Executive Summary

The objective of this study was to perform an assessment of indoor air quality and ventilation efficiency of the hair and makeup trailers in the Vancouver motion picture industry. Motivation for the study arose from the use of volatile paints, aerosols, and solvents in small working environments, coupled with limited previous investigations. Carbon dioxide (CO_2), carbon monoxide, volatile organic compounds (VOC), relative humidity and temperature were identified as potential indoor air quality issues from an initial walkthrough. Monitoring was conducted in 10 different trailers. Four trailers were monitored twice to assess day to day variability (N=14). Methods for measurements of gas concentrations and physical characteristics of air involved the placement of two direct reading instruments in each trailer. Concurrent observations were made on the tasks performed, number of occupants and opened or closed status of the door(s) and window(s). Results found that on average trailers had sufficient outdoor air exchange. However, 12 of 14 trailer visits experienced periods of insufficient distribution of outdoor air as indicated by levels of CO_2 above the study's 1000 ppm guideline level. Carbon monoxide levels were below regulatory exposure limits. Average total VOC concentrations were above 3 ppm comfort guidelines in 4 of the 15 trailers, and all trailers experienced elevated peak concentrations. Levels appeared highest during airbrushing, airbrush product cleanup and morning openings of the trailers. In conclusion, when CO_2 levels are above 1000 ppm or VOC average levels are elevated above outdoor conditions, it is recommended that trailers receive regular air exchanges with 100% fresh air to ensure the elimination of indoor air contaminants. Local exhaust ventilation, such as downdraft venting, is recommended for trailers undertaking regular airbrushing, as natural ventilation was not found capable of controlling the short bursts of high VOC concentrations sufficiently. Future personal sampling for paint particulate and airbrushing solvents is recommended in prosthetic trailers where total VOC levels were observed to be the highest.

Recommendations

Employer (Production)

1. When CO_2 levels are above the guideline of 1000 ppm or VOC average levels are above outdoor conditions, it is recommended that trailers receive regular air exchanges with 100% fresh air to ensure the removal of indoor air contaminants. Achieving this strictly through natural ventilation (opening of doors/windows) was not found to be consistently possible or practicable in this study. Use of mechanical or local exhaust ventilation are possible solutions.

2. In trailers where one or more airbrushes are consistently used, local exhaust ventilation is highly recommended as prolonged exposure to the aerosolized particulate can cause respiratory irritation and chronic pulmonary tissue damage. In addition, exposure to the two most commonly used thinners, isopropyl alcohol and 244 fluid, can cause eye, skin and respiratory tract irritation – both Material Safety Data Sheets (MSDSs) recommend use with local exhaust ventilation.

- Permanent solutions include use of trailers with exhaust hoods or downdraft vents. When this is not practicable, temporary solutions include using portable exhaust fans set up next to airbrush or aerosol spraying stations that exhaust to the outside through flexible ducting.

3. Opening of regular hair/makeup and prosthetic trailer doors before the initiation of a shooting day for a minimum of 1 hour prior to worker entrance is recommended as a precautionary action. Monitoring of initial morning openings found that trailers in which VOCs had built-up from offgassing during non working hours took a minimum of 1 hour to reach average levels.

- Minimum airing out periods will clearly vary according to trailer construction materials, trailer size, opening sizes and products contained.

4. Ensure that air conditioning and ventilation systems in the trailers are regularly maintained, in particular the cleaning and replacing of filters.

- As per Section 4.78 Preventative maintenance in the OHS regulation.

5. Hair and makeup products are generally perceived as benign and unregulated, however controlled substances under the Workplace Hazardous Material Information System (WHMIS) are used in the trailers. Knowledge of health effects and methods of controls for each product is crucial in protecting worker health. It is recommended that MSDSs are provided for all such products. Common examples include, isopropanol (99% alcohol), ethanol (70% alcohol) and ethanol with a denaturing agent (SD alcohol 40).

- As per Section 5.16(1) in the OHS regulation, an employer must ensure that a copy of an MSDS required by sections 5.14 or 5.15 is made readily available

Supervisor (HODs or Keys)

1. Health and safety orientations of all individuals to each new trailer should be provided as they move between productions. Of particular importance is the controls of the ventilation system if it is present, such as the use of extractors below station tables or downdraft vents – even

experienced workers were occasionally observed to be unfamiliar with the controls. Removal of contaminants is crucial for worker health, but won't be effective if it is not used properly and consistently.

- As per section 3.23(1) in the OHS regulation, an employer must ensure that before a young or new worker begins work in a workplace, the young or new worker is given health and safety orientation and training specific to that young or new worker's workplace.

2. Request MSDSs for cosmetic products. Cosmetic products do not require MSDSs, however some manufacturers will still provide them. It is encouraged for workers to show a strong preference for products that supply them. Increased ingredient transparency and accountability from the manufacturers will help give workers the knowledge to use hair and makeup products safely.

- Sections 2, 4 and 8 of the 16 section format MSDS (Potential Health Effects, First Aid Measures and Exposure Controls/Personal Protection), in the investigators opinion, provide the most relevant and readable information for hair and makeup worker health.

Workers (1st Assistant, 2nd Assistant, Day Calls) See Appendix 2 for Airbrushing Tips

1. Minimize the usage of temporary colouring hair sprays as much as possible as they contain products that can cause mild to moderate irritation of the eyes, skin and respiratory tract. The desired effects can often be achieved with topically applied products.

2. To reduce VOC levels from offgassing, ensure all hair and makeup products in the trailer are securely capped, and cleanup is prompt when work with actors is finished. See Appendix 2 for airbrushing best practices.

3. Remove obstructions from air condition and ventilation systems. Hair and makeup workers must make the most out of working in tight confines in the trailers, however these systems are greatly reduced in efficiency when they are obstructed by equipment placed in front of or on top of air intakes or discharge points.

Appendix 2 - Airbrushing Best Practices:

- Use the lowest pressure level possible to achieve the desired effect
    - The higher the pressure the smaller the aerosols created by the airbrush become, which poses a health risk for two reasons.
        1. Smaller droplets take longer to settle out of the air, and therefore have a greater likelihood of being inhaled.
        2. The smaller a droplet is the further it penetrates into the lungs, where it is more difficult for the body to eliminate.
    - The higher the pressure the more paint 'bounce back' or overspray is created, resulting in less paint on the cast and more in the trailer air.
- Use an airbrush cleaning pot or cleaning station to minimize VOCs created in the trailer.

    - When cleaning the airbrush with alcohol or 244, spray the excess solvent into a cleaning pot, sometimes referred to as a cleaning station. The cleaning station has a filter system that helps to trap VOCs so they are not introduced into the trailer air.
- Use as little paint possible to achieve the desired effect.
    - Experienced airbrushers report being able to use less paint for the same effect: use double action airbrushes that enable greater control when the task allows.
- Use of paint products that can be thinned with water are recommended to achieve a desired effect whenever possible, as water is the most benign solvent.
- If it is awkward to adjust the pressure on the regulator of the compressor, and the compressor can't be moved, consider substituting for airbrushes that are now available equipped with a regulator built in near the front of the brush to increase ease of use.
- When airbrushing with isopropanol (99% alcohol) or 244 fluid ensure there are no nearby ignition sources as both solvents are flammable.
- Above all, airbrushing, especially body spraying or other substantial spraying, should be undertaken in the presence of local exhaust ventilation (ie extractors or downdraft vents).