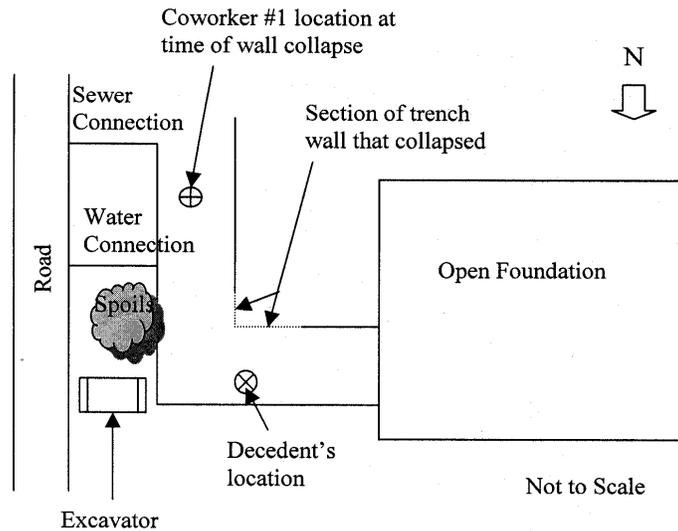


MIFACE INVESTIGATION REPORT: #06MI174

Subject: Hispanic Laborer Dies as a Result of a Trench Collapse

Summary

On October 24, 2006, a 29-year-old male Hispanic laborer who was installing water service lines for a newly constructed residential home foundation was killed when a trench wall collapsed. The decedent was one of two laborers working in a nearly vertical, "L"-shaped excavation that was 50 feet long, 9 feet deep, 7 feet wide on top and 6 feet 6 inches wide at the bottom. The work consisted of laying schedule 40, 4-inch pipe from the water/sewer main near the street to the home. The decedent was assigned to dig



under the footing near the basement while his coworker was laying pipe near the street. There were no trench boxes. The decedent's coworker heard the south corner of the wall collapse and ran to the decedent's location (Diagram A and Figures 1 and 2). He found him under a large chunk of dirt that collapsed from the south corner. The heavy equipment operator told the coworker to call the company. He did so, and the company representative instructed him to call 911. He called 911. Prior to emergency response arrival, a nearby landscape worker heard a call for help and entered the trench with the decedent's coworker to move the dirt chunk from the decedent. The excavator was close enough that the heavy equipment operator used the bucket to dig around the decedent. Emergency response arrived. While attempting rescue, the south wall collapsed again. The decedent was declared 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 a trench box designed in accordance with MIOSHA Construction Safety Standard, Part 9, Excavation, Trenching, and Shoring, R408.40941.
- Employers should ensure that a qualified person inspects the excavation, adjacent areas, and supporting systems on an ongoing basis and that the qualified person ensures the appropriate measures necessary to protect workers are followed.

- 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.
- Employers should develop a trench emergency action plan that describes rescue and medical duties and ensure that all employees are knowledgeable of those procedures.
- Employers should periodically evaluate its organizational commitment and leadership in regards to its safety program.
- Employers should ensure that employee performance reviews include adherence to measurable safety and health criteria.
- Employers should institute a Health and Safety (H&S) committee as part of their health and safety program.
- Employers should take advantage of on-site consultation services provided by MIOSHA Consultation Education and Training Division and trade organizations to improve worksite safety and health.
- Emergency medical services and fire-rescue personnel should be knowledgeable about proper rescue techniques involving excavation sites and ensure that adequate shoring equipment is on hand at all times.
- Emergency medical service companies and fire-rescue departments providing first response should consider providing technical rescue operation training, such as trench rescue training to their personnel.
- The State of Michigan’s Office of Fire Fighter Training should partner with existing organizations that provide trench rescue training to fire fighters as a part of their “Rescue” curriculum.

INTRODUCTION

On October 24, 2006, a 29-year-old male Hispanic laborer who was installing water service lines for a newly constructed foundation for a residential home was killed when a trench wall collapsed. The Michigan Occupational Safety and Health Administration (MIOSHA) personnel received the fatality report on their 24-hour-a-day hotline on October 25, 2006. MIOSHA notified MIFACE on October 25, 2006. The MIFACE researcher interviewed the company president on January 4, 2008, at the company headquarters. During the course of writing this report, the death certificate, medical examiner’s report, police report and MIOSHA file and citations were reviewed. The pictures used in Figures 1 and 3 are courtesy of the responding police department. The pictures used in Figures 2, 4, and 5 are courtesy of the MIOSHA file. Diagram A was developed from information contained in the police report.

The firm was an excavation and grading contractor employing 50 individuals, 5 of whom had the same job title of the decedent – underground laborer. The firm had been in business for 10 years, performing excavating and grading work. The primary language of the decedent was Spanish, but he spoke and understood English. He worked full time, 8-hour days. His work shift started at 7:00 a.m. and ended at 4:30 p.m. The decedent had been employed with the company for three years. He had six years of experience working

in excavation and trenching, having worked for another company performing similar activities for three years prior to his current employment.

The firm had a written health and safety program, which included written safety rules and procedures for excavation safety. The company utilized outside consulting services to develop its safety program, including a trade group, insurance consultant, and legal expert. The person having primary responsibility for the safety program had both on-the-job experience and had attended some safety and health classes. The safety person reported directly to the company president.

The company had a Health and Safety Committee, but it was not formalized. Both management and employees were members of the Committee. All managers worked in the field. Top management, which included the safety person, reviewed safety issues identified by the trade group representative who audits their worksites plus those issues identified internally. If further work practices or procedures need modification or purchases need to be made, the safety officer is authorized to purchase and/or institute changes.

Yearly safety meetings were held with employees. The firm had a written disciplinary procedure in place for health and safety policy violations. The safety program and training materials were provided in both English and Spanish. The company president indicated that the decedent took tests in Spanish because it was easier for him to do so.

The equipment operator was considered to be the foreman on the job and was responsible for maintaining compliance with company policies at the job site as well as enforcing safety behavior for employees. For this work site, the excavator operator had training certification cards from a university-based training course which met the requirements for First Aid as set forth in 30 CFR 56/57.18010 and Qualified Person training in Excavation and Trenching Safety pursuant to MIOSHA Safety Standard Part 9, Excavation, Trenching and Shoring by a local trench box manufacturer.

The firm provided the MIFACE researcher with a copy of their newly revised (March, 2007) Employee Handbook & Safety Manual.

At the conclusion of their investigation, MIOSHA Construction Safety and Health Division issued the following Serious citations to the employer:

- Personal Protective Equipment, Part 6, Rule 622(1).
 - No head protection was being worn while employees, who were engaged in installing water service lines for a newly constructed residential home, were working inside of an excavation with spoil piles stored at the edge of the excavation.
- Excavation, Trenching and Shoring, Part 9.
 - Rule 932(5): A qualified person's actions were not consistent with that of a trained qualified person. The employees were engaged in installing water service lines for a residential home inside of a near vertical

excavation. The trench was 50 feet long, 9 feet deep with a 7-foot wide top and a 6 foot 6 inch wide bottom. The soil condition was of a runny sand loam, clay mixture.

- Rule 933(2): Spoil piles were stored at the edge of an excavation while employees were performing work inside. A Model #312 Caterpillar was stored at the edge of an excavation while an employee was performing work inside.
- Rule 933(5): No ladder was provided within 25 feet of an employee working inside of a near vertical trench 9 feet in depth. The standard requires that an excavation 48 or more inches in depth and occupied by an employee shall be provided with either a ladder extending not less than 3 feet above the top as a means of access or with a ramp meeting the requirements of subrule (6). Lateral travel along the wall of a trench to a ladder or other means of egress shall not exceed 25 feet.
- Rule 941(1): The sides of the excavation were not cut to the proper angle of repose – no shoring or trench box was being used.

INVESTIGATION

The company had been contracted to install water and sewer lines from the basement of a home under construction to the water/sewer taps at the street. The company had employed the crew foreman for five years. He was designated as the qualified person on the site and operated the Caterpillar 312B excavator used to dig the trench. He was the first crewmember of the three-person crew to arrive that morning at the site. The decedent and Coworker #1 were laborers and arrived at the site at approximately 7:45 a.m. Coworker #1, who had been employed by the company for approximately two and one-half years, was also trained to operate the excavator, but was not assigned to this duty at this job site. This three-member crew had worked together on many job sites.

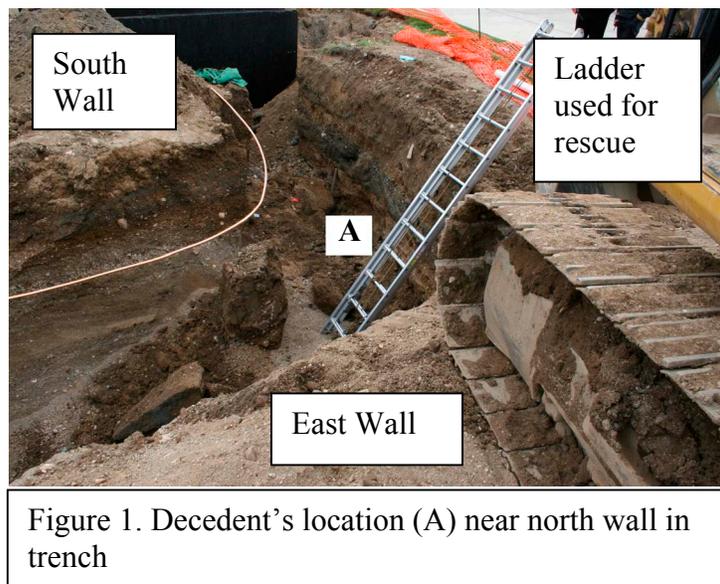


Figure 1. Decedent's location (A) near north wall in trench

The crew foreman dug a nearly vertical, “L”-shaped excavation that was 50 feet long, 9 feet deep, 7 feet wide on top and 6 feet 6 inches wide at the bottom (Diagram A). The soil was sandy material with clay layer top (mixture of a medium clay and runny sand/loam mix). The first 18 inches to 2 feet were composed of clay. The company president indicated that there was a ladder in the trench, but it was not within 25 feet of the

decedent. The company president also indicated that there was a ramp present at both ends of the trench. The company safety person had been present at the job site for most of the morning checking on the work crew and the progress of the work. He had left the work site 15 to 20 minutes prior to the incident.

The crew was laying schedule 40, 4-inch pipe from the main near the street to the home. Prior to the trench collapse, the decedent was hand digging around the foundation with a pick ax. Coworker #1 was in the trench near the street, approximately 20 to 30 feet away from the decedent using a gas-powered saw to cut a damaged piece of PVC pipe for the sewer line. The foreman had taken a shovel full of dirt from the trench and swung the shovel to his left to dump the dirt when he heard the trench wall collapse. Coworker #1 also heard the trench wall collapse, put the saw down, yelled to the foreman concerning the location of the decedent, and then ran around the corner of the trench.

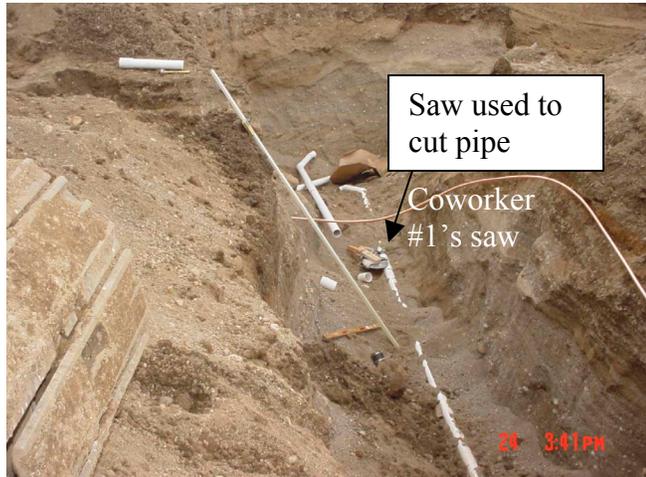


Figure 2. Location of Coworker #1 in trench cutting pipe when trench wall collapse occurred

A large amount of dirt at the southeast corner wall of the trench collapsed. The foreman looked back toward the foundation. The decedent was not where he had last seen him. The foreman jumped down from the excavator and entered the trench with Coworker #1. They could see some of the decedent's hair sticking up out of the soil. The two men began digging by hand in an attempt to rescue him. They were unable to move the chunks of clay, which were estimated to weigh 300 pounds, from around the decedent. They uncovered the decedent's head and one of his hands. Coworker #1 indicated in the police report that the decedent showed no signs of life and was bleeding from his mouth and ear.

Coworker #1 left the trench, yelled for help, and then called the company office. The office instructed him to call 911. A landscaper was



Figure 3. Position of excavator and spoils

laying sod on the house directly across from the scene when he heard someone yell, “call 911, help, call 911.” He ran to see if he could help and observed the foreman in the excavator. He saw the decedent’s coworker running back and forth along the side of the trench where the deceased was located. The landscaper jumped into the trench and worked with Coworker #1 to try to dig the decedent out.

While the landscape worker and Coworker #1 continued their attempt to rescue the decedent, the foreman used the excavator to move dirt away from the area where the decedent was buried. He was afraid that the soil between the excavator and the decedent could shift and cover the decedent and the rescuers. The landscape contractor told the foreman to stop using the excavator to remove the dirt, because he was too close to the rescuers/decedent. The police department report stated that the foreman knew it was contrary to the training that he had received to use the excavator in such a situation. The excavator shovel bucket did not hit the decedent nor did it hit any rescuers during its operation.

The landscaper was able to free the decedent from the dirt. The first fire fighter arrived and observed Coworker #1 standing in trench and the decedent lying on the ground in the trench. The fire fighter looked into the trench and noted the decedent was right next to the trench wall, lying on his back slightly rolled to his left with his head facing left. He was in a kneeling position with his legs bent under him, facing away (east) of the excavator. The fire fighter characterized the decedent as having “obvious crushing injury to the head”, and “no signs of life visibly present.” When the second fire fighter arrived, there were two individuals in the trench. He was directed to get a ladder from the rescue rig and place the ladder in the trench for the individuals to climb out of the trench. Loose soil was coming down in different areas of the trench.

One of the Fire Department personnel on site assumed the responsibilities of Incident Commander. The Incident Commander instructed one of the fire fighters to check for a pulse on the decedent. The fire fighter entered the trench and did not find a pulse. The ambulance arrived, and the fire fighter placed leads on the decedent and printed a strip for the ambulance crew, who stated that it was a rhythm not conducive to life. The fire fighter exited the trench and the staff on scene deemed the rescue to be a body recovery due to the observed trauma and negative vital signs. A trench box was brought to the site and placed by emergency response personnel. The fire department with assistance provided by the water department began recovery



Figure 4. Position of trench box in trench during rescue operation

operations. Two fire fighters entered the trench box, secured the decedent to a long board, and the decedent was lifted from the trench.

The police report stated that because of the risk of collapse, the police department officer assigned to take photographs did not enter the trench. After the MIOSHA finished its investigation, a company employee filled in the trench.

CAUSE OF DEATH

The cause of death as stated on the death certificate was multiple injuries. Toxicology was negative for alcohol and illicit drugs.

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 a trench 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 2,500 pounds producing a crushing injury to anyone caught in the wall collapse. A cubic yard of soil can weigh nearly the same amount as a mid-size automobile.

The foreman and company safety officer did not adhere to the written company policy concerning trenching. Per the company handbook, the foreman and safety officer did not ensure that spoil was at least two feet back from the lip of the trench, that employees working in the excavation were within a protective system, and that the trench, which was over five feet, was cut to the angle of repose, sheeted or shored. Additionally, the employees working in the trench did not have a ladder or a ramp within 25 feet from their work area.



Figure 5. Location of decedent (X) in trench

R408.40942 of Part 9 details what must be evaluated during an excavation to protect workers inside the excavation. 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. 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 also 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.

To assist employers in complying with Part 9, the Michigan Infrastructure and Transportation Association (MITA) has developed a Trench Safety Handbook. Although not intended to be a substitute for the MIOSHA standards, the handbook provides employers with a quick reference to identify and avoid potential hazards associated with excavation activities. Employers may download without charge the MITA safety literature, including the Trench Safety Handbook, by accessing the MITA website: <http://www.mi-ita.com/>. Click on the Safety link, and then click on Safety Reference & PDFs. Several of MITA's educational materials are also available in Spanish.

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

A qualified person means 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 and work. The company had assigned the job foremen as the qualified person.

Although the foreman, decedent and his coworker, and the safety officer had been through the company-required training program, none of them implemented the company's written program nor followed safe work practices. The company's Accident Prevention Program/General Safety Rules required that a "qualified employee" is designated for each crew or project. The designated individual has many responsibilities on the jobsite. Pertinent to this incident, according to the company's handbook, the qualified person's responsibilities included:

- Instructing each employee regarding operating procedures, hazards and safeguards of tools and equipment when necessary to perform the job.
- Inspecting the construction site, tools, and equipment to assure unsafe conditions that may create a hazard are eliminated.
- Instructing each employee in the recognition and avoidance of hazards.

- Assuring that safety program is implemented.
- Inspecting the job site to assure that no unsafe conditions exist.
- Ensuring that necessary protective equipment is on hand and used when required.
- Instructing all employees in safe procedures and job safety requirements – follow up and insist on compliance.

The conditions and the directions given to the employees were not consistent with those of a qualified person demonstrating adequate knowledge about safe work practices in excavation techniques. If the qualified person responsibilities had been carried out in compliance with MIOSHA regulations, unsafe conditions would have been recognized and the workers would have been removed from the trench until necessary safety precautions had been taken. Unfortunately, the work crew accepted the risks of not adequately shoring the excavation, using a trench box, or having the proper angle of repose.

- 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.

Employers should ensure that all employees are trained to recognize and avoid hazardous work conditions. Employers should also ensure that the training in recognizing and avoiding hazards is coupled with employer assessment that workers are competent in the recognition of hazards and safe work practices.

The company president mentioned to the MIFACE investigator that a “normal” construction pattern is that the foundation would not be present when water and sewer lines are placed. In this case, this could not be done because the water and sewer permits were not pulled in time, so the foundation was dug first. By having the foundation dug first, it was more difficult to work because the crew did not have adequate space.

Because jobsite conditions change on a daily basis, MIFACE recommends that employers discuss the day’s work with the employees prior to the start of the work. This could be accomplished in short daily “tailgate” talks, covering applicable health and safety issues, weather issues, equipment issues, etc.

- 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 in Phase Three.

A trench emergency action plan did not exist for the site. Untrained coworkers and volunteers attempted to uncover and remove the decedent from the trench before trained rescue personnel arrived at the scene. When the decedent's coworkers first recognized that he 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 onto them 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 is essential to avoid further injury and to make sure that the lives of those performing the rescue are not also endangered. 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. The plan should also instruct employees to first call 9-1-1 for emergency assistance, and then call the office/supervisor to update them on the emergency.

MIFACE recommends only those persons trained in requirements of National Fire Protection Association (NFPA) 1670 should attempt rescue operations after a trench cave-in.

- The employer should evaluate its organizational commitment and leadership in regards to its safety program.

The employer's safety officer was on site just prior to the trench collapse and did not order a halt in work. By not stopping the job and requiring adequate shoring/sloping, the employer gave tacit approval to the employees working in an unsupported trench. The management, by not "saying" anything to the employees about the excavation site conditions contributed to lax safety work habits by the employees.

Safety starts at the top of an organization. Organizational commitment, management commitment and leadership, and employee motivation and buy-in are necessary to make a safety program effective. The safety culture of an organization can have a profound effect upon the employee's willingness to adopt and adhere to safe work practices and the company's safety program requirements. Top management must have middle management first accountable for safety in their work processes. A safety culture of thoroughly planning the work is one of the keys to prevent a work-related injury. As illustrated in this incident, because obstructions were present and proper sloping was not an option, then the work plan should have ensured that the proper equipment (shoring/trench box) was available on site.

MIFACE recommends that employers audit themselves on their management commitment to safety. There are several examples of management safety audit systems on the Internet that can be modified by for use by any employer:

- International Organization of Oil and Gas Producers: “Checklist for an audit of safety management” <http://www.ogp.org.uk/pubs/160.pdf>
 - United Kingdom, Health and Safety Commission, Health and Safety Executive: Textile Safety Management System Audit, Parts 1-4
www.hse.gov.uk/textiles/audit/part1.htm,
www.hse.gov.uk/textiles/audit/part2.htm,
www.hse.gov.uk/textiles/audit/part3.htm
www.hse.gov.uk/textiles/audit/part4.htm
 - OHSAS 18001: OHSAS 18000 is an international occupational health and safety management system specification. It comprises two parts, 18001 and 18002 and embraces BS8800 and a number of other publications.
www.ohsas-18001-occupational-health-and-safety.com/index.htm
- Employers should ensure that employee performance reviews include adherence to measurable safety and health criteria.

Based on the company’s Employee Handbook, the safety person and job foreman were given supervisory roles based on their past work performance and training. The Employee Handbook states, “your performance may, in the sole discretion of the company, be formally evaluated on an annual or other periodic basis. Such reviews may be conducted to assist you in improving your job performance or to provide a measurement of your contribution to the company and the achievement of its objectives, as well as to assess your readiness for advancement and other career development opportunities.”

MIFACE encourages the employer to include, as part of the performance review, safety related performance objectives, measures, and expectations, especially for supervisory positions. Safety goals/objectives should be measurable, attainable, and reasonable. Accountability should be built into the system with goals/objectives tied into the individual’s annual/periodic performance review.

The Employee Handbook also states that employees “are expected to do the very best job that he/she can on every assignment given.” This includes “using good judgment, asking questions, anticipating problems, taking the initiative to prevent problems from occurring and offering your ideas on how to get the job done better.” All company employees must be encouraged, without the fear of recrimination, to voice concerns about their working conditions.

- Employers should institute a Health and Safety (H&S) committee as part of their health and safety program.

An H&S Committee, comprised of both management and hourly employees provides a forum for management and employees to regularly discuss health and safety issues in the workplace. An H&S Committee is an important way for employees to help manage their own health and safety and assist the employer in providing a safer, healthier workplace. The formation of the Committee provides a process for open communication on health and safety issues and enhances the ability of employees and management to resolve safety and health concerns reasonably and cooperatively.

Much of the potential value of an H&S Committee can be lost without careful development of the purpose, functions and activities of the Committee. The Committee will function effectively only after the need for the committee is recognized and employees, supervisors and managers welcome its services. At their worst, Health and Safety Committees can be a “negative-minded” group confining their approach primarily to (after-the-fact) placing of blame. However, at their best, they can become an effective tool to help prevent unsafe practices and conditions, reduce the risk of injury and illnesses and to help motivate employees and supervisors to become actively involved.

MIOSHA has several resources that can be accessed on the Internet to assist an employer in the development of an effective H&S Committee. The *Good Safety and Health Programs are Built with Good Safety Committees* brochure (www.michigan.gov/documents/cis_wsh_cet0140_103132_7.pdf) details the advantages of having an effective H&S Committee. The MIOSHA Safety and Health Toolbox, which can be found at the homepage of MIOSHA Consultation, Education and Training Division, contains materials that focus on the major components of a health and safety system. Module 2 of the Toolbox focuses on employee involvement and contains several resources for Health and Safety Committee development. The MIOSHA CET Division website can be accessed through the Michigan Department of Labor and Economic Growth website at <http://michigan.gov/dleg>. Click on the MIOSHA link located in the box on the left side of the web page, then click on the Consultation, Education, and Training link. MIOSHA CET can also be contacted by telephone: (517) 322-1809.

The State of Wisconsin “Guidelines for Developing an Effective Health and Safety Committee” (www.doa.state.wi.us/docs_view2.asp?docid=665) and the Canadian Centre for Occupational Health and Safety, Occupational Safety and Health Answers: Health and Safety Committees (www.ccohs.ca/oshanswers/hsprograms/hscommittees/) both provide valuable resources and a framework for selection of H&S Committee membership, purpose, function, and activities.

- Employers should take advantage of on-site consultation services provided by MIOSHA Consultation Education and Training Division and trade organizations to improve worksite safety and health.

MIFACE encourages individuals performing excavation work to contact the MIOSHA Consultation Education and Training (CET) Division to learn about the many health and

safety courses, including excavation safety offered across the state and the course schedule and locations.

The MIOSHA 10-hour Construction Course held at the MIOSHA Training Institute at Macomb Community College includes an overview of MIOSHA Construction Safety Standard Part 9 – Excavations, Trenching and Shoring. The MIOSHA Training Institute website can be found at <http://www.macomb.edu/Businesses+And+Municipalities/Economic+Development+And+Workforce+Training/Workforce+Development+Institute/Course+Offerings/MIOSHA+Training+Institute.htm>.

Excavation companies can also sign up for trade organization safety personnel to inspect their worksites. These individuals can assess the worksite to identify safety issues and make recommendations to the employer for correction. In addition, the trade organization's representative can identify actions the employer is already incorporating into their work practices to comply with MIOSHA construction standards and best practices. Employers can sign up for these inspections on a quarterly basis (company president recommendation) or another inspection schedule, such as twice per year.

- Emergency medical services and fire-rescue personnel should be knowledgeable about proper rescue techniques involving excavation sites and ensure that adequate shoring equipment is on hand at all times.

The Fire Department's Incident Commander instructed the fire fighter to enter the trench to assess the decedent's status without providing trench wall stabilization/shoring, placing the fire fighter at risk of becoming a victim. The police report stated that due to the risk of trench wall collapse, the police department officer taking pictures of the incident site did not go down into the trench; the fire department took several of the pictures. The MIOSHA file indicated that while attempting rescue, the south wall collapsed again, indicating that the trench wall may have been unstable at the time of the fire fighter's initial entry.

According to NFPA 1670, Standard on Operations and Training for Technical Search and Rescue Incidents, general hazards associated with search and rescue operations can present the authority having jurisdiction with uniquely challenging situations. Within this standard, all trench and many excavation collapses necessitate a confined space rescue. Responding personnel should be familiar with and trained in confined space rescue requirements and techniques. Workers should never, under any circumstances, enter a hazardous environment to attempt a rescue operation unless properly equipped and trained in the use of the equipment and methods required for rescue.

- Emergency medical service companies and fire-rescue departments providing first response should consider providing technical rescue operation training, such as trench rescue training, to their personnel.

NFPA 1670 Standard On Operations and Training For Technical Rescue Incidents is designed to assist local fire departments assess their level of operational capabilities for technical rescue incidents and to establish training criteria that will help create safe and

- o Structural Collapse (Chapter 3)
- o Rope Rescue (Chapter 4)
- o Confined Space (Chapter 5)
- o Vehicle and Machinery (Chapter 6)
- o Water (Chapter 7)
- o Wilderness Search And Rescue (Chapter 8)
- o Trench and Excavation (Chapter 9)

efficient operations. NFPA 1670 lists the following Technical Rescue Operations: Under the Chapter 2, General Requirements, the fire department (authority having jurisdiction or AHJ) must ... "establish levels of operational capability needed to conduct operations at technical rescue incidents, safely and effectively...(2-1.1).

(2-1.2) "The AHJ shall establish written standard operating procedures consistent with one of the following operational levels.

(a) AWARENESS. This level represents the minimum capability of a responder who, in the course of his or her regular job duties, could be called upon to respond to, or could be the first on the scene of, a technical rescue incident. This level can involve search, rescue, and recovery operations. Members of a team at this level are generally not considered rescuers.

(b) OPERATIONS. This level represents the capability of hazard recognition, equipment use, and techniques necessary to safely and effectively support and participate in a technical rescue incident. This level can involve search, rescue, and recovery operations, but usually are carried out under the supervision of technician-level personnel.

(c) TECHNICIAN. This level represents the capability of hazard recognition, equipment use, and techniques necessary to safely and effectively coordinate, perform, and supervise a technical rescue incident. This level can involve search, rescue, and recovery operations.

There are several organizations in Michigan that provide trench rescue training for first responders. One organization, Michigan Urban Search and Rescue Training Foundation (MUSAR TF), was formed from a partnership with the Operating Engineers Local 324 Journeyman and Apprenticeship Training Fund and Michigan Urban Search and Rescue. MUSAR TF workshop-based curriculum teaches both firefighters and Operating Engineers trench and excavation rescue techniques that meet or exceed NFPA 1670 and other "technical rescue" programs. Information about upcoming classes can be found at the MUSAR TF website: <http://www.musartf.org/>.

- The State of Michigan’s Office of Fire Fighter Training should partner with organizations that provide trench rescue training to fire fighters as a part of their “Rescue” curriculum.

Fire fighters are often the first on scene in a trench emergency. According to their website, the Office of Fire Fighter Training (OFFT) serves the training and certification needs of the State’s 1,075 fire departments and 30,672 firefighters and officers. The office prepares and publishes training standards, establishes courses of study, certifies instructors, establishes regional training centers, cooperates with State, federal, and local fire agencies to facilitate training of firefighters, and develops and administers mandatory certification examinations for new firefighters. The OFFT offers a Fire Fighter I and Fire Fighter II certifications. Currently, no course is offered to fire fighters on the procedures needed to conduct a trench rescue.

The Office of Fire Fighting Training and available courses can be found by the Department of Labor and Economic Growth (MDLEG) website at <http://www.michigan.gov/dleg>. Click on Agencies and Commissions, then click on the Bureau of Fire Services, and then click on the Office of Fire Fighter Training link. The Director of the Office of Fire Fighter Training may also be contacted at 517-241-8847. Training should be documented and tracked by the administration to ensure all individuals have received proper and current training.

REFERENCES

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.

- MIOSHA Construction Safety and Health Standard, Part 9, Excavation, Trenching and Shoring.
- National Fire Protection Association, (NFPA) 1670, Standard on Operations and Training for Technical Search and Rescue Incidents, 2004 Edition. <http://www.nfpa.org/aboutthecodes/AboutTheCodes.asp?DocNum=1670&cookie%5Ftest=1>
- Canada’s National Occupational Health and Safety Resource. www.ccohs.ca/
- Industrial Accident Prevention Association (IAPA). Free downloads of health and safety information. <http://www.iapa.ca/> Click on Resources.
- OHSAS 18001 Occupational Health and Safety Zone. <http://www.ohsas-18001-occupational-health-and-safety.com/index.htm>
- Operating Engineers Local 324. Journeyman & Apprentice Training Fund, Inc. 275 East Highland Road. Howell, Mi 48843. www.benesysinc.com/benefit/oe324jatf.asp

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- AFSCME Training Publications, Workplace Safety and Health: Excavation, Trenching and Shoring Safety. www.afscme.org/publications/1340.cfm
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- MIFACE Investigation Report #04MI160: Carpenter Dies When Eight-foot Trench Wall Collapses During Sewer Pipe Replacement. <http://www.oem.msu.edu/MiFace/04MI160v1.pdf>
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- International Organization of Oil and Gas Producers: “Checklist for an audit of safety management.” <http://www.ogp.org.uk/pubs/160.pdf>
- United Kingdom, Health and Safety Commission, Health and Safety Executive. www.hse.gov.uk/textiles/audit/part1.htm

Key Words: Excavation, Trench, Cave-in, Construction, Struck By

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