



and decreased cognitive functioning (Salvendy, 1997; ASTM F1166, 2007, 1995; ANSI/ASHRAE 55a, 2009; BS ISO 11399, 1995).

In addition to temperature-related concerns, the thermal environment also includes humidity levels and air exchanges rates. Design concerns include the intended areas of operations for the vessel or offshore installation, location of the spaces within the design, tasks performed in these spaces, and personnel exposure to these conditions in these areas (BS ISO 11399, 1995).

### Illumination

For most activities, vision is the main sensory channel for receiving information. Suitable illumination for effective visual task performance is therefore a critical element in designing for habitability. (Salvendy, 1997; Sanders and McCormick, 1993; IESNA RP-12, 1997; BS 5266, 1999). The objective of controlled illumination is to enhance crew safety and emergency and escape activities, and to maintain satisfactory lighting levels in all workspaces. Lighting installations are designed for performance of visual tasks but also for visual comfort. Visual discomfort-causing conditions such as flicker, glare, shadows, and veiling reflections can lead to degraded visual performance in the form of visual task difficulty, under- or overestimation of distances, distraction, and perceptual confusion leading to, for example, the misreading of a display. Ineffective lighting systems contribute to eye fatigue, increased human error and rates, and increases in reaction/response times. (Salvendy, 1997; Sanders and McCormick, 1993).



Ergonomic workplace lighting design involves factors such as the source of illumination, the technology of lighting fixture design, reflection from surfaces, flicker, glare, and shadow reduction, control of cast light direction, distribution, diffusion, and the intensity of illumination required for specific tasks. Early design considerations in the selection and placement of suitable lighting fixtures are essential to attain satisfactory lighting levels (Salvendy, 1997; IESNA RP-12, 1997; BS 5266, 1999; NORSOK, 1996; NORSOK, 1997).

### SUMMARY

Due to the identification of fatigue and human error as major factors in maritime accidents, recent publications address the design, placement, and arrangement of the various spaces onboard where crew members must live and work. Although these are not as well defined as ambient environmental criteria, they provide the designer with general and specific design requirements. The objective is to provide the seafarer with satisfactory accommodations in which to live and work which will not contribute to decreases in safety or increases in fatigue (NORSOK, 1996; NORSOK, 1997; ILO, 1998).

### REFERENCES

- American Bureau of Shipping (ABS), *Guidance Notes on the Application of Ergonomics to Marine Systems*, Houston, TX, March, 2013.
- American Bureau of Shipping (ABS), *Guide to Crew Habitability on Ships*, Houston, Texas, 2012.
- American Bureau of Shipping (ABS), *Guide to Crew Habitability on Workboats*, Houston, Texas, 2012.
- ANSI/ASHRAE 55a, *Thermal Environmental Conditions for Human Occupancy*, 2009.