MASSACHUSETTS State FACE Program
Fatality Assessment & Control Evaluation
Massachusetts Department of Public Health

FACE NIOSH National Institute for Occupational Safety and Health

INCIDENT HIGHLIGHTS

DATE:
May 7, 2019

TIME:
1:00 p.m.

VICTIM:
49-year-old laborer

INDUSTRY/NAICS CODE:
Cut Stone & Stone Product Manufacturing /327991

EMPLOYER:
Stone slab product fabrication company

SAFETY & TRAINING:
Employer provided PPE and some on-the-job training

SCENE:
Company showroom and manufacturing facility

LOCATION:
Massachusetts

EVENT TYPE:
Crushing

REPORT#: 19MA015 **REPORT DATE:** 12/02/2021

Laborer Crushed Between Two Large Stone Slabs at a Manufacturing Facility—Massachusetts

SUMMARY

On May 7, 2019, a 49-year-old laborer was killed while assisting in moving a large stone slab to be stored on an A-frame rack. He was positioned between two A-frame racks, trying to disconnect the slab lifter, when he was crushed between two large stone slabs.

READ THE FULL REPORT> (p.3)

CONTRIBUTING FACTORS

Key contributing factors identified in this investigation include:

- *Not using the slab rack's safety posts;*
- *Victim position within the fall shadow;*
- *Forklift operator lacked training and state license;*
- *Job hazard analysis for moving stone slabs was not performed;*
- *Standard operating procedures for moving stone slabs were not developed; and*
- *Lack of a safety and health program and overall safety training. LEARN MORE> (p. 7)*

RECOMMENDATIONS

The Massachusetts FACE Program concluded that, to help prevent similar occurrences, employers should:

- Use slab racks designed with fixed safety posts and individual compartments for each slab;
- Ensure that employees are never located in the fall shadow of a stone slab while the slab is being accessed to be moved;
- Ensure that only employees with the required OSHA training and state license are permitted to operate forklifts;
- Ensure that a job hazard analysis is performed for all routine tasks and updated when needed; and
- Develop, implement, and enforce standard operating procedures (SOP) for moving, storing, and retrieving stone slabs, which includes ensuring employees are never located in the fall zone. *LEARN MORE> (p.7)*

Fatality Assessment and Control Evaluation (FACE) Program

The Massachusetts Department of Public Health, in cooperation with the National Institute for Occupational Safety and Health (NIOSH), conducts investigations on the causes of work-related fatalities. The goal of this program, known as Massachusetts Fatality Assessment and Control Evaluation (Massachusetts FACE) is to prevent future fatal workplace injuries. Massachusetts FACE aims to achieve this goal by identifying and studying the risk factors that contribute to workplace fatalities, by recommending intervention strategies, and by disseminating prevention information to employers and employees.

NIOSH funded state-based FACE Programs currently include: California, Kentucky, Massachusetts, Michigan, New York, Oregon, and Washington.

SUMMARY

On May 7, 2019, a 49-year-old laborer was killed while assisting in moving a large stone slab. He was standing in-between two A-frame racks while a co-worker was operating a forklift with a boom and lifter attachment. The stone slab that was being moved from a truck to one of the A-frame racks started to tip and fell over onto the victim. The victim was crushed/caught between the stone slab that tipped and another stone slab on an adjacent A-frame rack. A co-worker placed a call for emergency medical services (EMS). The victim was pronounced dead at a local hospital that same day.

INTRODUCTION

A laborer for a stone slab product manufacturing company was fatally injured when he was crushed between two large stone slabs. The Massachusetts FACE Program learned of the incident from the local news media. On June 6, 2019, a representative from the Massachusetts FACE Program traveled to the company location to discuss the incident. The police report, fire/EMS records, death certificate, workers' compensation records, OSHA records, and other information were reviewed during the course of the investigation.

EMPLOYER

The employer was a stone product manufacturer that focused on fabricating and installing stone slab products and had been in business for two years. The company's main task was fabricating stone slabs into products, primarily countertops. The company had one owner and six employees at the time of the incident. The workforce consisted of laborers and equipment operators. The victim was a laborer and two of his main tasks were to ensure that the shop area and the showroom were clean and to help move stone slabs. He did not operate any equipment, including the forklift and cutting equipment.

In general, employees worked five or six days a week and each workday was about nine hours. The work shifts typically started around 7:30 a.m. for employees and this was also true for the victim. Although most employees worked at some point during the weekend, the victim did not work weekends.

At the time of the incident, the company's workers' compensation insurance that covered its employees had expired three months earlier and had not been renewed. As required by Massachusetts law, all employers operating in Massachusetts are required to carry workers' compensation insurance for their employees and for themselves if they are an employee of their company. The requirement applies no matter the number of hours worked or the number of employees. Employees of the company did not have union representation.

WRITTEN SAFETY PROGRAMS and TRAINING

At the time of the incident, the company did not have a comprehensive safety and health program. Workers were provided some basic on-the-job training. Workers were provided with personal protective equipment (PPE), including hearing protection, eye protection, dust masks, goggles, and rubber aprons. Formal training was not provided to employees on how and when to use the PPE. At the time of the incident there was no powered industrial truck program, no training provided to employees who operated forklifts, and employees did not have the state required hoisting license for operating forklifts. The company's owner was a member of the Natural Stone Institute and had some worker safety-related information from them.

WORKER INFORMATION

The victim was a 49-year-old, white non-Hispanic male who had been employed as a laborer by the company for approximately two months at the time of the incident. He had some previous experience in construction. He was born

in Brazil and had been in the United States for only a short period of time. His immediate family remained in Brazil.

INCIDENT SCENE

The incident occurred at a cut stone and stone product manufacturer. The building that housed the company was a single-story wood structure, with over 7,500 square feet of indoor space. It was located in a commercial area of town. The indoor space was divided into a fabrication shop, showroom, and offices. The fabrication shop had a large overhead door, allowing for easy maneuverability when transporting large stone slabs into and out of the shop. The outdoor space was mostly flat and paved with asphalt. The incident occurred inside the fabrication shop, near the overhead door.

WEATHER

The weather at the time of the incident was approximately 61 degrees Fahrenheit, 58% humidity, with a 20 miles per hour south-southwest wind, and fair skies.[1] The weather is not believed to have been a factor in this incident.

EQUIPMENT

A propane-powered forklift was being used at the time of the incident (Figure 1). The company had a long-term rental agreement for the forklift, and the machine was in overall good condition. The forklift had four wheels, a three-stage mast with a maximum lift height of 15 feet and six inches, and a load capacity of 5,000 pounds. The forklift had a boom attached to its tines and a slab lifter attached to the end of the boom (Figure 1 and 2). Both the boom and the slab lifter were manufactured by the same company and were designed specifically for lifting slab material.

The telescoping boom attachment consisted of two rectangular steel tube sections. Specifications from the manufacturer indicated the boom weighed 286 pounds, had a maximum rated load capacity of 3,300 pounds when fully retracted, and a maximum load capacity of 1,320 pounds when fully extended. The telescoping range of the boom was from approximately 6.8 feet to 11.7 feet in three increments of 19 inches. The boom could only be extended manually and had a series of pins and clips to hold it in position. The boom attached to the forklift by sliding onto the forklift tines and was secured by two bolts and two restraint pins (Figure 1).

Figure 1 – The forklift inside the shop with the boom and slab lifter attached.

Figure 2 – The slab lifter.

The slab lifter was an accessory attachment for the boom that was used for gripping, lifting, and moving slab loads (Figure 1 and 2). The slab lifter had a spring-loaded latch incorporated into the design. The spring-loaded latch would automatically release the grip of the lifter from the slab once the slab had been fully lowered to the ground.

An A-frame rack was in use at the time of the incident and was designed to hold slabs in a range of sizes (Figure 3). The rack was equipped with removable caster wheels that were in place at the time of the incident. The caster wheels consisted of 8-inch diameter roller bearing wheels that were rated at 2,000 pounds each. Two of the four wheels were swivel casters with brakes and the other two wheels were rigid. The rack's rated capacity was 8,000 pounds, 4,000 pounds for each side of the rack with the installed wheels (it had a 10,000 pound capacity, 5,000 pounds per side, without the optional wheels installed). The rack was equipped with four hold-down ratchet straps to secure the slabs being stored on the rack. It was also equipped with four safety posts, two for each side, to prevent a slab from tipping off the rack and provide safe access of unstrapped loads that may shift unexpectedly. The rack was 96 inches long by 28 inches wide and 99 inches high (88 inches high without the optional caster wheels).

Figure 3 - A-frame rack involved in the incident without the caster wheels attached and the safety posts not installed.

Figure 4 – The marble slab involved in the incident.

INVESTIGATION

On the day of the incident, the victim arrived at approximately 7:30 a.m. to the company location. The victim would have been performing his normal work tasks the morning of the incident. Prior to the incident occurring, a customer arrived to view a stone slab and the positioning of a countertop template onto the slab. The stone slab that was involved in the incident was a marble slab measuring 114 inches long by 69 inches high by 1 1/8 inches thick. This marble slab weighed approximately 719 pounds (Figure 4).

The marble slab was located in the back of one of the company trucks. It was at this time that the victim was asked to help with the tasks of retrieving the slab from the truck and moving it onto an A-frame rack inside the shop. A co-

worker used the forklift with the boom and slab lifter attachment to retrieve the marble slab from the back of the truck. The marble slab was then brought inside the fabrication shop area and placed on the A-frame rack as the victim helped.

The A-frame rack was positioned inside the shop area, next to another rack with stored stone slabs. These racks were located near the overhead door. At the time of the incident, the company owner and the customer were close by waiting to view the slab. The forklift operator drove the forklift with the marble slab attached to the slab lifter into the fabrication shop. The marble slab was positioned onto the A-frame rack. The victim was standing off to the side of the marble slab and rack. The rack's safety posts were not being used and they were located in the post storage locations on the rack, which are for when the rack is being transported.

Once the slab was lowered onto the rack, the slab lifter grip automatically released. As the forklift operator was lifting the boom up to move the forklift way from the slab and rack, it appears that the slab lifter became hung up on the horizontal top beam of the rack. As a result, the forklift and boom were not able to move away from the rack. The stone slab was blocking the forklift operator's view of the rack, therefore the operator could not see what the issue was and what was causing the slab lifter and boom to be stuck. The victim walked over to the slab lifter to assess and fix the issue.

While the victim was positioned near the center of the rack and marble slab, within the fall shadow of the slab, he was having trouble releasing the slab lifter from the slab. The forklift operator tried raising the boom a couple more times, but as the boom raised the slab lifter was still getting caught on the top of the rack, causing the slab lifter to push out towards the victim. This pushing motion of the slab lifter caused the slab to also be pushed out towards the victim. At this point, the marble slab tilted and became free from the slab lifter and tipped uncontrollably towards the victim. The slab pushed the victim into another stone slab on a rack behind him. The victim was standing and was crushed/caught between two large stone slabs. At this point, the company owner and the forklift operator realized what happened and, with another co-worker, pushed the marble slab off the victim and back onto the A-frame rack. A call was immediately placed for emergency medical services (EMS). EMS arrived within minutes to the incident location and the victim was transported to a local hospital where he was pronounced dead later that same day.

CAUSE OF DEATH

The medical examiner listed the cause of death as blunt force chest trauma.

CONTRIBUTING FACTORS

Occupational injuries and fatalities are often the result of one or more contributing factors or key events in a larger sequence of events that ultimately result in the injury or fatality. The Massachusetts FACE Program identified the following contributing factors in this incident:

- *Not using the slab rack's safety posts;*
- *Victim's position within the fall shadow;*
- *Forklift operator lacked training and state license;*
- *Job hazard analysis for moving stone slabs was not performed;*
- *Standard operating procedures for moving stone slabs were not developed; and*
- *Lack of a safety and health program and overall safety training.*

RECOMMENDATIONS/DISCUSSION

Recommendation #1: Employers should use slab racks designed with fixed safety posts and individual compartments for each slab.

Discussion: This fatal incident underscores the need to use slab racks designed with fixed safety post and individual compartments for each stone slab. If a rack with fixed safety posts was being used, the hazard of the slab tipping uncontrollably while it was being placed in the rack would have been eliminated. By eliminating the potential uncontrolled tipping hazard the fatal injury that occurred would have been prevented.[2]

It appears that the safety posts were infrequently used at this company. If A-frame racks with removable safety posts have to be used, employers should make sure the safety posts are being used by securing them in place at all times. This will help ensure the stone slabs don't tip over uncontrollably when using the racks. in addition, slabs that are not being accessed and will remain on the A-frame rack should be tied down to ensure that these slabs will not move unexpectedly.

In this case, as soon as it was realized there was an issue while placing the marble slab on the A-frame rack, the forklift operator should have stopped the task and the situation should he been evaluated. At this point because the safety posts were not being used, the safety post should have been immediately installed by the worker on the ground. While installing the safety posts the worker must stay out of the fall shadow. If this was performed when the stone started to tip the safety posts would have stopped the slab and prevented the injury.

Recommendation #2: Employers should ensure that employees are never located in the fall shadow of a stone slab while the slab is being accessed to be moved.

Discussion: The fall shadow of a stone slab is the potential path the slab will take as it tips and falls uncontrollably.[3] The fall shadow is located on both sides (Figure 5). The fall shadow will become larger when the slab is lifted. The higher the slab is lifted, the larger the fall shadow becomes. Ensuring employees are always positioned outside of the fall shadow will help prevent employees from being crushed or struck-by an uncontrolled stone slab.

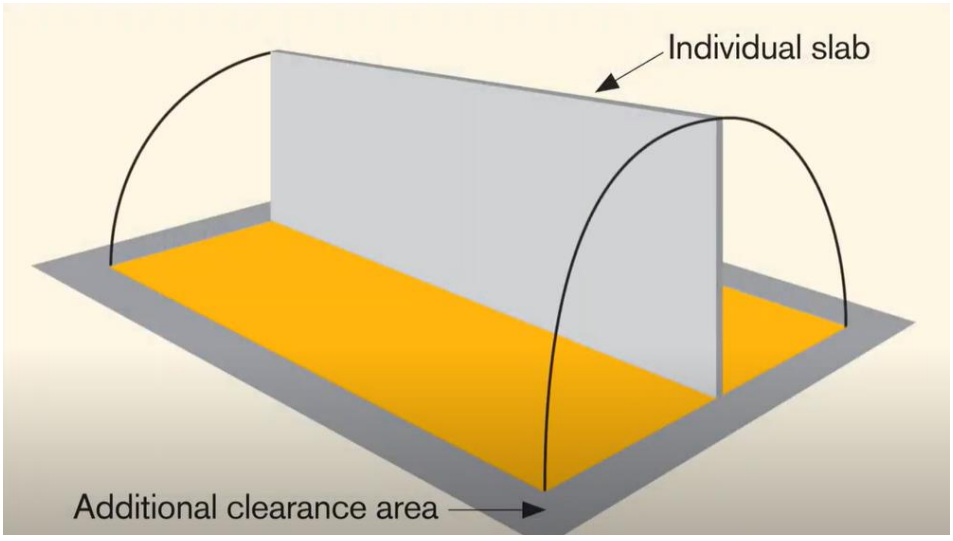

Figure 5 – Example of the fall shadow. The yellow area is where the slab would land if it tipped over.

To ensure employees are positioned outside of the fall shadow, employers must make sure employees are standing at the ends of the slab and not at the center of the slab, or anywhere along the flat sides of the slab. Employees should keep, at a minimum, an arms-length away from the ends of the slab.

Recommendation #3: Employers should ensure that only employees with the required OSHA training and a state license are permitted to operate forklifts.

Discussion: Employers have to comply with federal and state requirements before allowing employees to operate forklifts. In Massachusetts, employers are required to provide OSHA-approved forklift training to employees who will operate forklifts and ensure that the employees have obtained a specific operator's license issued by the Office of Public Safety and Inspections (OPSI). Obtaining a license to operate hoisting machinery, (forklifts are officially included under the category of hoisting machinery), requires training and passing a written or practical examination.

1) OSHA requirements: In this case, the employer did not have a powered industrial truck training program as required by OSHA, therefore no forklift training was provided to employees.[4] The OSHA powered industrial truck training is required for forklift operators and should be refreshed every three years. At the time of the incident, there were multiple employees that operated the forklift as part of their job and none of them were provided with the required training. Employers should ensure that the OSHA forklift training is refreshed every three years.

2) Massachusetts license requirements: In Massachusetts, the 1C Hoisting License issued by OPSI is required to operate forklifts for work.[5] In order to obtain a hoisting license, operators must be 18 years of age, complete an application, and successfully pass an examination covering all working parts of the hoisting machinery, safety inspection of the equipment, safe operating practices, and hand signals. Information about the hoisting license can be found on the OPSI web site at www.mass.gov/hoisting. In Massachusetts employers should never permit employees to operate hoisting equipment, including forklifts, without a valid Hoisting License. Some companies can become an exempt company and obtain an OPSI issued Company License. A Company License is only valid for hoisting machinery used on company property. To become exempt, a company must develop an OPSI approved in-service training program. In addition, the company must have at least one supervisory employee who holds a license issued by OPSI and who is designated as the responsible person in charge of the hoisting equipment.[5]

Recommendation #4: Employers should ensure that a job hazard analysis is performed for all routine tasks and updated when needed.

Discussion: A job hazard analysis (JHA) is a technique to systematically evaluate job tasks to ensure they are performed safely. It involves identifying potential hazards and hazardous situations that could occur when performing tasks by focusing on the relationship between the worker, the task, the tools, and the work environment.[6] The analysis should be routinely performed to identify uncontrolled and potential hazards. The JHA should begin by breaking down the tasks to be performed into steps, including the selection and operation of any equipment and the use of tools to complete the task. Each step should be evaluated to identify the hazards or potential hazards and the best equipment and tools to be used to safely complete the task. Information in the manufacturer operator's manual and on the equipment's warning labels should be reviewed as part of the JHA. Once hazards are identified, employers should take steps to eliminate or control these hazards, such as selecting different equipment and tools or the proper personal protective equipment. It is important to have employees participate in the JHA.

In this case, the JHA for routine tasks could have been performed when the company was first starting out. During this time the company should have started to develop a comprehensive safety and health program and standard operating procedures specifically for moving stone slabs. The JHA would have identified the common hazard when moving large stone slabs, including the stone slab's fall shadow and the hazard of not using rack's safety posts at all times.

Recommendation #5: Employers should develop, implement, and enforce standard operating procedures (SOP) for moving, storing, and retrieving stone slabs, which includes ensuring employees are never located in the fall zone.

Discussion: Employers can prevent similar situations from occurring by developing, implementing, and enforcing standard operating procedures (SOP) for moving, storing, and retrieving slab materials. When developing SOPs, employers should review the equipment's owner's manuals and seek input from employees about current task

procedures and hazards. SOPs should address all identified hazards. In this case, the SOP should address the proper handling and movement of heavy stone slabs by ensuring that employee exposure to slabs that are being moved is limited, and that employees on the ground are never located in the fall shadow (Recommendation #2) when slabs are in the process of being moved.

The SOP should include, but not be limited to:

- Employee location - always ensure that employees on foot who are assisting with moving stone slabs are outside of the slab's fall shadow.
- Retrieval – when available, always use mechanical equipment, such as a gantry crane or forklift with proper attachments, to move slabs, and always limit employee exposure to moving slabs.
- Rack type – use racks with individual compartments for each slab that have fixed support pins.
- Storage – store slabs by height and never overcrowd a rack with slabs or exceed a rack's weight limits.
- Avoidance of potential hazardous situations – never disassemble any portion of a slab rack that is storing stone slabs, including removing safety posts.

Once they've been developed, employees should be trained on the SOP. It is important to routinely retrain employees on the SOP, including when it is identified that the SOP is not being followed. See Recommendation #6 for more information on how training should be implanted and documented.

Recommendation #6: Employers should develop and implement a comprehensive safety and health program that addresses hazard recognition, avoidance of unsafe conditions and includes training.

Discussion: Having a safety and health program is an important part of keeping employees safe. A safety and health program should include the systematic identification, evaluation, and prevention or control of both general workplace hazards and the hazards of specific jobs and tasks. The core elements of an effective safety and health program are management leadership, worker participation, hazard identification and assessment, hazard prevention and control, education and training, and program evaluation and improvement.[7] The program should outline safe work practices workers are expected to adhere to, specific safety protection for all tasks workers perform, how workers can identify and avoid hazards, and who workers should contact when safety and health issues or questions arise. The program should also include an explanation of the workers' rights to protection from hazards in the workplace.

When developing a safety and health program, employers could start by performing a general hazard analysis (Recommendation #4) of tasks routinely performed by employees. This would identify potential hazards and the controls of these routine tasks and this information would be incorporated into the comprehensive program.[7] Employers should also use their employees' expertise throughout the program development process, and during the updating process, by seeking employee input. Once the program is developed, employers should ensure that they have fully and effectively implemented their safety and health program by routinely performing assessments of tasks and immediately addressing any observed unsafe conditions. The program should also be updated when safety concerns arise and when new equipment, chemicals, and tasks are introduced into the workplace.

All training provided to employees should be documented. Routine training should be provided to all employees on the program's topics, ensuring that workers know how to safely perform required tasks. Training should also include hazard recognition and the avoidance of unsafe conditions. Avoidance of unsafe conditions should include, but not be limited to, the work practice where employees never risk physical harm to accomplish tasks. Trainings should be performed by a competent person, which is defined by OSHA as "one who is capable of identifying existing and predictable hazards in

the surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them." Any training needs to be provided in the employee's preferred language. This means the training must be provided in the language(s) and at the literacy level(s) of the employees.

In this case, the hazard of being crushed when retrieving large stone slabs from a slab rack and the controls for this hazard, including ensuring racks with fixed safety posts are being used and ensuring employees stay out of the slab's fall shadow, should be incorporated into the comprehensive health and safety program. Stone product manufacturers should also address respiratory hazards in the health and safety program. Although not a factor in this incident, when cutting and buffing stone and stone products, employees could be exposed to respirable silica without proper controls. Exposure to silica can cause the lung disease silicosis. Silicosis is preventable, but once you have silicosis it is incurable, debilitating and often fatal. Employers should train employees on the proper controls for any respiratory hazard and other health hazards to which employees are exposed.[8]

The Massachusetts Department of Labor Standards (DLS) offers free consultation services to help small employers improve their safety and health programs, identify hazards, and train employees. DLS can be contacted at 508-616-0461. More information about DLS can be found on their website at www.mass.gov/dos/consult.

The Massachusetts Department of Industrial Accidents (DIA) has grants available for providing workplace health and safety training to employers and employees. Any company covered by the Massachusetts Workers' Compensation Insurance Law is eligible to apply for these grants. More information about these DIA grants can be found on their website at www.mass.gov/dia/safety.

ADDITIONAL RESOURCES

MDPH, Massachusetts FACE Facts. Worker Killed When Crushed by Multiple Stone Slabs, December 2006, www.mass.gov/doc/worker-killed-when-crushed-by-multiple-stone-slabs-0/download

OSHA, Safety and Health Information Bulletins, Hazards of Transporting, Unloading, Storing and Handling Granite, Marble and Stone Slabs, SHIB 08-12-2008, www.osha.gov/dts/shib/shib081208.html

National Stone Institute, Fall Shadow Video, April 2017, www.youtube.com/watch?v=ydvUhvpn9Vg

DISCLAIMER

Mention of any company or product does not constitute endorsement by the National Institute for Occupational Safety and Health (NIOSH). In addition, citations to websites external to NIOSH do not constitute NIOSH endorsement of the sponsoring organizations or their programs or products. Furthermore, NIOSH is not responsible for the content of these websites. All web addresses referenced in this document were accessible as of the publication date.

REFERENCES

1. Weather Underground. Weather History. Massachusetts: TWC Product and Technology LLC.

2. Massachusetts FACE Facts, Worker Killed When Crushed by Multiple Stone Slabs, December 2006, https://www.mass.gov/doc/worker-killed-when-crushed-by-multiple-stone-slabs-0/download

3.OSHA, Safety and Health Information Bulletins, Hazards of Transporting, Unloading, Storing and Handling Granite, Marble and Stone Slabs, SHIB 08-12-2008, https://www.osha.gov/dts/shib/shib081208.html

4. OSHA PIT Code of Federal Regulations [1998]. 29 CFR 1910.178. Powered industrial trucks. Washington, DC: U.S. Printing Office, Office of the Federal Register

5. Code of Massachusetts Regulations, Office of Public Safety and Inspections: 520 CMR 6 Hoisting Machinery. https://www.mass.gov/regulations/520-CMR-6-hoisting-machinery

6. OSHA. Job Hazard Analysis. Publication Number: 3071. www.osha.gov/Publications/osha3071.pdf.

7. OSHA. Recommended Practices for Safety and Health Programs. OSHA 3885. 2016. www.osha.gov/shpguidelines/

8. Occupational Safety and Health Administration, Safety and Health Topics, Silica, Crystalline. https://www.osha.gov/dsg/topics/silicacrystalline/