MICHIGAN State FACE Program
Fatality Assessment & Control Evaluation

Michigan State University
Department of Medicine • Occupational and Environmental Medicine
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REPORT#: **17MI045** **REPORT DATE:** 10/22/19

Plasterer/Drywall Installer Dies From 30-Foot Fall Through Skylight

INCIDENT HIGHLIGHTS

DATE:
Spring, 2017

TIME:
Approximately 5:30 p.m.

VICTIM:
Laborer in his 20s

INDUSTRY/NAICS CODE:
Construction/23

EMPLOYER:
Plaster/Drywall Installation

SAFETY & TRAINING:
On-the-Job

SCENE:
Water Treatment Plant

LOCATION:
Michigan

EVENT TYPE:
Fall

SUMMARY

In Spring 2017, a 20-year-old male plasterer/drywall installer died from an approximate 30-foot fall through a 24-inch by 48-inch plastic bubble-covered skylight. The decedent was working on the flat roof next to the skylight. His work area was cluttered with demolition debris. The decedent applied adhesive to the back of a 2-foot by 4-foot expanded foam board and took the prepared board to the firm owner, who was working in a boom lift for installation. After handing the board to the owner, the decedent walked back to the prep area to prepare another board. The firm owner heard a "crushing" sound, and when he looked over towards the sound, he saw the decedent sitting on the skylight cover. The skylight cover then "gave out"..... READ THE FULL REPORT> (p.3)

CONTRIBUTING FACTORS

Key contributing factors identified in this investigation include:

- No guarding for skylight
- Fall protection not utilized near unguarded skylight
- Lack of employer and employee experience working with, identifying, and training for skylight hazards
- LEARN MORE> (p.9)

RECOMMENDATIONS

MIFACE investigators concluded that, to help prevent similar occurrences, employers should:

- Develop, implement, and enforce a comprehensive, written health and safety program that includes safety requirements when working near/around roof openings and skylights.
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Michigan Fatality Assessment and Control Evaluation (FACE) Program

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SUMMARY

In Spring 2017, a 20-year-old male plasterer/drywall installer died from an approximate 30-foot fall through a 24-inch by 48-inch plastic bubble-covered skylight to a concrete floor. The decedent was working on the west side of a flat building roof next to the skylight of a water treatment plant. His work area was cluttered with demolition debris, including lumber, metal pipes, a five-gallon bucket and several pieces of foam installation material. The decedent's work task was to apply adhesive to the back of a 2½- inch thick, 2-foot by 4-foot expanded foam board to be used for a penthouse exterior wall plastering operation. After troweling on the adhesive to the foam board, he walked with the foam board to the west side of the building and gave it to the firm owner, who was working in a boom lift for installation on the penthouse wall. The decedent walked back to the prep area to prepare another piece of foam. The firm owner heard a "crushing" sound, and when he looked over towards the sound, saw the decedent sitting on the plastic skylight cover. The skylight cover then "gave out". The decedent attempted to grab the sides of the skylight to keep from falling through but was unsuccessful. He fell to the concrete floor 30-feet 8-inches below.

INTRODUCTION

In Spring 2017, a 20-year-old male plasterer/drywall installer died from an approximate 30-foot fall through a 24-inch by 48-inch plastic skylight. MIFACE learned of this death from the MIOSHA fatality reporting system. MIFACE personnel contacted the decedent's employer, who agreed to be interviewed. MIFACE reviewed the death certificate, police and medical examiner's reports and the MIOSHA compliance officer's file during the writing of this report. Pictures used in the report are courtesy of MIOSHA and the responding police department.

EMPLOYERS

The firm for whom the decedent worked performed plaster/drywall installation and had been in business for 4 years. The owner employed 14 individuals. The firm was non-union. The firm specialized in plaster and expanded insulated foam finish system (EIFFS).

This was a multi-employer worksite. The water treatment plant was undergoing renovation. One of the several renovation locations at the plant was on the roof level, involving the reconstruction of a penthouse and the filling in of 10 roof skylights. Firm 1 removed the penthouse's asbestos siding. Firm 2 (General Contractor) demolished and removed the existing framing and upper and lower windows of the penthouse, and then installed temporary plastic to it make weathertight. Firm 3 installed new steel stud framing and sheathing on the penthouse after Firm 2 removed the temporary plastic. Firm 4 (decedent's employer) was contracted to install foam board and the expanded insulated foam finish system (EIFFS). Firm 5 was an engineering firm.

WRITTEN SAFETY PROGRAMS and TRAINING

The decedent's employer(Firm4) indicated that he had a written safety program and that his program was the same one as used by Firm 3. The owner provided on-the-job training, including scaffold training, roof edge training and scissor lift training. His employees "look[ed] out for one another". The firm did not have a written disciplinary program, but he had fired individuals if they violated safety rules. The safety program did not have written rules or procedures for working near skylights.

The owner indicated to the MIFACE researcher that this was the first time his firm had worked around skylights, and that he had not provided any training regarding the hazards of working around skylights during his daily safety briefings. He

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mentioned that he repeatedly told his workers to avoid walking near the skylights as well as the edges of the roof. He told the MIFACE researcher that, because so many other individuals had worked on the roof and the skylights were untouched and not protected by anything, that he thought the skylights were safe.

One of Firm 2's superintendents was interviewed by the MIOSHA compliance officer. This superintendent had been with Firm 2 for approximately 12 years. The superintendent indicated to the MIOSHA compliance officer that a site safety audit (job safety analysis) is performed upon starting a project; the purpose of the safety audit is to identify safety concerns, means and methods for protecting employees and subcontractors. The superintendents review the results of the audit with the Firm 2's safety director. The superintendent could not recall if Firm 2's accident prevention program or if the safety audit checklist had an item for floor holes to be guarded on a construction project. It was determined during the investigation that the firm's accident prevention program addressed walking surface holes but did not address skylight hazards. The superintendent acknowledged that the skylights were observed and that no individual had addressed the skylights with him. The superintendent on-site did not recognize that the skylights with the factory-installed covers in place constituted a fall hazard. Although Firm 2 required a job safety analysis (JSA) from subcontractors, skylights were not recognized and addressed in the JSA. Firm 2 (general contractor) held weekly toolbox talks with all general contractor personnel and subcontractor foreman. The hazards posed by the skylights were not addressed in meetings with subcontractors. All subcontractors were required to submit their company's safety policies and (M)SDS booklets.

WORKER INFORMATION

The decedent was a 20-year-old Hispanic male plasterer/drywall installer and had worked for this employer for six months as a laborer. He was paid an hourly rate. The firm worked a standard day shift (8 a.m.-4 p.m.). The decedent determined his own work schedule; per the employer, the decedent usually worked at least 2-3 days per week, sometimes every weekday. The decedent had previously worked in concrete and had been laid off. He had not received fall protection training. He was not given and was not wearing fall protection. A hard hat was found in the location of the decedent; it was unknown if it was his hard hat.

The decedent's coworker working nearby had worked at the firm for approximately 2 months. He had not received fall protection training. The coworker indicated to MIOSHA that this was the first time he had ever seen skylights and that he had not received any information regarding skylight hazards.

INCIDENT SCENE

The penthouse was on the northern half of the one-story building, toward the western side (See Photos 1 and 2). At the time of the incident, there were no elevated warning lines or ropes along or near the edge of the roof. The distance from roof to the concrete floor below was 30 feet 8 inches.

Photo 1. Front of water treatment plant undergoing renovation.

Roof work included renovation of the penthouse. The exterior of the penthouse was finished with an EIFFS. The Penthouse EIFFS work included:

- Installation of 2½-inch cold formed steel studs; studs clipped to each existing steel channel support

- Installation of ½-inch glass mat sheathing over 2 ½-inch cold formed steel studs
- Brush/roller application of waterproofing to ½-inch glass mat sheathing
- Installation of 3-inch molded expanded polystyrene board insulation over ½-inch glass mat sheathing, and rasping of irregularities off surface of installed insulation board

Photo 2. Water treatment plant building roof. Blue circle with X was approximate location of incident skylight. Picture courtesy of Google maps.

Skylight Information

Responding police department personnel noted the following skylight dimensions in their report:

- Outside frame dimension: 2 feet 3½ inches wide by 4 feet 3½ inches long.
- Inside frame dimension: 1 foot 10 inches wide by 3 feet 10½ inches long.
- Frame of the skylight extended 7½ inches above the roof.
- The skylight opening was covered by two separate plastic domes. The inner dome was a white opaque color and the outer dome was clear. Both were curved upward from the edges. The top of the curve for the inner dome was 3 inches above the frame. The top of the curve for the outer dome was 6 inches above the frame.
- Broken area of the domes: 1 foot 9 inches from the frame edge to the nearest point of the clear outer dome.
- The broken area of both the inner and outer domes was clear from side to side giving an opening of 1 foot 10 inches.

Several skylights had previously had their covers removed and no barricade or cover had been placed around/over them. Two of the opened skylights had ventilation fans placed in them, providing air movement to the first-floor work sites (Photo 3). The decedent's employer did not know which firm removed the skylight covers.

The skylight involved in the incident was within 11 feet from the southern penthouse wall. Next to the southern wall was a scaffold that was erected by either Firm 1 or Firm 2. The distance from the roof edge is unknown. The lumber seen in Photo 3 belonged to another contractor.

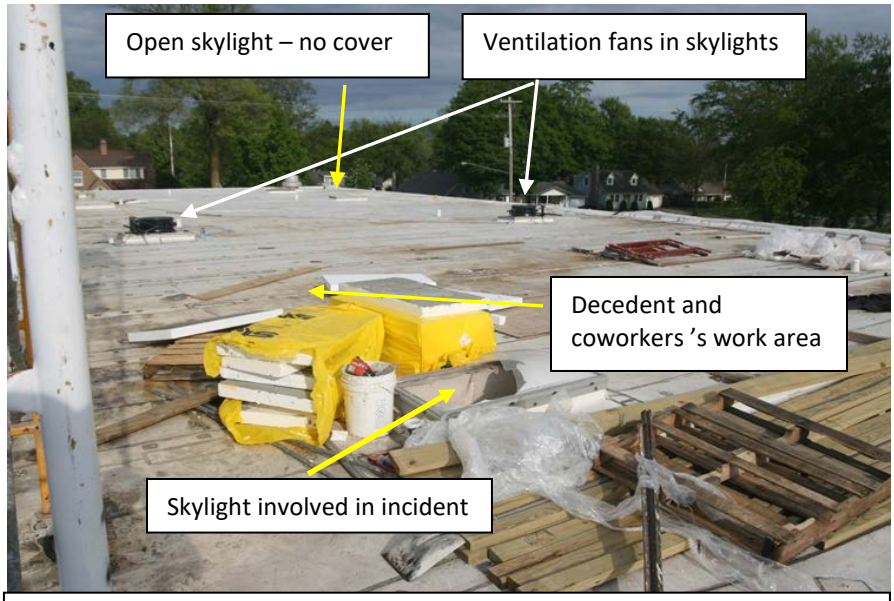

Photo 3. Incident area showing skylight involved in incident, open skylights with ventilation fans, and open skylight with no cover

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Roof work had been in progress for the past three months by Firms 1, 2 and 3. It was the 10th day of work for the decedent's employer; the decedent had been working on the roof for all of the 10 days.

WEATHER

Weather Underground was utilized to check the weather conditions on the day of the incident. The temperature at the time of the incident was in the high 50s with wind from the south-southwest at 7-8 mph. [Weather Underground]

Photo 4. Incident area, looking north

INVESTIGATION

The decedent and his coworker accessed the roof through a 3-foot by 3-foot wall opening on the east side of the penthouse. The decedent's employer indicated that he was aware of the skylights and told his employees working on the roof to be careful and not break them.

During the MIFACE interview, the owner indicated that he wanted to quit work for the day, but the decedent encouraged him to "finish the job" as the west penthouse wall was near completion. The owner "was talked into it", and the 3-person crew (the owner in the boom lift, the decedent, and the decedent's coworker) continued to work. Neither the decedent or the decedent's coworker were wearing fall protection.

The decedent and his coworker, who was cutting foam, were working next to the skylight through which the decedent fell. The decedent was mudding the foam board near the west side of the roof at the east side of the skylight involved in the incident. The firm owner, elevated in a boom truck owned by Firm 2, was positioned on the southwest corner of the penthouse applying the prepared foam. After mudding the foam board, the decedent walked approximately 8-

Photo 5. Incident area. Dotted lines show most likely path of decedent when he carried the prepared foam board to the owner working in the boom lift

to 10-feet from his mudding position to the boom truck. The decedent's path placed him between the skylight and the south side of the penthouse which had the scaffold positioned next to it (Photos 4 and 5).

After handing the foam to the owner so he could place it on the penthouse wall, the decedent walked back to his work station.

During the MIFACE interview, the firm owner didn't know if the decedent tripped or just sat on the fiberglass cover. He hypothesized that the decedent sat on the skylight cover, rather than tripped while walking. When the owner heard a "crack or crunching sound" he looked over and saw the decedent in a seated position on the skylight cover.

Photo 6. Skylight involved in incident

The owner indicated that the decedent was looking up at him and kind of smiling, indicating that his expression was almost like he was thinking that he made a mistake because he had broken the skylight. When the skylight gave way and the decedent began to fall through the skylight, the owner stated he saw the decedent trying to grab the sides of the skylight to keep himself from falling but was unable to do so (Photos 6 and 7). The owner got off the lift and then went into the plant to try and find where the decedent had fallen.

The decedent's coworker did not know the decedent had fallen – he did not hear a scream or any sounds. When he looked up from his work, the decedent was not there. He then saw the broken skylight cover.

The decedent's employer stated during the MIFACE interview that at the time of the incident, he did not think skylights were a hazard because:

- Why would they be there if not sturdy enough to support the weight of a person?
- Other contractors had been on roof – if they were a hazard, why weren't the skylights already covered?

Photo 7. Incident skylight. Photo taken while standing on floor 30 feet below skylight.

After the fall, the decedent was transported by ambulance to a local hospital where he was stabilized and then transferred by helicopter to another hospital. While in the air, the decedent had a cardiopulmonary arrest and CPR was initiated. He was pronounced dead in the second hospital's emergency room.

After the incident, Firm 2 installed ¾-inch plywood over the 10 skylights and spray-painted "hole" on each piece of plywood. Firm 2 also placed warning lines at the roof edge.

MIOSHA Citations

MIOSHA Construction Safety and Health Division issued the following Serious violations to the decedent's employer at the conclusion of its investigation.

SERIOUS: GENERAL RULES, CS PART 1, RULE 408.40119(1): Materials, including scrap and debris, shall be piled, stacked, or placed in a container in a manner that does not create a hazard to an employee.

Scrap material and debris is scattered around work area of roof, creating a tripping hazard to employees.

SERIOUS: FALL PROTECTION, CS PART 45:

- RULE 1926.502(i)(2): All other covers shall be capable of supporting, without failure, at least twice the weight of employees, equipment, and materials that may be imposed on the cover at any one time.

  Plastic dome-type skylight cover was not capable of supporting twice the weight of employees who were working on the roof of the City water treatment plant. *(MIFACE removed the name of the city)*

- RULE 1926.502(i)(4): All covers shall be color coded or they shall be marked with the word "HOLE" or "COVER" to provide warning of the hazard.

  Plastic dome-type skylight cover was not identified or marked for employees who were working on the roof of the City water treatment plant. *(MIFACE removed the name of the city)*

SERIOUS: FALL PROTECTION, REF 408.44502, CS PART 45, RULE 1926.503(a)(1): The employer shall provide a training program for each employee who might be exposed to fall hazards. The program shall enable each employee to recognize the hazards of falling and shall train each employee in the procedures to be followed in order to minimize these hazards.

Employer's fall protection training did not enable employees to recognize skylights as fall hazards, or the required safeguards to be used while working around skylights.

CAUSE OF DEATH

The death certificate listed the cause of death as craniocerebral trauma. Post-mortem toxicology was positive for nicotine, caffeine, prescription drugs (dicyclomine, midazolam, levamisole) and illegal drugs (cocaine, fentanyl).

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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 following hazards were identified as key contributing factors in this incident:

- *No guarding for skylight*
- *Fall protection not utilized near unguarded skylight*
- *Lack of employer and employee experience working with, identifying, and training for skylight hazards*
- *Written fall protection program did not address skylights hazards*
- *General contractor, city, engineering firm and other firms working on roof did not provide safety training for skylights*

RECOMMENDATIONS/DISCUSSION

Recommendation #1: Employers working on roofs should develop, implement, and enforce a comprehensive, written health and safety program that includes safety requirements when working near/around roof openings and skylights. This should include fall protection measures such as skylight screens or covers, guardrails, or a personal fall protection system.

Discussion: Most skylight covers, unless specifically designed to do so, are not meant to bear the weight of a worker. When employees work around skylights and roof and floor openings, employers must ensure the use of an appropriate fall prevention system. Options available to employers include covers or screens capable of supporting, without failure, at least twice the maximum intended load) OR railings or guardrails OR a personal fall arrest system (PFAS), including a full-body harness, lanyard, connectors, and appropriate anchorage points (tie-offs). Maximum intended load means the total load (weight and force) of all employees, equipment, vehicles, tools, materials, and other loads the employer reasonably anticipates being applied to a walking-working surface at any one time. In general, it is better to provide fall prevention systems, such as guardrails, than fall protection systems, such as safety nets or fall arrest devices, because they provide more positive safety means.

MIOSHA Part 1. General Rules, Rule 114 requires an Accident Prevention Program at every construction work site which must address fall hazards. MIOSHA, Part 45. Fall Protection, addresses minimum requirements and criteria for fall protection at construction workplaces. MIOSHA Construction Safety & Health Division Fact Sheet: Falls – Unprotected Sides, Wall Openings, and Floor Holes lists the following to avoid fall hazards:

- Use at least one of the following whenever employees are exposed to a fall of 6 feet or more above a lower level: Guardrail Systems; Safety Net Systems; Personal Fall Arrest Systems.
- Cover or guard floor holes as soon as they are created during new construction.
- For existing structures, survey the site before working and continually audit as work continues. Guard or cover any openings or holes immediately.
- Construct all floor hole covers so they will effectively support two times the weight of employees, equipment, and materials that may be imposed on the cover at any one time. Covers must be secured and color coded or marked with the words "HOLE" or "COVER."

Recommendation #2: Employers should assure that all workers required to work near roof openings or skylights are adequately trained to recognize the serious hazard of falls through roof openings, and the danger of sitting or stepping on skylights.

Discussion: One of the contributing factors identified in this incident was insufficient knowledge regarding the hazards posed by skylights, by both the employer and employees. The decedent and his coworker were not trained on recognition of fall hazards or personal protective equipment selection. Appropriate worker safety training is needed to identify work hazards and the necessary PPE for the job.

MIFACE recommends employers and employees consult the following free resources to enhance their knowledge of fall protection strategies:

- MIOSHA Consultation, Education and Training Division: Stop Falls, Safe Lives webpage. The webpage is a "one stop shop" for employers and employees to gather information and implement solutions to minimize the likelihood of a fall. The webpage includes the following topic areas: Fatality Summaries, MIOSHA Publications, MIOSHA Standards, MIOSHA Standard Interpretations, Polices and Procedures, Video Library and Streaming Services, MIOSHA Training Institute (MTI) Courses and Other Resources.
- NIOSH: Preventing Falls of Workers through Skylights and Roof and Floor Openings in English and Spanish
- CPWR-The Center for Construction Research and Training (the NIOSH-funded National Construction Center): Stop Construction Falls campaign website
- OSHA Fall Protection webpage

Each worker who may be exposed to a fall hazard should receive training to be able to recognize fall hazards and the procedures to follow for minimizing these hazards. Employees must be trained by a competent person qualified in the following areas:

- Nature of fall hazards in the area.
- Correct procedures for erecting, maintaining, disassembling, and inspecting the fall protection systems to be used.
- Use and operation of guardrail systems, personal fall arrest systems, safety net systems, warning line systems, safety monitoring systems, controlled access zones and other protection to be used.
- Role of each employee in the safety monitoring system when this system is used.
- Limitations on the use of mechanical equipment during the performance of roofing work on low-sloped roofs.
- Correct procedures for the handling and storage of equipment and materials and the erection of overhead protection.
- Role of employees in fall protection plans.
- Appropriate standards.

Recommendation #3: Employers on multi-employer sites should utilize contract language that clearly defines the safety responsibilities of each contractor prior to the initiation of work.

Discussion: This was a multi-employer worksite. Three different employers worked on the roof near the unprotected skylights, and at least one employer removed the plastic covers from several skylights to place ventilation fans, leaving unguarded roof openings. None of these employers placed a guardrail around the skylights, and pictures taken by site personnel show workers on the roof, working from scaffolds and near the skylights without personal fall arrest systems.

A contract should be written that contains clear and concise language as to which party is responsible for a given safety and health issue. The contract language should require all subcontractors (and their subcontractors) to identify how they intend to implement a site-specific safety and health program. Differences should be negotiated and resolved before work begins. Once the provisions for these responsibilities have been established, the respective parties should ensure that all provisions regarding safety and health are upheld. Contracts should include language that states that at the time the openings are made in the roof, the firm making the roof opening should be required to install covers which are secured in place and clearly labeled, so that other work crews on the roof will not be exposed to the potential fall hazard.

Employers working in Michigan should use MIOSHA safety regulations as a basis for constructing effective worker safety policies, and foremen and other site management personnel should ensure enforcement of these policies on the job site. If site management personnel witness a hazard that places a worker in immediate danger, such as working near an unprotected skylight, control measures should immediately be implemented.

On June 13, 2019, MIOSHA published a revised Multi-Employer Worksite Instruction MIOSHA-COM-04-1R5, which provides guidelines for the Construction Safety and Health Division (CSHD) and the General Industry Safety and Health Division (GISHD) SO/IH safety officer/industrial hygienist (SO/IH) to follow when conducting enforcement activities at and preparing citations for multi-employer work sites. A PDF of the Multi-Employer Worksite Instruction may be found here or by accessing the following internet link: (https://adms.apps.lara.state.mi.us/File/DownloadDmsDocument/12774).

Recommendation #4: Employers should implement an employee assistance program (EAP).

Discussion: The decedent, had prescription medication and illegal substances in his bloodstream, the side effects of which may have contributed to impaired balance or judgement. In addition to the possible side effects of the drugs, and although working outside, may have been exposed to solvent vapors.

EAPs are programs intended to help employees deal with personal problems that might adversely impact their work performance, health and well-being. The issues that are primarily dealt with in an EAP can include: substance abuse, family changes (birth, death, empty nest, and divorce), emotional distress, work relationship issues, financial issues, etc. Employees in need of assistance due to the issues identified previously may take unscheduled absences, arrive late to work more often, and can be less productive on the job (in this incident, another organization member had to step in and "take over" for the decedent during her shift). Research has shown that EAPs can be cost effective for the employer; for each dollar invested in an EAP, the return on investment is between $3 to $16.

MIFACE recommends the decedent's employer to develop an employee assistance program and to reach out to local organizations to see what kind of free or low-cost EAP resources are available. Sample EAP program templates can be found in the Additional Resources section below.

ADDITIONAL RESOURCES

- MIFACE Case Reports:
  - Investigation Report #06MI006: Truck Driver Killed After Falling Through Unprotected Skylight.
  - Investigation Report #08MI015: Construction Worker Dies From 69-Foot Fall Through Roof Opening
  - Investigation Report #10MI144: Hispanic Roofer Dies After Falling Through an Improperly Secured Roof Hatch Cover

- MIOSHA Resources:
  - Stop Falls, Safe Lives webpage.
  - MIOSHA-COM-04-1R5; Multi-Employer Worksite Instruction https://adms.apps.lara.state.mi.us/File/DownloadDmsDocument/12774
- NIOSH Resources:
  - Fatality Assessment and Control Evaluation (FACE) webpage. Searchable webpage for NIOSH and State FACE Investigation Reports.
  - Publication: Preventing Falls of Workers through Skylights and Roof and Floor Openings in English and Spanish
- OSHA Safety and Health Topic: Fall Protection. https://www.osha.gov/SLTC/fallprotection/
  - Protecting Roofing Workers. OSHA Publication 3755, (2015).
- CPWR Resources: Stop Construction Falls: Safety Pays-Falls Cost webpage. https://stopconstructionfalls.com/
- An Employers Guide to Employee Assistance Programs. https://www.businessgrouphealth.org/pub/?id=f31372a2-2354-d714-51e4-ae4127ced552
- Employee Assistance Program Policy Template: https://www.businessgrouphealth.org/pub/?id=f31372a2-2354-d714-51e4-ae4127ced552
- Workable. *Employee Assistance Program Policy Template. https://resources.workable.com/employee-assistance-program-policy*

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REFERENCES

Weather Underground [2014]. Weather history for nearby weather station. The Weather Channel Interactive, Inc.

MIOSHA standards may be found at and downloaded from the MIOSHA, Michigan Department of Licensing and Regulatory Affairs (LARA) website at: www.michigan.gov/mioshastandards. MIOSHA standards are available for a fee by writing to: Michigan Department of Licensing and Regulatory Affairs, MIOSHA Regulatory Services Section, 530 West Allegan, P.O. Box 30643, Lansing, Michigan 48909-8143 or calling (517) 284-7740.

- MIOSHA Constructions Safety and Health Division, General Rules, Part 1.
- MIOSHA Constructions Safety and Health Division, Fall Protection, Part 45

Google Maps. https://www.google.com/maps

ACKNOWLEDGEMEMENT

The Michigan FACE Program would like to acknowledge the employer for providing assistance and information for this investigation.