Promoting alertness and sleep by dynamic lights for control room operators

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Conclusion
It seems that appropriate dynamic light in windowless rooms during the dark Nordic season may promote alertness, sleep and better adaptation to quickly rotating shiftwork.

Aim
To improve alertness, sleep and adaptation to rotating shiftwork, a new dynamic light regiment adjusted to current work hours was tested during the Scandinavian winter.

Methods
The illumination level in a control room at a nuclear power station was about 200 lux at the work stations (horizontal gaze). New lights were installed in part of the control room, see figure 1. Three levels of exposure were used, see figure 2. Operators were followed with sleep/wake diaries during one week (starting on Saturday) in the shift sequence NNNxMMA (N=night, x=day off, M=morning, A=afternoon). They were studied in a crossover design with 7 weeks in-between study weeks. The study was conducted during winter months with no opportunities to receive day light exposure after night work or before morning work. Operators were given actigraphs, filled in a sleep/wake diary and melatonin saliva samples were collected at work (only ratings presented here). Ratings of KSS (Karolinska Sleepiness Scale) were given every second hour. ANO-VAs were calculated in connection to night work, free days and morning work using the factors group (exposed reactor operators/non-exposed controls) (new/old exposure) and time.

Study groups
7 reactor operators (experimental group, mean age 50.2 yrs) and 15 turbine operators/technicians (control group, mean age 46 yrs) from seven different teams participated.

Results
Results from the wake/sleep diary showed that the new light treatment decreased sleepiness in connection to night work, in particular during the second night shift, see figure 3 (interaction group x light x time, p<0.05). During free days after night work, sleep length increased with 0.7 hours to 7.42 hours with the new lights (interaction group x light, p<0.05) and these days were rated as being better (interaction group x light, p<0.05). Sleepiness in connection to the first morning shift did not differ in-between conditions or groups, see figure 4.

Figure 1. New fixtures (Savio) and old lighting above operators.

Figure 2. Light schedule. Three levels of exposure gave either a white strong light (1050lux, 6000K) a yellow moderate light (700lux, 4000K) or a yellow light (650lux, 3000K).

Figure 3. Sleepiness ratings (KSS) given in connection to the second night shift.

Figure 4. Sleepiness ratings (KSS) given in connection to the first morning shift.