HEALTH AND SAFETY PLAN
FOR
UNDERGROUND STORAGE
TANK REMOVAL
CLEAR PRINT PAPER COMPANY
1482 67TH STREET
EMERYVILLE, CALIFORNIA, 94608

PREPARED FOR:

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PREPARED BY:

JOHN PRUETT and ROBERT FLORY
MARCOR ENVIRONMENTAL SERVICES
MARCOR OF CALIFORNIA
HAYWARD, CALIFORNIA 94545

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1.0 INTRODUCTION

MARCOR of California, Inc. (MARCOR) has developed a Health and Safety Plan (HASP) for Clear Print Paper Company (Clear Print) in preparation for the excavation and removal of four (4) underground storage tanks (UST) on the Clear Print Paper Company site at 1482 67TH Street, Emeryville, California, 94608.

1.1 Site Description

The Clear Print site has been used for the preparation of high quality paper products. Paper production processes at the site used medical grade mineral oil and Soltrol[tm] which contains 2,2,4 trimethylpentane. No Soltrol[tm] is present used on site, however residual amounts of the chemical may be present in several of the tanks. MSDS sheets for these products are attached as Appendix A.

1.2 Intent

The intent of this plan is to provide the minimum safety requirements and general procedures to be met by MARCOR and MARCOR subcontractor personnel. All MARCOR personnel will follow the applicable Federal/State rules and regulations and MARCOR Procedure No. 05-510-01 Underground Storage Tank Removal. In the event of conflicting procedures, personnel will follow those which afford the highest protection.

1.3 Scope of Work

The project involves the installation of a 5,000 gallon aboveground storage tank, installation of a 250 gallon day tank and associated peripherals and the excavation and removal of four USTs and restoration of the site.

Specific work activities covered by this HASP include:

1. Install one 5,000 gallon aboveground storage tank, 250 gallon day tank with associated piping, monitors and controls.
2. Cut, break, remove, and dispose of overlying concrete.
3. Install shoring as needed.
4. Excavation of overburden.

5. Empty and rinse tanks.

6. Remove and dispose of tanks.

7. Backfill excavation, and restore site.

1.4 Hazard Overview

The possible hazards associated with the work activities outlined in section 1.3 are slip, trip, and fall accidents, moving equipment and vehicles, falling objects, eye, skin and respiratory contact with dust containing, and eye, skin and respiratory contact with rinse water containing hydrocarbons.

2.0 PROJECT PERSONNEL AND ON-SITE ORGANIZATION

The key project personnel are as follows:

Project Manager Robert F. Flory

Office: (510) 732-7888 Home: (408) 972-9853 Pager: (510) 539-1650

The Project Manager has overall responsibility for ensuring that the management of the excavation and loading is properly carried out. He coordinates between office and field personnel and manages administrative requirements for the HASP.

Project Supervisor

Office: (510) 732-7888 Home: (510) 833-0804 Pager: (510) 448-4502

The Project Supervisor monitors the project's progress, regularly reviews the project schedule, and reviews all major work elements prior to submittal. He oversees scheduling and budgeting, and serves as the primary contact between MARCOR and Clear Print for health and safety issues.

Site Safety and Health Officer John Pruett

The Site Safety and Health Officer (SSHO) is responsible for MARCOR employees and subcontracted personnel on the work site, unless otherwise specified in the HASP. The SSHO will establish operating standards in conjunction with the project manager and project

supervisor and coordinate safety and health activities for the work site. He will review project plans and revisions to plans to assure that safety and health procedures are incorporated through all of the work phases.

The SSHO is responsible for:

- Assuring that a complete copy of the HASP is at the site prior to the start of work activities and that all workers are familiar with it.
- Conducting on-site health and safety training and briefing sessions.
- Ensuring the availability, use and proper maintenance of personal protective decontamination and other safety or health equipment.
- Maintaining a high level of safety awareness amount workers and communicating pertinent safety and heath matters to them promptly.
- Assuring that all activities are performed in a manner consistent with the MARCOR policy and the HASP.
- Monitoring for dangerous conditions during field activities.
- Coordinating with emergency response personnel and medical support facilities.
- Initiating immediate corrective actions in the event of an emergency or unsafe condition.
- Promptly notify the project manager of any emergency, unsafe condition, problem encountered or needed exception to this HASP.
- Recommending improvements in safety and health measures to the project manager.
- Conducting safety and health performance and system audits.

The SSHO has the authority to:

- Suspend activities or otherwise limit exposures if the health or safety of any person appears to be endangered.
- Notify personnel to alter work practices that he deems to not properly protect them or the environment surrounding the AID facilities.
- Suspend an individual from work for violation of the requirements of this HASP.

3.0 SITE ACCESS AND CONTROL

Access to the work site will be limited to the trained authorized personnel governed by this plan. Such personnel are anticipated to include selected employees and subcontractors of AID and MARCOR. Access to the established exclusion zone, where cleaning and loading activities will take place is limited to authorized personnel wearing appropriate personal protective equipment (AWAKE).

The exclusion zone will be cordoned off with flagging tape. The zone will be monitored by the SSHO to ensure personnel do not enter without proper AWAKE. The entry/exit corridor, decontamination zone, and support zone will be located upwind of the active work zone. A sign-in log will be employed to ensure that only authorized employees participate in the removal activities.

4.0 HAZARD EVALUATION

Pharmaceutical grade mineral oil is known to be present. Mineral oil is considered to be non-hazardous, however if taken internally mineral oil has a strong laxative effect if taken orally. Exposure to Soltron™ may trigger eye and skin irritation. Inhalation may cause headaches, dizziness, nausea, and unconsciousness. Ingestion may cause irritation of the stomach and intestines.

The following possible additional hazards are expected on site: high noise levels, falling objects moving equipment and vehicles, trip, slip, and fall accidents, eye, skin and respiratory contact with dust containing, and eye, skin and respiratory contact with rinsate containing hydrocarbons.

5.0 ON-SITE WORK PLAN AND PERSONAL PROTECTIVE EQUIPMENT

5.1 Cleaning and Removal of Tank

Conduct all work in accordance with the Health and Safety Plan (HASP), Clear Print requirements, and local, State, and Federal Regulations. Prior to work initiation, restrict the work area to authorized personnel. Tank cleaning will be completed by MARCOR personnel wearing level "D" Personnel Protective Equipment (AWAKE) consisting of Tyvek, safety glasses, gloves, hard hats, and steel toed boots. Care will be taken to prevent any liquid from reaching the ground. Tank entry will not be authorized.

If allowed the interior of each tank will be rinsed using a detergent, then rinsed using a 2,000 psi cold water pressure washer. Flushing of the ancillary piping will be completed under the direction of Clear Print personnel. Existing piping will be capped inside the building. Rinsate and tank bottoms will be removed from the tanks by vacuum truck and each under uniform hazardous manifest to Gibson Oil and Refining, Redwood City, California.

The tanks will be inerted using dry ice and sealed prior to removal from the excavation. The tanks will be transported under hazardous waste manifest by H & H Environmental Services, Inc. to their facility in San Francisco, California for destruction and recycling.

6.0 SITE MONITORING AND ACTION LEVELS

Potential hazards have been determined by facility knowledge. Monitoring of oxygen levels within the tanks monitored prior to removal of the tanks from the excavations.

7.0 DECONTAMINATION PROCEDURES

Personnel and equipment leaving the exclusion zone shall be checked thoroughly and decontaminated if necessary. Decontamination of personnel will be by scrubbing with a soap/water, mixture followed by clean water rinses. All protective clothing will be added to the debris being transported off-site. Equipment will be pressure washed if necessary

8.0 MEDICAL MONITORING

Medical monitoring will be required for any employees required to wear respirators and required to wear hearing protection. Employees must be provided respirators in accordance with the guidelines of 29 CFR 1910.134. The regulations requires that an individual's ability to wear respiratory protection be medically certified therefore he/she performs designated duties. Employees who wear or may wear hearing protection devices must be provided them in accordance with the guidelines of 29 CFR 1910.95. This regulation requires that an individuals hearing level be medically evaluated.

9.0 PERSONNEL TRAINING

All personnel must have satisfactorily completed hazardous communication training meeting the requirements of 29 CFR 1910.1200 and completed site specific training as outlined below.

Managers and supervisors must have completed an off-site training course of at least 8 hours meeting the requirements of 29 CFR 1910.120(e) on supervisor responsibilities for safety and health at hazardous waste operations within the last 12 months.

A written certificate of training is included in Appendix B for each employee and supervisor requiring training.

Site Specific Training: Site specific training shall be provided to each employee before beginning work on the site. Personnel will be briefed by the SSHO as to the potential hazards to be encountered. Topics will include:

- Availability of this HASP.
- General site hazards and specific hazards in the work areas including those attributable to the chemicals present.
- Selection, use, testing and care of the body, eye, ear, hand, foot, and respiratory protective equipment to be worn, with the limitations of each.
- Decontamination procedures for personnel, their personal protective equipment and other equipment used on the site.
- Emergency response procedures and requirements.
- Emergency alarm systems and other forms of notification, and evacuation routes to be followed.
- Methods to obtain emergency assistance and medical attention.

10.0 EMERGENCY RESPONSE

10.1 Notification of Site Emergencies

In the event of an emergency, site personnel will signal distress with three blasts from an appropriate horn (vehicle horn, air horn, etc.). This sound signal will be loud enough to be clearly heard above other noise present. Appropriate authorities will then be immediately notified of the nature and extent of the emergency.

The table below shows Emergency Response Telephone ;Numbers. This table will be maintained at the work site by the SSHO. The location of the nearest telephone will be determined prior to the initiation of on-site activities.

Emergency Response Telephone Numbers

Fire Department (Emeryville)	911	or	(510) 596-3771
Fire Inspector George Warren (Emeryville)			(510) 596-3759
Ambulance	911	or	(510) 596-3737
Hospital (Children's Hospital Oakland)			(510) 428-3000
Poison Control Center			(800) 523-2222
Chemical Emergency Advice			(800) 424-9300

Should someone be transported to a hospital or doctor, a copy of this Health and Safety Plan must accompany them.

10.2 Responsibilities

The SSHO (or designee) will be responsible for responding to all emergencies. The SSHO will:

1.) Notify appropriate individuals, authorities and/or health care facilities of the potentially hazardous activities and potential wastes that may develop as a result of the investigation.

2.) Have working knowledge of safety equipment available at the site.

3.) Ensure that a map which details the most direct route to the nearest hospital is prominently posted with the emergency telephone numbers.

Employees who will respond to emergency situation involving hazardous materials shall be trained in how to respond to such emergencies. The project supervisor will ensure that the following safety equipment is available at the site; eyewash station, first aid supplies, and fire extinguisher. The emergency response plan will be reviewed daily to ensure its applicability for the planned day's operations.

10.3 Accidents and Injuries

In the event of a safety or health emergency at the site, appropriate emergency measures will immediately be taken to assist those who have been injured or exposed and to protect others from hazards (See Figure 1 for the location of area hospitals in relationship to the site). Personnel trained in first aid procedure should be present during site activities to provide appropriate treatment of injuries or illnesses occurring during site activities.

In the event of a safety or health emergency at the site, the SSHO will be immediately notified. Upon notifications of an exposure incident, the SSHO will contact the appropriate emergency response personnel, who will, according to the seriousness of the accident, provide recommended medical diagnosis and, if necessary, treatment.

The Project Manager and Project Supervisor will be immediately informed of any injuries or incidents. The Project Supervisor and the SSHO will investigate facility/site conditions to determine whether, and at what levels, exposure actually occurred, the cause of such exposure and the means to be taken to prevent the incident from recurring.

An exposure-incident reporting form will be completed by the SSHO, the Project Supervisor and the exposed individual. The form will be filed with the employee's medical and safety records to serve as documentation of the incident and the actions taken.

10.4 Site Communications

Hand signals will be utilized where phones are impractical. If possible, mobile telephones will be present during site activities for emergency response and office communications. The locations of public telephones will be identified prior to the start of activities. These will provide back up for the mobile telephones and serve as the primary off-site communication network. Daily tailgate safety meetings will be used to communicate any new hazards to all site personnel and to reinforced adherence to see work practices.

10.5 Site Security and Control

Site security and control shall be maintained by the Project Supervisor and/or his designee, and the SSHO and/or his designee. Their duties include limiting access to the site to authorized personnel, oversight of project equipment and materials, and general oversight of site activities, as appropriate.

10.6 Emergency Response and Decontamination

In case of emergency, site personnel should evacuate to the identified safe refuge location, both for their own personal safety and to prevent hampering response/rescue efforts. Unless changed by the Project Manager, the command center will be used as the safe refuge. In the case of an evacuation, the SSHO will account for all personnel.

In the event of an emergency, the SSHO will direct all notification, response and follow-up actions with the concurrence of Clear Print. Contact with any outside response personnel (ambulance, fire department, etc.) will be done at the direction of the SSHO, again with the individuals trained in first aid procedures. If an individual is transported to a hospital or a doctor, a copy of this HASP must accompany the individual.

Follow-up activities must be completed before on-site work is resumed following an emergency. All used emergency equipment must be recharged, refilled or replaced. Government agencies must be notified as appropriate. An investigation of the incident must be conducted as soon as possible. The resulting report must be accurate, objective, complete and authenticated (signed and dated).

10.7 Medical/First Aid Response

On-site medical and/or first aid response to an injury or illness will only be provided by trained personnel competent in such matters. The SSHO is responsible for directing these actions and contacting the appropriate off-site response personnel (paramedic, etc.), again with the concurrence of Clear Print.

10.8 Fire Fighting Procedures

A fire extinguisher, intended for small fires, will be available on each operating piece of heavy equipment and in the Project Supervisor's (or his designee's) vehicle during all construction activities. When the fire cannot be controlled with the extinguisher, the area should be evacuated immediately. The SSHO (or designee) will determine the time to contact fire department response personnel.

10.9 Emergency Decontamination Procedure

The extent of emergency decontamination depends on the severity of the injury or illness and the nature of the contamination. Minimum decontamination will consist of detergent washing and rinsing and removal of contaminated outer clothing and equipment. If the emergency is such that there is insufficient time to complete all of these actions, it is acceptable to remove the contaminated clothing without washing it. If the situation is such that the contaminated clothing can not be removed, the person should be given required first aid treatment, and then wrapped in plastic or a blanket prior to transportation to medical care. If heat stress is a factor in the victim's illness/injury, the outer protective garment must be removed from the victim immediately.

10.10 Emergency Equipment

On-site equipment for safety and emergency response shall be maintained, as follows:

- fire extinguisher
- first aid kit
- eye wash station (wash bottles at a minimum)
- extra copy of the Health and Safety Plan

These will be located on-site in the field office area of the Project Supervisor and/or the SSHO.

11.0 SPECIAL PRECAUTIONS

11.1 Heat Stress/Cold Injury Protection Program

Formal training in prevention of heat and/or cold injuries will be provided as part of the site specific training. Informal review of these techniques will be made as part of daily pre-work briefings. Any person who experiences signs of heat related distress will be instructed to stop work immediately. Medical attention will be sought if there is any doubt that prompt and full recovery will result without it. Symptoms of heat related distress include muscle cramps, pale and clammy or hot, dry and flushed skin, confusion, disorientation and incoherent speech, nausea and/or convulsions.

11.2 Heavy Machinery/Equipment

Site employees must remain aware of those site activities that involve the use of heavy equipment and machinery. Respiratory protection, hearing protection and protective eye wear must be worn during site activities. This protective equipment significantly reduces peripheral vision of the wearer. Therefore, it is essential that all employees at the site exercise extreme caution during operation of equipment and machinery to avoid physical injury to themselves or others.

11.3 Construction Materials and Site Refuse

All construction materials and site refuse will be contained in appropriate areas or facility. Site personnel should make certain that soil spoils, cuttings, etc. are not scattered throughout the area of activity and that trash and scrap materials are immediately and properly disposed of.

11.4 Additional Safety Practices

The following are important safety precautions which will be enforced during this work:

- Eating, drinking, chewing gum or tobacco, smoking, or any practice that increases that probability of hand-to-mouth transfer and ingestion of material is prohibited in the exclusion and decontamination zones. Smoking is prohibited anywhere on the work site.
- Hands and face must be thoroughly washed upon leaving the work area and before eating, drinking, or any other activity.
- Contact with potentially contaminated surfaces should be avoided whenever possible. One should not walk through puddles, mud, or other discolored surfaces; kneel on ground, or place equipment on drums, containers, vehicles, or the ground.

- Respirators will be issued for the exclusive use of one worker and will be cleaned and disinfected after each use by the worker.
- Air-purifying respirators will be inspected daily by the SSHO.
- Cartridges for air-purifying respirators in use will change daily at a minimum.
- No excessive facial hair which interferes with the effectiveness of a respirator will be permitted on personnel required to wear respiratory protection equipment. The respirator must seal against the face so that the wearer receives air only through the air purifying cartridges attached to the respirator. Fit testing will be performed prior to respirator use to ensure a proper seal is obtained by the wearer.
- Medicine and alcohol can mask the effect from exposure to certain compounds. Controlled substances and alcoholic beverages must not be consumed by personnel involved in the project. Consumption of prescribed drugs must be at the direction of a physician familiar with the person's work.
- Activities in the exclusion zone will be conducted using the "Buddy System". the Buddy is another worker fully dressed in the appropriate PPE, who can perform the following activities:

  - Provide his/her partner with assistance;
  - Observe his/her partner for signs of chemical or heat exposure;
  - Periodically check the integrity of his/her partner's PPE; and
  - Notify others if emergency help is needed.

- Work areas for various operational activities should be established.
- Personnel and equipment in the work areas should be minimized, consistent with effective site operations.
- Procedures for leaving the work area must be planned and implemented prior to going to the site. Work areas and decontamination procedures and locations must be established on the basis of prevailing site conditions.

- Safety gloves and boots will be taped to the disposable, chemical-protective suits.
- Unsafe equipment left unattended will be identified by a "DANGER, DO NOT OPERATE" tag.

11.5 Daily Log Contents

The Project Manager and the SSHO will establish a system appropriate to the site, the work and the work zones that will record, as a minimum, the following information: Personnel on the site, their arrival and departure times and their destination on the site; Incidents and unusual activities that occur on the site such as, but not limited to, accidents, spills, breaches

of security, injuries, equipment failures and weather related problems. Conversations that may affect the work such as:

1. Media Visits
2. Safety and Health Inspections by the SSHO and external agencies.
3. Owner/Agent Meetings
4. Employee/Union Meetings.

Changes to the Work Plan and the Health and Safety Plan. Daily Information generated such as:

1. Changes to Work and Health and Safety Plans.
2. Work accomplished and the current site status.
3. Air monitoring results.

11.6 Plan Acknowledgement

All site personnel have read the above plan are familiar with its provisions.

PRINTED NAME	SIGNATURE
Site Safety and Health Officer	_____
Project Manager	_____
Project Supervisor	_____
Other Site Personnel	
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
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_____	_____
_____	_____

Procedure Number: 05-510-01

Procedure Name: Underground Storage Tank Removal

Effective Date: 11-01-91

Supersedes Procedure Number: 4.1.3

Responsible Positions: Supervisor, Assistant Operations Manager, Project Manager, and Health and Safety Coordinator

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Objective: Standard Operating Procedure (SOP) for removal and remediation of underground (or aboveground, as it applies) storage tanks.

To provide guidelines that permit MARCOR employees the assurance of a safe and healthful work place during all phases of Underground Storage Tank remediation.

UNDERGROUND STORAGE TANK REMOVAL

OUTLINE

I. ASSIGNMENT OF RESPONSIBILITIES

II. DEFINITIONS

III. PROCEDURE

IV. SPECIAL REQUIREMENTS

V. REFERENCES

H. HOT WORK
Any work involving burning, welding, riveting, or similar fire-producing operations, as well as work which produces a source of ignition, such as electrical equipment, drilling, grinding, abrasive blasting, etc.

I. IGNITION SOURCE
Refers to a heat source of sufficient energy to cause ignition of flammable vapors. The most commonly encountered categories of ignition sources in industry are open flames, hot surfaces, and electrical or frictional sparks.

J. INERTING
Displacement of the atmosphere by a nonreactive gas (such as nitrogen or carbon dioxide) to such an extent that the resulting atmosphere is noncombustible, i.e. oxygen less than 10%.

K. LEAD HAZARD
Refers to the potential that exists for exposure to (tetraethyl) lead in tanks which have been used for leaded petroleum products. Since these tanks will contain residual lead of varying concentrations, they must be regarded as dangerous, to the extent that respiratory protection and protective clothing must be used during the cleaning process in accordance with the Confined Spaces, Leaded Product. These tanks must not be considered lead-free unless indicated by lead-in-air analysis.

L. LEL (LOWER EXPLOSIVE LIMIT)
The Minimum concentration of a combustible gas or vapor in air (usually expressed in percent by volume at sea level), which will ignite if an ignition source is present.

M. LEL/O_2 METER
A meter that measures the vapor or gas concentrations sufficient to support an explosion. Same use as a combustible gas indicator and explosion meter. These meters should always be used when entering a site or confined space where explosive vapors may be encountered. These meters do not measure accurate gas or vapor concentrations in an oxygen deficient atmosphere (<19.5% oxygen). An LEL/O_2 Meter also measures concentration of oxygen.

T. QUALIFIED PERSON
A person, such as a supervisor or engineer, who by reason of experience or instruction, has successfully demonstrated his ability to anticipate, recognize, and evaluate hazards to employees that may occur during underground storage tank closure projects. Training in evaluation of employee exposure to toxic substances, confined spaces entry procedures, and in the use of atmospheric testing instruments is required.

U. SCBA
Self Contained Breathing Apparatus.

V. TRENCH
An excavation made below the surface of the ground. In general, the depth is greater than the width at the bottom, but the width of a trench at the bottom is not greater than fifteen feet.

W. UNDERGROUND STORAGE TANK (UST)
By regulatory definition, a tank with ten percent or more of its volume below ground. Included in the volume is all piping attached to the tank (RCRA, Subtitle I, Section 9002 (1)).

X. UNDERGROUND UTILITY STAKE-OUT
This involves placing a telephone call to utility companies (water, gas, electric, sewer, storm sewer, cable TV, telephone) to inform them where (by street address) we will be excavating. The utility companies will go to the site and mark the lines or call us to let us know they have no lines in that area.

III. PROCEDURES

A. PRELIMINARY REQUIREMENTS

State or local agencies mandated to regulate the RCRA Underground Storage Tank Program shall be notified, and applicable permits must be obtained by the Project Manager or the client.

All underground storage tank projects' health and safety plans shall be reviewed by the Health and Safety Coordinator. Specific information that a Project Manager shall relay to the Health and Safety Coordinator includes tank product identification, concentration or constituents, volume, number of tanks, and the method of tank closure. Refer to MARCOR Procedure No 05-505-01.

The on site Supervisor shall assure that construction equipment and personnel do not come closer than 15 feet to any energized overhead high voltage conductor such as electric utility lines.

Before work begins the Project Manager or Supervisor and Health and Safety Coordinator, if necessary, will evaluate the job site to identify specific site hazards and determine appropriate safety and health control measures needed to protect employees from existing and potential hazards.

If the substance in and around the tank has not been properly identified at this time, steps must now be taken to accurately identify and determine the hazard. Level B Personal Protection must be provided if the contents of the tank and its surroundings cannot be accurately identified and evaluated.

No person is permitted to enter into an area which is potentially hazardous or contaminated without proper PPE unless the area has been analyzed and is safe for human occupancy. Refer to MARCOR Procedure No. 02-102-01 on Respiratory Protection.

C. SITE SPECIFIC SAFETY AND HEALTH PLAN
For each project a Site Specific Safety and Health Plan must be designed by the Project Manager and reviewed by the Health and Safety Coordinator that accurately and completely identifies all hazards associated with that particular job site. Refer to MARCOR Procedure 02-150-01 on Site Health and Safety Plan.

D. JOB SET UP
Before work begins each job site must contain specific exclusion zones to control access to and identify areas in which hazardous substances actually or potentially exceed their permissible exposure limits and where flammable gases or vapors could possibly approach the action level of 10% of the lower explosion limit (LEL).

The on site Supervisor will set up these zones as well as rope or barricade off the work area. Refer to MARCOR Procedure No. 05-552-01 on Site Control.

Fall protection devices shall be used by personnel when work is being performed on top of a UST that has been excavated around one or more sides and the depth of excavation is more than ten (10) feet. The site specific Health and Safety Plan shall address the appropriate means of fall protection in these situations.

F. DRAINING/PUMPING THE TANK

After the top side of the UST has been exposed and the exterior air has been monitored revealing concentrations less than 10 percent of the LEL, the substance may be removed by pumping from the tank. During this operation, employees shall remain in level D protection unless a greater level of protection has been recommended in the Health and Safety Plan.

During pumping, a static electric charge may be created by the turbulent action of the liquid traveling through the hose. If enough static electricity accumulates, a static electric spark may be created causing ignition. Therefore, before any pumping is allowed to transpire, proper grounding must take place. This is accomplished by attaching a metal to metal connection from the tank truck to a grounding device. All dirt, rust or paint must be removed from the metal surfaces to allow for proper bare metal connection.

If at any time, the contents of the UST are determined to be a hazardous substance proper PPE and work practices must be implemented, to prevent employee exposure and safely monitor the work area as recommended by the Health and Safety Coordinator or the Project Manager.

G. INERTING THE TANK

Inerting of the UST is accomplished by introducing a non-combustible gas such as nitrogen or carbon dioxide into the tank (carbon dioxide can be in gas or solid (dry ice) form).

Before inerting, all tank openings (except the vent and fill holes) must be sealed. The vent line must then be extended in a location away from any possible ignition sources and monitored with the combustible gas indicator or LEL meter for explosive conditions.

The non-combustible gas must be entered in a slow fashion, never more than 5 PSI. One standard method of tank inerting is the placement of 15 lbs of dry ice (carbon dioxide) per 1000 gallons of tank capacity into the tank. Allow the dry

The traffic pattern at a work site should also be examined. If the flow of public traffic will be interrupted, its control should be well planned. Signs, barricades and flagpersons may be needed. Workers exposed to vehicular traffic must wear reflective warning vests or other suitable garments.

If mobile equipment is operated next to an excavation, or when such equipment must approach the edge of an excavation and the operator does not have a clear view of the edge of the excavation, barricades, stop logs or some other suitable warning system will have to be used to prevent accidents and caveins.

Personnel entry into any excavation or trench that is more than 5 feet deep shall only be permitted if the excavation or trench is properly sloped or shored and safe for entry as determined by a qualified person.

Excavations must be inspected before work begins each day and after any changes in the trenching environment. The inspection should cover the entire work site, the excavation itself and the protective system. If any danger signals are noticed, workers must leave the hazardous area until corrective steps have been taken.

Workers must wear the appropriate protective clothing, hard hats, work boots and safety glasses.

No one is allowed underneath loads handled by lifting or digging equipment.

No one should work on the sides of sloped or benched excavations above other workers unless the workers in the excavation are protected from falling materials.

Workers are to be protected from soil, equipment and other materials that could fall into an excavation.

Trenches more than 4 feet deep shall have ladders or steps located so as to require no more than 25 feet of lateral travel between means of egress. Ladders shall be placed at an angle not more than 30 degrees from vertical and secured as necessary. Ladder side rails shall extend at lease 3 feet above the original ground surface.

Since even "cold cutting" techniques can be a source of ignition, the atmosphere inside and surrounding the tank will be continuously monitored with an LEL/O^2 meter to ensure that LEL readings remain at less than 10% and oxygen readings are less than 10%.

Before, during, and after cutting, additional tank inerting must take place since some of the noncombustible gas may have escaped and conditions may have once again become dangerous.

K. FIRE SAFETY
Hot work shall not be conducted unless all requirements of welding, cutting, and other hot work in hazardous locations have been met. **Regardless of the inerting process or inert state of the tank the initial cut shall never be with an open flame.**

Cold cutting of USTs to facilitate cleaning shall only be performed under direct supervision of the qualified person on the job site.

A minimum of 2 fire extinguishers with a minimum rating of 10B:C shall be strategically located in the area of active work.

Smoking and any other activity that could potentially be a source of ignition is strictly prohibited on MARCOR UST projects.

L. TANK CLEANING/DISPOSAL
USTs must be cleaned of all liquids, sludges, and residues prior to it's ultimate disposal. Residues may become trapped behind heavy rust and scale inside the tank. Disposal of the tank as a scrap metal will require that the tank be free of all hazardous substances. During cleaning, ventilation or inerting of the tank is necessary.

Thorough tank cleaning may not remove all flammable substances in the tank, such as those that have been absorbed in or penetrated the walls of the UST or those that are retained in seams located at the junction of walls and ends of tanks. Low readings on a LEL/O_2 meter do not assure that explosive conditions will not occur later under conditions that promote vaporization of such residues.

All tank cleaning must be done with non-sparking tools (i.e., bronze, plastic). In addition, if tank illumination is needed, approved explosion proof lighting must be used.

The proper handling and disposal of rinseate, residual product and sludge is necessary. A determination of whether the waste is hazardous or not must take place, and once that determination is made, the waste is handled appropriately. Accordingly, all sludge product and rinseate will be containerized, labeled and analytical samples taken if needed.

Once clean, the tank is marked clean or decommissioned. Two openings are required for a tank to be decommissioned. Proper disposal of a decommissioned storage tank is at a landfill or at a scrap yard. Documentation of transportation and disposal shall be provided to the appropriate regulatory agency, if required, and the client.

IV. SPECIAL REQUIREMENTS

A. AIR MONITORING
Three major hazards involved in UST projects are: exposure to oxygen deficient atmospheres, flammable atmospheres and toxic atmospheres. Air monitoring must be performed to accurately assess the various atmospheres throughout the work site to which MARCOR employees and other people may be exposed.

1. Oxygen Deficient Atmospheres
During various phases of UST projects, the lack (or presence) of oxygen will become a major concern to the health and safety of MARCOR Employees. Therefore air monitoring with an oxygen indicator must be performed at various times throughout the project.

Normal oxygen in air is 20.8 percent. If at any time the oxygen level falls below 19.5 percent, workers must wear a supplied air respirator.

2. Flammable Atmospheres
Flammable liquids or vapors are evaluated by their flammable range. This range is expressed by lower explosive limits (LEL) and upper explosive limits (UEL) in percentages. Below the level of the LEL, the lack of adequate concentrations of flammable gases or vapors will prohibit combustion.

3. Toxic Atmospheres

Toxic Substance Indicators must be used to determine the toxic atmospheres in which employees may be exposed. Their use is important in selecting proper levels of protection for employees. Various models are available to determine the type and concentration of a hazardous vapor in the atmosphere.

A toxic substance possesses the inherent ability to cause adverse effects of injury to the body. This inherent ability to cause adverse effects represents the "hazard" associated with the chemical. "Risk" reflects the probability that injury will result as a consequence of the exposure to or use of that chemical.

Toxic effects that occur within a short time after exposure (within 24 hours) to a hazardous substance are termed "acute". An example of an acute effect is a burn caused by acid coming in contact with the skin. A "chronic" effect is associated with repeated exposures to a substance at concentrations significantly lower than those required to cause an acute toxic effect. An example of a chronic effect is a hepatoma or cancer of the liver caused by repeated exposures to carbon tetrachloride.

The Occupational Safety and Health Act of 1970 established legally enforceable exposure limits to which workers can be exposed for an eight hour day or 40 hour work week without feeling ill effects. These PELs are codified in Tables A-1, Z-2 and Z-3 of 29 CFR 1910.1000. The latest revision was adopted in 1989.

The PELs are time weighted average (TWA) exposure values based on an eight hour day or 40 hour work week. Most workers will be exposed to concentrations above and below these values, but the TWA for the full shift must be at or below the PEL for the chemical(s) to which the workers are exposed.

Threshold Limit Values (TLVs) are recommended limit values established by the American Conference of Governmental Industrial Hygienists (ACGIH). The TLVs also are time weighted average (TWA) exposure values to which workers can be exposed for a normal eight hour day or a 40 hour work week without ill effects. In general

OSHA has not assigned a permissible exposure limit (PEL-TWA) for hydrogen sulfide. However, the National Institute for Occupational Safety and Health (NIOSH) has recommended a permissible exposure limit of 15 milligrams per cubic meter (equivalent to 10 ppm) averaged over a 10 minute period. Areas in which the concentration of H_2S exceeds 70 milligrams per cubic meter should be excavated. ACGIH recommends a threshold limit value (TLV-TWA) of 10 ppm.

To detect or measure the concentration of H_2S in the tank or excavation, a toxic gas detector with a hydrogen sulfide gas sensor is recommended. These instruments require occasional calibration and sensor replacement. Personnel assigned to monitor hazardous and confined spaces should be properly trained in the use and maintenance of the instrumentation.

In addition to its toxicity, hydrogen sulfide gas is flammable. Its lower and upper flammable limits are 4.3 and 46 percent by volume in air, respectively (see the section titled Flammable and Explosive Materials for safety precautions to be taken when working with explosive materials). Therefore, before workers enter tanks that contain hydrogen sulfide gas, the atmosphere inside the tank must be tested with a combustible gas meter in addition to the toxic gas detector.

Tetraethyl and tetramethyl are highly toxic organic lead additives used as antiknock compounds in gasoline. They can cause diseases of the central and peripheral nervous systems, the kidneys and bloodforming system. Skin absorption of these compounds is the major route of entry into the body. However, inhalation of the chemicals can produce similar clinical effects.

The OSHA PEL for both additives is 0.075 milligrams per cubic meter (mg/m^3) while the ACGIH recommends TLVs for tetraethyl lead and tetramethyl lead of 0.01 and 0.15 mg/m^3, respectively.

Tanks that have been used for the mixing, storage or dispensing of leaded gasoline are potential sources of for organic lead poisoning because of the presence of leaded compounds in the sludge and in the scale on the tank shell. Other lead poisoning hazards may arise from

B. DECONTAMINATION
All personnel, personal protective equipment, instruments, and equipment (including the vacuum truck or pumps) shall be decontaminated at the site. The decon solution (typically water) shall be collected and remain on site until proper disposal is arranged.

V. REFERENCES

A. U.S. Environmental Protection Agency (USEPA), Underground Storage Tanks, Technical Requirements, 40 CFR Part 280 and Preamble, Federal Register, September 23, 1988.

B. New York State Department of Environmental Conservation (NYSDEC), Spill Response Guidance Manual, January, 1990.

C. American Petroleum Institute, Assessment and Remediation of Underground Petroleum Releases, API Publication 1628, Second Edition, August, 1989.

D. MARCOR Procedures
1. Excavation and trenching 02-130-01
2. Confined Space 02-120-01
3. Site Health and Safety Plan 05-405-01

FORM UPDATED: 11-01-91 FORM 02303F1

HOT WORK PERMIT (FLAME OR SPARK)

JOB COPY

ISSUED TO

DETAILED DESCRIPTION OF JOB

DATE ISSUED | TIME | AREA OR BUILDING NO.

THE ANSWERS AND ACTIONS TAKEN FOR THE FOLLOWING QUESTIONS MUST BE IN AGREEMENT WITH THE RULES OF THE STANDARD OPERATING PROCEDURE.	YES	NO
1. CAN THE JOB BE DONE OUTSIDE IN A SAFE AREA RATHER THAN IN THE BUILDING?	☐	☐
2. HAVE ALL PROCESS MATERIALS (SOLIDS, LIQUIDS, GASES) BEEN REMOVED FROM THE EQUIPMENT?	☐	☐
3. HAVE ALL LINES BEEN DISCONNECTED AND BLANKED?	☐	☐
4. HAS EXPLOSIMETER TESTS BEEN TAKEN? RESULTS _____ SIGNATURE OF TESTER _____	☐	☐
5. IS A FIRE WATCH REQUIRED?	☐	☐
IF SO, HAS FIRE WATCH BEEN ADVISED OF HIS DUTIES? SIGNATURE OF FIRE WATCH _____	☐	☐
6. IS FIRE EXTINGUISHER OR WATER HOSE AVAILABLE FOR FIRE WATCH?	☐	☐
7. CAN FLAME OR SPARKS IGNITE MATERIALS IN VICINITY OR ON LOWER FLOORS OR LEVELS?	☐	☐
8. HAVE WORKMEN BEEN GIVEN SPECIFIC SAFETY INSTRUCTIONS?	☐	☐
9. IF WORK INVOLVES CONFINED SPACE ENTRY, ARE THE RULES OF THE CONFINED SPACE ENTRY STANDARD OPERATING PROCEDURE BEING ADHERED TO AND HAS CONFINED SPACE ENTRY PERMIT BEEN ISSUED?	☐	☐
10. IS ADJACENT AREA AND EQUIPMENT SAFE?	☐	☐

11. SPECIAL PRECAUTIONS TO BE TAKEN _____

I HAVE PERSONALLY INSPECTED WORK SITE AND APPROVED THIS PERMIT

DATE	TIME ISSUED	DATE	TIME
	☐☐		☐☐

PERSON DOING WORK	SUPERVISOR (PROCESS)	SUPERVISOR OF WORKMEN

FORM UPDATED: 11-01-91 FORM #05510F1

UNDERGROUND UTILITY STAKE-OUT

1) JOB NO.: _____ 2) JOB NAME: _____

3) JOB ADDRESS: _____

4) DESCRIPTION & EXTENT (WIDTH, DEPTH, LENGTH) OF EXCAVATION:

_____

_____

5) DATE OF START: _____

	CO. NAME & TELE. NUMBER	CLEAR	STAKED
GAS			
ELECTRIC			
WATER			
SEPTIC			
STORM SEWER			
TELEPHONE			
CABLE TV			
OTHER			
OTHER			
OTHER			

APPLICABLE UTILITIES HAVE BEEN STAKED AT THE SITE.

_____

PM SIGNATURE DATE

FORM UPDATED: 11-01-91 FORM 05510F2

OWNER AUTHORIZATION FOR EXCAVATION

_____ (Owner)
(Company Name)
hereby authorizes MARCOR to enter and excavate or drill at

_____
(Facility or Location Address).

In the absence of confirmed underground utility or structure locations, Owner agrees to accept the risk of damage and possible costs associated from damage, resulting from this excavation work.

_____
Signature of Owner and Date

_____
Signature of MARCOR and Date

Procedure Number: 02-130-02

Procedure Name: Excavation and Trenching

Effective Date: 07-01-92

Supersedes Procedure Number: 02-130-01

Responsible Positions: Health and Safety Coordinator, Supervisor, Project Manager

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Objective: To set forth minimum health and safety requirements and procedures for personnel who either design or direct the installation of shoring, sloping, and benching systems, or who work in and about trenches or excavations.

Multiple hazards associated with working in and about trenches or excavations include: the potential of running soils, cave-ins, dislodged soil, lack of quick access and egress, and those associated with performance of work in confined spaces. Federal OSHA reports that as many as 100 workers die each year in trenching and excavation operations. Non-fatal injuries occur with greater frequency. Causes of bodily injury, illness, or death include asphyxiation, internal injuries due to physical crushing, and toxic exposures.

A. Pre-excavation Requirements

1. Preparation for Excavation/Trenching

a. The Project Manager shall perform a site reconnaissance and confirm locations of USTs and all associated piping with the client.

In addition, the Project Manager shall assure and record in writing that all existing utility or other underground facilities in the work area are located before commencing excavation. An underground utility stake-out will be conducted prior to any excavation. Underground Utility Stake-Out Form #05510F1 will be used to record the utility stake-out information. If a utility company cannot be utilized, or the lines are privately owned, site plans and an appropriate device such as a cable-avoiding tool or similar device shall be used to locate gas lines, electrical lines, water lines, etc. with the owner. Use Form #05510F2 Owner Authorization for Excavation to document the owner's approval to excavate.

All owners of such facilities shall be advised of the proposed work at least two days (excluding Saturdays, Sundays, and holidays) prior to any excavation.

b. Trees, boulders, poles, and other surface encumbrances located at the excavation/trenching site shall be made safe or removed prior to beginning excavation/trenching.

2. Notification

a. Any project involving trenching or excavations that are five feet or deeper where a person is required to descend shall be reviewed and approved by the Health and Safety Coordinator or his designee.

b. California Specific Requirement: Health and Safety Coordinators shall submit the appropriate pre-job notification to Cal-OSHA; the Cal-OSHA Form 691-b.

3. Permits

a. Outside of California: MARCOR Project Managers shall consult the Health and Safety Coordinator to determine whether or not an OSHA excavation/trenching permit is required. Other state OSHA programs that may require permitting include Alaska, Hawaii, Michigan, Oregon and Washington.

4. Employee Training and Indoctrination

a. Formal Classroom Training

Employees assigned to design, supervise or work in or about excavation/trenches shall have completed formal classroom training which includes the following:

1. Types of hazards associated with excavation/trenching operations;

2. Safe work practices and techniques;

3. Applicable Federal, state and local regulations;

b. Tailgate Safety Meetings

Tailgate Safety Meetings detailing specific hazards of the work to be performed and safety precautions and procedures specific for the job shall be conducted by the Supervisor at the beginning of each shift for each job. Employees shall be reminded daily, prior to the start of the workshift, of the hazards associated with excavation/trenching. Signs of potential earth movement shall be brought to the immediate attention of the Supervisor.

c. Retraining

Personnel shall be periodically retrained in the subject areas listed above. Proof of training and retraining shall be fully documented in writing. Records shall be maintained by the Corporate Training Department.

d. Supervisory Reinforcement

The training described above shall be complemented with effective, ongoing, on-the-job training and one-on-one instruction, as part of standard employee supervision, and to the extent necessary to assure compliance with this directive, other MARCOR policies and procedures, and good health and safety practices.

B. Excavation/Trenching Work Practices

1. Design

Walls and faces of all excavations and trenches five feet or greater in depth, into which employees may enter, shall be guarded by shoring and sloping of the ground, or equivalent means. Design of shoring, sloping or benching systems shall conform with accepted engineering requirements and applicable state or Federal OSHA regulations. All design work shall be approved by a qualified Design Engineer (typically subcontracted).

2. Installation

The MARCOR Supervisor shall ensure that installation of shoring, sloping or alternative systems designed to allow work in an excavation or trench, shall conform with accepted engineering requirements and applicable state or Federal OSHA regulations. As necessary, the Design Engineer shall visit the excavation/trenching site to assure proper installation of the sloping, shoring or alternate system.

3. Work Supervision

Work in an excavation or trench shall at all times be supervised by a MARCOR Supervisor. This individual will remain above the excavation at all times and will be responsible for identifying any unusual developments above ground which may warn of impending earth movement. The Supervisor shall not make changes in the shoring or sloping system without first consulting the Design Engineer.

4. Inspections

Frequent inspections of excavations shall be made by the Supervisor, both before initial entry and as work progresses. If there is any evidence of possible cave-ins or slides, all work in an excavation shall cease until the necessary safeguards have been taken. Particular attention shall be paid after rainstorms or other earth destabilizing events.

5. Work Adjacent to Excavations

No employee shall work adjacent to any excavation until a reasonable examination of the excavation and surrounding area has been made to determine that no conditions exist that may expose employees to injury from moving ground. Special precautions shall be taken at excavations adjacent to streets, railroad tracks, or other sources of external vibrations or superimposed loads.

6. Confined Space Work

Trenching and excavation work that requires employee entry into a confined space shall be performed in accordance with MARCOR procedure #02-120-01 on Confined Space.

7. Unauthorized Entry

No employees shall be permitted to enter the excavation/trench unless they are specifically required to do so. Unauthorized persons shall not be allowed access.

8. Soil Placement

All soil shall be located at least two feet from the edge of the excavation to prevent it from falling back into the excavation. Since surface subsidence indicators, such as fissures or cracks, usually occur within a four-foot distance from the lip of the trench excavation, it is important that Supervisors consider placing soil at a greater distance from the lip so that surface indicators are not covered. No method that disturbs the soil in place (such as driving stakes) shall be used to contain the spoil material.

9. Worksite Guarding

Trenches and excavations shall be completely surrounded and barricaded with orange safety fence. A minimum distance of two feet from the edges shall be maintained where possible. This is to warn employees and/or equipment operators from inadvertently falling into the excavation or trench.

10. Battery-lighted Barricades

Battery-lighted barricades shall be used as follows:

a. A minimum of two battery-lighted barricades shall be used at corners, one on either side of the barricade.

b. At least one battery-lighted barricade shall be used where vehicular traffic approaches the trench at a right angle.

c. Where trenches parallel roadways, distance between battery-lighted barricades shall not exceed 40 feet unless this requirement conflicts with (a) or (b) above and additional units are required.

d. All battery-lighted units shall be serviced as necessary to ensure equipment is operating.

e. Install caution ribbons as appropriate.

11. Entry and Egress

Safe means of entry and egress from the excavation/trench shall be provided. This may be a ladder, stairway or ramp securely fastened in place. Use of ladders for this purpose requires that the ladder side rails shall extend at least three feet above the original ground surface level. Trench access shall be provided and located so as to require no more than 25 feet of lateral travel.

12. Walkways and Bridges

Trenches shall only be crossed where safe crossings have been provided. When the depth of the excavation or trench exceeds 7.5 feet, walkways and bridges shall have standard guardrails (42 inches high at minimum and able to withstand 200 pounds force laterally at the center), and toeboards.

13. Operating Equipment

Employees working near operating excavation equipment shall not be allowed to work in positions that place them in danger of contacting the equipment's moving parts.

14. Undermining

No undermining is permitted without prior review and approval by the Health and Safety Coordinator.

15. Surrounding Work Area

The work area around the excavation/trench shall be kept as free as possible of unnecessary clutter and equipment.

16. Water Entry and Drainage

Appropriate measures shall be taken to prevent surface water from entering the trench or excavation and to provide adequate drainage of the area adjacent to the excavation/trench. Accumulation of water or fluids that could endanger the health and safety of MARCOR employees, either directly or through affecting the excavation/trench's stability, shall be controlled before further work progresses.

17. Backfilling

All trenches, excavations, temporary walls, exploratory drilling, etc., shall be promptly backfilled after work is completed and all associated equipment is removed.

18. Other MARCOR procedures

All applicable MARCOR procedures specific to the job are to be followed in addition to these noted excavation/trench work practices and conditions.

C. DEFINITIONS

1. Accepted Engineering Requirements

Those requirements or practices which are compatible with standards required by a registered architect, a registered professional engineer, or other duly licensed or recognized authority.

2. Angle of Repose

The greatest angle above the horizontal plane at which a material will lie without sliding.

3. Benching

A method of excavation whereby the faces of an excavation or trench are widened progressively outward with respect to the bottom by a specific series of moving ground.

4. Responsible Employee

The MARCOR supervisor who is capable of identifying existing and predictable hazards in the excavation/trenching work area and who has the authority to take prompt corrective measures to eliminate them. Nomenclature for responsibilities equivalent to a Competent Person varies from state to state. For example, in California, the individual with excavation/trenching installation and supervision responsibilities is a "qualified person".

5. Confined Space

Enclosure having limited means for entry and exit, by reason of location, size, or numbers of openings; and has unfavorable natural ventilation that could contain or produce dangerous air contaminants, flammable atmospheres, and/or oxygen deficiency.

6. Design Engineer

A MARCOR employee or subcontractor who is currently registered as a civil engineer in the applicable state, who, in all other respects, meets the requirements of a pertinent State OSHA Program, or Federal OSHA in terms of his or her ability to design shoring, sloping, benching, or alternate trench/excavation systems.

7. Excavation

Any manmade cavity or depression in the earth's surface, including its sides, walls, or faces, formed by earth removal and producing unsupported earth conditions by reasons of the excavation.

8. Hard Compact Soil

All earth materials not classified as running or unstable.

9. Project Manager

An individual who is responsible to coordinate and direct the activities of both the Design Engineer and Supervisor. The Project Manager is responsible to assure that all pre-excavation requirements are met: site preparation, Health and Safety Coordinator notification, OSHA and/or MARCOR internal project permitting, and employee training.

10. Supervisor

A person, such as a supervisor or engineer, who is familiar with the installation of shoring or sloping/benching systems and the attendant hazards of excavation or trenching operations. Supervisors shall meet the particular requirements of State OSHA Programs, or where applicable, the requirements of a Federal OSHA Competent Person. Supervisors shall assure that excavation/trenching work practices are properly followed.

11. Qualified Person (Federal OSHA, 29 CFR 1926.32 (1))

A person, such as an engineer, who by possession of a recognized degree, certificate, or professional standing, or who by extensive knowledge, training and experience has successfully demonstrated his or her ability to design shoring, sloping/benching or alternate systems that meet accepted engineering requirements.

12. Running Soil

Earth material where the angle of repose is approximately zero, as in the case of soil in a nearly liquid state, or dry, unpacked sand which flows freely under slight pressure. Running material also includes loose or disturbed earth that can only be contained with solid sheeting.

13. Shoring System

A temporary structure for the support of earth surfaces formed as a result of excavation work. This structure is formed with metal-wood or hydraulic shoring with sheeting, or use of a trench shield.

14. Sloping

A method of excavation whereby the faces of an excavation or trench are laid back to provide protection from moving ground.

15. Soil

The earth material that is removed in the formation of an excavation.

16. Trench

An excavation made below the surface of the ground. In general, the depth is greater than the width at the bottom, but the width of a trench at the bottom is not greater than 15 feet.

17. Underground Utility Stake-Out

This involves placing a telephone call to utility companies (water, gas, electric, sewer, storm sewer, cable TV, telephone) to inform them where (by street address) we will be excavating. The utility companies will go to the site and mark the lines or call us to let us know they have no lines in that area.

18. Trench Shield

A shoring system composed of steel plates and bracing, welded or bolted together, which support the walls of a trench from the ground level to the trench bottom and which can be moved along as work progresses.

19. Unstable Soil

Earth material, other than running, that because of its nature or the influence of related conditions, cannot be depended upon to remain in place without extra support, such as would be furnished by a system of shoring.

D. REFERENCES

1. Title 29, CFR, 1926(P); Federal OSHA Construction Safety Standards - Excavations, Trenching, and Shoring

2. Title 8, Article 6, California Administrative Code; Cal-OSHA Construction Safety Orders - Excavations, Trenches, Earthwork

1FORM UPDATED: 11-01-91 FORM #05510F1

UNDERGROUND UTILITY STAKE-OUT

1) JOB NO.: _____ 2) JOB NAME: _____

3) JOB ADDRESS: _____

4) DESCRIPTION & EXTENT (WIDTH, DEPTH, LENGTH) OF EXCAVATION:

_____

_____

5) DATE OF START: _____

	CO. NAME & TELE. NUMBER	CLEAR	STAKED
GAS			
ELECTRIC			
WATER			
SEPTIC			
STORM SEWER			
TELEPHONE			
CABLE TV			
OTHER			
OTHER			
OTHER			

APPLICABLE UTILITIES HAVE BEEN STAKED AT THE SITE.

_____

PM SIGNATURE DATE

FORM UPDATED: 11-01-91 FORM 05510F2

OWNER AUTHORIZATION FOR EXCAVATION

_____ (Owner)

(Company Name)
hereby authorizes MARCOR to enter and excavate or drill at

_____

(Facility or Location Address).

In the absence of confirmed underground utility or structure locations, Owner agrees to accept the risk of damage and possible costs associated from damage, resulting from this excavation work.

_____

Signature of Owner and Date

_____

Signature of MARCOR and Date

Procedure Number: 02-303-01

Procedure Name: Welding, Cutting and Other Hot Work in Hazardous Locations

Effective Date: 11-01-91

Supersedes Procedure Number: 4.1.9

Responsible Positions: Health and Safety Coordinator, Project Manager, Operations Manager, Assistant Operations Manager, Supervisor

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Objective: To prescribe workplace health and safety procedures for welding, cutting and other hot work in hazardous locations.

SCOPE

All operations which process, handle or otherwise have an exposure to combustible or flammable liquids, vapors, gases and solids are subject to the provisions of this directive. This shall include, but is not limited to, hot work in conjunction with the following operations.

A. Chemical waste treatment facilities and tank farms.

B. Oil reclamation facilities and tank farms.

C. Repair and maintenance of vacuum trucks, portable tanks, hydroblasters, pressure washers, and other rolling equipment where fuel sources are present.

DISCUSSION

Approximately six percent of fires in industrial properties have been caused by cutting and welding, primarily with portable equipment in areas not specifically designed or approved for such work. Industrial experience has shown that most of the deaths, injuries, and property damage resulting from such fires can be prevented by initiating and maintaining hot work permit programs.

These programs, by definition, require that authorization be secured before equipment capable of igniting combustible materials is handled outside areas normally specified for its use.

The purpose of this directive is to prescribe policies and procedures which can be used to reduce the potential fire hazards of hot work. The extent to which the measures can be applied will depend upon the size of the plant, facility or equipment; the complexity of the operations and the degree of hazard present at the work site and in surrounding areas.

Procedure Number: 02-303-01
Procedure Name: Welding, Cutting and Other Hot Work in Hazardous Locations

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PROCEDURE

A. Management Responsibilities

1. Based on fire potential the Health and Safety Coordinator shall establish approved areas for welding, cutting and other hot work on its property.

2. The Health and Safety Coordinator is responsible for authorization of welding, cutting, and other hot work in areas not specifically designed or approved for such operations. The Health and Safety Coordinator shall be aware of the fire hazards involved and familiar with the provisions of this directive, and may delegate this responsibility to qualified persons as necessary.

3. Equipment for the purpose of hot work, such as torches, manifolds, regulators, or pressure reducing valves, and acetylene generators, must be approved by the health and Safety Coordinator prior to use by MARCOR employees and contractor personnel.

4. The Health and Safety Coordinator shall ensure that cutters or welders and their supervisors are properly trained in the safe operation of their equipment, the safe use of the process, and emergency procedures in the event of a fire.

5. Selection of contractors shall be limited to those who have suitably trained personnel to perform welding, cutting and other hot work.

6. All contractors must be advised of specific hot work areas, and hazardous locations where special procedures for hot work are necessary.

B. Fire Prevention Precautions

1. Cutting, welding, or other hotwork shall be permitted only in areas that are or have been made firesafe.

2. Within the confines of an operating plant, tank farm, or building, cutting and welding shall be done in either

   a. A specific area designed or approved for such work, such as a maintenance shop or detached outside

location which shall be of noncombustible or fire-resistive construction, essentially free of combustible and flammable contents, and suitably segregated from adjacent areas; or

b. When work cannot be moved practically, the area shall be made firesafe by removing combustibles or protecting combustibles from ignition sources.

3. Cutting or welding shall NOT be permitted in the following situations:

a. In unauthorized areas.

b. In the presence of explosive atmospheres (mixture of flammable gases, vapors, liquids or dusts with air) or explosive atmospheres that may develop inside uncleaned or improperly prepared drums, tanks, or other containers and equipment which has previously contained such materials.

c. In any area where combustible gas indicator readings are in excess of ten percent of the lower explosive limit or if oxygen levels are elevated (22% or above) unless the atmosphere can be inerted by lowering of the % oxygen to less than 10%.

d. On storage or process vessels or lines in service which contain flammable or combustible liquids, gases, vapors or solids.

C. Preparation and Permits for Hot Work

1. Before any welding, cutting, or other hot work is permitted, the area shall be inspected by the Health and Safety Coordinator to ensure that the following requirements have been met.

a. Cutting and welding equipment to be used shall be in safe operating condition and in good repair.

b. Where practical, all combustible material shall be relocated at least 35 feet horizontally from the work site. Where relocation is impractical, combustibles shall be protected with flame-proofed covers or otherwise shielded.

c. Openings or cracks in walls, floors or ducts within 35 feet of the site shall be tightly covered to prevent the passage of sparks to adjacent areas.

d. Where cutting or welding is to be done near walls, partitions, ceiling or roof of combustible construction, fire-resistent shields or guards shall be provided to prevent ignition. If welding is to be done on a metal wall, partition, ceiling, or roof, precautions shall be taken to prevent ignition of combustibles on the other side, due to conduction or radiation.

e. Fully charged and operable fire extinguishers, appropriate for the type of possible fire, shall be available at the work areas. Where fire hose lines are available, they shall be connected and ready for use.

f. Individuals assigned to watch for fire must be designated whenever hot work is performed in hazardous locations.

g. Combustible gas indicator readings are taken and the work area is free of combustible gases and vapors in concentrations above 10% of the LEL.

h. The work area is free of toxic contaminants at concentrations in excess of established threshold limit values, or, all personnel who will work in the area have been provided respiratory protective devices and protective apparel appropriate for the degree of exposure. In the case of chlorinated hydrocarbons, there can be no contamination at any concentration due to the danger of generating phosgene.

i. If hot work requires an entry into a confined space, as defined above, all provisions of Confined Space MARCOR Procedure #02-120-01 shall be met, including Inspections and Tests for Entry Into Confined Spaces Form #02120F1 shall be completed and posted at the entrance to the confined space.

j. When hot work is to be performed on the tanks or other vessels that contain or have contained

flammable or combustible liquids, the vessel shall be properly isolated, purged, and cleaned as appropriate, to reduce the concentrations of flammable and toxic air contaminants to safe levels.

k. When hot work is to be performed on tanks or other vessels that contain or have contained leaded products, and represent a lead hazard, all provisions of Confined Space MARCOR Procedure #02-120-01 shall be met, and only after consultation with the Health and Safety Coordinator shall hot work be authorized.

l. When hot work is to be performed on the bottoms of tanks or other vessels that are not supported above grade, special procedures shall be followed due to the possible entrapment of flammable liquids or vapors beneath the tank. For vessels that have at one time contained flammable materials refer to "Preparing Tank Bottoms for Hot Work" Petroleum Safety Data 2207, American Petroleum Institute (attached).Work shall be performed on stationary tank bottoms only when both the qualified person and the contractor personnel have become familiar with this reference and the contractor personnel shall follow the outlined procedures.

D. Hot Work Permit

1. When the qualified person is satisfied that all the requirements have been met, the Hot Work Permit Form #02303F1 (American Petroleum Institute, PSD 2207, "Preparing Tank Bottoms for Hot Work") shall be completed, reviewed with personnel who will perform the hot work, and posted near the jobsite.

2. The hot work permit is good only for the date issued, and is valid only for the eight-hour shift for which it is issued.

3. If at any time during the hot work operation a change in conditions at the work site is suspected, such as release of flammable gases or vapors in the work area, work shall be stopped immediately and the qualified person shall be notified. Such work stoppage invalidates the hot work

permit and a new permit shall be completed after inspections and tests have been performed by a qualified person.

4. No erasures or changes of dates on hot work permits shall be permitted.

5. When two or more departments or operating divisions have equipment in an area in which a hot work permit is needed, the department or division most closely associated with the hot work shall secure whatever clearance is needed from the other departments or divisions.

E. Special Permits

In addition to regular hot work permits such as those for welding and cutting, it may be necessary, based on the potential fire hazard, to require the use of special hot work permits for particular sources of ignition used in hazardous locations.

The following activities and types of equipment are among the potential sources of ignition for which hot work permits may be required:

1. Torches and other open flames.
2. Hot riveting.
3. Hot forgoing.
4. Salamanders.
5. Combustion engines.
6. Portable electric tools.
7. Grinding.
8. Polishing.
9. Drilling.
10. Chipping.
11. Soldering.
12. Sandblasting.
13. Freeing seized bearings.
14. Portable propane or electrical heaters.
15. Hot plates.
16. Discharging photographic flash bulbs.

DEFINITIONS - FOR THE PURPOSE OF THIS DIRECTIVE

A. Atmosphere - The gases, vapors, mists, fumes and dusts within

a confined space.

B. Confined Space - Normally considered to be enclosures having limited means of entry and exit by reason of location, size or number of openings; and unfavorable natural ventilation which could contain or produce dangerous air contaminants, flammable or explosive atmospheres, and/or oxygen deficiency. Confined spaces include, but are not limited to, storage tanks, compartments of ships, process vessels, pits, silos, vats, degreasers, reactions vessels, boilers, ventilation and exhaust ducts, sewers, tunnels, underground utility vaults, bins, tubs, tank trucks and pipelines.

Classes of confined spaces, based on concentrations of toxic contaminants, have been established and are defined in Confined Spaces - Industrial.

C. Contaminant - Any organic or inorganic substance, dust, fume, mist, vapor, or gas, the presence of which in air can be harmful or hazardous to human beings.

D. Hot work - Any work involving during, welding, riveting, or similar fire producing operations, as well as work which produces a source of ignition, such as drilling, abrasive blasting, and space heating.

E. Ignition source - Refers to a heat source of sufficient energy to cause ignition of flammable vapors. The most commonly encountered categories of ignition sources in industry are open flames, hot surfaces, and electrical frictional sparks.

F. Inerting - Displacement of the atmosphere by a nonreactive gas (such as nitrogen or carbon dioxide) to such an extent that the resulting atmosphere is noncombustible.

G. Isolation - A process whereby the confined space is removed from service and completely protected against the inadvertent release of materials by the following means: inserting a suitable full-pressure blank (skillet type metal blank between flanges) in all lines, misaligning sections of lines and pipes, or valve chain lockout of lines and pipes; and lockout of all sources of electrical power and blocking or disconnecting all mechanical linkages.

H. Lead Hazard - Refers to the potential for exposure to organic (tetraethyl) lead in tanks which have been used for leaded petroleum products. Since these tanks will contain residual

lead of varying concentrations, they must be regarded as dangerous to the extent that respiratory (fresh-air gear) and whole body skin protection must be used throughout the cleaning process. These tanks must not be considered lead-free until proven so by lead-in-air analysis. Specific requirements for entry into confined spaces which contain or have contained leaded products are prescribed in Confined Spaces, Leaded Product.

I. LEL (lower explosive limit) - The minimum concentration of a combustible gas or vapor in air (usually expressed in percent by volume at sea level), which will ignite if an ignition source is present.

J. Oxygen deficiency - Refers to an atmosphere with a partial pressure of oxygen of less than 132mm Hg. Normal air contains approximately 21% oxygen. For the purpose of this directive, any atmosphere containing less than 19.5% oxygen shall be considered oxygen deficient and immediately dangerous to life and health. All requirements for work in Confined Spaces, Class "B" must be met.

K. Purging - The method by which gases, vapors, or other airborne impurities are displaced from a confined space. This may involve such measures as mechanical ventilation, steam ventilation or introducing another gas such as nitrogen or carbon dioxide to control flammable vapors.

L. Qualified person - A person designated by the employer, in writing, as capable (by education and/or specialized training) of anticipating, recognizing, and evaluating employee exposure to hazardous substances or other unsafe conditions. Training in the evaluation of employee exposure to toxic substances and in the use of atmospheric testing instruments is required, plus knowledge or experience in specifying the necessary precautions to be taken for the protection of employees under the applicable conditions.

REFERENCES

A. Standard for Fire Prevention in Use of Cutting and Welding Processes, NFPA No. 51-B-1976.

B. Standard for the Installation and Operation of Oxygen-Fuel Gas Systems for Welding and Cutting, NFPA No. 51-1974.

C. Gas Systems for Welding and Cutting, Title 8, California Administrative Code, Group 10, Cal-OSHA.

ATTACHMENTS

"Preparing Tank Bottoms for Hot Work", American Petroleum Institute, PSD 2207.

PETROLEUM SAFETY DATA

Compiled by Committee on Safety and Fire Protection

AMERICAN PETROLEUM INSTITUTE
1801 K Street, N.W. Washington, D.C. 20006

PREPARING TANK BOTTOMS FOR HOT WORK

SCOPE

The purpose of this data sheet is to outline safety precautions for preventing accidental fires and/or explosions while making hot-work repairs to the bottoms of tanks.

INTRODUCTION

For the purpose of this data sheet, the term "hot work" is defined as any operation that will or can produce a spark or flame hot enough to cause the ignition of flammable liquids or vapors.

Special techniques are required in the performance of hot work on tank bottoms to prevent ignition of flammable liquids or vapors that may be entrapped under the tank.

Tanks that have contained flammable liquids must be considered unsafe for hot work, regardless of age and type of construction, until safety inspection proves otherwise.

Although each repair job must receive careful individual consideration, the safety procedures described herein provide various methods for preparing tank bottoms for hot work which will be applicable to most situations.

GENERAL PRECAUTIONS

The tank must be safety isolated, cleaned, and ventilated in accordance with applicable provisions of API RP 2015: Cleaning Petroleum Storage Tanks before authorization is given to perform hot-work operations.

Visual inspections of the hot-work area will be necessary. The conditions and safety precautions under which hot work is to be performed must be clearly stated. The person or persons responsible for authorizing the hot work should designate the precautions to be followed.

Adequate first aid fire-fighting equipment should be available and ready for instant use. Workmen should be instructed in the proper use of this equipment.

INSPECTION PROCEDURES

When hot-work repairs are contemplated, an inspection of the tank bottom must be made, regardless of suspected condition.

Appropriately sized small openings are sometimes made in the tank bottom in each area where hot work is to be performed to facilitate visible inspections and combustible gas tests. Cold cutting or drilling with hand or air operated tools is considered safe from an ignition hazard for cutting such openings. A coolant should be applied to the cutting edge of such tools to reduce the heat of friction.

The results of combustible gas tests taken from the underside of a tank bottom and analysis of samples of soil under the tank will determine if a potential hazard from flammable liquids or vapors exists and the correct work procedures to follow.

SAFE WORK PROCEDURES

The work procedures adopted will be determined by the condition of the tank bottom, the type and extent of the hot-work repairs to be performed, and inspection results.

Inasmuch as tank bottoms proven free of flammable liquids and/or vapors pose no problem, the safe work procedures described in the following apply only to those situations where flammable liquids or vapors are present.

Minor Repairs

This type of hot work usually involves the welding of supports, braces, corrosion pits, patches, or other repair jobs localized to small areas.

1. Drill an tap a 1/2-in. hole adjacent to the repair area.
2. Connect a cylinder of carbon dioxide (CO2) or other inert gas to the 1/2-in. tap by using metal tubing.
3. Maintain a flow of inert gas to insure that before work has begun and during the course of work the atmosphere below the tank, in the area of welding, will not support combustion of any flammable vapor that may be present.
4. Remove tubing, plug hole, and backweld promptly, as required.

Major Repairs

When repair jobs involving most of the tank bottom are planned, it may be desirable to displace the flammable liquids and/or vapor beneath the tank by water flooding.

1. Drill and tap 1/2-in. holes in the bottom of the tank at high points, sufficiently spaced to assure proper inspection and dispersement of water.

2. Install pipe nipples to be used as vents, check points, and water inlets. Height of nipples should exceed the earthen dike mentioned next.

3. Construct an earthen dike higher than the highest floor plate in the tank around the outer shell of the tank.

4. Fill the space underneath the tank with water. Continue the flow of water as required to maintain a constant high water level within the dike.

5. Watch for leakage inside the tank and temporarily plug leaks as necessary to keep the tank bottom dry.

6. Remove nipples, plug holes, and backweld as required after repairs are completed.

Perimeter Repairs

Repairs around the periphery of a tank bottom may be made safely after the following preparations:

1. Excavate under the edge of the tank. Such excavations should extend a minimum of 12 in. beyond the point of any hot work area and must be large enough for a man to work in with safety and comfort.

2. Seal off all openings between the floor plates and the tank foundation by packing with mud, asbestos, or some other suitable material. Such packing should be checked from time to time to assure that the seal has remained intact.

3. Use a combustible gas indicator to check excavations and seals between floor plates and foundation.

4. A portable air blower may be used for ventilation purposes.

NOTE: Excavations should be carefully refilled to prevent possible failures to tank foundations.

* MARCOR Note: Use of asbestos must be approved and proper precautions and personal protection should be used.

Sectional Repairs

When making sectional repairs to tank bottoms, the following methods may be used:

1. Cold-cut the tank bottom to be replaced, using a hand or air operated tool, and remove. A coolant should be applied to the cutting edge of such tools to reduce the heat of friction.

2. Remove earth from under the section to be replaced. Fill with sand and seal the perimeter of the patch area with mud, asbestos, or other suitable noncorrosive material.

3. Use a combustible gas indicator to be sure an effective seal has been made.

4. Maintain an inert atmosphere under the patch area when hot work is being done during installation of a new section. This may be accomplished by using dry ice or CO2 or other inert gas contained in a cylinder.

Double-Bottom Installation

When constructing a double bottom in a tank, the following procedures may be used:

1. Place at least 4in. of sand over the existing floor.

2. Install a new bottom by welding.

NOTE: Hot work can be safely performed on tank foundations that are saturated with oils if there are no combustible vapors present and there is no imminent danger of oil penetrating the sand barrier and contacting the new bottom to be welded on.

The foregoing procedures are not intended to cover all the different types of tank bottom hot-work repairs that may be encountered. They do, however, describe a variety of situations which point out the basic principles of safety that can be applied.

SPECIFIC PRECAUTIONS

1. Work permits for tank entry and/or hot work must be properly signed and issued before work is started.

2. An air mover should be in operation at all times during entry and hot work.

* MARCOR Note: Use of asbestos must be approved and proper precautions and personal protection should be used.

3. Lines to and from the tank that have been blanked off, disconnected, or otherwise isolated should not be disturbed or dismantled during entry and/or hot work.

4. Metal surfaces of tanks previously used in leaded products service should be cleaned of all deposits at least 12in. on all sides of heat contact prior to performing hot work. As an alternate to cleaning down to bare metal, workmen performing the hot work may use fresh-air respiratory equipment.

5. Grounding leads from the welding machine should be attached directly to the tank where hot work is to be performed.

6. Cylinders of compressed gas used for cutting operations should be securely fastened in an upright position and kept outside the tank at a safe distances away from the open manholes. Cutting torches and hoses must be shut off at the cylinder valves and kept outside the tank when not in use.

7. The area inside and outside the tank should be kept clear of combustible material.

FORM UPDATED: 11-01-91 FORM 02303F1

HOT WORK PERMIT (FLAME OR SPARK)

JOB COPY

ISSUED TO

DETAILED DESCRIPTION OF JOB

DATE ISSUED	TIME	AREA OR BUILDING NO.

THE ANSWERS AND ACTIONS TAKEN FOR THE FOLLOWING QUESTIONS MUST BE IN AGREEMENT WITH THE RULES OF THE STANDARD OPERATING PROCEDURE.	YES	NO
1. CAN THE JOB BE DONE OUTSIDE IN A SAFE AREA RATHER THAN IN THE BUILDING?	☐	☐
2. HAVE ALL PROCESS MATERIALS (SOLIDS, LIQUIDS, GASES) BEEN REMOVED FROM THE EQUIPMENT?	☐	☐
3. HAVE ALL LINES BEEN DISCONNECTED AND BLANKED?	☐	☐
4. HAS EXPLOSIMETER TESTS BEEN TAKEN? RESULTS _____ SIGNATURE OF TESTER _____	☐	☐
5. IS A FIRE WATCH REQUIRED?	☐	☐
IF SO, HAS FIRE WATCH BEEN ADVISED OF HIS DUTIES? SIGNATURE OF FIRE WATCH _____	☐	☐
6. IS FIRE EXTINGUISHER OR WATER HOSE AVAILABLE FOR FIRE WATCH?	☐	☐
7. CAN FLAME OR SPARKS IGNITE MATERIALS IN VICINITY OR ON LOWER FLOORS OR LEVELS?	☐	☐
8. HAVE WORKMEN BEEN GIVEN SPECIFIC SAFETY INSTRUCTIONS?	☐	☐
9. IF WORK INVOLVES CONFINED SPACE ENTRY, ARE THE RULES OF THE CONFINED SPACE ENTRY STANDARD OPERATING PROCEDURE BEING ADHERED TO AND HAS CONFINED SPACE ENTRY PERMIT BEEN ISSUED?	☐	☐
10. IS ADJACENT AREA AND EQUIPMENT SAFE?	☐	☐

11. SPECIAL PRECAUTIONS TO BE TAKEN _____

I HAVE PERSONALLY INSPECTED WORK SITE AND APPROVED THIS PERMIT

DATE	TIME ISSUED	DATE	TIME
	AM ☐ PM ☐		AM ☐ PM ☐

PERSON DOING WORK	SUPERVISOR (PROCESS)	SUPERVISOR OF WORKMEN

Procedure Number: 02-342-01

Procedure Name: Hearing Conservation

Effective Date: 11-01-91

Supersedes Procedure Number: 4.1.18

Responsible Positions: Health and Safety Coordinator

Objective: To prescribe the general requirements of the hearing conservation program, and to provide information and guidance on the proper selection, instruction and training, and use of hearing protective devices.

Evidence is well established that worker exposure to noise of sufficient intensity and duration can result in hearing damage. Noise induced hearing loss can happen unnoticed over a period of years. Hearing loss in the high frequency ranges seriously affects understanding of speech, since hearing at these higher frequencies is necessary to discriminate the consonants of speech that carry information. Many factors may influence the course of noise induced hearing loss.

The overall "decibel level" of the noise exposure is obviously important. If a noise exposure does not cause auditory fatigue, the exposure is not considered harmful to hearing sensitivity.

The "frequency spectrum" of the noise must also be considered. Noise exposure in the high frequency ranges is generally more harmful than low frequency noise.

The daily "time distribution" of the noise exposure is another factor. Noise which is intermittent in character is generally less harmful to hearing than steady state noise. Individual consideration must be given since not every individual will develop identical hearing impairment if exposed to the same noise intensity over the same time period.

The extra-auditory (or non-auditory) effects of noise should also be considered. While evidence to support extra-auditory health effects may not be as complete as the case for hearing loss, some concern is warranted. Noise can alter the normal functions of the endocrine, cardiovascular and neurological systems. Subjective complaints of nausea, malaise, and headache have been reported in workers exposed to ultrasonic noise levels.

Employees exposure to excessive noise levels are regulated by both Federal OSHA (29 CFR 1910.95). These regulations require that the employee administer a continuing, effective hearing conservation program whenever employee noise exposures equal or exceed an 8-hour time-weighted average sound level of 85 decibels.

This MARCOR directive prescribes the general work place practices and controls required to prevent employee exposure to excessive noise levels. The extent to which the measures can be applied will depend on the nature of the operations, the types of equipment used in the work area, and the degree of hazard at the work site and in surrounding areas.

PROCEDURE

A. General Program Requirements

1. A hearing conservation program shall be implemented and protection against the effects of noise exposure shall be provided when the sound levels exceed those shown in 29 CFR 1910.95 Appendix A, Table A-1, when measured on the A-weighted scale of a standard sound level meter at slow response.

2. For compliance purposes, a minimally effective hearing conservation program consists of the following items:

   a. Monitoring of the workplace to determine the representative exposure of employees to excessive noise levels;

   b. An audiometric testing program which includes: a baseline audiogram for all employees exposed to noise levels equal to or in excess of the standard; annual audiograms for each overexpose employee; analysis of audiogram results with retesting and/or referral to an otolaryngologist or qualified physician when a significant threshold shift (STS) occurs, and written employee notification of the STS;

   c. A training program for all employees exposed to noise levels equal to or in excess of the standard; and

d. Personal protective equipment shall be provided to all affected employees when administrative or engineering controls fail to reduce sound levels to within the levels of the standards.

3. Employees shall be notified of the need to avoid high levels of non-occupational noise exposure during this 14 hour period.

4. Annual Audiograms

Annual audiograms shall be obtained as a regular part of the periodic/update medical examination.

B. Employee Training and Information

1. Training Program

a. All employees who are subject to exposure to excessive noise levels shall complete a formal training program, which shall include, as a minimum, the following information:

1. The effects of noise on hearing;

2. The purpose of hearing protectors, the advantages, disadvantages, and attenuation of various types, and instructions on selection, fitting, use and care;

3. The specific nature of the operations which could result in exposure to excessive noise levels;

4. A description of the medical surveillance program, including a description of the purpose of audiometric testing, and an explanation of the test procedures; and

5. The engineering controls and safe work practices associated with the employee's job assignment.

b. The training program shall be repeated annually. Training records are maintained by the Corporate Health, Safety and Training Department.

2. Tailgate Safety Meetings

Job site Tailgate Safety Meetings, conducted in accordance with MARCOR 4.3.2, shall include instruction on the need for hearing protection devices in designated areas.

3. Hearing Conservation Program Information

a. The Health and Safety Coordinator is responsible to determine and comply with state requirements for disclosure, posting, etc.. of information concerning the hearing conservation program.

b. All employees shall be provided a Hearing Conservation Program Information Sheet at the time of their annual audiogram or upon request. Additionally, new employees shall be provided this information at the time of their baseline (preemployment) audiogram.

C. Control Measures

1. General - A straightforward method of controlling noise exposure is to examine the problem in terms of its three basic elements: i.e., sound arises from a source, travels over a path, and affects a receiver, or listener. Solution of a given noise problem might require alteration or modification of any all of these three basic elements:

a. low-noise certification;

b. advertisement of "quiet" operation, evidence of noise control design;

c. evidence of "lower" and "slower" operating characteristics;

d. conduct side-by-side noise tests of equipment;

e. request an "on-site" or "in operation" inspection of mechanical equipment before purchase.

2. Reduce Operating Noise - Most mechanical devices are complex noise generators. Though it is impractical to discuss all possible solutions to all noise problems, some general descriptions of control measures are provided below;

   a. reduce impact or impulse noise by reducing weight, size or height of fall impacting mass;

   b. reduce speed in machines and flow velocities and pressure in fluid systems;

   c. balance rotating parts to control machinery noise and vibration of fans, fly wheels, pulleys, cams, shafts, etc.

   d. reduce frictional resistance between rotating, sliding or moving parts in mechanical systems: frequent lubrication, proper alignment of moving parts; correction of eccentricity or "out-of-roundness" of wheels, gears, rollers, pulley, etc.

   e. reduce resistance in air or fluid systems: use of low flow velocities, smooth boundary surfaces of duct or pipe systems, and long radius turns and flared sections in pipes, etc., to reduce turbulence noise.

   f. isolate vibration elements in machinery; install motors, pumps, etc., on most massive part of machine; use belt or roller drives in place of gear trains; use flexible hoses and wiring, etc.

   g. apply vibration damping materials such as liquid mastics; pads of rubber, felt, foam or fibrous blankets; or sheet metal viscoelastic laminates or composites to vibrating machine surfaces.

   h. reduce noise leakage from the interior of machines such as compressors by sealing or covering all openings or applying acoustical materials to machine interiors.

D. Noise Control in the Transmission Path

1. Separate the noise source and receiver as much as possible.

2. Use sound absorbing materials on ceiling, floor or wall surfaces as close to the machine as possible.

3. Use sound barriers and deflectors in the noise path.

4. Use acoustical lining on inside surfaces of such passageways as ducts, pipe chases or electrical channels.

5. Use mufflers, silencers or snubbers on all gasoline or diesel engines, regardless of size; and particularly on equipment when large quantities of high-pressure, high velocity gases, liquids, steam or air are discharged into the open air.

6. Use vibration isolators and flexible couplers where the noise transmission path is structure borne in character.

E. Protection for the Receiver

1. General

a. When engineering controls fail to reduce the levels to within the levels specified in Table A-1, Appendix A, personal protective equipment shall be provided.

b. Hearing protectors shall be provided at no cost to employees and shall be replaced as necessary.

c. Supervisors shall ensure that hearing protectors are worn by all employees who are exposed to a time-weighted average of 85 decibels or greater and who have experienced a significant threshold shift.

d. Employees shall be given the opportunity to select their hearing protectors from a variety of suitable protectors.

F. Recordkeeping

1. Audiograms
This record shall include:

a. Name and job classification of the employee.

b. Date of the audiogram.

c. The examiner's name.

d. Date of the last acoustic or exhaustive calibration of the audiometer.

e. Employee's most recent noise exposure assessment.

2. Record Retention
Records required in this section shall be retained for at least the following periods:

a. Noise exposure measurement records shall be retained for 2 years.

b. Audiometric test records shall be retained for the duration of the affected employee's employment.

c. Access to Records. All records required by this section shall be provided upon request to employees, former employees, representatives designated by the individual employee and any authorized representative of the Chief of the Division of Occupational Safety and Health, State of California.

DEFINITIONS

A. Ambient noise (residual noise: background noise) - Noise of a measurable intensity that is normally present in the background in a given environment.

B. Audiogram - A chart, table or graph resulting from an audiometric test showing an individual's hearing threshold levels as a function of frequency.

C. Audiologist - A professional, specializing in the study and rehabilitation of hearing, who is certified by the

American Speech, Hearing and Language Association or licensed by a state board of examiners.

D. Auditory Trauma - Damage to the hearing mechanism resulting in some degree of permanent or temporary hearing loss. Auditory trauma may be caused by agents other than noise, e.g., head injury; burns; sudden or excessive changes of atmospheric pressure.

E. A-Weighted Sound Level - To obtain a single number representing the sound level of a noise containing a wide range of frequencies in a manner representative of the ear's response, it is necessary to reduce, or weight, the effects of the low and high frequencies with respect to the medium frequencies. Three weighting networks are provided on standard sound level meters in an attempt to duplicate the response of the human ear to various sounds. The A-weighting network is the most useful since from it most human responses can be predicted adequately.

F. Baseline Audiogram - The audiogram against which future audiograms are compared.

G. Criterion Sound Level - A sound level of 90 decibels.

H. dBA (Decibels - A-Weighted) - A unit of measurement of sound level corrected to the A-weighted scale, as defined in ANSI S1.4 - 1971 (R 1976), using a reference level of 0.00002 Newton per square meter.

I. DRC (Damage Risk Criterion) - A graphical or other expression of sound levels above which a designated or a general population incurs a specified risk of noise-induced hearing loss.

J. Dosimeter - An instrument which registers the occurrence and cumulative duration of noise exceeding a predetermined level at a chosen point in the environment or on a person.

K. Ear Defender (Ear Protector) - A device inserted into or placed over the ear in order to attenuate air-conducted sounds.

L. Earmuff - An ear defender that encloses the entire outer ear.

M. Earplug - An ear defender, having specified or standard acoustic characteristics, which upon insertion occludes the external auditory meatus.

N. Frequency - The number of times per second that a sine-wave repeats itself. It is expressed in hertz (Hz) or cycles per second (cps)).

O. Hearing Impairment - Hearing loss exceeding a designated criterion (commonly 25 dB, re ISO standards, averaged from the threshold levels at 500, 1000 and 2000 Hz).

P. Impulse Noise (Impact Noise) - Noise of short duration (typically, less than one second) especially of high intensity, abrupt onset and rapid decay, and often rapidly changing spectral composition.

Q. Medical Pathology - A disorder or disease affecting the ear, which should be treated by a physician specialist.

R. Noise Reduction Rating (NRR) - A rating system for ear protective devices developed by the Environmental Protection Agency. The NRR is a measure of the ability of a given protective device to attenuate noise, as a function of noise intensity and frequency. The NRR must be shown on the hearing protector package.

S. Otolaryngologist - A physician specializing in diagnosis and treatment of disorders of the ear, nose, and throat.

T. Representative Exposure -Measurements of an employee's noise dose or 8-hour time-weighted average sound level that the employers deem to be representative of exposures of other employees in the workplace.

U. Significant Threshold Shift (STS) - Defined by OSHA as follows:

1. A change in hearing threshold relative to the baseline audiogram of 20 dB or greater at any test frequency other than 500 Hz in either ear, if no previous audiograms have thresholds that exceed 25 dB with reference to audiometric zero as specified by American National Standard S3.6-1969; or

2. A change in hearing threshold relative to the baseline audiogram of 10 dB or greater at 1000 or 2000 Hz, 15 dB at 3000 or 4000 Hz or 20 dB at 6000 Hz, in either ear, if any previous audiogram has one or more thresholds that exceed dB with reference to audiometric zero; or

3. A change in hearing threshold relative to the baseline audiogram of 10 dB or greater at any frequency other than 500 Hz in either ear, if any previous audiogram has thresholds exceeding an average of 25 dB with reference to audiometric zero at the frequencies 1000, 2000 and 3000 Hz; or

4. A change in hearing threshold relative to the baseline audiogram of 10 dB or grater at any test frequency other than 500 Hz in either ear, if the employee previously has suffered one or more permanent significant threshold shifts.

Sound Level - Ten times the common logarithm of the ratio of the square of the measured A-weighted sound pressure to the square of the standard reference pressure of 20 micropascals, given in decibels (dB). For use with the directive, slow time response, in accordance with ANSI S1.4-1971 (S 1976), is required.

NOISE EXPOSURE COMPUTATION

Computation of Employee Noise Exposure

A. Noise dose is computed using Table A-1 as follows: When the sound level, L, is constant over the entire work shift, the noise dos, D, in percent, is given by: D= 100 C/T where C is the total length of the work day, in hours, and T given in Table A-1 or by the formula shown as a footnote to that table.

B. When the workshift noise exposure is composed of two or more periods of noise at different levels, the total noise dose over the work day is given by: D = 100 (C1/T1 + C2/T2 ... + Cn/Tn), where Cn indicates the total time of exposure at a specific noise level, and Tn indicates the reference duration for that level as given by Table A-1.

C. The eight-hour time-weighted average sound level (TWA), in decibels, may be computed from the dose, in percent, by means of the formula: TWA = 16.61 log 10 (D/100) + 90. For an eight-hour workshift with the noise level constant over the shift, the TWA is equal to the measured sound level.

D. Table A-2 relates dose and TWA.

Conversion Between "Dose" and "8-Hour Time-Weighted Average" Sound level.

Noise exposure is usually measured with an audiodosimeter which gives a readout in terms of "dose". Dosimeter readings can be converted to an 8-hour time-weighted average sound level (TWA).

In order to convert the reading of dosimeter into TWA, use 29 CFR 1910.95, Appendix A, Table A-2. This table applies to dosimeters that are set to calculate dose or percent exposure according to the relationships in 29 CFR 1910.95, Appendix A, Table A-1. So, for example, a dose of 91 percent over an eight hour day results in a TWA of 89.3 dB, and a dose of 50 percent corresponds to a TWA of 85 dB.

If the dose as read on the dosimeter is less than or greater than the values found in Table A-2, the TWA may be calculated by using the formula:

$$TWA = 16.61 \log 10(D/100) + 90$$

where TWA = 8-hour time-weighted average sound level and D = accumulated dose in percent exposure.

REFERENCES

A. Title 29, Code of Federal Regulations, Section 1910.95.

B. Title 8, California Administrative Code, Article 105.

C. Cheremisinoff and Ellerbusch, Guide for Industrial Noise Control; Ann Arbor Science Publishers; Ann Arbor, Michigan, 1982.

D. NIOSH; The Industrial Environment - Its Evaluation and Control; DHEW, 1973.

E. Beaulieu, Harry J. and Buchan, Roy M.; Quantitative Industrial Hygiene; Garland Publishing, Inc.; New York, New York; 1981.

F. AIHA; Industrial Noise Manual , 3rd Edition; Akron, Ohio, 1975.

Procedure Number: 02-340-01

Procedure Name: Heat Stress

Effective Date: 11/01/91

Supersedes Procedure Number: 4.1.14

Responsible Positions: Health and Safety Coordinator, Supervisor, Project Manager, Operations Manager, Assistant Operations Manager

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Objective: To establish guidelines to protect all employees from the effects of heat stress (hyperthermia) when working in a hot environment.

DISCUSSION

Adverse climatic conditions are important consideration in planning and conducting site operations. High ambient temperature can result in health effects ranging from transient heat fatigue, physical discomfort, reduced efficiency, personal injury, increased accident probability, etc. to serious illness or death. Heat stress is of particular concern when chemical protective garments are worn, since these garments prevent evaporative body cooling. Wearing personal protective equipment puts a worker at considerable risk of developing heat stress.

Heat stress is caused by a number of interacting factors, including environmental conditions, clothing, workload, and the individual characteristics of the worker. Because heat stress is probably one of the most common (and potentially serious) illnesses at sites, regular monitoring and other preventive precautions are vital.

Note: Chemical protective clothing is defined as, but not limited to:

- Polyethylene coated Tyvek
- Saranex coated Tyvek
- Medium weight polyvinylchloride (PVC)
- Sigel suits (heavyweight PVC)
- Fully encapsulating suits

PROCEDURES

A. Recommended Guidelines

1. Note that the following guidelines discussed in this section are only intended to be used as a means for initial establishment of a work-rest regimen. It will be the responsibility of a Health and Safety Coordinator to

evaluate the conditions at a specific operation and make final determinations of the work-rest regimen. Physiological monitoring, as discussed in the following section, will be used to establish more stringent regimens.

2. Unacclimatized Workers - The total heat exposure to unacclimatized workers not wearing protective clothing shall not exceed the guidelines given in Attachment 1. Note that it generally takes an employee seven to ten days to become acclimated to the heat.

3. Acclimatized Workers - The total heat exposure to acclimatized healthy workers not wearing protective clothing shall not exceed the guidelines given in Attachment 2.

4. The guidelines shown in Attachment 1 and 2 are for the worker not wearing chemical protective clothing. If the worker is wearing chemical protective clothing, the guidelines in Attachment 1 and 2 should be changed by 10° F. In other words, add 10° F to the WBGT reading and use this adjusted WBGT in Attachment 1 and 2.

5. The metabolic heat rate to use in Attachment 1 and 2 shall be estimated using Attachment 3.

B. Physiological Monitoring

1. For operations at which workers are wearing impermeable chemical protective clothing, physiological monitoring is necessary when the ambient temperature exceeds 78° F (25.5° C).

2. After the initial work-rest regimen is established, as discussed in Section A, it is necessary to perform physiological monitoring to determine if the established work-rest regimen should be adjusted. The following guidelines will be used to adjust the regimen and should be recorded on the Employee Physiological Monitoring Record Form #02340F1.

a. Baseline Information

Determine a baseline heart rate for each employee prior to on-site activities by counting the radial pulse.

b. Increasing Work Rate

1. If a worker's heart rate and oral temperature do not increase, or only increase slightly (10% or less for the heart rate and 0.5% or less for the oral temperature) from the baseline readings after the first work cycle, the work period (according to the established work-rest regimen) can be increased by 20%.

2. The worker shall be monitored closely after the next work cycle period and if there are still no significant increases in heart rate and oral temperature, the work period can be increased by an additional 10% and the rest period remains the same.

3. Increases in the work period can be made throughout the shift if there are no significant increases in the physiological monitoring indices.

4. Note that the increases to the work period are made based on the work-rest regimen established from WBGT (Wet Bulb Globe Thermometer) readings. These WBGT readings will change throughout the day as the temperature rises or falls.

c. Decreasing Work Rate

1. Pulse

   a. Count the radial pulse as early as possible in the rest period.

b. If a worker's heart rate exceeds 110 beats per minute after a work period, shorten the next work cycle by 30% and keep the rest period the same.

c. If the heart rate still exceeds the 110 beats per minute after the next work period, shorten the following work cycle by 30%.

d. Continue to shorten the employee's work cycle until the heart beat is below 110 beats per minute.

2. Temperature

a. Use a clinical thermometer or similar device to measure the oral temperature at the end of a work period (before drinking).

b. If the oral temperature exceeds 99.6° F (37.6° C), shorten the next work cycle by 30% without changing the rest period.

c. If the oral temperature exceeds 99.6° F at the beginning of the next rest period, shorten the following work cycle by 30%.

d. Do not permit a worker to return to the work area when the oral temperature exceeds 100.6° F (38.1° C).

C. Prevention

1. Establish a work-rest regimen according to the guidelines given in Section A and B of this policy.

2. Adequate liquids must be provided to replace lost body fluids. Employees must replace water and salt lost from sweating. Employees must be encouraged to drink more than the amount required to satisfy thirst. Thirst satisfaction is not an accurate indicator of adequate salt and fluid replacement. A minimum of 2 cups/30 minutes is required.

Replacement fluids can be a 0.1% salt water solution, a commercial mix, such as Gatorade or Quik Kick, or a combination of these with fresh water. Employees should be ecouraged to salt their foods more heavily.

The replacement fluid temperature should be kept cool.

3. Cooling devices such as vortex tubes or cooling vests can be worn beneath protective garments. If cooling devices are worn, only physiological monitoring will be used to determine work activity.

4. All breaks are to be taken in a cool, shaded rest area (77° F is best).

5. Employees shall remove chemical protective garments during rest periods.

6. Employees shall not be assigned other tasks during rest periods.

7. All employees shall be informed of the importance of adequate rest and proper diet in the prevention of heat stress.

8. Employees shall be informed of the harmful effects of excessive alcohol consumption in the prevention of heat stress.

D. Training

Those personnel (including contractor employees) potentially exposed to heat stress conditions shall have the following training:

1. Employees

a. Sources of heat stress, influence of protective clothing, and importance of acclimatization.

b. How the body handles heat.

c. Heat related illnesses.

d. Preventative/Corrective measures.

e. First Aid procedures.

f. Be provided at hire with "A Working Person's Guide to Prevent Heat Stress" (Attachment 5).

2. MARCOR Supervisors

a. Measurement methods and calculations of WBGT and physiological monitoring.

ASSIGNMENT OF RESPONSIBILITIES

A. Health and Safety Coordinator

Health and Safety Coordinator will be responsible for initial on-site coordination of the heat stress policy. He/she shall establish work/rest regimens from the Wet Bulb Globe Thermometer (WBGT) readings and conduct physiological monitoring when on site.

B. Project Manager

The Project Manager will be responsible for field implementation of the heat stress policy. This includes assurance that all personnel on-site comply with the policy. He/she shall be responsible for establishing and monitoring safe work practices. He/she will ensure that all personnel potentially exposed to heat have proper training and that on-site supervision implements the program in his/her absence.

C. Supervisor

The Supervisor will be responsible for ensuring that work crews comply with all site requirements, including the heat stress policy. In the absence of the Health and Safety Coordinator, he/she shall also be responsible for physiological monitoring as outlined in Guideline Attachment 3 to this procedure. Team members shall also observe their fellow workers for signs of heat stress.

D. Team Member

All Team Members will be responsible for understanding and complying with all site requirements, including the heat stress policy.

REFERENCES

A. Threshold Limit Values and Biological Exposure Indices for 1985-1986, American Conference of Governmental Industrial Hygienists.

B. Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities, NIOSH/OSHA/EPA, Health and Human Services, Public Health Service, Center for Disease Control, NIOSH.

C. Criteria for a Recommended Standard, Occupational Exposure to Hot Environments, Revised Criteria 1986, U.S. Department of Health and Human Services, Public Service, Center for Disease Control, NIOSH.

ATTACHMENTS

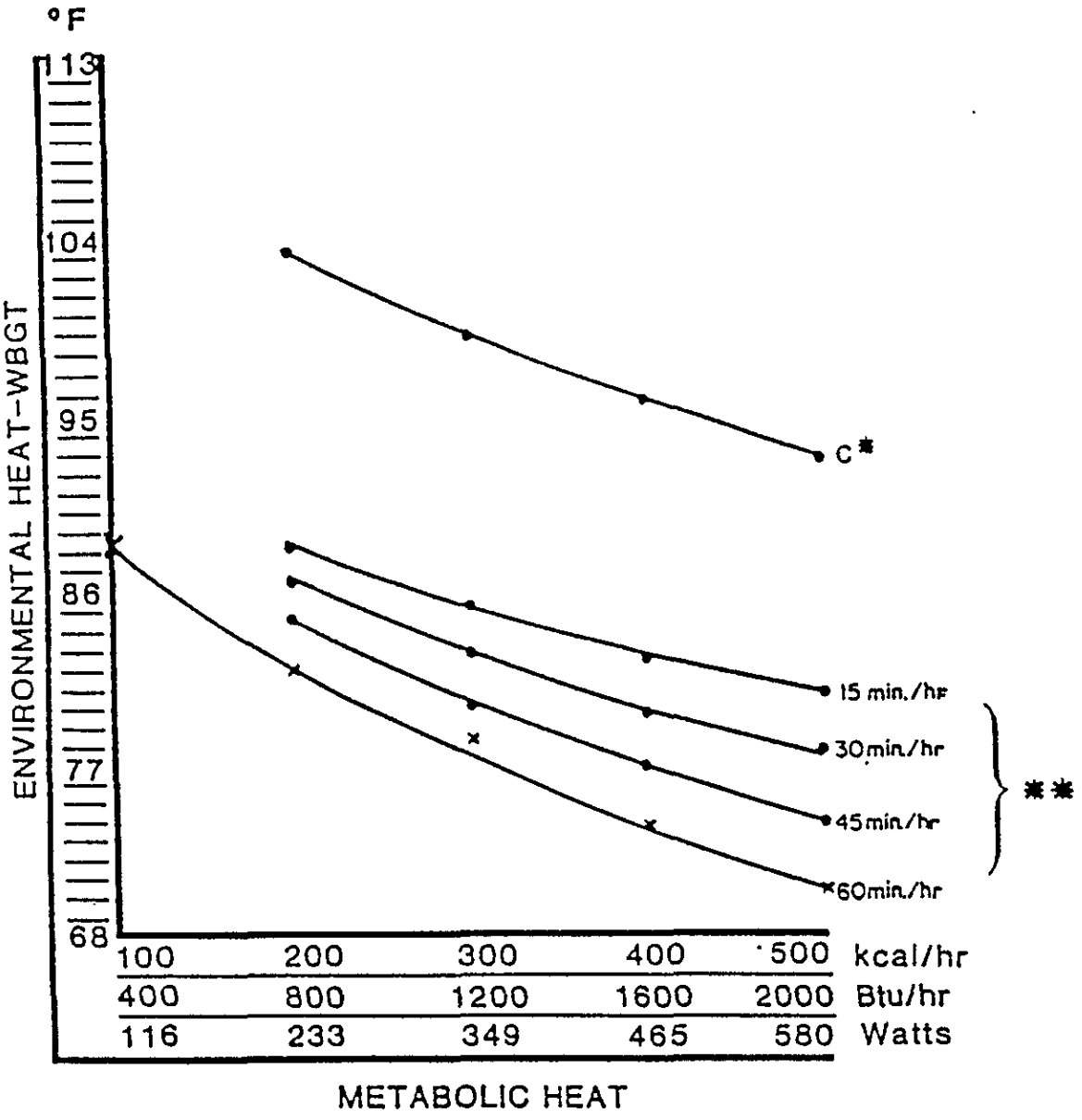
1. Recommended Heat Stress Guidelines for Unacclimated Workers in Hot Environments.

2. Recommended Heat Stress Guidelines for Acclimated Workers in Hot Environments.

3. Assessment of Employee Work Load in Hot Environments.

4. Employee Physiological Monitoring Record for Heat Stress.

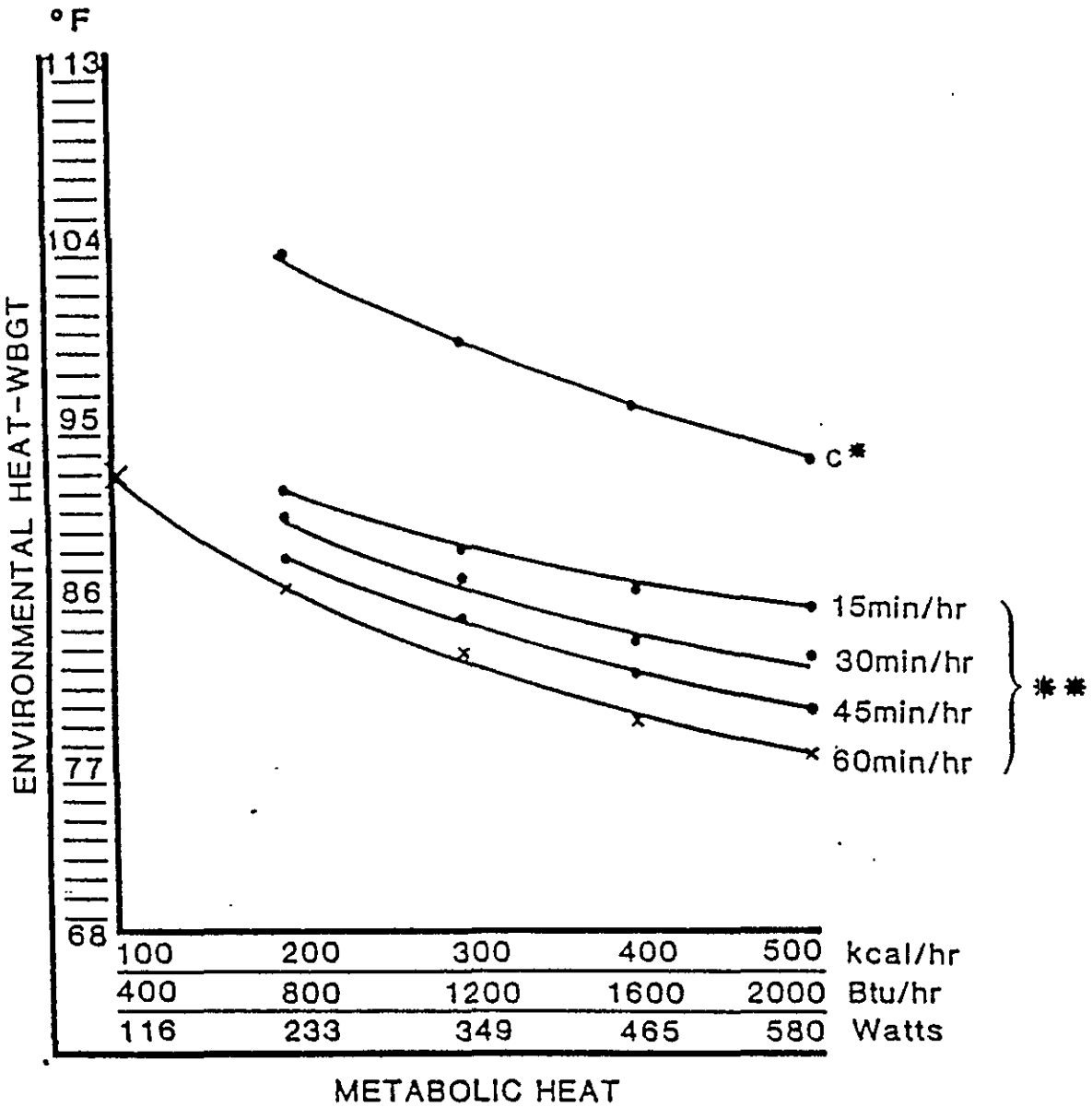
5. A Working Person's Guide to Prevent Heat Stress.



Recommended Heat Stress Guidelines for Unacclimated Workers in Hot Environments

* C= Ceiling Limit – No work should be performed without body cooling provided

** Work–Rest Regimen – Minutes worked per hour



Recommended Heat Stress Guidelines for Acclimated Workers in Hot Environments

* C= Ceiling Limit – No work should be performed without body cooling provided

** Work–Rest Regimen = Minutes worked per hour

ATTACHMENT 3

ASSESSMENT OF EMPLOYEE WORK LOAD IN HOT ENVIRONMENTS

A. BODY POSITION AND MOVEMENT

	kcal/min
Sitting	0.3
Standing	0.6
Walking	2.0-23.0
Walking Uphill	add 0.8 per meter rise

B. TYPE OF WORK

	Average kcal/min	Range kcal/min
Hand Work		
Light	0.4	0.2-1.2
Heavy	0.9	
Work One Arm		
Light	1.0	0.7-2.5
Heavy	1.8	
Work Both Arms		
Light	1.5	1.0-3.5
Heavy	2.5	
Work Whole Body		
Light	3.5	2.5-9.0
Moderate	5.0	
Heavy	7.0	
Very Heavy	9.0	

C. BASAL METABOLISM

1.0

D. SAMPLE CALCULATION

	Average kcal/min
Assembly Work With Heavy Hand Tools	
1. Standing	0.6
2. Two-Arm Work	3.5
3. Basal Metabolism	1.0
TOTAL	5.1 kcal/min x 60 = 306 kcal/hr

FORM UPDATED: 11-01-91

FORM #02340F1

EMPLOYEE PHYSIOLOGICAL MONITORING RECORD FOR HEAT STRESS

Employee Name: _____ Date: _____ Employee S.S. #: _____

Division: _____ Start Time: _____ Location: _____

P.C. #: _____ Stop Time: _____ Job Number: _____

Health & Safety Coordinator: _____ Supervisor: _____

TEMPERATURES

A. INITIAL READING
1. Ambient Air Temperature _____
2. Baseline Oral Temperature _____
3. WBGT _____

B. AFTER FIRST WORK PERIOD
1. Ambient Air Temperature _____
2. Oral Temperature _____
3. WBGT _____

C. AFTER SECOND WORK PERIOD
1. Ambient Air Temperature _____
2. Oral Temperature _____
3. WBGT _____

D. AFTER THIRD WORK PERIOD
1. Ambient Air Temperature _____
2. Oral Temperature _____
3. WBGT _____

E. AFTER FOURTH WORK PERIOD
1. Ambient Air Temperature _____
2. Oral Temperature _____
3. WBGT _____

F. AFTER FIFTH WORK PERIOD
1. Ambient Air Temperature _____
2. Oral Temperature _____
3. WBGT _____

HEART RATE

A. INITIAL READING
1. Baseline Heart Rate _____ B/min

B. AFTER FIRST WORK PERIOD
1. Heart Rate _____ B/min

C. AFTER SECOND WORK PERIOD
1. Heart Rate _____ B/min

D. AFTER THIRD WORK PERIOD
1. Heart Rate _____ B/min

E. AFTER FOURTH WORK PERIOD
1. Heart Rate _____ B/min

F. AFTER FIFTH WORK PERIOD
1. Heart Rate _____ B/min

This completed form should be retained in project file.

B/min = Beats per minute

ATTACHMENT 5

A WORKING PERSON'S GUIDE TO PREVENT HEAT STRESS

WHAT IS HEAT STRESS?

Heat stress is an illness which results from too much exposure to heat. This illness may include heat exhaustion (headaches, nausea or dizziness) or heat cramps (cramping in the muscles). If unrecognized and not treated early, heat stress can lead to heat stroke. Heat stroke can be fatal and occurs on hot jobs.

WHAT ARE HOT JOBS?

Hot jobs have hot processes, radiant heat exposure, or unprotected sun exposure. These jobs cause constant sweating and require additional fluid intake. Workers on hot jobs must use protective measures.

WHAT ARE PROTECTIVE MEASURES?

1. Take Frequent Rest Breaks

   Hot jobs require frequent rest breaks in cool areas, often on an hourly basis. With heavy work and higher temperatures, rest periods must be longer and more often on hot jobs. On hot days, employers may need to furnish relief workers.

2. Drink Water or Other Fluids At Least Every Hour For Effective Sweating

   A quart or more of water is lost each hour by sweating on hot jobs. Your body must replace this water loss by drinking water often. On very hot jobs you should drink fluid twice or more an hour. This is necessary because your stomach cannot hold enough fluid from one drink (over a quart) to adequately supply your body for one hour on a hot job.

3. Avoid Overuse of Salt Tablets

   You may need salt tablets for one or two weeks after beginning on a hot job or after returning from a vacation or a sick leave. If you get heat cramps, this indicates a need for salt. Otherwise, avoid salt tablets because the average American diet has plenty of salt for a worker adjusting to a hot job. Excess salt may increase your risk for high blood pressure.

4. Use Appropriate Clothing and Other Protection

   Although it is a tradition to wear long underwear while working in hot places, this prevents the body from cooling through sweating. If hot processes give off so much heat that you feel more comfortable in long underwear, reflective clothing or other heat reflective barriers are needed. This equipment will protect you from radiant heat and also allow cooling by sweating.

5. Protect Your Health

   Protect your health by coming to work in good physical condition. Avoid alcohol before coming to work. If you have a hangover, your body needs more water than usual and you may be at a greater risk of heat stress. If you have a hot job and are on fluid pills or other medication, check with your doctor. Although these personal measures alone are not sufficient protection, they are helpful.