PURPOSE

The Confined Space Entry Program is provided to regulate entry into confined spaces and to protect authorized employees that will enter confined spaces and may be exposed to hazardous atmospheres, engulfment in materials, conditions which may trap or asphyxiate due to converging or sloping walls, or any other safety or health hazards. Reference: OSHA Permit Required Confined Spaces 29 CFR 1910.146. Permit required confined spaces located on the WKU campus are identified on our website under Confined Space Inventory.

DEFINITIONS

Attendant: An individual stationed outside the confined space who monitors the entrants inside the confined space. There must be at least one attendant for each confined space. Attendants must meet regulatory requirements to perform this job.

Authorized person: An employee who is trained and authorized by the employer to be an attendant or to enter a permit required space.

Blanking or blinding: absolute closure of a pipe, line, or duct by the fastening of a solid plate that is capable of withstanding the maximum pressure of the pipe, line, or duct with no leakage beyond the plate

Confined space:

- Is large enough or so configured that an employee can bodily enter and perform work.
- Has limited or restricted means for entry or exit
- Is not designed for continuous employee occupancy.

Engulfment: Surrounding of a person by a flowing solid or liquid that can exert enough force or strength on the body to cause death by strangulation, constriction, or crushing.

Entrant: an employee who is authorized by WKU to enter a confined space.

Entry: when any part of the employees' body breaks the plane of any opening of the permit-required confined space and performs any work inside that space.

Entry Supervisor: A person, who authorizes entry into permit confined space, knows the hazards, authorizes job operation within space, and can terminate entry and permit.

Hazardous atmosphere an atmosphere that exposes employees to a risk of death, incapacitation, injury or acute illness from one or more of the following causes:

- An atmospheric oxygen concentration below 19.5 percent or above 23.5 percent;
- A flammable gas, vapor, or mist in excess of 10 percent of its lower explosive limit (LEL);
- An atmospheric concentration at or above the permissible exposure limit of any substance considered toxic.

- An airborne combustible dust at a concentration that obscures vision at a distance of five feet (1.52M) or less;
- Any atmospheric condition recognized as immediately dangerous to life or health.

Hot Work: Work that could result in a source of ignition such as welding cutting, burning or heating which can cause additional hazards within a confined space. A hot work permit must be issued for all hot work to be performed within a confined space.

Inerting: Is the displacement of the atmosphere in a permit space by a noncombustible gas to such an extent that the resulting atmosphere is noncombustible.

IDLH: Immediately Dangerous to Life and Health.

Non-Permit confined space is a confined space that does not contain or, with respect to atmospheric hazards, have the potential to contain any hazard capable of causing death or serious physical harm.

Permit required confined space (permit space) is a confined space that has one or more of the following characteristics:

- Contains or has a potential to contain a hazardous atmosphere.
- Contains a material that has the potential for engulfing an entrant.
- Has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls or by a floor that slopes downward and tapers to a smaller cross-section.
- Contains any other recognized serious safety or health hazard.

Project Manager: Anyone who is responsible for demolition, construction, renovation of any size project regardless of their job title (i.e. painting, carpet replacement, whole building construction, wall removal or additions, alterations to HVAC and electrical systems, etc.)

Testing is the process by which the hazards that may confront entrants to a permit space are identified and evaluated. The tests are to be specified that will be performed in the permit space.

RESPONSIBILITIES

Management

- Identify and assess confined spaces on campus
- Ensure proper training of employees who will enter confined spaces & will act as the non-entry rescue team.
- Provide proper equipment for entry of confined space & non-entry rescue teams.

Environmental Health and Safety (EHS)

- Annually review program and all Entry Permits
- Set up dates for entry rescue teams training.
- Provide and or assist with OSHA required training to WKU employees who are authorized to enter permit required confined spaces.
- Provide technical assistance to the departments as needed

Project Managers

- Inform contractor of the locations of permit required confined spaces and the hazards involved including notification of the presence of asbestos (refer to Western Kentucky's Asbestos Management Program).
- Ensure that the contractor's confined space program and permit is compliant with all regulatory requirements
- Coordinate entry when employees of more than one employer (including WKU employees) are involved. If WKU employees will be entering a space with a contractor the WKU permit must be used.
- Notify EHS whenever new manholes are added to the campus infrastructure so the space can be evaluated and mapped.

Contractor Responsibilities

- Obtain all available information regarding permit space hazards and entry operations from the Project Manager.
- Have a permit space entry program that is compliant with all regulatory requirements and inform the Project Manager of the permit space program that will be followed.
- Ensure that employees making the entry are properly trained.
- Provide the equipment and resources necessary for safe entry.
- Post permit at entry site for the duration of the entry.
- Inform Project Manager of any hazards confronted or created in the permit space through a debriefing or during the entry operation.

Entry Supervisor

Entry supervisors are responsible for the overall permit space entry and must coordinate entry procedures, tests, permits, equipment and other relevant activities. The following entry supervisor duties are required:

- Know the hazards that may be faced during entry, including the mode, signs or symptoms, and consequences of exposure.
- Verify by checking that necessary information has been entered on the permit, all tests specified by the permit have been conducted and that all procedures and equipment specified by the permit are in place before endorsing the permit and allowing entry to begin.
- Ensure that a permit has been posted at the job site.
- Verify that rescue services are available, (call Bowling Green Fire Department at 393-4831 to let them know that permit required space is being entered) and that the means for summoning them are operable.
- Ensure barriers or barricades are in place.
- Remove unauthorized persons who enter or attempt to enter the space during entry operations.
- Determine that entry operations and entry conditions are maintained based on the hazards and operations performed within the space remain consistent with the permit terms.
- Terminate the entry and cancel the permit when the entry is complete or there is a need for terminating the permit.

Entry Attendants

At least one attendant is required outside the permit space into which entry is authorized for the duration of the entry operation. Responsibilities include:

- Know the hazards that may be faced during entry, including the mode, signs or symptoms, and consequences of the exposure.
- Be aware of possible behavioral effects of hazard exposure on entrants.
- Continuously maintain an accurate count of entrants in the permit space and ensure a means to accurately identify authorized entrants.
- Remain outside the permit space during entry operations until relieved by another attendant (once properly relieved, he/she may participate in other permit space activities, including non-entry rescue if properly trained and equipped).
- Maintain continuous verbal or radio communication with entrants as necessary to monitor entrant status and alert entrants of the need to evacuate.
- Monitor activities inside and outside the space to determine if it is safe for entrants to remain in the space and order the entrants to immediately evacuate if: the attendant detects a prohibited condition, detects entrant behavioral effects of hazard exposure, detects a situation outside the space that could endanger the entrants; or if the attendant cannot effectively and safely perform all attendant duties.
- Summon rescue and other emergency services as soon as the attendant determines the entrants need assistance to escape the permit space hazards.
- Does not participate in other duties that would interfere with monitoring and protecting the entrants.
- Take the following action when unauthorized persons approach or enter a permit space while entry is under way:
    1. Warn the unauthorized persons that they must stay away from the permit space
    2. Advise unauthorized persons that they must exit immediately if they have entered the space, and
    3. Inform the authorized entrants and the entry supervisor if unauthorized persons have entered the permit space.

Entrants

All entrants must be authorized by the entry supervisor to enter permit spaces. Entrants must observe all entry procedures and must have received the required training. Entrant must:

- Know the hazards that may be faced during entry, including the mode, signs or symptoms, and consequences of the exposure.
- Properly use the equipment required for safe entry.
- Communicate with the attendant as necessary to enable the attendant to monitor the status of the entrants and to enable the attendant to alert the entrants of the need to evacuate the space, if necessary.
- Alert the attendant whenever the entrant recognizes any warning signs or symptoms of exposure to a dangerous situation, or any prohibited condition is detected.
- Exit the permit space as quickly as possible whenever the attendant or entry supervisor gives an order to evacuate the permit space, the entrant recognizes any warning signs or symptoms of exposure to a dangerous situation, the entrant detects a prohibited condition, or an evacuation alarm is activated.

Rescue Services

- Bowling Green Fire Department will respond to an emergency call when entry into a confined space becomes necessary to rescue workers who cannot exit on their own and cannot be rescued with on site non-entry retrieval equipment.
- Conduct practice rescue drills annually and when feasible at WKU confined spaces.

HAZARD CONTROL

Types of Hazards (see Appendix D)

- Explosive / Flammable Atmospheres
- Toxic Atmospheres
- Engulfment
- Asphyxiation
- Entrapment
- Slips & Falls
- Chemical Exposure
- Electric Shock
- Thermal / Chemical Burns
- Noise & Vibration
- Airborne Fibers, Dusts

Engineering Controls

- Lock entry points to prohibit unauthorized entry
- Temporary forced mechanical ventilation eliminating hazardous atmosphere (shall not be used if asbestos is present)
- Temporary Lighting

Administrative Controls

- Signs
- Employee training
- Entry procedures
- Atmospheric Monitoring
- Rescue procedures
- Use of prescribed PPE

PERMIT REQUIRED CONFINED SPACE ENTRY
GENERAL RULES

During all Confined Space Entries, the following Safety Rules must be strictly enforced:

1. No employee may enter a confined space until all hazards are eliminated
2. Upon entry if hazards are identified or suspected, including asbestos, exit the area immediately and contact the project manager or supervisor.
3. Only trained and authorized employees may enter a confined space or act as an attendant.
4. No Smoking is permitted in a confined space or near entrance/exit area. No running vehicles are permitted near the entrance.
5. During confined space entries, an attendant must be present at all times.
6. Constant visual or voice communication will be maintained between the attendant and employees entering a confined space.
7. No bottom or side entry will be made or work conducted below the level of any hanging material or material that could cause engulfment.
8. Air monitoring is required before entering any permit-required confined space.
   For a clean isolated confined space the air monitoring must have been conducted within two hours of entry.
   For all other confined spaces the air monitoring must have been conducted within 15 minutes of entry.
   Atmospheric testing will check for oxygen levels (must be between 19.5% and 23.5%), carbon monoxide (must be less than 35 ppm), hydrogen sulfide (must be less than 10 ppm), and explosive gas levels (must be lower than 10% of the lower explosive limit). If the minimum oxygen content of 19.5 percent cannot be maintained by forced air ventilation, entry will not be permitted. Additional ventilation and oxygen level monitoring is required when welding is performed. Air monitoring results will be made immediately available to all entrants or their authorized representative. Re-testing the space will be done upon entrant's (or authorized representative) request.
9. All openings to confined spaces must be protected by a temporary barrier (such as barrier tape or a railing) when covers are removed.
10. When continuous forced air ventilation is used to eliminate a hazardous atmosphere, air should be taken from a clean source and should be continued until all employees have left the space. This method shall not be used if asbestos is present in the space.
11. When the possibility of a release of hazardous energy exists, the appropriate lockout/tagout procedures shall be utilized.
12. All required personal protective equipment shall be worn.
13. If an emergency entry rescue becomes necessary, the Bowling Green Fire Department should be notified at 911 immediately.

CONFINED SPACE ENTRY PERMITS

14. A Confined Space Entry Permit must be completed **before** any worker enters a Permit-Required Confined Space. There are two available permits on our website; one is for the Steam Plant and the other permit will be used for all other permit required spaces.
15. The completed permit shall be made available and posted from the time of entry until work is completed and the permit is cancelled.
16. Permits will expire before the completion of the shift, if any pre-entry conditions change, or when work is completed. Permits will be maintained on file for 12 months.

Reclassified permit space as a non-permit space.

A permit space may be reclassified as a non-permit space provided there has been shown that no potential atmospheric hazards exists within the space and that they have been eliminated without entry into the space.

TRAINING

Training for confined space entry includes:

- Duties of Entry Supervisor, Entrants and Attendants
- Proper completion of Confined Space Entry permits
- Hazards of Confined Spaces
- Use of Communication Equipment
- Use of Air Monitoring Equipment
- Emergency Action & Rescue Procedures
- Care and use of Confined Space Non-Entry Rescue Equipment
- Care, use and limitations of personal protective equipment
- Annual rescue training on campus for the Bowling Green Fire Department to familiarize the entry rescue team with the area, and entry and removal procedures

EQUIPMENT

The following equipment for confined space entry is kept at the Heat Plant:

- Multi-gas meter – for air monitoring
- Tripod – for non-entry rescue
- Body harnesses
- Ventilating equipment
- Communications equipment

The following equipment for confined space entry is kept in the DFM Electrical Shop:

- Multi-gas meter – for air monitoring
- Tripod – for non-entry rescue (with non-conductive cable)
- Body harnesses

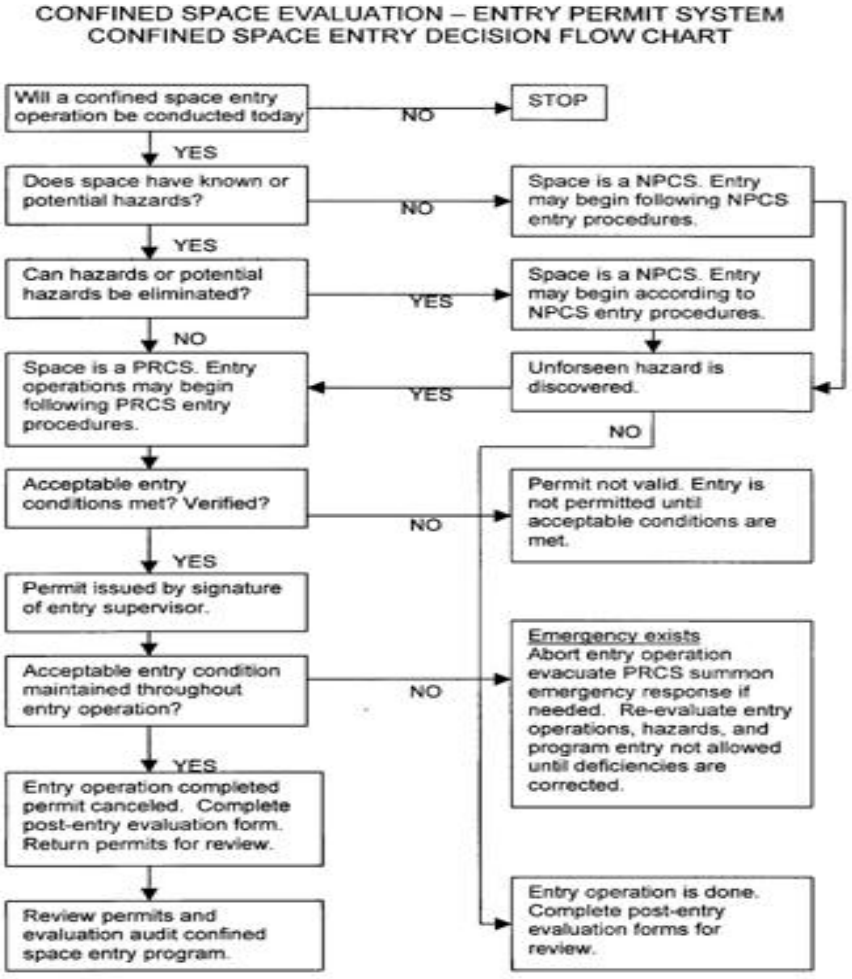
The following equipment is kept in the Environmental Health and Safety office:

- Tripod for non entry rescue
- Multi-gas meter for air monitoring
- Body harnesses

DOCUMENTATION

- EHS will keep all entry permits on file for a minimum of 12 months and will review the permits and program annually.
- Confined Space Training records for WKU employees will be kept by the EHS office for a minimum of 3 years.
- Documentation verifying that air-monitoring equipment has been recalibrated shall be maintained by departments using equipment.

CONFINED SPACE EVALUATION
FLOW CHART



CONTRACTOR CHECKLIST
PRE-ENTRY/POST ENTRY REVIEW FOR
WKU PROJECT MANAGERS AND CONTRACTORS

Pre-Entry

Date _____

1. Inform the contractor that the spaces to be entered are permit-required confined spaces and of the potential hazards present in the space including the notification of the presence of asbestos (if applicable).
2. Ensure that the contractor's confined space program is compliant with all OSHA requirements and that there is a contingency plan in the event that an entry rescue becomes necessary.
3. Apprise the contractor of any precautions or procedures that are normally used to protect employees in or near the permit spaces where contractor personnel will be working.
4. Coordinate entry operations with the contractor, when both University personnel and contractor personnel will be working in or near the permit spaces.
5. Provide contractor with the link to the online WKU Environmental Health and Safety confined space entry permit:

Post entry

Date _____

1. Debrief the contractor at the conclusion of entry operations, on the procedures followed and any hazards confronted or created during entry.

Confined Space(s) to be entered:

Reviewed by:

WKU Project Manager _____

Contractor Representative _____

Company _____

CONFINED SPACE HAZARDS

Flammable Atmospheres

A flammable atmosphere generally arises from enriched oxygen atmospheres, vaporization of flammable liquids, byproducts of work, chemical reactions, concentrations of combustible dusts, and desorption of chemical from inner surfaces of the confined space.

Flammable gases such as acetylene, butane, propane, hydrogen, methane, natural or manufactured gases or vapors can be trapped in confined spaces, and since many gases are heavier than air, they will seek lower levels as in pits, sewers, and various types of storage tanks and vessels. In a closed top tank, it should also be noted that lighter than air gases may rise and develop a flammable concentration if trapped above the opening.

A flammable atmosphere will only occur when a certain chemical/oxygen mixture is present. Below this level, called the Lower Flammable Limit (LFL) or above this level, called the Upper Flammable Limit (UFL), the substance will not ignite. Between the LFL and the UFL, a source of ignition (e.g., sparking or electrical tools) could result in an explosion. **According to OSHA, a space is unsafe if the flammable gas or vapor level is above 10% of the LFL and workers shall not enter.**

The byproducts of work procedures can generate flammable or explosive conditions within a confined space. Specific kinds of work such as spray painting can result in the release of explosive gases or vapors. Welding in a confined space is a major cause of explosions in areas that contain combustible gas.

Combustible dust concentrations are usually found during the process of loading, unloading, and conveying grain products, nitrated fertilizers, finely ground chemical products, and any other combustible material. High charges of static electricity, which rapidly accumulate during periods of relatively low humidity (below 50%), can cause certain substances to accumulate electrostatic charges of sufficient energy to produce sparks and ignite a flammable atmosphere. These sparks may also cause explosions when the right air or oxygen to dust or gas mixture is present.

Methane (CH_4), a highly flammable, nontoxic gas is also released during the decomposition process. Asphyxiation is also possible in a confined space with a high concentration (5 to 15 percent) of methane. Methane is odorless, lighter than air, and displaces oxygen in a space. One of the gases found in manure pits.

Hydrogen sulfide (H_2S) is a very poisonous gas having a readily recognizable "rotten egg" odor. A concentration of only 50 parts per million (comparable to only 3 pounds of sugar mixed with 62,500 pounds of salt) can cause dizziness, irritation of the respiratory tract, nausea, and headache. With concentrations exceeding 1,000 parts per million, death from respiratory paralysis can occur with little or no warning. Hydrogen sulfide is considered the most dangerous of the by-products of manure decomposition. Both carbon dioxide and hydrogen sulfide are

heavier than air, and will tend to settle to the lower areas of the storage facility and remain in high concentrations even after ventilation.

Toxic Atmospheres
The substances to be regarded as toxic in a confined space can cover the entire spectrum of gases, vapors, and finely divided airborne dust in industry. The sources of toxic atmospheres encountered may arise from the following:

1. The manufacturing process (for example, in producing polyvinyl chloride, hydrogen chloride is used as well as vinyl chloride monomer, which is carcinogenic).
2. The product stored [removing decomposed organic material from a tank can liberate toxic substances, such as hydrogen sulfide (H2S)].
3. The operation performed in the confined space (for example, welding or brazing with metals capable of producing toxic fumes).

During loading, unloading, formulation, and production, mechanical and/or human error may also produce toxic gases, which are not part of the planned operation.

Carbon monoxide (CO) is a hazardous gas that may build up in a confined space. This odorless, colorless gas that has approximately the same density as air is formed from incomplete combustion of organic materials such as wood, coal, gas, oil, and gasoline; it can be formed from microbial decomposition of organic matter in sewers, silos, and fermentation tanks. Carbon monoxide is an insidious toxic gas because of its poor warning properties. Early stages of CO intoxication are nausea and headache. Carbon monoxide may be fatal at 1000 ppm in air, and is considered dangerous at 200 ppm, because it forms carboxyhemoglobin in the blood, which prevents the distribution of oxygen in the body.

Carbon monoxide is a relatively abundant colorless, odorless gas, therefore, any untested atmosphere must be suspect. It must also be noted that a safe reading on a combustible gas indicator does not ensure that CO is not present. Carbon monoxide must be tested for specifically. The formation of CO may result from chemical reactions or work activities, therefore fatalities due to CO poisoning are not confined to any particular industry. There have been fatal accidents in sewage treatment plants due to decomposition products and lack of ventilation in confined spaces. Another area where CO results as a product of decomposition is in the formation of silo gas in grain storage elevators. In another area, the paint industry, varnish is manufactured by introducing the various ingredients into a kettle, and heating them in an inert atmosphere, usually town gas, which is a mixture of carbon dioxide and nitrogen.

In welding operations, oxides of nitrogen and ozone are gases of major toxicological importance, and incomplete oxidation may occur and carbon monoxide can form as a byproduct.

Another poor work practice, which has led to fatalities, is the recirculation of diesel exhaust emissions. Increased CO levels can be prevented by strict control of the ventilation and the use of catalytic converters.

Irritant (Corrosive) Atmospheres
Irritant or corrosive atmospheres can be divided into primary and secondary groups. The primary irritants exert no systemic toxic effects (effects on the entire body). Examples of primary irritants are chlorine, ozone, hydrochloric acid, hydrofluoric acid, sulfuric acid, nitrogen dioxide, ammonia, and sulfur dioxide. A secondary irritant is one that may produce systemic toxic effects in addition to surface irritation. Examples of secondary irritants include benzene, carbon tetrachloride, ethyl chloride, trichloroethane, trichloroethylene, and chloropropene.

Irritant gases vary widely among all areas of industrial activity. They can be found in plastics plants, chemical plants, the petroleum industry, tanneries, refrigeration industries, paint manufacturing, and mining operations. Prolonged exposure at irritant or corrosive concentrations in a confined space may produce little or no evidence of irritation. This may result in a general weakening of the defense reflexes from changes in sensitivity. The danger in this situation is that the worker is usually not aware of any increase in his/her exposure to toxic substances.

Asphyxiating Atmospheres
The normal atmosphere is composed approximately of 20.9% oxygen and 78.1% nitrogen, and 1% argon with small amounts of various other gases. Reduction of oxygen in a confined space may be the result of either consumption or displacement.

The consumption of oxygen takes place during combustion of flammable substances, as in welding, heating, cutting, and brazing. A more subtle consumption of oxygen occurs during bacterial action, as in the fermentation process. Oxygen may also be consumed during chemical reactions as in the formation of rust on the exposed surface of the confined space (iron oxide). The number of people working in a confined space and the amount of their physical activity will also influence the oxygen consumption rate.
A second factor in oxygen deficiency is displacement by another gas. Examples of gases that are used to displace air, and therefore reduce the oxygen level are helium, argon, and nitrogen. Carbon dioxide may also be used to displace air and can occur naturally in sewers, storage bins, wells, tunnels, wine vats, and grain elevators. Aside from the natural development of these gases, or their use in the chemical process, certain gases are also used as inerting agents to displace flammable substances and retard pyrophoric reactions. Gases such as nitrogen, argon, helium, and carbon dioxide, are frequently referred to as non-toxic inert gases but have claimed many lives. The use of nitrogen to inert a confined space has claimed more lives than carbon dioxide. The total displacement of oxygen by nitrogen will cause immediate collapse and death. Carbon dioxide and argon, with specific gravities greater than air, may lie in a tank or manhole for hours or days after opening. Since these gases are colorless and odorless, they pose an immediate hazard to health unless appropriate oxygen measurements and ventilation are adequately carried out.

Oxygen deprivation is one form of asphyxiation. While it is desirable to maintain the atmospheric oxygen level at 21% by volume, the body can tolerate deviation from this ideal. When the oxygen level falls to 17%, the first sign of hypoxia is a deterioration to night vision, which is not noticeable until a normal oxygen concentration is restored. Physiologic effects are

increased breathing volume and accelerated heartbeat. Between 14-16% physiologic effects are increased breathing volume, accelerated heartbeat, very poor muscular coordination, rapid fatigue, and intermittent respiration. Between 6-10% the effects are nausea, vomiting, inability to perform, and unconsciousness. Less than 6% oxygen causes spasmodic breathing, convulsive movements, and death.

Mechanical Hazards
If activation of electrical or mechanical equipment would cause injury, each piece of equipment should be manually isolated to prevent inadvertent activation before workers enter or while they work in a confined space.

To prevent vapor leaks, flashbacks, and other hazards, workers should completely isolate the space. To completely isolate a confined space, the closing of valves is not sufficient. All pipes must be physically disconnected or isolation blanks bolted in place. Other special precautions must be taken in cases where flammable liquids or vapors may re-contaminate the confined space. The pipes blanked or disconnected should be inspected and tested for leakage to check the effectiveness of the procedure. Other areas of concern are steam valves, pressure lines, and chemical transfer pipes. A less apparent hazard is the space referred to as a void, such as double walled vessels, which must be given special consideration in blanking off and inerting.

Airborne Dusts and Fibers
Asbestos fibers can be found in some of the steam utility tunnels of the manholes in the insulation. Mechanical ventilation shall NOT be used in steam utility manholes when working in the extended tunnels, because the moving air could cause asbestos fibers to become airborne. Consult the WKU Asbestos Management Program for more information.

Thermal Effects
Four factors influence the interchange of heat between people and their environment. They are: (1) air temperature, (2) air velocity, (3) moisture contained in the air, and (4) radiant heat. Because of the nature and design of most confined spaces, moisture content and radiant heat are difficult to control. As the body temperature rises progressively, workers will continue to function until the body temperature reaches approximately 102° F. When this body temperature is exceeded, the workers are less efficient, and are prone to heat exhaustion, heat cramps, or heat stroke. In a cold environment, certain physiologic mechanisms come into play, which tend to limit heat loss and increase heat production. The most severe strain in cold conditions is chilling of the extremities so that activity is restricted. Special precautions must be taken in cold environments to prevent frostbite, trench foot, and general hypothermia.

Noise
Noise within a confined space may become a hazard due the design of the space or the work conducted with in the space. Increased noise can damage workers hearing temporarily or it may cause permanent loss. Noise can affect communication and the ability to interpret commands or danger signals.

Vibration
Whole body vibration may affect multiple body parts and organs depending upon the vibration characteristics. Segmental vibration, unlike whole body vibration, appears to be more localized in creating injury to the fingers and hands of workers using tools, such as pneumatic hammers, rotary grinders or other hand tools which cause vibration.

Other Hazards
Some physical hazards cannot be eliminated because of the nature of the confined space or the work to be performed. These hazards include such items as scaffolding, surface residues, and structural hazards. The use of scaffolding in confined spaces has contributed to accidents caused by workers or materials falling, improper use of guardrails, and lack of maintenance to insure worker safety. The choice of material used for scaffolding depends upon the type of work to be performed, the calculated weight to be supported, and the surface on which the scaffolding is placed, and the substance previously stored in the confined space.
Surface residues in confined spaces can increase the already hazardous conditions of electrical shock, reaction of incompatible materials, liberation of toxic substances, and bodily injury due to slips and falls. Without protective clothing, additional hazards to health may arise due to surface residues.