom	restroom
Illuminance (Fc)	Illuminance (Fc)	Illuminance (Fc)	Illuminance (Fc)
Average=24.44	Average=24.43	Average=28.29	Average=28.28
Maximum=30.6	Maximum=30.6	Maximum=35.0	Maximum=35.0
Minimum=19.5	Minimum=19.5	Minimum=23.8	Minimum=23.8
Avg/Min=1.25	Avg/Min=1.25	Avg/Min=1.19	Avg/Min=1.19
Max/Min=1.57	Max/Min=1.57	Max/Min=1.47	Max/Min=1.47

Figure 82: Footcandle Comparisons of Different Luminaires Being "On"

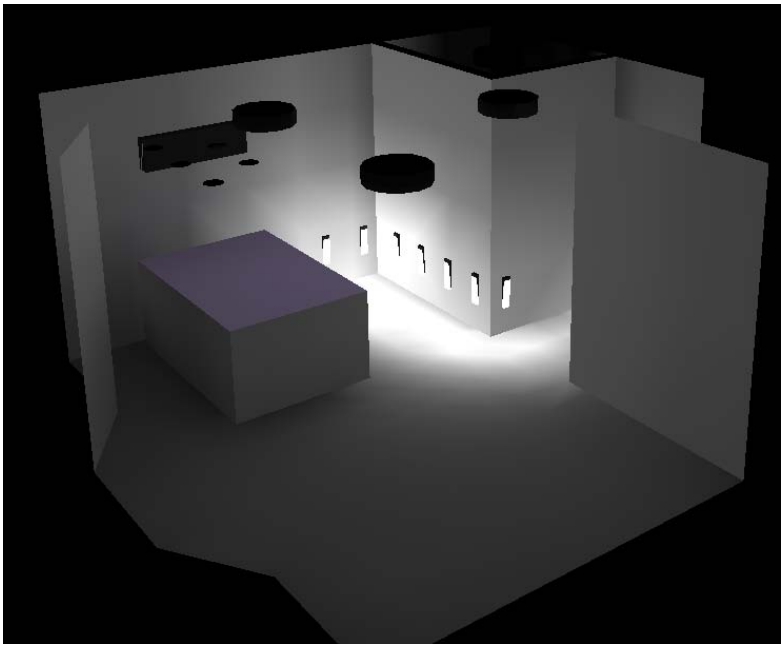


Figure 83: Rendering of Only Nightlights "On"

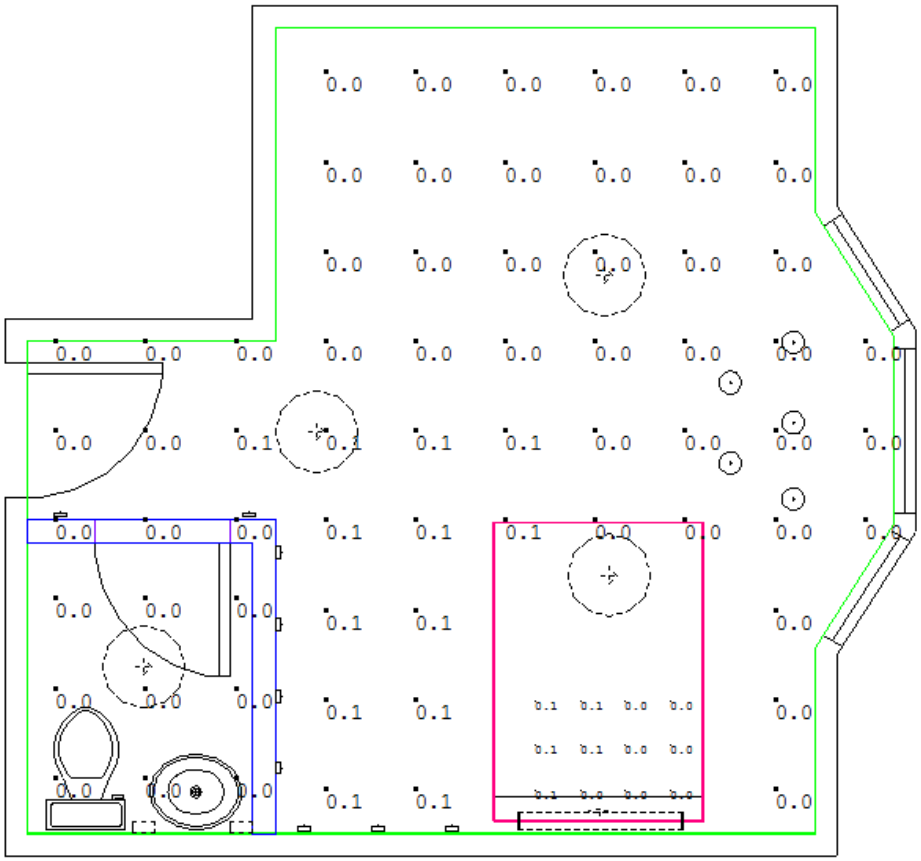
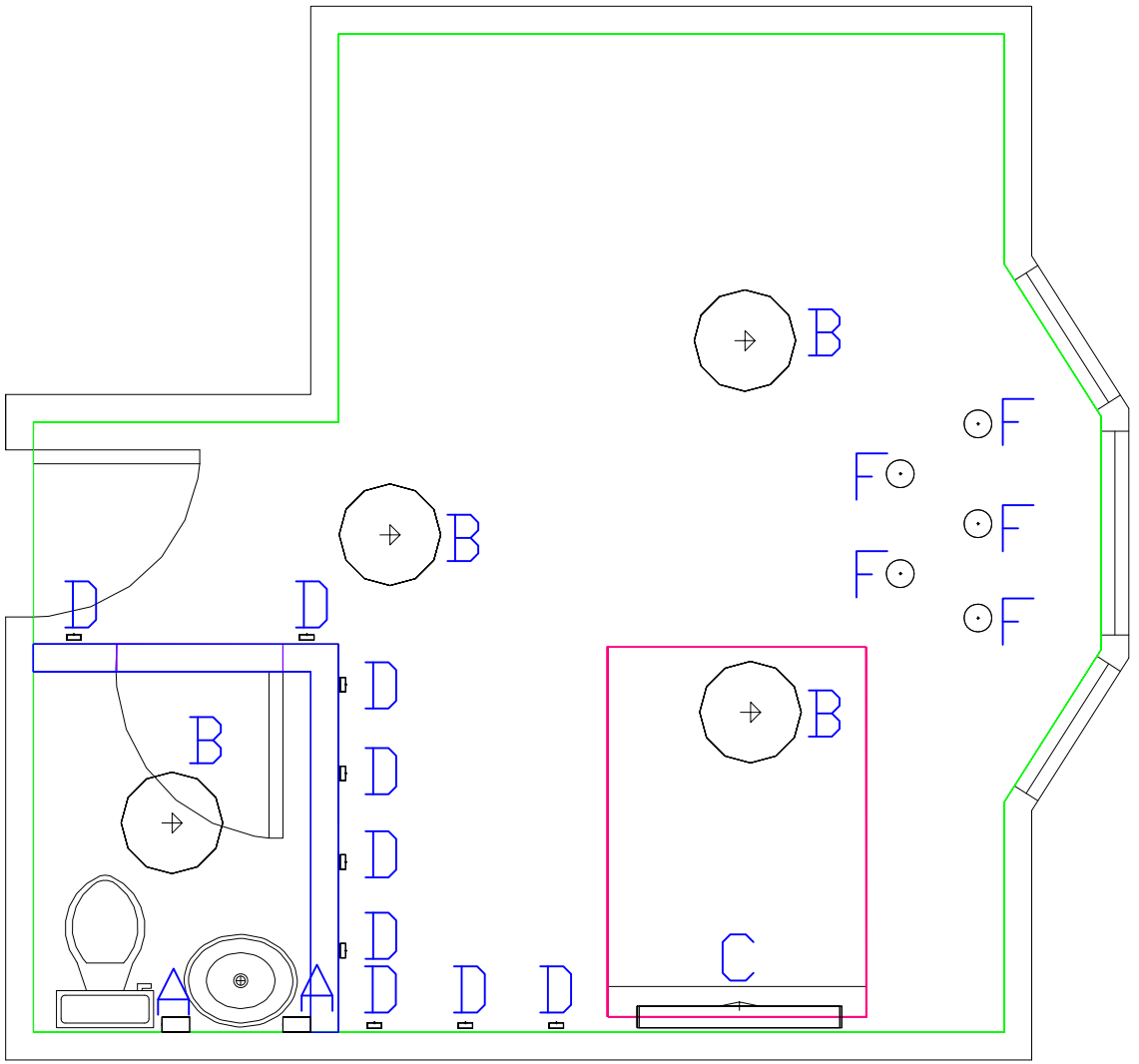


Figure 84: Footcandle Levels of Only Nightlights "On"



A/1 IMPROVED BEDROOM LUMINAIRE LAYOUT

SCALE: NTS

Luminaire Schedule										
Symbol	Qty	Label	Total Lamp Lumens	LLF	Lum. Watts	Arr. Watts	Total Watts	Symbol-Iso	No. Lamps	Lumens/Lamp
	9	NIGHT LIGHT WGH1 ITL58824	32	0.800	2.7	2.7	24.3		1	23
	5	42w CLF	3200	0.800	50	50	250		1	3200
	1	ITL59768 horizon	10440	0.800	115.1	115.1	115.1		4	2610
	4	lumidome 39w	5800	0.800	78	78	312		2	2900
	2	RR side fix 30 in LTL242	N.A.	0.800	18.37	18.37	36.74		1	N.A.

PRODUCED BY AN AUTODESK EDUCATIONAL PRODUCT

PRODUCED BY AN AUTODESK EDUCATIONAL PRODUCT

SoftLook

Semi-Recessed Luminaire

LED

SL1 Series

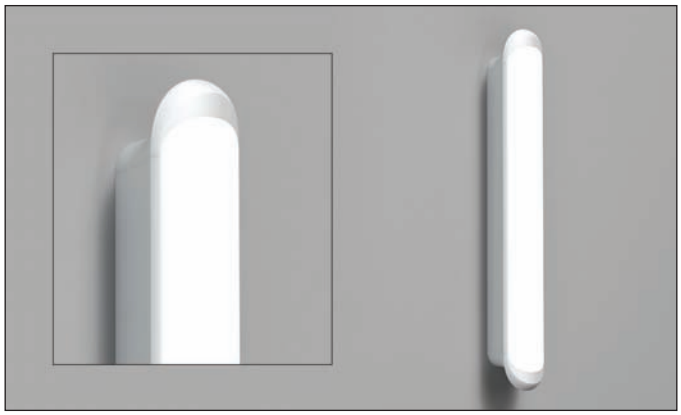
Project	Type
IMPROVED BEDROOM	A
Project Location	
MANHATTAN, KS	
Catalog #	
3L130-301-120-SHW	

Description

SoftLook offers the versatility to satisfy a wide range of application opportunities. It can be wall- or ceiling-mounted and is available in four lengths and three standard finishes. The sleek form is not only aesthetically pleasing but is designed for easy cleaning. A uniform lens appearance is achieved with a long-life LED light source and with a CRI of 85, high quality illumination is delivered. The sealed optical compartment, with a wet location listing and IP65 rating, further enhances SoftLook's low maintenance characteristics.

Additional Features:

- SoftLook is ADA compliant.
- Available in 18", 24", 30" and 36" lengths.
- LED board and driver are field replaceable.
- All standard finishes have an antimicrobial additive to inhibit the growth of microbes.



Specifications

Construction Extruded aluminum housing and die cast aluminum end caps. The back plate and back box are formed from 16 gauge galvanized steel. Transluscent acrylic lens.

Finish The housing has a polyester powder-coat paint finish. All standard finishes have an antimicrobial finish to inhibit the growth of microbes.

Light Source The LED source is 3000K with a CRI of 85. The LEDs maintain a lumen output greater than 70% of the initial lumen rating at 50,000 hours of life. LED source is field replaceable.

Electrical SoftLook utilizes an electronic driver and is available for 120v and 277v applications.

Installation A custom back box attaches to the back plate and can be repositioned in the field to work around wall or ceiling structure. (The back box for the SL118 model has a fixed location.) The SoftLook housing attaches to the back plate with set screws.

Listing UL and CUL Wet Location Listed. IP65 Rated. The luminaire is also IBEW (International Brotherhood of Electrical Workers) labeled. The antimicrobial has been listed with the U.S. Food and Drug Administration (FDA), certified by the National Sanitation Foundation (NSF) and registered with the U.S. Environmental Protection Agency.

Ordering Information

Sample Catalog No: SL124 - 301 - 120 - SWH

3L130	–	301	–	120	–	SHW
Model Number		**LED Color Temp.**		**Voltage**		**Finish**
SL118		301 3000K		120		SWH Soft White
SL124				277		TPE Taupe
SL130						AL Aluminum
SL136						CC[1] Custom Color

[1] Customer to provide color chip to match.

11500 Melrose Avenue Franklin Park, Illinois 60131
Phone: 847-451-0700 Toll-Free: 1-866-50ALKCO
Fax: 847-451-7512 www.alkco.com 07/11

PHILIPS ALKCO

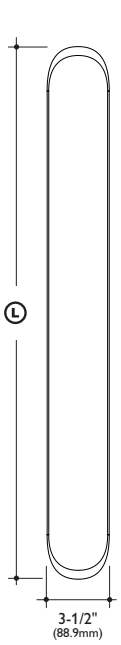
SoftLook

Semi-Recessed Luminaire
LED

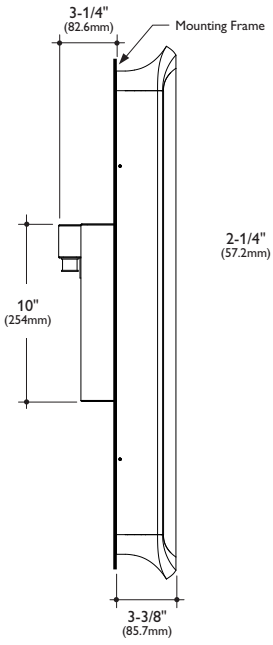
SL1 Series

Project	Type
IMPROVED BEDROOM	A

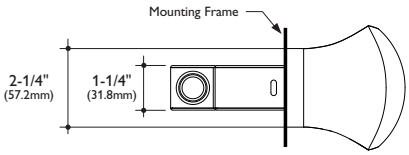
Dimensional Data



Front View



Side View



End View

DIMENSION	Ⓛ
SL118	18" (457.2mm)
SL124	24" (609.6mm)
SL130	30" (762mm)
SL136	36" (914.4mm)

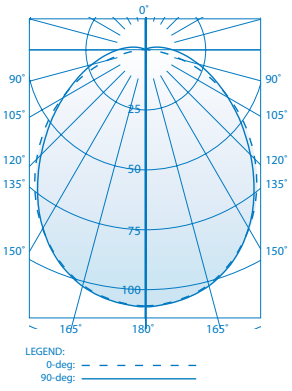
ELECTRICAL DATA - 120V				
Model	SL118	SL124	SL130	SL136
Watts	9.6	14.0	18.4	22.7
Amps	0.082	0.117	0.154	0.190
Power Factor	0.979	0.990	0.995	0.997

ELECTRICAL DATA - 277V				
Model	SL118	SL124	SL130	SL136
Watts	11.5	15.2	19.6	23.4
Amps	0.054	0.070	0.084	0.097
Power Factor	0.775	0.783	0.839	0.865

Photometric Data

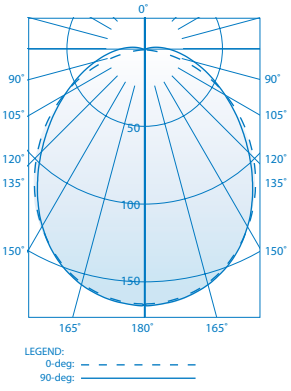
SL118

(24) White LEDs
287 Lumens
Report No.: LTL24276
Tested per IESNA LM-79-08



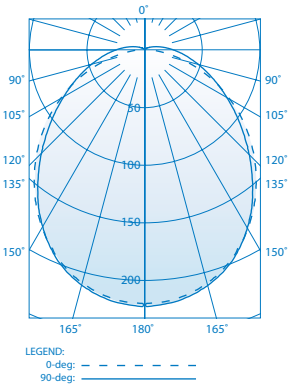
SL124

(36) White LEDs
440.3 Lumens
Report No.: LTL24277
Tested per IESNA LM-79-08



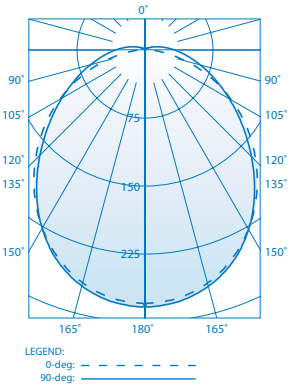
SL130

(48) White LEDs
618.1 Lumens
Report No.: LTL24278
Tested per IESNA LM-79-08



SL136

(60) White LEDs
772.8 Lumens
Report No.: LTL24279
Tested per IESNA LM-79-08



▶ Go to www.alkco.com for additional Photometric Data

11500 Melrose Avenue Franklin Park, Illinois 60131
Phone: 847-451-0700 Toll-Free: 1-866-50ALKCO
Fax: 847-451-7512 www.alkco.com 07/11

PHILIPS
ALKCO

SoftLook

Semi-Recessed Luminaire
LED

SL1 Series

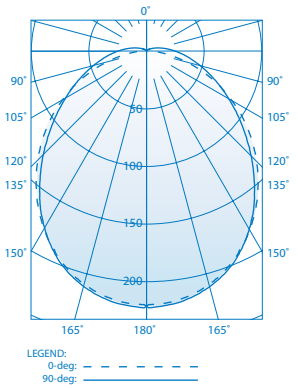
LED LIGHT SOURCE · ANTI-MICROBIAL · WET LISTED · IP65 RATED

Project	Type
IMPROVED BEDROOM	A

Photometric Data

SL130

(48) White LEDs
618.1 Lumens
Report No.: LTL24278
Tested per IESNA LM-79-08



CO-EFFICIENTS OF UTILIZATION

Effective floor cavity reflectance=20%

rc		80				70				50			30			10		0
rw		70	50	30	10	70	50	30	10	50	30	10	50	30	10	50	30	10	0
RCR	0	732	732	732	732	713	713	713	713	678	68	678	646	646	646	616	616	616	602
	1	665	634	606	581	646	618	593	570	589	568	549	562	545	529	537	523	511	497
	2	605	553	510	474	587	540	500	467	512	482	453	493	465	441	472	449	429	414
	3	552	587	436	395	536	476	429	391	455	145	382	436	402	373	418	389	365	350
	4	507	432	378	336	491	423	372	333	405	361	327	389	351	321	374	342	315	301
	5	467	387	332	291	453	379	328	289	364	319	284	251	311	279	338	303	275	262
	6	432	350	295	255	419	343	291	253	330	284	250	318	277	246	307	271	243	230
	7	401	318	264	226	289	312	261	225	301	255	222	291	250	219	281	245	247	204
	8	374	290	238	202	363	286	236	201	276	231	199	267	227	197	259	222	195	183
	9	349	267	217	183	340	263	215	182	255	211	180	147	207	178	239	203	176	165
	10	328	147	198	166	319	243	197	165	236	193	168	229	190	162	223	187	161	150

CANDLEPOWER DISTRIBUTION

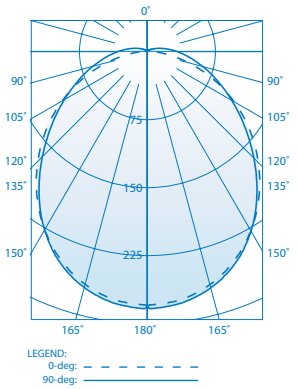
Vertical Angle	Horizontal Angle 0°	45°	90°	135°	180°
0°	230	230	230	230	230
5°	227	228	229	228	227
15°	217	218	219	218	217
25°	196	197	197	197	196
35°	168	168	165	168	168
45°	136	133	129	133	136
55°	102	99	97	99	102
65°	67	67	69	67	67
75°	33	42	47	42	33
85°	5	23	31	23	5
90°	0	16	24	16	0

ZONAL LUMEN SUMMARY

Zone	Lumens	% Lamp	% Fixt.
0-30	173.6	N/A	28.1
0-40	278.1	N/A	45.0
0-60	468.8	N/A	75.8
0-90	602.2	N/A	97.4
90-120	15.9	N/A	2.6
0-180	618.1	N/A	100.0

SL136

(60) White LEDs
772.8 Lumens
Report No.: LTL24279
Tested per IESNA LM-79-08



CO-EFFICIENTS OF UTILIZATION

Effective floor cavity reflectance=20%

rc		80				70				50			30			10		0
rw		70	50	30	10	70	50	30	10	50	30	10	50	30	10	50	30	10	0
RCR	0	915	915	915	915	892	892	892	892	847	847	847	807	807	807	770	770	770	752
	1	831	791	756	725	807	772	740	711	735	709	685	701	680	660	670	653	639	618
	2	755	690	636	590	733	673	624	582	643	601	565	614	579	579	588	559	534	516
	3	689	607	543	492	668	593	534	486	567	516	475	543	500	464	520	484	454	436
	4	632	539	471	419	613	527	464	414	505	450	406	485	437	399	466	425	391	374
	5	582	483	413	362	564	472	407	359	454	397	353	436	386	347	420	377	342	325
	6	538	435	366	317	522	427	362	315	411	353	310	396	345	306	382	337	302	285
	7	500	396	328	281	485	388	324	279	375	317	276	362	310	272	349	304	269	253
	8	466	362	296	251	452	355	293	250	343	287	247	332	281	244	322	276	242	227
	9	435	322	269	227	423	327	267	225	317	262	223	307	257	221	298	252	219	204
	10	409	307	146	206	398	302	244	205	293	240	203	285	236	201	277	231	199	186

CANDLEPOWER DISTRIBUTION

Vertical Angle	Horizontal Angle 0°	45°	90°	135°	180°
0°	283	283	283	283	283
5°	279	281	283	281	279
15°	267	268	180	268	267
25°	242	244	245	244	242
35°	208	208	206	208	208
45°	169	166	162	166	169
55°	127	123	121	123	127
65°	84	85	87	85	84
75°	41	53	60	53	41
85°	7	30	39	30	7
90°	0	21	30	21	0

ZONAL LUMEN SUMMARY

Zone	Lumens	% Lamp	% Fixt.
0-30	214.4	N/A	27.7
0-40	344.2	N/A	44.5
0-60	583.0	N/A	75.4
0-90	752.3	N/A	97.3
90-120	20.5	N/A	2.7
0-180	772.8	N/A	100.0

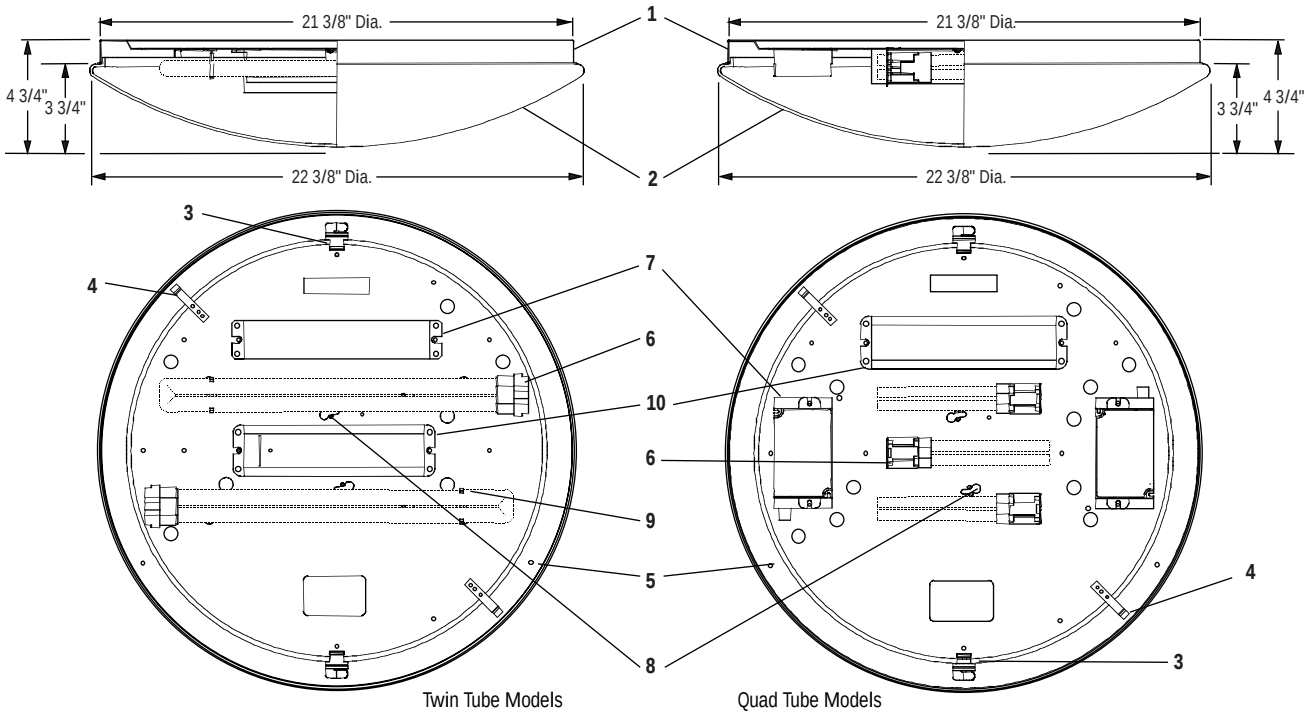
▶ Go to www.alkco.com for additional Photometric Data

11500 Melrose Avenue Franklin Park, Illinois 60131
Phone: 847-451-0700 Toll-Free: 1-866-50ALKCO
Fax: 847-451-7512 www.alkco.com 07/11

PHILIPS ALKCO

Decorative Lumidome® Basic 5241CFL

Ceiling or Wall Mounted Compact Fluorescent



Ordering Information:

Cat. No.	Diameter	Depth	Finish	Voltage	Lamps (by others)
5241WH239U	22-3/8"	4-3/4"	Gloss White	**120/277V**	(2) 36/39W Twin Tube 4-Pin Compact Fluorescent (2G11 base) 36W – / FT36DL / * / PL-L36W /* 39W F39/36BX/SPX * / – / – *Manufacturers' color temperature designation.
5241WH326U	22-3/8"	4-3/4"	Gloss White	**120/277V**	(3) 26W Quad Tube 4-Pin (G24q-3 base) General Electric F26DBXT4/SPX */4P Osram/Sylvania CF26DD/E/* Philips PL-C26W/ * /4P

Features

1. **Ceiling Pan:** Die-formed 16 ga. aluminum.
2. **Diffuser:** Formed white translucent acrylic.
3. **Bracket:** (2) Twist-lock fastener.
4. **Stop:** Formed 18 ga. galvanized steel.
5. **Mounting Holes:** (3) 3/16" Dia., 120° apart on a 20 1/4" Dia. Bolt circle.
6. **Lamp Socket:** See Lamps.
7. **Ballast:** See Electrical/Ballast
8. **Keyhole Mounting Slots:** (2) for direct mounting to 4" octagonal outlet box.
9. **Lamp Support Clip:** (2) on Twin Tube Series only.

†**10.Emergency Lighting:** Add suffix **E** (See Specification Sheet SU-EM)

Electrical/Ballast

	36/39W Electronic 120V	36/39W Electronic 277V	26W Electronic 120/277V
Total Input Watts	65	75	85
Max. Line Current (Amps)	.51	.27	.73 / .34
Power Factor	> .98	> .98	> .98
Ballast Factor	1.12	1.09	1.0
THD	< 10%	< 10%	< 10%
Min. Starting Temps.	-20°C (-4°F)	-20°C (-4°F)	-20°C (-4°F)

Labels

UL Listed, suitable for Damp Locations.
†UL Listed, (for Indoor Dry Locations only).

Job Information Type: A

Job Name: EXISTING BEDROOM

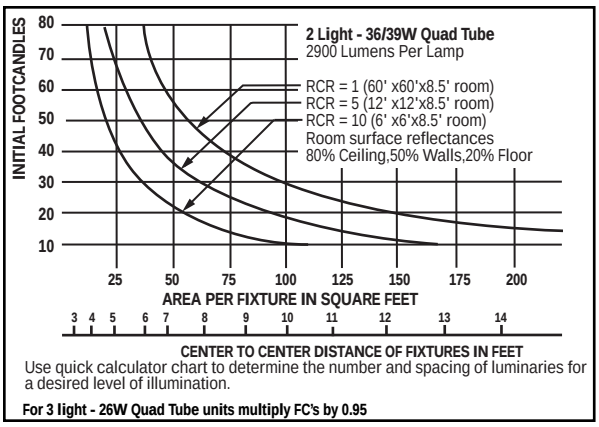
Cat. No.: 5241WH239U

Lamp(s): 2 (39W)

Notes: MAIN, GLASS LUMINAIRE

Lightolier a Genlyte company www.lightolier.com
631 Airport Road, Fall River, MA 02720 • (508) 679-8131 • Fax (508) 674-4710

LIGHTOLIER®



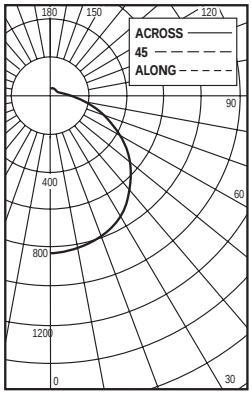
Use quick calculator chart to determine the number and spacing of luminaries for a desired level of illumination.

For 3 light - 26W Quad Tube units multiply FC's by 0.95

SPACING RATIO = 1.3

CERTIFIED TEST REPORT NO. 1045FR
COMPUTED BY LSI PROGRAM **TEST-LITE**

LIGHTOLIER SURFACE UTILITY FLOURESCENT LUMIDOME
CAT. 5241WH239F1 WITH TWIST LOCK ACRYLIC DIFFUSER
2-39W DULUX L SYL.LAMPS. LUMEN RATING = 2900 LMS.
ROBERTSON BALLAST #RER2LT8-120H,120VAC



CANDLEPOWER DATA

ANGLE	CANDLEPOWER	LUMENS	ANGLE	CANDLEPOWER	LUMENS
0	850		95	83	92
5	846	81	100	62	
10	836		105	49	54
15	819	232	110	41	
20	795		115	39	39
25	766	354	120	38	
30	730		125	38	35
35	688	432	130	39	
40	640		135	39	30
45	589	456	140	38	
50	532		145	38	25
55	472	423	150	38	
60	410		155	38	18
65	349	348	160	37	
70	291		165	35	10
75	237	253	170	31	
80	189		175	32	4
85	147	162	180	33	
90	108				

ZONAL LUMENS AND PERCENTAGES

ZONE	LUMENS	% LAMP	%LUMINAIRE
0-30	666	11.48	21.92
0-40	1097	18.92	36.11
0-60	1975	34.05	65.01
0-90	2735	47.17	90.04
40-90	1638	28.25	53.93
60-90	760	13.12	25.03
90-180	302	5.22	9.96
0-180	3038	52.39	100.00

** EFFICIENCY = 52.4% **

TESTED ACCORDING TO IES PROCEDURES. TEST DISTANCE EXCEEDS FIVE TIMES THE GREATEST LUMINOUS OPENING OF LUMINAIRE.

COEFFICIENTS OF UTILIZATION ZONAL CAVITY METHOD
%EFFECTIVE FLOOR CAVITY REFLECTANCE = .20

ROOM CAVITY RATIO	80			70			50			30			10			
	50	30	10	50	30	10	50	30	10	50	30	10	50	30	10	0
1	.53	.50	.48	.51	.49	.47	.48	.46	.44	.45	.43	.42	.42	.41	.40	.38
2	.46	.42	.39	.44	.41	.38	.42	.39	.37	.39	.37	.35	.37	.35	.33	.32
3	.40	.36	.33	.39	.35	.32	.37	.33	.31	.35	.32	.29	.33	.30	.28	.27
4	.36	.31	.28	.35	.31	.27	.33	.29	.26	.31	.28	.26	.29	.27	.25	.23
5	.32	.27	.24	.31	.27	.23	.29	.26	.23	.28	.24	.22	.26	.24	.21	.20
6	.29	.24	.21	.28	.23	.20	.26	.23	.20	.25	.22	.19	.24	.21	.18	.17
7	.26	.21	.18	.25	.21	.17	.24	.20	.17	.22	.19	.16	.21	.18	.16	.15
8	.23	.19	.16	.22	.18	.15	.21	.18	.15	.20	.17	.15	.19	.16	.14	.13
9	.21	.17	.14	.21	.16	.14	.19	.16	.13	.19	.15	.13	.18	.15	.12	.11
10	.19	.15	.12	.19	.15	.12	.18	.14	.12	.17	.14	.11	.16	.13	.11	.10

DETERMINED IN ACCORDANCE WITH CURRENT IES PUBLISHED PROCEDURES
For 3 light - 26W Quad Tube units multiply CU's by 0.95

Job Information	Type: A

Lightolier a Genlyte company www.lightolier.com
631 Airport Road, Fall River, MA 02720 • (508) 679-8131 • Fax (508) 674-4710

LIGHTOLIER®

Horizon

Patient Bed Light

T8/T5/T5HO Fluorescent

HZN

LAMPS INCLUDED · ANTI-MICROBIAL · PATIENT CONTROL

Project	Type
IMPROVED BEDROOM	A
Project Location	
MANHATTAN, KS	
Catalog #	
3L130-301-120-SHW	

Description

The Horizon bed light's design and functionality fits the needs of both patient rooms and assisted living environments. The smooth shape reduces its visual impact on the wall while simplifying routine cleaning. The die-cast endcaps and extruded aluminum body provides the durability needed. Horizon is available with either T5 or T8 lamps in several different configurations to satisfy the application. The lamping options are complimented by numerous switching choices.

Additional Features:

- Horizon is available in four standard colors and custom colors are available upon request. All standard colors include an antimicrobial additive to inhibit the growth of microbes.
- An integral emergency cut-off switch option is available to protect the luminaire from damage from motorized hospital beds.
- Three-piece assembly simplifies installation and servicing.
- Horizon can be specified in 2, 3 or 4 foot lengths.

Specifications

Construction The mounting plate is 18 gauge galvanized steel and reflector assembly is fabricated from 20 gauge cold rolled steel. The exterior housing is extruded aluminum with die cast endcaps and socket covers.

Finish The reflector assembly is painted after fabrication with white polyester powder coat paint with a minimum reflectance of 87%. The exterior housing is painted after fabrication with polyester powder coat paint. Four standard colors are available with other custom colors available upon request. All standard colors have an antimicrobial finish to inhibit the growth of microbes.

Lens The custom linear lens is extruded from acrylic with a DR additive and has a nominal thickness of .063". Lens is held within .25" extruded channels to insure retention.

Lamps Horizon is available with T8, T5 or T5HO lamps in a variety of configurations. (See Ordering Information for details.) 3500K lamps are included with the luminaire. Alternative color temperatures can be supplied upon request.

Switching The standard switch configuration is an on-off pull chain for the direct light compartment with the indirect light compartment controlled from a remote wall switch provided by others. Optional 4-position pull chain switch for sequential control of indirect and direct light compartments.

There is also an optional low voltage relay (installed in the luminaire) that is compatible with industry standard bed control systems (by others) and can be field wired for either separate or sequential switching of indirect and direct lamps.

The luminaire can also be specified "less switch" (LS option).

Listing UL and CUL listed for Damp Locations. The product is IBEW labeled.

The Agion® antimicrobial has been listed with the U.S. Food and Drug Administration (FDA), certified by the National Sanitation Foundation (NSF) and registered with the U.S. Environmental Protection Agency.

Electrical Electronic, high power factor ballasts. Ballasts are thermally protected and have a Class "A" sound rating. T5 and T5HO ballasts have end-of-life protection. One ballast is provided for each lamp compartment.

Installation Horizon installs in three simple steps. The back plate is mounted over the junction box and secured to the wall studs or with wall anchors. The ballast/reflector assembly attaches to the back plate with two screws. The housing is positioned over the back plate and ballast/reflector assembly and attaches with two screws.

Lamp replacement is performed by removing the lens and socket cover.

agion Nature's antimicrobial

Ordering Information

Sample Catalog No: **HZN2T5 - 22 - 120 - SWH - HDS**

3L130	—	22	—	120	—	SHW	—	HDS

NOM. LENGTH / Model Number

NOM. LENGTH	Model Number	
2′	**HZN2T8**	F17 T8 (Med. Bipin)
	HZN2T5	F14 T5 (Med. Bipin)
	HZN2T5HO	F24 T5HO (Med. Bipin)
3′	**HZN3T8**	F25 T8 (Med. Bipin)
	HZN3T5	F21 T5 (Med. Bipin)
	HZN3T5HO	F39 T5HO (Med. Bipin)
4′	**HZN4T8**	F32 T8 (Med. Bipin)
	HZN4T5	F28 T5 (Med. Bipin)
	HZN4T5HO	F54 T5HO (Med. Bipin)

Lamp Configuration

11	(1 lamp up, 1 lamp down)
22	(2 lamps up, 2 lamps down)
12	(1 lamp up, 2 lamps down)
21	(2 lamps up, 1 lamp down)
01	(solid top, 1 lamp down)
02	(solid top, 2 lamps down)
10	(1 lamp up, solid bottom)
20	(2 lamps up, solid bottom)

Voltage

120
277
347[1]

Finish (standard color is SWH)

SWH	Soft White
TPE	Taupe
AL	Aluminum
ALM	Almond
CC[2]	Custom Color

Options

HDS[3]	4-position pull chain switch for sequential control of indirect and direct lamp compartments (120v only)
LVC[3]	Low voltage controller (4′ only)
LS	Less switch
EM1	Emergency ballast (4′ only)
NL	LED night light
SBF	Slow blow fuse
BSS	Bed shut-off switch (3′ and 4′ only)
PC	Replacement 6′ plastic pull cord (non-latex)
DIM1[4]	(1) Dimming ballast
DIM2[5]	(2) Dimming ballasts
RSP1[4,6]	(1) Radio Suppressor
RSP2[4,6]	(2) Radio Suppressors

[1] 347 volt is available for HZN2T8, HZN3T8, HZN4T8 and HZN4T5HO.
[2] Customer to provide color chip to match.
[3] HDS and LVC cannot be used together.
[4] For 01, 02, 10 and 20 lamp configurations.
[5] For 11, 22, 12 and 21 lamp configurations.
[6] Not available for 2′ models.

11500 Melrose Avenue Franklin Park, Illinois 60131
Phone: 847-451-0700 Toll-Free: 1-866-50ALKCO
Fax: 847-451-7512 www.alkco.com 08/10

PHILIPS ALKCO

Horizon

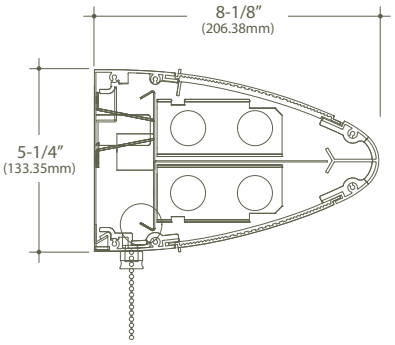
Patient Bed Light
T8/T5/T5HO Fluorescent

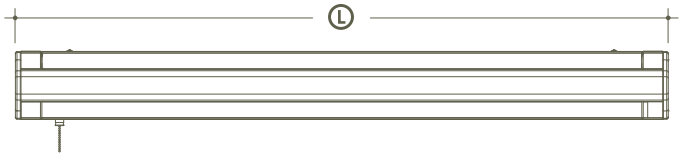
HZN

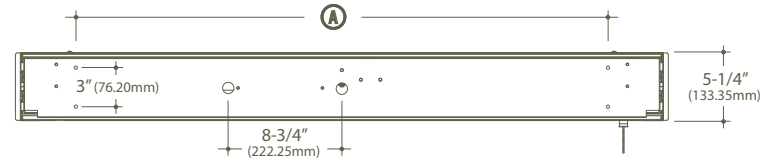
LAMPS INCLUDED · ANTI-MICROBIAL · PATIENT CONTROL

Project	Type
IMPROVED BEDROOM	A

Dimensional Data





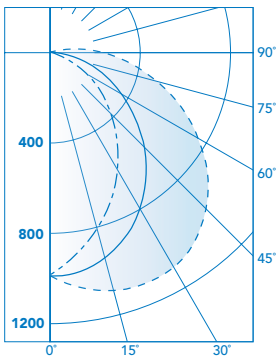


DIMENSION	L	A
HZN2T8	26-5/16" (668.34mm)	17" (431.8mm)
HZN2T5/T5HO	24-3/4" (628.65mm)	17" (431.8mm)
HZN3T8	38-5/16" (973.14mm)	28" (711.20mm)
HZN3T5/T5HO	36-9/16" (928.69mm)	27" (685.80mm)
HZN4T8	50-5/16" (1277.94mm)	41" (1041.40mm)
HZN4T5/T5HO	48-3/8 (1228.73mm)	39" (990.6mm)

Photometric Data

Direct - HZN4T5

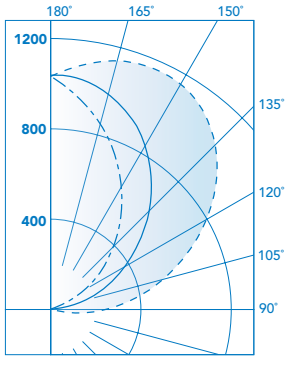
(2) 28W T5 Fluorescent
(2 lamps indirect/2 lamps direct)*
2610 lumens per lamp
* Testing direct lamps only.
Report No.: ITL59769
Efficiency: 54.9%



LEGEND:
0-deg:
90-deg:
180-deg:

Indirect - HZN4T5

(2) 28W T5 Fluorescent
(2 lamps indirect/2 lamps direct)
2610 lumens per lamp
* Testing indirect lamps only.
Report No.: ITL59770
Efficiency: 58.4%



LEGEND:
0-deg:
90-deg:
180-deg:

▶ Go to www.alkco.com for additional Photometric Data

(Hg) Some luminaires use fluorescent or high intensity discharge (HID) lamps that contain small amounts of mercury. Such lamps are labeled "Contains Mercury" and/or with the symbol "Hg". Lamps that contain mercury must be disposed of in accordance with local requirements. Information regarding lamp recycling and disposal can be found at www.lamprecycle.org

11500 Melrose Avenue Franklin Park, Illinois 60131
Phone: 847-451-0700 Toll-Free: 1-866-50ALKCO
Fax: 847-451-7512 www.alkco.com 08/10

PHILIPS ALKCO

Horizon

Patient Bed Light
T8/T5/T5HO Fluorescent

HZN

LAMPS INCLUDED · ANTI-MICROBIAL · PATIENT CONTROL

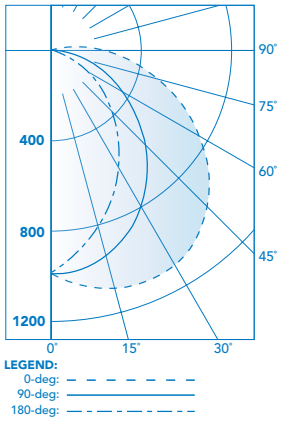
Project: IMPROVED BEDROOM

Type: A

Photometric Data

Direct - HZN4T5

(2) 28W T5 Fluorescent
(2 lamps indirect/2 lamps direct)*
2610 lumens per lamp
* Testing direct lamps only.
Report No.: ITL59769
Efficiency: 54.9%



CO-EFFICIENTS OF UTILIZATION

Effective floor cavity reflectance=20%

rc		80				70				50			30			10		0
rw		70	50	30	10	70	50	30	10	50	30	10	50	30	10	50	30	10	0
RCR	0	65	65	65	65	64	64	64	64	61	61	61	58	58	58	55	55	55	54
	1	59	56	54	51	57	55	53	51	52	51	49	50	49	47	48	47	46	44
	2	54	49	45	42	52	48	44	41	46	43	40	44	41	39	42	40	38	37
	3	49	43	38	35	47	42	38	34	40	37	34	39	35	33	37	34	32	31
	4	45	38	33	29	43	37	33	29	36	32	29	34	31	28	33	30	28	26
	5	41	34	29	25	40	33	29	25	32	28	25	31	27	24	30	27	24	23
	6	38	31	26	22	37	30	25	22	29	25	22	28	24	21	27	24	21	20
	7	35	28	23	19	34	27	23	19	26	22	19	25	22	19	25	21	19	18
	8	33	25	21	17	32	25	20	17	24	20	17	23	20	17	23	19	17	16
	9	31	23	19	16	30	23	19	16	22	18	15	22	18	15	21	18	15	14
	10	29	21	17	14	28	21	17	14	21	17	14	20	16	14	19	16	14	13

CANDLEPOWER DISTRIBUTION

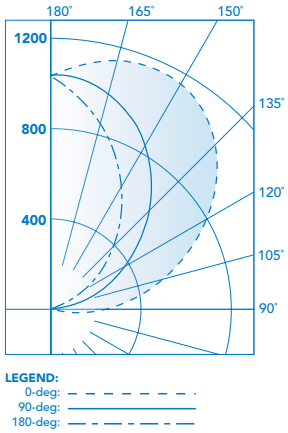
Vertical Angle	Horizontal Angle 0°	45°	90°	135°	180°
0°	990	990	990	990	990
5°	1034	1023	989	949	926
15°	1092	1046	941	845	803
25°	1109	1024	855	716	669
35°	1072	954	728	576	521
45°	977	839	587	431	380
55°	838	691	436	286	244
65°	664	523	287	157	118
75°	485	356	155	43	19
85°	301	198	41	9	12
90°	225	136	0	0	0
95°	147	39	0	0	0
105°	20	2	0	0	0

ZONAL LUMEN SUMMARY

Zone	Lumens	% Lamp	% Fixt.
0-30	761	14.6	26.5
0-40	1238	23.7	43.2
0-60	2163	41.4	75.4
0-90	2825	54.1	98.5
90-120	42	0.8	1.5
90-130	42	0.8	1.5
90-150	42	0.8	1.5
90-180	42	0.8	1.5
0-180	2867	54.9	100.0

Indirect - HZN4T5

(2) 28W T5 Fluorescent
(2 lamps indirect/2 lamps direct)
2610 lumens per lamp
* Testing indirect lamps only.
Report No.: ITL59770
Efficiency: 58.4%



CO-EFFICIENTS OF UTILIZATION

Effective floor cavity reflectance=20%

rc		80				70				50			30			10		0
rw		70	50	30	10	70	50	30	10	50	30	10	50	30	10	50	30	10	0
RCR	0	56	56	56	56	48	48	48	48	33	33	33	19	19	19	7	7	7	1
	1	50	48	46	44	43	41	39	38	28	27	26	16	16	15	5	5	5	0
	2	46	42	38	36	39	36	33	31	25	23	21	14	13	13	5	4	4	0
	3	42	37	33	29	36	31	28	26	22	20	18	13	12	11	4	4	4	0
	4	38	32	28	25	32	28	24	21	19	17	15	11	10	9	4	3	3	0
	5	35	29	24	21	30	25	21	18	17	15	13	10	9	8	3	3	3	0
	6	32	25	21	18	27	22	18	16	15	13	11	9	8	7	3	3	2	0
	7	29	23	18	15	25	20	16	13	14	11	10	8	7	6	3	2	2	0
	8	27	20	16	13	23	18	14	12	12	10	8	7	6	5	2	2	2	0
	9	25	19	14	12	21	16	13	10	11	9	7	7	5	4	2	2	1	0
	10	23	17	13	10	20	15	11	9	10	8	6	6	5	4	2	2	1	0

CANDLEPOWER DISTRIBUTION

Vertical Angle	Horizontal Angle 0°	45°	90°	135°	180°
75°	30	0	0	0	0
85°	174	89	0	0	0
90°	251	153	0	0	0
95°	337	225	50	10	11
105°	517	389	171	42	21
115°	705	561	307	162	116
125°	884	734	462	299	249
135°	1031	889	622	448	399
145°	1126	1003	770	604	551
155°	1160	1073	897	753	704
165°	1137	1090	986	886	848
175°	1070	1061	1032	995	977
180°	1033	1033	1033	1033	1033

ZONAL LUMEN SUMMARY

Zone	Lumens	% Lamp	% Fixt.
0-30	0	0.0	0.0
0-40	0	0.0	0.0
0-60	0	0.0	0.0
0-90	53	1.0	1.7
90-120	715	13.7	23.5
90-130	1178	22.6	38.6
90-150	2197	42.1	72.1
90-180	2996	57.4	98.3
0-180	3049	58.4	100.0

(Hg) Some luminaires use fluorescent or high intensity discharge (HID) lamps that contain small amounts of mercury. Such lamps are labeled "Contains Mercury" and/or with the symbol "Hg". Lamps that contain mercury must be disposed of in accordance with local requirements. Information regarding lamp recycling and disposal can be found at www.lamprecycle.org

11500 Melrose Avenue Franklin Park, Illinois 60131
Phone: 847-451-0700 Toll-Free: 1-866-50ALKCO
Fax: 847-451-7512 www.alkco.com 08/10

PHILIPS ALKCO

WayGlo

Night Light
LED

WG Series

Project	Type
IMPROVED BEDROOM	A
Project Location	
MANHATTAN, KS	
Catalog #	
3L130-301-120-SHW	

Description

WayGlo is a LED night light that provides a smooth pattern of light at the floor plane. It is available in two different faceplate designs with versions for both vertical and horizontal junction box orientations. WayGlo's versatility makes it a suitable selection for additional applications such as task lighting at a counter, or corridor and stair illumination. The LED source insures limited maintenance and low energy consumption.

Additional Features:

- The sealed optical compartment and smooth surface allows simple cleaning of the faceplate.
- WayGlo can install with the provided back box or can be retrofitted into either a NEMA single-gang junction box or a 1900 junction box fitted with a single-gang plaster ring. (WayGlo is also available in a Thru-wall design. See Specification Sheet E1.4 - WGT.)
- WayGlo is available with white, amber or blue LEDs.
- No exposed fasteners.
- WayGlo comes in three standard paint colors (white, black and aluminum) or can be specified in custom colors.
- All standard finishes have an antimicrobial additive to inhibit the growth of microbes for the life of the product.
- WayGlo is rated for wet location environments.
- Optional integral photocell control available.




Specifications

Construction The faceplate and reflector are die cast aluminum. The backplate is formed from 18 gauge galvanized steel and provided with a neoprene gasket. The back box is formed from 16 gauge galvanized steel.

Finish The faceplate and reflector have a polyester powdercoat paint finish. All paint colors have an antimicrobial finish to inhibit the growth of microbes.

Lens The custom lens is molded from acrylic.

Lamps WayGlo is available in either white (2850K), amber (590nm) or blue (460nm) LEDs. The LEDs maintain a lumen output greater than 70% of the initial lumen rating at 50,000 hours of life.

Listings ETL and CETL listed for wet location applications (standard orientation only). The product is IBEW labeled.

The Agion® antimicrobial has been listed with the U.S. Food and Drug Administration (FDA), certified by the National Sanitation Foundation (NSF) and registered with the U.S. Environmental Protection Agency.

Electrical The electronic driver can is available for 120 and 277 volt applications. The power consumption is ≤3 watts.

Installation The backplate and driver can be mounted to the single-gang back box that is provided with the product. In addition, the backplate and driver can be retrofitted to a NEMA single-gang junction box or to a 1900 junction box with a single-gang plaster ring. An optional tamper-resistant mounting screw and tool are provided. For wet location applications, follow the installation instructions.

WayGlo is also available in a Thru-wall design (see Specification Sheet E1.4 - WGT).

Warranty The driver has a warranty of 3 yrs. from date of manufacture.

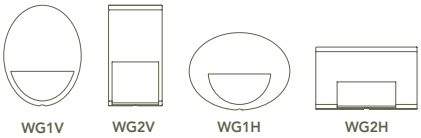
agion
Nature's antimicrobial

Ordering Information

Sample Catalog No: **WG1V - 1 - 120 - AL**

3L130	—	2	—	120	—	SHW	—	HDS
Model Number		**LED Color**		**Voltage**		**Finish** [1]		**Options**
WG1V		**1** White		**120**		**SWH** Soft White		**PCC** Photocell Control
WG2V		**2** Amber		**277**		**BL** Black		
WG1H		**3** Blue				**AL** Aluminum		
WG2H						**CC** [2] Custom Color		

Single-gang back box is provided.



[1] The finish designation is for the faceplate only. The reflector comes standard as SWH - Soft White.

[2] Customer to provide RAL number or color chip to match.

11500 Melrose Avenue Franklin Park, Illinois 60131
Phone: 847-451-0700 Toll-Free: 1-866-50ALKCO
Fax: 847-451-7512 www.alkco.com 06/10

PHILIPS ALKCO

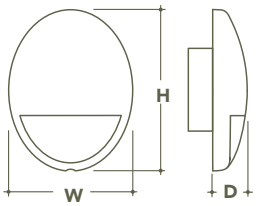
WayGlo

Night Light
LED

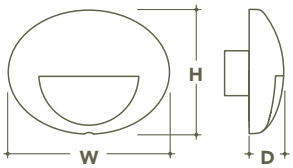
WG Series

Project	Type
IMPROVED BEDROOM	A

Dimensional Data

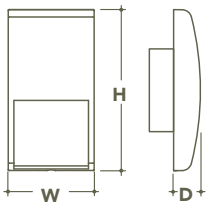


WG1V

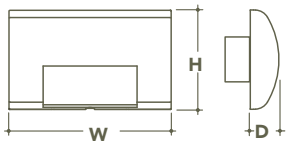


WG1H

Model #	Height	Width	Depth
WG1V	5-11/16″ (144.4 mm)	4-3/8″ (111.1 mm)	1-1/4″ (31.8 mm)
WG1H	4-3/8″ (111.1 mm)	5-11/16″ (144.4 mm)	1-3/16″ (30.2 mm)



WG2V



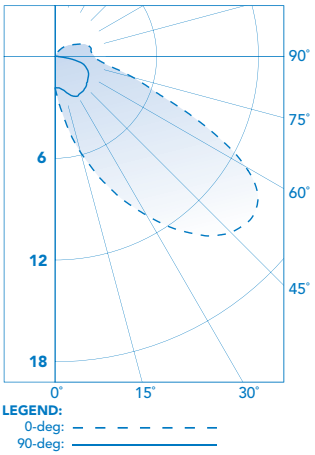
WG2H

Model #	Height	Width	Depth
WG2V	5-11/16″ (144.1 mm)	3″ (76.2 mm)	15/16″ (23.8 mm)
WG2H	3-15/16″ (84.1 mm)	5-3/8″ (136.5 mm)	15/16″ (23.8 mm)

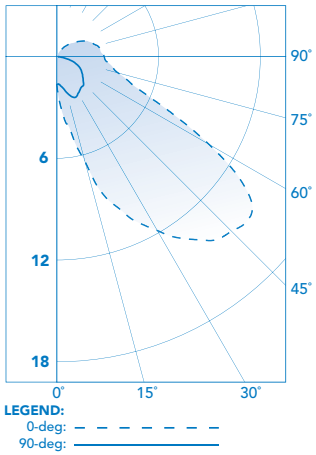
Photocell Control Note:
The photocell is factory set to switch off at 10fc (± 2.5fc) of ambient light and switch on when the light level is below 5fc (± 2.5fc). The sensitivity of the photocell is not field adjustable and performance can vary depending on room finishes, mounting location and surrounding objects.

Photometric Data

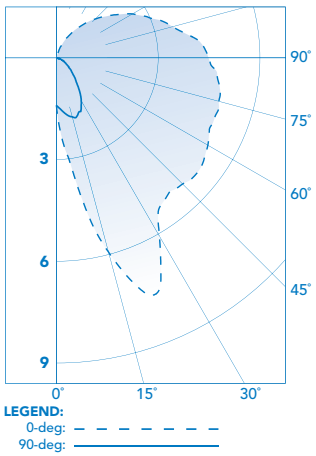
Model: WG1V-1



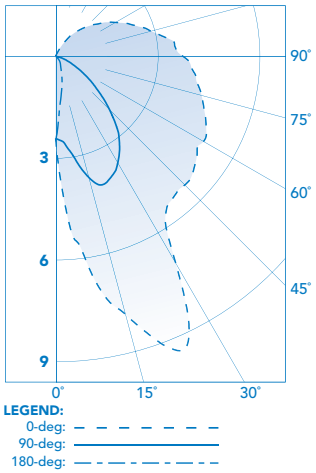
Model: WG1H-1



Model: WG2V-1



Model: WG2H-1



▶ Go to www.alkco.com for additional Photometric Data

11500 Melrose Avenue Franklin Park, Illinois 60131
Phone: 847-451-0700 Toll-Free: 1-866-50ALKCO
Fax: 847-451-7512 www.alkco.com 06/10

PHILIPS ALKCO

WayGlo

Night Light
LED

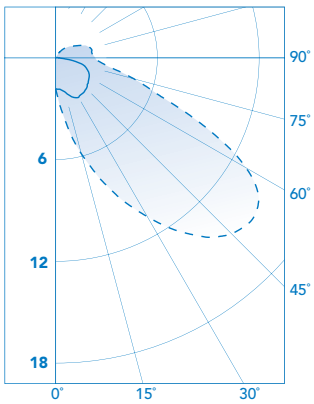
WG Series

Project: IMPROVED BEDROOM
Type: A

Photometric Data

WG1V-1

(2) 2 Watt White Light Emitting Diodes (LEDs)
Report No.: ITL58823



CO-EFFICIENTS OF UTILIZATION

Effective floor cavity reflectance=20%

rc		80				70				50			30			10		0
rw		70	50	30	10	70	50	30	10	50	30	10	50	30	10	50	30	10	0
RCR	0	117	117	117	117	113	113	113	113	106	106	106	100	100	100	94	94	94	91
	1	104	99	93	89	101	95	91	87	90	86	82	84	81	78	79	77	74	71
	2	93	84	76	69	90	81	74	67	76	70	64	71	66	62	67	63	59	56
	3	84	71	62	55	80	69	61	54	65	58	52	61	55	49	57	52	48	45
	4	75	62	52	44	72	60	51	44	56	48	42	53	46	40	49	44	39	36
	5	68	54	44	37	66	52	43	36	49	41	35	46	39	34	43	37	32	30
	6	62	48	38	31	60	46	37	30	43	35	29	41	34	28	38	32	27	25
	7	57	42	33	26	55	41	32	26	39	31	25	37	29	24	34	28	23	21
	8	53	38	29	22	51	37	28	22	35	27	21	33	26	21	31	25	20	18
	9	49	34	26	20	47	33	25	19	32	24	19	30	23	18	28	22	18	15
	10	46	31	23	17	44	30	22	17	29	21	16	27	21	16	26	20	15	13

CANDLEPOWER DISTRIBUTION

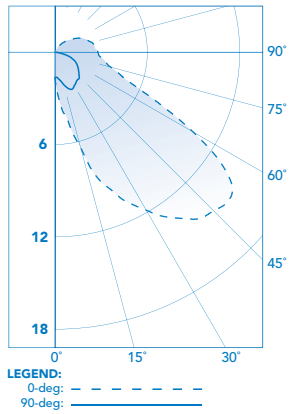
Vertical Angle	Horizontal Angle 0°	45°	90°	135°	180°	Vertical Angle	Horizontal Angle 0°	45°	90°	135°	180°
0°	1.8	1.8	1.8	1.8	1.8	95°	3.5	2.4	0.0	0.0	0.0
5°	2.8	2.5	1.8	1.3	1.1	105°	2.9	1.9	0.0	0.0	0.0
15°	5.9	4.7	2.1	0.5	0.2	115°	2.3	1.4	0.0	0.0	0.0
25°	9.2	6.9	2.6	0.1	0.0	125°	1.8	1.0	0.0	0.0	0.0
35°	12.4	8.8	2.6	0.0	0.0	135°	1.2	0.6	0.0	0.0	0.0
45°	14.7	10.2	2.5	0.0	0.0	145°	0.7	0.3	0.0	0.0	0.0
55°	14.6	10.5	2.3	0.0	0.0	155°	0.2	0.1	0.0	0.0	0.0
65°	9.9	8.8	2.2	0.0	0.0	165°	0.0	0.0	0.0	0.0	0.0
75°	4.8	4.1	1.7	0.0	0.0	175°	0.0	0.0	0.0	0.0	0.0
85°	2.6	1.9	0.5	0.0	0.0	180°	0.0	0.0	0.0	0.0	0.0
90°	2.3	1.6	0.2	0.0	0.0						

ZONAL LUMEN SUMMARY

Zone	Lumens	% Fixt.
0-30	3	11.1
0-40	5	23.0
0-60	14	58.7
0-90	21	89.3
90-120	2	8.3
90-130	2	9.5
90-150	2	10.6
90-180	2	10.7
0-180	23	100.0

WG1H-1

(2) 2 Watt White Light Emitting Diodes (LEDs)
Report No.: ITL58824



CO-EFFICIENTS OF UTILIZATION

Effective floor cavity reflectance=20%

rc		80				70				50			30			10		0
rw		70	50	30	10	70	50	30	10	50	30	10	50	30	10	50	30	10	0
RCR	0	116	116	116	116	112	112	112	112	104	104	104	97	97	97	90	90	90	87
	1	104	98	93	88	99	94	90	86	88	84	81	82	79	76	76	74	71	68
	2	93	83	76	69	89	80	73	67	75	69	64	69	65	60	64	61	57	54
	3	83	72	63	55	80	69	61	54	64	57	51	60	54	49	55	51	46	43
	4	76	62	53	45	72	60	51	44	56	48	42	52	45	40	48	43	38	35
	5	69	55	45	38	65	53	44	37	49	41	35	46	39	34	42	37	32	29
	6	63	48	39	32	60	47	38	31	43	36	30	40	34	28	38	32	27	25
	7	58	43	34	23	55	42	33	26	39	31	25	36	29	24	34	28	23	21
	8	53	39	30	23	51	37	29	23	35	27	22	33	26	21	30	25	20	18
	9	49	35	26	20	47	34	26	20	32	24	19	30	23	18	28	22	18	15
	10	46	32	23	18	44	31	23	17	29	22	17	27	21	16	25	20	15	13

CANDLEPOWER DISTRIBUTION

Vertical Angle	Horizontal Angle 0°	45°	90°	135°	180°	Vertical Angle	Horizontal Angle 0°	45°	90°	135°	180°
0°	1.6	1.6	1.6	1.6	1.6	95°	2.6	1.8	0.1	0.0	0.0
5°	3.1	2.8	1.6	1.1	0.9	105°	2.5	1.6	0.1	0.0	0.0
15°	6.4	5.0	2.2	0.5	0.3	115°	2.1	1.2	0.0	0.0	0.0
25°	10.6	8.7	2.6	0.2	0.0	125°	1.6	0.8	0.0	0.0	0.0
35°	13.1	10.6	2.4	0.0	0.0	135°	1.0	0.5	0.0	0.0	0.0
45°	14.6	11.5	2.2	0.0	0.0	145°	0.6	0.3	0.0	0.0	0.0
55°	13.6	11.1	1.9	0.0	0.0	155°	0.2	0.1	0.0	0.0	0.0
65°	6.8	7.7	1.5	0.0	0.0	165°	0.0	0.0	0.0	0.0	0.0
75°	3.8	3.2	0.9	0.0	0.0	175°	0.0	0.0	0.0	0.0	0.0
85°	2.9	2.1	0.2	0.0	0.0	180°	0.0	0.0	0.0	0.0	0.0
90°	2.8	1.9	0.1	0.0	0.0						

ZONAL LUMEN SUMMARY

Zone	Lumens	% Fixt.
0-30	3	12.6
0-40	6	25.9
0-60	14	62.4
0-90	20	87.7
90-120	2	9.5
90-130	3	11.0
90-150	3	12.2
90-180	3	12.3
0-180	23	100.0

11500 Melrose Avenue Franklin Park, Illinois 60131
Phone: 847-451-0700 Toll-Free: 1-866-50ALKCO
Fax: 847-451-7512 www.alkco.com 06/10

PHILIPS ALKCO

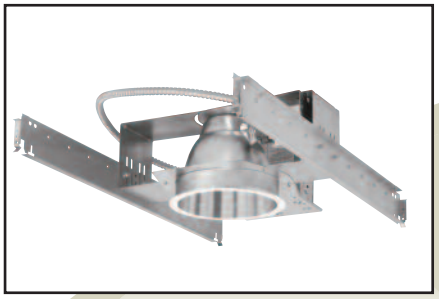
OM61H42PLT

6" Open Reflector Horizontal Downlights

CAT. NO: OM6-1-H-42PLT-BB-CS-CL-0-120

TYPE: F

PROJECT: IMPROVED BEDROOM



PRODUCT INFORMATION

Applications

Small aperture open reflector downlight for use with long-life energy efficient compact fluorescent lamps. Provides medium, uniform light distribution with excellent color rendition. Ideal for areas requiring long hours of continuous operation such as lobbies, corridors, reception areas and offices.

Specifications

1. **Ballast** - One (1) Type 1 Class P, high power factor universal voltage electronic compact fluorescent ballast. Offers 1 lamp operation for 120 through 277 volt input voltage.

	18W 120V	18W 277V	26W 120V	26W 277V	32W 120V	32W 277V	42W 120V	42W 277V
Line current amps	.19	.08	.25	.11	.32	.14	.42	.18
Input watts including ballast loss	22	22	28	28	36	36	48	48
Ballast factor	1.00	1.00	.98+	.98+	1.00	1.00	.98+	.98+
Minimum starting temperature	0°F	0°F	0°F	0°F	0°F	0°F	0°F	0°F

2. **Mounting pan** - Precision die-stamped 16 gauge galvanized steel mounting pan and yoke assembly. Accommodates ceiling materials up to 1-3/8" thick.

3. **Installation** - Mounting pan has pre-installed C-channel with vertical and horizontal adjustments. Ballast, junction box and mounting brackets are accessible from below ceiling. For 27" flat bar hanger pair, specify Q1031 accessory, ordered separately.

4. **Reflector** - Precision spun .050 aluminum one piece reflector, self flanged with clear specular Alzak low iridescent finish. Reflector is screw mounted for positive attachment to socket assembly. Standard flat flange is painted white. Optional polished flange matching reflector finish available, add FF to catalog number.

5. **Baffle** - Precision machined .051 aluminum with deep grooves to minimize aperture glare, anodized matte black or matte white finish. Standard flat flange is painted white. Optional black flange available, add FF to catalog number.

6. **Sockets** - CFM42W/GX24q, CFM32W/GX24q, CFM26W/GX24q, CFM18W/GX24q, horizontally mounted 4 pin plug-in type. Socket assembly rotates 90° to allow for alignment of lamps and reflector within fixture, for design flexibility. (Lamps ordered separately.)

7. **Junction box** - Extra large 43.75-cubic inch 16 gauge galvanized steel with snap-on covers and ground wire riveted to frame. Approved for through wiring with up to 8 #12 AWG conductors.

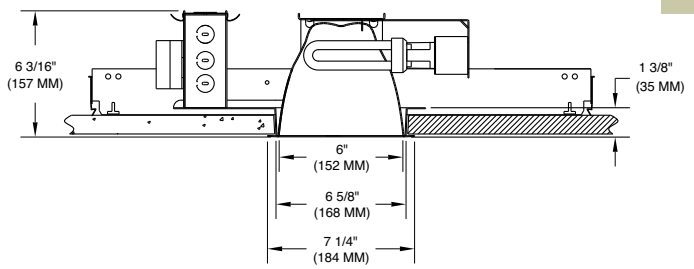
8. **Optional emergency system** - Emergency system includes battery, electronic circuitry, charger and test/monitor plate with test switch and charging indicator light. Test/monitor plate may be installed in the ceiling near fixture or other remote location. Operates appropriate lamp wattage for a minimum of 90 minutes following power failure. Emergency system complies with NFPA life safety code, OSHA and NEC. Suitable for dry locations.

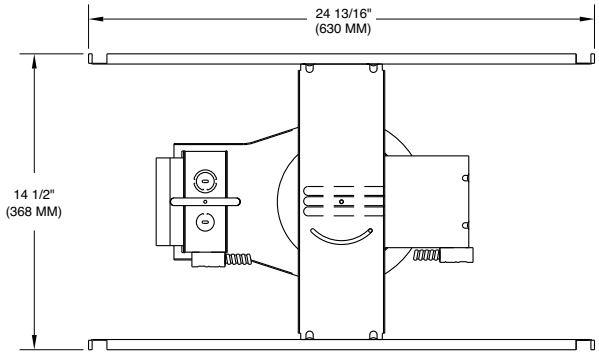
9. **U.L. Listed** - For use in damp locations and approved for Through Branch Circuit Wiring. I.B.E.W. union made.

Canadian Specifications may vary from these shown, consult Canadian Division.

HeatSink LAMP SOCKET

6





CATALOG SYSTEM AND OPTIONS

EXAMPLE OF COMPLETE CATALOG NUMBER: **OM61H42PLT-CS-120/277**

OMEGA Aptr.	No. of Lamps	Lamps Position	Lamp (by others)	Reflector Option	Finish	Options	Sloped Ceiling Adapter Angle	Supply Voltage
OM6	1	H Horizontal	42PLT **42 PLT** Triple Tube CFL **32 PLT** Triple Tube CFL **26 PLT** Triple Tube CFL **18 PLT** Triple Tube CFL	BB **BB** Black Baffle	- CS **CS** Clear Specular **CSS** Clear Semi-Specular **HZ** Haze **GS** Gold Specular **WT** Wheat **PW** Pewter **BK** Black **BZ** Bronze **WH** White **FCS** Faceted Clear Specular **FCSS** Faceted Clear Semi Specular **FF** Finish Flange (as suffix to color)	- CL **EM** Emergency **IE** Integral Emergency **FZ120** Fusing **FZ277** Fusing **FZ347** Fusing **CP** Chicago Plenum **Q1031** Flat Bar Hangers **SA6** Sloped Ceiling Adpt. **DL1** Dimming, Lutron Compact SE, 120v **DL2** Dimming, Lutron Compact SE, 277v **DX1** Dimming, Advance Mark X, 120v **DX2** Dimming, Advance Mark X, 277v **CL** Clear Lens **PL** Prismatic Lens **FL** Fresnel Lens	- 0 5 10 15 20 25 30	- 120 120/277 347

made with pride in the United States of America

FIVE YEAR Warranty

OMEGA LIGHTING: 776 South Green St., Tupelo, MS 38804 Phone 662.842.7212 FAX 662.841.5501

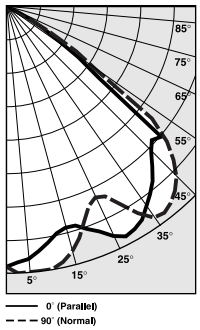
OM61H42PLT-CS — Photometric Data

Clear Specular Reflector
Report Number: 20716
Lamp: (1)CFM42W
Total Lumens: 3200
Fixture Efficiency: = 53.9%
IES File: F20716.IES
S/MH Ratio = 1.4, 1.5
Beam Angle: 106.85

LIGHTING PERFORMANCE DATA

CEILING HEIGHT* (FT.)	INITIAL FOOTCANDLES	BEAM DIAMETER (FT.-IN.)
8	23.0	14-10
10	12.4	20-3
12	7.7	25-7
14	5.3	30-12
16	3.8	36-5

DISTRIBUTION CURVE



DEGREES	CANDELA AT 0°	CANDELA AT 90°	FOOT-LAMBERTS
90	0	0	
85	0	0	0
75	0	0	93
65	37	24	1155
55	235	292	7350
45	549	645	13509
35	654	690	
25	678	564	
15	613	680	
5	679	714	
0	697	697	

COEFFICIENTS OF UTILIZATION ZONAL CAVITY METHOD

Effective Floor Cavity Reflectance 0.20

RC	80		70		50	
RW	50	30	50	30	50	30
0	64	64	63	63	59	59
1	57	56	56	55	55	53
2	54	48	51	48	48	46
3	46	42	46	42	44	41
4	41	38	40	36	40	36
5	38	33	36	33	35	33
6	34	29	34	28	33	28
7	30	27	30	26	29	26
8	28	23	28	23	27	23
9	26	22	26	22	25	20
10	23	20	23	20	23	20

6

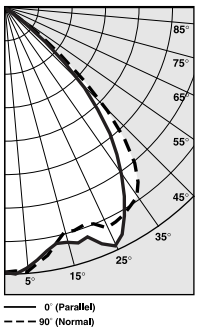
OM61H32PLT-CS — Photometric Data

Clear Specular Reflector
Report Number: 21516
Lamp: (1)CFM32W
Total Lumens: 2400
Fixture Efficiency: = 55.9%
IES File: F 21516.IES
S/MH Ratio = 1.3, 1.3
Beam Angle: 89.61

LIGHTING PERFORMANCE DATA

CEILING HEIGHT* (FT.)	INITIAL FOOTCANDLES	BEAM DIAMETER (FT.-IN.)
8	25.5	10-11
10	13.7	14-11
12	8.5	18-10
14	5.8	22-10
16	4.2	26-10

DISTRIBUTION CURVE



DEGREES	CANDELA AT 0°	CANDELA AT 90°	FOOT-LAMBERTS
90	0	0	
85	0	0	0
75	0	0	0
65	0	0	0
55	30	53	837
45	332	426	7513
35	597	674	
25	766	708	
15	708	678	
5	762	773	
0	771	771	

COEFFICIENTS OF UTILIZATION ZONAL CAVITY METHOD

Effective Floor Cavity Reflectance 0.20

RC	80		70		50	
RW	50	30	50	30	50	30
0	51	51	50	50	48	48
1	47	46	46	45	45	44
2	44	42	43	42	42	40
3	41	38	40	38	39	37
4	38	35	37	35	36	34
5	35	32	34	32	34	31
6	32	30	32	28	31	29
7	30	27	30	27	29	27
8	27	25	27	24	27	24
9	25	22	25	22	24	22
10	23	20	23	20	22	20

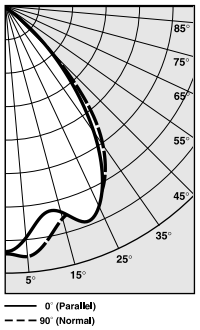
OM61H26PLT-CS — Photometric Data

Clear Specular Reflector
Report Number: 2762
Lamp: (1)CFM26W
Total Lumens: 1800
Fixture Efficiency: = 47.5%
IES File: EY3495.IES
S/MH Ratio = 1.2, 1.2
Beam Angle: 80.71

LIGHTING PERFORMANCE DATA

CEILING HEIGHT* (FT.)	INITIAL FOOTCANDLES	BEAM DIAMETER (FT.-IN.)
8	19.7	9-4
10	10.6	12-8
12	6.6	16-1
14	4.5	19-6
16	3.3	22-11

DISTRIBUTION CURVE



DEGREES	CANDELA AT 0°	CANDELA AT 90°	FOOT-LAMBERTS
90	0	0	
85	0	0	0
75	0	0	0
65	0	0	0
55	25	15	694
45	173	198	4483
35	378	411	
25	530	516	
15	495	512	
5	554	607	
0	595	595	

COEFFICIENTS OF UTILIZATION ZONAL CAVITY METHOD

Effective Floor Cavity Reflectance 0.20

RC	80		70		50	
RW	50	30	50	30	50	30
0	56	56	55	55	52	52
1	52	51	51	50	49	48
2	48	46	47	45	46	44
3	44	42	44	41	43	41
4	41	38	40	38	39	37
5	38	35	37	34	36	34
6	35	32	35	32	34	31
7	32	29	32	29	31	29
8	29	26	29	26	29	26
9	27	24	27	23	26	23
10	25	21	24	21	24	21

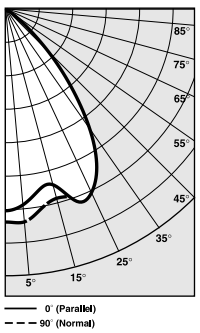
OM61H18PLT-CS — Photometric Data

Clear Specular Reflector
Report Number: 2771
Lamp: (1)CFM18W
Total Lumens: 1250
Fixture Efficiency: = 51.4%
IES File: EY3493.IES
S/MH Ratio = 1.2, 1.2
Beam Angle: 80.26

LIGHTING PERFORMANCE DATA

CEILING HEIGHT* (FT.)	INITIAL FOOTCANDLES	BEAM DIAMETER (FT.-IN.)
8	14.6	9-3
10	7.5	12-7
12	4.9	16-0
14	3.3	19-4
16	2.4	22-9

DISTRIBUTION CURVE



DEGREES	CANDELA AT 0°	CANDELA AT 90°	FOOT-LAMBERTS
90	0	0	
85	0	0	0
75	0	0	0
65	0	0	0
55	16	2	438
45	135	113	3053
35	314	293	
25	427	402	
15	365	404	
5	414	454	
0	441	441	

COEFFICIENTS OF UTILIZATION ZONAL CAVITY METHOD

Effective Floor Cavity Reflectance 0.20

RC	80		70		50	
RW	50	30	50	30	50	30
0	61	61	59	59	57	57
1	56	55	55	54	53	52
2	52	50	51	49	50	48
3	48	46	48	45	46	44
4	45	42	44	41	43	40
5	41	38	41	38	40	37
6	38	35	38	35	37	34
7	35	32	35	32	34	31
8	32	29	32	29	31	28
9	29	26	29	26	29	26
10	27	24	27	23	26	23

*Readings at working plane, 2'6" above floor. Beam Angle and Diameter Cutoff at 50% of max.
Candlepower Coefficients used at effective reflectances of: 70% Ceiling, 50% Walls, 20% Floor

To convert values for optional reflector colors, multiply by:
Gold .90 Bronze .82 Pewter .87

Additional photometric test files are available @ omegalighting.com

OMEGA LIGHTING

OMEGA LIGHTING:
776 South Green St., Tupelo, MS 38804
Phone 662.842.7212 FAX 662.841.5501

CANADIAN DIVISION:
189 Bullock Drive, Markham, Ontario, Canada L3P 1W4
Phone 905.294.9570 FAX 800.268.0003

Appendix H - Completed Questionnaires

If you need additional appendices, use style “Appendix A – Heading 6” for the appendix heading. This will label appendices in alphabetical order (A, B, C, etc.).

A

Name of Facility:

Can I use the name of your Facitlly in my report? (Yes) No

Number of Alzheimer's patients living there: 4

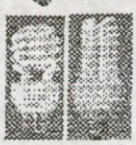
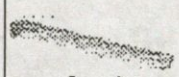
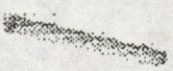
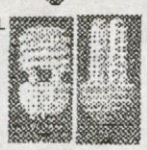
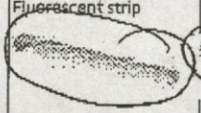
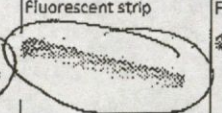
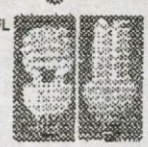
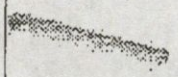
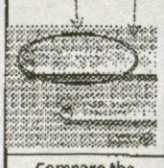
Total number of residents living there: 72

Are Alzheimer's residents and regular resident's mixed together? (Yes) No

If they are sepearate, is there anything unique about the Alzheimer's section? Yes No (N/A)

If yes, please explain. (more windows, more lights, more lighting controls, more time by the windows, etc) N/A

Please fill out the boxes below as a general consensus of all the residents OR pick a specific resident(s) and fill out the boxes for them in each room.

Lamp Information	Bedroom/Main Light	Restroom	Common Room	Dining Room	Other	Other
Type of Light	Incandescent  Incandescent Flood  CFL  Fluorescent Strip  Other Circle flourescent	Incandescent  Incandescent Flood  and CFL  Fluorescent Strip  Other ____	Incandescent  Incandescent Flood  CFL  Fluorescent strip  Other ____	Incandescent  Incandescent Flood  CFL  Fluorescent strip  Other Both strips and chandelier (Incandescents)	Incandescent  Incandescent Flood  CFL  Fluorescent strip  Other ____	Incandescent  Incandescent Flood  CFL  Fluorescent strip  Other ____
Kinds of Light (Please list other kinds of accent lights if applicable)	Table lamps - CFL's and floorlamps - CFL's	—	—	—		
Number of Bulbs Per Lamp	1 (2) 3 4 5 6	1 2 (3) 4 5 6	1 (2) 3 4 5 6	1 (2) 3 4 5 6	1 2 3 4 5 6	1 2 3 4 5 6
Watts Per Bulb	15 30 (32) 42 60 75 100 Other ____	15 30 32 42 60 75 100 Other 25 watted	15 30 (32) 42 60 75 100 Other ____	15 30 (32) 42 60 75 100 Other ____	15 30 32 42 60 75 100 Other ____	15 30 32 42 60 75 100 Other ____
Bulb Manufacturer	Sylvania Philips GE Other No preference	Sylvania Philips GE Other No preference	Sylvania Philips GE Other No preference	Sylvania Philips GE Other No preference	Sylvania Philips GE Other ____	Sylvania Philips GE Other ____
Model Number and/or Description 	Ex: GE Reveal A 19: 81871-100A/CL/RVL	Ex: Lights of America 8W CFL: F8T5CW	Ex: GE Cool White T 12: 10116	Ex: Philips Advantage T8: F17T8 ADV830 ALTO	Ex:Osram Sylvania Dulux: 29590	Ex: Osram Slyvania Dulux: 20538
Compare the Brightness of the Rooms to Each	Brighter than the Rest Average (Dimmer than the Rest)	(Brighter than the Rest) Average Dimmer than the Rest	Brighter than the Rest (Average) Dimmer than the Rest	Brighter than the Rest (Average) Dimmer than the Rest	Brighter than the Rest Average Dimmer than the Rest	Brighter than the Rest Average Dimmer than the Rest
Brightness More Specifically	This room is brighter than a closet room, but duller than dining room room	This room is brighter than bedroom room, but duller than the Sun room	This room is brighter than Same room, but duller than Same room	This room is brighter than Same room, but duller than Same room	This room is brighter than ____ room, but duller than ____ room	This room is brighter than ____ room, but duller than ____ room
	10 fc	29 fc	144.7 fc (DAYLIGHT)	16.5 fc	30 fc (HALL)	

TIME OF DAY: 11:00AM
WEATHER: SUNNY

Lamp Information	Bedroom	Restroom	Common Room	Dining Room	Other	Other
Typical Behavior-Compared to other rooms (on an individual basis) residents are generally more... [Circle all that apply]	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative No different from other spaces Other	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative No different from other spaces Other	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative No different from other spaces Other	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative No different from other spaces Other	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative No different from other spaces Other	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative No different from other spaces Other
Age of Lights	Original Retrofit	Original Retrofit	Original Retrofit	Original Retrofit	Original Retrofit	Original Retrofit
Year of Original or Retrofit						
Why Did You Change the Lights?	Better for residents Can't buy old bulbs New bulbs are cheaper N/A	Better for residents Can't buy old bulbs New bulbs are cheaper N/A	Better for residents Can't buy old bulbs New bulbs are cheaper N/A	Better for residents Can't buy old bulbs New bulbs are cheaper N/A	Better for residents Can't buy old bulbs New bulbs are cheaper N/A	Better for residents Can't buy old bulbs New bulbs are cheaper N/A
Do You Think Your Light Affect Your Resident's?	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
What Behavior Would You Like to See Improved the Most	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative Other	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative Other	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative Other	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative Other	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative Other	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative Other
Approximate Size of Space	15x20x8 LengthxWidthxHeight	6x4x8 LengthxWidthxHeight	30x30x8 LengthxWidthxHeight	60x50x12 LengthxWidthxHeight	LengthxWidthxHeight	LengthxWidthxHeight
Windows in the Room	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
Number of Windows	1 2 3 4 N/A	1 2 3 4 N/A	1 2 3 4 N/A	1 2 3 4 + N/A	1 2 3 4 N/A	1 2 3 4 N/A
Approximate Size of Windows	62x38 WidthxHeight	N/A WidthxHeight	105x38 WidthxHeight	Many, about 30x60 WidthxHeight	WidthxHeight	WidthxHeight
Do Resident's Like Sitting Next to the Windows?	Yes No No Windows	Yes No No Windows	Yes No No Windows	Yes No No Windows	Yes No No Windows	Yes No No Windows
Do They Have Better Behavior While Sitting Next to the Windows?	Yes No No Different From Other Spaces No Windows	Yes No No Different From Other Spaces No Windows	Yes No No Different From Other Spaces No Windows	Yes No No Different From Other Spaces No Windows	Yes No No Different From Other Spaces No Windows	Yes No No Different From Other Spaces No Windows
What Time of Day do Resident's Sit by the Windows? [Circle all that apply]	At Breakfast Breakfast-Lunch At Lunch Lunch-Dinner At Dinner After Dinner Any Time They Can No Time in Particular	At Breakfast Breakfast-Lunch At Lunch Lunch-Dinner At Dinner After Dinner Any Time They Can No Time in Particular	At Breakfast Breakfast-Lunch At Lunch Lunch-Dinner At Dinner After Dinner Any Time They Can No Time in Particular	At Breakfast Breakfast-Lunch At Lunch Lunch-Dinner At Dinner After Dinner Any Time They Can No Time in Particular	At Breakfast Breakfast-Lunch At Lunch Lunch-Dinner At Dinner After Dinner Any Time They Can No Time in Particular	At Breakfast Breakfast-Lunch At Lunch Lunch-Dinner At Dinner After Dinner Any Time They Can No Time in Particular

Lamp Information	Bedroom	Restroom	Common Room	Dining Room	Other	Other
Do Resident's Like Rooms with Windows More than Rooms Without Windows?	**Yes** No	**Yes** No	**Yes** No	**Yes** No	Yes No	Yes No
Please Put a ★ in Room Where the Resident's Have Their Best Behavior			✱			
Have You Ever Tried Different Lights in this Room?	Yes No (Remodel coming, new lights coming →)	Yes No	Yes No	Yes No	Yes No	Yes No
What Other Types of Light Have You Tried?	Incandescent Incandescent Flood CFL Fluorescent Strip Other ____	Incandescent Incandescent Flood CFL Fluorescent Strip Other ____	Incandescent Incandescent Flood CFL Fluorescent Strip Other ____	Incandescent Incandescent Flood CFL Fluorescent Strip Other ____	Incandescent Incandescent Flood CFL Fluorescent Strip Other ____	Incandescent Incandescent Flood CFL Fluorescent Strip Other ____
Did the Resident's Behavior Change With the New Lights?	**Yes** No	**Yes** No	**Yes** No	**Yes** No	Yes No	Yes No
How Did Their Behavior Change? They are more ____ than before. [Circle all that apply]	Agitated **Happy** Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative No Change Other ____	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative **No Change** Other ____	Agitated **Happy** Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative No Change Other ____	Agitated **Happy** Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative No Change Other ____	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative No Change Other ____	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative No Change Other ____
Place a ☺ in the Room the Resident's Like the Most			☺			
Place a ☹ in the Room the Resident's Dislike the Most				☹		
Is There Anything You Think Could Be Done to Improve Resdient's Comfort?	**Yes** No	Yes **No**	**Yes** No	**Yes** No	Yes No	Yes No
What Are Your Suggestions?	New lights, better windows					

*Please attach photos of the lights if possible without any resident's in the picture

Please e-mail back the response at: Lgeiger@ksu.edu. If you prefer to fax, please fax it to the Department of Architectural Engineering at K-State with Laura Geiger on the top to: 785-532-3556. If you have any questions, feel free to e-mail me or call me: 913-221-2609. Thank you for your help.

B

Name of Facility:

Can I use the name of your Facitily in my report? (Yes) No

Number of Alzheimer's patients living there: 54 Residents

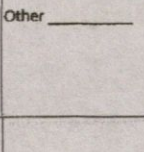
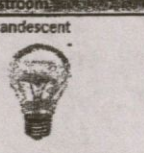
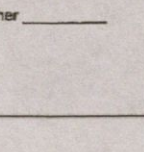
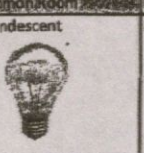
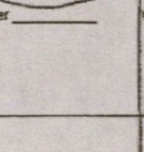
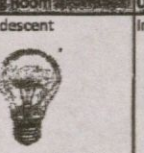
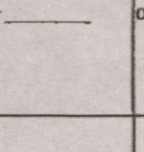
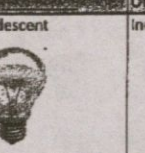
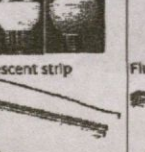
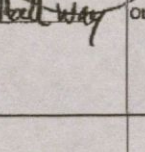
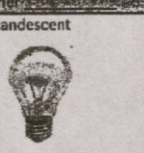
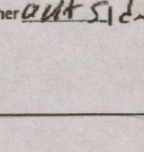
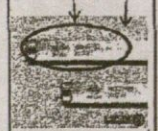
Total number of residents living there: 59

Are Alzheimer's residents and regular residnet's mixed together? (Yes) No

If they are sepearate, Is there anything unique about the Alzheimer's section? Yes (No)

If yes, please explain. (more windows, more lights, more lighting controls, more time by the windows, etc)

Please fill out the boxes below as a general consensus of all the residents OR pick a specific resident(s) and fill out the boxes for them in each room.

Lamp Information	Bedroom/Main Light Fixt	Restroom	Common Room	Dining Room	Other	Other
Type of Light	Incandescent  Incandescent Flood  CFL  Fluorescent Strip  Other _____	Incandescent  Incandescent Flood  CFL  Fluorescent Strip  Other _____	Incandescent  Incandescent Flood  CFL  Fluorescent strip  Other _____	Incandescent  Incandescent Flood  CFL  Fluorescent strip  Other _____	Incandescent  Incandescent Flood  CFL  Fluorescent strip  Other hall way	Incandescent  Incandescent Flood  CFL  Fluorescent strip  Other out side
Kinds of Light (Please list other kinds of accent lights if applicable)	N/A					
Number of Bulbs Per Lamp	(1) (2) 3 (4) 5 6	1 2 3 4 5 6	1 2 3 4 5 6	1 2 3 4 5 6	1 2 3 4 5 6	1 2 3 4 5 6
Watts Per Bulb	15 30 32 42 60 75 100 Other 40-60 W	15 30 32 42 60 75 100 Other 40 W	15 30 32 42 60 75 100 Other 40-60	15 30 32 42 60 75 100 Other 40-60	15 30 32 42 60 75 100 Other 40-60	15 30 32 42 60 75 100 Other _____
Bulb Manufacturer	Sylvania Philips GE Other _____	Sylvania Philips GE Other _____	Sylvania Philips GE Other _____	Sylvania Philips GE Other _____	Sylvania Philips GE Other _____	Sylvania Philips GE Other _____
Model Number and/or Description 	N/A Ex: GE Reveal A 19: 81871-100A/CL/RVL	N/A Ex: Lights of America 8W CFL: F8T5CW	N/A Ex: GE Cool White T 12: 10115	N/A Ex: Philips Advantage T8: F17T8 ADV830 ALTO	N/A Ex:Osram Sylvania Dulux: 29590	N/A Ex: Osram Slyvania Dulux: 20538
Compare the Brightness of the Rooms to Each	Brighter than the Rest (Average) Dimmer than the Rest	Brighter than the Rest Average Dimmer than the Rest	Brighter than the Rest Average Dimmer than the Rest	Brighter than the Rest Average Dimmer than the Rest	Brighter than the Rest Average Dimmer than the Rest	Brighter than the Rest Average Dimmer than the Rest
Brightness More Specifically	This room is brighter than Dining room, but duller than Living room	This room is brighter than _____ room, but duller than _____ room	This room is brighter than _____ room, but duller than _____ room	This room is brighter than _____ room, but duller than _____ room	This room is brighter than _____ room, but duller than _____ room	This room is brighter than _____ room, but duller than _____ room
	115 fc	24 fc	7 fc	133 fc	30 fc	

TIME OF DAY: 10:30 AM

WEATHER: CLOUDY

Lamp Information	Bedroom	Restroom	Common Room	Dining Room	Other Patio	Other Outside
Typical Behavior-Compared to other rooms (on an individual basis) residents are generally more [Circle all that apply]	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative No different from other spaces Other ______	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative No different from other spaces Other ______	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative No different from other spaces Other ______	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative No different from other spaces Other Eating	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative No different from other spaces Other ______	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative No different from other spaces Other ______
Age of Lights	Original Retrofit 30 day	Original Retrofit 20 days	Original Retrofit 14 day	Original Retrofit 10 day	Original Retrofit 30 day	Original Retrofit 45 days
Year of Original or Retrofit						
Why Did You Change the Lights?	Better for residents Can't buy old bulbs New bulbs are cheaper N/A	Better for residents Can't buy old bulbs New bulbs are cheaper N/A	Better for residents Can't buy old bulbs New bulbs are cheaper N/A	Better for residents Can't buy old bulbs New bulbs are cheaper N/A	Better for residents Can't buy old bulbs New bulbs are cheaper N/A	Better for residents Can't buy old bulbs New bulbs are cheaper N/A
Do You Think Your Light Affect Your Resident's?	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
What Behavior Would You Like to See Improved the Most	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative Other ______	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative Other ______	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative Other ______	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative Other ______	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative Other ______	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative Other ______
Approximate Size of Space	Width LengthxWidthxHeight	Width LengthxWidthxHeight	Length & Width LengthxWidthxHeight	Length & Width LengthxWidthxHeight	Good as it is LengthxWidthxHeight	N/A LengthxWidthxHeight
Windows in the Room	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
Number of Windows	1 2 3 4 N/A	1 2 3 4 N/A	1 2 3 4 N/A	1 2 3 4 N/A	1 2 3 4 N/A	1 2 3 4 N/A
Approximate Size of Windows	48 x 36 WidthxHeight	N/A WidthxHeight	35 x 36 WidthxHeight	48 x 48 x2 45 x 36 -2 WidthxHeight	— WidthxHeight	— WidthxHeight
Do Resident's Like Sitting Next to the Windows?	Yes No No Windows	Yes No No Windows	Yes No No Windows	Yes No No Windows	Yes No No Windows	Yes No No Windows
Do They Have Better Behavior While Sitting Next to the Windows?	Yes No No Different From Other Spaces No Windows	Yes No No Different From Other Spaces No Windows	Yes No No Different From Other Spaces No Windows	Yes No No Different From Other Spaces No Windows	Yes No No Different From Other Spaces No Windows	Yes No No Different From Other Spaces No Windows
What Time of Day do Resident's Sit by the Windows? [Circle all that apply]	At Breakfast Breakfast-Lunch At Lunch Lunch-Dinner At Dinner After Dinner Any Time They Can No Time in Particular	At Breakfast Breakfast-Lunch At Lunch Lunch-Dinner At Dinner After Dinner Any Time They Can No Time in Particular	At Breakfast Breakfast-Lunch At Lunch Lunch-Dinner At Dinner After Dinner Any Time They Can No Time in Particular	At Breakfast Breakfast-Lunch At Lunch Lunch-Dinner At Dinner After Dinner Any Time They Can No Time in Particular	At Breakfast Breakfast-Lunch At Lunch Lunch-Dinner At Dinner After Dinner Any Time They Can No Time in Particular	At Breakfast Breakfast-Lunch At Lunch Lunch-Dinner At Dinner After Dinner Any Time They Can No Time in Particular

Lamp Information	Bedroom	Restroom	Common Room	Dining Room	Other Patio	Other Outside
Do Resident's Like Rooms with Windows More than Rooms Without Windows?	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
Please Put a ★ in Room Where the Resident's Have Their Best Behavior	★				★	★
Have You Ever Tried Different Lights in this Room?	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
What Other Types of Light Have You Tried?	Incandescent Incandescent Flood CFL Fluorescent Strip Other ______	Incandescent Incandescent Flood CFL Fluorescent Strip Other ______	Incandescent Incandescent Flood CFL Fluorescent Strip Other ______	Incandescent Incandescent Flood CFL Fluorescent Strip Other ______	Incandescent Incandescent Flood CFL Fluorescent Strip Other ______	Incandescent Incandescent Flood CFL Fluorescent Strip Other ______
Did the Resident's Behavior Change With the New Lights?	Yes No	Yes N/A No	Yes N/A No	Yes N/A No	Yes NA No	Yes NA No
How Did Their Behavior Change? They are more ______ than before. (Circle all that apply)	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative No Change Other ______	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative No Change Other ______	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative No Change Other ______	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative No Change Other ______	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative No Change Other ______	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative No Change Other ______
Place a ☺ in the Room the Resident's Like the Most	☺			☺		
Place a ☹ in the Room the Resident's Dislike the Most		☹				
Is There Anything You Think Could Be Done to Improve Resident's Comfort?	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
What Are Your Suggestions?			Plant Shower	Music		

*Please attach photos of the lights if possible without any resident's in the picture

Please e-mail back the response at: Lgeiger@ksu.edu. If you prefer to fax, please fax it to the Department of Architectural Engineering at K-State with Laura Geiger on the top to: 785-532-3556. If you have any questions, feel free to e-mail me or call me: 913-221-2609. Thank you for your help.

C

Name of Facility:

Can I use the name of your Facitily in my report? **Yes** No

Number of Alzheimer's patients living there: 18 (newly opened)

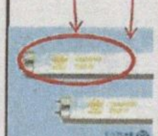
Total number of residents living there: 18

Are Alzheimer's residents and regular residnet's mixed together? N/A Yes **No**

If they are sepearate, is there anything unique about the Alzheimer's section? **Yes** No

If yes, please explain. (more windows, more lights, more lighting controls, more time by the windows, etc) The entire design of our building is geared towards someone with dementia. Lots of windows, open floor plan, outdoor spaces

Please fill out the boxes below as a general consensus of all the residents OR pick a specific resident(s) and fill out the boxes for them in each room.

Lamp Information	Bedroom-Main Light	Restroom	Common Room	Dining Room	Other ______	Other ______
Type of Light	Incandescent Incandescent Flood **CFL** Fluorescent Strip Other ______	Incandescent Incandescent Flood **CFL** Fluorescent Strip Other ______	Incandescent Incandescent Flood **CFL** Fluorescent strip Other ______	Incandescent Incandescent Flood **CFL** Fluorescent strip Other ______	Incandescent Incandescent Flood CFL Fluorescent strip Other ______	Incandescent Incandescent Flood CFL Fluorescent strip Other ______
Kinds of Light (Please list other kinds of accent lights if applicable)			4 can's 1 Fixture	5 Fixtures 1 Fixture		
Number of Bulbs Per Lamp	1 **2** 3 4 5 6	TOTAL 1 2 3 **4** 5 6	**1** **2** 3 4 5 6	1 2 **3** 4 **5** 6	1 2 3 4 5 6	1 2 3 4 5 6
Watts Per Bulb	15 30 32 42 **60** 75 100 Other______	15 30 32 42 **60** 75 100 Other______	15 30 32 42 **60** 75 100 Other______	15 30 32 42 **60** 75 100 Other______	15 30 32 42 60 75 100 Other______	15 30 32 42 60 75 100 Other______
Bulb Manufacturer	Sylvania **Philips** GE Other ______	Sylvania **Philips** GE Other ______	Sylvania **Philips** GE Other ______	Sylvania **Philips** GE Other ______	Sylvania Philips GE Other ______	Sylvania Philips GE Other ______
Model Number and/or Description 	Ex: GE Reveal A 19: 81871-100A/CL/RVL	Ex: Lights of America 8W CFL: F8T5CW	Ex: GE Cool White T 12: 10116	Ex: Philips Advantage T8: F17T8 ADV830 ALTO	Ex:Osram Sylvania Dulux: 29590	Ex: Osram Slyvania Dulux: 20538
Compare the Brightness of the Rooms to Each	Brighter than the Rest Average **Dimmer than the Rest**	Brighter than the Rest **Average** Dimmer than the Rest	Brighter than the Rest **Average** Dimmer than the Rest	**Brighter than the Rest** Average Dimmer than the Rest	Brighter than the Rest Average Dimmer than the Rest	Brighter than the Rest Average Dimmer than the Rest
Brightness More Specifically	This room is brighter than N/A room, but duller than ______ room	This room is brighter than Bedroom room, but duller than Dining room	This room is brighter than Bathroom room, but duller than Dining room	This room is brighter than All room, but duller than N/A room	This room is brighter than ______ room, but duller than ______ room	This room is brighter than ______ room, but duller than ______ room
	54.2fc	20fc	27fc	80fc		

TIME OF DAY: 10:00AM
WEATHER: SUNNY

Lamp Information	Bedroom	Restroom	Common Room	Dining Room	Other ________	Other ________
Typical Behavior- Compared to other rooms (on an individual basis) residents are generally more.... [Circle all that apply]	Agitated Happy Sad Mad **Calm** Angry Restless Aggressive **Sleepy** Anxious Talkative No different from other spaces Other	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative **No different from other spaces** Other	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative **No different from other spaces** Other	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative **No different from other spaces** Other	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative No different from other spaces Other ________	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative No different from other spaces Other ________
Age of Lights	**Original** Retrofit 4mo	**Original** Retrofit 4mo	**Original** Retrofit 4mo	**Original** Retrofit 4mo	Original Retrofit	Original Retrofit
Year of Original or Retrofit	2011	2011	2011	2011		
Why Did You Change the Lights?	Better for residents Can't buy old bulbs New bulbs are cheaper **N/A**	Better for residents Can't buy old bulbs New bulbs are cheaper **N/A**	Better for residents Can't buy old bulbs New bulbs are cheaper **N/A**	Better for residents Can't buy old bulbs New bulbs are cheaper **N/A**	Better for residents Can't buy old bulbs New bulbs are cheaper N/A	Better for residents Can't buy old bulbs New bulbs are cheaper N/A
Do You Think Your Light Affect Your Resident's?	**Yes** No	Yes **No**	**Yes** No	**Yes** No	Yes No	Yes No
What Behavior Would You Like to See Improved the Most	Agitated Happy Sad Mad Calm Angry **Restless** Aggressive Sleepy Anxious Talkative Other ________	Agitated Happy Sad Mad Calm Angry **Restless** Aggressive Sleepy Anxious Talkative Other ________	Agitated Happy Sad Mad Calm Angry **Restless** Aggressive Sleepy Anxious Talkative Other ________	Agitated Happy Sad Mad Calm Angry **Restless** Aggressive Sleepy Anxious Talkative Other ________	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative Other ________	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative Other ________
Approximate Size of Space	18' x 10' LengthxWidthxHeight	8' x 6' LengthxWidthxHeight	22' x 18' LengthxWidthxHeight	16' x 16' LengthxWidthxHeight	LengthxWidthxHeight	LengthxWidthxHeight
Windows in the Room	**Yes** No	Yes **No**	**Yes** No	**Yes** No	Yes No	Yes No
Number of Windows	**1** 2 3 4 N/A	1 2 3 4 **N/A**	1 2 3 **4** + N/A	1 2 3 **4** + N/A	1 2 3 4 N/A	1 2 3 4 N/A
Approximate Size of Windows	36" x 48" WidthxHeight	— WidthxHeight	36" x 72" WidthxHeight	36" x 72" WidthxHeight	WidthxHeight	WidthxHeight
Do Resident's Like Sitting Next to the Windows?	**Yes** No No Windows	Yes No **No Windows**	**Yes** No No Windows	**Yes** No No Windows	Yes No No Windows	Yes No No Windows
Do They Have Better Behavior While Sitting Next to the Windows?	Yes No **No Different From Other Spaces** No Windows	Yes No No Different From Other Spaces **No Windows**	Yes No **No Different From Other Spaces** No Windows	**Yes** No No Different From Other Spaces No Windows	Yes No No Different From Other Spaces No Windows	Yes No No Different From Other Spaces No Windows
What Time of Day do Resident's Sit by the Windows? [Circle all that apply]	**At Breakfast** Breakfast-Lunch At Lunch Lunch-Dinner At Dinner After Dinner Any Time They Can **No Time in Particular**	At Breakfast Breakfast-Lunch At Lunch Lunch-Dinner At Dinner After Dinner Any Time They Can **No Time in Particular**	At Breakfast **Breakfast-Lunch** At Lunch **Lunch-Dinner** At Dinner After Dinner Any Time They Can No Time in Particular	**At Breakfast** Breakfast-Lunch **At Lunch** Lunch-Dinner **At Dinner** After Dinner Any Time They Can No Time in Particular	At Breakfast Breakfast-Lunch At Lunch Lunch-Dinner At Dinner After Dinner Any Time They Can No Time in Particular	At Breakfast Breakfast-Lunch At Lunch Lunch-Dinner At Dinner After Dinner Any Time They Can No Time in Particular

Lamp Information	Bedroom	Restroom	Common Room	Dining Room	Other _____	Other _____
Do Resident's Like Rooms with Windows More than Rooms Without Windows?	Yes / No	N/A Yes / No	Yes / No	Yes / No	Yes / No	Yes / No
Please Put a ★ in Room Where the Resident's Have Their Best Behavior				★		
Have You Ever Tried Different Lights in this Room?	Yes / No	Yes / No	Yes / No	Yes / No	Yes / No	Yes / No
What Other Types of Light Have You Tried?	Incandescent Incandescent Flood CFL Fluorescent Strip NA Other _____	Incandescent Incandescent Flood CFL Fluorescent Strip NA Other _____	Incandescent Incandescent Flood CFL Fluorescent Strip NA Other _____	Incandescent Incandescent Flood, CFL Fluorescent Strip NA Other _____	Incandescent Incandescent Flood CFL Fluorescent Strip Other _____	Incandescent Incandescent Flood CFL Fluorescent Strip Other _____
Did the Resident's Behavior Change With the New Lights?	Yes / No NA	Yes / No NA	Yes / No NA	Yes / No NA	Yes / No	Yes / No
How Did Their Behavior Change? They are more _____ than before. [Circle all that apply]	Agitated Happy Sad Mad Calm Angry Restless Aggressive NA Sleepy Anxious Talkative No Change Other _____	Agitated Happy Sad Mad Calm Angry Restless Aggressive N/A Sleepy Anxious Talkative No Change Other _____	Agitated Happy Sad Mad Calm Angry Restless Aggressive NA Sleepy Anxious Talkative No Change Other _____	Agitated Happy Sad Mad Calm Angry Restless Aggressive NA Sleepy Anxious Talkative No Change Other _____	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative No Change Other _____	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative No Change Other _____
Place a ☺ in the Room the Resident's Like the Most	☺			☺		
Place a ☹ in the Room the Resident's Dislike the Most		☹				
Is There Anything You Think Could Be Done to Improve Resdient's Comfort?	Yes / No	Yes / No	Yes / No	Yes / No	Yes / No	Yes / No
What Are Your Suggestions?	NONE	—	→	→		

*Please attach photos of the lights if possible without any resident's in the picture

Please e-mail back the response at: Lgeiger@ksu.edu. If you prefer to fax, please fax it to the Department of Architectural Engineering at K-State with Laura Geiger on the top to: 785-532-3556. If you have any questions, feel free to e-mail me or call me: 913-221-2609. Thank you for your help.

D

Name of Facility: [redacted]

Can I use the name of your Facitily in my report? Yes No

Number of Alzheimer's patients living there: varies @ any given time

Total number of residents living there: varies. 12 room facility.

Are Alzheimer's residents and regular residnet's mixed together? (Yes) No

If they are sepearate, is there anything unique about the Alzheimer's section? N/A Yes No

If yes, please explain. (more windows, more lights, more lighting controls, more time by the windows, etc)

Please fill out the boxes below as a general consensus of all the residents OR pick a specific resident(s) and fill out the boxes for them in each room.

Room Information	Bedroom/Main Light	Kitchen	Common Room	Dining Room	Other	Other
Type of Light	Incandescent Incandescent Flood CFL (circled) Fluorescent Strip Other ________	Incandescent (circled) Incandescent Flood CFL Fluorescent Strip Other ________	Incandescent Incandescent Flood CFL (circled) Fluorescent strip Other ________	Incandescent Incandescent Flood CFL (circled) Fluorescent strip Other ________	Incandescent Incandescent Flood CFL Fluorescent strip Other ________	Incandescent Incandescent Flood CFL Fluorescent strip Other ________
Kinds of Light (Please list other kinds of accent lights if applicable)						
Number of Bulbs Per Lamp	1 2 (3) 4 5 6	1 2 3 4 5 (6)	not sure 1 2 3 4 5 6	1 2 3 4 (5) 6	1 2 3 4 5 6	1 2 3 4 5 6
Watts Per Bulb	15 30 32 42 60 75 100 Other ________ Ø sure	15 30 32 42 60 75 100 Other ________ Ø sure	15 30 32 42 60 75 100 Other ________ Ø sure	15 30 32 42 60 75 100 Other ________	15 30 32 42 60 75 100 Other ________	15 30 32 42 60 75 100 Other ________
Bulb Manufacturer	Sylvania " " Philips GE Other ________	Sylvania " " Philips GE Other ________	Sylvania " " Philips GE Other ________	Sylvania " Philips GE Other ________	Sylvania Philips GE Other ________	Sylvania Philips GE Other ________
Model Number and/or Description	Ex: GE Reveal A 19: 81871-100A/CL/RVL	Ex: Lights of America 8W CFL: F8T5CW	Ex: GE Cool White T 12: 10116	Ex: Philips Advantage T8: F17T8 ADV830 ALTO	Ex:Osram Sylvania Dulux: 29590	Ex: Osram Slyvania Dulux: 20538
Compare the Brightness of the Rooms to Each	Brighter than the Rest Average Dimmer than the Rest	Brighter than the Rest Average Dimmer than the Rest	Brighter than the Rest Average Dimmer than the Rest	Brighter than the Rest Average Dimmer than the Rest	Brighter than the Rest Average Dimmer than the Rest	Brighter than the Rest Average Dimmer than the Rest
Brightness More Specifically	This room is brighter than ________ room, but duller than ________ room	This room is brighter than ________ room, but duller than ________ room	This room is brighter than ________ room, but duller than ________ room	This room is brighter than ________ room, but duller than ________ room	This room is brighter than ________ room, but duller than ________ room	This room is brighter than ________ room, but duller than ________ room

Lamp Information	Bedroom	Restroom	General Room	Dining Room	Other	Other
Typical Behavior-Compared to other rooms (on an individual basis) residents are generally more.... [Circle all that apply]	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative No different from other spaces Other ____	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative No different from other spaces Other ____	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative No different from other spaces Other ____	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative No different from other spaces Other ____	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative No different from other spaces Other ____	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative No different from other spaces Other ____
Age of Lights	Original Retrofit	Original Retrofit	Original Retrofit	Original Retrofit	Original Retrofit	Original Retrofit
Year of Original or Retrofit						
Why Did You Change the Lights?	Better for residents Can't buy old bulbs New bulbs are cheaper N/A	Better for residents Can't buy old bulbs New bulbs are cheaper N/A	Better for residents Can't buy old bulbs New bulbs are cheaper N/A	Better for residents Can't buy old bulbs New bulbs are cheaper N/A	Better for residents Can't buy old bulbs New bulbs are cheaper N/A	Better for residents Can't buy old bulbs New bulbs are cheaper N/A
Do You Think Your Light Affect Your Resident's?	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
What Behavior Would You Like to See Improved the Most	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative Other ____	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative Other ____	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative Other ____	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative Other ____	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative Other ____	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative Other ____
Approximate Size of Space	LengthxWidthxHeight	LengthxWidthxHeight	LengthxWidthxHeight	LengthxWidthxHeight	LengthxWidthxHeight	LengthxWidthxHeight
Windows in the Room	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
Number of Windows	1 2 3 4 N/A	1 2 3 4 N/A	1 2 3 4 N/A	1 2 3 4 N/A	1 2 3 4 N/A	1 2 3 4 N/A
Approximate Size of Windows	WidthxHeight	WidthxHeight	WidthxHeight	WidthxHeight	WidthxHeight	WidthxHeight
Do Resident's Like Sitting Next to the Windows?	Yes No No Windows	Yes No No Windows	Yes No No Windows	Yes No No Windows	Yes No No Windows	Yes No No Windows
Do They Have Better Behavior While Sitting Next to the Windows?	Yes No No Different From Other Spaces No Windows	Yes No No Different From Other Spaces No Windows	Yes No No Different From Other Spaces No Windows	Yes No No Different From Other Spaces No Windows	Yes No No Different From Other Spaces No Windows	Yes No No Different From Other Spaces No Windows
What Time of Day do Resident's Sit by the Windows? [Circle all that apply]	At Breakfast Breakfast-Lunch At Lunch Lunch-Dinner At Dinner After Dinner Any Time They Can No Time in Particular	At Breakfast Breakfast-Lunch At Lunch Lunch-Dinner At Dinner After Dinner Any Time They Can No Time in Particular	At Breakfast Breakfast-Lunch At Lunch Lunch-Dinner At Dinner After Dinner Any Time They Can No Time in Particular	At Breakfast Breakfast-Lunch At Lunch Lunch-Dinner At Dinner After Dinner Any Time They Can No Time in Particular	At Breakfast Breakfast-Lunch At Lunch Lunch-Dinner At Dinner After Dinner Any Time They Can No Time in Particular	At Breakfast Breakfast-Lunch At Lunch Lunch-Dinner At Dinner After Dinner Any Time They Can No Time in Particular

Lamp Information	Bedroom	Restroom	Common Room	Dining Room	Other ______	Other ______
Do Resident's Like Rooms with Windows More than Rooms Without Windows?	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
Please Put a ★ in Room Where the Resident's Have Their Best Behavior						
Have You Ever Tried Different Lights in this Room?	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
What Other Types of Light Have You Tried?	Incandescent Incandescent Flood CFL Fluorescent Strip Other ______	Incandescent Incandescent Flood CFL Fluorescent Strip Other ______	Incandescent Incandescent Flood CFL Fluorescent Strip Other ______	Incandescent Incandescent Flood CFL Fluorescent Strip Other ______	Incandescent Incandescent Flood CFL Fluorescent Strip Other ______	Incandescent Incandescent Flood CFL Fluorescent Strip Other ______
Did the Resident's Behavior Change With the New Lights?	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
How Did Their Behavior Change? They are more ______ than before. [Circle all that apply]	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative No Change Other ______	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative No Change Other ______	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative No Change Other ______	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative No Change Other ______	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative No Change Other ______	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative No Change Other ______
Place a ☺ in the Room the Resident's Like the Most						
Place a ☹ in the Room the Resident's Dislike the Most						
Is There Anything You Think Could Be Done to Improve Resdient's Comfort?	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
What Are Your Suggestions?						

*Please attach photos of the lights if possible without any resident's in the picture

Please e-mail back the response at: Lgeiger@ksu.edu. If you prefer to fax, please fax it to the Department of Architectural Engineering at K-State with Laura Geiger on the top to: 785-532-3556. If you have any questions, feel free to e-mail me or call me: 913-221-2609. Thank you for your help.

E

Name of Facility:

Can I use the name of your Facitily in my report? Yes (No)

Number of Alzheimer's patients living there: 100

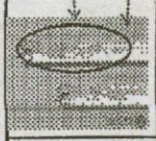
Total number of residents living there: 100

Are Alzheimer's residents and regular resident's mixed together? Yes No N/A

If they are sepearate, is there anything unique about the Alzheimer's section? Yes No

If yes, please explain. (more windows, more lights, more lighting controls, more time by the windows, etc)

Please fill out the boxes below as a general consensus of all the residents OR pick a specific resident(s) and fill out the boxes for them in each room.

Lamp Information	Bedroom Main Light	Restroom	Common Room	Dining Room	Other	Other
Type of Light	Incandescent Incandescent Flood CFL (X) Fluorescent Strip Other 32	Incandescent Incandescent Flood CFL Fluorescent Strip Other 32W FL	Incandescent Incandescent Flood CFL Fluorescent strip Other 26W FL	Incandescent Incandescent Flood CFL Fluorescent strip Other 26w	Incandescent Incandescent Flood CFL Fluorescent strip Other	Incandescent Incandescent Flood CFL Fluorescent strip Other
Kinds of Light (Please list other kinds of accent lights if applicable)						
Number of Bulbs Per Lamp	1 2 (3) 4 5 6	1 (2) 3 4 5 6	1 (2) 3 4 5 6	1 (2) 3 4 5 6	1 2 3 4 5 6	1 2 3 4 5 6
Watts Per Bulb	15 30 32 42 60 75 100 Other	15 30 32 42 60 75 100 Other	15 30 32 42 60 75 100 Other	15 30 32 42 60 75 100 Other	15 30 32 42 60 75 100 Other	15 30 32 42 60 75 100 Other
Bulb Manufacturer	Sylvania Philips GE Other Minka	Sylvania Philips GE Other Minka	Sylvania Philips GE Other Minka	Sylvania Philips GE Other Minka	Sylvania Philips GE Other	Sylvania Philips GE Other
Model Number and/or Description 	N/A	N/A	N/A	N/A		
	Ex: GE Reveal A 19: 81871-100A/CL/RVL	Ex: Lights of America 8W CFL: F8T5CW	Ex: GE Cool White T 12: 10116	Ex: Philips Advantage T8: F17T8 ADV830 ALTO	Ex:Osram Sylvania Dulux: 29590	Ex: Osram Slyvania Dulux: 20538
Compare the Brightness of the Rooms to Each	Brighter than the Rest (Average) Dimmer than the Rest	Brighter than the Rest (Average) Dimmer than the Rest	Brighter than the Rest (Average) Dimmer than the Rest	Brighter than the Rest (Average) Dimmer than the Rest	Brighter than the Rest Average Dimmer than the Rest	Brighter than the Rest Average Dimmer than the Rest
Brightness More Specifically	This room is brighter than BR room, but duller than Common room	This room is brighter than N/A room, but duller than All room	This room is brighter than BR room, but duller than N/A room	This room is brighter than BR room, but duller than Common room	This room is brighter than _____ room, but duller than _____ room	This room is brighter than _____ room, but duller than _____ room
	Curve 32.2fc	71.6fc	64.7fc	Area 49.1fc	52.9 (HALL)	

TIME OF DAY: 10:30AM

WEATHER: SUNNY

Lamp Information	Bedroom	Restroom	Common Room	Dining Room	Other ____	Other ____
Typical Behavior- Compared to other rooms (on an individual basis) residents are *generally more....* [Circle all that apply]	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative No different from other spaces Other ____	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative No different from other spaces Other ____	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative No different from other spaces Other ____	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative No different from other spaces Other ____	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative No different from other spaces Other ____	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative No different from other spaces Other ____
Age of Lights	Original Retrofit	Original Retrofit	Original Retrofit	Original Retrofit	Original Retrofit	Original Retrofit
Year of Original or Retrofit	8.2011	?.2011	?.2011	?2011		
Why Did You Change the Lights?	Better for residents Can't buy old bulbs New bulbs are cheaper N/A	Better for residents Can't buy old bulbs New bulbs are cheaper N/A	Better for residents Can't buy old bulbs New bulbs are cheaper N/A	Better for residents Can't buy old bulbs New bulbs are cheaper N/A	Better for residents Can't buy old bulbs New bulbs are cheaper N/A	Better for residents Can't buy old bulbs New bulbs are cheaper N/A
Do You Think Your Light Affect Your Resident's?	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
What Behavior Would You Like to See Improved the Most	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative Other ____	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative Other ____	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative Other ____	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative Other ____	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative Other ____	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative Other ____
Approximate Size of Space	LengthxWidthxHeight	LengthxWidthxHeight	LengthxWidthxHeight	LengthxWidthxHeight	LengthxWidthxHeight	LengthxWidthxHeight
Windows in the Room	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
Number of Windows	1 2 3 4 N/A	1 2 3 4 N/A	1 2 3 4 N/A	1 2 3 4 + N/A	1 2 3 4 N/A	1 2 3 4 N/A
Approximate Size of Windows	WidthxHeight	WidthxHeight	WidthxHeight	WidthxHeight	WidthxHeight	WidthxHeight
Do Resident's Like Sitting Next to the Windows?	Yes No No Windows	Yes No No Windows	Yes No No Windows	Yes No No Windows	Yes No No Windows	Yes No No Windows
Do They Have Better Behavior While Sitting Next to the Windows?	Yes No No Different From Other Spaces No Windows	Yes No N/A No Different From Other Spaces No Windows	Yes No No Different From Other Spaces No Windows	Yes No No Different From Other Spaces No Windows	Yes No No Different From Other Spaces No Windows	Yes No No Different From Other Spaces No Windows
What Time of Day do Resident's Sit by the Windows? [Circle all that apply]	At Breakfast Breakfast-Lunch At Lunch Lunch-Dinner At Dinner After Dinner Any Time They Can No Time in Particular	At Breakfast Breakfast-Lunch At Lunch Lunch-Dinner At Dinner After Dinner Any Time They Can No Time in Particular	At Breakfast Breakfast-Lunch At Lunch Lunch-Dinner At Dinner After Dinner Any Time They Can No Time in Particular	At Breakfast Breakfast-Lunch At Lunch Lunch-Dinner At Dinner After Dinner Any Time They Can No Time in Particular	At Breakfast Breakfast-Lunch At Lunch Lunch-Dinner At Dinner After Dinner Any Time They Can No Time in Particular	At Breakfast Breakfast-Lunch At Lunch Lunch-Dinner At Dinner After Dinner Any Time They Can No Time in Particular

? Did you take measurements

Lamp Information	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Do Resident's Like Rooms with Windows More than Rooms Without Windows?	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
Please Put a ★ in Room Where the Resident's Have Their Best Behavior						
Have You Ever Tried Different Lights in this Room?	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
What Other Types of Light Have You Tried?	Incandescent Incandescent Flood CFL Fluorescent Strip Other ______	Incandescent Incandescent Flood CFL Fluorescent Strip Other ______	Incandescent Incandescent Flood CFL Fluorescent Strip Other ______	Incandescent Incandescent Flood CFL Fluorescent Strip Other ______	Incandescent Incandescent Flood CFL Fluorescent Strip Other ______	Incandescent Incandescent Flood CFL Fluorescent Strip Other ______
Did the Resident's Behavior Change With the New Lights?	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
How Did Their Behavior Change? They are more ______ than before. [Circle all that apply]	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative No Change Other ______	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative No Change Other ______	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative No Change Other ______	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative No Change Other ______	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative No Change Other ______	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative No Change Other ______
Place a ☺ in the Room the Resident's Like the Most						
Place a ☹ in the Room the Resident's Dislike the Most						
Is There Anything You Think Could Be Done to Improve Resdient's Comfort?	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
What Are Your Suggestions?						

*Please attach photos of the lights if possible without any resident's in the picture

Please e-mail back the response at: Lgeiger@ksu.edu. If you prefer to fax, please fax it to the Department of Architectural Engineering at K-State with Laura Geiger on the top to: 785-532-3556. If you have any questions, feel free to e-mail me or call me: 913-221-2609. Thank you for your help.

F

Name of Facility:

Can I use the name of your Facility in my report? (Yes) No

Number of Alzheimer's patients living there: 18

Total number of residents living there: 48

Are Alzheimer's residents and regular resident's mixed together? NO Yes No

If they are sepearate, is there anything unique about the Alzheimer's section? Yes No

If yes, please explain. (more windows, more lights, more lighting controls, more time by the windows, etc)

Please fill out the boxes below as a general consensus of all the residents OR pick a specific resident(s) and fill out the boxes for them in each room.

Type of Light	Incandescent Incandescent Flood CFL (Fluorescent Strip) Other _____	Incandescent Incandescent Flood CFL Fluorescent Strip Other _____	Incandescent Incandescent Flood CFL Fluorescent strip Other _____	Incandescent Incandescent Flood CFL Fluorescent strip Other _____	Incandescent Incandescent Flood CFL Fluorescent strip Other _____	Incandescent Incandescent Flood CFL Fluorescent strip Other _____
Kinds of Light (Please list other kinds of accent lights if applicable)						
Number of Bulbs Per Lamp	1 2 3 4 5 6	1 2 3 4 5 6	1 2 3 4 5 6	1 2 3 4 5 6	1 2 3 4 5 6	1 2 3 4 5 6
Watts Per Bulb	(15) 30 32 42 60 75 100 Other_____	(15) 30 32 42 60 75 100 Other_____	(15) 30 32 42 60 75 100 Other_____	(15) 30 32 42 60 75 100 Other_____	15 30 32 42 60 75 100 Other_____	15 30 32 42 60 75 100 Other_____
Bulb Manufacturer	Sylvania Philips GE Other TCP	Sylvania Philips GE Other TCP	Sylvania Philips GE Other Ecolab	Sylvania Philips GE Other Ecolab	Sylvania Philips GE Other	Sylvania Philips GE Other
Model Number and/or Description	EOXO-14 Ex: GE Reveal A 19: 81871-100A/CL/RVL	EOXO-14 Ex; Lights of America 8W CFL: F8T5CW	ESL15BR30/ECO16 Ex: GE Cool White T 12: 10116	ESL15BR30/ECO16 Ex: Philips Advantage T8: F17T8 ADV830 ALTO	Ex:Osram Sylvania Dulux: 29590	Ex; Osram Slyvania Dulux: 20538
Compare the Brightness of the Rooms to Each	Brighter than the Rest Average Dimmer than the Rest	Brighter than the Rest Average Dimmer than the Rest	Brighter than the Rest Average Dimmer than the Rest	Brighter than the Rest Average Dimmer than the Rest	Brighter than the Rest Average Dimmer than the Rest	Brighter than the Rest Average Dimmer than the Rest
Brightness More Specifically	This room is brighter than _____ room, but duller than _____ room	This room is brighter than _____ room, but duller than _____ room	This room is brighter than _____ room, but duller than _____ room	This room is brighter than _____ room, but duller than _____ room	This room is brighter than _____ room, but duller than _____ room	This room is brighter than _____ room, but duller than _____ room

TIME OF DAY: 10:30AM
WEATHER: SUNNY

35.8fc | 10.6fc | 182.6fc (SKYLIGHT) | 200fc (SKYLIGHT) | 3.5fc (HALL)

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Typical Behavior-Compared to other rooms (on an individual basis) residents are generally more.... [Circle all that apply]	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative No different from other spaces Other ___	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative No different from other spaces Other ___	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative No different from other spaces Other ___	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative No different from other spaces Other ___	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative No different from other spaces Other ___	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative No different from other spaces Other ___
Age of Lights	Original Retrofit	Original Retrofit	Original Retrofit	Original Retrofit	Original Retrofit	Original Retrofit
Year of Original or Retrofit	2009	2009	2009	2009	2009	2009
Why Did You Change the Lights?	Better for residents Can't buy old bulbs New bulbs are cheaper N/A	Better for residents Can't buy old bulbs New bulbs are cheaper N/A	Better for residents Can't buy old bulbs New bulbs are cheaper N/A	Better for residents Can't buy old bulbs New bulbs are cheaper N/A	Better for residents Can't buy old bulbs New bulbs are cheaper N/A	Better for residents Can't buy old bulbs New bulbs are cheaper N/A
Do You Think Your Light Affect Your Resident's?	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
What Behavior Would You Like to See Improved the Most	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative Other ___	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative Other ___	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative Other ___	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative Other ___	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative Other ___	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative Other ___
Approximate Size of Space	LengthxWidthxHeight	LengthxWidthxHeight	LengthxWidthxHeight	LengthxWidthxHeight	LengthxWidthxHeight	LengthxWidthxHeight
Windows in the Room	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
Number of Windows	1 2 3 4 N/A	1 2 3 4 N/A	1 2 3 4 N/A	1 2 3 4 N/A	1 2 3 4 N/A	1 2 3 4 N/A
Approximate Size of Windows	WidthxHeight	WidthxHeight	WidthxHeight	WidthxHeight	WidthxHeight	WidthxHeight
Do Resident's Like Sitting Next to the Windows?	Yes No No Windows Sometimes	Yes No No Windows	Yes No No Windows	Yes No No Windows	Yes No No Windows	Yes No No Windows
Do They Have Better Behavior While Sitting Next to the Windows?	Yes No No Different From Other Spaces No Windows	Yes No No Different From Other Spaces No Windows	Yes No No Different From Other Spaces No Windows	Yes No No Different From Other Spaces No Windows	Yes No No Different From Other Spaces No Windows	Yes No No Different From Other Spaces No Windows
What Time of Day do Resident's Sit by the Windows? [Circle all that apply]	At Breakfast Breakfast-Lunch At Lunch Lunch-Dinner At Dinner After Dinner Any Time They Can No Time in Particular	At Breakfast Breakfast-Lunch At Lunch Lunch-Dinner At Dinner After Dinner Any Time They Can No Time in Particular	At Breakfast Breakfast-Lunch At Lunch Lunch-Dinner At Dinner After Dinner Any Time They Can No Time in Particular	At Breakfast Breakfast-Lunch At Lunch Lunch-Dinner At Dinner After Dinner Any Time They Can No Time in Particular	At Breakfast Breakfast-Lunch At Lunch Lunch-Dinner At Dinner After Dinner Any Time They Can No Time in Particular	At Breakfast Breakfast-Lunch At Lunch Lunch-Dinner At Dinner After Dinner Any Time They Can No Time in Particular

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Do Resident's Like Rooms with Windows More than Rooms Without Windows?	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
Please Put a ★ in Room Where the Resident's Have Their Best Behavior					☆	
Have You Ever Tried Different Lights in this Room?	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
What Other Types of Light Have You Tried?	Incandescent Incandescent Flood CFL Fluorescent Strip Other ___	Incandescent Incandescent Flood CFL Fluorescent Strip Other ___	Incandescent Incandescent Flood CFL Fluorescent Strip Other ___	Incandescent Incandescent Flood CFL Fluorescent Strip Other ___	Incandescent Incandescent Flood CFL Fluorescent Strip Other ___	Incandescent Incandescent Flood CFL Fluorescent Strip Other ___
Did the Resident's Behavior Change With the New Lights?	Yes N/A No	Yes No	Yes No	Yes No	Yes No	Yes No
How Did Their Behavior Change? They are more ___ than before. (Circle all that apply)	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative No Change Other ___	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative No Change Other ___	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative No Change Other ___	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative No Change Other ___	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative No Change Other ___	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative No Change Other ___
Place a ☺ in the Room the Resident's Like the Most					☺	
Place a ☹ in the Room the Resident's Dislike the Most		☹				
Is There Anything You Think Could Be Done to Improve Resdient's Comfort?	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
What Are Your Suggestions?						

*Please attach photos of the lights if possible without any resident's in the picture

Please e-mail back the response at: Lgeiger@ksu.edu. If you prefer to fax, please fax it to the Department of Architectural Engineering at K-State with Laura Geiger on the top to: 785-532-3556. If you have any questions, feel free to e-mail me or call me: 913-221-2609. Thank you for your help.

We work w/ alzheimer's + dementia lighting is important however ⊖ behaviors they'll have

G

Name of Facility:

Can I use the name of your Facility in my report? (Yes) No

Number of Alzheimer's patients living there: 5

Total number of residents living there: 5

Are Alzheimer's residents and regular resident's mixed together? (Yes) No

If they are sepearate, is there anything unique about the Alzheimer's section? Yes No NA

If yes, please explain. (more windows, more lights, more lighting controls, more time by the windows, etc)

Please fill out the boxes below as a general consensus of all the residents OR pick a specific resident(s) and fill out the boxes for them in each room.

Lamp Information	Bedroom Main Light	Restroom	Common Room	Dining Room	Other Entry	Other
Type of Light	Incandescent Incandescent Flood CFL Fluorescent Strip Other	Incandescent Incandescent Flood CFL Fluorescent Strip Other	Incandescent Incandescent Flood CFL Fluorescent strip Other	Incandescent Incandescent Flood CFL Fluorescent strip Other	Incandescent Incandescent Flood CFL Fluorescent strip Other	Incandescent Incandescent Flood CFL Fluorescent strip Other
Kinds of Light (Please list other kinds of accent lights if applicable)	floor lamp		lamps	lamps		
Number of Bulbs Per Lamp	1 2 (3) 4 5 6	1 (2) 3 4 5 6	1 2 (3) 4 5 6	1 2 (3) 4 5 6	1 (2) 3 4 5 6	1 2 3 4 5 6
Watts Per Bulb	15 30 32 42 60 (75) 100 Other	15 30 32 42 60 (75) 100 Other	15 30 32 42 60 (75) 100 Other	15 30 32 42 60 (75) 100 Other	15 30 32 42 60 (75) 100 Other	15 30 32 42 60 75 100 Other
Bulb Manufacturer	(Sylvania) Philips GE Other	(Sylvania) Philips GE Other	(Sylvania) Philips GE Other	(Sylvania) Philips GE Other	(Sylvania) Philips GE Other	Sylvania Philips GE Other
Model Number and/or Description	I will email	"	"	"	"	B
	Ex: GE Reveal A 19; 81871-100A/CL/RVL	Ex: Lights of America 8W CFL: F8T5CW	Ex: GE Cool White T 12; 10116	Ex: Philips Advantage T8: F17T8 ADV830 ALTO	Ex:Osram Sylvania Dulux: 29590	Ex: Osram Slyvania Dulux: 20538
Compare the Brightness of the Rooms to Each	Brighter than the Rest Average (Dimmer than the Rest	(Brighter than the Rest Average Dimmer than the Rest	Brighter than the Rest (Average) Dimmer than the Rest	(Brighter than the Rest Average Dimmer than the Rest	Brighter than the Rest Average (Dimmer than the Rest	Brighter than the Rest Average Dimmer than the Rest
Brightness More Specifically	This room is brighter than Entry room, but duller than Dining room	This room is brighter than Entry room, but duller than Common room	This room is brighter than Bedroom room, but duller than Dining room	This room is brighter than all rooms room, but duller than none room	This room is brighter than Bathroom room, but duller than every room	This room is brighter than _____ room, but duller than _____ room

TIME OF DAY: 10:00AM

WEATHER: CLOUDY

15.3fc 10.3fc 12.9fc 10fc 8fc (HALL)

Lamp Information	Bedroom	Restroom	Common Room	Dining Room	Other: Entry	Other
Typical Behavior- Compared to other rooms (on an individual basis) residents are generally more... (Circle all that apply)	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative No different from other spaces Other	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative No different from other spaces Other	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative No different from other spaces Other	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative No different from other spaces Other	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative No different from other spaces Other	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative No different from other spaces Other
Age of Lights	Original Retrofit	Original Retrofit	Original Retrofit	Original Retrofit	Original Retrofit	Original Retrofit
Year of Original or Retrofit						
Why Did You Change the Lights?	Better for residents Can't buy old bulbs New bulbs are cheaper N/A	Better for residents Can't buy old bulbs New bulbs are cheaper N/A	Better for residents Can't buy old bulbs New bulbs are cheaper N/A	Better for residents Can't buy old bulbs New bulbs are cheaper N/A	Better for residents Can't buy old bulbs New bulbs are cheaper N/A	Better for residents Can't buy old bulbs New bulbs are cheaper N/A
Do You Think Your Light Affect Your Resident's?	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
What Behavior Would You Like to See Improved the Most	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative Other	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative Other	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative Other	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative Other	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative Other	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative Other
Approximate Size of Space	14x10x8 LengthxWidthxHeight	6x8x8 LengthxWidthxHeight	20x20x8 LengthxWidthxHeight	25x20x8 LengthxWidthxHeight	6x14x8 LengthxWidthxHeight	LengthxWidthxHeight
Windows in the Room	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
Number of Windows	1 2 3 4 N/A	1 2 3 4 N/A	1 2 3 4 N/A	1 2 3 4+ N/A 10	1 2 3 4 N/A	1 2 3 4 N/A
Approximate Size of Windows	4x6 WidthxHeight	NA WidthxHeight	4x6 WidthxHeight	3x8 WidthxHeight	3x4 WidthxHeight	WidthxHeight
Do Resident's Like Sitting Next to the Windows?	Yes No No Windows	Yes No No Windows	Yes No No Windows	Yes No No Windows	Yes No No Windows	Yes No No Windows
Do They Have Better Behavior While Sitting Next to the Windows?	Yes No No Different From Other Spaces No Windows	Yes No No Different From Other Spaces No Windows	Yes No No Different From Other Spaces No Windows	Yes No No Different From Other Spaces No Windows	Yes No No Different From Other Spaces No Windows	Yes No No Different From Other Spaces No Windows
What Time of Day do Resident's Sit by the Windows? (Circle all that apply)	At Breakfast Breakfast-Lunch At Lunch Lunch-Dinner At Dinner After Dinner Any Time They Can No Time in Particular	At Breakfast Breakfast-Lunch At Lunch Lunch-Dinner At Dinner After Dinner Any Time They Can No Time in Particular NA	At Breakfast Breakfast-Lunch At Lunch Lunch-Dinner At Dinner After Dinner Any Time They Can No Time in Particular	At Breakfast Breakfast-Lunch At Lunch Lunch-Dinner At Dinner After Dinner Any Time They Can No Time in Particular	At Breakfast Breakfast-Lunch At Lunch Lunch-Dinner At Dinner After Dinner Any Time They Can No Time in Particular	At Breakfast Breakfast-Lunch At Lunch Lunch-Dinner At Dinner After Dinner Any Time They Can No Time in Particular

Lamp Information	Bedroom	Restroom	Common Room	Dining Room	Other [illegible]	Other
Do Resident's Like Rooms with Windows More than Rooms Without Windows?	(Yes) No	(Yes) No	★ (Yes) No	★ (Yes) No	(Yes) No	Yes No
Please Put a ★ in Room Where the Resident's Have Their Best Behavior						
Have You Ever Tried Different Lights in this Room?	(Yes) No	(Yes) No	Yes (No)	Yes (No)	Yes (No)	Yes No
What Other Types of Light Have You Tried?	Incandescent Incandescent Flood CFL Fluorescent Strip Other Brighter	Incandescent Incandescent Flood CFL Fluorescent Strip Other Brighter	Incandescent Incandescent Flood CFL Fluorescent Strip Other ____	Incandescent Incandescent Flood CFL Fluorescent Strip Other ____	Incandescent Incandescent Flood CFL Fluorescent Strip Other ____	Incandescent Incandescent Flood CFL Fluorescent Strip Other ____
Did the Resident's Behavior Change With the New Lights?	(Yes) No	(Yes) No	Yes No	Yes No	Yes No	Yes No
How Did Their Behavior Change? They are more ____ than before. [Circle all that apply]	Agitated Happy Sad Mad (Calm) Angry Restless Aggressive Sleepy Anxious Talkative No Change Other ____	Agitated Happy Sad Mad (Calm) Angry Restless Aggressive Sleepy Anxious Talkative No Change Other ____	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative No Change Other ____	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative No Change Other ____	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative No Change Other ____	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative No Change Other ____
Place a ☺ in the Room the Resident's Like the Most			☺	☺		
Place a ☹ in the Room the Resident's Dislike the Most		☹				
Is There Anything You Think Could Be Done to Improve Resident's Comfort?	Yes (No)	(Yes) No	Yes (No)	Yes (No)	Yes (No)	Yes No
What Are Your Suggestions?		Put a window or better light				

*Please attach photos of the lights if possible without any resident's in the picture

Please e-mail back the response at: Lgeiger@ksu.edu. If you prefer to fax, please fax it to the Department of Architectural Engineering at K-State with Laura Geiger on the top to: 785-532-3556. If you have any questions, feel free to e-mail me or call me: 913-221-2609. Thank you for your help.

We need more natural light that is cost effective.

H

Name of Facility: [redacted]

Can I use the name of your Facility in my report? (Yes) No

Number of Alzheimer's patients living there: 11

Total number of residents living there: 37

Are Alzheimer's residents and regular resident's mixed together? Yes (No)

If they are seperate, is there anything unique about the Alzheimer's section? (Yes) No

If yes, please explain. (more windows, more lights, more lighting controls, more time by the windows, etc) more specialized recreational programming

Room 129

Please fill out the boxes below as a general consensus of all the residents OR pick a specific resident(s) and fill out the boxes for them in each room.

Lamp Information	Bedroom/Main Light	Bathroom	Common Room	Dining Room	Other Hallway	Other
Type of Light	Incandescent; Incandescent Flood; CFL (1); Fluorescent Strip (1); Other	Incandescent; Incandescent Flood; CFL; Fluorescent Strip; Other	Incandescent; Incandescent Flood; CFL; Fluorescent Strip; Other floor lamps; 2 60W tall floor bulbs pedestal	Incandescent; Incandescent Flood; CFL; Fluorescent strip; Other; accent lamps	Incandescent; Incandescent Flood; CFL; Fluorescent strip; Other	Incandescent; Incandescent Flood; CFL; Fluorescent strip; Other
Kinds of Light (Please list other kinds of accent lights if applicable)		2 accent lamps 60W	6 CFL lamps; 2 Fluorescent strips like in hallway	12 total CFL lamps in DR	11 flourescent strips 2 bulbs each	
Number of Bulbs Per Lamp	1 2 3 4 5 6	(1) 2 3 4 5 6	1 2 3 4 5 6	1 2 3 4 5 6	1 (2) 3 4 5 6	1 2 3 4 5 6
Watts Per Bulb	15 30 32 42 (50) 75 100 Other	15 30 32 42 (60) 75 100 Other	15 30 32 42 (60) 75 100 Other	15 30 32 42 (60) 75 100 Other	15 30 32 42 60 75 100 Other 34	15 30 32 42 60 75 100 Other
Bulb Manufacturer	Sylvania; (Philips); GE; (Other) TCP	Sylvania; (Philips); GE; (Other) TCP	Sylvania; Philips; GE; Other TCP	Sylvania; (Philips); GE; Other TCP	Sylvania; (Philips); GE; Other	Sylvania; Philips; GE; Other
Model Number and/ or Description	Ex: GE Reveal A19: 81871-100/A/CL/RVL	Ex: Lights of America 8W CFL: R8T5CW	Ex: GE (Cool White) T 12: 10116	Cool White; Ex: Philips Advantage T8: F17T8 ADV830 ALTO	Ex: Osram Sylvania Dulux: 29590	Ex: Osram Sylvania Dulux: 20538
Compare the Brightness of the Rooms to Each	Brighter than the Rest; (Average); Dimmer than the Rest	Brighter than the Rest; (Average); Dimmer than the Rest	Brighter than the Rest; (Average); Dimmer than the Rest	Brighter than the Rest; (Average); Dimmer than the Rest	(Brighter than the Rest); Average; Dimmer than the Rest	Brighter than the Rest; Average; Dimmer than the Rest
Brightness More Specifically	This room is brighter (natural) than common room room, but duller than hallway room	This room is brighter than bedroom room, but duller than none room	This room is brighter (has no natural) than dining room, but duller than bedroom room	This room is brighter (than) than none room, but duller than all room	This room is brighter than common room, but duller than none room	This room is brighter than _____ room, but duller than _____ room

TIME OF DAY: 4:30PM
WEATHER: SUNNY
NOTES!
E = EAST SIDE
W = WEST SIDE

22.9 fc E
124 fc W

11.4 fc E
12.1 fc W

10.9 fc

11.7 fc

36.6 fc

Lamp Information	Bedroom	Restroom	Common Room	Dining Room	Other (Hallway)	Other
Typical Behavior- Compared to other rooms (on an individual basis) residents are generally more... [Circle all that apply]	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative No different from other spaces Other	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative No different from other spaces Other	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative No different from other spaces Other	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative No different from other spaces Other	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative No different from other spaces Other	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative No different from other spaces Other
Age of Lights	Original Retrofit	Original Retrofit	Original Retrofit	Original Retrofit	Original Retrofit	Original Retrofit
Year of Original or Retrofit	10	10	10	10	10	
Why Did You Change the Lights?	Better for residents Can't buy old bulbs New bulbs are cheaper N/A	Better for residents Can't buy old bulbs New bulbs are cheaper N/A	Better for residents Can't buy old bulbs New bulbs are cheaper N/A	Better for residents Can't buy old bulbs New bulbs are cheaper N/A	Better for residents Can't buy old bulbs New bulbs are cheaper N/A	Better for residents Can't buy old bulbs New bulbs are cheaper N/A
Do You Think Your Light Affect Your Resident's?	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
What Behavior Would You Like to See Improved the Most	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative Other	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative Other	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative Other	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative Other	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative Other	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative Other
Approximate Size of Space	LengthxWidthxHeight	LengthxWidthxHeight	LengthxWidthxHeight	LengthxWidthxHeight	LengthxWidthxHeight	LengthxWidthxHeight
Windows in the Room	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
Number of Windows	1 2 3 4 N/A	1 2 3 4 N/A	1 2 3 4 N/A	1 2 3 4 N/A	1 2 3 4 N/A	1 2 3 4 N/A
Approximate Size of Windows	3' x 5' WidthxHeight	— WidthxHeight	— WidthxHeight	3' x 6' WidthxHeight	— WidthxHeight	WidthxHeight
Do Resident's Like Sitting Next to the Windows?	Yes No not always No Windows	Yes No No Windows	Yes No No Windows	Yes No No Windows	Yes No No Windows	Yes No No Windows
Do They Have Better Behavior While Sitting Next to the Windows?	Yes No No Different From Other Spaces No Windows	Yes No No Different From Other Spaces No Windows	Yes No No Different From Other Spaces No Windows	Yes No No Different From Other Spaces No Windows	Yes No No Different From Other Spaces No Windows	Yes No No Different From Other Spaces No Windows
What Time of Day do Resident's Sit by the Windows? [Circle all that apply]	At Breakfast Breakfast-Lunch At Lunch Lunch-Dinner At Dinner After Dinner Any Time They Can No Time in Particular	At Breakfast Breakfast-Lunch At Lunch Lunch-Dinner At Dinner After Dinner Any Time They Can No Time in Particular	At Breakfast Breakfast-Lunch At Lunch Lunch-Dinner At Dinner After Dinner Any Time They Can No Time in Particular	At Breakfast Breakfast-Lunch At Lunch Lunch-Dinner At Dinner After Dinner Any Time They Can No Time in Particular	At Breakfast Breakfast-Lunch At Lunch Lunch-Dinner At Dinner After Dinner Any Time They Can No Time in Particular	At Breakfast Breakfast-Lunch At Lunch Lunch-Dinner At Dinner After Dinner Any Time They Can No Time in Particular

Lamp Information	Bedroom	Bathroom	Common Room	Dining Room	Other: Hallway	Other
Do Resident's Like Rooms with Windows More than Rooms Without Windows?	Yes (circled) to all - they aren't necessarily aware of this fact. but they wander more where there is no natural light No	Yes No	Yes No	Yes No	Yes No	Yes No
Please Put a ★ in Room Where the Resident's Have Their Best Behavior	★					
Have You Ever Tried Different Lights in this Room?	Yes (circled) No	Yes No (circled)	Yes (circled) No	Yes No (circled)	Yes No (circled)	Yes No
What Other Types of Light Have You Tried?	Incandescent (circled) Incandescent Flood CFL (circled) Fluorescent Strip Other ____	Incandescent Incandescent Flood CFL Fluorescent Strip Other ____	Incandescent Incandescent Flood (circled) CFL (circled) Fluorescent Strip Other ____	Incandescent Incandescent Flood CFL Fluorescent Strip Other ____	Incandescent Incandescent Flood CFL Fluorescent Strip Other ____	Incandescent Incandescent Flood CFL Fluorescent Strip Other ____
Did the Resident's Behavior Change With the New Lights?	Yes (circled) No	Yes N/A No	not sure Yes b/c too many other factors/distractions No	Yes N/A No	Yes N/A No	Yes No
How Did Their Behavior Change? They are more ____ than before. [Circle all that apply]	Agitated Happy Sad Mad Calm (circled) Angry Restless Aggressive Sleepy Anxious Talkative No Change Other ____	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative No Change Other ____	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative No Change Other ____	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative No Change Other ____	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative No Change Other ____	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative No Change Other ____
Place a ☺ in the Room the Resident's Like the Most	☺ b/c it's THEIRS			☺ b/c it's also the activity group space		
Place a ☹ in the Room the Resident's Dislike the Most					☹ b/c they feel they're supposed to be following it somewhere - so it induces anxiety	
Is There Anything You Think Could Be Done to Improve Resident's Comfort?	Yes (circled) if unattended to No	Yes No	Yes (circled) No	Yes No	Yes No	Yes No
What Are Your Suggestions?	individuating & personalizing which is usually done.		better furniture placement & MORE SPACE			

*Please attach photos of the lights if possible without any resident's in the picture

Please e-mail back the response at: Lgeiger@ksu.edu. If you prefer to fax, please fax it to the Department of Architectural Engineering at K-State with Laura Geiger on the top to: 785-532-3556. If you have any questions, feel free to e-mail me or call me: 913-221-2609. Thank you for your help.

I

Name of Facility:

Can I use the name of your Facility in my report? (Yes) No

Number of Alzheimer's patients living there: 36 in memory care

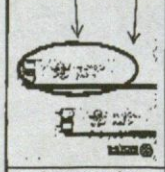
Total number of residents living there: 173 in entire community

Are Alzheimer's residents and regular resident's mixed together? Yes Not usually, occassionally in skilled rehab

If they are sepearate, is there anything unique about the Alzheimer's section? secure, part of community (Yes) No but not in memorycare

If yes, please explain. (more windows, more lights, more lighting controls, more time by the windows, etc)
high ceilings, life skill areas

Please fill out the boxes below as a general consensus of all the residents OR pick a specific resident(s) and fill out the boxes for them in each room.

Type of Light	Incandescent Incandescent Flood CFL Fluorescent Strip Other _____	Incandescent Incandescent Flood CFL Fluorescent Strip Other _____	Incandescent Incandescent Flood CFL Fluorescent strip Other _____	Incandescent Incandescent Flood CFL Fluorescent strip Other _____	Incandescent Incandescent Flood CFL Fluorescent strip Other _____	Incandescent Incandescent Flood CFL Fluorescent strip Other _____
Kinds of Light (Please list other kinds of accent lights if applicable)						
Number of Bulbs Per Lamp	(1) 2 3 4 5 6	(1) 2 3 4 5 6	(1) 2 3 4 5 6	(1) 2 3 4 5 6	(1) 2 3 4 5 6	(1) 2 3 4 5 6
Watts Per Bulb	15 30 32 42 (60) 75 100 Other_____	15 30 32 42 (60) 75 100 Other_____	15 30 32 42 (60) 75 100 Other_____	15 30 32 42 (60) 75 100 Other_____	15 30 32 42 (60) 75 100 Other_____	15 30 32 42 (60) 75 100 Other_____
Bulb Manufacturer	Sylvania Philips GE Other Energy Star	Sylvania Philips GE Other Energy Star	Sylvania Philips GE Other Energy Star	Sylvania Philips GE Other Energy Star	Sylvania Philips GE Other Energy Star	Sylvania Philips GE Other Energy Star
Model Number and/or Description 	Energy Saving Bulb UB144 Ex: GE Reveal A 19: 81871-100A/CL/RVL	Energy Saving Bulb UB144 Ex: Lights of America 8W CFL: F8T5CW	Energy Saving Bulb UB144 Ex: GE Cool White T 12: 10116	Energy Saving Bulb UB144 Ex: Philips Advantage T8: F17T8 ADV830 ALTO	Energy Saving Bulb UB144 Ex:Osram Sylvania Dulux: 29590	Energy Saving Bulb UB144 Ex: Osram Slyvania Dulux: 20538
Compare the Brightness of the Rooms to Each	Brighter than the Rest Average Dimmer than the Rest	Brighter than the Rest (Average) Dimmer than the Rest	Brighter than the Rest (Average) Dimmer than the Rest	(Brighter than the Rest) Average Dimmer than the Rest	Brighter than the Rest (Average) Dimmer than the Rest	Brighter than the Rest (Average) Dimmer than the Rest
Brightness More Specifically	This room is brighter than _____ room, but duller than _____ room	This room is brighter than _____ room, but duller than _____ room	This room is brighter than _____ room, but duller than _____ room	This room is brighter than _____ room, but duller than _____ room	This room is brighter than _____ room, but duller than _____ room	This room is brighter than _____ room, but duller than _____ room
	28.5fc	54.4fc	39.2fc	31.6 fc	9.45 (HALL)	

TIME OF DAY: 11:00AM
WEATHER: SUNNY

Typical Behavior- Compared to other rooms (on an individual basis) residents are generally more.... [Circle all that apply]	Agitated Happy Sad Mad (Calm) Angry Restless Aggressive Sleepy Anxious Talkative No different from other spaces Other	Agitated Happy Sad Mad (Calm) Angry Restless Aggressive Sleepy Anxious Talkative No different from other spaces Other	Agitated Happy Sad Mad (Calm) Angry Restless Aggressive Sleepy Anxious (Talkative) No different from other spaces Other	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious -at times Talkative No different from other spaces Other	Agitated Happy Sad Mad (Calm) Angry Restless Aggressive Sleepy Anxious (Talkative) No different from other spaces Other	Agitated Happy Sad Mad (Calm) Angry Restless Aggressive Sleepy Anxious Talkative No different from other spaces Other
Age of Lights	(Original) Retrofit	(Original) Retrofit	(Original) Retrofit	(Original) Retrofit	(Original) Retrofit	(Original) Retrofit
Year of Original or Retrofit	2009	2009	2009	2009	2009	2009
Why Did You Change the Lights?	Better for residents Can't buy old bulbs New bulbs are cheaper (N/A)	Better for residents Can't buy old bulbs New bulbs are cheaper (N/A)	Better for residents Can't buy old bulbs New bulbs are cheaper (N/A)	Better for residents Can't buy old bulbs New bulbs are cheaper (N/A)	Better for residents Can't buy old bulbs New bulbs are cheaper (N/A)	Better for residents Can't buy old bulbs New bulbs are cheaper (N/A)
Do You Think Your Light Affect Your Resident's?	(Yes) No	Yes (No)	(Yes) No	(Yes) No	Yes (No)	Yes (No)
What Behavior Would You Like to See Improved the Most	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative Other	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative Other	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative Other	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy (Anxious) Talkative Other	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative Other	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative Other
Approximate Size of Space	11 x 13 x 10 LengthxWidthxHeight	LengthxWidthxHeight	LengthxWidthxHeight	LengthxWidthxHeight	LengthxWidthxHeight	LengthxWidthxHeight
Windows in the Room	(Yes) No	Yes (No)	(Yes) No	(Yes) No	(Yes) No	Yes (No)
Number of Windows	(1) (2) or 3 4 N/A	1 2 3 4 (N/A)	1 2 3 (4) N/A	1 2 3 (4) N/A	1 2 3 (4) N/A	1 2 3 4 (N/A)
Approximate Size of Windows	4.5 x 3.5 WidthxHeight	~~4 x 3.5~~ WidthxHeight	4.5 x 3.5 WidthxHeight	4.5 x 3.5 WidthxHeight	4.5 x 3.5 WidthxHeight	— WidthxHeight
Do Resident's Like Sitting Next to the Windows?	(Yes) No No Windows	~~Yes~~ No (No Windows)	(Yes) No No Windows	(Yes) No No Windows	(Yes) No No Windows	Yes No (No Windows)
Do They Have Better Behavior While Sitting Next to the Windows?	Yes No (No Different From Other Spaces) No Windows	Yes No (No Different from Other Spaces) (No Windows)	Yes No (No Different From Other Spaces) No Windows	Yes (No) No Different From Other Spaces No Windows	Yes No (No Different From Other Spaces) No Windows	Yes No No Different From Other Spaces (No Windows)
What Time of Day do Resident's Sit by the Windows? [Circle all that apply]	At Breakfast Breakfast-Lunch At Lunch Lunch-Dinner At Dinner After Dinner Any Time They Can (No Time In Particular) Varies	At Breakfast Breakfast-Lunch At Lunch Lunch-Dinner At Dinner After Dinner Any Time They Can No Time in Particular	At Breakfast Breakfast-Lunch At Lunch Lunch-Dinner At Dinner After Dinner (Any Time They Can) No Time In Particular Varies	At Breakfast Breakfast-Lunch (At Lunch) Lunch-Dinner (At Dinner) After Dinner Any Time They Can No Time in Particular	At Breakfast Breakfast-Lunch At Lunch Lunch-Dinner At Dinner After Dinner Any Time They Can No Time in Particular Varies	At Breakfast Breakfast-Lunch At Lunch Lunch-Dinner At Dinner After Dinner Any Time They Can No Time in Particular

[illegible]	[illegible]	[illegible]	Common Room	Dining Room	Other ____	Other
Do Resident's Like Rooms with Windows More than Rooms Without Windows?	Yes (circled) No	Yes No (circled)	Yes (circled) No	Yes (circled) No	Yes (circled) No	Yes No (circled)
Please Put a ★ In Room Where the Resident's Have Their Best Behavior	★		★			
Have You Ever Tried Different Lights in this Room?	Yes No (circled)	Yes No	Yes No (circled)	Yes No	Yes No	Yes No
What Other Types of Light Have You Tried?	Incandescent Incandescent Flood CFL (circled) Fluorescent Strip Other ____	Incandescent Incandescent Flood CFL (circled) Fluorescent Strip Other ____	Incandescent Incandescent Flood CFL (circled) Fluorescent Strip Other ____	Incandescent Incandescent Flood CFL (circled) Fluorescent Strip Other ____	Incandescent Incandescent Flood CFL (circled) Fluorescent Strip Other ____	Incandescent Incandescent Flood CFL (circled) Fluorescent Strip Other ____
Did the Resident's Behavior Change With the New Lights?	Yes No (circled)	Yes No (circled)	Yes No (circled)	Yes No (circled)	Yes No (circled)	Yes No (circled)
How Did Their Behavior Change? They are more ____ than before. [Circle all that apply]	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative No Change Other ____	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative No Change Other ____	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative No Change Other ____	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative No Change Other	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative No Change Other ____	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative No Change Other ____
Place a ☺ In the Room the Resident's Like the Most	☺		☺	☺		
Place a ☹ In the Room the Resident's Dislike the Most						☹
Is There Anything You Think Could Be Done to Improve Resident's Comfort?	Yes No (circled)	Yes No (circled)	Yes No (circled)	Yes No (circled)	Yes No (circled)	Yes No (circled)
What Are Your Suggestions?						

*Please attach photos of the lights if possible without any resident's in the picture

Please e-mail back the response at: Lgeiger@ksu.edu. If you prefer to fax, please fax it to the Department of Architectural Engineering at K-State with Laura Geiger on the top to: 785-532-3556. If you have any questions, feel free to e-mail me or call me: 913-221-2609. Thank you for your help.

J

Name of Facility:

Can I use the name of your Facitily in my report? Yes No

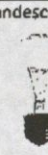
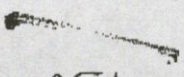
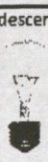
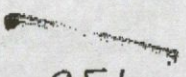
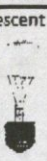
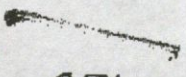
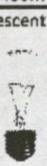
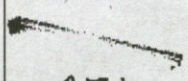
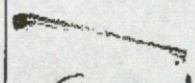
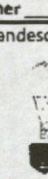
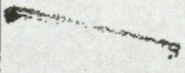
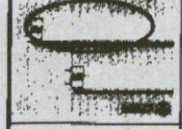
Number of occupants living there:

Are Alzheimer's residents and regular resident's mixed together? Yes No

If they are sepearate, is there anything unique about the Alzheimer's section? Yes No

If yes, please explain. (more windows, more lights, more lighting controls, more time by the windows, etc)

Please fill out the boxes below as a general consensus of all the residents OR pick a specific resident(s) and fill out the boxes for them in each room.

Lamp Information	Bedroom	Restroom	Common Room	Dining Room	Other ____	Other ____
Type of Light	Incandescent  Incandescent Flood  CFL  Fluorescent Strip  Other CFL	Incandescent  Incandescent Flood  CFL  Fluorescent Strip  Other CFL	Incandescent  Incandescent Flood  CFL  Fluorescent strip  Other CFL	Incandescent  Incandescent Flood  CFL  Fluorescent strip  Other CFL	Incandescent  Incandescent Flood  CFL  Fluorescent strip  Other Fluorescent	Incandescent  Incandescent Flood  CFL  Fluorescent strip  Other ____
Number of Bulbs Per Lamp	1 2 (3) 4 5 6	1 2 3 4 5 6	1 2 (3) 4 5 6	1 2 (3) 4 5 6	1 2 3 (4) 5 6	1 2 3 4 5 6
Watts Per Bulb	15 30 42 60 75 100 Other 32	15 30 42 60 75 100 Other 15	15 30 (32) 42 60 75 100 Other 32x3 96x6	15 30 (32) 42 60 75 100 Other ____	15 (30) 32 42 60 75 100 Other ____	15 30 32 42 60 75 100 Other ____
Bulb Manufacturer	(Sylvania) Philips GE Other ____	Sylvania Philips GE Other ____	Sylvania Philips GE Other ____	Sylvania Philips GE Other ____	Sylvania Philips GE Other ____	Sylvania Philips GE Other ____
Model Number and/or Description 	Ex: GE Reveal A 19: 81871-100A/CL/RVL	Ex: Lights of America 8W CFL: F8T5CW	Ex: GE Cool White T 12: 10116	Ex: Philips Advantage T8: F17T8 ADV830 ALTO	Ex:Osram Sylvania Dulux: 29590	Ex: Osram Slyvania Dulux: 20538
Compare the Brightness of the Rooms to Each	Brighter than the Rest (Average) Dimmer than the Rest	Brighter than the Rest (Average) Dimmer than the Rest	Brighter than the Rest (Average) Dimmer than the Rest	Brighter than the Rest (Average) Dimmer than the Rest	Brighter than the Rest (Average) Dimmer than the Rest	Brighter than the Rest Average Dimmer than the Rest
Brightness More Specifically	This room is brighter than 5-60 WATT room, but duller than ____ room	This room is brighter than 4-60W room, but duller than ____ room	This room is brighter than 5-60WATT room, but duller than ____ room	This room is brighter than 5-60WATT room, but duller than ____ room	This room is brighter than Same as #12 room, but duller than ____ room	This room is brighter than ____ room, but duller than ____ room

TIME OF DAY: 3:30PM
WEATHER: SUNNY

19.9 fc | 30.2 fc | 38-73 fc | 31.3 fc | 20 fc (HALL)

Typical Behavior-Compared to other rooms (on an individual basis) residents are generally more.... [Circle all that apply]	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative No different from other spaces Other ____	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative No different from other spaces Other ____	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative No different from other spaces Other ____	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative No different from other spaces Other ____	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative No different from other spaces Other ____	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative No different from other spaces Other ____
Age of Lights	Original Retrofit ✓	Original Retrofit ✓	Original Retrofit ✓	Original Retrofit ✓	Original Retrofit ✓	Original Retrofit
Year of Original or Retrofit	9/1 →					
Do You Think Your Light Affect Your Resident's?	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
What Behavior Would You Like to See Improved the Most	Agitated Happy ✓ Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative Other ____	Agitated Happy ✓ Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative Other ____	Agitated Happy ✓ Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative Other ____	Agitated Happy ✓ Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative Other ____	Agitated Happy ✓ Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative Other ____	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative Other ____
Approximate Size of Space	LengthxWidthxHeight	LengthxWidthxHeight	LengthxWidthxHeight	LengthxWidthxHeight	LengthxWidthxHeight	LengthxWidthxHeight
Windows in the Room	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
Number of Windows	1 Large 2 3 4 N/A	~~1~~ 2 3 4 N/A	1 Large 2 3 4 N/A	1 Large 2 3 4 + N/A	1 Large 2 3 4 N/A	1 2 3 4 N/A
Approximate Size of Windows	WidthxHeight	WidthxHeight	WidthxHeight	WidthxHeight	WidthxHeight	WidthxHeight
Do Resident's Like Sitting Next to the Windows?	Yes No No Windows	Yes No No Windows	Yes No No Windows	Yes No No Windows	Yes No No Windows	Yes No No Windows
Do They Have Better Behavior While Sitting Next to the Windows?	Yes No No Windows	Yes No No Windows	Yes No No Windows	Yes No No Windows	Yes No No Windows	Yes No No Windows
What Time of Day do Resident's Sit by the Windows? [Circle all that apply]	At Breakfast ✓ Breakfast-Lunch At Lunch ✓ Lunch-Dinner ✓ At Dinner After Dinner Any Time They Can	At Breakfast Breakfast-Lunch At Lunch Lunch-Dinner At Dinner After Dinner Any Time They Can	At Breakfast Breakfast-Lunch At Lunch Lunch-Dinner At Dinner After Dinner Any Time They Can	At Breakfast Breakfast-Lunch At Lunch Lunch-Dinner At Dinner After Dinner Any Time They Can	At Breakfast Breakfast-Lunch At Lunch Lunch-Dinner At Dinner After Dinner Any Time They Can	At Breakfast Breakfast-Lunch At Lunch Lunch-Dinner At Dinner After Dinner Any Time They Can
Do Resident's Like Rooms with Windows More than Rooms Without Windows?	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No

Please Put a ★ Room Where the Resident's Have Their Best Behavior						
Have You Ever Tried Different Lights in this Room?	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
What Other Types of Light Have You Tried?	Incandescent Incandescent Flood CFL Fluorescent Strip Other ______	Incandescent Incandescent Flood CFL Fluorescent Strip Other ______	Incandescent Incandescent Flood CFL Fluorescent Strip Other ______	Incandescent Incandescent Flood CFL Fluorescent Strip Other ______	Incandescent Incandescent Flood CFL Fluorescent Strip Other ______	Incandescent Incandescent Flood CFL Fluorescent Strip Other ______
Did the Resident's Behavior Change With the New Lights?	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
How Did Their Behavior Change? They were more Same than before. [Circle all that apply]	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative Other ______	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative Other ______	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative Other ______	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative Other ______	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative Other ______	Agitated Happy Sad Mad Calm Angry Restless Aggressive Sleepy Anxious Talkative Other ______
Place a ☺ in the Room the Resident's Like the Most	There Room And Everywhere There is An Activity					
Place a ● in the Room the Resident's Dislike the Most						
Is There Anything You Think Could Be Done to Improve Resdient's Comfort?	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
What Are Your Suggestions?						

*Please attach photos of the lights if possible without any resident's in the picture

Appendix I - Circadian Rhythm System

As people age, their circadian rhythm break down, causing a loss in "many biological functions such as disturbances in sleep quality and quantity, lack of alertness, quality of well being, and even impacts on health ("Research Recap." *LD+A* 2003)." These outcomes from disruptions in the circadian rhythm are why is it important to try and shift the internal body clock to the correct position.

Circadian rhythm has been discussed in the information already presented, but some people are unaware of what the circadian rhythm does and how it affects people's behaviors. The circadian rhythm effects sleeping patterns; however, it also affects the typical AP's behavior throughout the day as well. Figure 85 illustrates typical behaviors found in average humans associated with different times during the 24-hour day. Deep sleep normally occurs at 2am, which is consistent with figure 35 in Chapter 5 -Blue, White, and Red Wavelengths. By making sure an AP's internal clock matches this universal clock, they will sleep better through the night and be more present during the day.

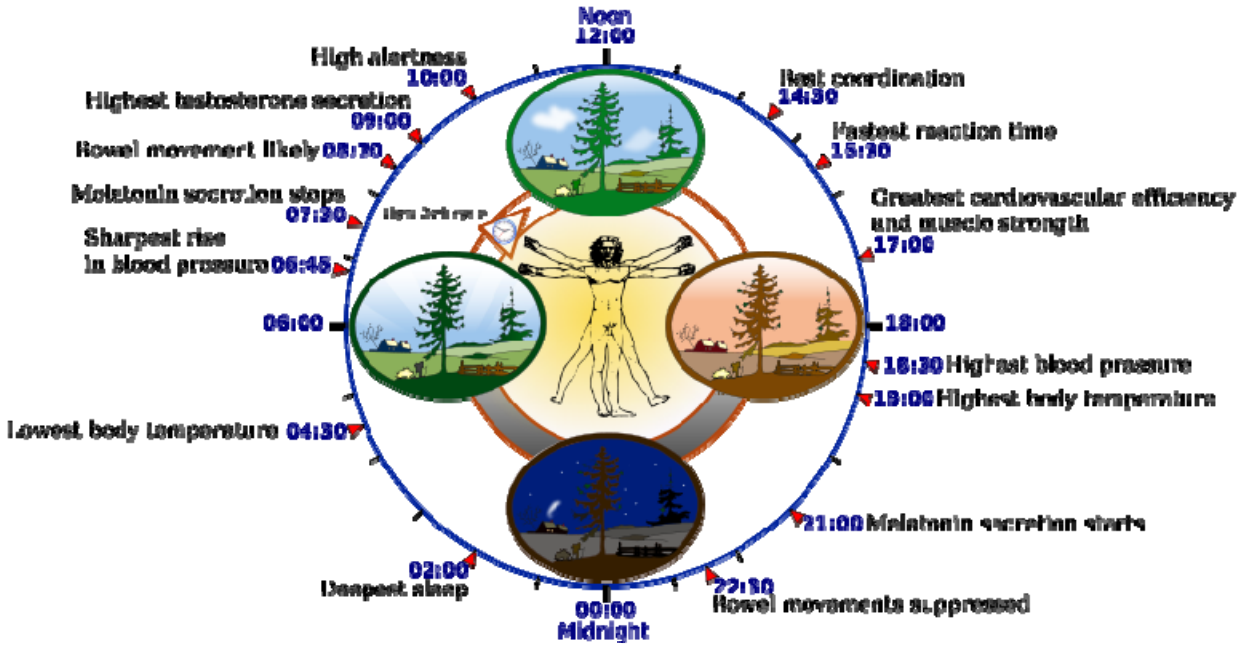


Figure 85: Circadian Clock

Using this visual clock, loved ones could plan their visits so they spend time with their loved one when they are most alert, 10am, or find it easier to move around, 5pm.. Typical AP's can fall asleep at any point in the day, so this clock only works if the AP has received the correct amount of light to allow them to sleep through the night, as well as getting enough stimulants to keep them alert throughout the day. If the caretakers do not do not administer proper amount of light to the APs, than this clock cannot be applied.

How individual's circadian rhythms sync with the 24-hour day is coordinated by the suprachiasmatic nucleus SCN (Lyndsley), which is effected by light. If the SCN did not exist, there would be no regular sleep-wake rhythm for people. The SCN can be removed from the body and cultured and still maintain its own cycle without external clues even though one kind of SCN receives clues by the amount of light entering the eye. The pattern of light and dark is the main "synchronizer of the SCN to the 24-hour solar day" (Figueiro, Rea, and Eggleston 200), and as people age, it takes more light to shift their circadian system. This is because there is less neuronal activity, especially after the age of 80, the SCN shrinks as people age, and their leses become yellowed. Therefore, light therapy uses more intense light than regular ambient light to aide in this shift.

The amount of shifting required is minimal, partially because body clocks cannot be shifted very much. Circadian Rhythm suggests humans can change their internal body clock to a 23.5 hour cycle or 24.65 hour cycle, which corresponds to Mar's day-night cycle, but does not mention any significant changes. While these shifts might seem small, when dealing with a group of APs, keeping them all on the same schedule helps caretakers remember why APs are acting a particular way. Caretakers can plan activities according to the time of day and the associated behavior, so they are not planning activities that require coordination in the morning.

Manipulating circadian rhythms is not discussed in the UFC, most likely because the UFC deals more with ambient luminaire layouts, while shifting the circadian rhythm requires addition light found in light therapy. However, the UFC does support administering light to people during the day and trying to reduce light at night because the circadian cycle depends on light during the day and darkness at night. There is research that shows potential for positive outcomes when using light therapy to treat sleep disorders, and therefore benefit from more awake and pleasant APs.

There are also contradictory studies whether light effects the circadian system at all. According to Dowling et al., light administered two hours before bed and two hours after patients woke up had little or no effect on the circadian phases. However, during their tests, they did find small increases in agitation, aggression, depression, and eating, but since these improvements were so small, they could have been from a number of other sources, and conclusions about evening light cannot be drawn. Caretakers agree with many other researchers that more tests need to be conducted to have sufficient data for comprehensive results. These tests should include more people, extended periods of time, and include data collection on weekends.

Personal Test

Sleep disorders are commonly untreated, so Philips Lighting provides a free online test where users can see how badly their internal body clock is misaligned. They estimate 35 million American's suffer from body clock issues, but how severe one's body clock must be is unclear.

This test was first completed during the school year to represent college students. As seen in figure 86, students are more awake after dinner than normal, which makes falling asleep at a reasonable hour difficult. This in turn makes waking up early a challenge, which makes sense, because waking up before 9am or 10am sounds painful to most college students. Philips classifies this is a moderately misaligned body clock, and gives steps to adjust it in three days based on what time the test taker natural gets up and what time they need to get up in the mornings.

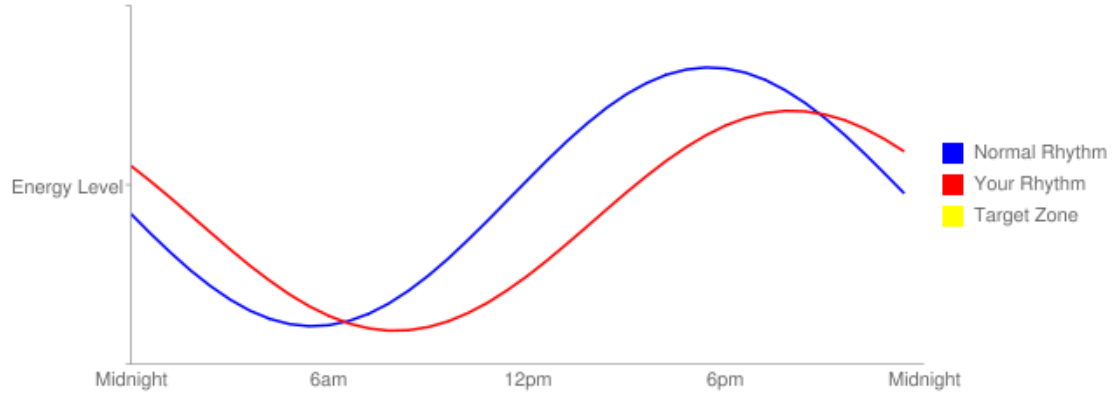


Figure 86: College Student Internal Body Clock

Figure from Philips Lighting Circadian Rhythm Test ("Philips – Circadian," 2011).

The second time the online test was completed to represent a full-time employee (see figure 87). This mildly misaligned clock also accurately represents the workforce because although their body clocks are still misaligned, they are not quite as severe as college students.

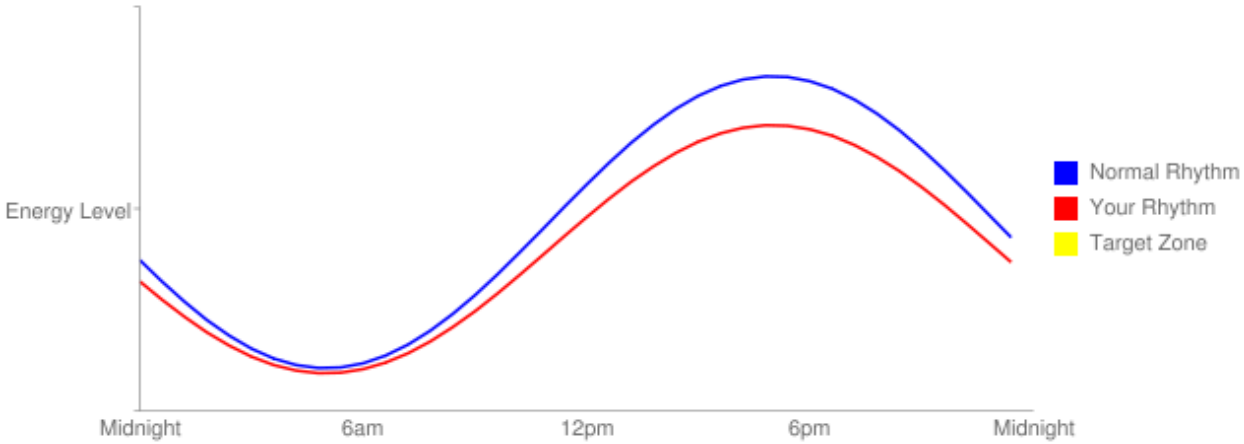


Figure 87: Full-time Employee Internal Body Clock

Figure from Philips Lighting Circadian Rhythm Test ("Philips – Circadian," 2011).

Without any help from artificial light, full-time employees can train their bodies to sleep by 11pm, so they can wake up at 7am by following the tips giving in the result. By realigning the body clock, even on the weekends, waking up at 8am was not out of the question. One of the

benefits from getting the proper amount of sleep is that employees are functional at work, even when they first arrive, because they have received eight hours of sleep. These same employees are more sociable early in the morning and pleasant to be around. Similar results can potentially be obtained if APs receive proper amounts of sleep.

From experience, transitioning from college life to the working world takes at least a week, but APs might not comprehend this transition or why routines are important to their health. Explain the reasoning behind going to bed earlier or waking up earlier to try and shift their body clocks could be difficult to explain. This is why daylight is important because taking the AP outside for an additional few minutes each day is a more natural and easy transition than waking up early. If going outdoors is not an option, light therapy luminaires can assist in the transition. If the AP always wakes up with bright light therapy, that helps signal the beginning of a new day, and if luminaires are dimmed after dinner, this helps signal night is approaching. Making sure this day/light pattern is seen by the AP is important for the SCN to properly function.

Consolidating Sleep/Wake Cycles

The rhythm of day/night light that influences a person's sleep/wake cycle can be easily disrupted, and the older the person, the easier this rhythm is disrupted according to Figueiro. The cause is neurodegeneration, which occurs with age ("Research Recap." *LD+A* 2003). Irregular sleep/wake patterns, along with more frequent disruptive behaviors, is the most common reason for moving APs from the home to an assisted living facility ("The Bright Side of Blue Light." *LD+A* 2005), so being able to consolidate sleep/wake cycles is beneficial to both the APs and their caregivers (Figueiro, Rea, and Eggleston 2003). This can be done by making sure the day/light pattern is seen by APs. The phrases "consolidating sleep/wake cycle" and "rest/activity patterns" say the same thing: realigning the internal body clock. Figueiro found "exposing APs to bright light during the day and darkness at night consolidated their rest/activity patterns ("Research Recap." *LD+A* 2003)." Consolidating cycles is related to phase advancing or phase delaying the circadian rhythm is to align AP's internal body clocks to the external 24-hour clock, which aides APs in sleeping at the correct time of day and consistently having energy at other times in the day. Another study by Figueiro, Rea, and Eggleston and found intensity, duration, and time of day, could also shift circadian systems. Additionally, they found blue wavelength is

most effective at shifting the circadian rhythm, while yellow/green light is better at affecting the visual performance, due to the different wavelengths of light. These color differences were discussed in Chapter 5.

Serotonin/Melatonin

There are multiple ways to see the effects of the sleep/wake cycle from core body temperature, levels of melatonin, urine production, cortex activity, to alertness. Alertness, in particular, is a variable which AD caregivers are interested. Higher levels of melatonin cause drowsiness, and melatonin production is related to the pineal gland. It is affected by the hypothalamus, which gets clues from light. Melatonin also affects the part of the body that breaks down carbohydrates, protein and fat, and regulates blood pressure. Making sure elders maintain appropriate blood pressure levels can be a challenge, but can help keep them healthy, out of hospitals, and healthcare costs to a minimum.

One cannot live without serotonin r melatonin, but the challenge is create a balance, at the right time of day, between the two. Suppressing melatonin and increasing serotonin during the day and the reverse at night helps correct the circadian rhythm because serotonin is a mood boosting chemical while melatonin promotes sleep. Rea found that "brighter pulses of light result in faster suppression of melatonin than dimmer pulses," so bright light therapy has implemented a variation on this discovery by using bright light for short periods of time, relative to the 24-hour day, to suppress melatonin.

Others also believe controlling the body's melatonin levels can aide in the sleep/wake cycle, because melatonin is released into the blood stream when the body is lacking light. Lyndsley reports, "light suppresses melatonin release." The interaction between light, melatonin, and the circadian cycle are important to get APs on the same daily routine and ease the workload of the caretakers.

How much light is needed to suppress melatonin is currently up for discussion. Rea found that typical fluorescent lamps emitting 500 lux are ineffective at suppressing melatonin, which is related to the circadian rhythm; however, more recently, there is a new hypothesis that low levels of light (3.5 lux) can affect the circadian rhythm. This hypothesis is contradictory to other research presented in this report.

Melatonin, and its effects on sleep, has also been studied intensely by Figueiro, who has written about some of her findings in the June 2003 issue of Research Recap. She found there is not enough data to be conclusive that melatonin "can help induce sleep by reducing the “wake-promoting” signal deriving for the circadian pacemaker."

Scotopic and Photopic Wavelengths

Another variable in shifting the circadian rhythm deals with figuring out the appropriate time of day and color of light to administer light therapy, which can be a delicate process. Different colors exhibit different wavelengths, and the eye's sensitivity to wavelengths varies between day and night. According to figure 88, scotopic light is better at shifting the circadian rhythm than photopic light because the wavelengths are closer to the circadian wavelength. Scotopic is the ability to see in low levels of light, and this wave drops off after peaking around 500nm, which coincides with the blue/green color. This is why blue is the most sensitive color in altering the circadian rhythm. Photopic is the ability to see in well lit conditions, and allows people to identify colors. The photopic wavelength is broader and shifted away from the circadian wavelength, thus affecting it less.

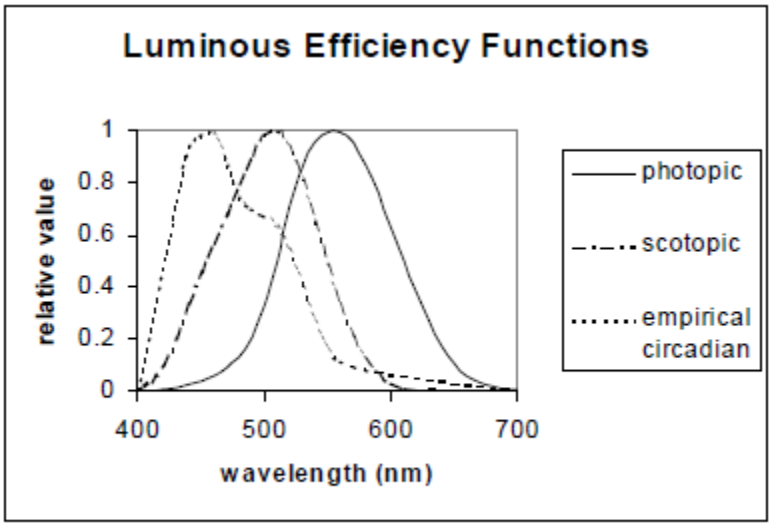


Figure 2: A luminous efficiency function for photopic, scotopic, and circadian responses; the latter is based on Brainard *et al.* and Thapan *et al.*[9, 10] Adapted from Rea *et al.*[21]

Figure 88: Photopic and Scotopic Wavelengths

Reprinted with permission from Mariana G. Figueiro (Figueiro, Mariana G.; Bullough, John D.; Rea, Mark S).