

# M&M EXCAVATING

# SAFETY

# PROGRAM

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SAFETY & QUALITY  
PRIDE & INTEGRITY  
FAMILY & COMMUNITY

UPDATED: 10/16/25



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# INTRODUCTION

It is the policy of M & M Excavating Company to provide a safe workplace for its employees. To this end, the company, in concert with employees, will seek to comply with all applicable standards promulgated pursuant to the Michigan Occupational Safety and Health Act. Since the most important component of any safety policy or program is implementation, it is our intent to communicate the contents of this program to our employees. In turn, all employees are expected to comply with this document and will be disciplined if found to be in non-compliance. Any questions regarding this document should be addressed to:

Safety Manager: Mathew Southwick

## MANAGEMENT COMMITMENT TO SAFETY

M&M Excavating is dedicated to ensuring the safety and well-being of all employees and individuals on our work sites. We prioritize worker safety above all else, recognizing that no job is more important than the health and safety of our team. Our commitment to safety is unwavering. We strive to meticulously plan and execute work in a manner that minimizes accidents and near misses. We adhere to all rules and regulations outlined in the Michigan Occupational Safety and Health Act (MIOSHA), ensuring strict enforcement by our management team. We understand the significance of fostering a positive safety culture within our organization. Employee involvement is key, and we actively encourage our team members to participate in creating and implementing effective safety policies and procedures. At M&M Excavating, we value open communication and transparency. Employees are empowered to promptly address and report any unsafe conditions or potential hazards to management without fear of reprisal. This commitment to safety is at the core of our operations, and we are dedicated to upholding the highest standards of safety for all.

- Designate a qualified safety officer to coordinate the program.
- Pre-plan for safety and health (e.g. JSA, Pre-Task Analysis).
- Provide on-going safety and health training to employees (e.g. formal classroom training, toolbox talks).
- Employee engagement (e.g. participation, problem solving, reporting).
- Follow safety rules and procedures.
- Conduct regular jobsite inspections and monitoring.
- Enforce safety and health rules and use appropriate discipline.

## ORGANIZATION & MANAGEMENT RESPONSIBILITY

- Safety should be prioritized for every task, every day.
- Mitigate potential hazards by ensuring adequate staffing, funding, time, and equipment are provided so that personnel can work safely and efficiently.
- Implement and monitor compliance with the company's safety goals.

# M & M EXCAVATING COMPANY SAFETY STANDARDS

It is the policy of this company to keep its employees informed of all safety rules contained in the Construction Safety Standards and the Occupational Health Standards.

Any employee may obtain a copy of any of the above-mentioned standards by contacting the company Safety Officer.

## SAFETY DIRECTOR RESPONSIBILITIES

John C. Landrie is the designated **Company Safety Director** and is responsible for coordinating, implementing, and administering this program.

The general responsibilities include:

- Employee Training. Coordinate safety and health training and keep employees informed of all MIOSHA Construction Safety Standards and Occupational Health Standards pertaining to the work operation. Copies of standards shall be provided to employees upon request.
- Safety/Health Procedures. Understand potential job hazards and how to eliminate them by establishing safety and health procedures.
- Employee Engagement. Encourage employee participation to improve safety on jobsites (i.e. recommendations on procedures and training topics; encourage employees to inspect their work areas and report safety concerns and near misses to Superintendent).
- Jobsite Inspections. Conduct periodic jobsite inspections to ensure Superintendent responsibilities are being implemented.
- Documentation. Document employee training (i.e. classroom, toolbox talks, pre-task analysis); jobsite inspections (**see Superintendent Safety Checklist**); and any other proactive safety records. Maintain copies of documentation at the main office.
- Postings. Ensure a safety bulletin with required postings is posted and maintained at the main office and on all jobsites having a company jobsite trailer.
- Incident Investigations. Participate in all incident investigations resulting in serious bodily harm or high financial impact (i.e. injuries, illnesses, property damage). Ensure every incident investigation has been properly documented on the and corrective actions are completed before work continues. **See Incident Investigation Report.**
- Recordkeeping. Ensure **Fatality and Injury Recording and Recording** requirements are being implemented.

# M & M EXCAVATING COMPANY RESPONSIBILITIES OF SUPERINTENDENT / QUALIFIED EMPLOYEE

The Superintendent or other designated qualified person is responsible for overall safety on the jobsite. Responsibilities and duties include:

- Provide periodic and ongoing safety instructions (i.e. weekly toolbox talks, daily safety huddles) to employees regarding operating procedures, hazards and safeguards of tools and equipment when necessary to perform the job; and how to recognize and avoid hazards.
- Inspect the construction site, tools and equipment to assure any unsafe conditions that may create a hazard are eliminated. (See Superintendent Safety Checklist.)
- Make sure that the necessary protective equipment is on hand and used when required.
- Instruct all employees in safe procedures and job safety requirements.
- Follow up and insist on compliance.
- Instruct each employee, where known harmful plants, reptiles, animals or insects are present, as to the potential hazards, how to avoid injury, and applicable first aid procedures to be used in the event of an injury.
- Instruct each employee required to handle or use known poisons, toxic materials, caustics and other harmful substances regarding the potential hazards, safe handling, use, personal hygiene, protective measures required and applicable first aid procedures to be used in the event of injury.
- Ensure all employees have been instructed in the steps to be taken in case of an incident or emergency for each job site (Incident Response /Investigation Process see page 76).
- See that all injuries are cared for properly and reported promptly.
- Investigate all incidents (i.e. injuries, illnesses, or property damages) on the job site that result in a recordable injury/illness or high financial impact.
- Serious near-miss incidents should also be investigated. Immediately inform the Safety Director of the incident and provide him/her with a copy of the Inform & Claimant Incident Investigation Report. Complete any corrective actions before work continues or remove employees from the hazard.
- Ensure the Company disciplinary policy is being implemented for employees found non-compliant with this safety and health program. Make sure each employee completes a sign-off sheet.
- Ensure employees are not knowingly allowed to work while under the influence of intoxicating beverages or substances which would impair the employee's ability to perform a task in a safe manner.
- Be familiar with the rules pertaining to safety.
- Assure that the safety program is implemented.
- Ensure a copy of this Safety and Health Program is available at the jobsite and maintain a safety bulletin board with required posters in jobsite trailers.

# M&M EXCAVATING SUPERINTENDENT SAFETY CHECKLIST

Superintendent:	
Job Number:	
Location:	
Date Inspected:	
Inspector:	

	Y	N
1. Emergency Phone Numbers Posted		
2. First Aid/CPR certified employee on each job site		
a. First-aid kits available		
b. CPR Mask available:		
c. Rubber Gloves:		
d. HazMat Disposal bag:		
3. Drinking water with cups available		
4. Toilet facilities provided or available		
5. Personal safety equipment in use:		
a. Hard hats		
b. Eye protection		
c. Ear protection		
d. Hand protection		
e. Foot protection		
f. Clothing protection		
6. Fuel Storage		
a. Fuel storage area marked "NO SMOKING"		
b. Appropriate extinguisher available <b>in</b> area		
c. All fuel cans safety type-transport only		
7. Traffic and pedestrian control devices properly used		
a. Construction signs		
b. Proper barricades		
c. Traffic cones		
d. Flag persons with six-foot staff with red flags and orange vest		
e. Flag persons properly instructed		
f. Flag persons used to assist trucks and vehicles in and out of traffic		
8. Tools		
a. Air tool connections secured with whip checks		
b. Portable electric tools provided with approved systems of double insulation and GFCI		
c. Extension cords are three wire type and in good condition		
d. Portable lights are equipped with bulb guards.		
e. Protective guards on portable saws in good order		
f. Ladder in good condition		
g. All hand tools in good condition, no cracked or splintered handles		
9. Trucks and equipment		
a. Parking brakes set when not in use		

b. Type ABC fire extinguishers available in trucks		
c. All horns and lights in good working order		
d. Seats firmly secured on vehicles used to transport employees		
e. A copy of the most recent equipment inspection checklist on sight		
f. Roll over protection and seat belts in good order		
g. Equipment safety chains in good order and in use		
h. Registration cards in all trucks		
i. Equipment and vehicle properly lubricated and maintained		
j. All drivers with valid licenses		
k. Back-up alarms in good working order		
l. Windshield void of cracks/wipers and defoggers in operable condition		
10. Excavation, trenching, shoring, pipe laying		
a. Qualified person makes periodic inspections of soil conditions and shoring systems		
b. Effort made to locate underground installations by inspection and notification to MISS DIG		
c. Excavated material stored 3 feet from edge of excavation		
d. Materials used for shoring in good working condition – trench box inspected for broken welds		
e. Walls on manhole and ditch excavations more than 5 feet deep shored or sloped or otherwise protected		
f. Means of ingress/egress provided every 25 feet in trenches over 4 feet deep		
g. Warning signs posted on truck cranes and excavating equipment. Maintain minimum 10-foot clearance when working near electrical lines		
11. Working in confined spaces		
a. Confined space tested for gas before entry		
b. Confined space ventilated with blowers before entry		
c. Smoking or open flame not permitted within 25 feet of confined space		
d. Upstream utilities tagged and locked out		
12. Handling and storage of materials		
a. Rigging equipment inspected at the beginning of each shift		
b. Chains are alloy steel with permanent tag showing size, grade, rated capacity, and manufacturer's name		
c. Material staked, raked, blocked, interlocked, or otherwise secured to prevent sliding, falling, or collapse during storage or transport		
d. Inspect hooks for stretching or twisting		
e. Slings in good condition and built properly		
13. MIOSHA safety poster displayed		
14. Accident report filled out promptly and completed after each accident. Phoned into office for typing and mailing		
15. Safety manual on jobsite		
16. new employees given brief orientation to company policies		
17. conduct one 20 minute job safety analysis with crew each week. Conduct one 10 minute Safety Meeting with crew each day. Records of topic and attendance must be turned into home office.		
18. SDS booklet and poster		

Remarks:



# Accident Prevention Program/General Safety Rules

1. It is the policy of M & M Excavating Company to furnish each employee employment, which is free from recognized hazards that are causing or are likely to cause death or serious physical harm to such employee.
2. M & M Excavating Company designates Mathew Southwick as corporate Safety Manager. This person is responsible for the implementation of the Company's safety program. If any employee needs to know who the company Safety Officer is, they can find out by asking any superintendent.
3. When practical, employees of M & M Excavating Company will participate in safety seminars sponsored by MITA, Inc., and/or other organizations.
4. The Safety Officer shall designate a qualified employee on each crew or project who will have the following responsibilities:
  - a. Instruct each employee regarding operating procedures, hazards and safeguards of tools and equipment when necessary to perform the job.
  - b. Inspect the construction site, tools and equipment to ensure unsafe conditions that may create a hazard are eliminated.
  - c. Instruct each employee in the recognition and avoidance of hazards.
  - d. Instruct each employee, where known harmful plants, reptiles, animals or insects are present, as to the potential hazards, how to avoid injury, and applicable first aid procedures to be used in the event of an injury.
  - e. Instruct each employee required to handle or use known poisons, toxic materials, caustics and other harmful sub- stances regarding the potential hazards, safe handling, use, personal hygiene, protective measures required and applicable first aid procedures to be used in the event of In Jury.
  - f. Instruct each employee required to enter a confined space regarding the hazards involved, the necessary precautions to be taken, the use of personal protective equipment, and the procedures to be followed if an emergency occurs.
  - g. Instruct all employees in the steps to be taken in case of an injury or accident.
5. M & M Excavating Company shall not knowingly permit an employee to work while under the influence of intoxicating beverages or substances which would impair the employee's ability to perform a task in a safe manner. Additionally, no employee shall possess/use intoxicating beverages or controlling substances at any M & M Excavating Company facility. Any employee violating this policy is subject to immediate dismissal.
6. The job superintendent will inspect all machines, tools and equipment on a regular basis to make certain that no defect is present that will affect the safety of employees.
7. All employee complaints or concerns regarding safety shall be immediately brought to the attention of the Safety Officer.
8. Periodic meetings will be held to inform all employees of the company safety program.
9. This safety program shall be made available to all employees.
10. A safety bulletin board will be located at the main office along with one at each job trailer.
11. The board will include the required safety postings. An EEO Manual is available for your review in the main office.
12. Employees will adhere to the following Safety Rules:
  - a. Adhere to all guidelines outlined in this Safety Program.
  - b. Perform work in a manner that prioritizes safety.
  - c. Take ownership of personal safety, as well as the safety of colleagues.
  - d. Promptly report any accidents, injuries, near misses, safety successes, or hazardous conditions.
  - e. Engage in accident inquiries as necessary.
  - f. Attend and actively contribute to weekly Safety Talks and Stand-down meetings.

# General Rules

Safety and accident prevention are vital. It is M&M Excavating's intent to prevent personal injury to our employees. It is our goal that:

- A. Safety hazards be eliminated.
- B. Unsafe acts or conditions be detected, reported, and corrected;
- C. Safety consciousness be instilled in all employees.

Listed below are some important guidelines to follow, but no set of rules can ever ensure safe operations. This can only be achieved by the following safety procedures and practices:

- Unsafe Conditions and Acts – Employees must report any unsafe condition, malfunction of a safety device, or any safety hazard immediately to management.
- Good Housekeeping – Work areas should be kept clean, orderly, and free of objects that may result in accidents or injuries.
- When lifting an object, employees should remember to lift with their legs and ask for assistance. It is always better to ask for assistance rather than causing an injury. Violation of any Company safety rule may result in disciplinary action, up to and including termination. The following safety and health rules must be obeyed by all employees.

## SAFE PRACTICES

1. Do not engage in horseplay or other unsafe behavior that would endanger you or another co-worker.
2. Watch where you are walking. Don't run. Keep your mind on your work.
3. Lift the right way — with your legs, not your back. Get help if a load is too heavy.

## REPORTING RESPONSIBILITIES

1. If you see an unsafe condition, correct it immediately (if feasible) and inform your superintendent. Do not hesitate to bring any safety concerns to your superintendent.
2. Report all injuries (yourself or coworkers), no matter how significant, immediately to your superintendent.
3. The use of illegal drugs or alcohol or being under the influence during working hours will be cause for termination. Inform your superintendent if you are taking strong prescription drugs that warn against driving or using machinery.
4. Make sure you know what the emergency procedures are at your jobsite (i. e.) location of emergency phone, jobsite address, first aid kit, fire extinguisher locations, evacuation plan, etc.). Ask your superintendent if you have any questions.

## HOUSEKEEPING

1. Maintain the floors of your work area. Pick up debris and sweep up daily.
2. Remove or secure any material located in open areas that could be picked up and blown away by the wind.
3. Material, scrap, and debris must be piled, stacked or placed in containers.

## HAZARDOUS ATMOSPHERES

Never enter a manhole, well, shaft, sewer, excavation, tunnel or other confined space which could possibly have a hazardous atmosphere due to lack of oxygen, or contain toxic or flammable gases, or has a possibility of engulfment by solids or liquids. If you come across these types of spaces, inform your superintendent and wait for further direction. See Confined Space Program section for additional information.

## PERSONAL PROTECTIVE EQUIPMENT POLICY

It is the policy of **M & M Excavating Company** that all employees comply with the Michigan Occupational Safety and Health Act standards in regard to the use of personal protective equipment. Violation of this policy will be subject to discipline as outlined in this section.

1. If instructed to wear personal protective equipment...wear it!
2. All employees shall wear a hard hat (that meets MIOSHA standards) and whenever there is a potential of being struck by an object or an object falling on you (l. e. working in excavations, working around mobile equipment, directing traffic, operating aerial lifts, tunneling). Although the wearing of hard hats is not always required it is recommended that all employees wear hard hats whenever they are outside of a cabbed vehicle. There will be no exceptions to this rule.
3. If it is mandated that a project includes a 100% hard hat or PPE policy, all employees must comply.
4. All employees must wear required hand protection, gloves, etc., when an employee is exposed to hazards such as radiation, alkalies, acids, adhesives and temperature extremes other than those caused by weather conditions. Appropriate hand protection other than ordinary work gloves will be supplied by the company.
5. Wear appropriate eye protection (l. e. goggles, safety glasses, welding shields) when cutting, grinding, welding, chipping, jackhammering, applying chemicals, flagging and other similar exposures.
6. Wear hearing protection (l. e. earplugs or noise-cancelling earmuffs) when working around loud noise.
7. Always wear a safety vest, hard hats, and boots when directing traffic.
8. Wear proper clothing on jobsites; the minimum requirements are work boots, shirts, and long pants. Other work operations may require safety-toed work boots, gloves, reflective vests, rubber boots, etc. Use sunblock to prevent sunburn.
9. Any personal protective equipment that is found to be defective shall be immediately reported to the safety officer or qualified person.

## Field Dress Code

Attire, grooming, and safety standards contribute to the morale of all employees and affect the professional image that M&M Excavating presents to the community. In accordance with MIOSHA requirements and the M&M Safety Manual, M&M Excavating expects its employees to always dress appropriately and for safe work practices.

General work attire guidelines for field staff include:

1. T-shirts with a minimum of 4-inch sleeves are allowed. Tank tops are not acceptable.
2. Employees may wear work pants such as jeans, Carhartt or Dickies. No sweatpants, jogging pants, or shorts are to be worn.
3. All clothing should be free of holes and major wear and tear/damage. Loose clothing is not permitted.
4. With the exception of single band rings and small earring studs, loose jewelry is not permitted (including necklaces, non-stud earrings, etc.).

5. Work boots are required; safety toe & boots with ankle support are recommended.
6. No tennis shoes are permitted.
7. Any time an individual is on a jobsite, within the work zone and outside of a vehicle, a safety vest must be worn. If overhead danger exists, a hard hat must be worn. If vision (I.E. Flying debris or particles) or hearing danger exists, safety glasses and hearing protection must be worn.
8. Wear an appropriate respirator when exposed to excessive dust and other air contaminants (I. e. cutting block, painting operations, chemical applications). Your superintendent will determine which appropriate respirator should be used. Refer to MITA Respirator Protection Program for additional information regarding voluntary use of respirators or employees providing their own respirators.

## **ELECTRICAL**

1. Do not use a portable tool or extension cord unless it is plugged into a ground fault circuit interrupter (GFCI). Test the GFCI before plugging in the tool or cord to make sure it is working properly.
2. Only use extension cords equipped with 3 prongs. Do not use extension cords if the ground prong has broken off.
3. Routinely inspect all extension cords and trailing cords on tools for damage. Do not use damaged cords, either repair them or throw them away.
4. Make sure all electrical power and other energy sources are locked out and tagged before working on equipment, machinery and tools.
5. Make sure underground lines are de-energized before jack hammering or using another tool or equipment that may contact the underground line.
6. Do not install, replace, or fix electrical systems unless you are qualified to work on electrical systems. Inform your superintendent if you think your work duties may expose you to energized electrical parts or equipment.

## **M & M EXCAVATING COMPANY EQUIPMENT GROUNDING CONDUCTOR PROGRAM**

This program is designed to inform employees of the inspection and testing of all electrical cords, plugs and tools to prevent injuries from occurring. The superintendent in conjunction with the shop is responsible for implementing this program.

1. All extension cords, plugs, electrical tools and equipment shall be visually inspected before each day use for external defects or damage and for possible internal damage. Damaged or defective cords, plugs, electrical tools or equipment shall not be used or sent to the shop for repair.
2. For the generators equipped with ground fault interrupters, please adhere to the following:
  - a. Check all ground fault interrupters every time the generator is started.
  - b. If the reset button pops out, the ground fault interrupter is good.
  - c. If the reset button does not pop out, the ground fault interrupter is bad.
  - d. A bad ground fault interrupter will cause shocking to occur.
  - e. Call the shop to repair or replace a bad ground fault interrupter.
  - f. Do not wire the throttle. It will cause the ground fault interrupter to go bad.

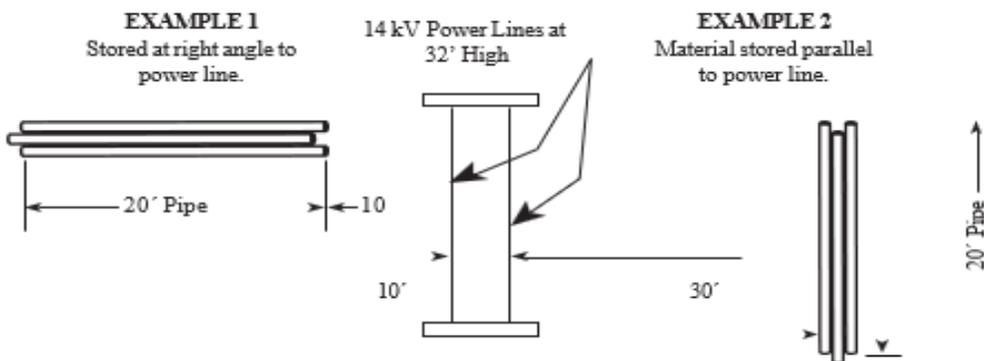
- g. The frame of all welders must be grounded.
3. The following tests shall be performed:
    - a. All equipment grounding conductors shall be tested for electrical continuity.
    - b. Each receptacle or plug shall be tested for correct attachment of the equipment grounding conductor. The equipment grounding conductor shall be connected to its proper terminal.
  4. All required tests shall be performed:
    - a. Before first use.
    - b. Before equipment is returned to service following any repairs.
    - c. Before equipment is used after any incident which can be reasonably suspected to have caused damage.
    - d. At intervals not exceeding 3 months, except that extension cords and receptacles which are fixed and not exposed to damage shall be tested at intervals not exceeding 6 months

Tests performed as required by MIOSHA shall be recorded. The records shall identify each extension cord or electrical equipment that passed the test and shall indicate the last date it was tested or the interval it was tested. This record shall be maintained until replaced by a more current record. The record shall be made available at the jobsite for inspection by a MIOSHA director or representative, and any affected employee.

## OVERHEAD POWERLINES

A. Keep yourself, tools, and equipment at least 10' away from overhead powerlines that are 50kV and below. The minimum distance increases for power lines over 50kV. Inform your superintendent if you have any questions or cannot maintain clearances.

B. Do not store material near or under power lines. If this is not feasible, the stored material must be kept a minimum of 10' plus the length of the material away from overhead power lines that are 50kV or less. The minimum distance increases for power lines over 50 kV. **See examples 1 & 2 below:**



# LOCKOUT PROGRAM

This policy establishes the minimum requirements for the lockout of energy sources whenever maintenance or servicing work is done on machines, equipment, or circuits. It shall be used to ensure that the machine, equipment, or circuit is stopped, isolated from all potentially hazardous energy sources, and locked out before employees perform any servicing or maintenance work where the unexpected/unintended energization or start-up of the machine or equipment, or release of stored energy could cause injury.

## GENERAL REQUIREMENTS

1. Disconnecting means shall be rendered inoperable, unless its design does not permit, and then ensure that such means are tagged to indicate that employees are at work.
2. An authorized employee is a person who locks out machines and equipment to perform servicing or maintenance on that machine, circuits, or equipment who is trained to perform lockout procedures.
3. An affected employee is a person whose job required him/her to operate a machine or equipment on which servicing, or maintenance is being performed under lockout, or whose job requires him/her to work in an area in which such servicing or maintenance is being performed.
4. Authorized employees trained in lockout will be issued a lock from the safety department prior to lockout activities taking place.
5. Lockout locks will be individually keyed. Lock keys shall only be in the possession of the employee performing the lockout.
6. Lockout locks shall have a durable tag attached which indicates the lockout condition and the name of the employee who attached the lock.
7. When the lockout process needs to occur in a specific order due to equipment specifications or design, this order shall be well documented in a site-specific lock out plan.

## WHAT TO LOCKOUT

During servicing or maintenance, equipment utilizing any hazardous energy source such as electrical, pneumatic, steam, hydraulic, gravity, and/or air must be locked out when the unexpected energization or startup of the machine or equipment or release of stored energy could cause injury to employees. The lockout must render the machine inoperative and immovable.

## WHEN TO LOCKOUT

1. Equipment Cleaning or Jam-clearing Tasks - When a normally moving piece of equipment is stopped for cleaning, clearing, or adjustment during which a startup could cause injury, lockout is used.
2. Equipment Repair - Whenever a repair is being performed on or near equipment where there is a possibility of injury as a result of starting the equipment, lockout is used. This includes any and all equipment from which a guard or other safety device has been removed.
3. Installation Tasks - Frequently during installation, either part of all the components making up the installation can be operated before the installation is complete. If needed for testing, precautions must be taken to prevent injuries to personnel during the test periods and the equipment again locked out when the test is complete or interrupted.

4. Electrical Repair Tasks - Whenever any work other than testing is to be performed on an electrical circuit, the wiring involved must be de-energized and locked out so that it cannot be reactivated during this work.

## GROUP LOCKOUT

1. Before the work begins, the lockout procedure will be reviewed with each group member. One authorized employee will be designated as responsible for the lockout.
2. If more than one company or work group is involved, one authorized employee will coordinate the lockout to ensure that all control measures are applied and there is continuous protection for the group.
3. Each authorized employee will affix their lockout lock to the group lockout box and will remove their lock when he/she stops working on the machine or equipment.

## SHIFT CHANGE

The continuous safeguarding of machines or equipment shall be maintained during personnel changes, shift change, or long intervals of time. During shift change the oncoming shift will apply their own lockout lock to the equipment or group lockout box prior to the preceding shift removing their locks.

## WHEN LOCKOUT METHODS ARE NOT REQUIRED

1. Minor tool changes (for example, changing a drill bit) are not covered when a stop button is used to control unexpected motion during the tool change or minor adjustment and when the start button is both visible and under the employee's immediate control.
2. Cord and plug connected equipment must be unplugged and under the exclusive control of the employee performing the service or maintenance work. The plug must physically be in the possession of the employee, or in arm's reach and in the line of sight of the employee.
3. Repair, troubleshooting and set-up adjustments must be performed on energized equipment only when it is necessary to leave the machine energized. For the purpose of this procedure, the trouble-shooting process will end and a lockout will be required when:
  4. Power is shut off
  5. A particular problem has been located and repairs start
  6. Individual machine components are being replaced
  7. Circuit changes are being made

## APPLICATION OF LOCKOUT CONTROL

1. Preparation for Shutdown - Personal safety locks and keys will be kept by each individual operator, mechanic, electrician. Supervisors will also have their own locks and keys. Authorized employees shall review the written lockout procedure to have complete understanding of the type(s) and magnitude of the energy, the hazards of the energy to be controlled, and the methods or means to control the energy.
2. Notification of Employees - Affected employees shall be notified by the authorized employees that the machine or equipment is going to be locked out.
3. Machine or Equipment Shutdown - The machine or equipment shall be turned off or shut down using the energy control procedures established for the machine or equipment.

4. Machine or Equipment Isolation - All energy isolating controls that are needed to control the energy of the machine or equipment shall be physically located and operated in such a manner as to isolate the machine or equipment from the energy sources (e.g., steam, pneumatic, hydraulic, and air). A Zero Energy State must be proven. If equipment does not permit the use of a standard lock out, another method such as a wire cable and lock can be used.
5. Lockout Device Application - The multiple lock adapter and lock shall be affixed in such a manner as to hold the energy isolation devices in a safe or off position.
6. Notification of Affected Personnel - Affected employees shall be notified by the authorized employees that the machine or equipment is locked out. In addition to verbal notification, a tag indicating a power lockout condition shall be used in conjunction with each lockout lock.
7. Verification of Isolation - Prior to starting work on a machine or equipment that has been locked out, each authorized employee involved shall verify that the isolation and de-energization of the machine or equipment have been accomplished by testing the effectiveness of the lockout by attempting to cycle the machine, start the equipment, or by verifying the absence of electrical energy with the appropriate testing equipment.
8. Each authorized employee will notify other authorized and affected personnel in the area that they are going to attempt to cycle the machine or equipment prior to doing so and shall ensure that personnel are free and clear of the machine or equipment prior to operating the controls.
9. If the controls activate the machine or equipment or cause any machine or equipment movement, each authorized employee will begin again at Step 1 Preparation for Shutdown.
10. If there is the possibility of re-accumulation of stored energy to a hazardous level, verification or isolation shall be continued until the servicing or maintenance is completed, or until the possibility of re-accumulation no longer exists. Stored or potential energy will be relieved, restrained, or otherwise made safe.
11. Begin Work Activity - Work activity will begin once each authorized employee involved has verified that the current control of hazardous energy sources has been effective.

## TESTING/POSITIONING OF MACHINES/EQUIPMENT/COMPONENTS

In situations in which lockout devices must be removed from the energy isolating device and the machine or equipment energized to test or position the machine, equipment or component, the following sequence of actions shall be followed:

1. Clear the machine or equipment of tools and materials.
2. Remove employees from the machine or equipment area.
3. Notify affected employees that the lockout devices are going to be removed.
4. Each authorized employee who applied a safety lock will remove their own safety lock.
5. Notify affected employees that the safety locks have been removed and that the machine or equipment is going to be energized.
6. Energize and test the equipment.
7. De-energize all systems and reapply energy control measures.

## LOCK REMOVAL

1. Each lockout lock shall be removed by the authorized employee who applied the device except for conditions specified in emergency lock removal.
2. When an authorized employee is not available to remove their lock, the supervisor of that employee has the authority to request the removal of a lock in the absence of the employee. The following procedure must be followed:
  - a. The supervisor must attempt to contact the employee to whom the lock belongs and determine if the employee is available to remove their lock.
  - b. If the employee is available, he/she alone has the authority to determine whether the lock can be removed based on the guidelines of the lockout plan.
  - c. If the employee is not available, the supervisor will make a reasonable effort to contact the employee and will ask the employee whether the work is complete, and the equipment is ready to be activated. The employee will be advised that his/her lock may be removed.
  - d. If the employee advises that the equipment is not ready to be activated, the supervisor must arrange to have another lock placed on the equipment as soon as the existing lock is removed.
  - e. If the employee advises that the equipment is ready to be activated, the supervisor shall inspect the work area to verify that there is no danger in re-energizing the equipment, remove the lock, and inform all affected employees that the equipment is operational.
  - f. If contact is not established, the supervisor will inspect the equipment for completeness of work and authorize the removal of the lock. The employee whose safety lock has been removed will be notified immediately upon return.
  - g. If the equipment is ready to be activated, the supervisor will inform all affected employees that the equipment is operational. At this point, the supervisor can authorize removal of the lock.
  - h. The person removing the safety lock is responsible for making certain that all requirements for restoring the energy source are followed prior to removing the safety lock.
  - i. The M & M safety department must be contacted if an employee's lock is removed at any time without the employee being present.

## TRAINING

1. Authorized employees will receive training in the recognition of applicable hazardous energy sources and the methods and means necessary for the energy isolation and control.
2. Affected employees shall be instructed in the purpose and use of the energy control procedure.
3. Employees shall be instructed about the procedure and about their responsibility not to restart or re-energize machines or equipment which are locked out.
4. Retraining shall be provided for all authorized and affected employees whenever there is a change in their job assignments, a change in machines, equipment or processes that present a new hazard, or when there is a change in the energy control procedures.

5. Additional retraining shall also be conducted whenever periodic inspection reveals, or whenever there is reason to believe, that there are deviations from or inadequacies in the employee's knowledge or use of the energy control procedures.
6. All employee training will be documented.

## PERIODIC INSPECTION

1. At least annually, M&M safety department will audit a lockout plan on the job when the lockout is being performed.
2. Any deviation or inadequacies identified during this audit will be corrected and communicated to all employees.
3. The inspection will also include a review of the employee's responsibilities under the energy control procedure.

## FIRE PROTECTION

1. Fire Extinguishers.
  - a. At least one 2A-rated fire extinguisher must be available on every jobsite.
  - b. Keep at least one 5 BC-rated fire extinguishers in the cab or within 25' of a crane or excavator and keep one within 75' of diesel and gasoline refueling areas.
  - c. Inspect fire extinguishers every 12 months and label them with an appropriate inspection tag.
2. Portable Fuel Containers.
  - a. Store and transport flammable liquids (i. e. gasoline) in approved safety cans having a spring-closing lid, flashback arrestor screen, spout cover and is designed to safely relieve internal pressure.
3. Smoking and Storage
  - a. Do not smoke around flammable, combustible materials or any areas posted with "No Smoking" signs (i. e. refueling stations).
  - b. Do not place or store flammable or combustible material near open flames, sparks, or other ignition source.
4. Gasoline-powered equipment
  - a. Shut engines off during refueling.
  - b. Do not use gasoline-powered equipment within closed buildings.
5. Propane/LP Storage
  - a. Store tanks/cylinders in an upright position with caps on.
  - b. Secure cylinders with a chain, wire or suitable rack. Small portable propane tanks that cannot fall over do not have to be secured.
  - c. Do not store tanks/cylinders in buildings or poorly ventilated areas.

# WELDING AND CUTTING

1. Always wear the appropriate personal protective equipment When welding or cutting, i.e., aprons, leggings, safety shoes, hard hats and proper goggles, shield or safety glasses for the operations being performed.
2. Backflow devices must be used on gas and oxygen hoses or use a cutting torch that is equipped by the manufacturer with an internal backflow device.
3. Do not weld or cut within 50' of explosives, stored cylinders, or stored fuel. All flammable or combustible material located within 35' of a welding or cutting operation must be removed or covered with fire-resistant blankets.
4. Keep a 2A-5BC portable fire extinguisher (minimum size) in the immediate area during welding and cutting operations.
5. Never weld or cut in a confined space without taking the proper precautions.
6. Only use welding and cutting equipment if you have been trained and authorized to do so.
7. Clean all drums, barrels and tanks of toxic or flammable, combustible material before performing welding or cutting operations.
8. Cylinder Storage.
  - a. Separate oxygen cylinders and fuel gas cylinders by a minimum of 20' or install a noncombustible barrier between the cylinders that is at least 5' high with a minimum fire- rating of one hour.
  - b. Store cylinders (full or empty) valve-end up and secure them with a chain or bracket.
  - c. Place caps on cylinders when they are not in use.
9. Exception for Storing Single Oxygen & Fuel Gas Cylinders
  - a. When in use, a single oxygen cylinder and a single fuel gas cylinder (i. e. acetylene) may be stored together on a cart if the cart is designed for that purpose or the two single cylinders may be secured to a wall or column.
  - b. Make sure that both cylinders are secured in an upright position to the cart or to the vertical surface with straps, chains or another securing device.
  - c. If using a cart, it must be set up on a firm, level surface.
  - d. Do not put the cylinders or carts in heavy trafficked areas where they could be struck by vehicles or equipment.
  - e. Both cylinders must have valves closed with protection caps on or are connected to a properly functioning regulator.
  - f. Always use properly rated lifting components (i. e. chains, shackles, etc..) when suspending carts from cranes or other lifting equipment.
  - g. The area below a suspended cart must be barricaded during active work hours.

# NOISE EXPOSURE

## GENERAL REQUIREMENTS

1. M & M shall ensure that protection against the consequences of noise exposure is provided when sound levels exceed the permissible exposure limit (PEL) of 90 dBA for all workers for an 8-hour day.
2. If administrative or engineering controls fail to reduce the sound levels within the levels listed in Table 1, proper PPE will be required.
3. Follow all manufacturer requirements for equipment. Even if the sound level does not exceed those listed in Table 1, the manufacturer may require hearing protection for the equipment being used.
4. If the daily noise exposure is composed of 2 or more periods of noise exposure at different levels, their combined effect shall be considered.

## TABLE 1

### PERMISSIBLE NOISE EXPOSURES

Duration per day, hours Sound level dBA, slow response

Duration per day, in hours	Sound level dBA
8	90
6	92
4	95
3	97
2	100
1 1/2	102
1	105
1/2	110
1/4 or less	115

## HEARING PROTECTION

1. Hearing protection shall be worn by all employees when sound levels exceed the levels listed in Table 1, or when the manufacturer requires.
2. Hearing protection will be provided by M & M.
3. Employees Shall be given an opportunity to select their hearing protection.

## TRAINING

1. Noise awareness training shall be performed before initial assignment and on an annual basis.
2. Training shall be consistent of changes in PPE and work processes and will include instruction on the proper use and fit of hearing protection.

## AUDIOGRAMS AND BASELINE TESTING

1. Employees subject to the Hearing Conservation Program who have TWA noise exposures of 85 dBA or greater for an 8-hour work shift will be required to have both a baseline and annual audiogram.
2. Within 6 months of an employee's first exposure at or above the action level, M & M shall establish a valid baseline audiogram against which subsequent audiograms can be compared.
3. Testing to establish a baseline audiogram shall be preceded by at least 14 hours without exposure to workplace noise. Hearing protectors may be used as a substitute for the requirement.
4. At least annually after obtaining the baseline audiogram, M & M shall obtain a new audiogram for each employee exposed at or above an 8-hour time-weighted average of 85 dBA.

## EVALUATION OF AUDIOGRAM

1. Each employee's annual audiogram shall be compared to that employee's baseline audiogram to determine if the audiogram is valid and if a standard threshold shift has occurred. This comparison may be made by a technician.
2. If the annual audiogram shows that an employee has suffered a standard threshold shift, M & M may obtain a retest within 30 days and consider the results of the retest as the annual audiogram.
3. The affected employee will be notified in writing of a standard threshold shift within 21 days of determination.

## FOLLOW-UP PROCEDURES

1. Unless a physician determines that the standard threshold shift is not work related or aggravated by occupational noise exposure, M & M shall ensure that the following steps are taken:
  - a. Employees not using hearing protection will be fitted for hearing protection and trained in their use and care and required to use them.
  - b. Employees already using hearing protectors shall be refitted and retrained in the use of hearing protection and provided with hearing protection offering greater attenuation if necessary.
2. If subsequent audiometric testing of an employee whose exposure to noise is less than an 8-hour TWA of 85 dBA indicates that a standard threshold shift is not persistent, M & M may discontinue the required use of hearing protection for that employee.

## MONITORING

1. The sampling strategy is designed to identify employees for inclusion in the hearing conservation program and to enable the proper selection of PPE.
2. Where circumstances such as high worker mobility, significant variations in sound level, or a significant component of impulse noise make area monitoring not feasible, M & M will use representative personal sampling to comply with the monitoring requirements of this paragraph unless M & M can show that area sampling produces equivalent results.
3. Monitoring noise exposure levels will be coordinated by the Safety Department. It is the responsibility of Superintendent/supervisor to notify the Safety Department when there is a possible need for monitoring.
4. Instruments used to measure employee noise exposure shall be calibrated to ensure measurement accuracy.
5. Monitoring shall be repeated whenever a change in production, process, equipment or controls increases noise exposures to the extent that:
6. Additional employees may be exposed at or above the action level
7. The attenuation provided by hearing protectors may be rendered inadequate to comply with Table 1.

8. M & M shall notify each employee exposed at or above an 8-hour time-weighted average of 85 dBA of the results of the monitoring.

## HEARING PROTECTION

1. M & M will ensure that hearing protection is utilized:
2. By any employee who is exposed to an 8-hour time-weighted average of 85 dBA or greater
3. By an employee who has experienced a standard threshold shift
4. Employees will be given the opportunity to select their hearing protectors from a variety of suitable hearing protectors provided by M & M.
5. M & M will ensure proper initial fitting and supervise the correct use of all hearing protectors.

## HEARING PROTECTOR ATTENUATION

1. M & M shall evaluate hearing protection attenuation for the specific noise environments in which the protector will be used.
2. The adequacy of hearing protection attenuation will be re-evaluated whenever employee noise exposure increases to the extent that the hearing protection provided may no longer provide adequate attenuation. M & M will provide more effective hearing protectors where necessary.

## TRAINING PROGRAM

1. All employees who are exposed to noise at or above an 8-hour time-weighted average of 85 dBA shall be trained before initial assignment and annually on the M & M Noise Exposure Program.
2. Information provided in the training program shall be updated to be consistent with changes in protective equipment and work processes.
3. M & M will ensure that each employee is informed of the following:
  - a. The effects of noise on hearing
  - b. The purpose of hearing protectors, the advantages, disadvantages, and attenuation of various types, and instructions on selection, fitting, use, and care
  - c. The purpose of audiometric testing, and an explanation of the test procedures
  - d. Review of the hearing protection regulations
  - e. Locations within M & M property where hearing protection is required
4. The program is reviewed at least annually to ensure both the safety of the M & M employees and compliance with the regulatory standards, as well as any state and local requirements.

## RECORD RETENTION

M & M shall retain records for at least the following periods:

1. Noise exposure measurement records shall be retained for two years.
2. Audiometric test records shall be retained for the duration of the affected employee's employment.

## PORTABLE LADDERS

1. Only use type IA or type I ladders for construction purposes.
2. Don't use damaged or defective ladders (i. e. broken spreaders and steps, split side rails). Tag damaged or defective ladders and remove them from service.
3. Make sure portable extension ladders are equipped with safety feet to prevent slippage. If a ladder is not equipped with safety feet, it must be tied off, blocked or otherwise secured.
4. Always secure both the top and the bottom of a ladder that is used in conjunction with a scaffold or other temporary platform.

# Heat-Illness Prevention Plan

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# COMPANY NAME HERE

## Model Heat-Illness Prevention Plan

### I. INTRODUCTION

The following Heat-illness Prevention Plan was prepared using guidelines provided by the Occupational Safety and Health Administration (OSHA), National Institute for Occupational Safety and Health (NIOSH) and the American Conference of Governmental Industrial Hygienists (ACGIH). This heat-illness prevention plan is provided as a resource and not designed to address all work site scenarios and heat stress hazards. It is designed to help employers reduce the development of heat-related illnesses in healthy, physically fit workers. It is not designed to meet state, local or other regulatory requirements on heat stress. It is not designed to protect workers with medical conditions or preexisting conditions that put them at risk of heat-stress. It is recommended that employers medically screen workers prior to work in hot environments, especially when physical exertion is required. It is recommended that employers seek further information on heat stress and prevention using OSHA provided resources and applicable regulations, available both online and via area offices.

The general approach addresses five (5) key areas of heat-illness prevention, as outlined below.

1. **Training workers and supervisors** on heat-illness prevention strategies, as well as recognizing and reporting the signs and symptoms of heat-related illnesses.
2. **Monitoring weather and workplace conditions.**
3. **Conducting a heat hazard assessment** of common environmental and work-related heat stress factors, when appropriate.
4. **Implementing heat-illness prevention strategies** to reduce heat stress. This includes:
  - a. Reducing worker exposures to heat-stress conditions.
  - b. Establishing an acclimatization program to help workers adapt to working in the heat.
  - c. Ensuring workers are provided adequate water, shade and rest periods.

- d. Monitoring workers for early signs and symptoms of heat stress, including the use of physiological measures of body temperature, recovery heart rate and/or body weight.
5. **Planning for heat-related medical emergencies** and ensuring victims receive prompt medical attention.

## II. PURPOSE

This heat-illness prevention plan was developed to provide supervisors and workers with the training and tools to help protect them from heat-related exposures and illnesses.

## III. SCOPE

Each work site and job task can be unique and contain a number of heat stress hazards that must be addressed prior to the beginning work and during work activities. Supervisors and workers are responsible for assessing these hazards and taking necessary corrective actions to reduce heat-related illnesses.

## IV. DEFINITIONS

Both OSHA and NIOSH provide the following definitions, in their various publications on heat stress and heat stress prevention.

### A - G

**Acclimatization:** The physiological changes that occur in response to a succession of days of exposure to environmental heat stress and reduce the strain caused by the heat stress of the environment; and enable a person to work with greater effectiveness and with less chance of heat injury.

**Body Heat Balance:** Steady-state equilibrium between body heat production and heat loss to the environment.

**Body Heat Balance Equation:** Mathematical expression of relation between heat gain and heat loss, expressed as  $S = (M - W) \pm C \pm R \pm K - E$

**Body Heat Storage (S):** The change in heat content (either + or -) of the body.

**clo:** A unit expression of the insulation value of clothing,  $1 \text{ clo} = 5.55 \text{ kcal}\cdot\text{m}^2\cdot\text{h}^{-1}\cdot^\circ\text{C}^{-1}$ . A clo of 1 is equal to the insulation required to keep a sedentary person comfortable at  $21^\circ\text{C}$  ( $\sim 70^\circ\text{F}$ ). It is also sometimes expressed as  $1 \text{ clo} = 0.155 \text{ m}^2\cdot^\circ\text{C}\cdot\text{W}^{-1}$ .

**Conductive Heat Transfer (K):** The net heat exchange involving the direct transfer of heat via direct contact between two mediums (solid, liquid, or gas) that have a temperature differential.

**Convective Heat Transfer (C):** The net heat exchange by convection between an individual and the environment.

**Evaporative Heat Transfer (E):** Rate of heat loss by evaporation of water from the skin or gain from condensation of water on the skin, expressed as  $\text{kcal}\cdot\text{h}^{-1}$ ,  $\text{W}\cdot\text{m}^{-2}$ , or  $\text{W}$ .

## H to N

**Heat Cramp:** A heat-related illness characterized by spastic contractions of the voluntary muscles (mainly arms, hands, legs, and feet), usually associated with restricted salt intake and profuse sweating without significant body dehydration.

**Heat Exhaustion:** A heat-related illness characterized by elevation of core body temperature above  $38^\circ\text{C}$  ( $100.4^\circ\text{F}$ ) and abnormal performance of one or more organ systems, without injury to the central nervous system. Heat exhaustion may signal impending heat stroke.

**Heat Strain:** The physiological response to the heat load (external or internal) experienced by a person, in which the body attempts to increase heat loss to the environment in order to maintain a stable body temperature.

**Heat Stress:** The net heat load to which a worker is exposed from the combined contributions of metabolic heat, environmental factors, and clothing worn which results in an increase in heat storage in the body.

**Heat Stroke:** An acute medical emergency caused by exposure to heat from an excessive rise in body temperature [above  $41.1^\circ\text{C}$  ( $106^\circ\text{F}$ ) and failure of the temperature-regulating mechanism. Injury occurs to the central nervous system characterized by a sudden and sustained loss of consciousness preceded by vertigo, nausea, headache, cerebral dysfunction, bizarre behavior, and excessive body temperature.

**Heat Syncope:** Collapse and/or loss of consciousness during heat exposure without an increase in body temperature or cessation of sweating, similar to vasovagal fainting except that it is heat induced.

**Heat Tolerance:** The physiological ability to endure heat and regulate body temperature at an average or better rate than others, often affected by the individual's level of acclimatization and physical conditioning.

**Humidity, Relative (RH):** The ratio of the water vapor present in the ambient air to the water vapor present in saturated air at the same temperature and pressure.

**Hyperpyrexia:** A body core temperature exceeding 40°C (104°F).

**Hyperthermia:** A condition where the core temperature of an individual is higher than 37.2°C (99°F). Hyperthermia can be classified as mild (37.2–38.5°C; 99–101.3°F), moderate (i.e., heat exhaustion [38.5–39.5°C; 101.3–103.1°F]), profound (>39.5°C; 103.1°F), or profound clinical hyperthermia (i.e., heat stroke [>40.5°C; 104.9°F]), and death can occur without treatment (>45°C; 113°F).

**Metabolism (M):** Transformation of chemical energy into free energy that is used to perform work and produce heat.

## O to S

**Pressure, Atmospheric (Pa):** Pressure exerted by the weight of the air, which averages 760 mmHg at sea level and decreases with altitude.

**Pressure, Water Vapor (Pa):** The pressure exerted by the water vapor in the air.

**Qualified Health Care Professional:** An individual qualified by education, training, and licensure/regulation and/or facility privileges (when applicable) who performs a professional service within his or her scope of practice in an allied health care discipline, and independently reports that professional service.

**Radiant Heat Exchange (R):** The net rate of heat exchange by radiation between two radiant surfaces of different temperatures.

**Recommended Alert Limit (RAL):** The NIOSH-recommended heat stress alert limits for unacclimatized workers.

**Recommended Exposure Limit (REL):** The NIOSH-recommended heat stress exposure limits for acclimatized workers.

**Rhabdomyolysis:** A medical condition associated with heat stress and prolonged physical exertion, resulting in the rapid breakdown of muscle and the rupture and necrosis of the affected muscles.

**Sweating, Thermal:** Response of the sweat glands to thermal stimuli.

## T to Z

**Temperature, Ambient ( $t_a$ ):** The temperature of the air surrounding a body. Also called air temperature or dry bulb temperature.

**Temperature, Core Body ( $t_{cr}$ ):** Temperature of the tissues and organs of the body. Also called Core Temperature.

**Temperature, Dew-point ( $t_{dp}$ ):** The temperature at which the water vapor in the air first starts to condense.

**Temperature, Globe ( $t_g$ ):** The temperature inside a blackened, hollow, thin copper globe measured by a thermometer whose sensing element is in the center of the sphere.

**Temperature, Natural Wet Bulb ( $t_{nwb}$ ):** The wet bulb temperature under conditions of the prevailing air movement.

**Temperature, Oral ( $t_{or}$ ):** Temperature measured by placing the sensing element under the tongue for 3 to 5 minutes.

**Temperature, Psychrometric Wet Bulb ( $t_{wb}$ ):** The lowest temperature to which the ambient air can be cooled by evaporation of water from the wet temperature-sensing element with forced air movement.

**Temperature, Rectal ( $t_{re}$ ):** Temperature measured 10 centimeters (cm) into the rectal canal.

**Temperature, Skin ( $t_{sk}$ ):** Temperature measured by placing the sensing element on the skin.

**Temperature, Tympanic ( $t_{ty}$ ):** True tympanic temperature is measured by placing the sensing element directly onto the tympanic membrane and recording the temperature. Estimates of tympanic temperature are usually obtained by placing a device into the ear canal close to the tympanic membrane.

**Temperature Regulation:** The maintenance of body temperature within a restricted range under conditions of positive heat loads (environmental and metabolic) by physiologic and behavioral mechanisms.

**Thermal Insulation, Clothing:** The insulation value of a clothing ensemble.

**Wet Bulb Globe Temperature (WBGT):** This is an environmental temperature arrived at by measuring dry air temperature, humidity, and radiant energy (i.e., usually direct sunlight being absorbed by clothing), used to calculate a thermal load on the person.

**Work:** Physical efforts performed using energy from the metabolic rate of the body.

## V. COMPANY POLICY

**M&M Excavating** is dedicated to protecting employees from on-the-job illnesses and injuries. All employees have the responsibility to work safely on the job. The purpose of this plan is to supplement our existing safety and health program and to ensure employees recognize heat stress hazards and act appropriately to address those hazards. The general approach addresses five (5) key areas of heat-illness prevention, as outlined below.

### Main Elements of Heat-Illness Prevention Plan

<b>Control</b>	<b>Description</b>
1. Train supervisors and workers	Train supervisors and workers on heat-illness prevention strategies, as well as to recognize and report the signs and symptoms of heat-related illnesses.
2. Monitor weather and workplace conditions	Monitor weather workplace conditions and take preventative measures to protect workers when the temperatures exceed 80 °F (21 °C).
3. Conduct a heat hazard assessment when temperatures exceed 80 °F	Determine an effective wet-bulb globe temperature (WBGT-Effective) and use established recommended alert limits (non-acclimatized workers) and exposure limits (acclimatized workers) to determine the level of risk to heat stress.
4. Implement heat-illness prevention strategies	Implement appropriate heat-illness prevention strategies based on established risk levels for heat stress.
5. Plan for heat-related medical emergencies	Ensure adequate supervision, first aid and medical services are readily available in the event a worker suffers from a heat illness.

## **Employee Training and Responsibilities**

Each employee will be trained in heat-illness prevention and will strictly adhere to the recommended practices, except when doing so would expose him/her to a greater hazard. If, in the employee's opinion, this is the case, the employee is to notify their supervisor of their concern and have the concern addressed before proceeding.

## **Employer Responsibilities**

On the job, it is the responsibility of the Safety Manager to implement this Heat-Illness Prevention Plan. Continual observational safety checks of work operations and the enforcement of the safety policy and procedures shall be regularly enforced. The supervisor is responsible for correcting any unsafe practices or conditions immediately.

It is the responsibility of the employer to ensure that all employees understand and adhere to the policies and procedures of this plan. It is also the responsibility of the employee to bring to management's attention any unsafe or hazardous conditions or practices that may cause injury to either themselves or any other employees. The Safety Manager must approve any changes to the Heat-Illness Prevention Plan.

Designated Safety Manager: \_\_\_\_\_Matthew Southwick\_\_\_\_\_

All Supervisors

## **VI. TRAINING**

To ensure workers are prepared to work safely under hot conditions, all employees and supervisors who may be exposed to heat stress and heat-related illnesses will receive training on the following:

### **Elements of the Company's Heat-Illness Prevention Plan**

1. Training
2. Monitoring
3. Hazard Assessment
4. Heat-Illness Prevention Strategies
5. Emergency Preparedness

### **Risk Factors for Heat Stress**

#### *Environmental risk factors for heat stress*

1. Temperature
2. Humidity
3. Air movement
4. Radiant heat (e.g., sun exposure)

#### *Work-related risk factors for heat stress*

1. Physical exertion
2. Clothing

#### *Personal risk factors for heat stress*

1. Age
2. Physical fitness
3. Acclimatization
4. Medical conditions
5. Medications

6. Alcohol and/or drug use
7. Caffeine

### **How the Body Handles Heat**

1. Increased heart rate
2. Increased blood circulation to skin
3. Evaporative cooling from sweating

### *The importance of acclimatization.*

1. Reduces risks of dehydration and salt loss
  - a. Sweating and evaporative cooling becomes more efficient
  - b. Salt loss becomes more efficient
2. Core body temperature maintained more efficiently
3. Reduces strain on heart
  - a. Blood circulation to skin becomes more efficient
  - b. Recovery heart rate improves
4. Human body needs to acclimate to hot environments, typically 10-14 days
  - a. Gradually increase exposure to hot environment over 7-14 days
  - b. Avoid prolonged exertion during hottest times of day
  - c. Schedule heavy exertion for cooler parts of day
5. Acclimatized workers will need 2-3 days of re-acclimatization if they stop working under heat stress conditions more than a week.

### *The importance of consuming water throughout the work shift*

1. One cup (8 oz.) of cool water or an electrolyte replacement fluid every 15-20 minutes; four cups of water every hour.
2. Increased water intake may be needed to account for increased physical exertion and/or sweating.

3. However, too much water intake can be dangerous and lead to headache, nausea, vomiting and/or mental confusion.
4. Physiological monitoring may be necessary under extreme conditions
  - a. If sweat is not trapped within clothing, then we can monitor body weight, which should not drop below 1.5% of starting body weight.
  - b. Urine color is another indicator of potential dehydration.
    - i. Normal urine should be a pale yellow.
    - ii. Use a urine color chart to help determine if you are properly hydrated. Some diets, medications and illnesses may affect results.

#### *The importance of rest breaks and shade throughout the work shift*

1. Prolonged physical exertion and muscle activity increases the body's core temperature and reduces the body's ability to cool itself. Short rest breaks are necessary to allow blood to flow to the skin to be cooled.
2. Rest breaks slow down the buildup of heat in the body from prolonged muscle activity.
3. Rest breaks are also important for the heart and allow your heart rate to recover from sustained heat stress and physical exertion.
4. Rest breaks in the shade help with cooling, especially if there is air movement with cool air.

### **Heat-Related Illnesses**

The following information needs to be covered in training on heat-related illnesses, including cause, preventative measures, signs and symptoms, first aid treatment and reporting requirements.

#### *Heat Rash*

1. Cause: Irritation of skin due to excessive sweating

2. Preventative measures:
  - a. Wear loose fitting clothing that allows sweat to dissipate
  - b. Wear freshly laundered clothing each day
  - c. Avoid working in sweat soaked clothing for prolonged periods (e.g., change at breaks as needed)
  - d. Wash sweat-soaked areas with mild soap and water and dry thoroughly at breaks and after your shift ends
3. Signs and symptoms:
  - a. Itchy and painful clusters of red blisters
  - b. Common to the neck, chest, groin, armpits and creases of the elbows and knees
4. First aid treatment:
  - a. Move person to a cool location
  - b. Have person take a cool shower
  - c. Thoroughly dry the skin following shower
  - d. Continue to ensure skin is cleaned and dried frequently, especially before and after shifts
  - e. Seek medical treatment if rash persists for more than two days or if rash becomes infected
5. Reporting: Report to supervisor and safety manager

### *Heat Cramps*

1. Cause: Depletion of salt and water in body due to excessive sweating. This is a precursor to more serious heat exhaustion and/or heat stroke.
2. Preventative measures:
  - a. Acclimatization to heat helps reduce salt and water loss
  - b. Drink adequate amounts of water throughout the day
  - c. Salt your foods to taste
3. Signs and symptoms:
  - a. Muscle cramps, spasms and/or pain

- b. Common to major muscles used for work (e.g., arms, legs, abdominal and back muscles)
- 4. First aid treatment:
  - a. Move person to a cool location
  - b. Provide person with an electrolyte replacement fluid to replace lost salt and water
  - c. Seek medical treatment if cramps persist or other heat-illness symptoms develop (e.g., elevated body temperature, elevated heart rate, headache, dizziness, etc.)
- 5. Reporting: Report to supervisor and safety manager

### *Heat Syncope*

- 1. Cause: Prolonged standing or sudden rising from a sitting or resting (supine) position; dehydration can be a contributing factor
- 2. Preventative measures:
  - a. Acclimatization to heat helps reduce dehydration
  - b. Drink adequate amounts of water throughout the day
  - c. Break up long periods of standing with small rest breaks
  - d. Rise slowly from sitting or resting positions
- 3. Signs and symptoms:
  - a. Light-headedness or dizziness
  - b. Fainting
- 4. First aid treatment:
  - a. If he/she is only slightly dizzy and able to move, have two people assist and carefully move to a cool location and have the person lay down on back with feet elevated above heart level; provide small amounts of water
  - b. If the dizziness persists, request immediate first aid and/or medical attention

- c. If he/she fainted, then secure the area, elevate his/her feet above heart level and request immediate first aid and/or medical attention; do not allow him/her to get up quickly or walk about
5. Reporting: Report to supervisor and safety manager

### *Heat Exhaustion*

1. Cause: The body's inability to cool itself, often due to a combination of several factors (e.g., high temperatures, humidity, physical exertion, dehydration, clothing that blocks sweat evaporation and/or alcohol use). This is a serious condition that can lead to a life-threatening heat stroke.
2. Preventative measures:
  - a. Acclimatization to heat helps reduce dehydration
  - b. Drink adequate amounts of water throughout the day
  - c. Take small rest breaks in shade to allow body to recover from heavy physical exertion and heat exposure
  - d. Protect skin against sunburn, which reduces body's ability to cool itself
  - e. If possible, perform heavier physical labor towards cooler part of the day (e.g., early morning or evening)
3. Signs and symptoms:
  - a. Elevated core body temperature of 100.4 to 102.2 °F (38 to 39 °C); oral temperature 99.6 to 101.4 °F
  - b. Weak, but rapid pulse (elevated heart rate)
  - c. Cool, moist skin (person may appear pale with clammy skin)
  - d. Excessive sweating
  - e. Headache and possible irritability
  - f. Fatigue or weakness
  - g. Dizziness and/or feeling faint
  - h. Nausea and/or vomiting
  - i. Decreased urine output

4. First aid treatment:
  - a. Seek immediate medical care (call 911)
  - b. Immediately help the person cool off
    - i. Move to a cool location
    - ii. Remove or loosen unnecessary clothing
    - iii. Have them drink small amounts of cool water
    - iv. Spray skin with cool water and fan rapidly to increase evaporation and cooling
    - v. Monitor body temperature and continue cooling efforts until body temperature returns to a normal temperature below 99 °F (37 °C).
    - vi. Implement additional heat stroke treatments if body temperature does not decrease below 100 °F (37.8 °C) after 30 minutes or increases above 102 °F (38.9 °C).
5. Reporting: Report to supervisor and safety manager

### *Heat Stroke*

1. Cause: Body is unable to cool itself and regulate core body temperature. This is a serious and life-threatening condition that requires immediate medical attention (call 911).
2. Preventable measures: Same as for heat exhaustion
3. Signs and symptoms:
  - a. Elevated core body temperature above 104 °F (40 °C); oral temperature above 103.2 °F
  - b. Hot, dry skin or heavy sweating
  - c. Mental confusion, agitation and/or irrational behavior
  - d. Clumsiness
  - e. Slurred speech
  - f. Fainting or a loss of consciousness
  - g. Seizures or convulsions

4. First aid treatment:
  - a. Call 911 and seek immediate medical attention for the victim; do not wait as their life depends on getting immediate medical care.
  - b. Provide immediate and aggressive cooling to their body
    - i. Elevate feet above heart level
    - ii. Remove or loosen unnecessary clothing
    - iii. Pack ice in groin and armpit areas
    - iv. Soak skin with cool water and fan rapidly and vigorously to increase cooling of skin
    - v. As an alternative, immerse them in a tub of cool water or spray body with large amounts of cool water
    - vi. Do not give person fluids to drink, especially if unconscious.
    - vii. Monitor body temperature and continue cooling efforts until body temperature returns to a normal temperature below 99 °F (37 °C).
  - c. Administer CPR as needed, if blood circulation or breathing stops, until emergency medical services arrive
5. Reporting: Report to supervisor and safety manager

### *Rhabdomyolysis*

1. Cause: Sometimes caused by a combination of heat stress and prolonged physical exertion, muscle starts to break down and die, releasing proteins and electrolytes into the bloodstream. This is a potentially life-threatening condition affecting the kidneys that requires immediate medical attention.
2. Preventative measures:
  - a. Same as for heat exhaustion and heat stroke.
  - b. Avoid overexertion, such as lifting objects heavier than you can comfortably lift or straining muscles to a point where they can no longer function properly.
  - c. Those with diabetes, thyroid conditions or muscular dystrophy are at greater risk.

- d. Those with a viral infection, such as flu, HIV or herpes, are at greater risk.
  - e. Use of alcohol and illegal drugs, such as heroin, cocaine and amphetamines can increase the risk.
  - f. Some medications, such as such as antipsychotics or statins, can increase the risk.
3. Signs and symptoms:
- a. Muscle cramps, pain and/or loss of range
  - b. Joint pain and/or stiffness
  - c. Swelling of muscles
  - d. Weakness and a decreased ability to perform physical exertion for even a small amount of time
  - e. Dark urine (similar to tea or cola in color)
  - f. If kidney damage and/or failure occurs the following life-threatening indicators may be observed:
    - i. Shortness of breath
    - ii. Irregular heart beat
    - iii. Swelling in the legs and feet
    - iv. Seizures
    - v. Coma
4. First aid treatment:
- a. Seek immediate medical care for the victim (IV fluids and treatments to combat toxic proteins in blood are needed to prevent kidney failure)
5. Reporting: Report to supervisor and safety manager

## Heat-illness prevention strategies

### *When Risk Level is High Incorporate Physiological Monitoring*

#### 1. Oral Temperature

- a. It is important to make sure the thermometer is stored in a cool environment and not exposure to temperatures above 95 °F.
- b. Readings should not be taken within 15-minutes of consuming hot or cool liquids and foods or if breathing heavy (mouth breathing).
- c. Oral temperatures should not exceed 99.5 °F.
- d. As a precautionary measure, when the oral temperature is elevated above 99.1 °F, adjust the work-rest schedule to increase the frequency and duration of rest breaks or take other preventative measures.

#### 2. Heart Rate Recovery

- a. The method involves taking an initial pulse rate reading at the beginning of a scheduled rest break. With the worker sitting and resting, an initial pulse rate reading is collected (P1) and if the pulse rate is above 110 bpm, then pulse rate readings are collected at a two-minute (P2) and four-minute (P3) interval.
- b. If the pulse rate does not drop to below 110 bpm during the test, then this indicates heat stress conditions are above an acceptable level. The resting heart rate is too high, which indicates the work rate is too high for the individual.
- c. With a starting pulse rate above 110 bpm, if the difference between two-minute intervals is less than 10 bpm, then this also indicates heat stress conditions are above an acceptable level. The heart rate is not effectively recovering at rest, which also indicates the work rate is too high for the individual. It could also indicate dehydration.
- d. There can be variation among individuals and some may exhibit much lower or higher resting pulse rates. A qualified medical provider should examine individuals with pre-work pulse rates above 100 bpm when at

normal rest. High resting pulse rates could be indicative of an underlying medical condition.

### 3. Additional Measures to Help Reduce Dehydration

#### a. Body Weight

- i. Assumes that the worker is wearing clothing that will allow sweat to evaporate from the skin and not be trapped within the clothing (e.g., chemical protective and impermeable suits can trap sweat).
- ii. Use a reliable scale that can read body weight within  $\pm 0.25$  lbs.
- iii. If body weight reduces by more than 1.5%, then not likely taking in enough water to replace the water lost due to sweating.

#### b. Urine Color

- i. Urine color can be a good indicator of potential dehydration, which can lead to heat stress and heat-related illnesses.
- ii. In some cases underlying diseases, medications or even some foods may affect urine color.
- iii. Check urine color against a color chart.
- iv. Normal urine should be a pale yellow. Darker color indicates potential dehydration.

### *Engineering Controls*

1. Reduce physical exertion and physical demands of work through use of powered tools and equipment, especially for tasks involving heavy lifting.
2. Reduce radiant heat loading from the sun or other sources of radiant heat (e.g., furnaces, combustion engines and compressors, hot surfaces, heated transfer lines, windows receiving intense sun, etc.). One effective method is to place line-of-sight, reflective barriers between the heat source and workers. Another method is to insulate hot surfaces, such as furnaces.
3. If air temperatures are below 95 °F, then increase air speed across skin of workers using fans or air movers, to increase evaporative cooling from skin.

4. If air temperatures are above 95 °F, then reduce air speed across skin of workers, to reduce convective heat transfer from air to skin.
5. If humidity is below 50%, then evaporative coolers and portable fans with water mist systems can be used to effectively cool the air by about 10 to 20 °F.
6. Decrease humidity to below 50% to increase evaporative cooling from sweating.

### *Administrative Controls*

1. Adjust work schedule to ensure workers are acclimated to work in hot conditions.
2. Schedule work or work requiring heavy physical exertion during the coolest parts of the day.
3. Modify the work-rest schedule to shorten heat exposure periods by including frequent rest breaks. Shorter, more frequent breaks are more effective than longer, less frequent rest breaks.
4. Encourage adequate water intake at frequent intervals to prevent dehydration (e.g., one 8-ounce cup of cool water or an electrolyte replacement fluid every 15-20 minutes).
  - a. The supervisor or foreman is responsible for making sure drinking water is provided, plus:
    - i. Ensure that water containers are clean and sanitary prior to filling.
    - ii. Ensure water containers are filled at a sanitary location.
    - iii. Provide sufficient disposable cups and a place for disposing cups.
    - iv. Ensure workers do not share cups and dispose of used cups.
    - v. Prohibit workers from opening the cooler top to fill cups and instead have workers use the provided spigot.
  - b. Pure and cool potable water must be made available to workers at no additional cost.
    - i. Do not use water from irrigation, sprinklers or firefighting systems.
    - ii. Do not use water from a garden hose, as it may contain contaminants from the hose and/or bacteria and other microbes.

- c. Water quantities need to be sufficient and at least 1 quart per worker per hour for the entire shift.
  - d. Locate water containers as close as practicable at all times.
  - e. Encourage workers to frequently drink water and not wait until thirsty.
5. Provide a shaded and/or air-conditioned space nearby for rest and water breaks.
6. Train workers on the recognition of the signs and symptoms of heat-induced illness and on heat-illness prevention strategies.
7. Alert workers to extreme heat events or heat stress conditions and provide a short review of the heat-illness prevention strategies for the day.
8. Work in pairs (buddy system) and monitor each other for signs and symptoms of heat stress or illness.
9. Avoid caffeine and alcohol before and during working in a hot environment.
10. Report illnesses or medical conditions that may put them at risk of heat stress (e.g., diarrhea, fever, infection, etc.)
11. Medically screen for work in hot environments.

#### *Protective Clothing and Equipment Controls*

1. Provide clothing designed to keep the body cool, such as air, cooled fluid or ice-cooled conditioned clothing.
2. Provide reflective clothing to reduce radiant heat loading from the sun or hot surfaces radiating heat.
3. If air temperatures are below 95 °F and worker is protected from radiant heat, then decrease clothing coverage or layers (when feasible) to increase evaporative cooling from skin. Caution: Do not remove clothing designed to protect workers from chemical, mechanical or other hazards without conducting a proper evaluation to address those hazards.
4. If air temperatures are above 95 °F, then increase clothing coverage to reduce air speed across skin of workers, which can help reduce convective heat transfer from air to skin.

## VII. MONITORING WEATHER AND WORKPLACE CONDITIONS

The Safety Manager and supervisors are responsible for monitoring the daily weather and workplace conditions to determine if workers will be exposed to temperatures greater than 70 °F (21 °C). The National Weather Service ([www.weather.gov](http://www.weather.gov)) should be used to monitor weather conditions. Public weather observation alternatives include Intellicast ([www.intellicast.com](http://www.intellicast.com)) and Weather Underground ([www.wunderground.com](http://www.wunderground.com)). Use the closest weather station to the worksite location.

If the temperatures will exceed 70 °F (21 °C) for more than an hour during the work shift, then a heat hazard assessment needs to be performed. The following additional weather information is required for the heat hazard assessment.

- Air temperature (°F)
- Humidity (%)
- Wind speed (mph)
- Barometric pressure (inches)
- Longitude and latitude
- Cloud cover

## VIII. HEAT HAZARD ASSESSMENT

When weather or workplace conditions will exceed 70 °F (21 °C), a heat hazard assessment must be conducted to take into account for environmental and work factors associated with heat stress and heat-related illnesses. Temperature, humidity, wind speed and solar irradiance are environmental factors that must be taken into account. Work factors include metabolic work rate (physical exertion) and clothing. These factors are all accounted for using an effective wet-bulb globe temperature (WBGT-Effective).

Use of a heat index, which only takes into account temperature and humidity, is not recommended. The heat index does not take into account wind speed, radiant heat,

clothing and metabolic heat from physical exertion, which are all factors that can contribute to heat stress and heat-related illnesses.

Instead, a WBGT-Effective and threshold limits established by NIOSH are used to assess risk and recommend effective heat stress controls. Further details and an example on this method are available in the OSHA Technical Manual, Section III, Chapter 4 on Heat Stress ([www.osha.gov](http://www.osha.gov)) and the NIOSH Criteria for a Recommended Standard: Occupational Exposure to Heat and Hot Environments ([www.cdc.gov/niosh](http://www.cdc.gov/niosh)). The following heat hazard assessment steps and guidelines are provided here and on the site-specific worksheet (Appendix A).

### **Step 1: Calculate WBGT Using Weather Data**

Argonne National Laboratory (ANL) developed a calculator that uses validated and literature-supported algorithmic equations to determine WBGT from National Weather Service weather data. The calculator uses an outdoor WBGT model described by Dr. James C. Liljegren in the *Journal of Occupational and Environmental Hygiene*, published August 2008. This product includes software produced by UChicago Argonne, LLC under Contract No. DE-AC02-06CH11357 with the Department of Energy. The calculator is available as a downloadable zip file from OSHA at:

[http://www.osha.gov/dts/osta/otm/otm\\_iii/wbgtutil.zip](http://www.osha.gov/dts/osta/otm/otm_iii/wbgtutil.zip)

The calculator uses the following required weather and location information to determine WBGT:

- a. Air Temperature (°F) during hottest hour of the work shift
- b. Barometric Pressure (inches of Hg)
- c. Relative Humidity (%) during hottest hour of the work shift
- d. Wind Speed (mph) during hottest hour of the work shift
- e. Date (MONTH DAY, YEAR; e.g., January 1, 2019)
- f. Time (HH:MM AM/PM; e.g., 12:00 PM) during hottest hour of the work shift

- g. Longitude and latitude (degrees) – input in “Options”
- h. Solar Irradiance (W/m<sup>2</sup>) based on Table 1 below, plus date, time of day and location (longitude and latitude)

*Table 1. Estimated Solar Irradiance Based on Cloud Cover*

<b>Reported Cloud Cover</b>	<b>Irradiance (W/m<sup>2</sup>)</b>
Sunny	990
Mostly Sunny, Partly Sunny/Cloudy Scattered Clouds	980
Mostly Cloudy	710
Cloudy	250

Source: OSHA as adapted from A. Ben Jemaa, et al. (2013) *Energy Procedia*, Volume 42, Pages 406-415.

The data entered into the calculator needs to be accurate to produce an accurate WBGT estimate. This includes time, date, longitude, latitude and barometric pressure, as these are used to adjust irradiance before calculating the WBGT.

The end-result output that will be used in the next steps is the “Wet Bulb Globe Temperature” in units of °F. Record the WBGT and proceed to step two.

**Step 2. Add Clothing Adjustment Factor**

As recommended by OSHA, the ACGIH Clothing Adjustment Factor (CAF) can be determined from Table 2 below and added to the previous WBGT to produce an effective WBGT value, termed WBGT-Effective. The formula for determining the effective WBGT is:

$$***WBGT-Effective = WBGT + CAF***$$

Table 2. Clothing Adjustment Factors (CAF)

Clothing Worn	CAF (°F)
Work clothes (long sleeves and pants). Examples: Standard cotton shirt/pants.	0
Coveralls (w/only underwear underneath). Examples: Cotton or light polyester material.	0
Double-layer woven clothing.	5.4
SMS (spunbond/meltblown/spunbond) Polypropylene Coveralls	0.9
Polyolefin coveralls. Examples: Micro- porous fabric (e.g., Tyvek™).	1.8
Limited-use vapor-barrier coveralls. Examples: Encapsulating suits, whole- body chemical protective suites, firefighter turn-out gear.	19.8

Source: OSHA Technical Manual as adopted from ACGIH "2017 TLVs and BEIs" and converted to °F.

### Step 3. Determine the Metabolic Heat

Select a work category in Table 3 that best represents the workload using the provided examples as a guide. Select the heaviest workload activity to account for the highest metabolic heat for use in the next step, which will help ensure proper controls are in place to protect workers.

Using guidelines provided by OSHA, the formula below was used to adjust estimated metabolic heat (MH) for body weight.

$$MH = \frac{\text{Metabolic heat (in Watts)} \times \text{Worker body weight (in lbs.)}}{154 \text{ lbs.}}$$

Table 3. Work Category Based on Metabolic Work Rates

Work Category	Examples	Estimated Metabolic Heat (Watts) for 154 lb. Person	Estimated Metabolic Rate (Watts) for 200 lb. Person	Estimated Metabolic Heat (Watts) for 250 lb. Person	Estimated Metabolic Heat (Watts) for 300 lb. Person
Light	Sitting, standing, light arm/hand work and occasional walking	233	303	377	454
Moderate	Normal walking, moderate lifting	349	454	565	681*
Heavy	Heavy material handling, walking at a fast pace	465	605*	753*	907*
Very Heavy	Pick and shovel work	580	754*	940*	1131*

Adapted from OSHA Technical Manual, NIOSH Criteria for a Recommended Standard: Occupational Exposure to Heat and Hot Environments, and ACGIH "2017 TLVs and BEIs"

**\* These activities are not recommended for persons of this body weight working under heat stress conditions. Special precautionary measures must be taken to reduce physical exertion and continually monitor workers for physiological signs of heat stress (e.g., body temperature and/or heart rate).**

#### **Step 4. Determine Exposure Threshold Limit**

A NIOSH recommended exposure limit (REL) is used to establish the exposure threshold for implementation of workplace controls for heat stress in healthy workers already acclimated to work in hot environments. The NIOSH recommended alert level (RAL) is an exposure threshold for use with unacclimatized workers. Use the provided tables and/or formulas to determine the appropriate threshold for later comparison to the WBGT-Effective. If the WBGT-Effective exceeds the REL or RAL temperature, then controls must be implemented to protect workers from heat stress and heat-related illnesses.

##### *Acclimated Workers: Recommended Exposure Limit (REL)*

The formula for the calculating the NIOSH REL in °F for acclimated workers working continuously without prolonged rest breaks, where MH is the metabolic heat in Watts, is:

$$**REL = 1.8 \times (56.7 - 11.5 \log_{10} MH) + 32**$$

When working for shorter intervals, workers may be able to work in higher temperatures without adverse heat-related health effects. The NIOSH REL is designed to take work/rest schedules into consideration, which are provided below. Use Tables 4 to 7 to determine the REL for different work/rest schedules, work categories and body weights.

Table 4. Recommended Exposure Limit (REL) for Continuous Work

Work Category	Example	REL for 154 lb. Person	REL for 200 lb. Person	REL for 250 lb. Person	REL for 300 lb. Person
Light	Sitting, standing, light arm/hand work and occasional walking	85 °F	83 °F	81 °F	79 °F
Moderate	Normal walking, moderate lifting	81 °F	79 °F	77 °F	75 °F *
Heavy	Heavy material handling, walking at a fast pace	79 °F	76 °F *	74 °F *	73 °F *
Very Heavy	Pick and shovel work	77 °F	74 °F *	72 °F *	71 °F *

*Adapted from NIOSH Criteria for a Recommended Standard: Occupational Exposure to Heat and Hot Environments and ACGIH "2017 TLVs and BEIs"*

**\* These activities are not recommended for persons of this body weight working under heat stress conditions. Special precautionary measures must be taken to reduce physical exertion and continually monitor workers for physiological signs of heat stress (e.g., body temperature and/or heart rate).**

Table 5. Recommended Exposure Limit (REL) for 75% Work & 25% Rest Each Hour

Work Category	Example	REL for 154 lb. Person	REL for 200 lb. Person	REL for 250 lb. Person	REL for 300 lb. Person
Light	Sitting, standing, light arm/hand work and occasional walking	87 °F	84 °F	82 °F	81 °F
Moderate	Normal walking, moderate lifting	84 °F	81 °F	79 °F	78 °F *
Heavy	Heavy material handling, walking at a fast pace	82 °F	79 °F *	77 °F *	76 °F *
Very Heavy	Pick and shovel work	79 °F	77 °F *	75 °F *	73 °F *

*Adapted from NIOSH Criteria for a Recommended Standard: Occupational Exposure to Heat and Hot Environments and ACGIH "2017 TLVs and BEIs"*

**\* These activities are not recommended for persons of this body weight working under heat stress conditions. Special precautionary measures must be taken to reduce physical exertion and continually monitor workers for physiological signs of heat stress (e.g., body temperature and/or heart rate).**

Table 6. Recommended Exposure Limit (REL) for 50% Work & 50% Rest Each Hour

Work Category	Example	REL for 154 lb. Person	REL for 200 lb. Person	REL for 250 lb. Person	REL for 300 lb. Person
Light	Sitting, standing, light arm/hand work and occasional walking	89 °F	86 °F	84 °F	83 °F
Moderate	Normal walking, moderate lifting	86 °F	83 °F	81 °F	80 °F *
Heavy	Heavy material handling, walking at a fast pace	84 °F	81 °F *	79 °F *	78 °F *
Very Heavy	Pick and shovel work	81 °F	79 °F *	77 °F *	75 °F *

*Adapted from NIOSH Criteria for a Recommended Standard: Occupational Exposure to Heat and Hot Environments and ACGIH "2017 TLVs and BEIs"*

**\* These activities are not recommended for persons of this body weight working under heat stress conditions. Special precautionary measures must be taken to reduce physical exertion and continually monitor workers for physiological signs of heat stress (e.g., body temperature and/or heart rate).**

Table 7. Recommended Exposure Limit (REL) for 25% Work & 75% Rest Each Hour

Work Category	Example	REL for 154 lb. Person	REL for 200 lb. Person	REL for 250 lb. Person	REL for 300 lb. Person
Light	Sitting, standing, light arm/hand work and occasional walking	90 °F	88 °F	86 °F	84 °F
Moderate	Normal walking, moderate lifting	88 °F	86 °F	84 °F	82 °F *
Heavy	Heavy material handling, walking at a fast pace	86 °F	84 °F *	82 °F *	80 °F *
Very Heavy	Pick and shovel work	84 °F	82 °F *	80 °F *	78 °F *

*Adapted from NIOSH Criteria for a Recommended Standard: Occupational Exposure to Heat and Hot Environments and ACGIH "2017 TLVs and BEIs"*

**\* These activities are not recommended for persons of this body weight working under heat stress conditions. Special precautionary measures must be taken to reduce physical exertion and continually monitor workers for physiological signs of heat stress (e.g., body temperature and/or heart rate).**

*Unacclimated Workers: Recommended Alert Limit (RAL)*

The formula for the calculating the NIOSH RAL in °F for unacclimated workers working continuously without prolonged rest breaks, where MH is the metabolic heat in Watts, is:

$$RAL = 1.8 \times (59.9 - 14.1 \log_{10} MH) + 32$$

When working for shorter intervals, workers may be able to work in higher temperatures without adverse heat-related health effects. The NIOSH RAL is designed to take work/rest schedules into consideration, which are provided below. Use Tables 8 to 11 to determine the RAL for different work/rest schedules and body weights.

Table 8. Recommended Alert Limit (RAL) for Continuous Work

Work Category	Example	REL for 154 lb. Person	REL for 200 lb. Person	REL for 250 lb. Person	REL for 300 lb. Person
<b>Light</b>	Sitting, standing, light arm/hand work and occasional walking	80 °F	77 °F	74 °F	72 °F
<b>Moderate</b>	Normal walking, moderate lifting	75 °F	72 °F	70 °F	<b>68 °F *</b>
<b>Heavy</b>	Heavy material handling, walking at a fast pace	72 °F	<b>69 °F *</b>	<b>67 °F *</b>	<b>65 °F *</b>
<b>Very Heavy</b>	Pick and shovel work	70 °F	<b>67 °F *</b>	<b>64 °F *</b>	<b>62 °F *</b>

*Adapted from NIOSH Criteria for a Recommended Standard: Occupational Exposure to Heat and Hot Environments and ACGIH "2017 TLVs and BEIs"*

**\* These activities are not recommended for persons of this body weight working under heat stress conditions. Special precautionary measures must be taken to reduce physical exertion and continually monitor workers for physiological signs of heat stress (e.g., body temperature and/or heart rate).**

Table 9. Recommended Alert Limit (RAL) for 75% Work & 25% Rest Each Hour

Work Category	Example	REL for 154 lb. Person	REL for 200 lb. Person	REL for 250 lb. Person	REL for 300 lb. Person
Light	Sitting, standing, light arm/hand work and occasional walking	82 °F	79 °F	77 °F	75 °F
Moderate	Normal walking, moderate lifting	78 °F	75 °F	73 °F	71 °F *
Heavy	Heavy material handling, walking at a fast pace	76 °F	73 °F *	70 °F *	68 °F *
Very Heavy	Pick and shovel work	73 °F	70 °F *	68 °F *	66 °F *

*Adapted from NIOSH Criteria for a Recommended Standard: Occupational Exposure to Heat and Hot Environments and ACGIH "2017 TLVs and BEIs"*

**\* These activities are not recommended for persons of this body weight working under heat stress conditions. Special precautionary measures must be taken to reduce physical exertion and continually monitor workers for physiological signs of heat stress (e.g., body temperature and/or heart rate).**

Table 10. Recommended Alert Limit (RAL) for 50% Work & 50% Rest Each Hour

Work Category	Example	REL for 154 lb. Person	REL for 200 lb. Person	REL for 250 lb. Person	REL for 300 lb. Person
Light	Sitting, standing, light arm/hand work and occasional walking	84 °F	81 °F	79 °F	77 °F
Moderate	Normal walking, moderate lifting	81 °F	78 °F	76 °F	73 °F *
Heavy	Heavy material handling, walking at a fast pace	78 °F	76 °F *	73 °F *	71 °F *
Very Heavy	Pick and shovel work	77 °F	74 °F *	72 °F *	69 °F *

*Adapted from NIOSH Criteria for a Recommended Standard: Occupational Exposure to Heat and Hot Environments and ACGIH "2017 TLVs and BEIs"*

**\* These activities are not recommended for persons of this body weight working under heat stress conditions. Special precautionary measures must be taken to reduce physical exertion and continually monitor workers for physiological signs of heat stress (e.g., body temperature and/or heart rate).**

Table 11. Recommended Alert Limit (RAL) for 25% Work & 75% Rest Each Hour

Work Category	Example	REL for 154 lb. Person	REL for 200 lb. Person	REL for 250 lb. Person	REL for 300 lb. Person
Light	Sitting, standing, light arm/hand work and occasional walking	86 °F	83 °F	80 °F	78 °F
Moderate	Normal walking, moderate lifting	83 °F	80 °F	78 °F	76 °F *
Heavy	Heavy material handling, walking at a fast pace	81 °F	78 °F *	76 °F *	74 °F *
Very Heavy	Pick and shovel work	80 °F	77 °F *	75 °F *	73 °F *

*Adapted from NIOSH Criteria for a Recommended Standard: Occupational Exposure to Heat and Hot Environments and ACGIH "2017 TLVs and BEIs"*

**\* These activities are not recommended for persons of this body weight working under heat stress conditions. Special precautionary measures must be taken to reduce physical exertion and continually monitor workers for physiological signs of heat stress (e.g., body temperature and/or heart rate).**

## Step 5. Determine Risk Level

The risk level is assessed by comparing the WBGT-Effective to the REL for acclimated workers or RAL for unacclimated workers. If the WBGT-Effective exceeds the respective REL or RAL, then additional workplace controls are required to protect workers from heat stress and heat-related illnesses.

### *Acclimated Workers: Hazard Quotient*

A hazard quotient (HQ) is used to evaluate the risk level for acclimated workers. The formula for HQ-Acclimated for use with acclimated workers is:

$$\mathbf{HQ-Acclimated} = \frac{\mathbf{WBGT-Effective}}{\mathbf{REL}}$$

### Interpretation of the HQ-Acclimated

If the HQ-Acclimated is below 1.0, then no heat stress hazard is anticipated and workers should be able to perform duties without additional control measures. However, if the HQ-Acclimated exceeds 1.0, then it is anticipated that workers will be at risk of heat stress and heat-related illnesses. In these cases, multiple heat-illness prevention strategies (controls) must be implemented to adequately protect workers. The risk level, determined in Table 12 can aid in the implementation of controls.

### *Unacclimated Workers: Hazard Quotient*

A hazard quotient (HQ) is used to evaluate the risk level for unacclimated workers. The formula for HQ-Unacclimated for use with unacclimated workers is:

$$\mathbf{HQ-Unacclimated} = \frac{\mathbf{WBGT-Effective}}{\mathbf{RAL}}$$

## Interpretation of the HQ-Unacclimated

If the HQ-Unacclimated is below 1.0, then no heat stress hazard is anticipated and workers should be able to perform duties without additional control measures.

However, if the HQ-Unacclimated exceeds 1.0, then it is anticipated that workers will be at risk of heat stress and heat-related illnesses. In these cases, multiple heat-illness prevention strategies (controls) must be implemented to adequately protect workers. The risk level, determined in Table 12 can aid in the implementation of controls.

### *Risk Level*

Table 12 is a general guideline for use in determining the risk level for heat stress for both acclimated and unacclimated workers. The risk levels can be used to determine the adequacy of controls needed to protect workers.

Table 12. Risk Level for Acclimated and Unacclimated Workers

<b>HQ</b>	<b>&lt; 1.0</b>	<b>1.0-1.02</b>	<b>1.03-1.04</b>	<b>1.04-1.07</b>	<b>&gt; 1.07</b>
<b>Risk Level</b>	Low	Moderate	High	Very High	Severe

## **IX. HEAT-ILLNESS PREVENTION STRATEGIES**

When the HQ is above 1.0, heat-illness prevention controls need to be implemented to protect workers. The heat-illness prevention strategies are broken down into five (5) steps:

1. First, implement controls aimed at reducing the hazard quotient (HQ).
2. Second, when the risk level is high, very high or severe, then incorporate physiological monitoring (e.g., body temperature and/or heart rate) as a precautionary measure to identify heat stress before a more serious condition or illness arises.
3. Third, implement engineering controls to reduce heat stress conditions.
4. Fourth, implement administrative controls to address acclimatization issues and/or reduce heat stress conditions.
5. Fifth, provide workers personal protective clothing and equipment to reduce heat stress conditions.

The heat-illness prevention strategies vary slightly for unacclimated workers. If workers have not worked in a hot environment within the previous week, then those workers must be placed in an acclimatization program designed to gradually acclimate them to work in a hot environment.

### **Step 1. Implement Controls to Reduce Hazard Quotient and Risk Level**

The first step in the heat-illness prevention strategy is to evaluate those factors used in the heat hazard assessment and determine what changes could be made to reduce the hazard quotient (HQ) to a value below 1.0, a low risk level. Examples of effective controls include:

1. Suspend activities during the hottest part of the day and change to work schedule to cooler times of the day. [HIGHLY EFFECTIVE]
2. Provide shade or shelter from the sun and eliminate solar irradiance to 0 Watts/m<sup>2</sup>. [HIGHLY EFFECTIVE]

3. When feasible, eliminate use of chemical vapor-barrier coveralls, such as encapsulating suits and whole-body chemical protective suits during hottest parts of day. [HIGHLY EFFECTIVE]
4. When feasible, eliminate double clothing layers. [HIGHLY EFFECTIVE]
5. When feasible, use mechanical and powered equipment to reduce worker physical exertion, especially heavy physical exertion. This includes the use of forklifts, hoists, earthmoving equipment (backhoes, loaders and excavators), conveyers, portable power tools (e.g., rotary auger in place of hand shoveling), etc. [HIGHLY EFFECTIVE]
6. When feasible, change the work-rest schedule to ensure workers receive adequate rest breaks, which will decrease accumulation of body heat. [MODERATELY TO HIGHLY EFFECTIVE]
7. If air temperatures are below 95 °F (skin temperature) and air velocities are less than 1-2 mph, then increasing the air velocity at workers using portable fans can be an effective control to increase cooling. Caution: If air temperatures are above 95 °F, then heat will be added to workers by convection, which puts them at risk of heat stress. [MODERATELY EFFECTIVE]
8. When feasible, adjust work clothing to lighter, more breathable cotton fabrics or change coveralls to a more breathable material. [SLIGHTLY EFFECTIVE]

## **Step 2. When Risk Level is High Incorporate Physiological Monitoring**

When the risk level is high, very high or severe, then it is important to incorporate physiological monitoring (e.g., body temperature and/or heart rate) as a measure to identify heat stress before a more serious condition or illness arises. At a minimum, either body temperature or recovery heart rate should be monitored. Body weight is recommended to ensure workers are properly hydrated.

### *Oral Body Temperature*

Oral temperature is inexpensive, reliable and easy to obtain in the field. It is important to use a reliable and accurate clinical thermometer and to use the thermometer

according to the manufacturer's instructions. Disposable oral thermometers are available and can be an inexpensive solution; however, readings will take longer (e.g., 3-4 minutes). Some digital oral thermometers can deliver an accurate reading in as little as 30 seconds. It is important to make sure the thermometer is stored in a cool environment and not exposure to temperatures above 95 °F. In addition, readings should not be taken within 15-minutes of consuming hot or cool liquids and foods or if the worker is breathing heavy (mouth breathing).

The generally accepted and recommended guideline is that worker oral temperatures should not exceed 99.5 °F. As a precautionary measure, when the oral temperature is elevated above 99.1 °F, adjust the work-rest schedule to increase the frequency and duration of rest breaks or take other preventative measures.

Follow the guidelines in Table 13 for collecting and interpreting oral temperatures.

Table 13. Collection and Interpretation of Oral Temperatures

<b>STEP</b>	<b>Instructions</b>
Schedule times for collection of oral temperature	During the hottest times of the workday, collect oral temperatures at least every hour. Under severe conditions, the cycle should be at least every 30 minutes.
Collect oral temperature	<p>If worker is not breathing heavily (mouth breathing), then collect oral temperature at a scheduled rest breaks, before consumption of water or fluids.</p> <p>If worker is breathing heavily, then have him/her first drink fluids and collect temperature at end of rest break, 15-minutes after drinking fluids.</p>
Thermometer reading less than 99.1 °F	If thermometer reading is less than 99.1 °F, then resume normal work activities and work-rest schedule.
Thermometer reading 99.2 to 99.5 °F	If thermometer reading is 99.2 to 99.5 °F, then take precautionary measures to reduce heat stress (e.g., adjust work-rest schedule or implement additional controls)
Thermometer reading above 99.5 °F	If thermometer reading is above 99.5 °F, then suspend work and physical exertion within the hot environment and take immediate actions to cool body temperature (e.g., relocate to a cool environment with air movement and provide cool fluids). Monitor body temperature and continue cooling efforts until body temperature returns to a normal temperature below 99 °F. Seek medical attention if worker exhibits additional signs of heat exhaustion or temperature does not drop or continues to elevate at rest.
Thermometer reading above 101.2 °F	If thermometer reading is above 101.2 °F, then seek immediate medical attention and take immediate actions to cool his/her body temperature assuming potential heat stroke conditions (e.g., relocate to a cool environment with air movement, remove excess clothing, spray his/her body with cool water and fan vigorously, and pack ice in armpits and groin area).

### *Recovery Heart Rate (Pulse Rate)*

If done properly, the recovery heart rate, as a pulse rate, is a good indicator of body temperature and heat stress. In addition, when a worker becomes dehydrated the volume of blood reduces and the heart rate can increase significantly. For simplicity, a modified Brouha method as described by NIOSH is recommended. The method involves taking an initial pulse rate reading at the beginning of a scheduled rest break. With the worker sitting and resting, an initial pulse rate reading is collected (P1) and if the pulse rate is above 110 bpm, then pulse rate readings are collected at a two-minute (P2) and four-minute (P3) interval. The general guidelines for interpretation are:

1. If the pulse rate does not drop to below 110 bpm (beats per minute) during the test, then this indicates heat stress conditions are above an acceptable level. The resting heart rate is too high, which indicates the work rate is too high for the individual.
2. With a starting pulse rate above 110 bpm, if the difference between two-minute intervals is less than 10 bpm, then this also indicates heat stress conditions are above an acceptable level. The heart rate is not effectively recovering at rest, which also indicates the work rate is too high for the individual. It could also indicate dehydration.

There can be variation among individuals and some may exhibit much lower or higher resting pulse rates. The heart rate recovery evaluation is designed to account for this. However, a qualified medical provider should examine individuals with pre-work pulse rates above 100 bpm when at normal rest. High resting pulse rates could be indicative of an underlying medical condition.

### Methods for Collecting Pulse Rate

Use of a reliable and accurate clinical pulse rate device for the finger, wrist or chest is recommended. As the pulse rate will change with time, it is important to collect the

pulse rate within a consistent and short interval (e.g., 5 to 10 seconds). Use the guidelines provided by the device manufacture when collecting pulse rates.

The pulse rate can be collected manually by counting the pulses at the inner wrist just below the palm on the thumb or neck to the side of the windpipe over a 30 second timed interval (e.g., using a stopwatch). Use the index and middle fingers to detect a pulse and do not start counting until a reliable pulse can be detected. A slight amount of pressure may be necessary. The number of pulses is then multiplied by 2 to give the pulse rate in bpm.

Follow the guidelines in Table 14 for collecting and interpreting pulse rate and heart rate recovery.

Table 14. Collection and Interpretation of Pulse Rates

STEP	Instructions
Schedule times for collection of pulse rates	During the hottest times of the workday, collect pulse rates at least every hour. Under severe conditions, the cycle should be at least every 30 minutes. The pulse rate needs to be collected at the start of the rest break, within the first few minutes.
Collect initial pulse rate (P1)	Have the work sit on a stool or chair and rest. Collect the initial pulse rate within a few minutes after the worker has stopped working, at the start of the rest break.
If the pulse rate is below 110 bpm	If the pulse rate is below 110 bpm, then resume normal work activities and work-rest schedule.
If the pulse rate is above 110 bpm	If the pulse rate is above 110 bpm, then evaluate heart rate recovery by collecting two additional pulse rate measurements at two-minute intervals.
If differences between 2-minute intervals is <u>greater</u> than 10 bpm and the pulse rate drops below 110 bpm	If differences between 2-minute intervals is <u>greater than 10 bpm and the pulse rate drops below 110 bpm</u> , then resume normal work activities and work-rest schedule.
If differences between 2-minute intervals is <u>less</u> than 10 bpm	If differences between 2-minute intervals is <u>less than 10 bpm</u> , then suspend work and physical exertion within the hot environment and take immediate actions to cool his/her body temperature (e.g., relocate to a cool environment with air movement and provide cool fluids). Monitor pulse rate and/or body temperature and continue cooling efforts until pulse rate drops below 90 bpm or body temperature returns to a normal temperature below 99 °F. Seek medical attention if worker exhibits additional signs of heat exhaustion or pulse rate and/or temperature do not drop or continue to elevate at rest.
Re-check pulse rate after 10 minutes	If the resting pulse rate remains above 110 bpm after 10 minutes of rest, then seek immediate medical attention and take immediate actions to cool his/her body temperature assuming potential heat stroke conditions (e.g., relocate to a cool environment with air movement, remove excess clothing, spray his/her body with cool water and fan vigorously, and pack ice in armpits and groin area).

### *Monitoring Weight Loss – In Addition to Body Temperature or Heart Rate Recovery*

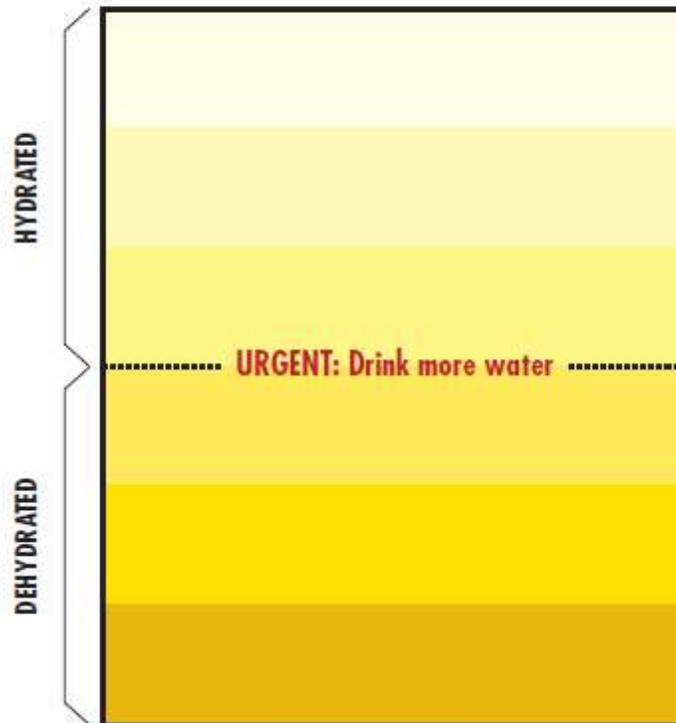
Weight loss is a good indicator of potential dehydration, which can lead to heat stress and heat-related illnesses. However, it is not a good indicator of heat stress or illness in itself. Having workers check their body weight during rest breaks can be an effective way for them to monitor water intake during work that involves physical exertion. As a general rule when using a reliable scale that can read body weight within  $\pm 0.25$  lbs., if a worker loses more than 1.5% of their body weight then he/she is likely not taking in enough water to replace the water lost due to sweating. This assumes that the worker is wearing clothing that will allow sweat to evaporate from the skin and not be trapped within the clothing (e.g., chemical protective and impermeable suits can trap sweat).

### *Monitoring Urine Color – In Addition to Body Temperature or Heart Rate Recovery*

Urine color can be a good indicator of potential dehydration, which can lead to heat stress and heat-related illnesses. However, it is not a good indicator of heat stress or illness in itself. In some cases underlying diseases, medications or even some foods may affect urine color. Having workers check their urine color against a color chart can help them to monitor water intake during work that involves physical exertion. Normal urine should be a pale yellow. The below urine color chart can be used to help a worker determine if he/she is properly hydrated. Some diets, medications and illnesses may affect results.

## Urine Color Chart

Are you hydrated?



Source: NIOSH Occupational Exposure to Heat and Hot Environments (2016)

### Step 3. Implement Engineering Controls

When the risk level is moderate or above, then implementation of effective engineering controls are recommended over administrative or protective clothing controls. The following are examples of effective engineering controls.

7. Reduce physical exertion and physical demands of work through use of powered tools and equipment, especially for tasks involving heavy lifting.
8. Reduce radiant heat loading from the sun or other sources of radiant heat (e.g., furnaces, combustion engines and compressors, hot surfaces, heated transfer lines, windows receiving intense sun, etc.). One effective method is to place line-

of-sight, reflective barriers between the heat source and workers. Another method is to insulate hot surfaces, such as furnaces.

9. If air temperatures are below 95 °F, then increase air speed across skin of workers using fans or air movers, to increase evaporative cooling from skin.
10. If air temperatures are above 95 °F, then reduce air speed across skin of workers, to reduce convective heat transfer from air to skin.
11. If humidity is below 50%, then evaporative coolers and portable fans with water mist systems can be used to effectively cool the air by about 10 to 20 °F.
12. Decrease humidity to below 50% to increase evaporative cooling from sweating.

### **Implement Administrative Controls**

When the risk level is moderate or above, then implementation of effective administrative controls are recommended when effective engineering controls are not feasible. Additionally, unacclimated workers must be placed in an acclimatization program designed to gradually acclimate them to work in a hot environment. This includes workers that have not previously worked in a hot environment within the previous week.

#### *Acclimatization Program*

The goal of an acclimatization program is to gradually increase exposure time under hot environmental conditions over 7 to 14 days. This allows the body to adjust to the hot conditions, which will result in more efficient evaporative cooling, a more efficient heart rate recovery and less stress on the heart. Use the following guidelines for acclimating workers to work under hot conditions.

1. For new workers, on day one schedule less than 20% of the work duration in the hot environment and then increase that no more than 20% each day. As an example, for an 8-hour work shift:
  - a. On day one, schedule no more than 1.6 hours under hot conditions.
  - b. On day two, schedule no more than 3.2 hours under hot conditions.

- c. On day three, schedule no more than 4.8 hours under hot conditions.
  - d. On day four, schedule no more than 6.4 hours under hot conditions.
  - e. On day five, schedule no more than 8 hours under hot conditions.
2. For workers with experience on the job, on day one schedule less than 50% of the work duration in the hot environment, 60% on day two, 80% on day three and 100% on day four. As an example, for an 8-hour work shift:
- a. On day one, schedule no more than 4 hours under hot conditions.
  - b. On day two, schedule no more than 4.8 hours under hot conditions.
  - c. On day three, schedule no more than 6.4 hours under hot conditions.
  - d. On day four, schedule no more than 8 hours under hot conditions.

### *Administrative Controls*

The following are examples of effective administrative controls.

- 12. Schedule work or work requiring heavy physical exertion during the coolest parts of the day.
- 13. Modify the work-rest schedule to shorten heat exposure periods by including frequent rest breaks. Shorter, more frequent breaks are more effective than longer, less frequent rest breaks.
- 14. Encourage adequate water intake at frequent intervals to prevent dehydration (e.g., one 8-ounce cup of cool water or an electrolyte replacement fluid every 15-20 minutes).
  - a. The supervisor or foreman is responsible for making sure drinking water is provided, plus:
    - i. Ensure that water containers are clean and sanitary prior to filling.
    - ii. Ensure water containers are filled at a sanitary location.
    - iii. Provide sufficient disposable cups and a place for disposing cups.
    - iv. Ensure workers do not share cups and dispose of used cups.
    - v. Prohibit workers from opening the cooler top to fill cups and instead have workers use the provided spigot.

- b. Pure and cool potable water must be made available to workers at no additional cost.
    - i. Do not use water from irrigation, sprinklers or firefighting systems.
    - ii. Do not use water from a garden hose, as it may contain contaminants from the hose and/or bacteria and other microbes.
  - c. Water quantities need to be sufficient and at least 1 quart per worker per hour for the entire shift.
  - d. Locate water containers as close as practicable at all times.
  - e. Encourage workers to frequently drink water and not wait until thirsty.
15. Provide a shaded and/or air-conditioned space nearby for rest and water breaks.
16. Train workers on the recognition of the signs and symptoms of heat-induced illness and on heat-illness prevention strategies.
17. Alert workers to extreme heat events or heat stress conditions and provide a short review of the heat-illness prevention strategies for the day.
18. Have worker work in pairs (buddy system) and monitor each other for signs and symptoms of heat stress or illness.
19. Instruct workers to avoid caffeine and alcohol before and during working in a hot environment.
20. Instruct workers to report illnesses or medical conditions that may put them at risk of heat stress (e.g., diarrhea, fever, infection, etc.)
21. Medically screen workers for work in hot environments.

### **Implement Personal Protective Clothing and Equipment Controls**

If engineering and/or administrative controls are not feasible, then personal protective clothing and equipment should be used to reduce heat stress conditions. The following are examples of effective personal protective clothing and equipment controls.

- 5. Provide clothing designed to keep the body cool, such as air, cooled fluid or ice-cooled conditioned clothing.

6. Provide reflective clothing to reduce radiant heat loading from the sun or hot surfaces radiating heat.
7. If air temperatures are below 95 °F and worker is protected from radiant heat, then decrease clothing coverage or layers (when feasible) to increase evaporative cooling from skin. Caution: Do not remove clothing designed to protect workers from chemical, mechanical or other hazards without conducting a proper evaluation to address those hazards.
8. If air temperatures are above 95 °F, then increase clothing coverage to reduce air speed across skin of workers, which can help reduce convective heat transfer from air to skin.

## **X. MEDICAL EMERGENCIES**

When workers are exposed to heat stress conditions, it is critical to ensure adequate supervision, first aid and medical services are readily available in the event a worker suffers from a heat illness. This includes ensuring adequate first aid supplies are available and supervisors and workers are trained on what to do if a co-worker suffers from a heat-related illness.

### **First Aid Supplies**

The following first aid supplies for heat-induced illnesses need to be on hand.

1. Reliable oral thermometer for checking body temperature.
2. Reliable instrument or timer for checking heart rate.
3. Cool water or electrolyte replacement fluids.
4. Cold packs or ice packs for treatment of heat stroke.
5. Spray bottles with water or an available water source for treating heat stroke.

### **First Aid Providers**

Each work site should have at least one person trained to administer first aid, with two or more preferred. The location, physical address and phone number of the nearest

hospital or emergency medical services must be obtained prior to the beginning of work activities under hot conditions. The following emergency response information must be obtained prior to the beginning of work activities.

1. Names, locations and phone numbers of all first aid trained supervisors or key personnel on site.
2. Phone numbers for on-site or local medical emergency services.
3. Address, phone number and directions from site to closest emergency medical services (e.g., hospital).
4. Physical address and detailed directions for emergency medical services. If the site is a remote location, then check with emergency medical services to ensure they can find the location. Some providers may require GPS coordinates.

### **First Aid Guidelines**

See Section VI Training for the general first aid guidelines for heat-related illnesses, for supervisors and workers. It is important that all supervisors and workers know how to recognize the signs and symptoms of heat stress, when to call for emergency medical assistance and what steps they need to take to help the victim of heat stress until emergency services arrive.

## **XI. ENFORCEMENT**

Constant awareness of and respect for heat stress hazards, and compliance with all safety rules are considered conditions of employment. The supervisor, as well as individuals responsible for safety and personnel, reserve the right to issue disciplinary warnings to employees, up to and including termination, for failure to follow the guidelines of this program.

## **XII. INCIDENT INVESTIGATIONS**

All incidents that result in a worker suffering from a heat-related illness, regardless of their nature, shall be investigated and reported to management. It is an integral part of any safety program that documentation take place as soon as possible so that the cause and means of prevention can be identified to prevent a reoccurrence. A Worksite

Incident Form is provided in the Appendix. The form is to be completed and used to initiate an incident investigation with the goal of taking corrective actions to prevent future occurrences.

In the event that an employee suffers from a heat-related illness or some other related, serious incident occurs, this plan shall be reviewed to determine if additional practices, procedures, or training need to be implemented to prevent similar types of incidents from occurring.

## **VIII. CHANGES TO PLAN**

The Safety Manager will review and approve any changes to the plan. The Safety Manager shall review this plan at least annually to determine if additional practices, procedures or training needs to be implemented to improve heat-illness prevention measures. Workers shall be notified and trained, if necessary, in the new procedures. A copy of this plan and all approved changes shall be maintained at the jobsite.

# SILICA PROGRAM

## PROGRAM REQUIREMENTS

1. The written exposure control plan must be evaluated at least once per year and as necessary. Situations where reevaluation may be necessary include regulatory updates, changes in equipment, and exposure incidents. Any changes resulting from this process must be communicated to affected employees.
2. The written exposure control plan shall be available to all employees.

## SILICA Health Hazards

The health hazards of silica come from breathing in the dust. If crystalline silica becomes airborne through industrial activities, exposure to fine crystalline silica dust (specifically exposure to the size fraction that is considered to be respirable) can lead to a disabling, sometimes fatal disease called silicosis.

The fine particles are deposited in the lungs, causing thickening and scarring of the lung tissue. The scar tissue restricts the lungs' ability to extract oxygen from the air. This damage is permanent, but the symptoms of the disease may not appear for many years. A worker may develop any of three types of silicosis, depending on the concentration of silica dust and the duration of the exposure:

**Chronic Silicosis:** Develops after 10 or more years of exposure to crystalline silica and relatively low concentrations.

**Accelerated Silicosis:** Develops 5 to 10 years after initial exposure to crystalline silica at high concentrations.

**Acute Silicosis:** Develops within a few months to less than 2 years, after exposure to very high concentrations of crystalline silica.

Initially, workers with silicosis may have no symptoms; however, as the disease progresses, workers may experience shortness of breath, severe cough and weakness. These symptoms can worsen over time and lead to death. Exposure to silica has also been linked to other diseases in the renal and immune system, other diseases like chronic bronchitis, tuberculosis, chronic obstructive pulmonary disease (COPD) and lung cancer.

Below are some common work practices that can lead to silica dust exposure:

- Stationary masonry saws
- Handheld power saws
- Walk-behind saws
- Drivable saws
- Rig-mounted core saws or drills
- Handheld and stand-mounted drills
- Dowel drilling rigs
- Vehicle-mounted drilling rigs
- Jackhammers and handheld powered chipping tools
- Handheld grinders
- Walk-behind milling machines and floor grinders
- Drivable milling machines
- Crushing Machines

- Heavy equipment and utility vehicles when used to abrade or fracture silica containing materials (such as hoe-ramming or rock ripping) or during demolition activities, and for tasks such as grading and excavating

## Definitions

- **Action level** means an airborne concentration of 25 µg/m<sup>3</sup> calculated as an 8-hour TWA. Exposures at or above the action level trigger requirements for exposure assessment.
- **Competent person** means an individual who can identify existing and foreseeable respirable crystalline silica hazards in the workplace and who has authorization to take prompt corrective measures to eliminate or minimize them. The competent person must have the knowledge and ability necessary to implement the written control plan required under the standard.
- **Employee exposure** means the exposure to airborne respirable crystalline silica that would occur if the employee were not using a respirator.
- **High-efficiency particulate (HEPA) filter** means a filter that is at least 99.97 percent efficient in removing mono-dispersed particles of 0.3 micrometers in diameter. HEPA-filtered vacuuming is an example of a housekeeping method that minimizes employee exposure to respirable crystalline silica, and some Table 1 tasks require HEPA-filtered vacuuming.
- **Objective data** means information, such as air monitoring data from industrywide surveys or calculations based on the composition of a substance, demonstrating employee exposure to respirable crystalline silica associated with a particular product or material or a specific process, task, or activity. The data must reflect workplace conditions closely resembling or with a higher exposure potential than the processes, types of material, control methods, work practices and environmental conditions in the employer's current operations.
- **Permissible Exposure Limit (PEL)** means that employers complying with the alternative exposure control methods must ensure that their employees' exposure to respirable crystalline silica do not exceed the PEL, which is 50 µg/m<sup>3</sup>.
- **Physician or other licensed health care professional [PLHCP]** is an individual whose legally permitted scope of practice (i.e., license, registration or certification) allows him or her to independently provide or be delegated the responsibility to provide some or all of the particular health care services required by this standard.

## GENERAL REQUIREMENTS

1. The silica rules apply to any work operation that generates silica dust except where employee exposure to the silica dust will remain below the action level of 25 micrograms of respirable crystalline silica per cubic meter of air (25 µg/m<sup>3</sup>) calculated as an 8-hour time-weighted average (TWA) under any foreseeable conditions. There are a few work operations that can reasonably be expected to remain below the action level such as pouring concrete and mixing small batches of concrete, however most tasks that create silica dust will be at or above the action level.
2. Employees who are exposed to silica dust must be protected with engineering controls (wet or vacuum), work practice controls, and sometimes respirators so as not to exceed the permissible exposure limit (PEL) of 50 µg/m<sup>3</sup> calculated as an 8-hour time-weighted average (TWA). Respirators will be provided to employees who are exposed to respirable crystalline silica.

### STEP 1: DETERMINE WHICH COMPLIANCE METHOD

When a work operation creates silica dust, the competent person (typically the superintendent) must determine which of the two compliance method options described below will be used to control exposure to silica dust before work begins:

#### Option #1: Table 1

Refer to Table 1 to determine if the work operation is listed as one of the 18 common equipment/tasks and if all the engineering controls, work practices, and respiratory protection that are specified in the table can be fully and properly implemented. If Table 1 can be used, no additional assessments or engineering controls are required unless exposure conditions change.

#### Option #2: Exposure Assessment and Alternative Exposure Controls

If the task to be completed is NOT listed in Table 1, or where engineering, work practices, and respiratory protection are not utilized, the superintendent is required to contact the M & M Safety Department before the task is performed. For tasks not listed in Table 1, the M & M Safety Department will complete an assessment to determine any hazards to the employee. Assessment results from tasks frequently performed by M & M employees will be compiled and referenced as needed.

1. **Exposure Assessment:** An independent exposure assessment must be conducted to determine who may be exposed to silica dust at or above the action level of 25 µg/m<sup>3</sup> calculated as an 8-hour TWA during the work operation. The assessment is based on any air monitoring data or objective data that is sufficient to accurately characterize exposures.
2. **If objective data is used** for the exposure assessment, the information must demonstrate how the employee is exposed to silica dust based on the specific material, process, or work operation. The data must reflect workplace conditions closely resembling or with a higher exposure potential than the types of material, control methods, work practices, and environmental conditions in the employer's current operations. An accurate record of the information must be kept when relying on objective data to comply with the silica standard. The record must include:
  - The date of the measurement for each sample taken.
  - The task monitored
  - Sampling and analytical methods used.
  - The number, duration and results of sample taken.
  - The identity of the laboratory that performed the analysis.
  - The type of personal protective equipment used (e.g., type of respirator worn); and
  - The name, social security number, and job classification of all employees represented by the monitoring.
3. **If air monitoring data is used** for the exposure assessment, the employer shall assess the exposure of each employee who is or may reasonably be expected to be exposed to respirable crystalline silica at or above the action level in accordance with either the performance option or the scheduled monitoring option. All results of air monitoring will be made available to the employee within 5 business days of analysis.
  - a. **Scheduled Monitoring:** The employer shall perform initial monitoring to assess the 8-hour TWA exposure for each employee based on one or more personal breathing zone air samples that reflect the exposures of employees on each shift, for each job classification, in each work area. Where several employees perform the same tasks on the same shift and in the same work area, the employer may sample a representative fraction of these employees to meet this requirement. In representative sampling, the employer shall sample the employees who are expected to have the highest exposure to respirable crystalline silica.
    - If initial monitoring indicates that employee exposures are below the action level, the employer may discontinue monitoring for those employees whose exposures are represented by such monitoring.

- Where the most recent exposure monitoring indicates that employee exposures are at or above the action level but at or below the PEL, the employer shall repeat such monitoring within six months of the most recent monitoring.
  - Where the most recent exposure monitoring indicates that employee exposures are above the PEL (50 µg/m<sup>3</sup>, calculated as an 8-hour TWA), the employer shall repeat such monitoring within three months of the most recent monitoring.
  - Where the most recent (non-initial) exposure monitoring indicates that employee exposures are below the action level, the employer shall repeat such monitoring within six months of the most recent monitoring until two consecutive measurements, taken seven or more days apart, are below the action level, at which time the employer may discontinue monitoring for those employees whose exposures are represented by such monitoring.
4. **Alternate Exposure Controls:** Alternate exposure controls must be used to limit employee exposures to the PEL of 50 micrograms of respirable crystalline silica per cubic meter of air (50 µg/m<sup>3</sup>) calculated as an 8-hour time-weighted average (TWA). The alternate exposure controls are as follows:
- Engineering controls are wet method and HEPA-filtered vacuuming. Wet methods involve applying water or foam at the point where dust is created to keep the dust from getting into the air (i.e. an integrated water delivery system on a stationary masonry saw). HEPA-filtered vacuuming removes dust by capturing it at or near the point where it is created (i.e. a dust collector on a handheld grinder).
  - Work practice controls are performing a task in a way that reduces or limits exposures (i.e. following the manufacturers' recommendations for equipment usage and maintenance.) or limiting the duration that an employee is exposed (i.e. rotating employees).
  - Respirators are typically required only when engineering controls cannot reduce exposures to acceptable levels

## Respiratory Protection Requirements

1. A written respiratory protection program must be on site when work operations require the use of a respirator. The designated competent person (typically the superintendent) must implement all the program requirements (i.e. proper selection, clean shaven, fit testing, and training). Refer to the Respiratory Protection Program for additional information.
2. Medical exams (including chest X-rays and lung function tests) must be offered to employees who are required to wear respirators for 30 or more days per year. An accurate record must be kept which includes the following information about the employee:
  - a. Name and social security number
  - b. A copy of the physicians and other licensed health care professionals (PLHCPs) and specialists' written opinions (See Appendix B)
  - c. A copy of the information given to PLHCPs and specialists (i.e. a description of the employee's former, current and anticipated duties and exposure levels; a description of the PPE used by the employee; and information from previous employment-related medical examinations that is currently within the control of the employer)

### STEP 2: RESTRICT ACCESS TO OTHER WORKERS

Other workers shall be prevented from entering areas where silica dust is at or above the action level (typically in the areas where respirators are required) using signs, barricades, enclosures, spotters, or by only performing work when the area is clear of other contractors and workers.

### STEP 3: HOUSEKEEPING

1. Only use wet-sweeping or a HEPA-filtered vacuum for cleaning surfaces or clothing unless the competent person determines that dry sweeping is the only feasible method.
2. Compressed air should not be used to clean clothing or surfaces unless the compressed air is used in conjunction with a ventilation system that effectively captures the dust cloud created by the compressed air.

## STEP 4: WRITTEN EXPOSURE CONTROL PLAN

The competent person must complete the Silica Exposure Control Plan - Appendix A for each work operation/task that generates silica dust (whether using Table 1 or alternative exposure control methods).

## STEP 5: REASSESSMENT WHEN WORK CONDITIONS HAVE CHANGED

Exposures, engineering controls, and work practices must be reassessed whenever a change in the work operation, equipment, personnel, or work practices may result in new or additional exposures at or above the action level.

## TRAINING

1. Employees must be trained in the recognition of work operations that generate silica dust, the hazards associated with silica dust, and ways to limit exposures.
2. The employer shall ensure that each employee covered by this section can demonstrate knowledge and understanding of at least the following:
  - a. The health hazards associated with exposure to respirable crystalline silica.
  - b. Specific tasks in the workplace that could result in exposure to respirable crystalline silica.
  - c. Specific measures the employer has implemented to protect employees from exposure to respirable crystalline silica, including engineering controls, work practices, and respirators to be used.
  - d. The identity of the competent person designated by the employer; and e. The purpose and a description of the medical surveillance program.
3. The competent person shall be trained to identify existing and foreseeable silica hazards in the workplace and have the authorization to take prompt corrective measures. The competent person must be trained to make frequent and regular inspections of job sites, materials, and equipment to implement the written exposure control plan.
4. The written exposure control plan must be evaluated at least once per year and as necessary. Situations where reevaluation may be necessary include regulatory updates, changes in equipment, and exposure incidents. Any changes resulting from this process must be communicated to affected employees.

**TABLE 1: Specified Exposure Control Methods When Working with Materials Containing Silica**

Equipment/Task	Engineering and Work Practice Control Methods	Required Respiratory Protection and Minimum Assigned Protection Factor (APF)	
		≤ 4 hours/shift	> 4 hours/shift
(i) Stationary masonry saws	<p>Use saw equipped with integrated water delivery system that continuously feeds water to the blade.</p> <p>Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions.</p>	None	None
(ii) Handheld power saws (any blade diameter)	<p>Use saw equipped with integrated water delivery system that continuously feeds water to the blade.</p> <p>Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions.</p> <ul style="list-style-type: none"> <li>▪ When used outdoors.</li> <li>▪ When used indoors or in an enclosed area.</li> </ul>	<p>None</p> <p>APF 10</p>	<p>APF 10</p> <p>APF 10</p>
(iii) Handheld power saws for cutting fiber-cement board (with blade diameter of 8 inches or less)	<p>For tasks performed outdoors only:</p> <ul style="list-style-type: none"> <li>▪ Use saw equipped with commercially available dust collection system.</li> <li>▪ Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions.</li> <li>▪ Dust collector must provide the air flow recommended by the tool manufacturer, or greater, and have a filter with 99% or greater efficiency.</li> </ul>	None	None

(iv) Walk-behind saws	<p>Use saw equipped with integrated water delivery system that continuously feeds water to the blade.</p> <p>Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions.</p> <ul style="list-style-type: none"> <li>• When used outdoors.</li> <li>• When used indoors or in an enclosed area.</li> </ul>	<p>None</p> <p>APF 10</p>	<p>None</p> <p>APF 10</p>
(v) Drivable saws	<p>For tasks performed outdoors only:</p> <ul style="list-style-type: none"> <li>• Use saw equipped with integrated water delivery system that continuously feeds water to the blade.</li> <li>• Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions.</li> </ul>	<p>None</p>	<p>None</p>
(vi) Rig-mounted core saws or drills	<ul style="list-style-type: none"> <li>• Use tool equipped with integrated water delivery system that supplies water to cutting surface.</li> <li>• Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions.</li> </ul>	<p>None</p>	<p>None</p>
(vii) Handheld and stand-mounted drills (including impact and rotary hammer drills)	<ul style="list-style-type: none"> <li>• Use drill equipped with commercially available shroud or cowl with dust collection system.</li> <li>• Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions.</li> <li>• Dust collector must provide the air flow recommended by the tool manufacturer, or greater, and have a filter with 99% or greater efficiency and a filter-cleaning mechanism.</li> <li>• Use a HEPA-filtered vacuum when cleaning holes.</li> </ul>	<p>None</p>	<p>None</p>
(viii) Dowel drilling rigs for concrete	<p>For tasks performed outdoors only:</p> <ul style="list-style-type: none"> <li>• Use shroud around drill bit with a dust collection system. Dust collector must have a filter with 99% or greater efficiency and a filter-cleaning mechanism.</li> <li>• Use a HEPA-filtered vacuum when cleaning holes.</li> </ul>	<p>APF 10</p>	<p>APF 10</p>

INSERT APPENDIX B HERE

**Appendix B**

**WRITTEN MEDICAL REPORT FOR EMPLOYEE**

EMPLOYEE NAME: \_\_\_\_\_ DATE OF EXAMINATION: \_\_\_\_\_

**TYPE OF EXAMINATION:**

Initial examination     Periodic examination     Specialist examination

Other: \_\_\_\_\_

Insert CRYSTALLINE SILICA EXPOSURE PLAN FORM HERE

### Crystalline Silica Exposure Plan

Jobsite: \_\_\_\_\_ Foreman: \_\_\_\_\_ Date: \_\_\_\_\_

List Materials containing crystalline silica on the jobsite: \_\_\_\_\_  
\_\_\_\_\_

List employee tasks that create exposure to crystalline silica: \_\_\_\_\_

## CONCRETE OPERATIONS

1. Wear the following PPE when performing concrete operations:
  - a. Rubber over-boots when working in wet concrete. Boots will be provided.
  - b. Kneepads when finishing concrete.
  - c. Gloves when installing or removing formwork.
  - d. Hardhats when working around swinging concrete chutes and pump hoses.
  - e. Avoid contact with eyes and skin. If contact occurs, flush the area with clean water. If irritation continues, consult SDS binder for additional information
  - f. Respirator when sweeping, cutting or drilling into concrete. Consult your superintendent to determine the appropriate respirator to use. Refer to MITA Silica Program for additional information.
2. Wash your hands at the wash station after handling concrete.
3. Make sure all utilities have been shut off before drilling or cutting.
4. Watch for moving traffic and heavy equipment when performing concrete pours on roadways. Always face the on-coming traffic and be aware of the float poles extending into active traffic lanes. Use a spotter if necessary.
5. Be cautious when working around overhead power lines. Make sure the ends of float poles are kept at least 10' away from powerlines up to 50kV.

## DEMOLITION OPERATIONS

1. Prior to demolition a survey will be conducted to determine: building condition, whether adjacent structures will be affected by demolition, check for any other conditions that may threaten employee safety. A copy of the written report should be kept in the field office.
2. Be sure all utilities have been shut off.
3. Manual demolition should be performed under the direction of the qualified person.
4. Do not torch-cut painted steel unless it has been determined that it does not contain lead.
5. Asbestos should be removed by an associate contractor prior to demolition. If you suspect or find asbestos material cease work and bring it to the attention of your superintendent.
6. Do not use mechanical equipment on a floor or other working surface unless it is capable of supporting the equipment and its intended load.
7. Use curbs or stop logs to prevent mechanical equipment from tracking over an edge or drop.

8. Only the employees necessary to the operation of mechanical demolition shall be permitted in the demo area.
9. When possible or feasible use water to control dust created during the demolition process.

## PILEDIVING SAFETY

1. All hose connections to piledriver hammers, pile extractors, or jet pipes shall be securely attached, with an adequate length of cable to prevent whipping if the joint is broken.
2. Hanging or swinging leads of piledrivers shall have fixed ladders. Fixed leads shall be provided with rings or attachment points so that the aloft worker may engage his/her safety belt lanyard to the leads.
3. Landings or leads shall not be used for storage of any kind.
4. Piledriver leads shall have stop blocks to prevent the hammer from being raised against the head block.
5. Pile hammers shall be lowered to the bottom of the leads while the piledriver is being moved.
6. Hoisting of steel piling shall be done by use of a closed shackle or other positive attachment that will prevent accidental disengagement.
7. If piling cannot be pulled without exceeding the load rating of equipment, a pile extractor shall be used.
8. Piling shall not be pulled by tipping the crane, releasing the load brake momentarily, and catching the load before the crane has settled.
9. A blocking device shall be always provided for placement in the leads under the hammer while employees are working under the hammer.
10. Guards shall be provided across the top of the head block to prevent the cable from jumping out of the sheaves.
11. Steam or airline controls shall consist of two shutoff valves, one of which shall be a quick-acting lever type within easy reach of the hammer operator.
12. All employees shall be kept clear when piling is being hoisted into the leads.
13. When driving jacked piles, all access pits shall be provided with ladders and bulkheaded curbs to prevent material from falling into the pit.

## AERIAL WORK PLATFORMS

1. Use one of the following fall protection systems when operating an extendable or articulating boom-supported aerial lift:
  - a. Fall Arrest System: Wear a safety harness and attach your lanyard to the designated anchor point that is provided on the equipment. The aerial lift must be designed to withstand the vertical and lateral loads imposed by an arrested fall.
  - b. Fall Restraint System: Wear a Safety harness with a short (2') lanyard that will not stretch or "break" away. Attach the lanyard to the anchor point on the equipment so the operator is not exposed to any fall distance. A fall restraint system must be used when operating aerial lifts that are not designed to withstand the vertical and lateral loads caused by an arrested fall (typically smaller aerial lifts).
2. Aerial work platforms should only be operated by employees who have been trained and issued a permit to use this equipment.
3. At the beginning of each work shift, the aerial lift operator must perform an inspection of all the following before use:
4. Operate all the platform and ground controls to ensure they are working properly.
  - a. Inspect the work area for ditches, drop-offs, holes, floor and overhead obstructions, debris, power lines, and clearances.

- b. All unsafe items must be corrected before using the lift.
5. Visually inspect the aerial lift for any defects that would affect its safe operation (i. e. cracked welds, bent or broken members, damaged controls and cables, loose wires, tires, fluid levels, and slippery conditions on the platform).
6. The permit issued may only be used when performing work for the employer who issued the permit.
7. All occupants of aerial work platforms must use a harness with lanyard attached to the appropriate points of the platform.
8. Never tie off to an adjacent structure when working from an aerial platform.
9. Operating Aerial Lifts Generally.
  - a. Do not exceed the manufacturer's rated load capacity.
  - b. Elevate the platform only when the lift is set up on a firm and level surface or within the slope limits.
  - c. Use the outriggers or stabilizers, if provided by the manufacturer. Set the brakes and position the outriggers and stabilizers on pads or a solid surface.
  - d. Keep platform floors clean. Only employees, their tools and necessary materials are allowed on or in the platform.
  - e. Keep your feet on the platform! Don't use rails, ladders, planks, or any other material to achieve additional height while working on the platform.
  - f. Keep gates closed and chains secured when the platform is elevated.
10. Operating Aerial Lifts on or Adjacent to Roadways.
  - a. Ensure traffic control complies with Part 6 of the MMUTCD.
  - b. Maintain adequate clearance distances from active traffic lanes to ensure that any portion of the aerial lift (i .e . articulating and extensible booms), tools or material will not encroach into the active lanes during its operation.
11. Never stand on rails or planks to achieve additional working height.
12. Always maintain a minimum 10' clearance from energized electrical lines.

## SCAFFOLDING

1. Scaffolding should only be erected under the direction of a qualified employee.
2. Scaffolds must be inspected each day by a competent person. Damaged or weakened components (i.e. bent braces, split planks, broken platforms, unstable ground support) must be removed from service or repaired before use.
3. If you notice any damaged components, missing guardrails or have other safety concerns regarding a scaffold, inform your superintendent immediately.
4. Every employee must be trained to recognize the hazards that are specific to the type of scaffold they are using.
5. Refer to MIOSHA Construction Safety Standard - Part 12 Scaffolds and Scaffold Platforms, manufacturer's recommendations, and engineering designs for additional information and specific requirements for scaffolding.
6. Keep scaffolding free from excess tools, materials and debris.
7. All scaffolding 6' or higher must have a guardrail system installed on any open side.
8. Remove from service any wood or laminated planks in poor condition, along with any bent scaffolding members.
9. Maintain a 6' clearance from energized lines.
10. A fall arrest device must be worn when working on a scaffold at or above 10'.

## MISCELLANEOUS RULES

1. Do not use tools or equipment that you have not been trained or authorized to use. This rule also applies to power-actuated tools.
2. Gasoline must be stored and transported in approved cans only. Engines must be shut off when refueling and no smoking anywhere near flammable liquids.
3. Immediately report all injuries, whether to yourself or a co-worker, to your superintendent.
4. Do not distract the attention of fellow workers.

## DEFINITIONS

1. Competent Person: means a person who is capable of identifying an existing or potential hazard in surroundings, or under working conditions, hazardous or dangerous to an employee and who has the authority to take prompt corrective measures to eliminate the hazards.
2. Qualified Person: means a person who, by possession of a recognized degree or professional standing, or who, by extensive knowledge, training experience, has successfully demonstrated the ability to solve or resolve the problems relating to the subject matter and work.
3. Authorized Person: a person approved or assigned by the employer to perform a specific type of duty or to be at a specific location at the jobsite.
4. For the purposes of this program, unless stated otherwise, a qualified individual will be deemed competent and authorized.

## EMPLOYEE INFORMATION AND TRAINING

All employees are required to have the necessary safety training in order to be present on the job site. If an individual needs training in a language other than English, written or oral translations will be provided to the best of our ability.

1. The Safety Officer shall coordinate & maintain records of training conducted for M & M Excavating Company.
2. Before starting work, or as soon as possible thereafter, each new employee will attend a safety briefing. In that class, each employee will be given information on:
  - a. Chemicals & their hazards in the workplace.
  - b. How to lessen or prevent exposure to these chemicals.
  - c. What the company has done to lessen or prevent workers exposure to these chemicals.
  - d. Procedures to follow if they are exposed.
  - e. How to read & interpret labels & S.D.S.
  - f. Where to locate S.D.S. and from whom they may obtain copies.
3. The employee will be informed that:
  - a. The employer is prohibited from discharging, or discriminating against, an employee who exercises the rights regarding information about hazardous chemicals in the workplace.
  - b. Attendance will be taken at training sessions. The records will be kept by the Safety Officer.
  - c. Before any new hazardous chemical is introduced into the workplace, each employee will be given information in the same manner as during the safety briefing.

# SIGNALS, SIGNS AND BARRICADES

1. The Michigan Manual of Traffic Control Devices (MMUTCD) is utilized for some traffic layouts on other projects. MDOT has developed plans for placement of these devices, please consult your qualified person regarding proper placement of traffic control devices.
2. A handheld stop/slow paddle with 6' staff is required when controlling traffic.
3. Barricades may be used to direct vehicular traffic whenever work is being done on a public right-of-way. Ask your superintendent.
4. When working in or adjacent to vehicular traffic always face the flow of traffic or use a spotter.
5. Barricade hazardous areas. Caution tape may not be suitable for preventing others from entering hazardous areas; guardrails or perimeter cables along with danger signs may be necessary to keep others out. Barricades should be illuminating and/or reflective during nighttime hours.
6. Do not enter an area that has been barricaded. Seek instruction from your superintendent.
7. Post danger signs to alert other workers where an immediate hazard may exist that may not be readily seen (i.e., DANGER – Overhead Powerlines).

# HEAVY EQUIPMENT RULES

1. Every employee, not just the equipment operator, must be fully aware of all the safety aspects of heavy construction equipment.
2. Be constantly alert when working around heavy equipment. The operator cannot always see other personnel around his equipment. Stay out from under suspended loads, away from moving equipment, and counterweights.
3. Only designated individuals shall be permitted to operate or service heavy equipment.
4. Perform frequent and periodic inspections as required.
5. Keep a 5BC fire extinguisher in an excavator cab or within 100'.
6. Do not ride on any part of heavy equipment unless a seat and seatbelt are provided. Operators must wear their seatbelt if one is provided.
7. Hooks that are attached to buckets and booms must be equipped with self-closing latches.
8. It is the responsibility of all employees to make certain that back-up alarms on obstructed rear view heavy equipment be in operable condition. Use a flagger to move equipment when back up alarms are inoperable.
9. Maintain a 10' minimum clearance from energized lines; use a spotter in difficult areas.

## When guarding work areas, adhere to the following:

1. Never use resteel (rebar) for guardrail construction.
2. Guardrail support posts should be spaced not more than 8' apart.
3. Guardrail height should be 42" plus or minus 3".
4. The intermediate rail should be halfway between the floor and top rail.
5. Open-sided floors and work platforms 6' high or greater should be guarded unless a safety belt or harness is used.

## FALL PROTECTION

1. All manholes which present a fall hazard should be covered and identified as a hole.
2. Do not walk or work on any surface (i.e. platforms, roofs, floors) that may be deteriorated, rotted, or not fully installed. Inform your superintendent if you notice any defective walking/ working surfaces. Walking and working surfaces must be inspected by the superintendent (or other designated employees) to determine if the surfaces have the strength and structural integrity to support employees.

# Guardrail Specifications

1. Guardrails must be installed along the edges of walking/ working surfaces that are 6' or more above lower levels. If a guardrail is not installed, another fall protection system must be used to protect employees.
2. A guardrail consists of a top rail and a mid-rail. Install a toe board when active work is taking place below.
3. Guardrails are typically constructed using 2' x 4' lumber or 3/8" wire rope cable. Never use rebar!
4. Install top rails/cables between 39"–45" above the floor or lower working level.
5. The top rails must be strong enough to withstand at least 200 pounds applied outward or downward.
6. If wire rope cable is used, the top cables must be tight and not sag or deflect lower than 39" when pushing downward or outward, then flagged every 6' with high visibility material.
7. Install mid rails/cables halfway between the floor or lower working level and the top rail. They should be tight and strong enough to withstand 150 pounds applied outward or downward.
8. Support posts should be spaced not more than 8' apart for 2" x 4" guardrails. The ends of the top rails and mid rails should be flush with the support posts with no sharp edges or protruding nails. The support points for wire rope guardrails may be spaced farther apart.
9. Guardrails around open shafts and bore pits deeper than 6' should be 42" plus or minus 3" high.
10. The intermediate rail should be positioned halfway between the floor and top rail.
11. The intermediate rail should be positioned halfway between the floor and top rail.
12. The threshold for fall protection use is 6'. Fall protection may be accomplished by guarding, personal fall arrest systems or safety nets. Ask your qualified person.

# Personal Fall Arrest System Specifications

1. Personal fall arrest systems must be worn when workers are exposed to falls 6' or greater.
2. The attachment point of harness shall be located in the center of the wearer's back, near the shoulder level.
3. Never use body harnesses as material handling devices.
4. Do not re-use fall protection devices that have been subjected to impact loading until they have been inspected and considered suitable for use by a qualified employee. Tag this equipment out of service until such an inspection can be performed.
5. A personal fall arrest system (PFAS) consists of three components: harness, lanyard or lifeline, and anchor point.
6. Visually inspect your harness, lanyard, lifeline, and anchor point before each use for excessive wear, damage and deterioration. Remove defective equipment from service – do not use!
7. Harnesses must fit properly – not too loose, but not so tightly your movement is constricted. Position the D-ring on the upper back near the shoulder level.
8. Only use properly rated lanyards, vertical lifelines, and connecting components that are designed to be used for fall protection. **Do not tie, shorten or knot lanyards!**
9. Only self-locking type snap hooks are allowed. **Do not** connect your snap hook to an object or structure unless the snap hook is designed for this type of connection. Check with your superintendent if you have questions.
10. Horizontal lifelines must be designed, installed, and used under the supervision of the superintendent or other designated qualified person. A horizontal lifeline system is typically designed by an engineer to ensure the system maintains a safety factor of at least two.

11. **Do not attach your lanyard or lifeline to a guardrail!** Lanyards and lifelines must be attached to an anchor point that can support at least 5,000 pounds per employee. Most guardrails are not designed to be used as an anchor point. Ask your superintendent if you have any questions.
12. Prompt rescue must be planned and provided for employees wearing a PFAS unless the system is designed to rescue them. Employees, ladders, aerial lifts and equipment can be used to rescue an employee.

## Restraint System Specifications.

1. Restraint systems must be designed and installed to prevent an employee from being exposed to or reaching any fall hazard (i. e. edge of walking/working surface, floor openings).
2. Only fixed-type lifelines, lanyards and anchorages can be used for restraint systems. Deceleration devices and other components that are designed to break away, elongate, or lengthen when activated must not be used!
3. The components and equipment that are used for restraint systems must meet the same criteria as those used for personal fall protection systems (i.e. harnesses, snap hooks, lifelines, lanyards). Do not use miscellaneous ropes or secure with knots!
4. A restraint system must be secured to an anchor point that is fixed and strong enough to support at least two times the potential load imposed.

# FALL PROTECTION PLAN FOR PRECAST BOX CULVERT CONSTRUCTION

## Statement of Company Policy

This company is dedicated to the protection of its employees from on-the-job injuries. All employees of this company have the responsibility to work safely on the job. The purpose of this plan is to supplement our standard safety policy by providing safety standards specifically designed to cover fall protection on this job and to ensure that each employee is trained and made aware of the safety provisions which are to be implemented by this plan prior to the start of construction.

This Fall Protection Plan addresses the use of other than conventional fall protection at a number of areas on the project, as well as identifying specific activities during box culvert construction that require non-conventional means of fall protection. These areas include:

1. Rigging (hooking and unhooking precast sections).
2. Connecting activity (point of erection).
3. Leading edge work.
4. Unprotected sides or edge.
5. Grouting.
6. Final Wrapping.

This plan is designed to enable our employees to recognize fall hazards on this job and to establish the procedures that are to be followed in order to prevent falls to lower levels. Each employee will receive training in these procedures and strictly adhere to them except when doing so would expose the employee to a greater hazard. If, in the employee's opinion, this is the case, the employee is to notify the superintendent of the concern, and the concern addressed before proceeding.

Safety policies and procedures on any one project cannot be administered, implemented, monitored and enforced by any one individual. The total objective of a safe, accident-free work environment can only be accomplished by a dedicated, concerted effort by every individual involved with the project from management down to the last employee.

Each employee must understand their value to this company; the costs of accidents, both monetary, physical, and emotional; the objective of the safety policy and procedures; the safety rules that apply to the safety policy and procedures; and what their individual role is in administering, implementing, monitoring, and compliance of their safety policy and procedures. This allows for a more personal approach to compliance through planning, training, understanding and cooperative effort, rather than by strict enforcement. If for any reason an unsafe act persists, strict enforcement will be implemented.

It is the responsibility of the superintendent to implement this Fall Protection Plan. He/she is responsible for continual observational safety checks of their work operations and to enforce the safety policy and procedures. The superintendent also is responsible for correcting any unsafe acts or conditions immediately. It is the responsibility of the employee to understand and adhere to the procedures of this plan and to follow the instructions of the superintendent. It is also the responsibility of the employee to bring to management's attention any unsafe or hazardous conditions or acts that may cause injury to either themselves or any other employees.

Any changes to this Fall Protection Plan must be approved by:

## Fall Protection Systems to Be Used on This Project

Where conventional fall protection is infeasible or creates a greater hazard at the leading edge and during initial connecting activity, we plan to do this work using a safety monitoring system and expose only a minimum number of employees for the time necessary to accomplish the job.

The role of Safety Monitor may be rotated with 2 or more employees on this project under the authority of the superintendent, provided the employees are trained in the specifics of this fall protection plan and their role as safety monitor. One of the designated Safety Monitors will monitor a maximum of three (3) designated erectors in the Controlled Access Zone. The Safety Monitor will be identified by wearing an orange hard hat for this project. The Safety Monitors for this project are:

Enter Safety Monitor's Name

Enter Safety Monitor's Name

Enter Safety Monitor's Name

Designated erectors are permitted to enter the controlled access zone and work without the use of conventional fall protection. The designated erectors will be identified by (wearing a blue hard hat) . The Designated Erectors for this project are:

Enter Designated Erector's Name

Enter Designated Erector's Name

Enter Designated Erector's Name

1. Only individuals with the appropriate experience, skills, and training will be authorized as designated erectors. All employees that will be working as designated erectors under the safety monitoring system shall have been trained and instructed in the following areas:
2. Recognition of the fall hazards in the work area. (At the leading edge, making initial connections, grouting, wrapping, and hooking and unhooking rigging from crane.
3. Avoidance of fall hazards using established work practices which have been made known to the employees.
4. Recognition of unsafe practices or conditions that could lead to a fall, such as windy conditions.
5. The function, use, and operation of safety monitoring systems, control zones and other protection to be used.
6. The correct procedure for erecting, maintaining, and inspecting the system(s) to be used.
7. Knowledge of box culvert construction sequence or the erection plan.

A conference will take place prior to starting work involving all designated erectors, safety monitors, crane crew and supervisors of any other concerned contractors. This conference will be conducted by our company superintendent. During the pre-work conference, erection procedures and sequences pertinent to this job will be thoroughly discussed and safety practices to be used throughout the project will be specified.

Further, all personnel will be informed that the controlled access zones are off limits to all personnel other than those designated erectors specifically trained to work in that area.

## Safety Monitoring System

A safety monitoring system is a fall protection system in which a competent person is responsible for recognizing and warning employees of fall hazards. The duties of the Safety Monitor are to:

1. Warn by voice when approaching the open edge in an unsafe manner.
2. Warn by voice if there is a dangerous situation developing which cannot be seen by another person involved with product placement.
3. Make the designated erectors aware they are in a dangerous area.
4. Be competent in recognizing fall hazards.
5. Warn employees when they appear to be unaware of a fall hazard or are acting in an unsafe manner.
6. Be on the same walking/working surface as the monitored employees and within visual sighting distance of the monitored employees.
7. Be close enough to communicate orally with the employees.
8. Not allow other responsibilities to encumber monitoring. If the safety monitor becomes too encumbered with other responsibilities, the monitor shall stop the erection process and turn over other responsibilities to another designated monitor. The safety monitoring system shall not be used when the wind is strong enough to cause instability of footing or when weather conditions cause the walking-working surfaces to become icy or slippery.

## Controlled Access Zone (CAZ)

A CAZ is an area designated and clearly marked, with signs or other means, in which leading edge work and other operations may take place without the use of guardrail, safety net or personal fall arrest systems to protect the employees in the area. The CAZ for this work operation is the entire top deck of the box culvert during the erection, grouting, and wrapping process and shall comply with the following provisions:

The CAZ shall be defined by a sign placed at the base of the ladder access with wording to restrict access to the area where the designated erectors are installing the precast sections.

## Implementation of Fall Protection Plan

Typically, box culverts used under roadways are a maximum of 12' high x 20' wide x up to 200' in length. For this project, the overall length of the precast concrete box culvert upon completion will be  **Enter Overall Length**. There will be  **Enter # of Sections** precast sections sequentially placed, connected, grouted, and wrapped. The dimensions of each box culvert section for this project are: Height:  **Enter Height** x Width:  **Enter Width** x Length:  **Enter Length**

The following is a list of the products and erection situations on this job:

### Rigging:

The precast sections are delivered to jobsite on a trailer. Each section is removed from the trailer and placed in a staging area until they are ready to assemble the box culvert. The designated erectors must access the top of each precast section with a portable ladder in order to attach and unhook the sections. He/she is not able to reach the attachment points on the section to hook up and unhook while working from

the ladder. After the section is hooked up or unhooked, the designated erector climbs down from the ladder while the section is hoisted and moved to the staging area or final assembly area. The ladder is footed at the bottom by another employee who can safely monitor the rigging process from the ground. The designated erector is exposed to a fall hazard for a much shorter duration (typically a few minutes) than the amount of time it would take to install and remove anchorage points to attach a lanyard.

## Precast Sections/Connections/Grouting:

During installation of the precast sections, the work deck continuously increases in length as more and more sections are being erected and positioned. Thus, the unprotected floor perimeter is constantly modified with the leading edge changing location as each member is installed. The fall protection for workers on the work deck during erecting, welding connections and grouting shall be assured by a safety monitoring system to ensure the safety of all designated erectors working on the work deck.

All work performed on the work deck will be performed by the designated erectors. Whenever possible, the designated erectors will approach the incoming member at the leading edge only after it is below waist height so that the member itself provides protection against falls.

Except for the situations described below, when the arriving member is within 2-3 inches of its final position, the designated erectors can then proceed to their position of erection at each end of the member under the control of the safety monitor. Crane hooks are

unhooked by the designated erectors under the direction and supervision of the safety monitor.

Designated erectors, while waiting for the next member, will be constantly under the control of the safety monitor for fall protection and are directed to stay a minimum of six (6) ft from the edge. In the event a designated erector must move from one end of a member, which has just been placed at the leading edge, they must first move away from the leading edge a minimum of six (6) ft and then progress to the other end while maintaining the minimum distance of six (6) ft at all times.

Connecting (welding) and grouting are incorporated into the erection sequence by the designated erectors at the time of the initial connection of each section under the direction and supervision of the safety monitor. Whenever possible, the designated erectors will maintain a minimum distance of six (6) ft and face the unprotected edges of the deck.

## Wrapping the Box Culvert:

After installation of all the sections of the box culvert have been completed, the designated erectors will wrap the top and sides of the finished box culvert with a membrane. The designated erectors install the membrane from the work deck and work their way backwards as each sheet is installed under the direction and supervision of the safety monitor. The membrane is approx. 4 feet wide.

## Conventional Fall Protection Considered for Box Culvert Precast Operations

### Personal Fall Arrest Systems

On this particular box culvert project, personal fall arrest systems (PFAS) requiring body belt/harness systems, lifelines and lanyards will not reduce possible hazards to workers and will create offsetting hazards during their usage when initially installing the culvert sections.

Rigging, leading edge work and initial connections are performed by employees who are specifically trained to do this type of work and are trained to recognize the fall hazards. The nature of such work

normally exposes the employee to the fall hazard for a short period of time and installation of fall protection systems for a short duration is not feasible because it exposes the installers of the system to the same fall hazard, but for a longer period of time.

1. It is necessary that the employee be able to move freely without encumbrance in order to hook and unhook culvert sections during unloading and staging, and when guiding the sections into their final position without having lifelines or lanyards attached which will restrict the employee's ability to move about.
2. A typical leading edge and connecting procedure requires 2 or more workers to maneuver around each other as each culvert section is positioned. If they are each attached to a lifeline, part of the attention must be diverted from their main task of positioning a member weighing several tons to the task of avoiding entanglements of their lifelines or avoiding tripping over lanyards. Therefore, if these workers are attached to lanyards, more fall potential would result than from not using such a device. In this specific erection sequence and procedure, retractable lifelines do not solve the problem of two workers becoming tangled.

In fact, such a tangle could prevent the lifeline from retracting as the worker moved, thus potentially exposing the worker to a fall greater than 6 ft.

Also, a worker crossing over the lifeline of another worker can create a hazard because the movement of one person can unbalance the other. In the event of a fall by one person there is a likelihood that the other person will be caused to fall as well. In addition, if contamination such as grout enters the retractable housing, it can cause excessive wear and damage to the device and could clog the retracting mechanism as the lanyard is dragged across the deck. Obstructing the cable orifice can defeat the device's shock absorbing function, produce cable slack and damage, and adversely affect cable function.

3. Employees tied to a lifeline can be trapped and crushed by moving structural members if the employee becomes restrained by the lanyard or retractable lifeline and cannot get out of the path of the moving load. The sudden movement of a culvert section being raised by a crane can be caused by a number of factors. When this happens, a designated erector may immediately have to move a considerable distance to avoid injury. If a tied off body belt/harness is being used, the connector could be trapped. Therefore, there is a greater risk of injury if the designated erector is tied to the structure for this specific erection sequence and procedure.

When necessary to move away from a retractable device, the worker cannot move at a rate greater than the device locking speed typically 3.5 to 4.5 ft/sec. When moving toward the device, it is necessary to move at a rate which does not permit cable slack to build up. This slack may cause cable retraction acceleration and cause a worker to lose their balance by applying a higher-than-normal jerking force on the body when the cable suddenly becomes taut after building up momentum. This slack can also cause damage to the internal spring-loaded drum, uneven coiling of cable on the drum, and possible cable damage. The factors causing sudden movements for this location include:

- 1) Cranes
  - a) Operator error.
  - b) Site conditions (soft or unstable ground).
  - c) Mechanical failure.
  - d) Structural failure.
  - e) Rigging failure.
  - f) Crane signal/radio communication failure.

- 2) Weather Conditions
    - a) Wind (strong wind/sudden gusting).
    - b) Snow/rain (visibility).
    - c) Fog (visibility).
    - d) Cold – causing slowed reactions or mechanical problems.
  - 3) Structure/Product Conditions.
    - a) Lifting Eye failure.
    - b) Bearing failure or slippage.
    - c) Structure shifting.
    - d) Bracing failure.
    - e) Product failure.
  - 4) Human Error.
    - a) Incorrect tag line procedure.
    - b) Tag line hang-up.
    - c) Incorrect or misunderstood crane signals.
    - d) Misjudged elevation of member.
    - e) Misjudged speed of member.
4. Anchorages or special attachment points could be cast into the precast concrete members if sufficient preplanning and consideration of erectors' position is done before the members are cast. Any hole or other attachment must be approved by the engineer who designed the member. It is possible that some design restrictions will not allow a member to be weakened by an additional hole; however, it is anticipated that such situations would be the exception, not the rule. Attachment points will require removal and/or patching. In order to remove and/or patch these points, requires the employee to be exposed to an additional fall hazard at an unprotected perimeter. The fact that attachment points could be available anywhere on the structure does not eliminate the hazards of using these points for tying off as discussed above.
5. Providing attachment at a point above the walking/working surface would also create fall exposures for employees installing their devices. Final positioning of a precast member requires it to be moved in such a way that it could pass through the area that would be occupied by the lifeline and the lanyards attached to the point above. Resulting entanglements of lifelines and lanyards on a moving member could pull employees from the work surface. Also, the structure is being created and, in most cases, there is no structure above the sections being placed.
- a. Temporary structural supports, installed to provide attaching points for lifelines limit the space which is essential for orderly positioning, alignment and placement of the precast section. To keep the lanyards a reasonable and manageable length, lifeline supports would necessarily need to be in proximity to the positioning process. A sudden shift of the precast section being positioned because of wind pressure or crane movement could make it strike the temporary supporting structure, moving it suddenly and causing tied off employees to fall.
  - b. The time in manhours which would be expended in placing and maintaining temporary structural supports for lifeline attaching points could exceed the expended manhours involved in placing the precast sections. No protection could be provided for the employees erecting the temporary structural supports and these supports would have to be moved for each successive step in the construction process, thus greatly increasing the employee's exposure to the fall hazard.
6. The ANSI A10.14-1991 American National Standard for Construction and Demolition Operations - Requirements for Safety Belts, Harnesses, Lanyards and Lifelines for Construction and Demolition Use, states that the anchor point of a lanyard or deceleration device should, if possible, be located

above the wearer's harness attachment. ANSI A10.14 also states that a suitable anchorage point is one which is located as high as possible to prevent contact with an obstruction below should the worker fall. Most manufacturers also warn in the user's handbook that the safety block/retractable lifeline must be positioned above the D-ring (above the workspace of the intended user) and OSHA recommends that fall arrest and restraint equipment be used in accordance with the manufacturer's instructions.

Attachment of a retractable device to a horizontal cable near floor level or using the inserts in the floor or roof members may result in increased free fall due to the dorsal D-ring of the full-body harness 6-foot-taller than the attachment point of the snaphook to the cable or insert (e.g., 6-foot tall worker with a dorsal D-ring at 5 feet above the floor or surface, reduces the working length to only one foot, by placing the anchorage five feet away from the fall hazard). In addition, impact loads may exceed maximum fall arrest forces (MAF) because the fall arrest D-ring would be 4 to 5 feet higher than the safety block/retractable lifeline anchored to the walking-working surface; and the potential for swing hazards is increased. Manufacturers also require that workers not work at a level where the point of snaphook attachment to the body harness is above the device because this will increase the free fall distance and the deceleration distance and will cause higher forces on the body in the event of an accidental fall.

Manufacturers recommend an anchorage for the retractable lifeline which is immovably fixed in a space and is independent of the user's support systems. A moveable anchorage is one which can be moved around (such as equipment or wheeled vehicles) or which can deflect substantially under shock loading (such as a horizontal cable or very flexible beam). In the case of a very flexible anchorage, a shock load applied to the anchorage during fall arrest can cause oscillation of the flexible anchorage such that the retractable brake mechanism may undergo one or more cycles of locking/unlocking/locking (ratchet effect) until the anchorage deflection is dampened. Therefore, use of a moveable anchorage involves critical engineering and safety factors and should only be considered after fixed anchorage has been determined to be not feasible.

Horizontal cables used as an anchorage present an additional hazard due to amplification of the horizontal component of maximum arrest force of a fall transmitted to the points where the horizontal cable is attached to the structure. This amplification is due to the angle of sag of a horizontal cable and is most severe for small angles of sag. For a cable sag angle of 2 degrees the horizontal force on the points of cable attachment can be amplified by a factor of 15.

It is also necessary to install the retractable device vertically overhead to minimize swing falls. If an object is in the worker's swing path (or that of the cable) hazardous situations exist:

- a) due to the swing, horizontal speed of the user may be high enough to cause injury when an obstacle in the swing fall path is struck by either the user or the cable
- b) the total vertical fall distance of the user may be much greater than if the user had fallen only vertically without a swing fall path.

With retractable lines, overconfidence may cause the worker to engage in inappropriate behavior, such as approaching the perimeter of the deck at a distance appreciable greater than the shortest distance between the anchorage point and the leading edge. Though the retractable lifeline may arrest a worker's fall before he or she has fallen a few feet, the lifeline may drag along the edge of the deck and swing the worker like a pendulum until the line has moved to a position where the distance between the anchorage point and deck edge is the shortest distance between those two

points. Accompanying this pendulum swing is a lowering of the worker, with the attendant danger that he or she may violently impact the deck or some obstruction below.

The risk of a cable breaking is increased if a lifeline is dragged sideways across the rough surface or edge of a concrete member at the same moment that the lifeline is being subjected to a maximum impact loading during a fall. The typical 3/16 in. cable in a retractable lifeline has a breaking strength of from 3000 to 3700 lbs.

7. The competent person, who can take into account the specialized operations being performed on this project, should determine when and where a designated erector cannot use a PFAS.

## Safety Net Systems

The nature of this box culvert project precludes the safe use of safety nets due to the completed deck structure is typically only 16 feet or less above the ground below.

1. The use of safety nets does not allow sufficient clearance underneath the nets to prevent contact with the ground when subjected to an impact force equal to the drop test specifications.
2. After each section of the member is position and secured, the net would have to be moved to a new location to protect workers placing the next piece in the construction sequence. The result would be the installation and dismantling of safety nets repeatedly throughout the normal work day. As the time necessary to install a net, test, and remove it is significantly greater than the time necessary to position and secure a precast member, the exposure time for the worker installing the safety net would be far longer than for the workers whom the net is intended to protect.
3. The use of safety nets on the perimeter of the installed deck causes attachment points to be left in the concrete which must be patched and filled with matching material after the net supporting hardware is removed. In order to patch these openings, additional numbers of employees will be exposed far longer than for the workers whom the net is intended to protect.
4. The use of safety nets at the leading edge will increase the probability that the member being lifted could become entangled in the net hardware. In addition, a safety net in this location would get in the way of the member being positioned.

## Guardrail Systems

On this particular precast project, guardrails, barricades, ropes, cables or other perimeter guarding devices or methods on the erection floor will pose problems to safe erection procedures. Typically, a box culvert is erected by placing structural members next to one another, connecting each member to the other, and then grouting. The perimeter of the erection deck changes each time a new member is placed into position. After the box culvert is completed, the entire culvert is wrapped on the sides and top with a 4 ft wide membrane. It is unreasonable and virtually impossible to erect guardrails and toe boards at the ever-changing leading edge of the deck and sides of the deck due to the erection procedures.

1. Attachment points for the guardrail system would require workers to drill holes along the perimeter of the deck to install and dismantle the guardrail system, thus exposing the workers far longer to a potential fall hazard than for the workers whom the guardrail is intended to protect. During precast culvert work, only designated erectors and the safety monitor are allowed on the work deck during the entire erection procedure.
2. There is no permanent boundary until all structural members have been placed. At the leading edge, designated erectors are working at the temporary edge of the structure as they work to position the next member in the sequence. Compliance with the standard would require a guardrail and toe board to

be installed along this edge. However, the presence of such a device would prevent a new member from being swung over the erected surface low enough to allow workers to control it safely during the positioning process. Further, these employees would have to work through the guardrail to align the new member and connect it to the structure. The guardrail would not protect an employee who must lean through it to do the necessary work, rather it would hinder the employee to such a degree that a greater hazard is created than if the guardrail were absent.

3. Guardrail requirements pose a hazard at the leading edge of installed floor or roof sections by creating the possibility of employees being caught between guardrails and suspended loads. The lack of a clear work area in which to guide the suspended load into position for placement and connecting of members into the existing structure creates still further hazards.

## Other Fall Protection Measures Considered for this Job.

The following is a list and explanation of other fall protection measures available and an explanation of limitations for use on this particular jobsite. If during the course of erecting the culvert the employee sees an area that could be erected more safely by the use of these fall protection measures, the superintendent should be notified.

1. Scaffolds are not used because:
  - a. The leading edge of the structure is constantly changing, and the scaffolding would have to be moved at very frequent intervals. Employees erecting and dismantling the scaffolding would be exposed to fall hazards for a greater length of time than they would be merely erecting the precast member.
  - b. A scaffold could interfere with the safe swinging of a load.
  - c. Power lines, terrain and site do not allow for the safe use of scaffolding.
2. Vehicle mounted platforms are not used because:
  - a. A vehicle mounted platform cannot be used due to site conditions and terrain.
  - b. A vehicle mounted platform could interfere with the safe swinging of a load.
3. Crane suspended personnel platforms are not used because:
  - a. A second crane close enough to suspend any employee in the working and erecting area could interfere with the safe swinging of a load by the crane hoisting the member to be erected.
  - b. Power lines and surrounding site work do not allow for the safe use of a second crane on the job.

## Weather Conditions

The weather conditions listed below will be considered when erecting the box culvert. Work operations will be suspended if warranted.

1. Wind (strong wind/sudden gusting).
2. Snow/rain (visibility).
3. Fog (visibility).
4. Cold - causing slowed reactions or mechanical problems.

## Enforcement

Constant awareness of and respect for fall hazards, and compliance with all safety rules are considered conditions of employment. The superintendent or Safety Director reserve the right to issue disciplinary warnings to employees, up to and including termination, for failure to follow the guidelines of this program.

# Accident Investigations

All accidents that result in injury to workers, regardless of their nature, shall be investigated and reported. It is an integral part of any safety program that documentation take place as soon as possible so that the cause and means of prevention can be identified to prevent a reoccurrence.

In the event that an employee falls or there is some other related, serious incident occurring, this plan shall be reviewed to determine if additional practices, procedures, or training need to be implemented to prevent similar types of falls or incidents from occurring.

# Changes to Plan

Any changes to the plan will be approved by **Enter Qualified Person's Name**. This plan shall be reviewed by a qualified person as the job progresses to determine if additional practices, procedures or training needs to be implemented by the competent person to improve or provide additional fall protection. Workers shall be notified and trained, if necessary, in the new procedures. A copy of this plan and all approved changes shall be maintained at the jobsite.

*This fall protection plan was designed to assist employers with complying with MIOSHA Construction Safety Standard Part 45 – Fall Protection. MITA nor its officers, employees, directors, contracting parties, members or publisher may be held responsible in any manner for any damage or loss, or any action whatsoever, resulting from inaccuracies or omissions in this fall protection plan.*

# Safety Net Specifications

1. Only safety nets and installation components that are rated and designed as a fall protection system may be used.
2. Install safety nets as close as possible underneath the walking/working surface where employees are working, but never more than 30' below.
3. Safety nets must extend outward from the outermost projection of the walking/working surface as follows:

Vertical distance from working level to horizontal plane of net	Minimum horizontal distance of outer edge of net from the edge of the working surface
Up to 5'	8'
More than 5' up to 8'	10'
More than 10'	13'

4. Install safety nets with sufficient clearance underneath them to prevent contact with the surface or structures below when performing drop tests.
5. Safety nets must have a drop test which is done by dropping a 400-pound bag of sand into the net from the highest point. Drop tests must be completed as follows:
  - a. After the initial installation and before being used.
  - b. Whenever the safety nets and components have been relocated.
  - c. After major repair.
  - d. At six-month intervals if left in one place.

If a drop test cannot be done, a competent person must certify (in writing) that the safety net and components meet the strength and clearance requirements. The certification record must be kept at the jobsite and include the location of the safety net and components, the date, and the signature of the person making the determination.

6. Remove any materials, scrap pieces, equipment and tools that have fallen into a safety net as soon as possible, but at least before the next work shift.
7. Inspect safety nets and components at least once a week for wear, damage, and other deterioration. Remove defective nets and components from service.

# Floor Openings and Holes

1. Covers must be installed over floor openings and holes (2" or greater) that are 6' or more above lower levels. Larger holes can be protected by a guardrail.
2. Covers must support at least twice the maximum anticipated load of the weight of the vehicle, employees, equipment, and materials that may be imposed at any one time.
3. Make sure covers are sufficiently secured to prevent displacement from wind, equipment, and employees.
4. Identify covers with a high visible paint or marked with COVER or HOLE to warn workers of the hazard.
5. If a cover is removed to complete a task, make sure to re- install the cover immediately afterwards. Never leave the hole or opening unprotected.

# Falling Object Protection

1. Always wear a hard hat when walking or working underneath areas where workers are working or otherwise exposed to falling objects.
2. If necessary, install toe boards, screens/panels, guardrails or canopies to prevent debris, material and tools from falling from the edges of overhead surfaces.

## WORKZONE SAFETY

Employees must wear the appropriate high-visibility safety apparel as prescribed below when working on a roadway or adjacent to vehicular traffic:

<b>Class 1:</b>	High-visibility shirt or safety vest. <b>(Daylight hours with good visibility.)</b>
<b>Class 2:</b>	High-visibility and 360-degree reflective safety vest or jacket with contrasting colors. <b>(Daylight hours with good visibility.)</b> Class 2 is the minimum MDOT requirement for working within the right-of-way on highways.
<b>Class 3:</b>	Apparel having more high-visibility background and 360-degree retro-reflective material.

Safety apparel includes safety vests or jackets, and hard hats. **(Nighttime work and during low visibility conditions in daylight hours.)**

Always face oncoming traffic or use a spotter when working on a roadway or adjacent to vehicular traffic.

## TRAFFIC CONTROL DEVICES

1. Placing, removing, and maintaining traffic control devices shall be as prescribed in *Part 6 of the Michigan Manual of Traffic Control Devices*. MDOT may also develop specific traffic control plans for certain projects. Always check with your superintendent or the designated qualified person to find out which traffic control plan and traffic control devices are being used for the project.
2. All traffic control devices are to be placed under the direction of the Qualified Employee. While flagging or directing vehicular traffic, a reflectorized, fluorescent orange warning vest, and hard hat shall be worn at all times. Flag people are to always be courteous.
3. A six-foot staff two-sided paddle sign with "STOP" on one side and "SLOW" on the other shall be used to control traffic.
4. Traffic control devices shall be installed and maintained as prescribed by Part 6 of the Michigan Manual of Uniform Traffic Control Devices.
5. When working in or adjacent to vehicular traffic always face the flow of traffic or use of a spotter.
6. Replace traffic control devices that have been damaged or downed signs as soon as possible.
7. Cover construction traffic control when work is not in progress if possible.
8. Consult the qualified person with traffic regulation questions.
9. Traffic regulator stations shall be illuminated with a minimum intensity of 10 foot-candles during nighttime hours.

# Rules of Conduct for Traffic Regulators

1. **Always pay attention to your surroundings!** Don't mingle with the work crew, traveling public or other people.
2. Be alert to the traffic conditions and never turn your back to approaching vehicles.
3. Recognize dangerous traffic situations and warn workers and other regulators in sufficient time to avoid injury.
4. Plan a safe escape route to avoid being struck by an errant vehicle. Move quickly to avoid danger from errant vehicles.
5. Do **not** abandon your traffic regulator station until a replacement traffic regulator arrives and is ready to assume traffic regulating duties.
6. Do **not** sit in a parked vehicle when directing traffic or have another person sitting in the parked vehicle.
7. Do **not** use cell phones to direct traffic unless instructed by your superintendent.

## UTILITY LOCATING-BEST PRACTICES

### Prior to Excavating

The MISS DIG System must be contacted at **800-482-7171** at least 72 hours in advance of construction, but not more than 14 calendar days. Retain your ticket number and be specific about the limits concerning the proposed area of excavation.

### Positive Response

All participating utility owners are required to notify MISS DIG via an automated response system. This useful tool will allow you to determine if all of the utilities in your proposed area of excavation have been located. If a utility owner has no facilities in the area, this information will also be part of the positive response.

This information is administered by MISS DIG and available through the web at **[www.missdig.org](http://www.missdig.org)** or the automated phone system at **800-763-3888**.

### No Marks

If the excavator, having commenced excavation within the 14-calendar day period on or after the dig start date and time as set forth in the Dig Notice, has cause to be concerned about the presence of an unmarked facility(s) because:

1. There is visible evidence of a facility(s),
2. A notified Underground Facility Owner failed to provide a positive response, or
3. There exists a positive response indicating a location was marked, but the marks are missing, then the excavator shall give notice to the potential unmarked Underground Facility Owners(s) by contacting MISS DIG. Upon notification of this situation to MISS DIG, the Underground Facility Owner shall respond within three (3) hours, unless a later time period for response is agreed upon by the excavator and the Underground Facility Owner.

### Additional Assistance

If the precise location of a marked facility cannot be determined and assistance is requested during normal working hours (7 a.m. to 5 p.m.) on a business day, the system facility owner has 3 hours to respond to the request or meet at a mutually agreed time.

**Requests for additional assistance must be made through MISS DIG: 800- 482-7171.**

## Excavating

Excavating must commence within **14 days** of the dig start date on the MISS DIG ticket. If excavating has not occurred within this time frame, a new ticket number must be obtained prior to excavating.

## Safe Zone

Your intended area of excavation has been divided into two areas with regard to excavating. The first area is as follows:

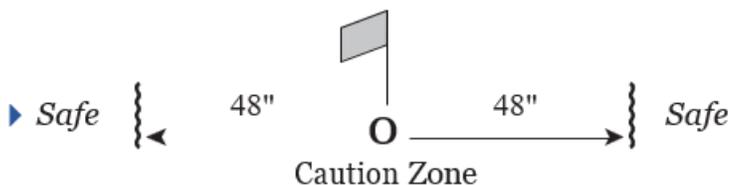
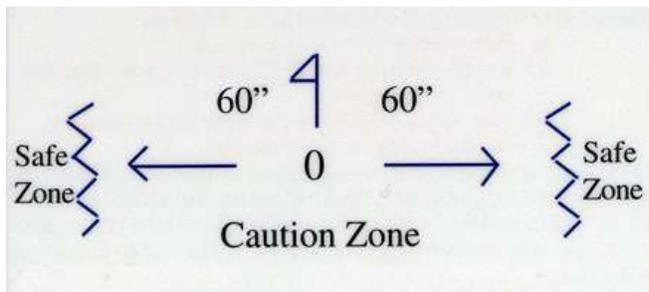
Safe zone - Relates to the area at least 48" or farther away from either side of the mark(s) provided by the utility owner. No hand digging or facility verification is required when excavating in the safe zone. Be sure to remain diligent regarding evidence of unmarked facilities.

## Caution Zone

Your intended area of excavation has been divided into two areas with regard to excavating. The first area was discussed above. The second area is as follows:

Caution Zone - Means the area within 48" of either side of the mark(s) provided by the utility owner. If excavating must occur within the caution zone, all facilities must be located prior to excavating by hand digging or other means of soft excavation. Excavations that run parallel to a facility in a caution zone require hand dug test holes at intervals as often as reasonably necessary to establish the precise location of the underground facility. You may commence excavation with powered equipment once you have established the location of the facility

## Diagram of Safe Zone and Caution Zone



## Marks

Paint, stakes, and/or flags may be utilized to mark underground facilities. Often times, a combination of all three are used to identify facilities. Color-coding is used to differentiate the various marks of facilities to be encountered. The following should help determine the type of facility being dealt with.

**Yellow** - indicates either natural gas, oil, steam, petroleum, or other gases

**Orange** - indicates phone and cable

**Red** - indicates electric

**Blue** - indicates water

**Green** - indicates storm drains

**Brown** - indicates sewer

## **EXCAVATIONS**

Protecting Underground Utilities.

1. **Do not** begin excavating until MISS DIG has been called and all the requirements in ***Utility Locating – P.A. 174*** have been complied with.
2. Adequately support all utilities (i.e. gas lines, piping, structures) that have been exposed or disturbed by work operations.
3. If a utility is accidentally struck or damaged during excavation work, inform the superintendent immediately. All employees must evacuate the excavation if the damaged utility could present a dangerous situation (i.e. gas explosion, asphyxiation, electrocution). Report any utility damages to the facility owner.

### **Inspections**

1. **Do not enter an excavation or trench unless instructed by your superintendent!** Your superintendent or other designated qualified person must inspect each excavation or trench before employees can enter and on an ongoing basis for evidence of instability (i. e . cracks, slides, cave-ins, water, flaking) due to rainstorms or other potential hazards.
2. If hazardous conditions are found, work shall stop, and employees shall immediately exit the excavation until protective measures (i. e . additional shoring or cutting the slope back) have been taken. **Inform your superintendent if you have safety concerns.**

### **General Excavation Requirements**

1. Cave-in protection (sloping, shoring, sheeting, trench boxes) must be installed before entering an excavation more than 5' deep.
2. Keep spoil piles, rocks, debris, and material at least 2' back from the edge of the excavation.
3. Always wear a hard hat and stay within the protective system when working in an excavation or trench.
4. Never climb on shoring, trench shields, or sloped walls or ride on any bucket, lift, hook, chain, cable, sling, or other equipment parts.
5. Do not work in an excavation where water is accumulating unless precautions are taken, i . e . special shoring to protect against cave-ins or slides (i . e . trench box), pumps to control the water level, or use of safety harness and lifeline.
6. Do not work in an excavation with atmospheric hazards unless air quality testing has been conducted to determine the permissible exposure levels and proper protection (i . e . respirators and ventilation) are provided.

## Access and Egress

1. Use a ladder or a ramp to get into or out of an excavation that is greater than 4' in depth.
2. Position the ladder or ramp within 25' laterally of where employees are working.
3. Ladders must be stable and extend 3' above the top of the excavation.
4. Earth ramps must be stable and constructed at a maximum 45° angle. Position the ramp no more than 30' from the bottom of the excavation.
5. Manholes, pipes, and other similar structures are treated as confined spaces. Before employees can use these types of structures to travel through to access and egress an excavation, a qualified person must first perform an evaluation and test the atmospheres for oxygen content and combustible and toxic gasses to determine whether employees may be allowed to enter them. Refer to Confined Space Program section for additional information.

## Fall Protection for Excavations

1. **Don't leave open manholes unprotected!** Manholes must be covered or protected by a guardrail or barricading. If a temporary cover is used, it must be labeled, have sufficient strength, and secured down or composed of a material that will prevent it from being dislodged.
2. Stationary or long-term excavations that are 6' or more in depth (i.e. bore pits, wells, shafts) must be protected by guardrails, fences, barricades or covers.

## Energized Lines

1. Excavating equipment (i.e. excavators and backhoes) must maintain a minimum clearance distance from overhead energized lines as prescribed in **Tables A & B**.
2. Use a spotter if it is difficult for the operator to maintain clearances by visual means. Spotters must maintain visual contact with the operator and limit their work activity to only spotting.

TABLE A

MINIMUM CLEARANCE DISTANCES	
Voltage (kV)	Minimum clearance distance (feet)
up to 50	10
over 50 to 200	15
over 200 to 350	20
over 350 to 500	25
over 500 to 750	35
over 750 to 1,000	45
over 1,000	Check with utility owner or operator. or registered professional engineer

TABLE B

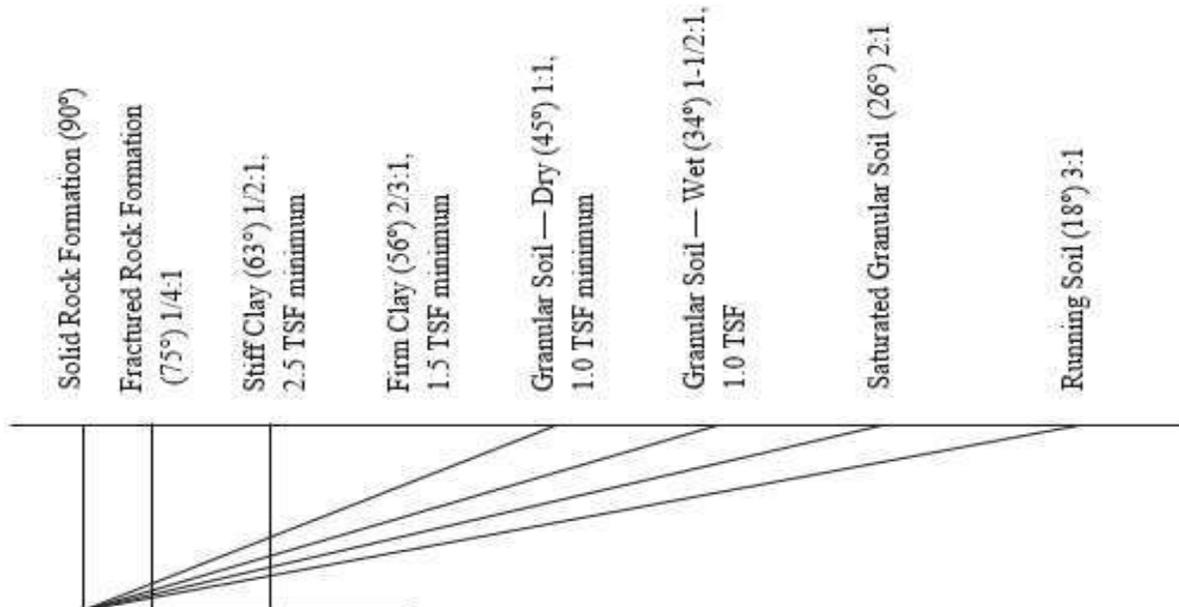
MINIMUM CLEARANCE DISTANCES WHILE TRAVELING WITH NO LOAD	
Voltage (kV)	Minimum clearance distance (feet) while traveling
up to 0.75	4
over .75 to 50	6
over 50 to 345	10
over 345 to 750	16
over 750 to 1,000	20
over 1,000	Check with utility owner or operator, or registered professional engineer

## Sloping Requirements

All trenches and excavations that are more than 5' deep must be cut back, sloped or benched to the proper angle of repose based on the type of soil and site conditions unless supported by sheeting or a shoring system. Use **Chart A** to determine the proper angle of repose.

### CHART A

MAXIMUM ANGLE OF REPOSE FOR THE SIDE OF AN EXCAVATION MORE THAN 5' DEEP.



The sides of the excavation must be flattened or cut back more than what is indicated in Chart A when the excavation is affected by water conditions, silty materials, loose boulders, erosion, frost, or slide plains.

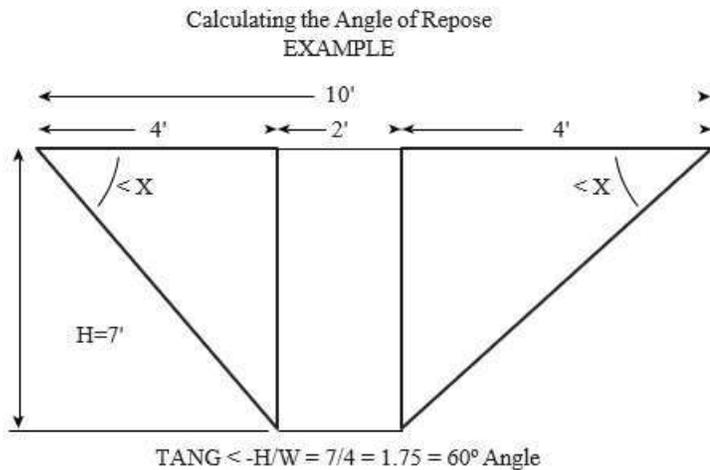
## Determining the Type of Soil using a Penetrometer.

1. Take several soil samples to determine the type and strength of the soil and to assist you in determining the proper angle of repose. Note: The penetrometer shows the strength of the soil in tons per square foot (TSF).
2. Take additional penetrometer readings if soil conditions change as the excavation gets deeper. Always make certain the employee performing the readings is protected.
3. Use the lowest penetrometer reading to determine the proper angle of repose. For example: If you took four penetrometer readings that varied between 1.5 – 2.5 TSF, the proper angle would be 56 degrees based on the 1.5 TSF reading.

## Calculating the Angle of Repose.

1. **Chart B** demonstrates how to measure and calculate the angle of repose to determine if the sides of an excavation have been cut back or sloped properly to satisfy the requirements of **Chart A**.

### Chart B



2. Using the example above, divide the height (7') over the width (4') as shown and the resulting number is the tangent (1.75).
3. Refer to **Chart C** to convert the tangent angle into the angle degree. The angle degree in the example above is 60°.

## CHART C

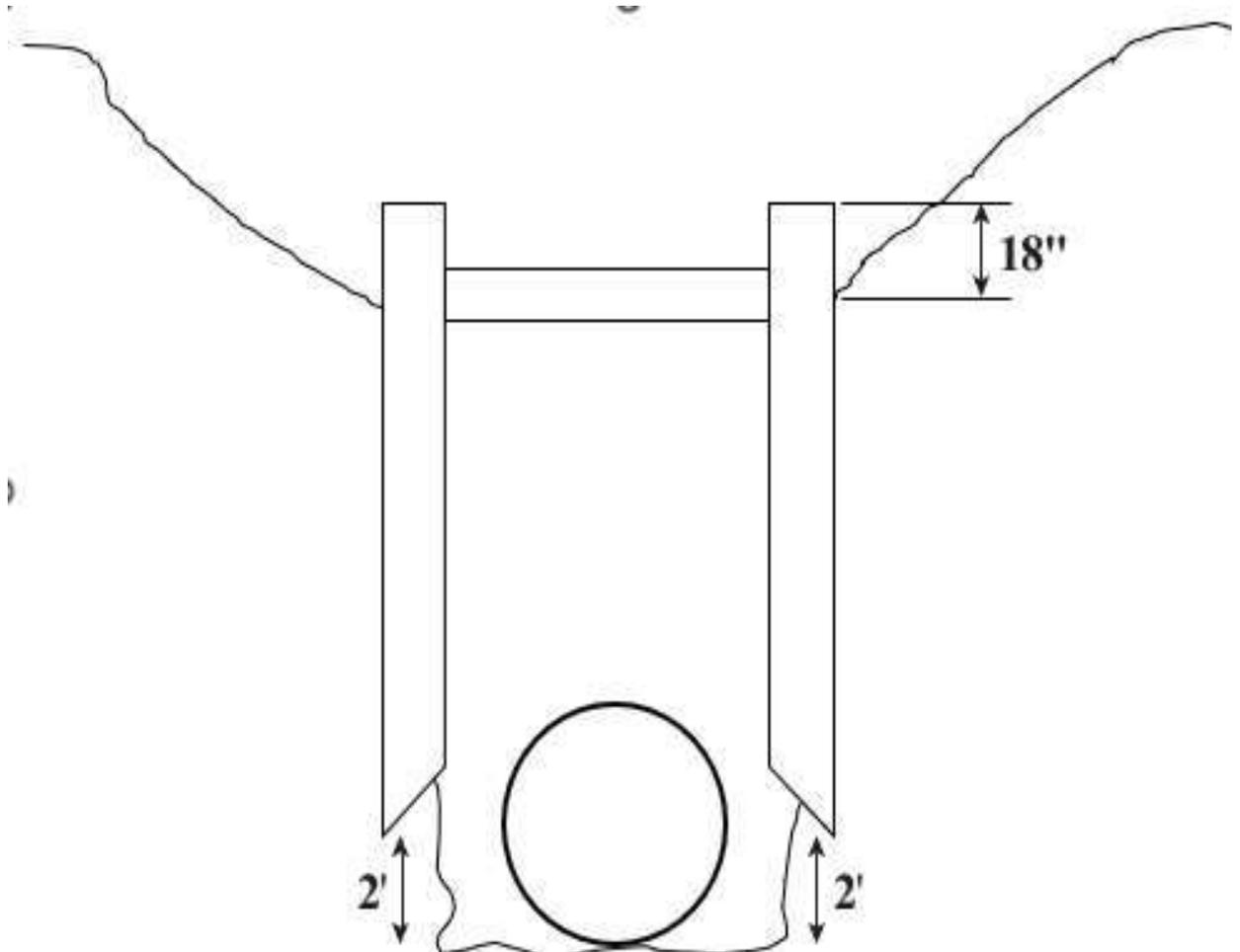
TANGENT ANGLE = $\frac{H}{W}$ = DEGREE OF ANGLE FROM THE HORIZONTAL					
TANGENT	DEGREE	TANGENT	DEGREE	TANGENT	DEGREE
0.000	0	0.577	30	1.732	60
0.017	1	0.601	31	1.804	61
0.035	2	0.625	32	1.881	62
0.052	3	0.649	33	1.963	63
0.070	4	0.675	34	2.050	64
0.087	5	0.700	35	2.145	65
0.105	6	0.727	36	2.246	66
0.123	7	0.754	37	2.356	67
0.141	8	0.781	38	2.475	68
0.158	9	0.810	39	2.605	69
0.176	10	0.839	40	2.748	70
0.194	11	0.869	41	2.904	71
0.213	12	0.900	42	3.078	72
0.231	13	0.933	43	3.271	73
0.249	14	0.966	44	3.487	74
0.268	15	1.000	45	3.732	75
0.287	16	1.036	46	4.011	76
0.306	17	1.072	47	4.332	77
0.325	18	1.111	48	4.705	78
0.344	19	1.150	49	5.145	79
0.364	20	1.192	50	5.671	80
0.384	21	1.235	51	6.314	81
0.404	22	1.280	52	7.115	82
0.424	23	1.327	53	8.144	83
0.445	24	1.376	54	9.514	84
0.466	25	1.428	55	11.43	85
0.488	26	1.483	56	14.30	86
0.510	27	1.540	57	19.08	87
0.532	28	1.600	58	28.64	88
0.554	29	1.664	59	57.29	89

### Benching Requirements.

1. Benching can only be used when the soil has the minimum strength to sustain a 5' vertical side (i.e. . stiff clay).
2. The vertical rise cannot be more than 5' and the step back must extend at least to the angle of repose as required in **Chart A**.
3. The height of the lower bench shall not be more than the lesser of 5' or the width of the trench measured at the bottom.

## Trench Boxes, Shoring, Shields and Sheeting.

1. Trench boxes, shoring, or sheeting are a safe and effective protective system and can be used in combination with sloping or benching. The qualified person will determine which type of protective system will be used. The trench box design (from the supplier or manufacturer) must be available on the job site.
2. Use a ladder or ramp to access the trench box.
3. Stay within the protective system (i.e. trench box, shoring, sloping, sheeting) when you are working in an excavation.
4. Exit the trench box prior to it being installed, moved, or removed.
5. The toe (bottom) of the trench box must not be more than 2' above the bottom of the trench unless suitable protection is provided below the bottom of the trench box.
6. The sides of the excavation must be kept at least 18" below the top of the trench box. Any soil above the trench box must be properly sloped. Refer to the following diagram.

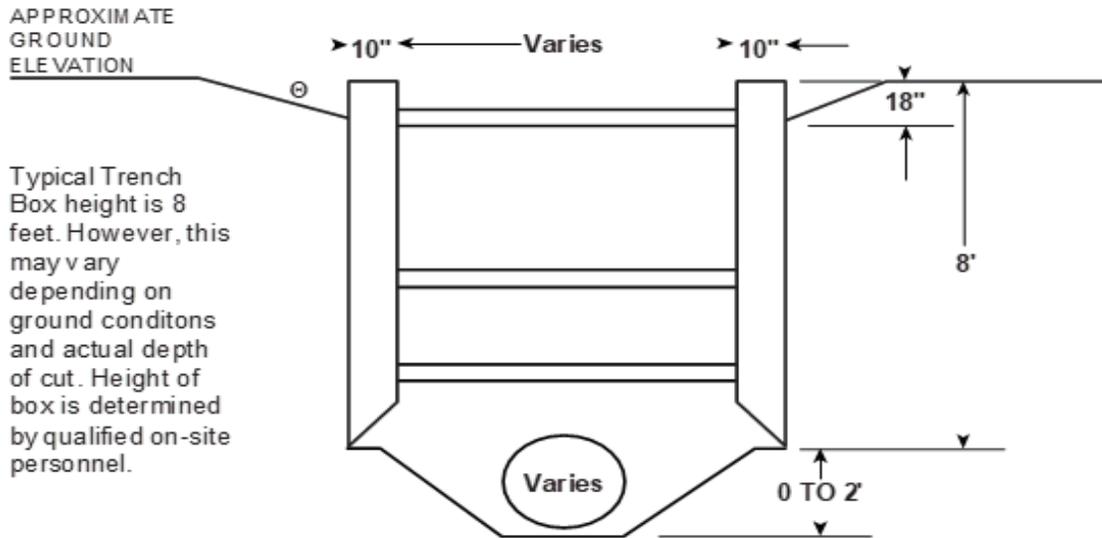


# SHORING DESIGNS

These shoring designs are intended to serve as a guide. They are not part of the MIOSHA Standards and are to be used only for reference purposes.

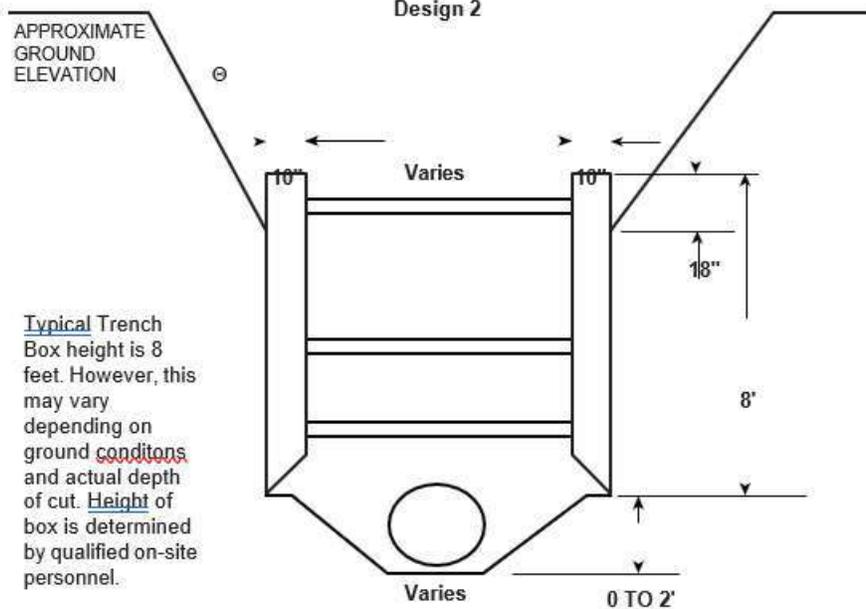
## SINGLE BOX

Design 1

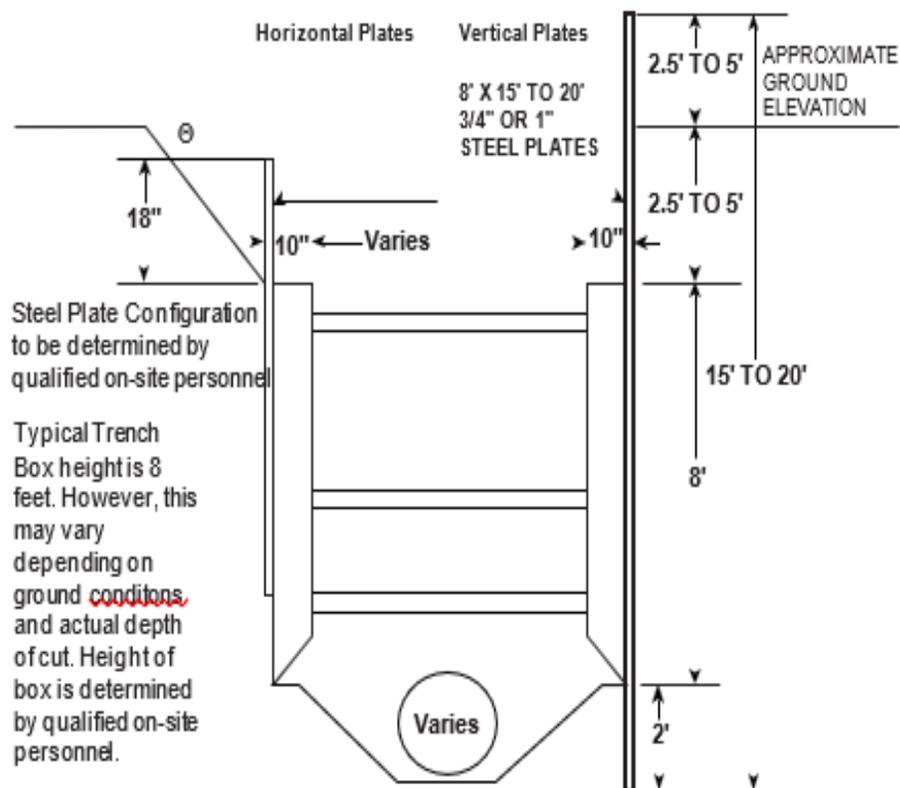


## SINGLE BOX — GROUND CUT TO PROPER ANGLE OF REPOSE ABOVE BOX

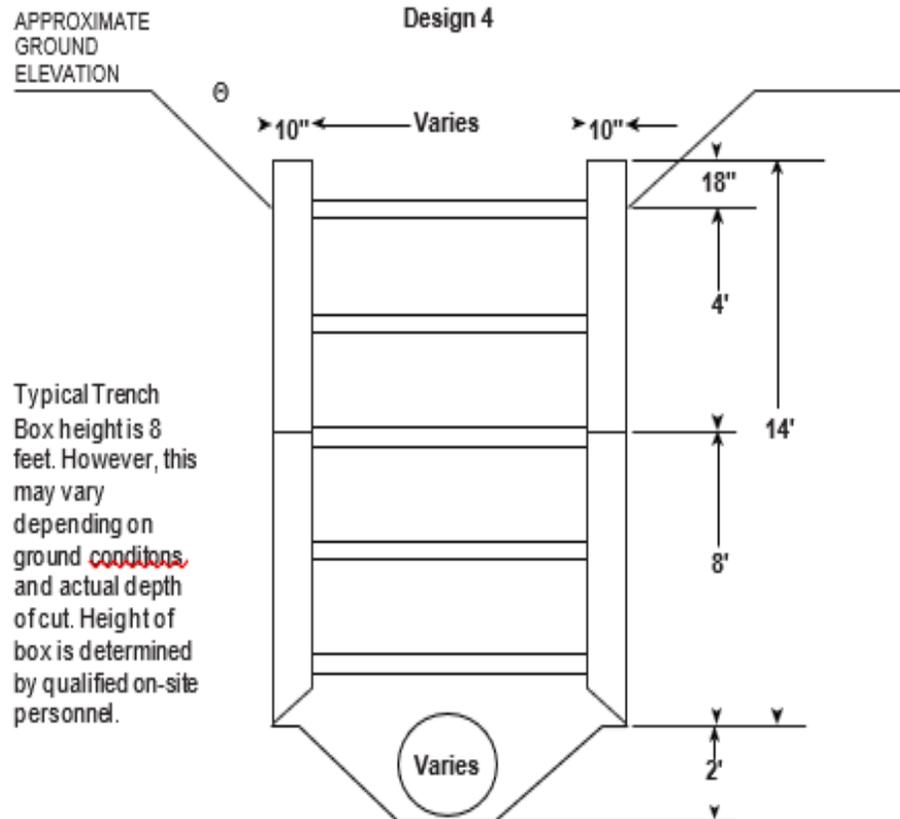
Design 2



**SINGLE BOX WITH PLATES**  
Design 3

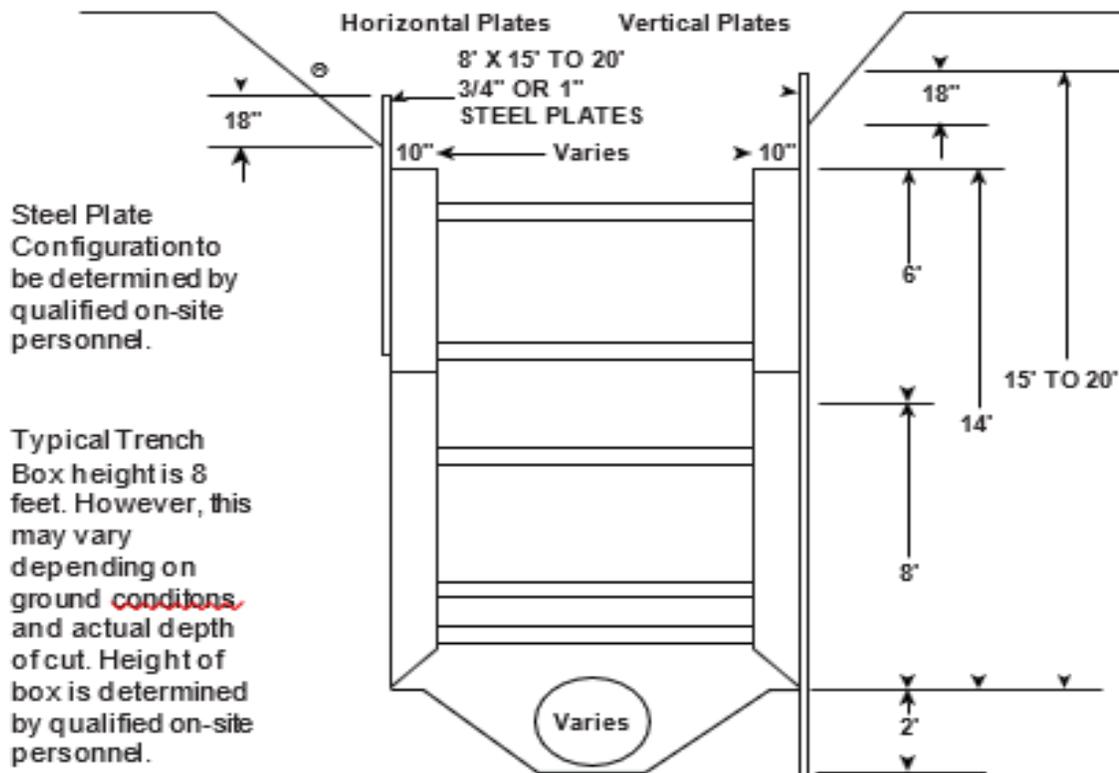


**STACKED BOXES**  
Design 4



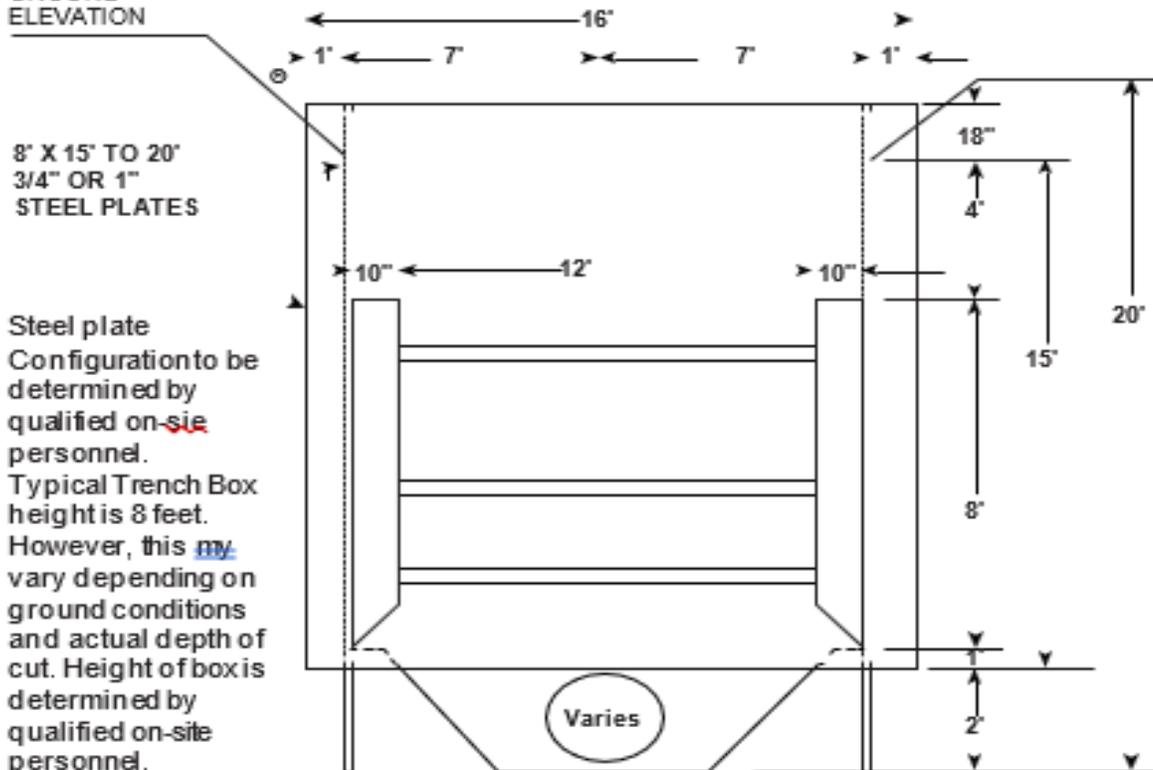
### STACKED BOXES Design 5

APPROXIMATE  
GROUND  
ELEVATION



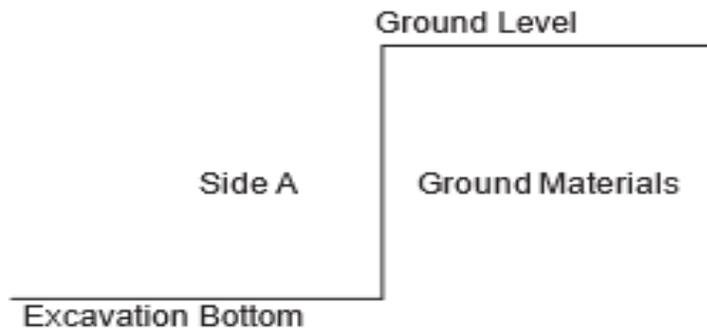
### SINGLE BOX AND PLATES Design 6

APPROXIMATE  
GROUND  
ELEVATION



# OPEN CUT EXAMPLES

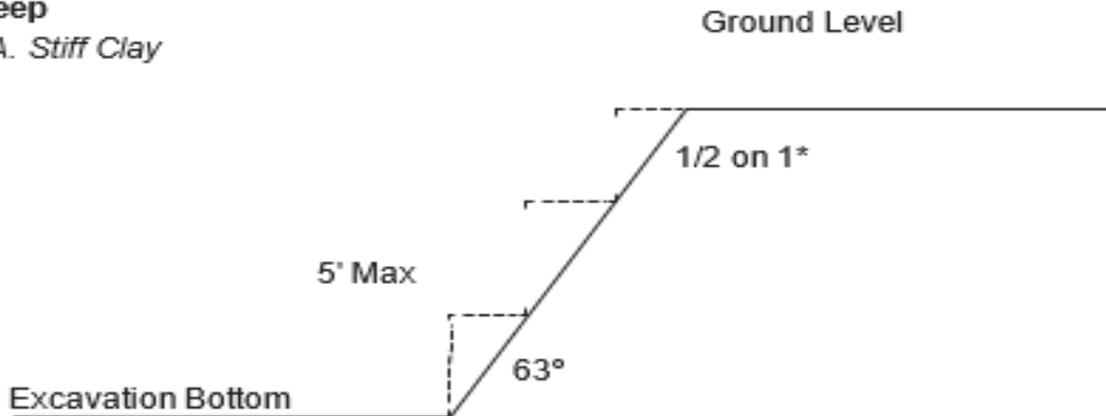
## EXAMPLE 1 0 – 5' Deep



Side A: If the ground shows indication of hazardous movement, Side A Shall be cut to the proper angle of repose or a supporting system shall be provided.

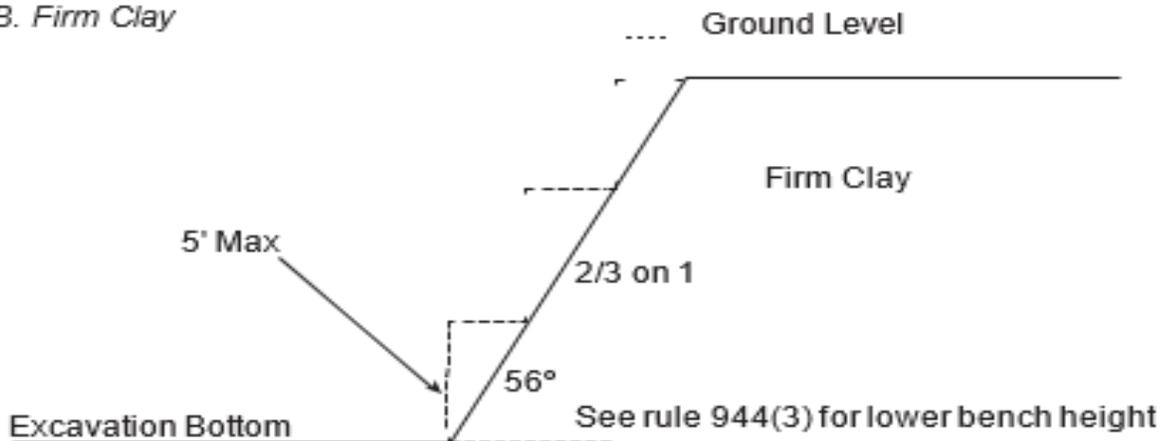
## EXAMPLE 2 More than 5' Deep

A. *Stiff Clay*



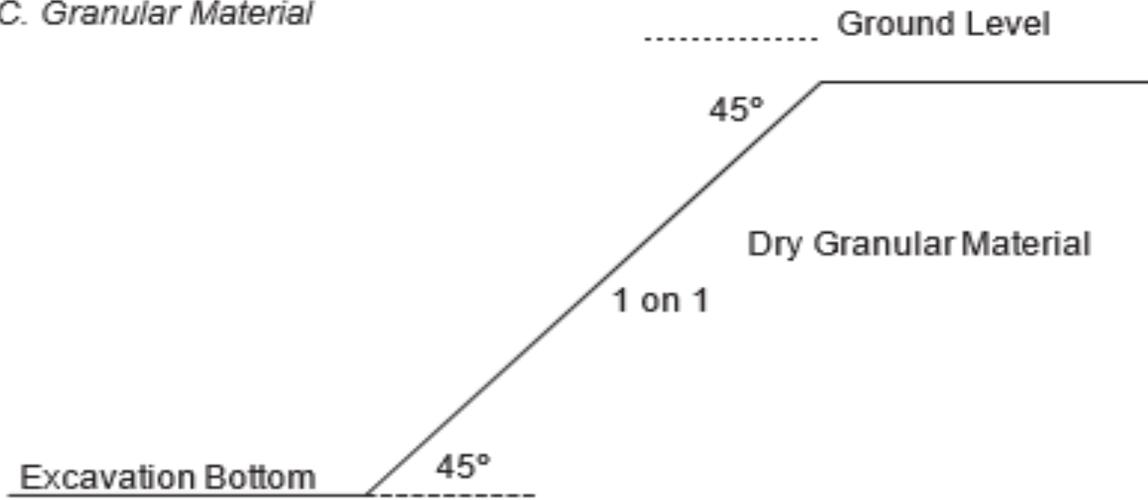
\*1/2 HORIZONTAL: 1 VERTICAL  
Penetrometer reading 2.5 TSF or greater required

B. *Firm Clay*

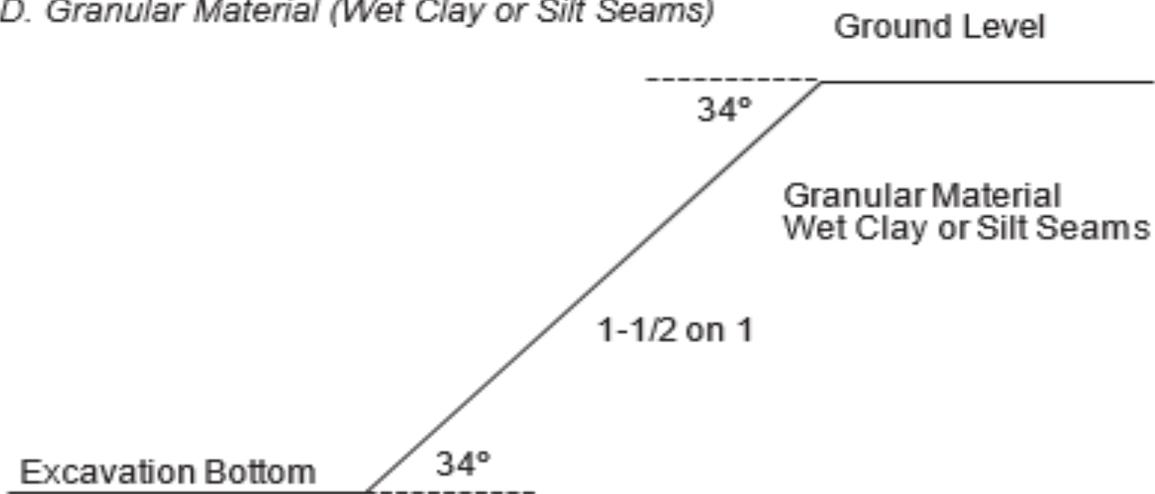


See rule 944(3) for lower bench height  
Penetrometer reading 1.5 TSF or greater required

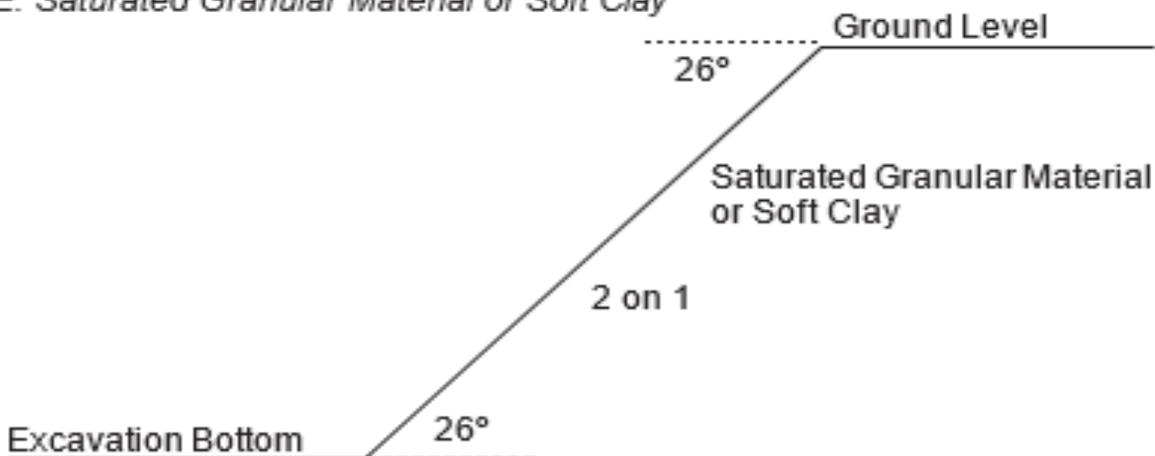
C. Granular Material



D. Granular Material (Wet Clay or Silt Seams)

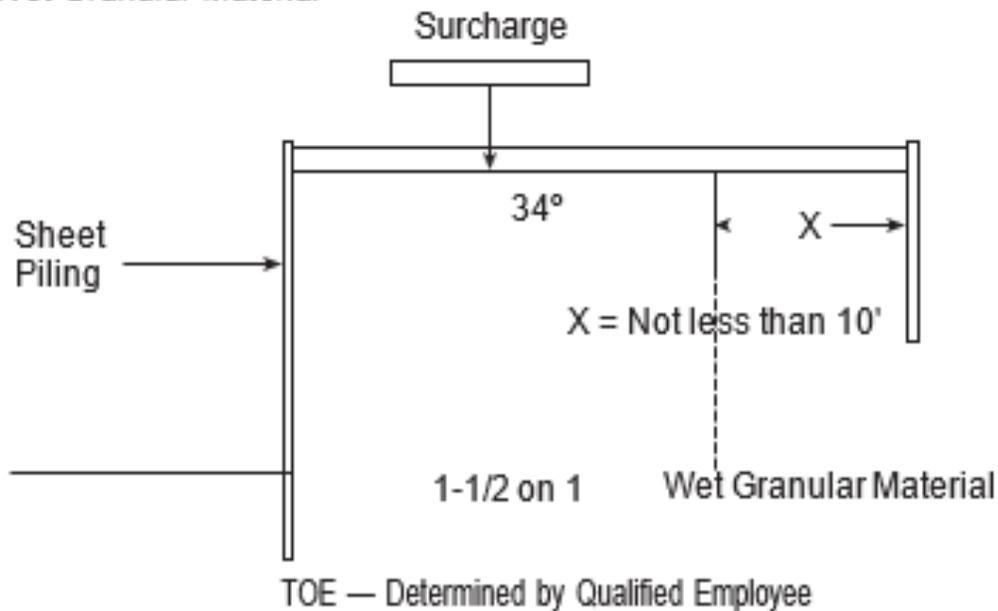


E. Saturated Granular Material or Soft Clay

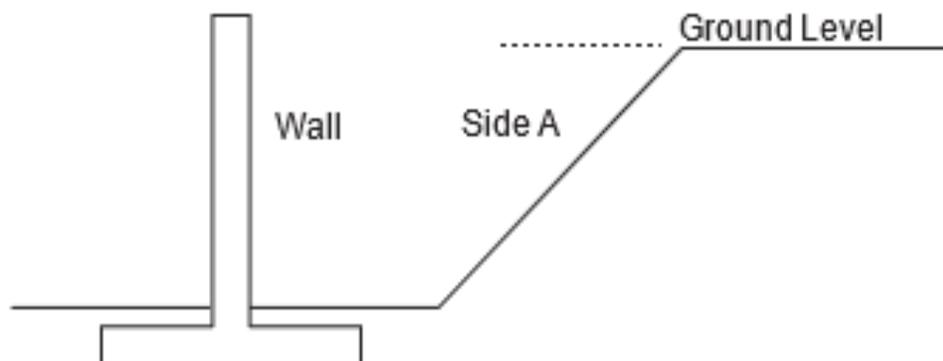


### EXAMPLE 3 Supporting System — Sheet Piling

*Wet Granular Material*



### EXAMPLE 4 Wall in Place

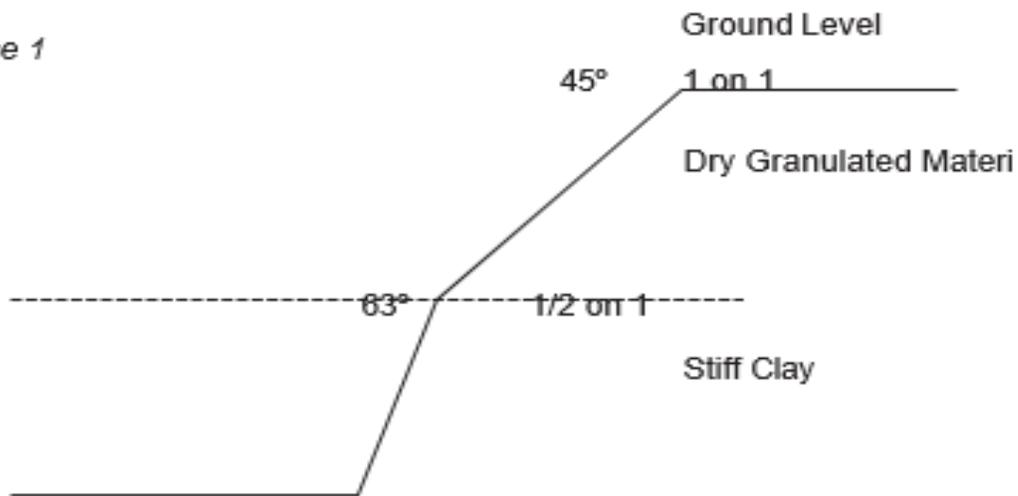


Side A: Side A should be cut to the angle of repose or a supporting system provided.

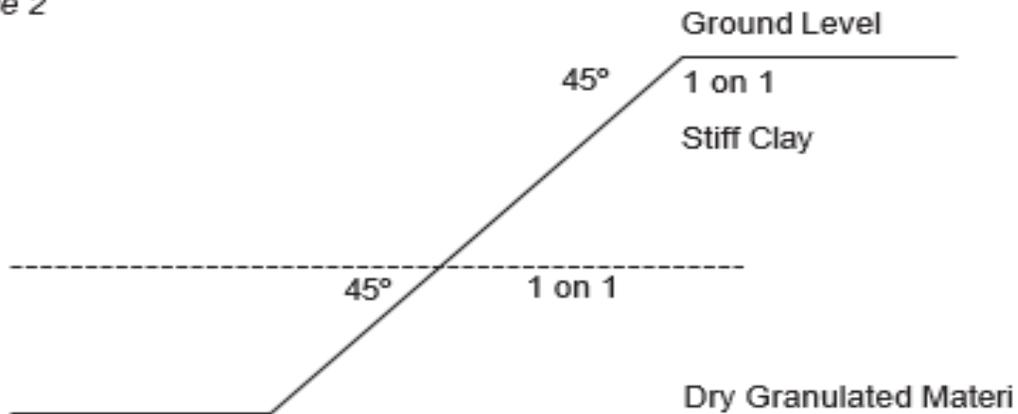
If support system is designed for Side A, no braces or members should bear against the wall unless the wall is designed to withstand bracing loads.

**EXAMPLE 5 Different Textured Soils**

Case 1



Case 2

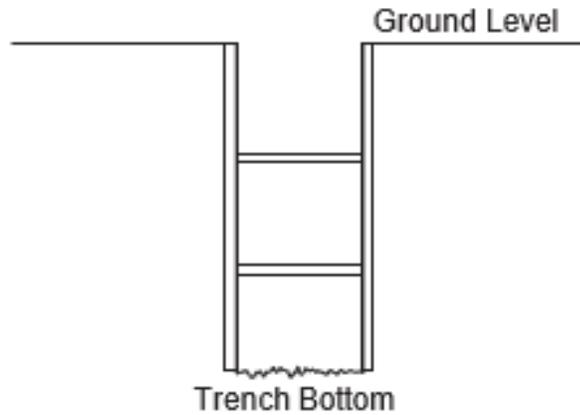


**EXAMPLE 6 0 – 5' Deep Trenches**



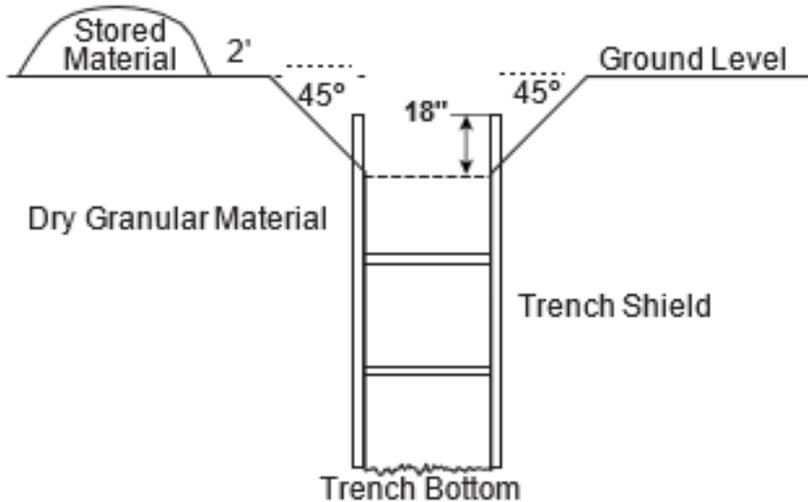
Side A & B: If examination of the ground indicates hazardous ground, movement may be expected. Sides A & B shall be sloped to the proper angle of repose.

### EXAMPLE 7 Trench Shoring System



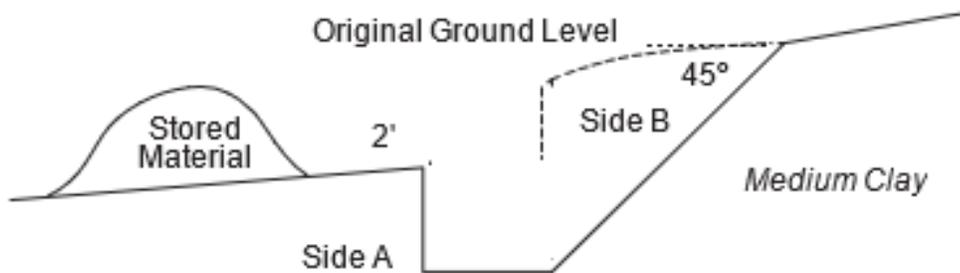
A trench support system shall be designed by a qualified employee knowledgeable in the field. The arrangement of stringers, struts, and braces should be as designed by the plans.

### EXAMPLE 8 0–5' Trench Support System Not Extending to Ground Level



### EXAMPLE 9 0–5' Trench Cut in Sloping Ground

*Medium Clay*

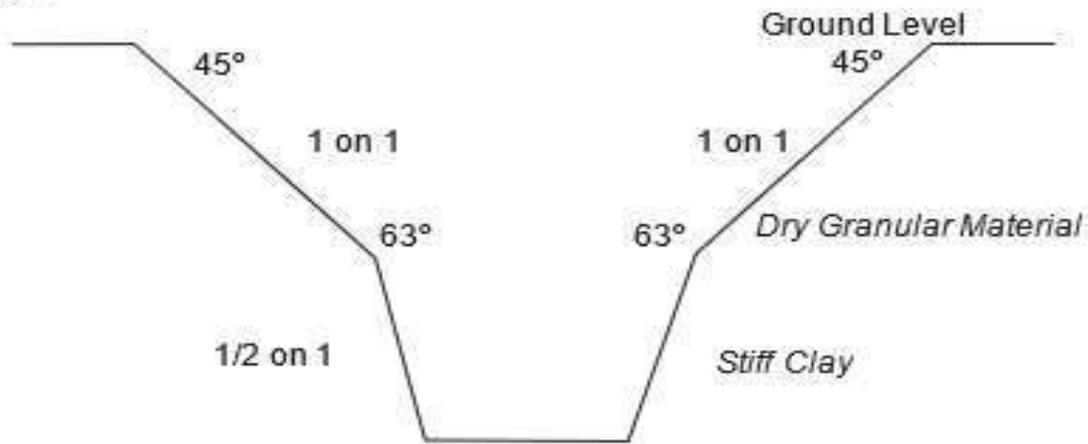


If Side A is 5' or less and Side B is more than 5':

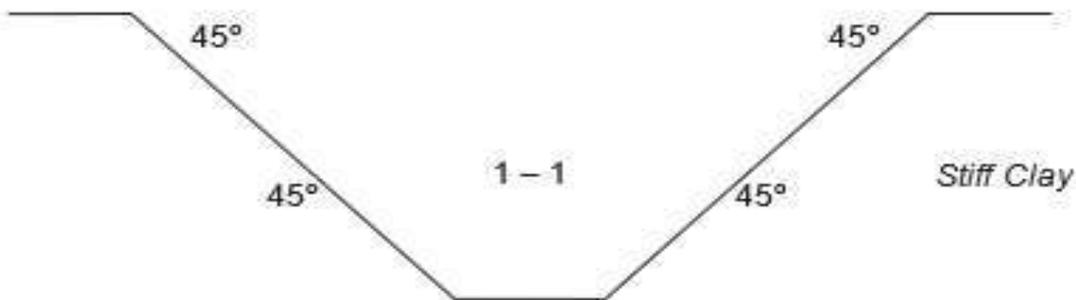
- (1) Side A should be sloped as provided for in Example 6.
- (2) Side B should be cut to the correct angle of repose.
- (3) All excavated material should be stored on the low side of the trench, if possible.

### EXAMPLE 10 Trench Cut in Different Textured Materials

Case 1

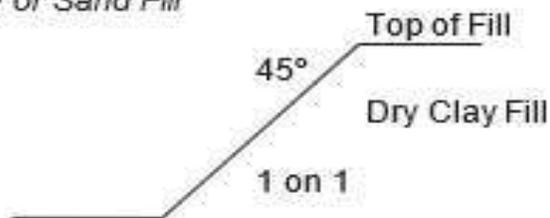


Case 2

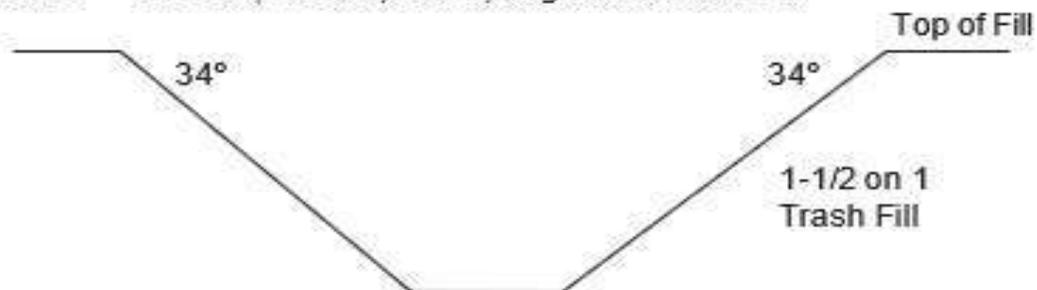


### EXAMPLE 11 Fill Areas

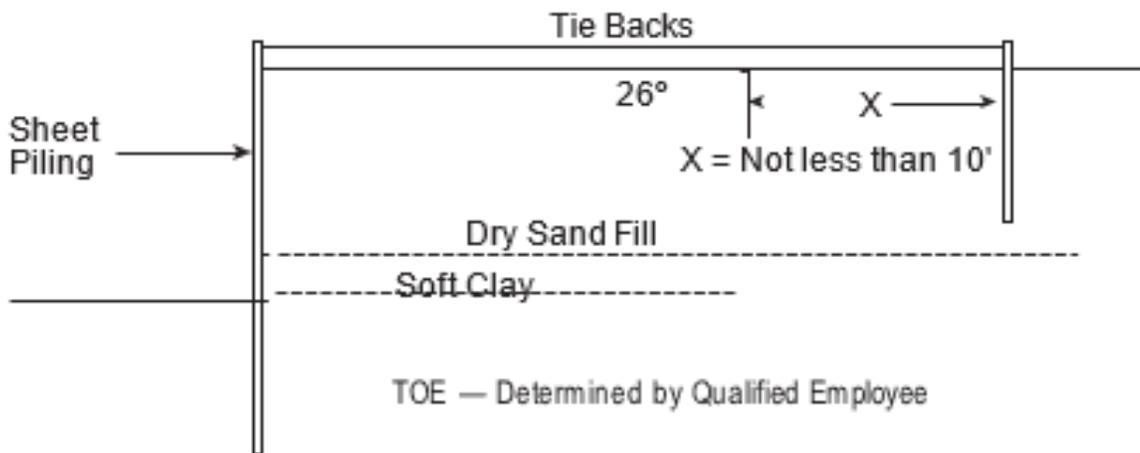
Case 1 *Dry Clay or Sand Fill*



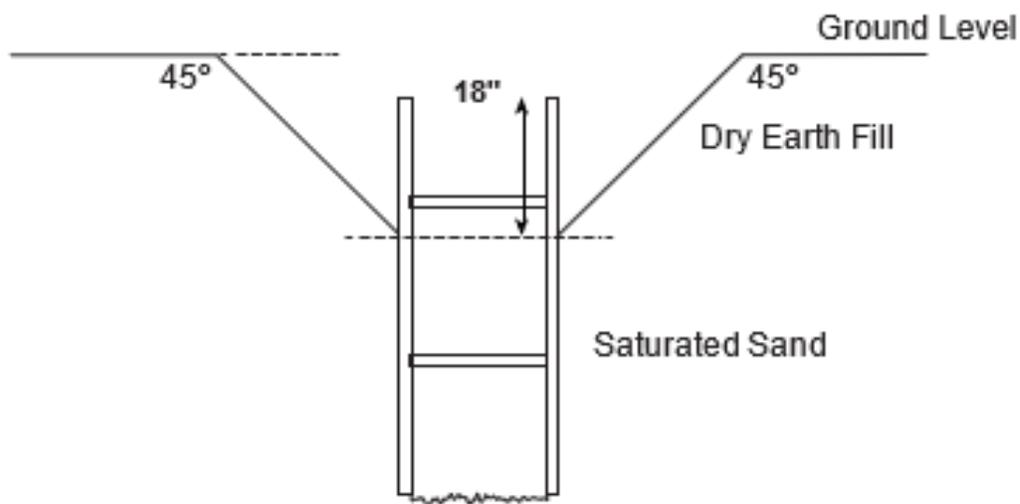
Case 2 *Wet Soil, Rubble, Trash, Organic Material Fill*



**EXAMPLE 12 Excavation — Saturated sand, soft clay or organic soil encountered at depth under fill area.**



**EXAMPLE 13 Trench — Saturated sand, soft clay or organic soil encountered at depth under fill area.**



If the bottom of the trench extends into saturated sand, soft clay, or organic soil under a fill, a trench supporting system should be used to provide protection below the fill

## TRENCHING RULES

1. Spoil must be at least 2 feet back from the lip of the trench.
2. All employees working in excavations or trenches must always stay within the protective system (trench shield, shoring, sloping).
3. Never climb on shoring, trench shields, or sloped walls or ride on any lift, hook, chain, cable, sling, or other equipment parts.
4. Ladders in a trench must extend at least 3 feet above the top of the trench. All employees working in a trench must be within 25 feet of a ladder or ramp.
  - a. For further excavation information, refer to the MITA *Trench Safety Handbook*.
  - b. All trenches over 5' deep must be cut to the angle of repose, sheeted or shored.

## TUNNEL RULES

1. Always use the in and out board.
2. Always wear the proper PPE depending on job assignment.
3. Never stand under suspended loads being lowered into shaft.
4. Prior to tunneling be sure the proper rescue equipment is in place and the tunnel rescue team is assembled.
5. Inspect haulage equipment regularly.
6. Always have a top-man when employees are working in the tunnel.
7. Tunnels longer than 225' must be equipped with a means of communication at the following points:
  - a. The working face
  - b. The top of the shaft
  - c. The working face
  - d. The bottom of the shaft
  - e. Hoisting station if provided
  - f. Each 1000 feet of tunnel
  - g. The office if provided
8. Test the atmosphere of the tunnel as often as necessary to assure air quality of at least 19.5% and no more than 22% oxygen, record results.

## AUGER OPERATIONS

1. Remain a safe distance from rotating augers.
2. Remove excess dirt when augers come to a complete stop.
3. Never work on auger equipment unless controls have been locked out, or keys removed to prevent accidental operation
4. Cover open holes until dewatering system is installed.

## PIPE BORING & JACKING OPERATIONS

1. Construct pit in accordance to design unless otherwise directed by the qualified person on site.
2. Barricade pit properly this may be done with one or a combination of the following:
  - a. Snow fencing at least 6' back from edge of pit.
  - b. Railing at least 42" high with mid-rail.
  - c. Steel plates driven in a manner that provides 42" of fall protection.
3. The area in front of the excavator will remain unbarricaded during work hours for equipment reach and operator visibility reasons. No employees are permitted between the excavator and open side of the pit. During non-working hours this area requires barricading.
4. Entry into any casing requires the following:
  - a. Test and record air monitoring results prior to entry. Continuous monitoring during occupation.
  - b. Never enter a small diameter casing without anklets and a lifeline **in** place.
  - c. The use of a rolling cart is recommended **in** small diameter casings.
  - d. Never enter a casing without an attendant present.
  - e. Have ventilation equipment available and use if necessary.
  - f. Five minute air packs must be available on site prior to entering any casing.
5. Ingress and egress should be accomplished by use of an approved ladder free from defects. All ladders must be secured from accidental displacement and extend 36" above the landing area.

## RESPIRATORY PROTECTION

(Mandatory) Information for employees using respirators when not required under the standard.

Respirators are an effective method of protection against designated hazards when properly selected and worn. Respirator use is encouraged, even when exposures are below the exposure limit, to provide an additional level of comfort and protection for workers. However, if a respirator is used improperly or not kept clean, the respirator itself can become a hazard to the worker. Sometimes, workers may wear respirators to avoid exposures to hazards, even if the amount of hazard substance does not exceed the limits set by OSHA standards. If your employer provides respirators for your voluntary use, or if you provide your own respirator, you need to take certain precautions to be sure that the respirator itself does not present a hazard.

You should do the following:

1. Read all instructions provided by the manufacturer on use, maintenance, cleaning and care, and warnings regarding the respirator's limitations.

2. Choose respirators certified for use to protect against the contaminant of concern. NIOSH, the National Institute for Occupational Safety and Health of the U. S. Department of Health and Human Services, certification should appear on the respirator packaging. It will tell you what the respirator is designed for and how much it will protect you.
3. Do not wear your respirator

4. in atmospheres containing contaminants for which your respirator is not designed to protect you against. For example, a respirator designed to filter dust particles will not protect you against gasses, vapors, or very small solid particles of fumes or smoke.
5. Keep track of your respirator so that you do not mistakenly use someone else's respirator.

Dust masks will be made available to employees for voluntary use. You may wish to consider the use of these masks during work operations that create dust environments.

## CONFINED SPACE RULES

1. Do not enter an area classified as a confined space unless you are properly trained and authorized by the company's qualified person. If you don't understand the definition of a confined space, ask your superintendent.
2. Atmospheric tests shall be done before any employee enters a confined space or goes underground and the results recorded. If a dangerous atmosphere is encountered, the space shall be ventilated, and air quality must be acceptable before entry is allowed. Any positive reading of toxic or explosive gas and any excessive or low levels of oxygen shall be reported to your superintendent. No employee shall enter the confined space under these conditions until such time that the readings are at an acceptable level. For more complete rules, see the Confined Space section of this program.

## CONFINED SPACE DEFINITION

A **confined space** is a space having all of the following criteria:

- (1) is large enough and so configured that an employee can bodily enter
- (2) has a limited or restricted means for entry and exit and
- (3) is not designed for continuous employee occupancy.

Examples of locations where confined spaces may occur include, but are not limited to, storage tanks, manholes, sewers, water mains, storm drains, underground utility vaults, concrete pier columns, precast concrete manhole units, drilled shafts, pipelines, gatewells, ducts, catch basins and open top spaces such as pits, tubs, vaults, and vessels.

## CONFINED SPACE CLASSIFICATIONS

**Non-Permit Space** is a confined space that does not contain existing or potential physical or atmospheric hazards. A space having only *physical hazard(s)* that have been isolated or eliminated can be reclassified as a non-permit space. Reclassifying is not allowed when a space contains an existing or potential *atmospheric hazard(s)* (i.e. existing sewers, manholes, and other similar locations).

**Alternate Entry Space** is a permit space that contains no physical hazards (or the physical hazards have been eliminated or isolated); the existing or potential atmospheric hazards can be controlled by continuous mechanical forced air ventilation; and, in the event the ventilation system stops working, entrants can exit the space safely. Alternate entry procedures are less stringent than full permit space procedures.

**Full Permit Space** is a permit space that contains existing or potential physical and/or atmospheric hazards. Full permit space entry procedures are required when workers enter the space.

## MIOSHA STANDARD REFERENCES

The requirements for confined spaces in construction are covered in Construction Safety Standard (CS) [Part 35 - Confined Space in Construction](#). Additional requirements for welding activities are covered in CS [Part 7 - Welding and Cutting](#) and General Industry Standard [Part 12 - Welding and Cutting](#).

Part 35 - Confined Space in Construction does not apply to certain construction work activities such as diving, excavations, and underground construction (i.e. tunnels, shafts, cofferdams, and caissons). The requirements for these activities are covered in CS [Part 9 - Excavation Trenching & Shoring](#) and [Part 14 - Tunnels, Shafts, Cofferdams, and Caissons](#); and Occupational Health Standards [Part 504 - Diving Operations](#) and [Part 665 - Underground Construction, Caissons, Cofferdams, and Compressed Air](#).

## EMPLOYEE RESPONSIBILITIES

Employees must not enter a confined space until properly trained and authorized by the supervisor/superintendent. If unsure whether an area or space is considered a confined space, contact your supervisor or superintendent.

## EMPLOYEE TRAINING

1. Every employee shall receive training and instruction as to the existence, location, and dangers posed by permit spaces and that they must not enter such spaces without authorization by the supervisor/ superintendent.
2. Employees who are involved in alternate entry and full permit space entry work operations shall receive specific training to ensure they have the knowledge, understanding and skills to perform their duties safely; understand the hazards in the permit spaces and the methods used to isolate, control or protect workers; and the dangers of attempting entry rescue unless authorized.
3. Employee names, trainer names, specific duties training, and dates of training shall be recorded and maintained at the office. The training records shall be made available to employees upon request.

## FIRST STEP: INITIAL WORK SITE EVALUATION

1. Before work begins, the competent person (typically the superintendent) must evaluate the worksite to determine if there are any spaces that workers may enter into that meet the definition of a confined space.
2. Employees are not authorized to enter a confined space until the superintendent has determined which of the following classifications and entry procedures will be used to enter the space:
  - a. [Non-Permit Space Entry](#)
  - b. [Alternate Entry Space](#)
  - c. [Full Permit Space Entry](#)
3. Use the **Classifying Confined Spaces** flowchart ([See Appendix A](#)) for assistance in determining classification and entry procedures.

4. Each confined space must be evaluated for existing and/or potential physical and atmospheric hazards. Whenever possible, the initial evaluation shall be completed without entering the space. If entry into the space is necessary to complete an initial evaluation, full permit space entry procedures are required.
5. The atmosphere in the space must be tested prior to changing the space's natural ventilation. Direct-reading instruments must be calibrated per manufacturers' specification and used to test for oxygen content, flammable gases and vapors, and potential toxic air contaminants, **in this order**. The testing will determine whether the following hazards are present or could be introduced by the work operation:
  - a. Oxygen deficiency (concentration less than 19.5 %) or excess (concentration above 23.5 %).
  - b. Concentration of any flammable gas, vapor, or mist in excess of 10 percent of its lower explosive limit (LEL).
  - c. Airborne combustible dust at a concentration equal to or greater than its lower explosive limit.
  - d. Atmospheric concentration of any substance that can cause death, incapacitation, impairment of ability to self-rescue, injury or acute illness.
6. **Section 1** of the **Pre Entry Checklist** ([See Appendix B](#)) must be completed for each confined space that employees may enter into and kept available at the job site. The Pre-Entry Certification (PEC) is necessary to document the results of the initial evaluation and atmospheric testing; and is the rationale used to classify the space and the entry procedures.

## NON-PERMIT SPACE ENTRY

1. If a space does not have an existing or potential physical or atmospheric hazard, it is classified as a non-permit space, and employees may enter. **Danger signs are not required for non-permit spaces.**
2. If a space contains an existing or potential physical hazard(s) only, the space can be reclassified as a non-permit space if the physical hazards have been eliminated or isolated. The rationale must be documented in **Section 1** on the Pre Entry Certification (PEC). Reclassifying is not allowed when a space contains an existing or potential atmospheric hazard (i.e. existing sewers, manholes, and other similar locations). In this situation, go to the [Alternate Entry Space](#) section.
3. Periodic atmospheric testing and evaluations may be necessary to ensure employee safety in a non-permit space, especially when a work operation (i.e. welding, cutting, using toxic materials) could introduce a new hazard into the space. Anytime a periodic or subsequent atmospheric test is conducted, the results must be documented and kept at the work site. ([See Appendix C](#)): **Confined Space Atmospheric Testing Data Sheet**. Atmospheric test results are not required to be documented if **continuously monitoring** the atmosphere within the space.
4. Employees must exit the space immediately if a hazard is introduced or detected. The space is then reclassified as a full permit space until additional testing and evaluation demonstrate that the space is safe for re-entry. The event, hazards, and steps taken to eliminate or isolate the hazard in order to prevent another occurrence must be documented in **Section 3** on the PEC. The superintendent must include his/her signature authorizing re-entry into the space. In addition, the GC must be informed of any hazards that occurred or were created in space during entry.

## ALTERNATE ENTRY SPACE

1. Alternate entry space procedures are less stringent requirements that may be used in lieu of the full permit space procedures, provided all of the following criteria can be obtained:
  - a. All physical hazards in the space are eliminated or isolated;
  - b. The only hazard is an actual or potential hazardous atmosphere that can be made safe for entry using continuous forced air ventilation; and
  - c. In the event the ventilation system stops working, entrants can exit the space safely.
2. Prior to entry, the superintendent must inform the controlling contractor of the existence, location, and hazards likely to be confronted or created during entry, and that alternate entry procedures will be used to enter the space. When another employer's employee(s) is working in the space at the same time, or when work activities that could result in a hazard are performed in the space at the same time, the alternate entry procedures must be coordinated with the controlling contractor and the other affected employer.
3. DANGER - PERMIT-REQUIRED CONFINED SPACE - DO NOT ENTER signs must be posted at each alternative entry space location to prevent unauthorized entry.
4. *Sections 1 and 2* on the PEC must be completed prior to entering the space when using alternate entry procedures. This will document the hazards, precautions, entry procedures and the supporting data for using alternate entry procedures and to verify the space is safe for entry. The PEC must be made available to each employee entering the space or to their authorized representative, as applicable, and kept at the job site.
5. Any conditions making it unsafe to remove an entrance cover (i.e. manhole cover) must be eliminated before the cover is removed. If an entrance cover is removed, the opening must be immediately guarded by a railing, temporary cover, or other temporary barrier that will prevent an accidental fall through the opening and will protect employees from falling objects when working in the space.
6. Continuous mechanical forced air ventilation must be set up and used to ventilate the space. Exhaust ventilation and natural ventilation are not acceptable substitutes for forced air ventilation. The forced air ventilation must be directed to ventilate the immediate areas where each employee will be working within the space and must continue until all employees have left the space. The air supply for the forced air ventilation must be from a clean source and must not increase the hazards in the space.
7. After the space has been ventilated, the atmosphere must be re-tested prior to entry to ensure that the forced air ventilation is preventing the accumulation of a hazardous atmosphere. After re-testing, the atmosphere must be continuously monitored unless periodic monitoring is sufficient to ensure that the atmosphere remains nonhazardous. Anytime a periodic, subsequent or re-test of the atmosphere is conducted, the results must be documented and kept at the work site. ([See Appendix C](#)): Confined Space Atmospheric Testing Data Sheet. Atmospheric test results are not required to be documented if *continuously monitoring* the atmosphere within the space.
8. Monitoring instruments must be equipped with an early warning audible alarm that is capable of alerting employees of any atmospheric hazard that may have entered into the space and provides sufficient time to exit the space.
9. If the ventilation system is equipped with an audible alarm, employee(s) must immediately leave the space on their own if the ventilation stops for any reason when the alarm sounds. If the ventilation system is not equipped with an audible alarm, an employee stationed at the top of the space opening (top man) must be readily available to monitor the ventilation system and be able to effectively communicate with the employees within to immediately exit the space on their own should the ventilation stop for any reason.

10. A safe method of entering and exiting the space must be provided. Any hoisting system that is used must either be designed or manufactured for personnel hoisting or be approved for personnel hoisting by a registered professional engineer prior to use.
11. Confirm local emergency units are readily available in the case of an emergency. **Attendants, rescue equipment and rescue teams are not required during alternate entry procedures unless the space is reclassified as a full permit space.**
12. If a hazard is detected while employees are working within the space, the superintendent must ensure each worker leaves the space immediately. The space is then reclassified as a full permit space until additional testing and evaluation demonstrate that the space is safe for re- entry. The superintendent must document the event, hazards, and steps taken to eliminate or isolate that hazard to prevent another occurrence in *Section 3* on the PEC. The superintendent must include his/her signature authorizing re-entry into the space.
13. The GC must be notified when work has been completed and informed of any hazards that occurred or were created in the space during entry. Document this in *Section 4* on the PEC.

## FULL PERMIT SPACE ENTRY

1. Complete Section 1 of the PEC to verify the conditions of the permit space during the initial work site evaluation and prior to entry. When hazards or potential hazards within a space cannot be eliminated, isolated, controlled with ventilation, or entrants are unable to exit the space in the event the ventilation system stops working, full permit space entry procedures must be established and implemented.
2. DANGER - PERMIT-REQUIRED CONFINED SPACE - DO NOT ENTER signs must be posted at each full permit space location to prevent unauthorized entry.
3. Prior to entry, the superintendent must inform the controlling contractor of the existence, and location, of hazards (including any hazards likely to be confronted or created), and that full permit entry procedures will be used to enter the space. The entry procedures must be coordinated with the controlling contractor when another employer's employee(s) is working in the permit space at the same time and when a work activity that could result in a hazard is performed in the space at the same time.
4. Full permit entry procedures must be developed and implemented to ensure safe entry into the space. The entry procedures must include, at a minimum, all of the following:
  - a. Specify the acceptable entry conditions;
  - b. Provide entrants or their authorized representative an opportunity to observe any monitoring or testing of space;
  - c. Isolate the space and physical hazards within the space;
  - d. Purging, inerting, flushing, or ventilating the space as necessary to eliminate or control atmospheric hazards;
  - e. Determine that, in the event the ventilation system stops working, the monitoring procedures and equipment will detect an increase in atmospheric hazard levels in sufficient time for entrants to safely exit the space;
  - f. Provide pedestrian, vehicle, or other barriers as necessary to protect entrants from external hazards;
  - g. Verify that conditions within the space are acceptable throughout entry.
5. Provide the following equipment, maintain the equipment, and ensure employees use the equipment properly:
  - a. Testing and monitoring equipment;
  - b. Ventilating equipment;

- c. Communication equipment;
  - d. Personal protective equipment when engineering and work-practice controls do not adequately protect employees;
  - e. Approved lighting equipment;
  - f. Barriers and shields;
  - g. Equipment, such as ladders, for safe access and egress;
  - h. Rescue and emergency equipment, unless equipment is provided by rescue services; and
  - i. Any other equipment necessary for safe entry into, safe exit from, and rescue.
6. Full permit space conditions must be evaluated as follows during entry:
- a. Test the atmosphere in the space before entry to determine if acceptable entry conditions exist before changes to the space's natural ventilation are made. If isolation of the space is infeasible, due to being large or is part of a continuous system (such as a sewer), all of the following must be conducted:
    - i. Perform pre-entry atmospheric testing to the extent feasible before entry;
    - ii. Continuous monitoring of conditions in the areas where entrants are working;
    - iii. Provide an early-warning system that continuously monitors for non-isolated engulfment hazards and alerts entrants and attendants in sufficient time to safely exit the space.
  - b. Continuously monitor atmospheric hazards unless periodic monitoring is sufficient to ensure that the atmosphere remains nonhazardous.
  - c. When testing the atmosphere, test first for oxygen, then for combustible gases and vapors, and then for toxic gases and vapors.
  - d. Allow entrants or their authorized representative to observe any testing.
  - e. Reevaluate the space as requested by the entrant or their authorized representative and provide them with the results of any testing.
7. The authorized entrant(s), attendant(s), and foremen each have specific duties whenever work is performed in a permit space. Their specific duties are listed below:

**Authorized entrants must:**

- a. Know space hazards, including information on the means of exposure such as inhalation or skin contact, and symptoms of the exposure;
- b. Use appropriate personal protective equipment properly;
- c. Stay in communication with attendant as necessary to enable the attendant to monitor the entrant's status and alert to evacuate when necessary;
- d. Exit from the permit space as soon as possible when:
  - e. Ordered by the attendant or superintendent;
  - f. When he/she recognizes the warning signs or symptoms of exposure;
  - g. A prohibited condition exists; or
  - h. An automatic alarm is activated.
- i. Alert the attendant when a prohibited condition exists or when warning signs or symptoms of exposure exist.

**Attendants must:**

- a. Remain outside the permit space during entry operations unless relieved by another authorized attendant;

- b. Perform non-entry rescues when specified by the rescue procedure;
- c. Know existing and potential hazards, including information on the types of exposure, signs or symptoms, consequences, and other effects;
- d. Maintain communication with and keep an accurate account of the workers within the space;
- e. Assess conditions inside and outside the space and order evacuation of the permit space when:
  - i. A prohibited condition exists;
  - ii. A worker shows behavioral effects of hazard exposure;
  - iii. A situation exists outside the confined space that could endanger the employees within the space; and
  - iv. The attendant cannot effectively and safely perform required duties.
- f. Summon rescue and other services during an emergency and when a worker becomes injured or ill.
- g. Ensure that unauthorized people stay away from permit spaces or exit immediately if they have entered into the space.
- h. Inform entry employees and superintendent if any unauthorized person enters the permit space; and
- i. Perform no other duties that interfere with the attendant's primary duties.

**Foremen must:**

- a. Know space hazards including information on the mode of exposure, signs or symptoms and consequences.
  - b. Verify that specified entry conditions are satisfied, including permits, tests, procedures and equipment before allowing entry;
  - c. Terminate entry and cancel or suspend permits when entry operations are completed or if a condition that is not allowed under the permit arises;
  - d. Verify that rescue services are available and that the means for summoning them are operable;
  - e. Take appropriate measures to remove unauthorized entrants; and
  - f. Ensure that entry operations remain consistent with the entry permit and that acceptable entry conditions are maintained.
8. At least one attendant must be stationed outside the permit space when workers are working within, and maintain communication with all entrants and keep track of their conditions. If one or more entrants suffers an injury or illness and is unable to exit the space without help, the attendant must initiate a rescue. When an attendant is required to monitor multiple permit spaces, additional procedures must be implemented in the event of an emergency within one or more of those spaces.
9. **Rescue and emergency** procedures must be established for summoning rescue and emergency services and preventing unauthorized personnel from attempting rescue.
- a. **Non-entry rescue:** It is preferable if the entrant(s) can be rescued without others entering the space to avoid having additional personnel exposure to the hazard that caused the illness or injury. Therefore, non-entry rescue procedures using retrieval equipment must be implemented, unless the retrieval equipment would increase the overall risk of entry or would not contribute to the rescue of the entrant, such as when obstructions can snag the retrieval line or the line can become entangled with air lines or electric cords. The attendant must be prepared to perform non-entry rescues if needed.

When non-entry procedure is selected, each entrant must wear a chest or full body harness, with a retrieval line attached at the D-ring in the center of the back or another point which positions the entrant so that he or she is small enough to be pulled out of the space. The other end of the retrieval line must be attached to a mechanical device or a fixed point outside the permit space. A mechanical device must be available to retrieve someone from vertical type permit spaces more than 5 feet deep. Wristlets or anklets may be used instead of a chest or full body harness only if the employer can demonstrate that use of a chest or full body harness is infeasible or creates a greater hazard.

When a non-entry rescue procedure is selected, the superintendent must also confirm, before entry begins, that emergency assistance (typically the local fire department) is available if the non-entry rescue fails.

- b. **Entry rescue:** When non-entry rescue is not feasible, the only way to rescue an entrant is for others to enter the permit space. For entry rescue, an on-site rescue team consists of our employees or another contractor's employees. An off-site rescue service is a local fire department or other rescue service. The off-site rescue service must be able to respond in time to get the entrant out of the space to receive medical treatment, which requires the superintendent to contact the rescue service prior to entering the space and informing them of the nature and hazards involved in the space. In some cases, this may require a standby rescue team, such as when the entrant is working in an atmosphere that is immediately dangerous to life or health (IDLH) and is wearing an airline respirator or a self-contained breathing apparatus.

When entry rescue takes place, an attendant must be stationed outside the permit space so that additional help can be summoned if needed. If the original attendant is to enter the space as part of the rescue team, a new attendant must be in position before the first attendant enters the space.

- c. **Training requirements for rescue teams and off-site rescue services:** All members of a rescue team must receive the training that is required for authorized entrants and have been trained to perform their assigned rescue duties. Rescue team members must be provided with personal protective and rescue equipment, including respirators, and must be instructed on how to use it. All rescuers must be trained in first aid and CPR. At a minimum, one rescue team member must be certified in first aid and CPR. Rescuers must be informed of the hazards within the permit space before entering. Rescue team practices or exercises must take place at least yearly. Off-site rescue services must be provided access to all permit spaces, if requested, in order to practice rescue operations.

Off-site rescue services must notify the superintendent in the event that their service is unavailable. The permit space work can be postponed or another off-site rescue service can be used.

If using an off-site rescue service, the superintendent must determine that the service has the ability and equipment to carry out a rescue in the particular permit space or type of permit space that entrants are working in. The superintendent must contact the rescue service to make sure that it will be able to respond in a timely manner whenever an entrant is in the permit space.

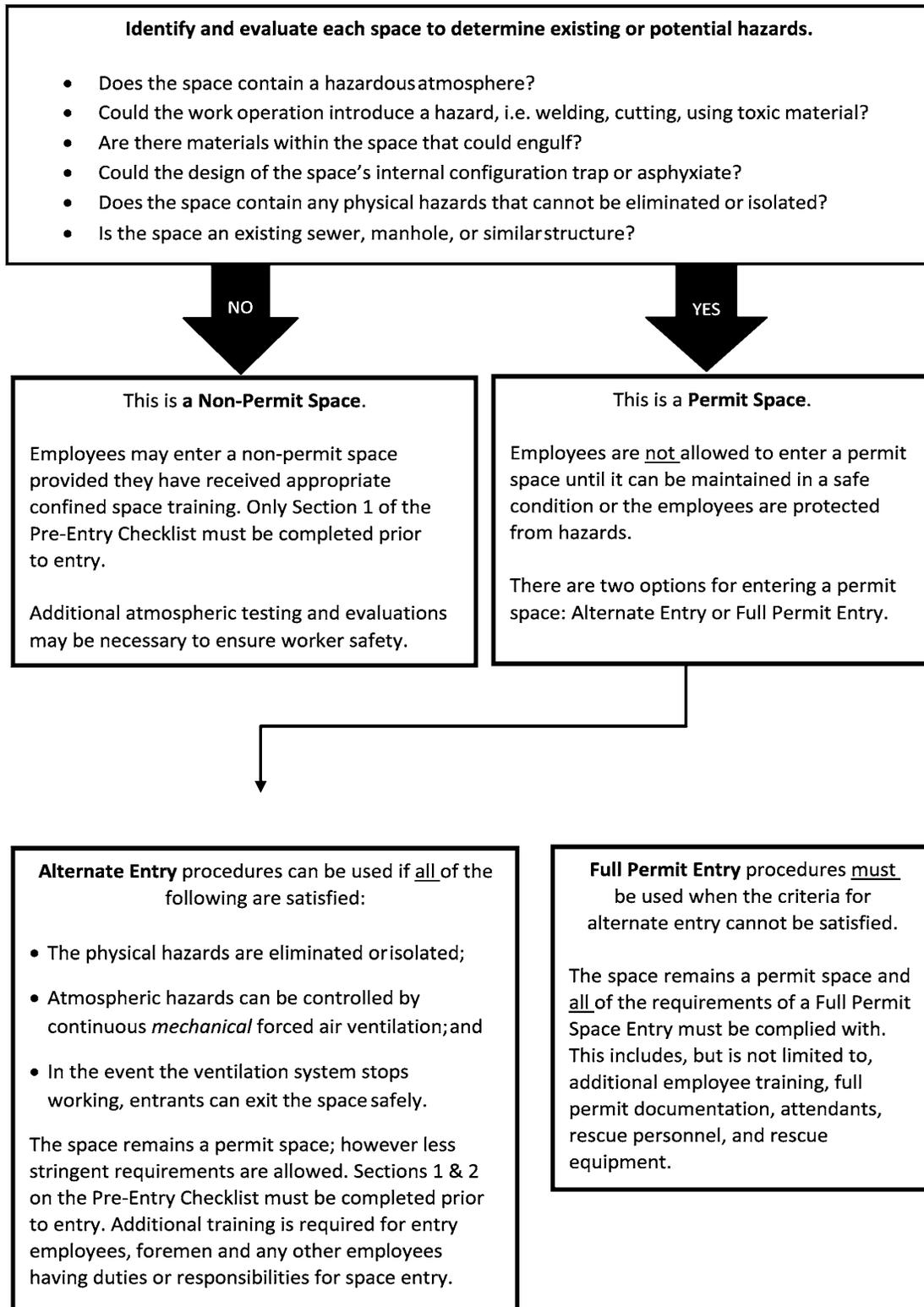
- 10. Full permit space entry procedures must be reviewed and deficiencies must be corrected whenever it is discovered that the procedures established may not be protecting employees

adequately. Circumstances requiring a review include an injury or near misses, unauthorized entry, detection of a new hazard or condition prohibited by the Entry Permit, or an employee complaint about the program's effectiveness. In addition, the Full Permit Space Procedures will be reviewed annually for effectiveness using the cancelled entry permits.

11. Prior to entry, a **Full Permit Space Entry Permit** ([See Appendix D](#)) must be completed for each full permit space that employees may enter into. The entry permit includes all of the following information:
  - a. Name of the permit space to be entered, authorized entrants(s), current attendants, and current entry foremen.
  - b. Purpose of entry.
  - c. Date and authorized duration of entry.
  - d. Means of detecting an increase in atmospheric hazard levels.
  - e. Name and signature of superintendent who authorizes entry.
  - f. Known hazards in the space.
  - g. Measures to be taken to isolate permit spaces and to eliminate or control space hazards.
  - h. Acceptable entry conditions.
  - i. Test results, date and time of tests(s), and the tester's initials or signature.
  - j. Name and telephone numbers of rescue and emergency services and means to be used to contact them.
  - k. Communication procedures and equipment to maintain during entry.
  - l. Special equipment and procedures, including personal protective equipment and alarm systems.
  - m. Any other information needed to ensure employee safety; and
  - n. Additional permits, such as for hot work, have been issued authorizing work in the permit space.
12. The superintendent must cancel entry permits when work has been completed within the space or when new hazards or conditions occur. Once a permit is cancelled, entry under it is no longer permitted. New hazards or conditions must be noted on the cancelled permit and used in revising the permit space program. Once the work has been completed and the entry permit cancelled, it must be kept for a least one year.
13. The superintendent may suspend an entry permit instead of cancelling it if a temporary condition has occurred in or near the space that, once corrected, is not expected to reoccur. The permit may be reinstated and entry may occur under the permit if the entry supervisor has determined that the conditions in the space match the allowable conditions listed on the permit.
14. The GC shall be informed when work has been completed within the space and of any hazards that occurred or were created in the space during entry.

## APPENDIX A

### CLASSIFYING CONFINED SPACES



## APPENDIX B PRE-ENTRY CHECKLIST

### SECTION 1: INITIAL WORK SITE EVALUATION

Date of Initial Evaluation:	Identify space being entered:	Person completing the evaluation:
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Can the initial evaluation be completed without entering?  Yes <input type="checkbox"/> Continue to next box. No <input type="checkbox"/> STOP! –Use full permit space procedures.	If a cover or guard has to be removed to perform the initial evaluation or testing, have all hazardous conditions been eliminated, isolated, or controlled? Yes <input type="checkbox"/> N/A <input type="checkbox"/>
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#### Atmospheric Hazard Assessment

Record initial atmospheric testing:  <table style="width: 100%; border: none;"> <tr> <td style="width: 70%;">Oxygen</td> <td style="width: 30%;">%</td> </tr> <tr> <td>Flammable/Explosive Gas</td> <td>% LEL</td> </tr> <tr> <td>Hydrogen Sulfide (H2S)</td> <td>PPM</td> </tr> <tr> <td>Carbon Monoxide (CO)</td> <td>PPM</td> </tr> <tr> <td>Other (Specify)</td> <td></td> </tr> </table> Record subsequent atmospheric testing on the Confined Space Atmospheric Testing Data Sheet (Appendix C).	Oxygen	%	Flammable/Explosive Gas	% LEL	Hydrogen Sulfide (H2S)	PPM	Carbon Monoxide (CO)	PPM	Other (Specify)		Does the space contain a hazardous atmosphere?  No <input type="checkbox"/> Yes <input type="checkbox"/> (Only Alternate Entry or Full Permit Entry procedures are allowed.)
Oxygen	%										
Flammable/Explosive Gas	% LEL										
Hydrogen Sulfide (H2S)	PPM										
Carbon Monoxide (CO)	PPM										
Other (Specify)											
	Could a hazardous atmosphere possibly enter the space after the initial testing, (i.e. sewers and manholes) <u>or</u> could a hazard be introduced from a work operation (i.e. welding, cutting, applying toxic material)?  No <input type="checkbox"/> Yes <input type="checkbox"/> (Only Alternate Entry or Full Permit Entry procedures are allowed.)										

#### Physical Hazard Assessment

Are there existing or potential physical hazards in the space (i.e. electrical, mechanical, engulfment)?  No <input type="checkbox"/> Yes <input type="checkbox"/> (Check applicable boxes below)	If physical hazards were detected in the space, were they eliminated or isolated?  No <input type="checkbox"/> Yes <input type="checkbox"/> (Check applicable boxes below)																				
<table style="width: 100%; border: none;"> <tr> <td><input type="checkbox"/> Electrical</td> <td><input type="checkbox"/> Entrapment</td> </tr> <tr> <td><input type="checkbox"/> Mechanical</td> <td><input type="checkbox"/> Converging Walls</td> </tr> <tr> <td><input type="checkbox"/> Engulfment/Water</td> <td><input type="checkbox"/> Fall Hazard</td> </tr> <tr> <td><input type="checkbox"/> Hydraulic/Pneumatic</td> <td><input type="checkbox"/> Temp. Extreme</td> </tr> <tr> <td><input type="checkbox"/> Other (Specify): _____</td> <td></td> </tr> </table>	<input type="checkbox"/> Electrical	<input type="checkbox"/> Entrapment	<input type="checkbox"/> Mechanical	<input type="checkbox"/> Converging Walls	<input type="checkbox"/> Engulfment/Water	<input type="checkbox"/> Fall Hazard	<input type="checkbox"/> Hydraulic/Pneumatic	<input type="checkbox"/> Temp. Extreme	<input type="checkbox"/> Other (Specify): _____		<table style="width: 100%; border: none;"> <tr> <td><input type="checkbox"/> Lock out/Tag out</td> <td><input type="checkbox"/> Personal Fall Arrest/Rest.</td> </tr> <tr> <td><input type="checkbox"/> Isolate/Guard</td> <td><input type="checkbox"/> Install Work Platform</td> </tr> <tr> <td><input type="checkbox"/> Purge/Drain/Clean</td> <td><input type="checkbox"/> Guard Rails/Hole Covers</td> </tr> <tr> <td><input type="checkbox"/> Blank/Block/Bleed</td> <td><input type="checkbox"/> Ventilation/Ice Vest</td> </tr> <tr> <td><input type="checkbox"/> Other (Specify): _____</td> <td></td> </tr> </table>	<input type="checkbox"/> Lock out/Tag out	<input type="checkbox"/> Personal Fall Arrest/Rest.	<input type="checkbox"/> Isolate/Guard	<input type="checkbox"/> Install Work Platform	<input type="checkbox"/> Purge/Drain/Clean	<input type="checkbox"/> Guard Rails/Hole Covers	<input type="checkbox"/> Blank/Block/Bleed	<input type="checkbox"/> Ventilation/Ice Vest	<input type="checkbox"/> Other (Specify): _____	
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<input type="checkbox"/> Lock out/Tag out	<input type="checkbox"/> Personal Fall Arrest/Rest.																				
<input type="checkbox"/> Isolate/Guard	<input type="checkbox"/> Install Work Platform																				
<input type="checkbox"/> Purge/Drain/Clean	<input type="checkbox"/> Guard Rails/Hole Covers																				
<input type="checkbox"/> Blank/Block/Bleed	<input type="checkbox"/> Ventilation/Ice Vest																				
<input type="checkbox"/> Other (Specify): _____																					

#### SPECIFY THE APPROPRIATE CLASSIFICATION AND ENTRY PROCEDURES

- Non-Permit Space.** There are no existing or potential physical hazards or atmospheric hazards. Periodic atmospheric testing may be necessary. Employees may enter the space.
- Alternate Entry Space.** There are no physical hazards. There are existing or potential atmospheric hazards that can be controlled by ventilation; and if the ventilation system stops working, entrants can exit the space safely on their own. Continue to Section 2: Alternate Entry Space.
- Full Permit Space.** There are physical hazards that cannot be eliminated or isolated and/or there are existing or potential atmospheric hazards that cannot be controlled by ventilation. Full permit space entry procedures are required.

### SECTION 2: ALTERNATE ENTRY SPACE

SECTION 2: ALTERNATE ENTRY SPACE

Confined space danger sign posted at the space? Yes

Are local emergency services readily available? Yes

GC notified of the work and entry procedure? Yes  N/A

Alternate entry training provided to employees? Yes

Check applicable boxes describing the existing or potential atmospheric hazards detected in the space:

- Oxygen Deficiency
- Carbon Monoxide (CO)
- Flammable/Explosive Gases/Vapors (Specify):
- Welding/Cutting
- Hydrogen Sulfide (H<sub>2</sub>S)
- Other (Specify):

Check applicable boxes that describe how the atmospheric hazards will be isolated or controlled in order to protect entrants:

- Mechanical ventilation system set at 100% outside air
- Open additional manholes to increase air circulation
- Use portable blowers to augment natural ventilation
- Repeat atmospheric testing after ventilating the space
- Continuous air monitoring during and after entry
- No burning, cutting, or welding operations in the space
- Use intrinsically safe lighting in the space
- Other (Specify):

In the event the ventilation system stops working, check applicable boxes that describe how the atmospheric hazards will remain at safe levels long enough for entrants to recognize the problem and safely exit the space:

- Fully ventilated space while unoccupied to get non-detect readings for atmospheric hazards; then shut down ventilation and monitored air quality. If atmospheric hazards are detected that reach maximum limits, full permit space procedures will be implemented.
- The atmospheric testing equipment is equipped with an audible alarm to alert entrants to exit the space.
- Entrants are wearing personal air monitors that are equipped with an audible alarm to alert them to exit the space.
- The ventilation system is equipped with an audible alarm to alert entrants to exit the space.
- A top man is readily available to monitor the ventilation system and alert the entrants to exit the space.
- Other (Specify):

Check applicable boxes that describe how employees are able to safely exit the space on their own:

- A fixed ladder is located in the space and safe for entrants to use to exit the space.
- A portable ladder will remain in the manhole during the time entrants are working in the space.
- A work platform has been installed in the space for egress.
- Other (Specify):

Check appropriate boxes that describe any additional steps or monitoring to be taken to ensure conditions are safe from physical hazards:  Periodic inspections  Early warning system  Other (Specify):

SECTION 3: COMPLETE ONLY WHEN A HAZARD IS DETECTED IN THE SPACE AFTER THE INITIAL EVALUATION

Were employees evacuated from the space when the hazard was detected? Yes

Describe the event, hazard, and steps taken to eliminate or isolate the hazard to prevent another occurrence:

Is the space safe for re-entry?

Yes  *Employees may re-enter the space.* Foreman Signature: \_\_\_\_\_

No  *Employees must not enter the space. This is now re-classified as a full permit space. Full permit space procedures are required until space has been made safe for re-entry.*

SECTION 4: AFTER WORK HAS BEEN COMPLETED IN THE SPACE

GC informed that work has been completed? Yes  GC informed of any hazards detected during entry? Yes  N/A



{Employer Name}

Confined Space Program

FULL PERMIT SPACE ENTRY PERMIT

<b>1. Permit space to be entered (i.e. sewer, tank, manhole, crawlspace, attic):</b>		Host, GC and Subs notified of the work? Yes <input type="checkbox"/> NA <input type="checkbox"/>
<b>2. Purpose of entry:</b>		Location:
<b>3. Date of entry:</b>	Auth. duration of entry permit:	Entry supervisor print name/contact information:
<b>4. Rescue type selected:</b> Non-entry <input type="checkbox"/> or Entry <input type="checkbox"/> Equipment: Tri-pod/Davit arm <input type="checkbox"/> or Emergency service <input type="checkbox"/> Emer. Service Available (Permit Space only): Onsite <input type="checkbox"/> or <input type="checkbox"/> Off-site (name & phone): Rescuer(s) trained in 1 <sup>st</sup> Aid/CPR (Permit Space only): <input type="checkbox"/> (Note: Part 1 1 <sup>st</sup> Aid requirements)		Communication Equipment: Radio <input type="checkbox"/> Voice <input type="checkbox"/> Cell Phone <input type="checkbox"/> Air Horn <input type="checkbox"/> <input type="checkbox"/> Other (Specify):

5. Authorized entrants (Print Names) Use back or attach page for more entrants	Entry time		Entry time		Entry time		Entry time	
	In	Out	In	Out	In	Out	In	Out

<b>6. Attendant (Print Name)</b>	<b>Date and Time</b>	<b>7. Current training for confined space workers verified?</b> Yes <input type="checkbox"/> No <input type="checkbox"/>
	<input type="checkbox"/> AM <input type="checkbox"/> PM	
	<input type="checkbox"/> AM <input type="checkbox"/> PM	

8A. Identify, evaluate and record hazards of space to be entered.	Yes	No	8B. Specify equipment and measures required to eliminate/control hazards before and during entry
A. Lack of Oxygen or Inert Gas Present (i.e. Argon, Nitrogen)	<input type="checkbox"/>	<input type="checkbox"/>	Continuous forced air ventilation <input type="checkbox"/> Blank, Block and Bleed <input type="checkbox"/>
B. Flammable Gas/Vapor (%LEL)	<input type="checkbox"/>	<input type="checkbox"/>	Purge, Clean, Drain <input type="checkbox"/> Intrinsically Safe Lighting <input type="checkbox"/>
C. Toxic Gas/Vapor (i.e. CO and H <sub>2</sub> S)	<input type="checkbox"/>	<input type="checkbox"/>	Respiratory Protection: Supplied Air with Escape Bottle <input type="checkbox"/> SCBA <input type="checkbox"/>
D. Chemical (impairs self-rescue)	<input type="checkbox"/>	<input type="checkbox"/>	Other (list) <input type="checkbox"/>
E. Electrical	<input type="checkbox"/>	<input type="checkbox"/>	Lockout/Tagout <input type="checkbox"/> Isolate/Guard <input type="checkbox"/>
F. Mechanical	<input type="checkbox"/>	<input type="checkbox"/>	Blank, Block and Bleed <input type="checkbox"/> Other (list) <input type="checkbox"/>
G. Hydraulic/Pneumatic	<input type="checkbox"/>	<input type="checkbox"/>	
H. Temp. Extreme	<input type="checkbox"/>	<input type="checkbox"/>	Continuous forced air ventilation <input type="checkbox"/> Ice Vest <input type="checkbox"/> Other (list) <input type="checkbox"/>
I. Engulfment	<input type="checkbox"/>	<input type="checkbox"/>	Drain <input type="checkbox"/> Pump <input type="checkbox"/> Other (list) <input type="checkbox"/>
J. Entrapment/Converging Walls	<input type="checkbox"/>	<input type="checkbox"/>	Install Work Platform <input type="checkbox"/> Hole Covers <input type="checkbox"/> Guard Rails <input type="checkbox"/> Personal Fall Arrest /Restraint <input type="checkbox"/>
K. Fall Hazard	<input type="checkbox"/>	<input type="checkbox"/>	Other (list) <input type="checkbox"/>
L. Introduced Hazards (i.e. Chemical, Hot Work)	<input type="checkbox"/>	<input type="checkbox"/>	Fire extinguisher <input type="checkbox"/> Hot Work Permit <input type="checkbox"/> Other (list) <input type="checkbox"/>
M. Other	<input type="checkbox"/>	<input type="checkbox"/>	Warning signs posted at access <input type="checkbox"/> Additional PPE <input type="checkbox"/>

**9. Gas tester(s)/monitor model(s)/type(s):** Serial/unit no(s): \_\_\_\_\_  
Bump test to confirm function? Yes  Verified: On-site test  Documentation

Test Required	Permissible levels	Initial test levels	Subsequent test type: Sample Continuous (take readings before EACH entry into space)				
		(before vent)	Test 2	Test 3	Test 4	Test 5	Test 6
A. Oxygen (O <sub>2</sub> )	19.5 to 23.5%						
B. Combustible gas/vapor (LEL)	10% LEL						
C. Hydrogen sulfide (H <sub>2</sub> S)	5 PPM						
D. Carbon monoxide (CO)	< 25 PPM						
E. Other							
	<b>Tester initials</b>						
	<b>Test Times</b>						

**10. Are entry conditions acceptable?** (Remove debris and other obstructions from entry point) Yes  No

Entry Suspended (time): \_\_\_\_\_ AM  PM  Time of reentry: \_\_\_\_\_ AM  PM   
Reason for suspending permit: \_\_\_\_\_  
Permit Canceled date/time \_\_\_\_\_ / \_\_\_\_\_ AM  PM  Unanticipated Hazards? No  Yes  If yes, describe below: \_\_\_\_\_  
Debriefing occurred after entry? Yes  No  \_\_\_\_\_  
Entry Supervisor Signature: \_\_\_\_\_



# HAZARD COMMUNICATION PROGRAM

## "RIGHT TO KNOW PROGRAM"

### GENERAL

The following hazard communication program has been established for **M & M Excavating Company** and will be available for review by all employees.

#### 1. HAZARD DETERMINATION

The Safety Officer will be relying on material safety data sheets from suppliers to meet determination requirements.

#### 2. LABELING

- a. The Safety Officer will be responsible for ensuring that all containers coming in are properly labeled.
- b. All labels shall be checked for:
  - i. Identity
  - ii. Hazard
  - iii. Name & address of responsible party

Each superintendent shall be responsible for seeing that all portable containers used in their work are labeled with identity & hazard warning.

#### 3. SAFETY DATA SHEETS (S.D.S.)

- a. The Safety Officer will be responsible for compiling the master S.D.S. file. It will be kept at:  
17 Old State Road, Gaylord, MI 49735
- b. Copies of S.D.S. for all hazardous chemicals to which employees may be exposed will be made available to all employees upon request.
- c. Each superintendent will be provided with the required MIOSHA Right-To- Know posters & postings notifying employees of new or revised S.D.S. within five (5) days of receipt of new or revised S.D.S.

#### 4. EMPLOYEE INFORMATION AND TRAINING

- a. The Safety Officer shall coordinate & maintain records of training conducted for **M & M Excavating Company**.
- b. Before starting work, or as soon as possible thereafter, each new employee will attend a safety briefing. In that class, each employee will be given information on:
  - i. Chemicals & their hazards in the workplace.
  - ii. How to lessen or prevent exposure to these chemicals.
  - iii. What the company has done to lessen or prevent workers' exposure to these chemicals.
  - iv. Procedures to follow if they are exposed.
  - v. How to read & interpret labels & S.D.S.
  - vi. Where to locate S.D.S. and from whom they may obtain copies.

- c. The employee will be informed that:
  - i. The employer is prohibited from discharging, or discriminating against, an employee who exercises the rights regarding information about hazardous chemicals in the workplace.
  - ii. Attendance will be taken at training sessions. The records will be kept by the Safety Officer.
  - iii. Before any new hazardous chemical is introduced into the workplace, each employee will be given information in the same manner as during the safety briefing.

#### 5. HAZARDOUS NON-ROUTINE TASKS

- a. On occasion, employees may be required to do work in potentially hazardous areas (e.g. confined spaces). Prior to starting work in such areas, each employee will be given information about the hazards involved in these areas. This information will include:
  - b. Specific chemical hazards.
  - c. Protection/ safety measures the employee can take to lessen risks.
  - d. Measures the company has taken to lessen the hazards including ventilation, respirators, the presence of another employee, and emergency procedures.
  - e. It is the policy of M & M Excavating Company that no employee will begin work in a confined space, or any non-routine task, without first receiving a safety briefing.

#### 6. INFORMING CONTRACTORS

- a. It is the responsibility of the Safety Officer to provide any subcontractors with employees on the job site exposed to our chemicals with the following information:
  - i. Hazardous chemicals with which they may come in contact.
  - ii. Measures the employees may take to lessen the risks.
  - iii. Where to get S.D.S. for all hazardous chemicals.
  - iv. SDS book is located 17 Old State Road, Gaylord, MI 49735
- b. It is the responsibility of the Safety Officer to obtain chemical information from contractors when they will expose our employees to hazardous chemicals which they may bring into our workplace.

#### 7. LISTS OF HAZARDOUS CHEMICALS

- a. The list of the chemicals used by **M & M Excavating Company** can be obtained by reviewing S.D.S.

# This Workplace Covered by the Michigan Right To Know Law



Employers must make available for employees in a readily accessible manner, Safety Data Sheets (SDS) for those hazardous chemicals in their workplace.

Employees cannot be discharged or discriminated against for exercising their rights including the request for information on hazardous chemicals.

Employees must be notified and given direction (by employer posting) for locating Safety Data Sheets and the receipt of new or revised SDS(S).

When the employer has not provided a SDS, employees may request assistance in obtaining SDS from the:

Michigan Department of Licensing and Regulatory Affairs  
Michigan Occupational Safety and Health Administration  
General Industry Safety and Health Division  
(517) 284-7750  
Construction Safety and Health Division and Asbestos Licensing  
(517) 284-7680  
[www.michigan.gov/miosha](http://www.michigan.gov/miosha)  
MIOSHA/CET #2105 (Rev. 05/18)



## SDS(s) For This Workplace Are Located At

Location(s)

Location(s)

Person(s) responsible for SDS(s)

Phone

*LARA is an equal opportunity employer/program.*

# MOBILE DEVICE POLICY

M&M Excavating understands that we live in a connected world where communication occurs via multiple channels throughout the day. At the same time, it is important that employees stay focused on workplace safety, productivity, quality and performance. Personal phone usage, including calls and messages, should therefore be kept to a minimum. To ensure the safety, efficiency, and privacy of the Company and Subcontractor work, the use of cell phones for social media and/or posting on social media sites is not tolerated during working hours. This includes, but is not limited to, current and ongoing jobsite photos or real-time photos/videos of job site tasks.

## 1. APPLICABILITY

- a. This policy applies to mobile cell phone usage (personal and employer-issued) and listening devices when working on a jobsite - regardless whether the cell phones or listening devices are hand-held or being used hands-free (i.e. Bluetooth earphones, earbuds, and headphones).
- b. The term "cell phone usage" means making or receiving phone calls, texting, messaging, checking emails, checking social media, taking photos and videos, or any other similar activities.

## 2. CELL PHONES

- a. Only foremen, superintendents, or other designated qualified persons are allowed to use mobile cell phones on jobsites or during working hours. Any exceptions to this policy must be approved by Management.
- b. Employees may use personal cell phones during breaks or lunch times in a safe location away from active work operations (i.e. jobsite trailer or parked vehicle) .
- c. Personal cell phone ringers must be turned off or set to mute or vibrate during work hours.

## 3. LISTENING DEVICES

- a. Listening devices (i.e. radios, portable CD players, iPods and other similar listening devices) are strictly prohibited on jobsites.

## 4. SAFE PRACTICES FOR CELL PHONES

- a. Use cell phones in a safe manner that does not expose the user and others to any recognizable hazard.
- b. Do not use cell phones, radios, and other devices when they could distract you from warning alarms and other approaching hazards. Move to a safe location before answering the call.
- c. Turn cell phones off or set to "silent" or "vibrate" before starting vehicles.
- d. Pull over to a safe place when making or receiving calls while on the road.
- e. Modify your voicemail greeting to indicate unavailability to answer calls or return messages while driving.

# M & M EXCAVATING COMPANY LEAD ABATEMENT OPERATIONS

## GENERAL

NIOSH and the Occupational Safety and Health Administration (OSHA) have recently recommended that exposure to lead dust and fumes be minimized by the use of engineering controls and work practices, and by the use of personal protective equipment (PPE) including respirators.

Workers are potentially exposed to lead during work on bridges or other steel structures such as water and fuel storage tanks. Workers who may be exposed to lead include abrasive blasters, inspectors, iron workers, painters and laborers.

### 1. HEALTH EFFECTS

Lead can be absorbed into the body by inhalation (breathing) and ingestion (eating). Lead is a cumulative poison. It accumulates in the blood, bones and organs. Cumulative exposure to lead, which is typical in construction settings, may result in damage to the blood, nervous system, kidneys, bones, heart and reproductive system and contributes to high blood pressure.

a. The symptoms of lead poisoning include the following:

- i. Headache
- ii. Poor appetite
- iii. Dizziness
- iv. Irritability/ anxiety
- v. Constipation
- vi. Pallor
- vii. Excessive tiredness
- viii. Numbness
- ix. Metallic taste in mouth
- x. Muscle & joint pain or soreness
- xi. Sleeplessness
- xii. Hyperactivity
- xiii. Weakness
- xiv. Reproductive difficulties
- xv. Nausea
- xvi. Fine Tremors
- xvii. Insomnia
- xviii. "Lead line" on gums
- xix. "Wrist drop" weakness of extensor muscles

### 2. EMPLOYEE SAFETY PRACTICES FOR LEAD PROTECTION

a. Personal Hygiene Practices

- i. All workers exposed to lead should wash their hands and faces before eating, drinking or smoking, and they should not eat, drink, or use tobacco products in the work area.
- ii. Contaminated work clothes should be removed before eating.
- iii. Workers should change into work clothes at the worksite.
- iv. Street clothes should be stored separately from work clothes in a clean area. Workers should change back into their street clothes after washing or showering before leaving the worksite to prevent the accumulation of lead dust in the workers' cars and homes and thereby protect family members from exposure to lead.

- v. Personal vehicles taken to the worksite should be parked where they will not be contaminated with lead.
  - b. Personal Protective Equipment (PPE)
    - i. Protective clothing should be worn in order to minimize the accumulation of lead on the worker's skin and hair. Workers should change into work clothes immediately before entering the work area, and change out of these clothes before leaving the jobsite.
    - ii. Employees are provided with a half mask respirator as protection against airborne lead concentrations. Sandblasters are provided with a supplied air sandblast hood. All respirators use NEPA filters or equal.
3. ENGINEERING CONTROLS FOR LEAD PROTECTION
- a. Warning signs are to be used to mark the boundaries of lead- contaminated work areas.
  - b. Blood tests for lead level will be required on an annual basis of all employees at risk of being exposed to lead.
    - i. Blood lead levels of 1 to 49 are within the acceptable range.
    - ii. Blood lead levels of 40 or above require a medical examination of worker and consultation.
    - iii. Blood lead levels of 50 or above call for removal of worker from any job with potential lead exposure.
  - c. Air monitoring will be performed at the worksite to determine:
    - i. Composition of the paint.
    - ii. Measure worker exposure to airborne lead and other hazardous agents e.g., silica and solvents.
    - iii. Select the engineering controls and PPE required.
  - d. When performing abrasive blasting, scaling, chipping, grinding or other operations to remove lead-based coatings, all available work practices will be utilized in order to decrease air-borne lead dust and fumes (e.g. negative air, wet plastering, daily clean-up of lead- containing and abrasives).
  - e. Workers will be trained/ notified on the following topics as they relate to lead exposure:
    - i. Information about the potential adverse health effects of lead exposure.
    - ii. Information about the early recognition of lead intoxication.
    - iii. Instruction about heeding signs that mark the boundaries of lead-contaminated work areas.
    - iv. Discussion of the importance of personal hygiene practices.
    - v. Instruction about the use and care of appropriate protective equipment.
4. SAFE WORK PRACTICES
- a. Use the exhaust ventilation system, where provided.
  - b. Use the correct, clean respirator.
  - c. Keep the worksite clean. Use only a vacuum with a HEPA filter or wet cleaning methods when removing lead dust. Never use
  - d. compressed air for cleaning.
  - e. Eat, drink, or smoke in areas outside the worksite. Keep all lunch boxes and coffee cups away from the work area. Use a separate
  - f. lunchroom.
  - g. Wash hands and face before eating, drinking, smoking or applying cosmetics.
  - h. Use protective clothing. Store street clothes separately from work clothes. Never wear contaminated clothes home.
5. TRAINING
- a. Construction standards, require that a potentially exposed employee be informed of the hazards of lead and be trained in the precautions to take when working around it. The employee shall

also be instructed in proper work practices, personal equipment, such as eye and face protection, head protection, coveralls and respirators.

# M & M EXCAVATING COMPANY HAZWOPER PROGRAM

## HAZMAT INFORMATION

The following employees of M & M Excavating Company have been trained and are certified in HAZMAT procedures:

Hazardous materials for job will be stored at:

### PPE Specifications for HAZMAT

Task	Level	Body	Head	Respirator
General work uniform when no chemical exposure is anticipated	D	Work clothes; steel-toe, steel-shank leather work boots; work gloves	Hardhat, Safety glasses, Ear protection	<b>None required</b>
All tasks with potential for chemical exposure	Modified D	<b>COVERALLS:</b> UncoatedTyvek® <b>BOOTS:</b> Steel-toe, Steel-shank chemical resistant boots or Steel-toe, steel-shank leather work boots with outer rubber boot covers. <b>Gloves:</b> Inner surgical-style nitrile glove and outer chemical-resistant nitrile glove.	Hardhat, splash shield, Safety glasses, Ear protection.	None required

Not Authorized	C	<b>COVERALLS:</b> UncoatedTyvek® <b>BOOTS:</b> Steel-toe, Steel-shank chemical resistant boots or Steel-toe, steel-shank leather work boots with outer rubber boot covers. <b>Gloves:</b> Inner surgical-style nitrile glove and outer chemical-resistant nitrile glove.	Hardhat, splash shield, Ear protection, Spectacle insrets	APR, full-face, MSA Ultratein or equivalent; with GME-H cartridges or equivalent.
Not Authorized	B	<b>COVERALLS:</b> UncoatedTyvek® <b>BOOTS:</b> Steel-toe, Steel-shank chemical resistant boots or Steel-toe, steel-shank leather work boots with outer rubber boot covers. <b>Gloves:</b> Inner surgical-style nitrile glove and outer chemical-resistant nitrile glove.	Hardhat, splash shield, Ear protection, Spectacle insrets	Positive pressure demand self-contained breathing apparatus (SCBA): MSA ultralite or equivalent.

## REASONS FOR UPGRADING OR DOWNGRADING LEVEL OF PROTECTION

<b>UPGRADE</b>	<b>DOWNGRADE</b>
<ul style="list-style-type: none"> <li>• Request from individual performing task.</li> <li>• Change in work task that will increase contact or potential contact with hazardous materials.</li> <li>• Occurrence or likely occurrence of gas or vapor emission.</li> <li>• Known or suspected presence of dermal hazards.</li> <li>• Instrument action levels (section 6) exceeded.</li> </ul>	<ul style="list-style-type: none"> <li>• New information indicating that situation is less hazardous than originally thought.</li> <li>• Change in site conditions that decreases the hazard.</li> <li>• Change in work task that will reduce contact with hazardous materials.</li> </ul>

### Decontamination Specifications

<b>Personnel</b>	<b>Sample Equipment</b>	<b>Heavy Equipment</b>
Boot wash/ rinse Glove wash/ rinse Outer-glove removal Body-suit removal Inner-glove removal Respirator removal Hand wash/ rinse Face wash/ rinse Shower ASAP  PPE disposal method, Bag and dispose on-site.  Water disposal method: none anticipated.	Wash/ rinse equipment Solvent-rinse equipment Solvent disposal method:	Power wash Steam clean Water disposal method:

#### Diagram of Personnel Decontamination Line

No eating, drinking, or smoking is permitted in contaminated areas and in exclusion or decontamination zones. The SSC should establish areas for eating, drinking, and smoking.

Contact lenses are not permitted in exclusion or decontamination zones.

The following diagram illustrates a typical establishment of work zones, including the decontamination line. Work zones are to be modified by the SSC to accommodate task-specific requirements.

#### ADDITIONAL DOCUMENTS

MIOSHA Publication 85-115 Standard Operating Safety Guides, US EPA and the Occupational Safety and Health Guidance manual for Hazardous Waste Site Activities, are available to view with the Superintendent at the M & M Excavating Company office located at: 17 Old State Rd, Gaylord, MI 49735

**HAZMAT EMERGENCY RESPONSE**

1. As part of its safety program it is the policy of M & M Excavating Company to make certain that all employees have been instructed as to proper procedures in case of an injury or accident.
2. M & M Excavating Company designates the 911 system as its first response in the event of a medical emergency and/ or rescue operation.
3. A list of emergency phone numbers will be posted at the jobsite when practical. If no suitable or convenient location exists, the list will be kept by the project superintendent.
4. All injuries and/ or accidents shall be reported to the job superintendent immediately.
5. All accidents and/ or injuries shall be reported to the Safety Officer as soon as is practical.
6. M & M Excavating Company will provide a person at each job site who is trained in CPR and First Aid procedures as required by any applicable Safety & Health Standards.
7. Never move an injured person unless absolutely necessary. Further injury may result. Keep the injured comfortable and utilize available first aid equipment until an ambulance arrives.

**EMERGENCY EQUIPMENT AND SUPPLIES**

Emergency equipment & supplies	Location
First Aid Kit	In field vehicle
Eye wash	In field vehicle
Portable water	In field vehicle
Additional equipment (specify) portable phone	In field vehicle

**INCIDENT RESPONSE**

- In fires, explosions, or chemical releases, actions to be taken include the following:
- Shut down site operations and evacuate work area.
- Account for personnel at the designated area(s).
- Notify appropriate response personnel.
- Assess the need for site evacuation and evacuate the site as warranted.

**EVACUATION SIGNALS**

Signal	Meaning
Grasping throat with hand	Emergency! Help me!
Thumbs up	OK, understood
Grasping buddy's wrist	Leave area now
Continuous sounding of horn	Emergency, leave site now

**EMERGENCY RESPONSE PHONE NUMBERS**

**Site Address:**

**Police:** 911\*

**Fire:** 911\*

**Ambulance:** 911\*

**Water:** MISSDIG 1-800-482-7171 OR

**Gas:** MISSDIG 1-800-482-7171

**Electric:** MISSDIG 1-800-482-7171

\*When using a cellular phone outside the telephone's normal calling area, exercise caution in relying on the cellular phone to activate 911. When the caller is outside the normal calling area, the cellular service carrier should contact the caller with emergency services in the area where the call originated, but this may not occur. Telephone numbers of backup emergency services should be provided if a cellular phone is relied on to activated 911.

## M&M Excavating Company

# EMERGENCY RESPONSE PROGRAM

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6. **M & M Excavating Company** will provide a person at each job site who is trained in CPR and First Aid procedures as required by any applicable Safety & Health Standards.
7. Never move an injured person unless absolutely necessary. Further injury may result. Keep the injured comfortable and utilize available first aid equipment until an ambulance arrives.

# MEDICAL EMERGENCIES JOBSITE PROCEDURES

All M&M job sites must have at least one employee who is trained in CPR and Basic First Aid procedures. These trained individuals will be identified and documented at the start of each job. In the event of an injury, employees should seek immediate assistance from a trained individual. Minor injuries can be treated on-site by a trained employee, or the injured individual can be transported in a company vehicle. For serious injuries, local emergency services should be contacted right away. First aid will be administered while waiting for emergency responders to arrive. An employee will meet the emergency personnel at the site entrance and guide them to the injured party. If no trained personnel are available, an employee should contact local emergency services immediately and provide basic care to the best of their ability.

# STOP WORK AUTHORITY

**Stop Work Protocol:** Every employee is empowered to halt work promptly and without fear of retaliation if they believe any of the following conditions are present:

- There is a threat to the health and safety of workers or the public.
- There is a risk of compromising the safe operation of a facility or causing significant damage.
- There is a potential for the release of hazardous substances that could surpass regulatory limits.

This policy ensures that employees have the authority to prioritize safety and prevent any potential harm or damage.

**Reporting Unsafe Conditions:** All employees are required to promptly report any activities or conditions that they believe to be unsafe. Notifications should be made to the supervisor or designated individual at the Job site where the unsafe activity or condition is observed. Upon receiving the notification, the responsible supervisor or management designee will take immediate action to address and resolve the issue. Your safety is our top priority, and we appreciate your cooperation in maintaining a safe work environment.

**Right to a safe workplace.** M&M is committed to providing a safe workplace for all employees. We do not tolerate discrimination against any employee who reports a work-related fatality, injury, or illness, files a safety and health complaint, requests access to injury and illness records, or exercises any rights granted by occupational safety and health laws.

We encourage all employees to speak up if they believe that an activity or condition is unsafe. It is their right to stop or refuse work without fear of retaliation from management or coworkers. We are dedicated to addressing any safety concerns before employees resume their work duties.

**Stop Work Resolution:** In the event that an employee or supervisor encounters a work stoppage issue that remains unresolved through standard procedures, it is imperative to promptly reach out to the safety manager or union representative for assistance.

ANNUAL INSPECTION OF EXCAVATORS

Owner: \_\_\_\_\_  
Date: \_\_\_\_\_  
Make: \_\_\_\_\_  
Serial #: \_\_\_\_\_

	Yes	No
1. Boom and Stick.		
a. Corrosion.	<input type="checkbox"/>	<input type="checkbox"/>
b. Cracks.	<input type="checkbox"/>	<input type="checkbox"/>
2. Loose bolts or rivets.	<input type="checkbox"/>	<input type="checkbox"/>
3. Worn, Cracked or Distorted.		
a. Pins.	<input type="checkbox"/>	<input type="checkbox"/>
b. Bearings.	<input type="checkbox"/>	<input type="checkbox"/>
c. Bushings.	<input type="checkbox"/>	<input type="checkbox"/>
d. Gears.	<input type="checkbox"/>	<input type="checkbox"/>
e. Locking devices.	<input type="checkbox"/>	<input type="checkbox"/>
4. Excessive wear on brake or clutch systems.	<input type="checkbox"/>	<input type="checkbox"/>
5. Malfunction in steering, braking or locking devices.	<input type="checkbox"/>	<input type="checkbox"/>
6. Hydraulic System.		
a. Flexible hose connection leaking.	<input type="checkbox"/>	<input type="checkbox"/>
b. Deformation/blistering of hose coating or covering.	<input type="checkbox"/>	<input type="checkbox"/>

- |  |                          |                          |
|--|--------------------------|--------------------------|
| c. Leaking at threaded or clamped joints.                  | <input type="checkbox"/> | <input type="checkbox"/> |
| d. Excessive abrasion on hoses.                            | <input type="checkbox"/> | <input type="checkbox"/> |
| 7. Hydraulic Pumps.  |                          |                          |
| a. Loose bolts / fasteners.                                | <input type="checkbox"/> | <input type="checkbox"/> |
| b. Leaks at joints between sections.                       | <input type="checkbox"/> | <input type="checkbox"/> |
| c. Shaft gear leaks.                                       | <input type="checkbox"/> | <input type="checkbox"/> |
| d. Unusual noises or vibration.                            | <input type="checkbox"/> | <input type="checkbox"/> |
| e. Loss of operating speed.                                | <input type="checkbox"/> | <input type="checkbox"/> |
| f. Loss of pressure.                                       | <input type="checkbox"/> | <input type="checkbox"/> |
| g. Excessive fluid heat.                                   | <input type="checkbox"/> | <input type="checkbox"/> |
| 8. Hydraulic Valves.                                       |                          |                          |
| a. Cracks in housing.                                      | <input type="checkbox"/> | <input type="checkbox"/> |
| b. Leaks at joints.  | <input type="checkbox"/> | <input type="checkbox"/> |
| 9. Hydraulic Cylinders.                                    |                          |                          |
| a. Fluid leaking past piston causing drifting.             | <input type="checkbox"/> | <input type="checkbox"/> |
| b. Leaking rod seals.                                      | <input type="checkbox"/> | <input type="checkbox"/> |
| c. Welded joints leaking.                                  | <input type="checkbox"/> | <input type="checkbox"/> |
| d. Dented case(s).   | <input type="checkbox"/> | <input type="checkbox"/> |
| e. Loose / deformed rod end or connecting joints.          | <input type="checkbox"/> | <input type="checkbox"/> |
| 10. Evidence of rubber particles or metal chips in filter. | <input type="checkbox"/> | <input type="checkbox"/> |

Annual con't.

- 11. Control Mechanisms.
  - a. Excessive wear.
  - b. Free of lubricants, etc.
- 12. Safety Devices Functioning.
- 13. Hydraulic System.
  - a. Deterioration.
  - b. Leakage.
- 14. Hooks.
  - a. Throat opening expanded to 115% of original size.
  - b. Twisted more than 10° from vertical.
  - c. Are any visible cracks.
- 15. Operable back-up alarms.

Annual con't.

PROJECT NAME \_\_\_\_\_

LOCATION \_\_\_\_\_

PROJECT NO. \_\_\_\_\_

DEI JOB NO. \_\_\_\_\_

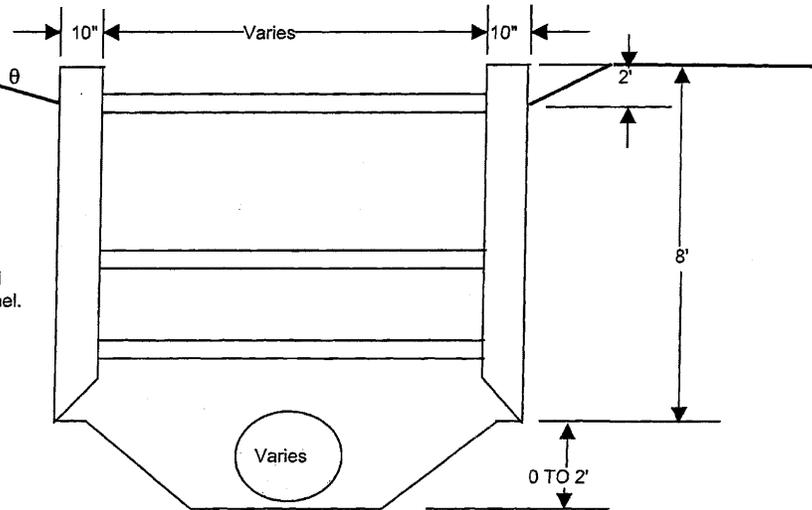
PREPARED BY \_\_\_\_\_

DATE \_\_\_\_\_ SHEET \_\_\_\_\_ OF \_\_\_\_\_

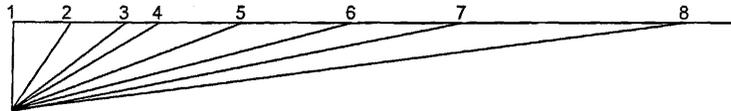
**Design 1**

APPROXIMATE  
GROUND  
ELEVATION

Typical Trench Box  
Height is 8 feet.  
However may vary  
depending on ground  
conditons and actual  
depth of cut.  
Height of box is determined  
by qualified on-site personnel.



ANGLE OF REPOSE (θ)



1. SOLID ROCK FORMATION (90 DEGREES)
2. FRACTURED ROCK FORMATION (75 DEGREES) 1/4:1
3. STIFF CLAY (63 DEGREES) 1/2:1 ; 2.5 TSF MINIMUM
4. FIRM CLAY (56 DEGREES) 2/3:1 ; 1.5 TSF MINIMUM
5. GRANULAR SOIL - DRY (45 DEGREES) 1:1 ; 1.0 TSF MINIMUM
6. GRANULAR SOIL - WET (34 DEGREES) 1 1/2:1 ; <1.0 TSF
7. SATURATED GRANULAR SOIL (26 DEGREES) 2:1
8. RUNNING SOIL (18 DEGREES) 3:1

\*Design acceptable for pipe installation from 0 to 10' in depth.

PROJECT NAME \_\_\_\_\_

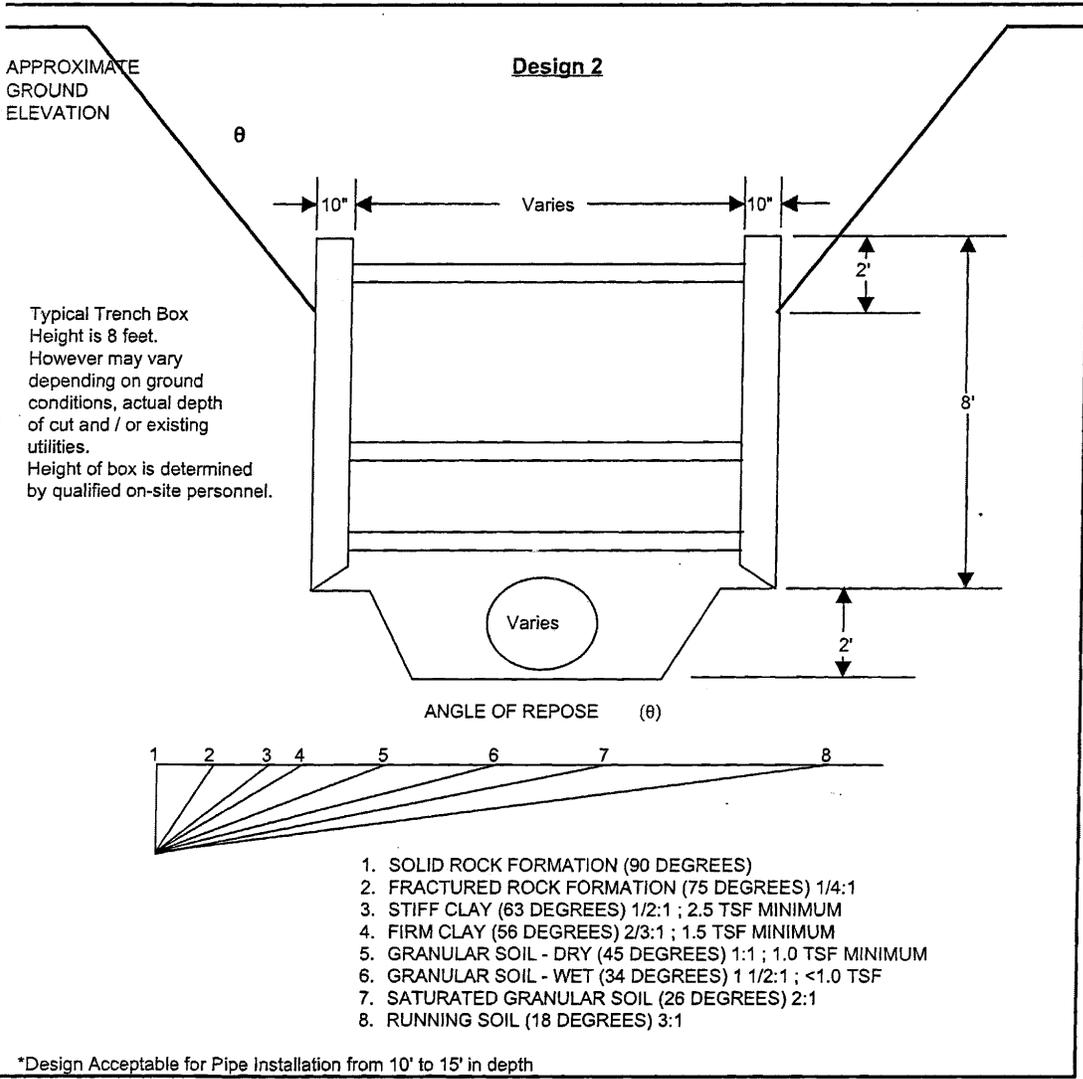
LOCATION \_\_\_\_\_

PROJECT NO. \_\_\_\_\_

DEI JOB NO. \_\_\_\_\_

PREPARED BY \_\_\_\_\_

DATE \_\_\_\_\_ SHEET \_\_\_\_\_ OF \_\_\_\_\_



AN EQUAL OPPORTUNITY EMPLOYER

PROJECT NAME \_\_\_\_\_

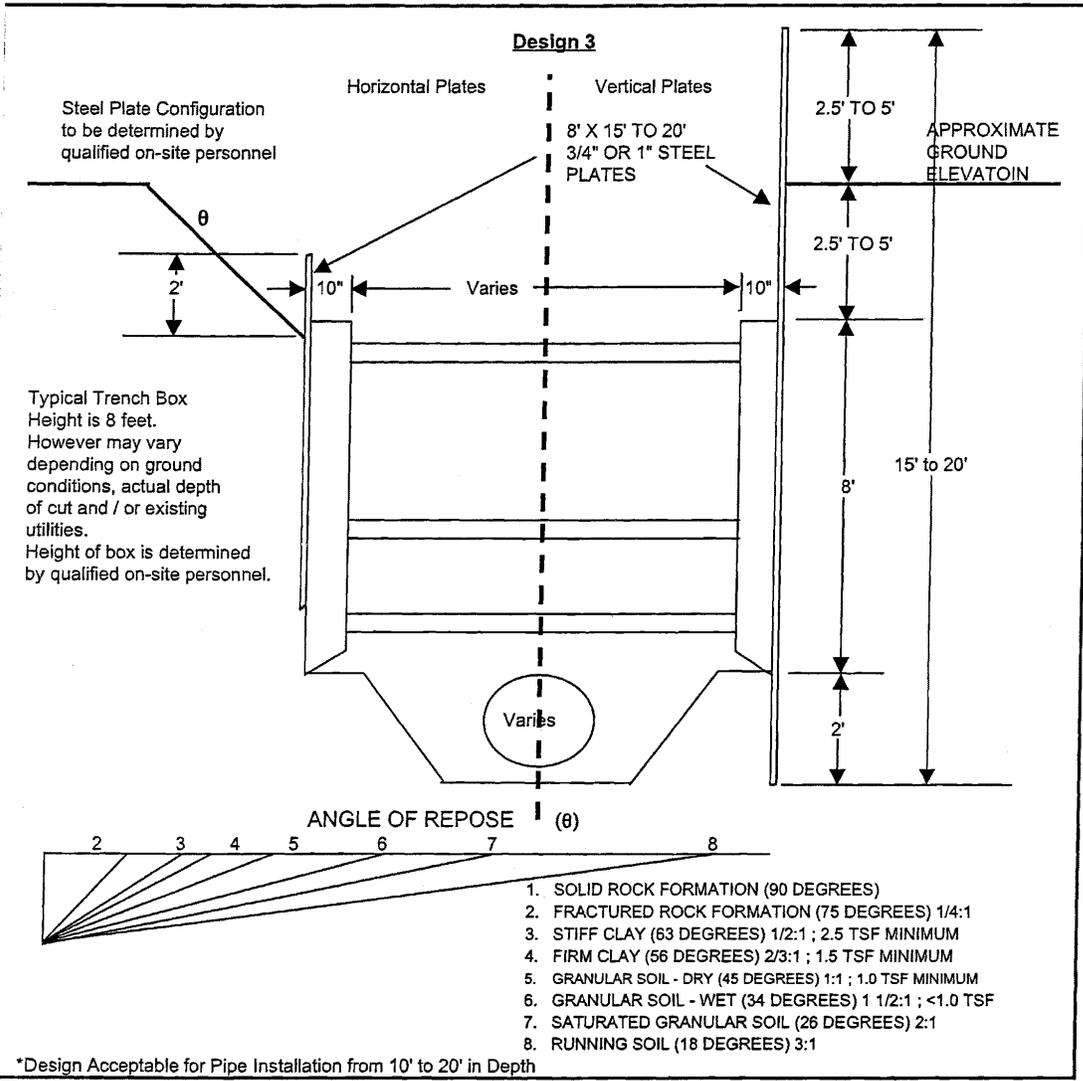
LOCATION \_\_\_\_\_

PROJECT NO. \_\_\_\_\_

DEI JOB NO. \_\_\_\_\_

PREPARED BY \_\_\_\_\_

DATE \_\_\_\_\_ SHEET \_\_\_\_\_ OF \_\_\_\_\_



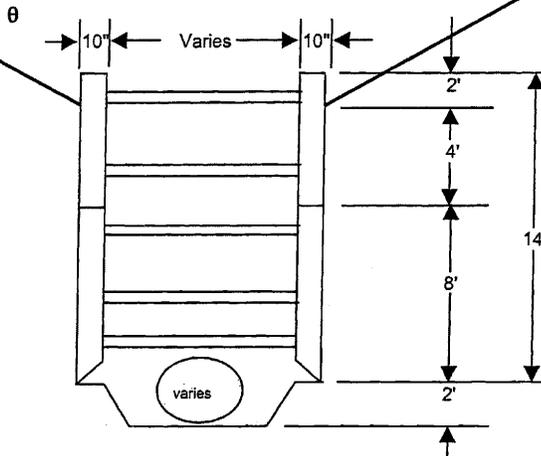
AN EQUAL OPPORTUNITY EMPLOYER

PROJECT NAME \_\_\_\_\_  
 LOCATION \_\_\_\_\_  
 PROJECT NO. \_\_\_\_\_  
 DEI JOB NO. \_\_\_\_\_  
 PREPARED BY \_\_\_\_\_  
 DATE \_\_\_\_\_ SHEET \_\_\_\_\_ OF \_\_\_\_\_

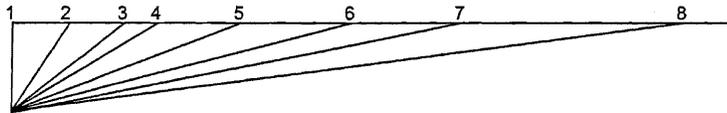
**Design 4**

APPROXIMATE  
GROUND  
ELEVATION

Typical Trench Box  
Height is 8 feet.  
However may vary  
depending on ground  
conditions, actual depth  
of cut and / or existing  
utilities.  
Height of boxes is determined  
by qualified on-site personnel.



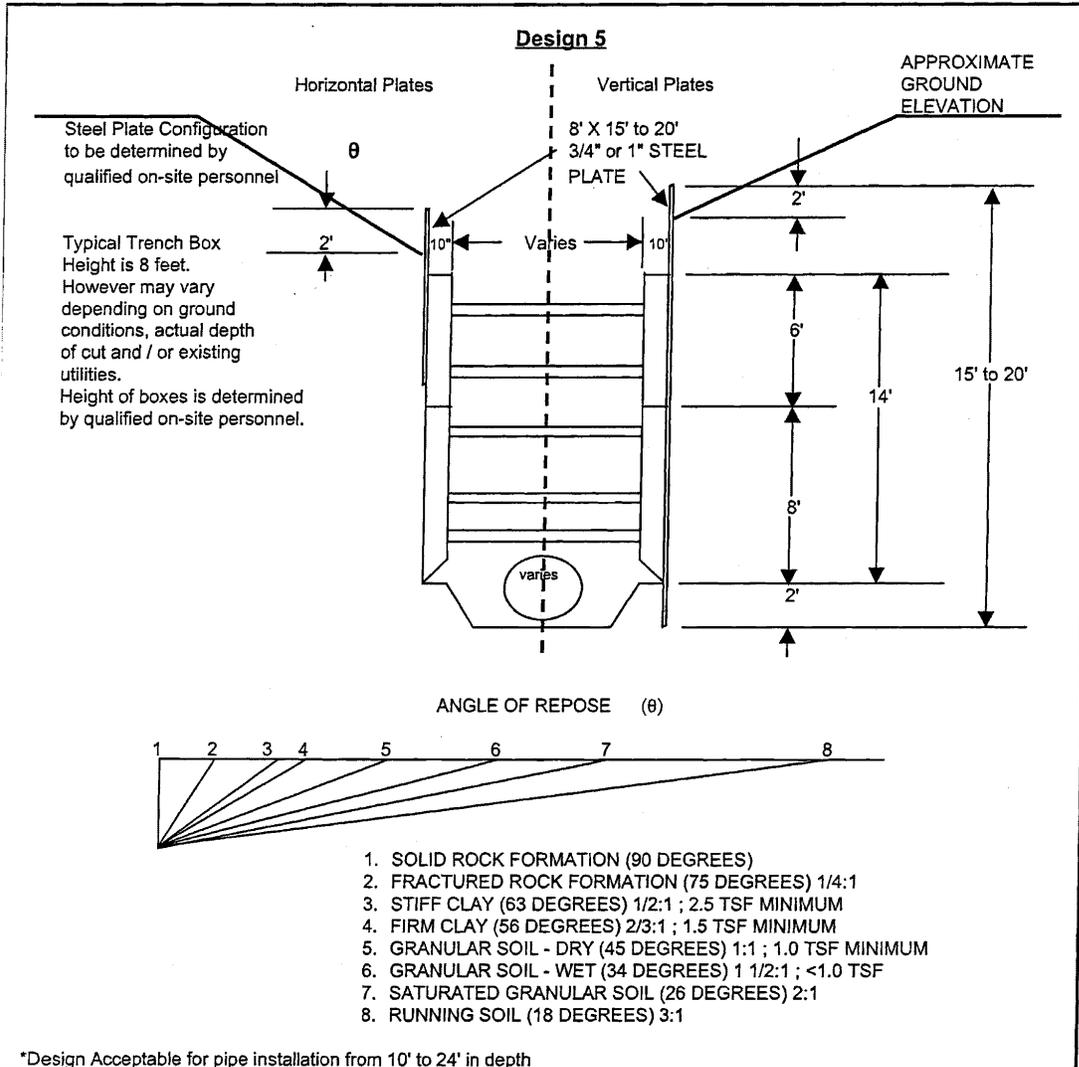
ANGLE OF REPOSE ( $\theta$ )



1. SOLID ROCK FORMATION (90 DEGREES)
2. FRACTURED ROCK FORMATION (75 DEGREES) 1/4:1
3. STIFF CLAY (63 DEGREES) 1/2:1 ; 2.5 TSF MINIMUM
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7. SATURATED GRANULAR SOIL (26 DEGREES) 2:1
8. RUNNING SOIL (18 DEGREES) 3:1

\*Design Acceptable for pipe installation from 10' to 24' in depth.

PROJECT NAME \_\_\_\_\_  
 LOCATION \_\_\_\_\_  
 PROJECT NO. \_\_\_\_\_  
 DEI JOB NO. \_\_\_\_\_  
 PREPARED BY \_\_\_\_\_  
 DATE \_\_\_\_\_ SHEET \_\_\_\_\_ OF \_\_\_\_\_



\*Design Acceptable for pipe installation from 10' to 24' in depth  
 AN EQUAL OPPORTUNITY EMPLOYER

PROJECT NAME \_\_\_\_\_

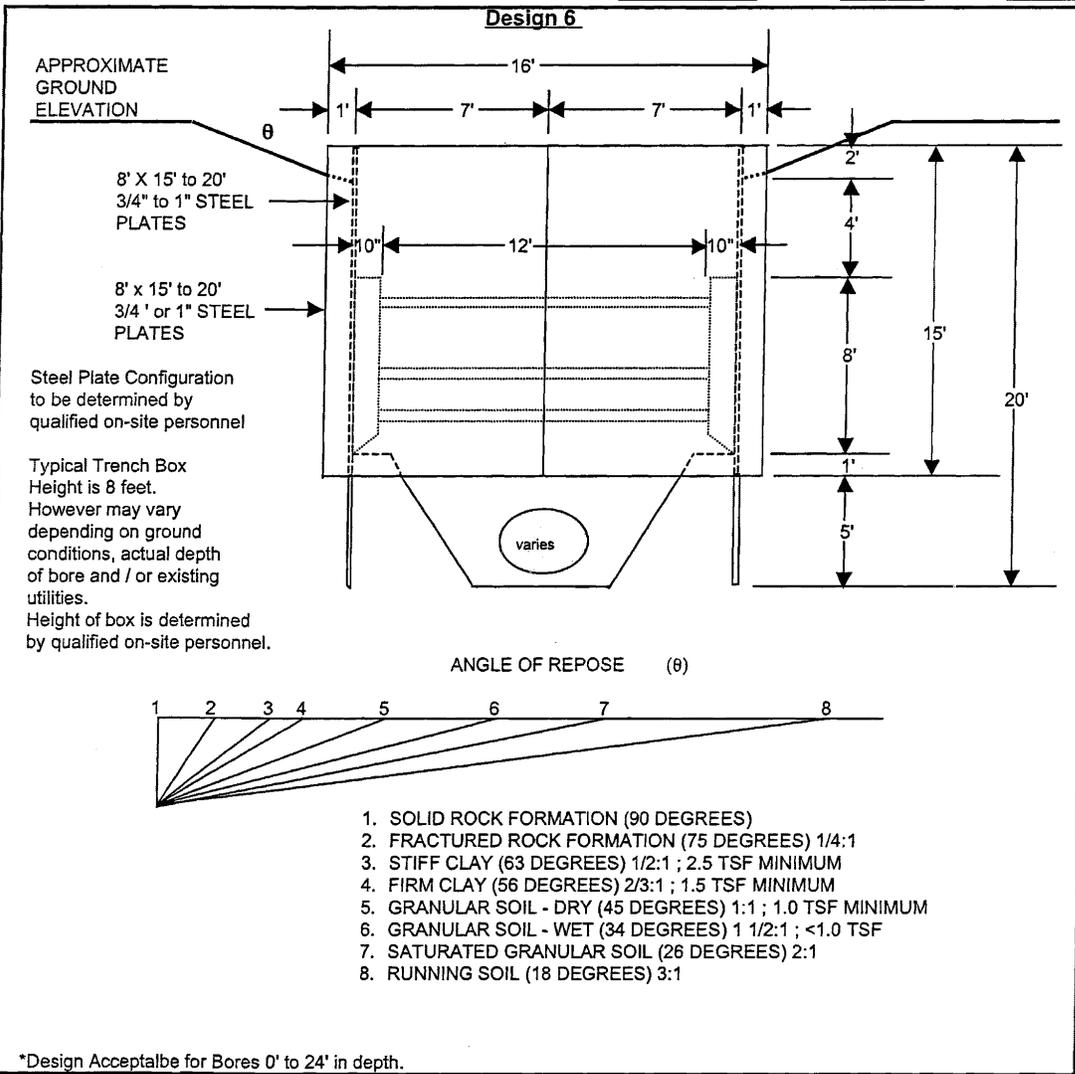
LOCATION \_\_\_\_\_

PROJECT NO. \_\_\_\_\_

DEI JOB NO. \_\_\_\_\_

PREPARED BY \_\_\_\_\_

DATE \_\_\_\_\_ SHEET \_\_\_\_\_ OF \_\_\_\_\_



AN EQUAL OPPORTUNITY EMPLOYER