Problem: The culprit was found to be a single mercury-vapor lamp that had been damaged by direct impact. This lamp has an inner arc tube which continues to function after the outer glass envelope has shattered; the arc tube produces extremely high levels of UV radiation (measured to be much greater than ACGIH TLV® at ground level). The lamp fixture was missing both a protective safety cage and a glass lens.

Resolution:

- Safety cages and glass lenses affixed to all light fixtures
- MV lamps were replaced with self-extinguishing bulbs to prevent the release of UV after the bulb has shattered
- No significant UV from replacement lamps

Benefit to Others:

- Ability to identify potential hazards associated with MV and metal halide bulbs
- Importance of using self-extinguishing MV lamps

226.

OCCUPATIONAL EXPOSURE TO SCATTERED ULTRAVIOLET RADIATION DURING LASIK TREATMENT.

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LASIK is a common technique for improving myopic vision using an excimer laser to remove underlying corneal tissue. During the procedure, operating room personnel may be exposed to scattered actinic ultraviolet radiation. The necessity for laser eye protection has been questioned by user personnel because the scattered UV levels are assumed to be very low levels. Little guidance is available from the current ANSI Z136.3 Standard for the Safe Use of Lasers in the Health-care Environment. This paper describes radiometric measurements that were made during LASIK procedures using an excimer laser operating at a wavelength of 193 nm. These measurements were then evaluated using a worst-case procedure and then compared to the ACGIH TLV®s to perform a risk/hazard analysis. It was concluded that eye protection is not necessary to protect operating room personnel since exposure levels are very low even under a worst-case scenario.

227.

ULTRAVIOLET RADIATION EXPOSURE ONBOARD MARINE VESSELS.

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Daytime ultraviolet radiation (UVR) is among the numerous occupational health hazards to which employees onboard marine vessels are potentially exposed. To determine the extent of exposure, a UV radiometer (International Light Inc., Model IL1400A) connected to one of three detectors of UV-A (Model SEL033), UV-B (Model SEL 240), and UV-C (Model 240) was used to measure UVR levels on 12 marine vessels 21–87 ft in late February in Louisiana. The irradiance ($\mu W/cm^2$) of: (1) UV-A ranged from 1470–2880 with a mean (SD) of 2075 (434); (2) UV-B ranged from 3.8–20 with a mean (SD) of 11 (5.1); and (3) UV-C ranged from 27–61 with a mean (SD) of 47 (11). A total of 441 workers (408 males, 33 females) were potentially exposed to these UV levels from a few minutes to a few hours per day. Compared to current guidelines, these results suggest that workers onboard marine vessels have the potential for UVR overexposure.

228.

IMPROVED ASSESSMENT OF RADIOFREQUENCY EXPOSURES AMONG MOBILE PHONE USERS.

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Our research addresses the need to improve understanding of exposure to radiofrequency (RF) energy among users of mobile phones. Better exposure assessment is critical to any future epidemiologic studies and can help analyze those completed and now underway. We identify the features of cell phones, cell phone systems, and their manner of use that can be used as markers for individual RF exposure. We have assumed that the ideal individual exposure information would be a continuous record of RF energy absorbed at specific sites in the body over a lifetime of cell phone use. We have conducted pilot testing to determine the importance of the following exposure predictors: (1) phone type, terrain, time of call, network, and population densities; (2) technical features of wireless technology and personal attributes such as age, gender, and income; and (3) personal habits such as the hand used to hold the phone and use of hands-free devices. In addition, we have initiated a study involving a comparison of questionnaire-reported cell phone usage to billing records and data from study participants using modified phones that record output power settings ("dose-phones"). This presentation summarizes the data accumulated to date and outlines future work that will be conducted.

229.

USE OF SWALLOWABLE CORE BODY TEMPERATURE SENSORS AND OTHER MEASURES TO EVALUATE HEAT STRESS AND STRAIN AMONG U.S. AIR FORCE FUEL SYSTEMS MAINTENANCE EMPLOYEES.

A. Krake, B. King, NIOSH, Cincinnati, OH.

Heat stress evaluations were conducted at seven southern/southwestern U.S. Air Force (USAF) bases as part of a collaborative study of USAF employees' acute exposure to jet fuel. USAF recruits employed as aircraft fuel systems maintenance inspection and repair workers were exposed to hot working conditions in confined spaces (aircraft fuel tanks) while wearing PPE. The potential for developing heat strain prompted USAF health and safety managers to request a heat stress evaluation. NIOSH investigators evaluated heat stress and strain using swallowable core body temperature (CBT) sensors, external heart rate (HR) monitors, and wet bulb globe temperature (WBGT) monitors. Pre- and post-shift body weight comparisons were also made on 50% of the employees. Job activities were analyzed according to metabolic heat production estimates. ACGIH suggests a maximum CBT of 101.3°F for medically selected, acclimatized personnel and 100.4°F for unselected, unacclimatized personnel. For individuals with normal cardiac performance, sustained HR (over several minutes) should not exceed 180 beats per minute minus age. And, because there is a greater risk of heat strain if profuse sweating is sustained over hours, weight loss over a shift should not exceed 1.5% of body weight. NIOSH work/rest regimen tables were used to plot the estimated metabolic heat against the environmental heat measurements. WBGT temperatures at all locations ranged from 53–93°F outdoors and from 60–88°F indoors and indicated that employees were exposed to heat stress conditions in excess of the NIOSH and ACGIH screening criteria for acclimatized individuals. Physiological sampling results indicated that about 25% of the study participants experienced heat strain signs (HR and/or CBT in excess of ACGIH criteria), and that 62% of those weighed developed at least mild dehydration during their activities. Recommendations were made to develop physiological monitoring programs and heat stress management and illness surveillance systems.

230.

HEAT WAVE: A WEB-BASED HEAT STRESS MANAGEMENT TOOL.

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Managers, supervisors, industrial hygienists, and health and safety technicians were seeking information that would help them to predict each day whether heat stress might become an issue, and if so, when. Users also desired clear work rest regimen decision points that would incorporate clothing and work rate changes without having to perform field calculations. "Heat Wave," a web-based heat stress management tool was created to meet these needs. The tool uses a simple model to estimate WBGT-°C from current local meteorological data. The model, statistically validated against empirical data, yielded the central 95% of data points within +/- 1.15 WBGT-°C and a multiple R-squared of 0.97. The "Estimator" section of the tool combines menu-chosen operational information provided by users (clothing ensemble, work rate, and acclimatization level) and ACGIH TLV® heat stress screening criteria to

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