P0102
Emerging Issues and Lessons Learned in the Oil and Gas Industry

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CS-102-01
Industrial Hygiene Monitoring Strategy for Unconventional Gas Drilling Sites in Texas and Pennsylvania Using the GGP-U Sampler

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Situation/Problem: Hydrocarbon based fluids are used during horizontal drilling operations at unconventional oil and gas well sites. These fluids can be diesel based or synthetic based drilling fluids. The work was done to assess air and dermal exposure and control risks to As Low As Reasonably Practicable (ALARP).

Resolution: An industrial hygiene air sampling strategy was developed using the GGP-U sampler, which is rarely used in the U.S. A semi quantitative dermal assessment was designed using the DREAM process as guidance. Worker exposure was evaluated at four drilling sites in Texas and Pennsylvania. This strategy allowed for accommodation to the logistical challenges associated with an unconventional site while still providing the basis to provide representative exposure data for an accurate exposure profile. Personal exposure monitoring was completed for BTEX/ Hexane/ Heptane. Selected jobs at each site with the highest exposure potential were evaluated by the on-site industrial hygienist.

Results: The use of synthetic based drilling fluid resulted in lower airborne exposures to hydrocarbons and a lower degree of dermal risk when compared to the diesel based drilling fluids. Worker inhalation exposure to BTEX/Hexane/Heptane was found at some sites using diesel based drilling fluids, but all results were well below the OSHA PEL. BTEX/Hexane/Heptane results below limit of detection for sites that used synthetic drilling fluids. The sampling strategy used in this survey demonstrated an effective approach for determining both airborne and dermal risk to hydrocarbons.

Lessons learned: More work needs to be done to identify what characteristics of synthetic drilling fluid are responsible for the observed lower exposure levels. For dermal exposure quantitative assessment of exposure will strengthen our insight in some of the potential differences in exposure observed.

CS-102-02
Impacts to Your DOT-111 Rail Tank Car Fleet

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Situation/Problem: Based on the Department of Transportation's (DOT) directives to make critical modifications to the widely used DOT-111 class of rail tank cars, many segments of the rail, chemical, oil & gas, and other industries find themselves facing decisive challenges to both meet the deadlines and keep their fleets moving. The catastrophic and high profile failure of some DOT-111 rail tank cars, carrying hazardous materials, has given additional emphasis to the industry as public opinion has dramatically shifted to an unpopular view regarding the use of these rail cars.

Resolution: The DOT directives established specific deadlines for industry to remove and replace certain rail tank car valves sold by McKenzie Valve & Manufacturing. In addition, the directive to improve the safety of Bottom Outlet Valves (BOVs) is yet another focus of DOT's efforts to improve the overall safety performance of the DOT-111 class of rail cars. Methods that industry has or may deploy to deal with these directives include: increased shop time for rail tank cars, use of other classes of rail tank cars, negotiation of contractual obligations, and Management of Change.

Results: While the exact economic impacts of these directives has not yet surfaced, the tight inventory of rail tank cars will inevitably impact a wide range of industries. The ability of a manufacturer to deliver its product on time and on schedule, the ability of rail tank car maintenance providers to meet the demand of these directives on top of existing regular rail tank car maintenance needs, and the ability of enforcement agencies to monitor the implementation of their directives will be key metrics by which we measure the safety of our railroads moving forward.

Lessons learned: The aging of a rail tank car fleet can be observed through many different metrics. However, when the regulatory environment forces an abrupt change, industry must be nimble enough to adjust.

SR-102-03
The Effects of Overtime Among Rotating Shiftworkers in the Oil Industry

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Objective: Refinery operators work extended shifts(12-hour), rotating shifts and increasing overtime rates have been reported. This study analyzes the effects of overtime on the frequency and intensity of shift rotation, and associated impacts on sleep, health, and quality of life indicators among the workforce.

Methods: We administered a self-reported health questionnaire to refinery workers who were members of the United Steelworkers' Oil Sector in 15 states. Reported work schedules, overtime estimates, typical sleep schedules and an evaluation of sleep quality were used to estimate fatigue exposure. Self-reported diagnoses of cardiovascular disease, hypertension, diabetes, and gastrointestinal illness were used to calculate disease prevalence within the workforce. Job stress and quality of life indicators were measured and a depression assessment was performed.

Results: Overtime was associated with increased numbers of shift changes, longer work sets, and fewer days off. Overtime impacted sleep quantity and quality. Poor sleep quality was associated with numerous mental and physical health problems. Overtime was highly correlated with recent GI discomfort, chest pains, elevated resting blood pressure, stress levels, and depressed mood. Individuals with more overtime-intensive work schedules also reported limited time for exercise and leisure, which correlated with elevated BMI and other chronic health conditions.

Conclusions: The 12-hour shift, a compressed work schedule

designed to offer more time at home, has affected many industries. But increasing rates of overtime diminish available recovery time needed to relieve work related fatigue. We found associations between overtime and decreased quality and quantity of sleep, with impacts on long term health and well-being.

SR-102-04

Analyzing Exposure Data from a Global Dataset

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Objective: As part of ExxonMobil's Exposure Assessment Strategy, workplace exposure results (qualitative and quantitative) are collected globally and stored in one database. This allows for global data analysis of exposure data and the assessments which have been completed by industrial hygienists to identify trends, evaluate exposure management program effectiveness, and prioritize continuous improvement activities. In this study, a global exposure data management system consisting of over 80,000 industrial hygiene samples was queried, resulting in a sub-set of approximately 27,300 samples. The samples were then further categorized to examine the effectiveness of controls during the performance of specific tasks. A second objective of this analysis was to identify key factors that would be critical for ensuring accurate interpretation and use of data from such a large data set.

Methods: Short term, personal benzene exposure monitoring data (sample duration of 180 minutes or less) were identified and sorted by task. The dataset was further narrowed down to focus on specific tasks where the use of specific controls could be verified. The analysis included samples collected from the time period 1999-2015 at multiple global manufacturing sites. Tasks such as loading materials, process sample collection, and tank gauging/dipping were grouped further by business line (e.g., supply and distribution, aviation, refining), source material, and control type. The final dataset was then analyzed to assess the effectiveness of control measures.

Results: The analysis of global monitoring data indicates that engineering controls can effectively mitigate exposures. A variety of engineering control categories was evaluated and the effectiveness of control types was compared. For loading tasks, top loading with vapor recovery and bottom loading resulted in significant reductions compared to top loading activities without vapor recovery. For process sample collection, closed system sampling resulted in significant reductions in benzene air concentrations compared to open system sampling.

Conclusions: This study demonstrates the effective reduction of exposures during the performance of typical tasks through the use of various engineering controls, it also highlights the utility of managing and understanding the data in large datasets, and summarizing it appropriately for use by other professionals, organizations, and researchers.

CS-102-05

Assessment of N.O.R.M in Crude Oil Process Equipment During Turnaround Activities

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Situation/Problem: HES identified the potential for residual NORM to be present in crude oil refining process equipment (asphalt storage tank) during a maintenance turnaround due to preceding/unrelated work activities.

Resolution: HES developed a turnaround NORM assessment plan using information collected from a cross-functional team to: (i) identify designs that might mask detecting activity externally and (ii) target specific equipment (anticipated to contain NORM residues) for internal assessment. Plan utilized externally screening equipment during normal operation and after process unit was shut down (pre- and post- chemical cleaning.) Internal surveys were conducted when equipment was initially opened and after additional cleaning. Surveys used a GM Survey Meter equipped with an internal scintillation counter and an external pancake GM detector probe.

Results: External and internal NORM surveys were successful in identifying equipment with residual NORM. Loose NORM residues were reduced to background levels after removal of sludge and areas of fixed NORM were identified. Soiled PPE showed no activity above background levels. Radiochemical analysis of sludge samples identified alpha and beta emitting isotopes.

Lessons learned: Incorporate NORM surveys within the maintenance schedule if mapping NORM distribution patterns. Distribution of NORM activity is not uniform within a process unit or within vertical columns. Plan for physical access challenges for some anticipated NORM accumulation areas. Loose NORM residual sludge is removable and activity levels can be reduced to background. Areas/surfaces near equipment feed inlets showed fixed NORM activity requiring exposure control protocols if the fixed NORM residue is physically disturbed.

CS-102-06

Heat Stress Management for Heater Hot Spot Repair

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Situation/Problem: This is a presentation on the control measures that were taken to address the risks from working in an environment with ambient temperature of more than 38°C. The worsening of a hot spot led to the formation of a hole on a heater roof. The elevated temperature and flue gas egress that resulted posed a risk to the operators who needed to assess the area regularly to perform their routine rounds. There was a critical need to make the area safe. However, as the heater was slated for shutdown in a few months and there was no suitable window for immediate shutdown, an online repair was performed to temporarily cover the hole.

Resolution: An inclusive heat stress management plan was applied to mitigate the risk of heat stress. Hierarchy of controls implemented were: 1) engineering (such as cutting off burners directly below the hot spot, increased ventilation, insulation, etc.), 2) administrative (considering water intake, work schedule, fitness to work, heat acclimatization, personal temperature monitoring, training, etc.), and 3) PPE (aluminized suit with vortex cooling vest). Two rounds of trial runs were conducted to test the above controls & the rescue plan. Controls were proven effective and areas of improvement were identified.

Results: The work was monitored closely to assess the effectiveness of the measures. Globe & ambient temperature

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