

Annotated Bibliography on
OSHA
(Occupational Safety and Health Administration)



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Technical Services Department

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Introduction:

About OSHA:

The Occupational Safety and Health Act of 1970 (OSH Act) was passed to prevent workers from being killed or seriously harmed at work. With the Occupational Safety and Health Act of 1970, the United States Congress created the Occupational Safety and Health Administration (OSHA) to ensure safe and healthful working conditions for workers by setting and enforcing standards and by providing training, outreach, education and assistance.¹

OSHA sets and enforces protective workplace safety and health standards and provides information, training, and assistance to employers and workers. Under the OSH Act, employers have the responsibility to provide a safe workplace.

OSHA has a variety of educational materials and electronic tools available on its website. These include utilities such as expert advisors, electronic compliance assistance, videos and other information for employers and workers. OSHA's software programs and eTools walk you through safety and health issues and common problems to find the best solutions for your workplace. OSHA's extensive publications help explain OSHA standards, job hazards, and mitigation strategies and provide assistance in developing effective safety and health programs.² OSHA publications are accessible from the OSHA website.

This annotated bibliography contains abstracts of articles from 2018 – 2023 for the benefit of the QHSWED department. The database used was Web of Science.

Contact NSTIC to request full-text articles.

¹ <https://www.osha.gov/aboutosha>

² <https://www.osha.gov/sites/default/files/publications/3439at-a-glance.pdf>

Articles' Abstracts:

1. Aday, S. (2019). Evaluation of twa-tlv stel findings toxic formaldehyde steam measured in the technical field. 2019 Medical Technologies Congress (Tiptekno), 286-289.

Abstract: Approximately 50-300 biopsies are accepted daily in routine pathology laboratories. Samples of these tissues and / or organs are fixed with ready-to-use 10% formaldehyde chemical and then tissue samples are converted to permanent paraffin blocks by following the subsequent tissue stages. These jobs and transactions are quite long and labor intensive activities. Formaldehyde is the basic chemical in fixation and can be easily inhaled and its vapors are considered toxic by WHO and OSHA. For this reason, it is compulsory for the employees to use this chemical carefully and to control the use of the chemical by the current legislation. For this reason, in the regulation no. In line with the mentioned regulation, 20 personnel who were exposed to toxic vapor at different times in Medical Pathology Laboratory were measured by using the badge card at the respiratory level for the detection of toxic 10% formaldehyde vapor gas exposure. After the necessary adjustments were made, the readings at the control level with the collar axle at the respiration level were found to be within the acceptable reference range level and the initial measurement values were reduced. The measured values between TWA and TLV-STEL are consistent, the amount of exposure is directly proportional to the duration of exposure, the appropriate working mode, by applying additional air circulation methods and controlled work with short and long-term exposure to the maximum permissible concentration values can be kept under control It is seen that control can be achieved even in formaldehyde studies carried out at high tempo with low cost effective measures.

2. Al-Bayati, A. J., Bilal, G. A., Esmaili, B., Karakhan, A., & York, D. (2021). Evaluating OSHA's fatality and catastrophe investigation summaries: Arc flash focus. Safety Science, 140, 105287.

Abstract: Incident investigations aim to provide meaningful information that can assist in the prevention of future recurrences and aid policymakers in identifying inadequate safety standards and systems. There are few, if any, studies that have assessed the public investigation effort and its contribution to improving overall site safety in the United States. This article assesses the Occupational Safety and Health Administration's (OSHA) Fatality and Catastrophe Investigation Summaries (FCIS) program. The findings indicate that the FCIS does not fulfill all its goals in improving overall site safety, and there is a need for improvement.

Specifically, the program methodology and data collection approach should be reevaluated and revamped to effectively determine the causes of work-related incidents. The findings of this study will assist and encourage public agencies to enhance their investigation programs. In addition, detailed descriptions of the current deficiencies in the process have been provided and should help public entities focus on the most critical elements that need improvement. Precisely, the investigation methodology and findings dissemination are the most critical elements that must be revisited. Overall, this study identifies the current program's key weaknesses that hinder valuable opportunities for acquiring practical knowledge for improving overall safety performance.

3. Alzamzam, W. S., & Alfaghi, W. B. (2021). Noise evaluation in oil and gas fields and associated risk assessment. *Euro-Mediterranean Journal for Environmental Integration*, 6(3), 78.

Abstract: This work investigates the noise levels in oil and gas fields and their impact on the health of operators, visitors, and trainees in these workplaces, as well as possible methods of maintaining that noise within acceptable levels. A risk assessment was performed to identify the noise hazards associated with particular activities or tasks in oil and gas fields. A case study focusing on sulfur recovery units (SRUs) at a gas processing complex consisting of three production plants was carried out. Many master points in these plants where workers present were selected at random. In order to accurately measure the noise level at each point, it was measured at different times during the period 2014-2017 and compared with the maximum safe noise level defined by OSHA (85 dB). Results show that most of the noise levels encountered in the field are above the maximum level. An Ishikawa diagram was created to analyze the causes and effects of excessive noise in the field. Causes included rotating machines, maintenance activities, steam leakages, fluid flows, and gas flares. Finally, the results of the risk assessment indicated that oil and gas fields can present high noise risk scores, implying that workers in those fields could be harmed by the noise.

4. Arbury, S., Collins, N. R., Magtahas, J., Holmes, M., & Hodgson, M. J. (2022). OSHA workplace violence enforcement. *Journal of Occupational and Environmental Medicine*, 64(4), E211-E216.

Abstract: Objective: To examine violence inspections at the Occupational Safety and Health Administration (OSHA). Methods: The authors examined all inspections that involved violence against workers begun by January 1, 2019. They conducted semi-structured interviews

with compliance officers who had conducted inspections on a sample of facilities that received General Duty Clause (GDC) citations (n = 22) or Hazard Alert Letters (HALs) (n = 22). Results: By January 1, 2019, OSHA initiated 726 "violence" inspections, with 502 (69.1%) in healthcare. In healthcare, 45 (11.1%) resulted in GDC citations and 241 (67.7%) in HALs. GDC facilities received statistically significantly lower scores in 5 of 6 domains examined through semi-structured interviews than HAL facilities. Both groups of facilities had poorly designed recordkeeping systems. Conclusions: Health care facilities continue to generate worker complaints with poorly designed violence prevention programs.

5. Arif, M. M., Ahmad, S. R., & Khan, S. M. (2019). Measurement of noise levels: An observational study in engineering laboratories. *Journal of the Pakistan Institute of Chemical Engineers*, 47(2), 9-14.

Abstract: The current study determines the sound levels observed in the engineering laboratories at the Institute of Chemical Engineering and Technology, University of the Punjab, Lahore, Pakistan. The objective of the study was to measure sound-levels of different engineering laboratories during specified time periods and compare them with OSHA standards. The sound-level parameters were investigated in five of the main laboratories. The time weighted average (TWA) and equivalent continuous sound level (L-eq) values were observed at different times and compared with the OSHA standards. The TWA in all the laboratories was estimated to be 65.75 dBA which are within the international OSHA standards for noise however a considerable number of sound-levels in different laboratories were slightly higher than the accepted standards. More studies should be undertaken, as background noise and noise coming from the laboratory equipment can not only cause hearing problems but may also lead to miscommunication and difficulties in performing routine laboratory tasks.

6. Brenner, B., Cawley, J. C., & Majano, D. (2020). Electrically hazardous jobs in the US. *IEEE Transactions on Industry Applications*, 56(3), 2190-2195.

Abstract: This article examined 1004 U.S. Occupational Safety and Health Administration cases of electrical injury that occurred between January 1, 2011 and June 28, 2017. The data are examined to determine which occupations experienced fatal electrical injury. Characteristics such as the degree of injury, the nature of injury, and task assignments at the time of injury were determined. There were 705 fatal electrical injuries from all causes. There were 17 occupations with ten or more fatal cases, led by, in order, "electricians," "construction laborers," "laborers, except construction," "electrical power installers and repairers," and "tree

trimming occupations." In addition, the data are also examined to isolate fatal overhead power line injuries. Overhead power lines were involved in 246 fatal electrical shock injuries to workers and ten burn injuries. Occupations most affected by overhead power line injuries were studied in greater detail. Just six occupations account for more than one half of all those fatally injured by electricity in overhead power line cases. Occupations with ten or more fatal overhead power line injuries include, in order, "construction laborer," "laborers, except construction," "tree trimming occupations," "electrical power installers and repairers," "roofers," and "truck drivers, heavy." Several identified occupations with unexpected electrical exposure, such as "roofers," "tree trimmers," and "truck drivers," are not usually associated with electrically hazardous jobs. Erecting, moving, and dismantling scaffolding, the use of conductive ladders, booms, and tag lines, and tree trimming in the vicinity of overhead power lines were common scenarios in which the fatal electrical injuries are studied. Working without deenergizing circuits, working without proper prejob hazard analysis and planning, and working without proper personal protective equipment also were mentioned in the accident narratives.

7. Brenner, B., & Majano, D. (2020). Expanding workplace electrical safety to non-electrical occupations. 2020 Ieee Ias Electrical Safety Workshop (Esw).

Abstract: This paper reviews 897 OSHA Fatality and Catastrophe Investigation Summaries of fatal electrical injuries between January 1, 2011 and December 31, 2018. These reports were reviewed to discover common trends in workplace electrical fatalities in all industries. The data shows that 64% of all workplace electrical fatalities occurred in occupations outside the electrical field, with many of the fatalities occurring in the "laborers, except construction," "construction laborers," and "tree trimming occupations." Analysis of the reports also found that 38% of all electrically related workplace fatalities occurred because of contact with overhead power lines. Out of the seven occupations that make up over 70% of all overhead power line fatalities, only one occupation is in the electrical field, "electrical power installers and repairers," who work directly with overhead power lines. Since 1976, NFPA 70E Standard for Electrical Safety in the Workplace has been the OSHA recognized standard for electrical safety, but its scope is not meant to create a standard for workers who do not interact with energized electrical equipment as their regular tasks. The authors believe that in order to reduce the number of electrically related fatalities in the workplace, standards provided by NFPA 70E need to be applied to the average non-electrical worker and broadened to include non-English materials.

8. Brenner, B., & Majano, D. (2021). Worker contact with electricity: The characteristics of a workplace electrical fatality. 2021 Ieee Ias Electrical Safety Workshop (Esw).

Abstract: According to the U.S. Bureau of Labor Statistics, since the introduction of the Occupational Injury and Illness Classification System 2.01 in 2011, half of all private industry workplace electrical fatalities occurred within the construction industry. Between 2011 and 2019, the Occupational Safety and Health Administration (OSHA) recorded that 378 cases of electrical fatalities occurred during construction projects. OSHA reports show that the greatest number of electrically related fatalities occurred in alterations or rehabilitations and in new projects or addition builds. Many of these construction projects were for single-family, duplex, or commercial building projects. In examining incidents where contacted voltage was recorded, 57% of fatalities occurred when a worker contacted an energy source of over 1,000 volts. Contact with energy sources of 480 volts and 7,200 volts accounted for the greatest number of fatalities. Gaining a better understanding of the jobs being completed and the source of energy contacted can help identify the behaviors and actions that need to be addressed to lower the number of electrical fatalities in the workplace.

9. Broughel, J., & Baxter, A. (2022). A mortality risk analysis for OSHA's COVID-19 emergency regulations. *Journal of Risk and Financial Management*, 15(10), 481.

Abstract: In 2021, the Occupational Safety and Health Administration (OSHA) issued two emergency temporary standard regulations related to COVID-19 hazards in US workplaces. One regulation covered healthcare sector workers, while the second regulation would have covered workers at firms with 100 or more employees. This paper conducts an original mortality risk analysis for these regulations. Mortality risk analysis evaluates the increase or decrease in expected mortality associated with a new policy, such as a rule or regulation, taking into account economic factors like lost income due to regulatory costs. If we accept OSHA's cost and health benefit estimates at face value, we find that the first regulation related to COVID-19 hazards in the healthcare sector reduces risk initially but increases risk over a longer time horizon. We find that the second regulation would reduce risk according to OSHA's main estimates but may not reduce risk after including some ancillary costs and adjusting the agency's prevented hospitalizations estimate based on more reasonable assumptions. Moreover, OSHA's economic analysis for the two regulations in question does not purport to comprehensively evaluate costs; ergo, our mortality risk estimates probably underestimate countervailing mortality risks stemming from these regulations. We review some of OSHA's underlying assumptions that could change the outcomes of our mortality analysis. These

estimates demonstrate that OSHA would benefit from more comprehensive consideration of costs in its economic analysis.

10. Caban-Martinez, A. J., Santiago, K. M., Stillman, J., Moore, K. J., Sierra, D. A., Chalmers, J., . . . Jordan, M. M. (2018). Physical exposures, work tasks, and OSHA-10 training among temporary and payroll construction workers. *Journal of Occupational and Environmental Medicine*, 60(4), E159-E165.

Abstract: Objective: We characterize and compare the self-reported physical exposures, work tasks, and OSHA-10 training in a non-probabilistic sample of temporary and payroll construction workers. Methods: In June 2016, a total of 250 payroll and temporary general laborers employed at Florida construction sites completed a survey at the job site as part of the falls reported among minority employees (FRAME) study. Results: Workers employed through temp agencies (57.1%) were significantly more likely to report moving or lifting materials more than 100 pounds than payroll workers (38.5%; $P < 0.01$). Temporary construction workers with 10-hour OSHA training (22.2%) spent significantly less time with intense hand use/awkward hand posture than temporary workers without 10-hour OSHA training (46.9%; $P = 0.048$). Conclusions: Temp construction workers with OSHA 10-hour training reported less hazardous physical postures than workers without the same training.

11. Cothorn, E. J., Brazile, W. J., & Autenrieth, D. A. (2023). The evaluation of worker exposure to airborne silica dust during five OSHA table I construction tasks. *Annals of Work Exposures and Health*, 67(5), 572-583.

Abstract: Fifty-one (51) personal silica air samples were collected over 13 days on 19 construction employees while they performed five different construction tasks found in the Occupational Safety and Health Administration's (OSHA) respirable crystalline silica standard for construction, Table 1, which specifies engineering, work practice, and respiratory protection controls that employers can use in lieu of exposure monitoring to adhere to the standard. The average construction task time was 127 min (range: 18-240 min) with a mean respirable silica concentration of $85 \mu\text{g m}^{-3}$ (standard deviation [SD] = 176.2) for all 51 measured exposures. At least one OSHA-specified silica dust control measure was used during all 51 samples collected. The mean silica concentrations for the five tasks were: core drilling $11.2 \mu\text{g m}^{-3}$ (SD = $5.31 \mu\text{g m}^{-3}$), cutting with a walk-behind saw $126 \mu\text{g m}^{-3}$ (SD = $115 \mu\text{g m}^{-3}$), dowel drilling $99.9 \mu\text{g m}^{-3}$ (SD = $58.7 \mu\text{g m}^{-3}$), grinding $172 \mu\text{g m}^{-3}$ (SD = $145 \mu\text{g m}^{-3}$), and jackhammering $23.2 \mu\text{g m}^{-3}$ (SD = $5.19 \mu\text{g m}^{-3}$).

Twenty four of 51 (47.1%) workers were exposed above the OSHA Action Level (AL) of 25 $\mu\text{g m}^{-3}$ and 15 of 51 (29.4%) were exposed above the OSHA Permissible Exposure Limit (PEL) of 50 $\mu\text{g m}^{-3}$ when exposures were extrapolated to an 8-h shift. When silica exposures were extrapolated to 4 h, 15 of 51 (29.4%) of workers sampled were exposed over the OSHA AL and 8 of 51 (15.7%) were exposed over the OSHA PEL. A total of 15 area airborne respirable crystalline silica samples were collected on days where the personal task-based silica samples were taken, with an average sampling time of 187 min. Of the 15 area respirable crystalline silica samples, only four were greater than the laboratory reporting limit of 5 $\mu\text{g m}^{-3}$. The four area silica samples with reportable concentrations revealed background silica concentrations of 23 $\mu\text{g m}^{-3}$, 5 $\mu\text{g m}^{-3}$, 40 $\mu\text{g m}^{-3}$, and 100 $\mu\text{g m}^{-3}$. Odds ratios were used to analyze the apparent association between dichotomous background construction site exposures to respirable crystalline silica (detectable or not detectable), and personal exposure category (over or not over the OSHA AL and PEL) when exposure times were extrapolated to 8 h. The associations were strongly positive and significant between detectable background exposures and personal overexposures for workers conducting the five Table 1 tasks with engineering controls in place. The results of this study suggest that exposure to hazardous levels of respirable crystalline silica may be present even when OSHA-specified engineering controls are implemented. The current study findings also suggest that background construction site silica concentrations may potentially cause task-based overexposures, even when the OSHA Table 1 control methods have been put in place.

12. Doney, B. C., Miller, W. E., Hale, J. M., & Syamlal, G. (2020). Estimation of the number of workers exposed to respirable crystalline silica by industry: Analysis of OSHA compliance data (1979-2015). *American Journal of Industrial Medicine*, 63(6), 465-477.

Abstract: Background Respirable crystalline silica (RCS) can potentially cause silicosis, lung cancer, and renal failure. The current study estimates the percentages of workers potentially overexposed to concentrations of RCS dust and silicosis proportional mortality rates (PMRs) by industry. Methods Occupational Safety and Health Administration compliance inspection sampling data for RCS collected during 1979 to 2015 were used to estimate percentages of workers exposed. The results were used in combination with US Census Bureau estimates to produce industry specific worker population estimates for 2014. Estimates of the numbers and percentages of workers exposed to RCS concentrations at least 1, 2, 5, and 10 times the National Institute for Occupational Safety and Health recommended exposure limit (REL) were

calculated by industry using the 2002 North American Industry Classification System. Silicosis PMRs by industry were estimated using National Center for Health Statistics multiple cause of death data. Results RCS concentrations/workers exposed were highest in the poured concrete foundation and structure contractors; commercial and institutional building construction; and masonry contractors. Approximately 100 000 workers were exposed above the RCS REL, and most (79%) worked in the construction industry. Tile and terrazzo contractors (12%); brick, stone, and related construction merchant wholesalers (10%); masonry contractors (6%) and poured concrete foundation and structure contractors (6%) were the highest percentages of workers potentially overexposed. PMRs were highest for the structural clay product manufacturing and the foundries industries. Conclusion Percentages of workers exposed to RCS varied by industry and in some industries workers are exposed over 10 times the REL. Exposures can be reduced below the REL by implementing the hierarchy of controls.

13. Earn, J. (2022). Exploring the gap in the occupational safety and health administration (OSHA) laboratory standard: A literature review and recommendations to enhance histology laboratory safety practices. *Journal of Histotechnology*, 45(3), 107-115.

Abstract: This article discusses current available resources with respect to regulatory agencies including the Occupational Safety and Health Administration (OSHA) for determining the requirements placed upon laboratories for handling of hazardous materials. The focus is specific to the histology laboratory and xylene use, and includes a literature review, admixed with historical reference points. Procedures and tasks in the histology laboratory are highlighted in relation to their connection to the quality of the work environment with an emphasis on air quality. Recommendations are provided for maintaining an appropriate work environment for the prevention of potential adverse health effects. The gap within the OSHA Laboratory Standard, i.e. a lack of explanatory language, leaves much open to interpretation regarding fume hood usage with volatile hazardous chemicals. As a result, both the level of safety training and the awareness of good laboratory practices (GLP) for handling volatile hazardous reagents such as xylene can become compromised.

14. Edwards, V., & Study, K. (2018). "It is better to be safe 100 times than dead once."- mark twain. *Process Safety Progress*, 37(4), 452-458.

Abstract: A number of major process incidents during the 1980s led the Occupational Safety and Health Administration (OSHA) to promulgate the process safety management regulation in 1992 (1). Those incidents and the anticipation of the new OSHA regulations energized the

South Texas Section of American Institute of Chemical Engineers (AIChE), and eight other organizations including the AIChE Center for Chemical Process Safety (CCPS), to create the first process plant safety symposium (PPSS) in 1992. The symposium was held in Houston as a low-cost and convenient training forum for the large community of engineers and scientists at regional chemical process plants and refineries. Approximately 700 people attended. Subsequently, the PPSS has evolved to become one of the four main tracks in AIChE's Global Congress on Process Safety. In the intervening years, 18 PPSSs have been held. The unique focus of these symposia has been on practices, perspectives, methods, and tools to improve process safety at the plant level. This article, presented at the 20th PPSS, reviews examples of how progress in process safety has been facilitated by these symposia. The article concludes with a look to the future for needed advances in process safety. (c) 2018 American Institute of Chemical Engineers Process Saf Prog 37: 452-458, 2018

15. Gauthier, T. L., Neitzel, D. K., & Wallis, D. (2020). The bottom line - live parts to which an employee may be exposed shall be deenergized. 2020 IEEE IAS Electrical Safety Workshop (ESW).

Abstract: This paper not only identifies the conditions in which deenergized equipment is mandated by the Occupational Safety and Health Administration (OSHA) in 29 CFR 1910.333(A)(1); it also identifies when energized work is allowed by OSHA under the same standard, and where energization is not allowed based on letters of interpretation and other OSHA standards. OSHA and the National Fire Protection Association (NFPA), as well as others, require employers to protect their employees from electrical hazards in the workplace. In order to protect workers, there must be a strong emphasis on performing work on equipment in a deenergized state. This paper will focus on the conditions listed in 29 CFR 1910.333(A)(1) which allow equipment to be worked on in an energized state when deenergization: Introduces additional or increased hazards Is infeasible due to equipment design or Operational limitations Once the disclaimers are removed from deenergized work, the only requirement left is to work on equipment in an electrically safe work condition - off and controlled.

16. Guth, K., Bourgeois, M., Johnson, G., & Harbison, R. (2020). Assessment of lead exposure controls on bridge painting projects using worker blood lead levels. Regulatory Toxicology and Pharmacology, 115, 104698.

Abstract: A retrospective analysis of worker blood lead levels (BLL) was conducted using blood lead data collected by four bridge painting contractors before and after lead exposure.

The objective of the study was to evaluate the effectiveness of exposure controls in preventing elevated blood lead levels ($> 25 \mu\text{g/dl}$) during bridge painting projects. The contractors selected for the study submitted BLL data for 289 workers representing ten work tasks and 11 bridge painting projects. In total, 713 blood lead levels results were evaluated. The mean blood lead level for all work classifications combined was $10.9 \mu\text{g/dl}$ at baseline compared with $14.9 \mu\text{g/dl}$ after two months of exposure and $15.0 \mu\text{g/dl}$ after four months of exposure. Two months after initial exposure, 29% of the painters and 35% of the laborers had a $10 \mu\text{g/dl}$ incremental increase or greater in blood lead level. Likewise, 18% of the painters and 26% of the laborers had a blood lead level greater than $25 \mu\text{g/dl}$ during the same time. The blood lead levels that exceeded the $25 \mu\text{g/dl}$ threshold ranged from $30 \mu\text{g/dl}$ - $63 \mu\text{g/dl}$ for painters and $26 \mu\text{g/dl}$ - $56 \mu\text{g/dl}$ for laborers. All work tasks with high-intensity exposure (abrasive blaster/painter, abrasive blaster, painter & laborer) experienced an average blood lead level increase that ranged from $0.2 \mu\text{g/dl}$ to $8.9 \mu\text{g/dl}$ two months after initial exposure. Blood lead testing conducted after modified exposure controls (two months after the initial follow-up blood testing) were implemented showed a decrease in average blood lead levels (range $-0.14 \mu\text{g/dl}$ to $-2.7 \mu\text{g/dl}$) for two high-intensity exposure work tasks. In comparison, the other two high-intensity work tasks had moderate increases (range $1 \mu\text{g/dl}$ to $2.4 \mu\text{g/dl}$). The modified exposure controls included an increase in the air velocity inside of the work containment and an administrative control in the form of additional worker training on lead exposure prevention. The reduction in the 95th percentile (point estimate) BLL exposure profile for each exposure group at the 4-month follow-up blood testing period is associated with modified exposure controls. Ineffective exposure controls were identified through the analysis of worker BLLs. We found two exposure groups (laborer and painter) whose 95th percentile (point estimate) exposure profile was greater than the OSHA construction lead standard's targeted BLL goal ($25 \mu\text{g/dl}$) during the first two months of exposure. Our research findings provide support for monthly blood lead testing after baseline until blood lead levels are controlled to an acceptable concentration.

17. King, G., Miller, A., Schneider, C., Feagan, G., & Gain, D. (2023). Evaluation of a self-cleaning portable dust collector for reducing worker exposures to silica at hydraulic-fracturing sites. *Journal of the Air & Waste Management Association*, 73(2), 109-119.

Abstract: National Institute for Occupational Safety and Health (NIOSH) researchers continue to study worker exposure to respirable crystalline silica (RCS) and develop interventions to reduce these exposures. Occupational overexposures to RCS continue to cause illness and

deaths in many industries and RCS has been identified as a serious exposure risk associated with hydraulic- fracturing operations during oil and gas extraction. In 2016 the Occupational Safety and Health Administration (OSHA) reduced the permissible exposure limit (PEL) to 0.05 milligrams of silica per cubic meter of air, averaged over an 8-hour day. This mandate requires hydraulic-fracturing operations to implement dust controls and safer work methods to protect workers from silica exposures above this PEL by June 23, 2021. At hydraulic-fracturing sites utilizing sand movers, pneumatic transfer of fracking sand is the primary source of aerosolized RCS. Currently, there are limited commercially available engineering controls for the collection of dust emitted from thief hatches on sand movers. The goal of this research is to develop a robust, cost-effective, weather resistant, portable, self-cleaning dust collection system that can be retrofitted onto sand mover thief hatches. A prototype was designed, built, and tested, and it was determined that the system could handle flows in the range of 600 to 1300 cfm with loading/cleaning cycle times of 40 and 5 minutes respectively and demonstrated operating efficiencies of 97-99%. Further development of this NIOSH prototype is being done in collaboration with an industry partner with the goal of developing a commercially viable, cost-effective solution to reduce RCS at hydraulic-fracturing sites around the world. Implications: This research has verified that airborne dust created by pneumatic transfer of fracking sand can be effectively collected using a passive cartridge filter system, and that the filters can be cleaned using blasts of air. Mounting these units to the thief hatches of sand movers will significantly reduce dust emissions from sand movers on hydraulic fracturing sites. Thus, this system offers the Oil and Gas Industry a method to reduce worker exposure to RCS on hydraulic fracturing sites that utilize sand movers. The success of this prototype has led researchers to devise a modified version for collecting dust at conveyor transfer points.

18. Ko, C., & Abdulmajeed, H. A. (2022). Improving construction safety: Lessons learned from COVID-19 in the united states. *Sustainability*, 14(12), 7137.

Abstract: During the COVID-19 pandemic, construction accidents in the United States (US) dropped dramatically compared to previous years. This research uses Saunders' research onion approach to conduct a deep and systematic analysis of pre- and post-COVID-19 data to understand this phenomenon. The proposed research framework examines safety and prevention measures implemented by the US government, using data collected from various US government agencies, including the Occupational Safety and Health Administration (OSHA), Centers for Disease Control and Prevention (CDC), and US Bureau of Labor

Statistics. COVID-19's effects on construction site health and safety were analyzed and ranked in order of efficacy in a hierarchy of control, and findings reveal a number of safety measures that can potentially be implemented to promote improved construction safety even after COVID-19 is over.

19. Kreffft, S., Wolff, J., & Rose, C. (2020). Silicosis: An update and guide for clinicians. *Clinics in Chest Medicine*, 41(4), 709-+.

Abstract: This overview provides an update on silicosis epidemiology with review of exposures and emerging trends in acute and accelerated silicosis in the twenty-first century. The silicosis epidemics in mining, denim sandblasting, and engineering stone industries are highlighted. Clinical presentations of silicosis and silica-related conditions such as autoimmune, kidney, and mycobacterial disease, as well as lung cancer, are discussed. Important aspects of the new OSHA 2017 Silica Standard are presented. This review also includes practical guidance for clinicians to address questions that may arise when evaluating silica-exposed patients and to the public health responses needed following a diagnosis of silica-related disease.

20. Liebman, A., Franko, E., Reyes, I., Keifer, M., & Sorensen, J. (2018). An overview and impact assessment of OSHA large dairy local emphasis programs in new york and wisconsin. *American Journal of Industrial Medicine*, 61(8), 658-666.

Abstract: Background: Farming has been exempted from most labor regulations and shielded from regulatory scrutiny by the Occupational Safety and Health Administration (OSHA). Yet, agriculture and dairy in particular, has relatively high injury and fatality rates. Methods: A recent shift in OSHA's approach to agricultural worker safety and health includes two dairy-focused Local Emphasis Programs (LEPs), one launched in Wisconsin in 2011 and the other in New York in 2014. We examine data from LEP-related, OSHA consultations and inspections as well as non-governmental audit programs, and review farmer perceptions about the LEP. Results: Inspections conducted by OSHA and private consultation programs highlight the presence and variety of hazards on dairy farms in Wisconsin and New York. Conclusion: The LEPs helped raise dairy producers' awareness of inherent hazards and methods to correct them. Farmers cited the LEP as beneficial, identifying it as a catalyst to reduce hazards on their farms.

21. Mahan, B., Maclin, R., Ruttenberg, R., Mundy, K., Frazee, T., Schwartzkopf, R., & Morawetz, J. (2018). Labor-management cooperation in illinois: How a joint union company team is improving facility safety. *New Solutions-a Journal of Environmental and Occupational Health Policy*, 28(2), 227-239.

Abstract: This study of Afton Chemical Corporation's Sauget facility and its International Chemical Workers Union Council (ICWUC) Local 871C demonstrates how significant safety improvements can be made when committed leadership from both management and union work together, build trust, train the entire work force in U.S. Occupational Safety and Health Administration 10-hour classes, and communicate with their work force, both salaried and hourly. A key finding is that listening to the workers closest to production can lead to solutions, many of them more cost-efficient than top-down decision-making. Another is that making safety and health an authentic value is hard work, requiring time, money, and commitment. Third, union and management must both have leadership willing to take chances and learn to trust one another. Fourth, training must be for everyone and ongoing. Finally, health and safety improvements require dedicated funding. The result was resolution of more than one hundred safety concerns and an ongoing institutionalized process for continuing improvement.

22. Marroquin, A., Rehman, A., & Madani, A. (2020). High-voltage arc flash assessment and applications. *IEEE Transactions on Industry Applications*, 56(3), 2205-2215.

Abstract: This article explores the need for high-voltage arc flash (HVAF) assessment for utility workers who are exposed to the line to line voltages above 15 kV. The regulatory requirements will be discussed including OSHA, NESC, etc., to get an understanding of how utilities consider HVAF. Furthermore, the methods for evaluating HVAF, key driving factors, and rule of thumbs, and HVAF personal protective equipment will be discussed and compared in great detail to aid in the selection of a thermal incident energy evaluation method. The article includes an example application of HVAF assessment using various commercially available software. This example illustrates the importance of performing an HVAF assessment for utility applications and highlights the differences between thermal incident energy evaluation methods and how they can be conservatively applied for situations outside their intended application range.

23. Mitchell, A. H., Pannell, M. A., Arbury, S., Thomas, R., & Hodgson, M. J. (2019). Bloodborne pathogens standard enforcement at the occupational safety and health administration: The first twenty-five years. *New Solutions-a Journal of Environmental and Occupational Health Policy*, 29(2), 172-185.

Abstract: Bloodborne pathogen exposures continue to be an occupational health concern of high importance. It is uncertain whether national regulations and enforcement have an impact on employer action for reducing risk. The goal of this research was to determine whether citations issued under the Occupational Safety and Health Administration's Bloodborne Pathogens Standard changed over time given these changing risks and controls. Researchers analyzed 31,066 inspections. There were 77,142 citations issued between 1991 and 2015. The highest frequency is the time period just after revisions of the 2001 standard. There were striking levels of noncompliance, most evident in Exposure Control Plan and Recordkeeping violations. No other pattern or change was evident. In the time periods after 2005, numbers of citations remained steady or declined. As new bloodborne pathogens emerge annually, it is essential to continue to focus on enforcing the standard to keep employers in compliance and workers protected.

24. Namian, M., Al-Bayati, A., & Nnaji, C. (2022). Role of safety training in reducing fatigue among construction workers. *Construction Research Congress 2022: Health and Safety, Workforce, and Education*, 641-650.

Abstract: Construction is one of the most hazardous industries for its workers responsible for performing physically and mentally demanding tasks. Several factors impact the safety performance of construction workers. The inherent nature of construction makes workers susceptible to suffer from high-fatigue levels. Fatigue has been proven to have adverse impacts on the functionality of workers and their safety performance. In other words, reducing fatigue positively contributes to safety risk mitigation and accident prevention in construction. Safety training programs (i.e., OSHA 10/30) aim to enhance construction safety and prevent accidents. Therefore, this study hypothesized that such safety training programs equip construction workers with the necessary skills to reduce fatigue risk. To test the research hypothesis, 117 construction workers in the United States participated in the study. Fifty-six (48%) workers had received OSHA 10 and/or 30-hour training, while 60 (52%) of them had not received the training. The fatigue levels of both groups were measured using Occupational Fatigue Exhaustion Recovery (OFER) Scale. The data analysis showed a significant difference (p -value < 0.01) in the fatigue levels between workers who received OSHA safety training (OFER-

Score = 33%) and workers who did not receive safety training (OFER-Score = 42%). The results of this study demonstrate that safety training such as OSHA 10/30 is associated with lower fatigue levels among workers. The findings suggest that such training courses that familiarize workers with safety skills (e.g., mitigating ergonomic risks) can help them perform their duties effectively and ergonomically, leading to lower fatigue levels.

25. Namian, M., Tafazzoli, M. (., Kermanshachi, S. (., & Huang, Y. (2022). Do OSHA 10/30-hours training programs revamp the safety attitudes of construction workers? Construction Research Congress 2022: Health and Safety, Workforce, and Education, 679-687.

Abstract: Safety attitude plays a major role in the safety performance of construction workers. Research has demonstrated that a positive safety attitude decreases the likelihood of workers' unsafe behavior. Unsafe behavior is reportedly accountable for the majority of construction accidents. The construction industry, unfortunately, suffers from high rates of fatal and non-fatal accidents, and workers' safety performance enhancement is essential to prevent accidents in workplaces. The Occupational Safety and Health Administration (OSHA) offers safety training, among which OSHA 10-h and OSHA 30-h programs are the most recognized and prevalent training. Extensive research studies have evaluated the effectiveness of such training programs. However, the impact of these out reach courses on the safety attitude of construction workers has not been investigated. Therefore, this article aims to examine the impact of OSHA 10/30-h construction training on the safety attitude. One-hundred and seventeen construction workers in the United States were recruited, and their safety attitude was measured using a standard questionnaire. Among the participants, 56 (48%) had participated in OSHA 10 and/or OSHA 30, and the rest of the workers asserted they did not attend such training courses. The results of the t-tests show a statistically significant difference among workers' safety attitudes, indicating that OSHA 10/30-h training succeeded in changing the safety attitude of workers for the better (cognitive and behavioral). Given the importance of safety attitude, the study's findings urge the safety trainers, professionals, and policymakers to incorporate safety attitude enhancement elements to OSHA 10/30 agendas and advance their training effectiveness to improve construction safety.

26. Neitzel, D. K. (2018). Identifying the requirements for qualified, unqualified, and competent persons' electrical safety training. *IEEE Transactions on Industry Applications*, 54(1), 5-9.

Abstract: This paper provides an understanding of what constitutes a qualified person, an unqualified person, and a competent person. Also included are the training requirements for each classification. The principles for performing a needs assessment, a job/task analysis, and job hazard analysis are addressed as they relate to the information gathering needed for the development of an effective training program. This gathered information applies to all personnel who are, or may be, exposed to electrical hazards, and who may work on, near, or interact with the electrical systems and equipment.

27. Nwudu, V., Fletcher, A. M., & Bauer, M. (2018). Patterns and predictors of personal protection compliance and workplace hygiene behaviors among workers with elevated blood lead levels in new york state. *Journal of Occupational and Environmental Hygiene*, 15(9), 654-663.

Abstract: Despite increasing awareness and significant progress in reducing lead exposure among workers, elevated blood lead levels (BLLs) continue to be an occupational health problem. Little is currently known about the extent of personal protective equipment (PPE) use among lead-exposed workers. We examined the patterns and predictors of consistent PPE use and workplace hygiene behaviors among workers with elevated BLLs using a survey of 1,459 workers with an occupational lead exposure in New York State (NYS). Routine availability of respirators was commonplace, however only approximately half of workers consistently wore PPE while working with lead. Regular access to showers was reported by 41% of workers, but less than a quarter took showers and subsequently changed into clean clothing before leaving work site. Significant predictors of consistent PPE use and good hygiene behaviors were identified. The findings highlight the need for further educational and policy interventions for lead-exposed employees. Increased employer efforts are also required to provide workplace structures and a culture that supports compliance. These include the provision of routine training and hazard communication, provision of appropriate PPE and hygiene facilities, and enforcing its use where necessary.

28. Park, S., Johnson, M. D., & Hong, O. (2020). Analysis of occupational safety and health administration (OSHA) noise standard violations over 50 years: 1972 to 2019. *American Journal of Industrial Medicine*, 63(7), 616-623.

Abstract: Introduction Noise exposure has long been an occupational health concern and has been an important area of focus of the Occupational Safety and Health Administration (OSHA) since its founding. Nevertheless, it remains unclear what effects OSHA's noise standards have had on employer efforts to reduce risks. Consequently, a review of OSHA noise standard violations was performed to clarify the violation trends between 1972 and 2019. Methods Using the OSHA Information System, researchers identified 119 305 violations involving four noise standards between 1972 and 2019: 29 CFR 1910.95, occupational noise exposure in general industry; 1926.52, occupational noise exposure in construction; 1926.101, hearing protection in construction, and 1904.10, recording criteria for cases involving occupational hearing loss. Violation frequencies of noise standard subparagraphs and relationships to factors such as industry differences were analyzed using descriptive statistics and t tests. Results The most commonly violated noise standard was 1910.95 in manufacturing. Such violations rose between 1972 and 1985 and then declined steadily. Whether in general industry or construction, four noise standards were most-frequently cited: lack of feasible administrative or engineering controls (1910.95[b] and 1926.52[d]) and inadequate hearing conservation program (1910.95[c] and 1926.52[b]). These violations were more highly penalized (mean = \$1036.50) than other subparagraph violations (mean = \$915.80). Programmed and unprogrammed inspections generated similar violation quantities except between 1980 and 1985, when programmed inspections exhibited a sharp spike in violations. Conclusion The study identified trends in OSHA noise standard violations and possible explanations for those trends. The study findings can support development of more practical noise-exposure protection policy.

29. Phillips, A., Cooney, R., Harris, Z., Myrttil, D., & Hodgson, M. (2019). Noise and occupational medicine common practice problems. *Journal of Occupational and Environmental Medicine*, 61(12), 1019-1029.

Abstract: Noise-induced hearing loss (NIHL) represents the second most common occupational disease in the United States. Although the Occupational Safety and Health Administration (OSHA) has promulgated an occupational noise exposure standard and associated record-keeping requirements, OSHA inspections increasingly document practices that violate both the noise standard and record-keeping regulation. This article describes five deviations from good clinical practices masking the true societal costs of NIHL, leading to

missed prevention opportunities, and creating burdens for individuals and society. These include attributing NIHL to nonoccupational sources, exculpating the workplace because of audiogram patterns without careful documentation, ignoring symptoms or physical examination findings, and simply denying work-relatedness, leading to employers inappropriately lining out cases from the OSHA 300 log. The practices identified by OSHA suggest that many individuals are not following widely recognized and accepted practices when administering hearing conservation programs.

30. Reul, N. K., Gray, Z., Braid, B. B., & Leland, M. A. (2022). Tuberculosis screening in silica-exposed workers developing a tool for health care providers. *Public Health Reports*, 137(2), 244-254.

Abstract: Both the Occupational Safety and Health Administration and Washington State require safety and health protections for workers exposed to respirable crystalline silica, including tuberculosis (TB) screening as part of occupational medical surveillance. We describe the creation of a TB screening tool for silica-exposed workers receiving regulated medical surveillance examinations in Washington State. The tool provides relevant clinical recommendations to assist health care providers and public health practitioners who choose to use the tool when performing such examinations. A cross-disciplinary team at the Washington State Department of Labor and Industries created the TB screening tool to help health care providers identify silica-exposed workers who should receive a comprehensive evaluation for active TB disease and workers who should or must receive testing for latent TB infection. The Washington State Adult Tuberculosis Screening Tool for Workers Exposed to Respirable Crystalline Silica benefits occupational and respiratory clinicians and public health practitioners by aiding both the individual- and population-level delivery of occupational health and TB screening services to silica-exposed workers receiving required medical surveillance examinations.

31. Sarazin, P., Burstyn, I., Kincl, L., Friesen, M. C., & Lavoue, J. (2018). Characterization of the selective recording of workplace exposure measurements into OSHA's IMIS databank. *Annals of Work Exposures and Health*, 62(3), 269-280.

Abstract: Objectives: The Integrated Management Information System (IMIS) is the largest multi-industry source of exposure results available in North America. In 2010, the Occupational Safety and Health Administration (OSHA) released the Chemical Exposure Health Data (CEHD) that contains analytical results of samples collected by OSHA inspectors.

However, the two databanks only partially overlap, raising suspicion of bias in IMIS data. We investigated the factors associated with selective recording of CEHD results into the IMIS databank. Methods: This analysis was based on personal exposure measurements of 24 agents from 1984 to 2009. The association between nine variables (level of exposure coded as detected versus non-detected (ND), whether a sampling result was part of a panel of chemicals, duration of sampling, issuance of a citation, presence of other detected levels during the same inspection, year, OSHA region, amount of penalty, and establishment size) and a CEHD sampling result being reported in IMIS was analyzed using modified Poisson regression. Results: A total of 461 900 CEHD sampling results were examined. The proportion of CEHD sampling results recorded into IMIS was 38% (51% for detected and 28% for ND measurements). In the models, the detected sampling results were associated with a higher probability of recording into IMIS than ND sampling results, and this difference was similar for panel versus non-panel samples. Probability of recording remained constant from 1984 to 2009 for sampling results measured on panels but increased for sampling results of single determinations of an agent. Some OSHA regions had probability of recording two times higher than others. No other variables that we examined were associated with a CEHD sampling result being reported in IMIS. Conclusions: Our results indicate that the under-reporting of sampling results in IMIS is differential: ND results (especially those determined from the panels) seem less likely to be recorded in IMIS than other results. It is important to consider both IMIS and CEHD data in order to reduce bias in evaluation of exposures in workplaces inspected by OSHA.

32. Suh, Y. (2021). Sectoral patterns of accident process for occupational safety using narrative texts of OSHA database. *Safety Science*, 142, 105363.

Abstract: The narrative text analytics has recently focused on identifying an accident process in the various fields of safety such as manufacturing, construction, chemicals, and service. In particular, narrative texts allow finding multiple accident factors and types of accident process including industry, hazard, work activity, and accident result. To present similarity and difference of accident process by categorizing those multiple accident factors shared across industries, identifying sectoral patterns of accidents are useful. In this respect, this study aims to identify the sectoral patterns of accident process using narrative texts information contained in accident reports. For this, the textmining and latent Dirichlet allocation (LDA) algorithms are used to extract topics of accidents and their main factors, matched with class of industries. As a result of the case study for the Occupational Safety and Health Administration (OSHA) in the United States, the five sectoral patterns of accident process are identified: scale-intensive,

facility-intensive, supplier-dominated, market-dominated, and service-dominated patterns. According to these sectoral patterns, managers and policy makers in the fields of safety take a look at the management issues related to the industry, source, activity, and accident result, considering respective characteristics of industrial sites.

33. Tinc, P. J., Carrabba, J., Meyerhoff, A., & Horsman, M. (2018). Assisting new york dairy farms with preparing for OSHA safety inspections. *Journal of Agromedicine*, 23(1), 20-24.

Abstract: In 2013, the Occupational Safety and Health Administration announced a Local Emphasis Program targeted at New York farmers. This program involved random inspections of dairy farms across the state. This article provides an overview of the efforts made in New York to prepare farmers for these inspections. As a result of this program launch, several safety services offered by the New York Center for Agricultural Medicine and Health were significantly impacted, and required expansion and modification in order to meet the needs of New York farmers.

34. Tustin, A. W., & Cannon, D. L. (2022). Analysis of biomonitoring data to assess employer compliance with OSHA's permissible exposure limits for air contaminants. *American Journal of Industrial Medicine*, 65(2), 81-91.

Abstract: Background The Occupational Safety and Health Administration (OSHA) regulates exposures to hazardous chemicals in workplace air. When contemporaneous exposure measurements are unavailable, retrospective analysis of biomarkers could provide valuable information about workers' exposures. Methods Single-compartment pharmacokinetic (PK) models were created to relate the concentration of a chemical in the air to the concentration of the chemical or its metabolite in workers' blood or urine. OSHA utilized the PK models in investigations of three fatal incidents in which workers were exposed to nickel carbonyl, methyl bromide, or styrene. To obtain the minimum plausible estimate of each exposure, OSHA used conservative assumptions about parameters such as workers' inhalation rates, baseline levels of biomarker, and chemicals' volumes of distribution. Results OSHA analyzed a worker's urinary nickel concentration and concluded that his 8-h time-weighted average exposure to nickel carbonyl was at least 0.06 mg/m³. Analysis of a worker's postexposure, premortem blood bromide level revealed that his exposure to methyl bromide was at least 181 mg/m³. Post-mortem blood styrene measurements suggested that a third worker's exposure to styrene was at least 625 mg/m³. These exposures exceeded OSHA's permissible exposure

limits of 0.007 mg/m³ for nickel carbonyl, 80 mg/m³ for methyl bromide, and 426 mg/m³ for styrene. OSHA successfully cited the three employers for violations of chemical exposure limits. Conclusions Analysis of biomarkers via PK modeling enables retrospective evaluations of workers' acute exposures to hazardous chemicals. These techniques are useful to occupational regulators who assess employer compliance with mandatory exposure limits.

35. Tustin, A. W., Cannon, D. L., Arbury, S. B., Thomas, R. J., & Hodgson, M. J. (2018). Risk factors for heat-related illness in US workers an OSHA case series. *Journal of Occupational and Environmental Medicine*, 60(8), E383-E389.

Abstract: Objective: The aim of this study was to describe risk factors for heat-related illness (HRI) in U.S. workers. Methods: We reviewed a subset of HRI enforcement investigations conducted by the Occupational Safety and Health Administration (OSHA) from 2011 through 2016. We assessed characteristics of the workers, employers, and events. We stratified cases by severity to assess whether risk factors were more prevalent in fatal HRIs. Results: We analyzed 38 investigations involving 66 HRIs. Many workers had predisposing medical conditions or used predisposing medications. Comorbidities were more prevalent in workers who died. Most (73%) fatal HRIs occurred during the first week on the job. Common clinical findings in heat stroke cases included multiorgan failure, muscle breakdown, and systemic inflammation. Conclusion: Severe HRI is more likely when personal susceptibilities coexist with work-related and environmental risk factors. Almost all HRIs occur when employers do not adhere to preventive guidelines.

36. Tustin, A. W., Cooney, R., Lamson, G. E., & Hodgson, M. J. (2021). A cluster of hypersensitivity pneumonitis associated with exposure to metalworking fluids. *American Journal of Industrial Medicine*, 64(11), 915-923.

Abstract: Background Workers exposed to metalworking fluids (MWF) can develop respiratory illnesses including hypersensitivity pneumonitis (HP). These respiratory manifestations are likely due to microbial contamination of aerosolized MWF. This paper reports a cluster of HP and respiratory symptoms at a manufacturing plant where MWF and workplace air were contaminated with bacterial endotoxin despite frequent negative bacterial cultures of MWF. Methods A pulmonologist assessed and treated three workers with respiratory symptoms. The Occupational Safety and Health Administration (OSHA) inspected the plant. OSHA's investigation included bacterial culture of MWF, measurement of endotoxin concentrations in MWF and workplace air, review of the employer's fluid management

program, and distribution of a cross-sectional symptom questionnaire. Results Three workers had biopsy-confirmed HP. In addition, 30.8% of questionnaire respondents reported work-related respiratory symptoms. OSHA detected endotoxin levels as high as 92,000 endotoxin units (EU)/ml in MWF and 3200 EU/m³ in air. Endotoxin concentrations and risk of MWF inhalation were highest near an unenclosed multistation computer numerical control machine. A contractor had tested this machine's MWF for bacterial growth weekly during the preceding three years, and most (96.0%) of those tests were negative. Conclusions Contaminated MWF can cause severe occupational lung disease even if microorganisms do not grow in fluid cultures. Endotoxin testing can increase the sensitivity of detection of microbial contamination. However, employers should not rely solely upon MWF testing data to protect workers. Medical surveillance and meticulous source control, such as engineering controls to suppress MWF mist and prevent its inhalation, can reduce the likelihood of respiratory disease.

37. Tustin, A. W., Kundu-Orwa, S., Lodwick, J., Cannon, D. L., & McCarthy, R. B. (2022). An outbreak of work-related asthma and silicosis at a US countertop manufacturing and fabrication facility. *American Journal of Industrial Medicine*, 65(1), 12-19.

Abstract: Background Outbreaks of severe silicosis have affected workers who fabricate artificial stone countertops. Work-related asthma (WRA) has not been a prominent feature of those prior outbreaks. Methods This report describes an outbreak of WRA and silicosis at a facility that manufactures and fabricates chemical-resistant countertops comprised of sand, epoxy resin, and phthalic anhydride (PA), a known respiratory sensitizer. The multi-disciplinary investigation included clinical examinations of workers, an industrial hygiene survey with qualitative and quantitative exposure assessments, and a cross-sectional questionnaire. Results Engineering controls and personal protective equipment were inadequate. Some workers were exposed to PA or silica above permissible exposure limits established by the Occupational Safety and Health Administration (OSHA). Clinical and epidemiologic investigations identified 16 workers with confirmed or suspected WRA. Two years later, after OSHA began to enforce its new silica standards, 12 workers received medical surveillance for silicosis. Of these 12 workers, four (33.3%) were diagnosed with silicosis based on abnormal chest computed tomography examinations. Conclusions Artificial stone countertop workers can develop asthma or silicosis. Risk of asthma may be highest in workers exposed to asthmagens such as PA and epoxy resins while manufacturing the artificial stone material.

38. Tustin, C. E., & Tustin, A. W. (2023). Reports to OSHA of severe occupational injuries due to animals, 2015-2021. *American Journal of Industrial Medicine*.

Abstract: Background: Workers can be injured by animals such as mammals and insects. Previous studies found that most animal-related occupational fatalities were caused by horses and cattle. We analyzed characteristics of recent nonfatal severe animal-related injuries in US workers. Methods: The severe injury reports (SIR) database, collected by the Occupational Safety and Health Administration, contains employer self-reports of inpatient hospitalizations and amputations. We used 2015-2021 SIR data to assess properties of animal-related injuries, including the type of animal involved, the nature of the injury, and the industry of the employer. Industry-specific incidence rates were calculated. Results: We identified 788 severe animal-related injuries during the 7-year study period. Mammals caused over half of these injuries (476; 60.4%), followed by insects, arachnids, and mites (183; 23.2%) and reptiles (127; 16.1%). Two-thirds (529; 67.1%) of animal-related injuries were traumatic, while 211 (28.0%) injuries were due to poisoning or allergic reaction. The highest observed incidence was in livestock merchant wholesalers (59.6 severe injuries per 100,000 workers per year); injuries in this industry were often due to cattle. Mail delivery and landscape architecture, two industries in which animal contact is atypical, were also among the 10 industries with the highest incidence. Conclusions: Workers in many industries experienced severe injuries due to animals. Among workers whose job involves animal contact, cattle workers appear to be at highest risk. Outdoor workers in some industries require protection from bites of dogs, snakes, and insects.

39. Wang, Y., Henriksen, T., Deo, M., & Mentzer, R. A. (2021). Factors contributing to US chemical plant process safety incidents from 2010 to 2020. *Journal of Loss Prevention in the Process Industries*, 71, 104512.

Abstract: Process safety incidents can result in injuries, fatalities, environmental impacts, facility damage, downtime & lost production, as well as impacts on a company's and industry's reputation. This study is focused on an analysis of the most commonly reported contributing factors to process safety incidents in the US chemical manufacturing industry. The database for the study contained 79 incidents from 2010 to 2019, partly investigated by the Chemical Safety Board (CSB). To be included in the study, the CSB archive of incident investigations were parsed to include only incidents which occurred at a company classified as 325 in the North American Industry Classification System (NAICS), assigned to businesses that participate in chemical manufacturing. For each incident, all of the identified contributing

factors were catalogued in the database. From this list of identified contributing factors, it was possible to name the 'top three' contributing factors. The top three contributing factors cited for the chemical manufacturing industry were found to be: design; preventive maintenance; and safeguards, controls & layers of protection. The relationship between these top contributing factors and the most common OSHA citations was investigated as well. The investigation and citation history for NAICS 325 companies in the Occupational Safety & Health Administration (OSHA) citations database was then analysed to assess whether there was any overlap between the top reported contributing factors to process safety events and the top OSHA citations recorded for the industry. A database consisting of the inspection and citation history for the chemical manufacturing industry identified by NAICS code 325 was assembled for inspections occurring between 2010 and 2020 (August). The analysis of the citation history for the chemical manufacturing industry specifically, identified that the list of the top contributing factors to process safety incidents overlapped with the most common OSHA violations. This finding is relevant to industry stakeholders who are considering how to strategically invest resources for achieving maximum benefit - reducing process safety risk and simultaneously improving OSHA citation history.

40. Wuellner, S., & Phipps, P. (2018). Employer knowledge of federal requirements for recording work-related injuries and illnesses: Implications for occupational injury surveillance data. *American Journal of Industrial Medicine*, 61(5), 422-435.

Abstract: Background: Accuracy of the Bureau of Labor Statistics Survey of Occupational Injuries and Illnesses (SOII) data is dependent on employer compliance with workplace injury and illness recordkeeping requirements. Characterization of employer recordkeeping can inform efforts to improve the data. Methods: We interviewed representative samples of SOII respondents from four states to identify common recordkeeping errors and to assess employer characteristics associated with limited knowledge of the recordkeeping requirements and non-compliant practices. Results: Less than half of the establishments required to maintain OSHA injury and illness records reported doing so. Few establishments knew to omit cases limited to diagnostic services (22%) and to count unscheduled weekend days as missed work (27%). No single state or establishment characteristic was consistently associated with better or worse record-keeping. Conclusion: Many employers possess a limited understanding of workplace injury recordkeeping requirements, potentially leading them to over-report minor incidents, and under-report missed work cases.

41. Yoon, N., Ari, M., Yorio, P., Iskander, J., & D'Alessandro, M. (2022). Applying the CDC science impact framework to the results of the national institute for occupational safety and health and the bureau of labor statistics 2001 survey of respirator use and practices. *Journal of Occupational and Environmental Hygiene*, 19(6), 394-407.

Abstract: During 2001-2002, the National Institute for Occupational Safety and Health (NIOSH), at the United States Centers for Disease Control and Prevention, collaborated with the Bureau of Labor Statistics (BLS) at the United States Department of Labor to conduct a voluntary survey of U.S. employers regarding the use of respiratory protective devices. In 2003, the survey results were jointly published by NIOSH and BLS. This study highlights and evaluates the scientific impact of the 2001-2002 survey by using the Science Impact Framework which provides a historical tracking method with five domains of influence. The authors conducted interviews with original project management as well as a thorough document review and qualitative content analysis of published papers, books, presentations, and other relevant print media. A semi-structured and cross-validated coding was applied across the five domains: Disseminating Science, Creating Awareness, Catalyzing Action, Effecting Change, and Shaping the Future. The 2001-2002 survey findings greatly enhanced understanding and awareness of respirator use in occupational settings within the United States. It also led to similar surveys in other countries, regulatory initiatives by the Occupational Safety and Health Administration and Mine Safety and Health Administration, and ultimately to a renewed partnership between NIOSH and BLS to collect contemporary estimates of respirator use in the workplace within the United States.

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