media was TSB, but lower values for the other fluids. Relative recovery for human adenovirus approached 1 for deionized water at the smallest particle sizes, but was lower for other fluids and larger particles. Recovery of live swine and avian influenza virus was poor under all conditions. On average, the Andersen impactor yielded higher values of R than the MOUDI impactor. Using gelatin filters did not improve virus recovery. **Conclusions:** Impactors can be used to sample live virus size-selectively, but high recoveries are possible for only some viruses

PO 133-3
Microbial Exposure Patterns and Concentrations in Feed Industry

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Objective: The objective of this study is (a) to investigate the distribution patterns and exposure concentrations of bioaerosols in livestock feed industries and (b) to compare the bioaerosol concentrations by two impaction methods and one filtration method. **Methods:** Airborne bacteria, fungi, endotoxin and dust were measured in 3 feed manufacturers. Airborne bacteria and fungi were measured with one stage impactor, six stage cascade impactor and gelatin filters. Endotoxin was collected with polycarbonate filters and analyzed by kinetic chromogenic LAL method. **Results:** The geometric means of airborne concentration of bacteria, fungi, endotoxin and dust in raw material process was 326 CFU/m^3, 953 CFU/m^3, 9.2 EU/m^3, and 0.9 mg/m^3. In pelleting process, 861 CFU/m^3, 428 CFU/m^3, 18.4 EU/m^3, and 0.63 mg/m^3. In packaging process, 545 CFU/m^3, 491 CFU/m^3, 19.8 EU/m^3, and 0.4 mg/m^3. In outdoor, 85.7 CFU/m^3, 281 CFU/m^3, 6.8 EU/m^3, and 0.2 mg/m^3. The results shows that the bacteria and temperature at pelleting process and the endotoxin and humidity at raw material process were significantly higher than the other processes ($p<0.05$). The ratio of indoor to outdoor concentration was 6.2, 1.9, 3.2 and 3.2 for bacteria, fungi, endotoxin and dust. The respiratory fraction of bacteria comprised 59.4, 72.0% and 57.7% and 77.3%, 89.5% and 83.7% for fungi endotoxin and bacteria concentration have strong correlation with all culture based methods (single stage, r=0.661, 6-stage r=0.623, filtration r=0.612). Among the bioaerosol sampling methods, filtration method was significantly higher than two impaction methods in bacterial and fungal concentrations. **Conclusion:** We found that bioaerosol results in feed industry shows that the Indoor/Outdoor ratio of microorganisms was larger than 1 and respiratory fraction pattern of microorganisms was more than 50% which indicate that occupational environment control for preventing worker's respiratory disease was necessary.

PO 133-4
Culture-Independent Characterization of Bacteria in Poultry and Dairy Bioaerosols Using Pyrosequencing: A New Approach

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Introduction: Culture-based methods are often used for characterization of bioaerosols. Limitations exist with culture-based methods as only microorganisms which are viable and able to grow on selected media can be characterized. A need exists to develop methodologies which are not subject to the limitations of culture-based characterization. Novel molecular techniques such as bacterial tag-encoded flexible (FLX) amplicon pyrosequencing (bTEFAP) may be a useful for the characterizing of bioaerosols. **Objective:** Use bTEFAP to characterizing and estimate concentrations of bioaerosols in dairy and poultry facilities. **Methods:** bTEFAP was used to characterize inhalable bioaerosols present in poultry and dairy facilities over an eight-hour work shift. Both personal and area samples were collected using the IOM at 2 L/min and a gelatin filter. The DNA present was pyrosequenced targeting the 16S bacterial genetic region. This genetic region if often targeted for identifying bacteria in environmental microbiological studies. The relative percentages of bacteria present in each sample were reported. **Results:** Preliminary results suggest large distributions of bacteria among inhalable samples collected in poultry and dairy facilities. Of the bacteria detected, 369 genera were identified. The inhalable bacteria concentrations were estimated to be 7503 cells/m^3 and 7657 cells/m^3 in poultry and dairy facilities, respectively. Prevalent bacteria identified in the dairy facility: *Papilibacter* (83%), *Clostridium* (53%) and *Clostridium lituseburense* (51%). Bacteria identified in the poultry facility: *Staphylococcus cohnii* (23%), *Staphylococcaceae* (14%). **Conclusions:** Bioaerosols were characterized; however concentrations of bacteria were lower than previously reported and these bacteria may not be viable. This is the first application of pyrosequencing technology for the characterization of bioaerosols. Furthermore, the fast processing speed of molecular techniques may revolutionize the ability to identify the phylogeny and concentration of bioaerosols. The impact of this technology has yet to be realized by the scientific community dedicated to evaluating occupational and environmental bioaerosol exposure

PO 133-5
Inhalable and Respirable Organic Dust Concentrations during Broiler Production

M. Nonnenmann, A. Hussain, K. Gilmore, J. Levin, University of Texas, Tyler, TX; W. Ward, J. Bray, S. Jerez, Stephen F. Austin State University, Nacadoches, TX.

Introduction: Organic dust is often a complex mixture of bedding, feces, skin, as well as various microorganisms and endotoxins. Little information is available about characteristics of organic dust and concentrations in broiler production. Exposure to organic dust has been associated with pulmonary symptoms and declines in the pulmonary function. **Objectives:** The objective of this study was to assess organic dust concentrations during the seven-week growth period in a broiler production building and provide respiratory protection recommendations to broiler producers. **Methods:** Dust concentrations were measured in a broiler production facility which housed approximately 27,000 birds. Inhalable and respirable dusts were measured gravimetrically using and IOM and aluminum cyclone at 2.0 and 2.5 L/min, respectively. Samplers were attached to a mannequin of the broiler production building which rotated 90° every 30 minutes for 12 hours. Samples were collected once per week over the seven week broiler growth period. **Results:** The lowest inhalable dust concentration was measured at 0.5 mg/m^3 during the first

week of the growth period. The highest inhalable dust concentration was measured the last week of broiler growth at 13.4 mg/m^3. Respirable dust concentrations were at the limit of detection until week four of the growth period with the maximum concentration observed being 0.7 mg/m^3. The inhalable and respirable dust concentrations were significantly correlated with week of growth at r = .86 (p = .01) and r = .76 (p = .05), respectively. **Conclusion:** The highest concentration of inhalable dust measured was 13.36 mg/m^3, which was greater than the recommended guidelines. These results suggest that workers in broiler production may be exposed to high concentrations of organic dusts. These results must be generalized with caution as the area sampling methodology may not represent occupational exposure. Respirator use is recommended, particularly in the later stages of the broiler growth period

PO 133-6
Quantitative Spectrofluorometric Analysis of Pesticide Exposure and Exposure Control Measures

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Objective: Optical brighteners (OBs) have been demonstrated to be safe and effective surrogates for quantifying pesticide exposure when applied in agricultural settings. This study aimed to develop and validate field and laboratory methods to quantify inhalation exposures and surface contamination and evaluate handler exposure control measures during pesticide application in tree fruit orchards using the optical brightener Tinopal OB©. **Methods:** Tinopal OB was applied to a cherry orchard block at an agricultural research station in Eastern Washington using an air blast sprayer at an application rate of 400 gal H_2O/acre. Using the optimal mass of OB determined by field testing, two exposure control measures—tractor with a cab for the applicator and a lower application volume of 200 gal H_2O/acre—were compared to the standard application procedures. Air and surface deposition samples were collected and analyzed using a Turner 430 spectrofluorometer. **Results:** The optimal mass of OB for each application was determined to be 2500g Tinopal OB per acre. Exposure potential varied according sample type and intervention strategy. Average air concentrations of Tinopal OB in applicator breathing area were 51.68 ng/m^3 in a tractor with cab and 10,555.77 ng/m^3 in a tractor without cab. Of the two exposure control measures investigated, application using a tractor with cab and higher-volume spray demonstrated lower overall OB concentrations than the cab-less tractor application and low-volume spray, respectively. **Conclusions:** Quantifying pesticide exposure in field applications using OBs is an effective means of monitoring exposure potential via air and surface deposition and assessing exposure intervention strategies. These results suggest that OB application using the enclosed cab was the most effective strategy for reducing overall applicator exposure. This was an exploratory study, and provides motivation for further investigation to correlate OB concentrations to pesticide concentrations during airblast spraying.

Podium Session 134 Ergonomics: Upper Extremity Considerations and Methodological Approaches

Thursday, May 19, 2011,
1:00 p.m.–3:20 p.m.
Papers PO 134-1 – PO134-7

PO 134-1
Evaluation of Fatigue Resulting from Intensive Computer Mouse Use with VDTlog

Y. Hwang, F. Chang, H. Liang, National Taiwan University, Taipei, Taiwan.

Objective: The aim of this study was to evaluate the possibility of using VDTlog monitoring system to assess the upper-extremity muscle fatigue with continuously intensive computer mouse use. **Methods:** Thirty males having no musculoskeletal disorders in upper extremity in the past year were recruited and asked to play a computer game continuously with a mouse for two hours. The VDTlog monitoring system software was applied to monitor the activities of the computer mouse. Meanwhile, at the beginning, the end of the first hour, and the end of the second hour of game playing, subjects were asked to assess the upper-extremity muscles fatigue by a self-report questionnaire. **Results:** It is shown that the extent of self-report fatigue of all parts of upper-extremity increased along with time, especially for the shoulder, neck and eyes, with average scores of 3.7, 3.5 and 4.4, respectively, in 5-point scale. Based on the records of VDTlog monitoring, mouse movement accounted for the most of mouse activities, i.e., 48% of all mouse actions. Average velocities of mouse movement in the first and the second hours of the computer game playing were 0.72 pixel/ms and 0.71 pixel/ms, respectively, while the 99%-tile acceleration were 0.130 pixel/ms^2 and 0.125 pixel/ms^2, respectively. The decreasing trends of average velocity and maximum acceleration of the mouse movement along with time implied the possibility of their uses as performance indicators for human's performance with the computer mouse. **Conclusions:** VDTlog monitoring system has the potential for assessing the computer user's fatigue with these two parameters derived from the VDTlog monitoring. Since the VDTlog monitoring system won't interfere with the on-going computer works and is easy to operate, this monitoring program is anticipated to be used in large scale epidemiological study to help computer work loading assessment by providing exposure information at individual level

PO 134-2
Interventions for Overhead Drilling into Concrete

D. Rempel, M. Robbins, A. Barr, D. Star, I. Janowitz, University of California, San Francisco, Richmond, CA.

Objective: The purpose of this 5-year study was to develop and evaluate interventions for overhead drilling to reduce the arm and shoulder loads. Seven different interventions were developed and tested; results from the final design are presented. **Method**: During their usual work, 23 commercial construction workers used the usual method and the intervention design for overhead drilling—each for 3 hours—order randomized. Afterwards, subjects rated fatigue in 5 body regions and usability on 12 items. The work was videotaped for productivity (N=19) and inclinometers measured shoulder posture and head inclination (N=16). Hand forces were measured for three subjects. **Results:** The intervention device was rated superior to the usual method on the usability measures of drilling/vibration, stability, and feel/handling. Perceived fatigue ratings

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