

MIFACE INVESTIGATION #06MI004

SUBJECT: 29-Year Old Male Hispanic Landscape Laborer Dies When Nine Foot Deep Trench Collapses

Summary

On February 1, 2006, a 29-year old male Hispanic landscape laborer died when the two-foot wide, sixteen-foot long and nine-foot deep trench he was working in collapsed and covered him with soil. The victim and four other laborers had been hand digging the trench over a two-day period at a private residence. The victim was kneeling to inspect a broken drain pipe at the bottom of the east end of the trench. At approximately 3:00 p.m., a laborer on top of the trench saw a crack in the soil and yelled to the victim. The wall collapsed and the victim was completely covered with soil in seconds.

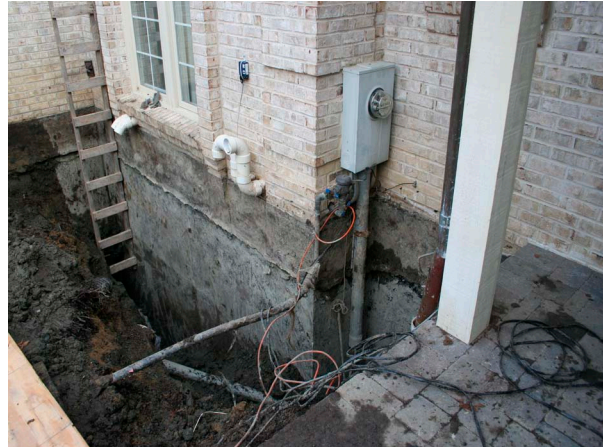


Figure 1. Photograph of trench after cave in.

Three laborers along with the company owner who was checking on the job began frantically hand digging to reach the victim. The fourth laborer remained above and outside of the trench. The owner stopped digging after a couple of minutes to call 911 with his cellular telephone. All four men (three laborers and company owner) continued to hand dig until the local fire and police departments arrived on the scene. Fire and police personnel continued hand digging. The victim's head was uncovered approximately 45 minutes after the trench collapse. Emergency personnel on the scene checked for vital signs. The victim was pronounced dead at the scene.

RECOMMENDATIONS

- Employers should ensure that employees working in excavations are protected from cave-in by an adequate protection system such as shoring, sloping or excavation box designed in accordance with MIOSHA Construction Safety Standard, Part 9: Excavation, Trenching and Shoring, R408.40941.
- Employers should ensure a qualified person inspects the excavation, adjacent areas and supporting systems on an ongoing basis, and the qualified person take the appropriate measures necessary to protect workers.
- Employer should develop, implement and maintain a comprehensive health and safety program.
- Employers should provide workers with training in the recognition and avoidance of unsafe conditions and the required safe work practices that apply to their work environments in the language of the workers.

Key Words: Excavation, Trench, Hispanic, Construction

- Employers should develop a trench emergency action plan that describes rescue and medical duties and ensure that all employees are knowledgeable of those procedures.
- In addition, MIFACE recommends MISS DIG be contacted prior to excavation activities to identify the location of utilities in the area.

INTRODUCTION

On February 1, 2006, a 29-year old male Hispanic landscape laborer died when a two-foot wide, sixteen-foot long and nine-foot deep trench collapsed, while he was working in the trench. On February 2, 2006, MIFACE was informed by the Michigan Occupational Safety and Health Administration (MIOSHA) personnel, who had received a report on their 24-hour-a-day hotline, that a work-related fatality had occurred on February 1, 2006. On May 8, 2006, the MIFACE researcher met with the company owner to discuss the incident. The police reports, autopsy results and MIOSHA investigation results were used to assist in writing this report. The picture used in Figure 1 is a police photograph taken at the time of the incident.

The landscaping company had been in business 15 years. In addition to performing traditional landscaping projects, the company also performs waterproofing projects with general contractors. The waterproofing projects are typically performed to correct water infiltration problems post-construction of new custom homes. The company employs thirteen full-time Hispanic laborers. The primary language of the laborers is Spanish. They speak and understand very little English. Although the Hispanic foreman understands and speaks English, he is not fluent in the English language. The foreman was not present at the site on the day of the accident.

The victim was a full-time, hourly laborer. He usually worked 9:00 a.m. to 5:00 p.m., five days a week. He worked for the company for five years. It is unclear if the victim had prior experience in landscaping work.

The company did not have a written comprehensive health and safety program. The owner indicated he was responsible for safety at the company. There was no safety committee nor were safety meetings held to address safety concerns. Employees had not received any training specific to health or safety hazards.

The company owner had never been cited or fined for health or safety violations prior to this incident. This was the company's first fatality. The company received four citations as a result of the MIOSHA inspection for the fatality. Each citation was classified as "Serious." Two citations under General Rules addressed the need for an accident prevention program and a certified person to render first aid. The other two citations called for a qualified person to inspect excavations and proper procedures to prevent trench collapse under the Excavation, Trenching and Shoring Rules.

INVESTIGATION

The victim along with four other laborers had been hand digging the trench over a two-day period at a private residence. The private residence was a two-story home with a full basement. The landscaping company had performed surface drainage work at the home during the previous summer. The home owner reported water infiltration into the home's basement. The landscape company's owner agreed to investigate the water infiltration, because he felt his previous work at the home may be the source of the leak.

The laborers hand dug the trench along the north side of the home. The trench was two feet wide and sixteen feet long. They dug down five to six feet on the first day. They continued to dig on the second day. Because soil was beginning to accumulate along the top of the trench, it was relocated to the home's driveway away from the trench. The ground was wet from recent snow fall. On the second day, the laborers dug down another four feet for a total of nine to ten feet when they reached a broken drain pipe. The victim was kneeling to inspect the broken drain pipe at the bottom of the east end of the trench. Two other laborers, one of which was the victim's brother, were in the trench ten feet away at the west end speaking to the company owner. The company owner was standing on the home's porch. At approximately 3:00 p.m., a fourth laborer on top of the trench saw a crack in the soil and yelled to the victim. The victim's brother saw the soil strike the victim and knock his head against the home's basement wall. The victim was completely covered with soil in seconds. The three laborers along with the owner began frantically hand digging to reach the victim. The fourth laborer remained above outside of the trench. The owner stopped digging after a couple of minutes to call 911 with his cellular telephone. All four men (three laborers and company owner) continued to hand dig until the local fire and police departments arrived on the scene. Fire and police personnel continued hand digging. The victim's head was uncovered approximately 45 minutes after the trench collapse. Emergency personnel on the scene checked for vital signs. Vital signs were absent. The victim was pronounced dead at the scene.

The local county trench rescue team arrived at this time. The rescue team changed the response from a rescue to a recovery due to the obvious death of the victim. They ordered everyone to evacuate the trench. MISS DIG was contacted along with the local utility companies. MISS DIG is a state program that coordinates with local utility companies to identify the location of underground water, natural gas and electrical lines. The utility personnel identified the presence of water and electrical lines in the area of the trench. The electric company terminated the electrical power to the home and surrounding area. The water line was isolated. The trench rescue team safe guarded the trench from further collapse. An excavator was requested from the local city public works department. The excavator was used to remove the soil and free the victim. The victim was completely uncovered and found in the kneeling position at 9:25 p.m. Paramedics performed an EKG and pronounced the victim dead. An autopsy was performed by county medical examiner.

CAUSE OF DEATH

The medical examiner listed the cause of death as compression/asphyxiation. A toxicology report was not available on the victim.

RECOMMENDATIONS/DISCUSSION

- Employers should ensure that employees working in excavations are protected from cave-in by an adequate protection system such as shoring, sloping or excavation box designed in accordance with MIOSHA Construction Safety Standard, Part 9: Excavation, Trenching and Shoring, R408.40941.

The MIOSHA Construction Safety Standard Part 9: Excavation, Trenching and Shoring, R408.40925 defines an excavation as any man-made cavity or depression in the earth's surface, including its sides, wall or faces, formed by earth removal. When earth is removed from the ground, the walls are left unsupported and pressures are generated at the face of the excavation. Where soil can no longer withstand the pressure, the wall will shear and break away. Usually, soil at the base of the excavation falls into the hole first, then as support is lost from below, higher wall failure may occur. One cubic foot of soil can weigh 100 pounds or more, depending on the soil's composition. Each cubic yard of soil may weigh more than 2500 pounds producing a crushing injury to anyone caught in the wall collapse. A cubic yard of soil weighs nearly the same amount as a mid-size automobile.

The company owner did not select nor implement any preventative measures to protect workers from the trench collapse. To protect workers from the danger of wall collapse, the MIOSHA Excavation, Trenching and Shoring Standard requires that an excavation, five feet or more in depth (unless soil conditions mandate protection in excavations less than five feet) be protected from cave-in. R408.40942 of the Excavation standard details what must be evaluated during an excavation to protect workers inside the excavation. The angle of repose and the design of the supporting system for a side of an excavation shall be based on the evaluation of all the following factors: (a) depth of cut and type of soil, (b) possible variation in the water content of the material while the excavation is open, (c) anticipated changes in the material due to exposure to air, sun, water or freezing, (d) load imposed by structures, equipment, overlying material or stored materials, and (e) vibration from traffic, equipment or blasting.

The selection of preventative measures is based on this evaluation. Methods such as angle of repose, sloping and benching, tight sheeting/sheet piling or trench boxes and shields may be used to protect personnel in the excavation. Sloping involves positioning the soil away from the excavation/trench at an angle that would prevent the soil from caving into the trench. Shoring systems are structures, such as a metal hydraulic, mechanical or timber that provide support to the walls of the trench and prevents cave-ins. If either adequate sloping or shoring had been used in this incident, the fatality may have been prevented.

Employers should consult Table 1 of Part 9 that details the maximum allowable angle of repose for the side of an excavation in excess of five foot depth that is required depending upon the soil and environmental conditions present at the site. Employers can consult the manufacturers of protective systems to obtain detailed guidance for the appropriate use of these products. The appendix in Part 9 has examples of good engineering practices based on the rules of Part 9.

Although water was not accumulating inside the trench at the time of the fatality, the employer should have taken precautions to ensure water did not contribute to the collapse of the trench. Because the employer was attempting to correct a leak in the home's basement, the soil surrounding the home was most likely damp. Damp soil is heavier and less stable. These soil conditions can contribute to the collapse of the trench wall.

- Employers should ensure a qualified person inspects the excavation, adjacent areas and supporting systems on an ongoing basis and the qualified person take the appropriate measures necessary to protect workers.

The employer indicated he was responsible for health and safety. However, he is not formally trained in health and safety, nor is he trained in safety involving excavations. Therefore, the company did not have a qualified person on site to conduct initial and ongoing inspections of the trench.

Part 9, Rule 932(5) defines a qualified person as a person, who by possession of a recognized degree or certificate of professional standing or who by extensive knowledge, training and experience has successfully demonstrated the ability to solve or resolve problems relating to the subject matter or work. The foremen/supervisor typically is the person given qualified person responsibilities. If an inspection by a qualified person had been carried out in compliance with MIOSHA regulations, unsafe conditions may have been recognized and the workers may have been removed from the trench until necessary safety precautions had been taken. When the qualified person finds evidence of a situation that could result in a possible cave-in, indications of failure of protective systems, hazardous atmospheres or other hazardous conditions, exposed employees must be removed from the hazardous area until the necessary precautions have been taken to ensure their safety.

- Employer should develop, implement and maintain a comprehensive health and safety program.

The employer did not have a formal health and safety program. The employer did not provide employee safety education and training. The employer should conduct a job hazard analysis for existing and new work procedures. Based on the findings of the job hazard analysis, the employer should develop and implement a comprehensive health and safety program.

A job hazard analysis would have identified hazards associated with performing excavation work. A copy of the OSHA Job Hazard Analysis publication can be downloaded from the OSHA website: www.osha.gov/. Click on the Newsroom Publication link and scroll down the OSHA publications until “Job Hazard Analysis” document is found.

The MIOSHA Consultation Education and Training (CET) Division has developed a sample Safety and Health Program to assist in developing a site-specific program. This program may be downloaded from the MIOSHA website: www.michigan.gov/miosha. Click on Publications, Forms and Media in the box at the left, then click Sample Plans and Special Programs. Click on Safety and Health Program.

- Employers should provide workers with training in the recognition and avoidance of unsafe conditions and the required safe work practices that apply to their work environments in the language of the workers.

The employer indicated the company has dug trenches in the past, but not as deep as the one involved in this fatality. He did not demonstrate adequate knowledge about safe work practices in excavation techniques. This lack of knowledge not only limited the employer from adequately training his personnel about proper excavation techniques, but also from providing adequate health and safety training, including hazard recognition and prevention.

The MIOSHA CET Division presents many health and safety courses, including excavation safety. These courses are held at various locations across the State. MIFACE encourages employers to contact the MIOSHA CET Division to learn about the course schedule and locations. The MIOSHA CET Division web site can be accessed through the Michigan Department of Labor and Economic Growth web site at www.michigan.gov/miosha. Click on the Consultation, Education and Training link. MIOSHA CET can also be contacted by telephone: 517-322-1809.

Even though the supervisor spoke the language of the employees fluently, they were not provided with safety training in their native language. Companies that employ workers who do not understand English should identify the languages spoken by their employees. The employer should design, implement and enforce a multi-language safety program. To the extent feasible, the safety program should be developed at a literacy level that corresponds with the literacy level of the company’s workforce. Company may need to consider providing special safety training for workers with low literacy to meet their safety responsibilities. The program, in addition to being multi-lingual, should include a competent interpreter to explain worker rights to protection in the workplace, safe work practices workers are expected to adhere to, specific safety protection for all tasks performed, ways to identify and avoid hazards and who to contact when safety and health issues arise.

- Employers should develop a trench emergency action plan that describes rescue and medical duties and ensure that all employees are knowledgeable of those procedures.

Soil walls may collapse multiple times or in phases in the same trench. The first collapse of the trench wall may result in an undercut area of the remaining trench wall, creating a large unsupported overhang of soil. Phase two of the collapse can occur when the overhanging section falls into the trench and may result in a smaller section of unsupported soil near the top of the trench. This section of unsupported soil is held in place only by the cohesion with the soil columns around it and will finally fail as phase three.

A trench emergency action plan did not exist for the site. Untrained coworkers attempted to uncover and remove the victim from the trench before trained rescue personnel arrived at the scene. When the victim's coworkers first recognized that the victim was covered with soil, their first reaction was to come to the aid of their fellow worker. Their reactions were driven by emotion and when they entered the trench, they put their own lives in danger. Fortunately, the trench did not collapse further during their rescue attempt. Many injuries and deaths to rescuers, coworkers or emergency responders are the result of forging ahead without stopping and assessing the situation.

Following formal procedures in the event of an emergency situation such as this are essential in order to avoid further injury and to make sure that the lives of those performing the rescue are not also endangered. To the extent feasible and practical, the employer should analyze jobsites for all foreseeable emergencies. A plan based on specific events should be developed. The plan should describe what actions to take regarding rescue and/or first aid.

Only those persons trained in requirements of NFPA 1670 should attempt rescue operations after a trench cave-in. All persons in the incident site should follow the directions given by the Incident Commander or his/her designee in order to provide the most optimal circumstances for the safety of all persons on the site during rescue operations.

- In addition, MIFACE recommends MISS DIG be contacted prior to excavation activities to identify the location of utilities in the area.

Utilities to the private residence were located in the area of the trench. Although the presence of utilities did not contribute to the fatality, they do present a potential hazard in excavations. It is the employer's responsibility to identify all underground utilities before beginning an excavation in accordance Part 9, 408.40931. MISS DIG may be contacted for this purpose.

The employer did not contact MISS DIG prior to the excavation to determine if any underground utilities were present, or if present, their exact locations. After the appropriate amount of time has passed, the employer should contact MISS DIG a second

time to ensure that all the appropriate utility companies have responded to the MISS DIG notice and have been to the site to mark their particular utility. If a utility has not responded, they should be contacted directly.

The county trench rescue team upon arrival at the incident scene called MISS DIG. The electrical company shut the power to the home and surrounding area. The water company isolated the water line to the home.

RESOURCES

MIOSHA standards cited in this report may be found at and downloaded from the MIOSHA, Michigan Department of Labor and Economic Growth (DLEG) web site at: <http://www.michigan.gov/mioshastandards>. MIOSHA standards are available for a fee by writing to: Michigan Department of Labor and Economic Growth, MIOSHA Standards Section, P.O. Box 30643, Lansing, Michigan 48909-8143 or calling (517) 322-1845.

The MIOSHA Consultation Education & Training (CET) Division services are provided throughout the state by an in-house staff of professional occupational safety consultants, occupational safety specialists and industrial hygienists. The staff in the CET Division is non-enforcement personnel. These consultants and specialists are located throughout Michigan and collectively they serve the employers and the employees in all 83 Michigan counties. MIOSHA CET Division can be contacted by writing to: Consultation Education and Training, 7150 Harris Drive, P.O. Box 30643, Lansing, Michigan 48909-8143 or calling (517) 322-1809. <http://www.michigan.gov/miosha>.

REFERENCES

- MIOSHA Construction Safety Standard, Part 9. Excavation, Trenching and Shoring.
Internet Address: www.michigan.gov/documents/CIS_WSH_part_9_47126_7.pdf
- Excavations. OSHA Publication 2226 (2000), 2.3 MB PDF file.
Internet Address: www.osha.gov/Publications/OSHA2226/2226.html
- Trenching and Excavation: Safety Principles. National Ag Safety Database.
Internet Address: www.cdc.gov/nasd/docs/d001701-d001800/d001755/d001755.pdf
- Excavations: Hazard Recognition in Trenching and Shoring. OSHA Technical Manual (TED 1-0.15A), Section V – Chapter 2 (1999, January 20)
Internet Address: http://www.osha.gov/dts/osta/otm/otm_v/otm_v_2.html
- ARK Technical Rescue Services, Inc., 5630 Flagler Drive, Centreville, VA 20120. Telephone: (703) 378-0855.
Internet Address: <http://arkrescue.com/news/stories/60.shtml>
- Michigan FACE 04MI160 report: Carpenter Dies When Eight Foot Trench Wall Collapses During Sewer Pipe Replacement.
Internet Address: <http://www.oem.msu.edu/MiFace/04MI160v1.pdf>

- Texas FACE 98TX145 report: A Pipe Layer Working in a Trench for a General Contractor in Texas, Died when a Trench Wall Gave Way and He Was Fully Engulfed in Sand/Dirt.
Internet Address: <http://www.cdc.gov/niosh/face/stateface/tx/98tx145.html>
- NFPA[1999]. NFPA 1670, Standard on Operations and Training for Technical Rescue incidents. 1999 Edition, Chapter Nine, Trench and Excavation. Quincy, MA; National Fire Protection Association.

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