APPENDIX L

SITE-SPECIFIC HEALTH AND SAFETY PLAN

SOUTH DAYTON DUMP AND LANDFILL SITE
MORAINE, OHIO

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Prepared by:
Conestoga-Rovers & Associates

651 Colby Drive
Waterloo, Ontario
Canada N2V 1C2

Office: (519) 884-0510
Fax: (519) 884-0525

web: http:\\www.CRAworld.com

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HEALTH AND SAFETY PLAN
Signature Page

Site Name: South Dayton Dump and Landfill Site

Location Address: Moraine, Ohio

Ref. No. 38443 CRA Office: Waterloo -Colby

Anticipated Start Date: May 21, 2008 Anticipated Project Duration: 2 years.

Prepared By (Signature): Crystal Harte Date: May 20, 2008

Project Manager (Signature): [signature] for Adam Lowry Date: May 20, 2008

Reviewed By (Signature): [signature] Date: May 20, 2008

This signature page must be completed and be available on Site for review. This page does not, however, replace the QSF-016 requirements.

L.1.0 INTRODUCTION

This Health and Safety Plan (HASP) was prepared in accordance with the Administrative Settlement Agreement and Order on Consent (ASAOC) for the South Dayton Dump and Landfill Site (Site) in Moraine, Ohio. Conestoga-Rovers & Associates (CRA) has prepared this HASP on behalf of the Respondents to the ASAOC. Required elements of this HASP, as referenced in the Statement of Work (SOW) append to the ASAOC, are addressed herein as follows.

Scope of Work Requirements	*Location in HASP*
Listing of Key Personnel	Section L.1.4
Scope of Work	Section L.2.0
Hazards and Risk Evaluation	Section L.3.0
Use of Personal Protective Equipment	Section L.4.0
Air Monitoring	Section L.5.0
Site Control Measures	Section L.6.0
Decontamination Procedures	Section L.6.4
Emergency Contingency Plan	Section L.7.0
Record Retention	Section L.8.0
Medical Monitoring Program	Section L.9.0
Employee Training Assignments	Section L.10.0

L.1.1 PURPOSE

The purpose of this Site-specific HASP is to provide specific guidelines and establish procedures for the protection of personnel performing the activities described in Section L.2.0 — Site Operations. The information in this HASP has been developed in accordance with applicable standards and is, to the extent possible, based on information available to date. The HASP is also a living document in that it must continually evolve as Site conditions and knowledge of the Site work activities develop.

A vital element of CRA's Health and Safety Policies and Procedures is the implementation of a Site-specific HASP for field activities. This HASP, as applicable to this project, includes the following measures:

- Communicate the contents of this HASP to Site personnel.
- Eliminate unsafe conditions. Efforts must be initiated to identify conditions that can contribute to an accident and to remove exposure to these conditions.
- Reduce unsafe acts. Personnel shall make a conscious effort to work safely. A high degree of safety awareness must be maintained so that safety factors involved in a task become an integral part of the task.
- Inspect frequently. Regular safety inspections of the work site, materials, and equipment by qualified persons ensure early detection of unsafe conditions. Safety and health deficiencies shall be corrected as soon as possible, or project activities shall be suspended. Documentation of daily inspections and corrective actions should be kept with the project files.

L.1.2 STOP WORK AUTHORITY

All CRA employees are empowered and expected to stop the work of co-workers, subcontractors, client employees, or other contractors if any person's safety or the environment are at risk. **NO** repercussions will result from this action.

The discovery of any condition that would suggest the existence of a situation more hazardous than anticipated shall result in the removal of Site personnel from that area and reevaluation of the hazard and the levels of protection.

L.1.3 PERSONNEL REQUIREMENTS

All personnel conducting activities on Site must conduct their activities in compliance with all applicable safety and health legislation throughout North America to include, but not limited to, the Occupational Safety and Health Administration (OSHA) 29 CFR 1910, 29 CFR 1926, and CRA polices and procedures. **Project personnel must also be familiar with the procedures and requirements of this HASP**. In the event of conflicting safety procedures/ requirements, personnel must implement those safety practices which afford the highest level of safety and protection.

Employees identified as CRA Short Service Employees (6 months or less) shall not be permitted to work without another non-short service CRA employee present.

L.1.4 PROJECT MANAGEMENT AND SAFETY RESPONSIBILITIES

Project Manager - CRA – Steve Quigley

The CRA Project Manager (PM) shall be responsible for the overall implementation of the HASP and for ensuring that all health and safety responsibilities are carried out in conjunction with this project. This shall include, but is not limited to, review and approval of the HASP. The PM will also ensure the appropriate resources are provided to support the project with respect to all operations.

Site Supervisor - CRA – Jeroen Winterink

The Site Supervisor (SS) is the person who, under the supervision of the PM, shall be responsible for the communication of the Site requirements to Site project personnel and subcontractors, and is responsible for carrying out the health and safety responsibilities by making sure that:

1. All necessary cleanup and maintenance of safety equipment is conducted by project personnel.
2. Emergency telephone numbers/services including hospital/clinic locations are verified/contacted.
3. Forms attached to the HASP are completed, filed, and submitted correctly.
4. A pre-entry briefing is conducted and documented, which will serve to familiarize on-Site personnel with the procedures, requirements, and provisions of this HASP.

Other duties include overall implementation of the HASP, and ensuring all health and safety responsibilities are carried out in conjunction with this project. This shall include, but is not limited to, review and approval of the HASP, communication of Site requirements to subcontractor personnel, and consultation with the client/Site representative regarding appropriate changes to the HASP.

The SS also has the responsibility of enforcing safe work practices for project employees. The SS watches for any ill affects on any crew member, especially those symptoms caused by cold/heat stress or chemical exposure. The SS oversees the safety of any visitors who enter the Site. The SS maintains communication with the client/Site representative(s).

Other specific duties of the SS include:

- Orders the immediate shutdown and/or stop work of Site activities in the case of a medical emergency, unsafe condition, or unsafe practice.
- Provides the safety equipment, personal protective equipment (PPE) Appendix L-A, and other items necessary for employees.
- Enforces the use of required safety equipment, PPE, and other items necessary for employee or community safety.
- Conducts Site inspections as a part of quality assurance for safety and health.
- Reports safety and health concerns to Site and/or project management as necessary.

Regional Safety and Health Manager - CRA – Jeff Maranciak

The Regional Safety and Health Manager (SHM) is a full-time CRA employee who is trained as a health and safety professional, who serves in a consulting role to the PM and SS regarding potential health and safety issues.

Employee Safety Responsibility

CRA employees are responsible for their own safety as well as the safety of those around them. CRA employees shall use any equipment provided in a safe and responsible manner, as directed by their supervisor.

Employees are directed to take the following actions when appropriate:

- Suspend any operations, which may cause an imminent health hazard to employees, subcontractors, or others.
- Correct project Site hazards when possible to do so without endangering life or health.
- Report safety and health concerns to the SS, PM, or Regional SHM.

Subcontractors

CRA subcontractors, United States Environmental Protection Agency (USEPA) and Ohio Environmental Protection Agency (OEPA) personnel and subcontractors are responsible for their own health and safety performance and the implementation of their HASP and agree to comply with its contents. CRA's HASP may serve as the minimum health and safety requirements for the Site but the responsibility for health and safety will rest with each employer at the Site, including subcontractors and USEPA/OEPA personnel. In the event of conflicting safety procedures/requirements, personnel must implement those safety practices, which afford the highest level of safety and protection. In addition, it is also understood that non-compliance with health and safety policies and procedures may subject the subcontractor to disciplinary action up to and including termination of their contract with CRA. Subcontractors will be required to attend an initial Site orientation and subsequent safety meetings.

Equipment Operators

All equipment operators are responsible for the safe operation of heavy equipment. Operators are responsible for inspecting their equipment on a daily basis to ensure safe performance. Brakes, hydraulic lines, backup alarms, and fire extinguishers must be inspected routinely throughout the project. Equipment will be taken out of service if an unsafe condition occurs.

Authorized Visitors

Authorized visitors shall be provided with all known information with respect to the Site operations and hazards as applicable to the purpose of their visit.

L.1.5 TRAINING REQUIREMENTS

All personnel conducting work at the Site shall have completed the appropriate health and safety training as applicable to their job tasks/duties. The required training is referenced throughout the HASP and identified on each task hazard analysis sheet.

L.1.5.1 SITE-SPECIFIC TRAINING

An initial Site-specific training session or briefing shall be conducted by the PM or SS prior to commencement of work activities. During this initial training session, employees shall be instructed on the following topics:

- Personnel responsibilities.
- Content and implementation of the HASP.
- Site hazards and controls.
- Site-specific hazardous procedures (e.g., drilling).
- Training requirements.
- PPE requirements.
- Emergency information, including local emergency response team phone numbers, route to nearest hospital, accident reporting procedures, and emergency response procedures.
- Instruction in the completion of required inspections and forms.
- Location of safety equipment (e.g., portable eyewash, first aid kit, fire extinguishers).

The various components of the HASP will be presented followed by an opportunity to ask questions to ensure that each attendee understands the HASP. Personnel will not be permitted to enter or work in potentially contaminated areas of the Site until they have completed the Site-specific training session. Personnel successfully completing this training session shall sign the HASP Training Acknowledgement Form, which is presented in Appendix L-B.

In addition to the initial Site briefing conducted at the commencement of the project, supplemental brief safety meetings shall be conducted by the SS to discuss potential health and safety hazards associated with upcoming tasks and the necessary precautions to be taken.

L.1.5.2 SAFETY MEETING/HEALTH AND SAFETY PLAN REVIEW

"Tailgate" safety meetings will take place each day prior to beginning the day's work. All Site personnel will attend these safety meetings conducted by the SS. The safety meetings will cover specific health and safety issues, Site activities, changes in Site

conditions, and a review of topics covered in the Site-specific pre-entry briefing. The safety meetings will be documented with written sign-in sheets containing a list of topics discussed. This form is located in Appendix L-B.

L.2.0 SITE OPERATIONS

L.2.1 SITE HISTORY/BACKGROUND

The Site is located at 1901 through 2153 Dryden Road and 2225 East River Road in Moraine, Ohio. The Site is bounded to the north and west by the Miami Conservancy District (MCD), by the MCD floodway, the Great Miami River Recreational Trail and the GMR beyond. The Site is bounded to the east by Dryden Road and light industrial facilities beyond, and to the southeast with residential and commercial properties with River Road and a residential trailer park beyond. To the south the Site is bounded by undeveloped land with industrial facilities beyond. The Site has been defined in the SOW as an area of approximately 80 acres, including the Valley Asphalt plant in the northernmost portion of the Site, an auto salvage yard in the southeast and a gravel pit/quarry pond to the south. The central 40 acres (described as 23 acres in some documents) of the Site was referred to as the South Dayton Dump and Landfill in some reports. More recent information, including a map in Montgomery County Health District (MCHD) files, soil boring logs, drums found at Valley Asphalt, USEPA's air photo analysis, underground storage tank (UST) closure reports, and the deposition of Horace Boesch Jr., indicate that landfilling and/or other waste disposal/handling activities occurred across most of the Site.

Landfill operations continued in the central portion of the Site until the death of the landfill's operator, Mr. Alcine Grillot, in 1996. The current owners of the properties located within the Site are Valley Asphalt, Jim City Salvage, MCD, Ronald Barnett, Kathryn A. Boesch and Margaret C. Grillot. The northern portion of the Site is owned by Valley Asphalt. The Site location is shown on Figure L.1.1. A layout of the Site, including property boundaries, is provided on Figure L.1.2.

L.2.2 SCOPE OF WORK

The objectives of this project are to conduct a Remedial Investigation/Feasibility Study (RI/FS) at the Site. The field program will include investigative activities described in the following work plans:

- Field Sampling Plan (FSP);
- Landfill Gas/Soil Vapor Investigation Letter Work Plan;
- Test Pit/Test Trench Investigation Letter Work Plan;

- Land Survey, Bathymetry Survey and Geophysical Investigation Letter Work Plan;
- Leachate Seep Investigation Letter Work Plan; and
- Groundwater Letter Work Plan.

This HASP covers the Site activities that will be conducted by CRA personnel and their subcontractors. These activities are as follows:

1. Mobilization of personnel, materials, and equipment to and from the Site;
2. Conducting a geophysical survey;
3. Conducting a bathymetry survey of the Quarry Pond;
4. Surficial metallic debris collection/staging;
5. Vertical Aquifer Sampling;
6. Install and measure surface water staff gauges;
7. Synoptic Water Level Measurements;
8. Groundwater Sampling;
9. Monitoring well installation including:
    - collecting soil and groundwater samples from boreholes,
    - installing monitoring wells in boreholes, and
    - performing monitoring well development;
10. Collecting groundwater samples from monitoring wells and private wells (if required);
11. Continuous hydraulic monitoring;
12. Excavating test pits and test trenches;
13. Collecting soil samples from test pits and test trenches;
14. Visual seep inspection;
15. Seep characterization and sampling;
16. Identifying areas requiring further investigation;
17. Land fill gas/soil vapor probe installation;
18. Landfill gas/soil vapor screening;
19. Decontamination of personnel and equipment;
20. Collecting sediment samples (potential future task – may not be required);

21. Collecting surface water samples (potential future task – may not be required); and

22. Collecting groundwater samples from private wells (potential future task – may not be required).

If Site operations are altered or if additional tasks are assigned, an addendum to this HASP shall be developed to address the specific hazards associated with these changes. All addenda will be developed in conjunction with project management and a CRA safety professional.

L.3.0 HAZARD EVALUATION

This section identifies and evaluates the potential chemical, physical, and biological hazards, which may be encountered during the completion of this project. Specific activity task hazard analysis (THA) tables (located in Appendix L-C) have been developed to address the hazards associated with the Site operations outlined in Section L.2.0.

L.3.1 CHEMICAL HAZARDS

The chemical hazards associated with conducting Site operations include the potential exposure to on-Site contaminants encountered during field activities such as those noted in Section L.2.2, products used in decontamination of equipment, and support products such as fuel. The potential routes of exposure from these products during normal use may occur through inhalation of vapors/dusts or direct contact or absorption with the materials. The chemical hazards of concern that may be encountered during the tasks identified in the project's scope of work include volatile organic compounds (VOCs), metals, herbicides, pesticides, semi-volatile organic compounds (SVOCs), polychlorinated biphenyls (PCBs), dioxins and furans, and asbestos. Low levels of radiation are also possible in foundry sands, which were historically disposed of at the Site. A listing of the contaminants of concern is found in Table L.3.1, which includes exposure limits, signs and symptoms of exposure, chemical properties, and physical characteristics.

L.3.1.1 ASBESTOS

Asbestos is the name given to a group of six different fibrous minerals (amosite, chrysotile, crocidolite, and the fibrous varieties of tremolite, actinolite, and anthophyllite) that occur naturally in the environment. Asbestos minerals have separable long fibers that are strong and flexible enough to be spun and woven and are heat resistant. Because of these characteristics, asbestos has been used for a wide range of manufactured goods, mostly in building materials (roofing shingles, ceiling and floor tiles, paper products, and asbestos cement products), friction products (automobile clutch, brake, and transmission parts), heat-resistant fabrics, packaging, gaskets, and coatings. Some vermiculite or talc products may contain asbestos.

Asbestos fibers can enter the air or water from the breakdown of natural deposits and manufactured asbestos products. Asbestos fibers do not evaporate into air or dissolve in water. Small diameter fibers and particles may remain suspended in the air for a long time and be carried long distances by wind or water before settling down. Larger diameter fibers and particles tend to settle more quickly. Asbestos fibers are not able to move through soil. Asbestos fibers are generally not broken down to other compounds and will remain virtually unchanged over long periods.

We are all exposed to low levels of asbestos in the air we breathe. These levels range from 0.00001 to 0.0001 fibers per milliliter of air, and generally are highest in cities and industrial areas. People working in industries that make or use asbestos products or who are involved in asbestos mining may be exposed to high levels of asbestos. People living near these industries may also be exposed to high levels of asbestos in air. Asbestos fibers may be released into the air by the disturbance of asbestos-containing material during product use, demolition work, building or home maintenance, repair, and remodeling. In general, exposure may occur only when the asbestos-containing material is disturbed in some way to release particles and fibers into the air. Drinking water may contain asbestos from natural sources or from asbestos-containing cement pipes.

Asbestos mainly affects the lungs and the membrane that surrounds the lungs. Breathing high levels of asbestos fibers for a long time may result in scar-like tissue in the lungs and in the pleural membrane (lining) that surrounds the lung. This disease is called asbestosis and is usually found in workers exposed to asbestos, but not in the general public. People with asbestosis have difficulty breathing, often a cough, and in severe cases heart enlargement. Asbestosis is a serious disease and can eventually lead to disability and death. Breathing lower levels of asbestos may result in changes called plaques in the pleural membranes. Pleural plaques can occur in workers and sometimes in people living in areas with high environmental levels of asbestos. Effects on breathing from pleural plaques alone are not usually serious, but higher exposure can lead to a thickening of the pleural membrane that may restrict breathing.

The Department of Health and Human Services (DHHS), the World Health Organization (WHO), and the USEPA have determined that asbestos is a human carcinogen. It is known that breathing asbestos can increase the risk of cancer in people. There are two types of cancer caused by exposure to asbestos: lung cancer and mesothelioma. Mesothelioma is a cancer of the thin lining surrounding the lung (pleural membrane) or abdominal cavity (the peritoneum). Cancer from asbestos does not

develop immediately, but shows up after a number of years. Studies of workers also suggest that breathing asbestos can increase chances of getting cancer in other parts of the body (stomach, intestines, esophagus, pancreas, and kidneys), but this is less certain. Early identification and treatment of any cancer can increase an individual's quality of life and survival. Cigarette smoke and asbestos together significantly increase an individual's chances of getting lung cancer. Therefore, if you have been exposed to asbestos you should stop smoking. This may be the most important action that you can take to improve your health and decrease your risk of cancer.

L.3.1.2 CHEMICAL HAZARD CONTROLS

Exposure to potential on-Site contaminants/chemicals, such as those listed in Table L.3.1 and Appendix L-D – Material Safety Data Sheets (MSDSs), shall be controlled by:

- Monitoring air concentrations for volatile organic vapors and radiation shall be conducted in the breathing zone;
- Employing dust control measures, such as wetting the immediate area, shall be employed;
- Using PPE/respiratory protection as appropriate, in areas known to have concentrations above the specified action level for each contaminant;
- Contacting the Regional SHM for additional information; and
- Should potential asbestos containing materials (ACM) be identified during work activities, dust control measures will be initiated (i.e., wetting the soil). Furthermore, workers will be required to wear a full-face respirator equipped with a P-100 cartridge in addition to disposable Tyvek coveralls with integral booties or separate shoe covers and gloves. Wrists and ankles of the suit will be securely taped with duct tape to prevent infiltration of contaminated dust. If potential ACM are observed, samples will be collected and analyzed to confirm the presence of asbestos. Appropriate PPE for working with asbestos will be maintained unless and until the materials in question are determined to not contain asbestos. If extended work near confirmed ACM is anticipated, a portable decontamination unit (or equivalent) with a shower will be provided for personnel decontamination. The shower water drainage will be filtered. All used PPE (including suits, boot covers, gloves, and respirator cartridges) and used shower filters will be collected separately from other trash and disposed of as ACM waste. The ACM waste will be double bagged in labeled 6-mil bags (or single bagged and placed in labeled fiber drums).

- If material resembling ash is encountered, samples will be collected and analyzed to confirm the presence of dioxins and furans. Appropriate PPE for working with dioxins and furans, i.e., Level C, will be maintained during prolonged intrusive work in areas containing ash-like material unless and until the materials in question are determined to not contain dioxins and furans.

L.3.1.3 SKIN CONTACT AND ABSORPTION OF CONTAMINANTS

Skin contact with chemicals may be controlled by use of the proper PPE and good housekeeping procedures. The proper PPE (e.g., Tyvek, gloves) as described in Section L.4.0 shall be worn for all activities where contact with potentially harmful media or materials is anticipated. Utilize manufacturer data on permeation and degradation to minimize skin contact potential (see Section L.4.2.1 for additional information).

L.3.1.4 FLAMMABLE AND COMBUSTIBLE LIQUIDS

The storage, dispensing, and handling of flammable and combustible liquids must be in accordance with industry standards such as National Fire Protection Association (NFPA) guidelines. The specific flammable or combustible liquids used at the Site may include gasoline, diesel, kerosene, oils, and solvents.

Flammable and combustible liquids are classified according to flash point. This is the temperature at which the liquid gives off sufficient vapors to readily ignite. Flammable liquids have flash points below 100°F (37.8°C). Combustible liquids have flash points above 100°F (37.8°C) and below 200°F (93.3°C).

Storage

Many flammables can ignite at temperatures at or below room temperature. They are far more dangerous than combustibles when they are heated. As a result, these products must be handled very carefully. At normal temperatures, these liquids can release vapors that are explosive and hazardous to health. Exposure to heat can cause some of these liquids to break down into acids, corrosives, or toxic gases. For this reason, flammable/combustible liquids should be stored in cool, well-ventilated areas away

from any source of ignition. Always consult the MSDS of the product for specific information.

Flammable and combustible liquids must be stored in designated areas. Such areas must be isolated from equipment and work activities that may produce flames, sparks, heat, or any form of ignition, including smoking. The most practical method is the use of one or more approved (commercially available) flammable/combustible liquid storage cabinets.

Cabinets must be labeled "Flammable - Keep Fire Away". Doors must be kept closed and labeled accordingly. Containers must be kept in the cabinet when not in use.

General Requirements

- Keep containers of flammable/combustible liquids closed when not in use.
- Keep flammable/combustible liquids in designated areas and approved cabinets.
- Do not allow the use of unapproved containers for transfer or storage. Use only approved safety cans (5-gallon maximum) with a spring closing lid and spout cover, designated to safely relieve internal pressure when exposed to heat or fire.
- Use only approved self-closing spigots, faucets, and manual pumps when drawing flammable/combustible liquids from larger containers/barrels.
- Use only approved metal waste cans with lids for disposal of shop towels/oily rags.
- Designate "Smoking" and "No Smoking" areas.
- Designate fueling areas.
- Observe all signs indicating "No Smoking", "No Flames", "No Ignition."

Transferring Flammable/Combustible Liquids

- This seemingly routine task can be hazardous if certain precautions are not followed. Grounding and bonding must be observed at all times to prevent the accumulation of static electricity when transferring containers/barrels one to another.
- Drums should be grounded (No. 4 copper conductor) to a grounding rod.
- Bonding is necessary between conductive containers (e.g., a barrel and a 5-gallon container).

L.3.2 PHYSICAL HAZARDS

Physical hazards that may be present during project work include: potential for close proximity to heavy equipment and drilling devices, noise, overhead or underground utilities, vehicle traffic, material handling, heavy lifting, excavations, use of hand and power tools, slip/trip/hit/fall injuries, heat stress/cold stress, working on or near water, biological hazards, and potential adverse weather conditions. In addition, personnel must be aware that the PPE worn may limit dexterity and visibility and may increase the difficulty of performing some tasks.

L.3.2.1 HEAVY EQUIPMENT AND DRILLING SAFETY

Heavy Equipment

The following practices shall be adhered to by personnel operating heavy equipment (such as backhoes) and personnel working in the vicinity of heavy equipment:

- Heavy equipment is to be inspected when equipment is initially mobilized/ delivered to a Site or after it is repaired and returned to service to ensure that it meets all manufacturer and OSHA specifications (e.g., fire extinguishers, backup alarms).
- Heavy equipment is to be inspected on a daily basis. Documentation of this daily pre-operational inspection is to be filed in the project file.
- Heavy equipment is only to be operated by authorized competent operators.
- Seat belts are to be provided on heavy equipment that is not designed for stand up operation.
- Equipment/vehicles whose payload is loaded by crane, excavator, loader, etc. will have a cab shield and/or canopy to protect the operator.
- Personnel will not be raised/lowered in buckets.
- Personnel will not ride on fender steps or any place outside the cab.
- Before leaving the equipment controls, ensure that the equipment is in its safe resting position. For a backhoe, apply the parking brake, put the front-loader bucket down on the ground level, and ensure that the rear excavator bucket is locked in the travel position. Bulldozers and scraper blades, loader buckets, dump bodies, and similar equipment will be fully lowered or blocked when not in use.

- Before raising a boom or bucket, check for overhead obstructions.
- Employees involved in the operation shall not wear any loose fitting clothing which has the potential to be caught in moving machinery.
- Personnel shall wear high visibility safety vests, steel-toed shoes, safety glasses, hearing protection, and hard hats during heavy equipment operations.
- When moving heavy equipment or when working in tight quarters, a spotter should be used.

Drilling Equipment

The following practices shall be adhered to by drilling personnel:

- Equipment should be inspected daily by the operator to ensure that there are no operational problems.
- Before leaving the controls, shift the transmission controlling the rotary drive into neutral and place the feed lever in neutral. Before leaving the vicinity of the drill, shut down the drill engine.
- Before raising the mast, check for overhead obstructions.
- Before the mast of a drill rig is raised, the drill rig must first be leveled and stabilized with leveling jacks and/or cribbing. Re-level the drill rig if it settles after initial setup. Lower the mast only when the leveling jacks are down, and do not raise the leveling jack pads until the mast is lowered completely.
- Employees involved in the operation shall not wear any loose fitting clothing which has the potential to be caught in moving machinery.
- During freezing weather, do not touch any metal parts of the drill rig with exposed flesh. Freezing of moist skin to metal can occur almost instantaneously.
- Personnel shall wear steel-toed shoes, safety glasses, hearing protection, and hard hats during drilling operations.
- The area shall be roped off, marked, or posted to keep the area clear of pedestrian traffic or spectators.
- Personnel should be instructed in the location and use of the emergency kill switch on the drill rig.

L.3.2.2 NOISE

Project activities that include working in close proximity to heavy equipment and/or drilling operations, or using power tools that generate noise levels exceeding the decibel (dBA) range of 85 dBA, will require the use of hearing protection with a Noise Reduction Rating (NRR) of at least 20. Hearing protection (earplugs/muffs) will be available to personnel and visitors who require entry into these areas.

When it is difficult to hear a co-worker at normal conversation distance, the noise level is approaching or exceeding 85 dBA and hearing protection is necessary. All Site personnel who may be exposed to high noise levels will participate in CRA's Hearing Conservation Program.

L.3.2.3 UTILITY CLEARANCES

Elevated superstructures (e.g., drill rigs, backhoes, scaffolding, ladders, cranes) shall remain a distance of 10 feet [3 meters (m)] away from utility lines (<50 kV) and 20 feet (6 m) away from power lines (>50 kV). Underground utilities, if present, shall be clearly marked and identified prior to commencement of work. Follow local/state/provincial regulations with regards to utility locating requirements (e.g., One-Call).

Personnel involved in intrusive work shall:

- Review and adhere to CRA's Subsurface Utility Clearance Protocol.
- Utilize the Property Access/Utility Clearance Data Sheet (QSF-019).
- Be able to determine the minimum distance from marked utilities which work can be conducted with the assistance of the locator line service.

L.3.2.4 VEHICLE TRAFFIC AND CONTROL

The following safety measures are to be taken by CRA personnel that have the potential to be exposed to vehicle traffic:

- A high visibility safety vest meeting ANSI Class II garment requirements is to be worn at all times.
- Employees will work using the "buddy system".

- Cones will be used to demarcate a safe work zone around the monitoring wells.
- Appropriate signage will be posted as necessary to inform roadway/parking lot users of any additional control measures necessary to protect the public and CRA employees.

L.3.2.5 MATERIAL HANDLING AND STORAGE

Material handling and storage practices to be conducted at the Site include manual lifting of materials and possibly the use of hoisting and rigging equipment. As a rule, use mechanical means for lifting heavy loads whenever possible.

General Storage Practices

The basic safety requirement for storage areas is that the storage of materials and supplies shall not create a hazard. Additional general storage area practices include the following:

- Bags, containers, and bundles stored in tiers shall be stacked, blocked, interlocked, and limited in height so that they are stable and secure against sliding or collapse.
- All stacked materials and cargo shall be examined for sharp edges, protrusions, signs of damage, or other factors likely to cause injury to persons handling these objects. Defects should be corrected as they are attached.
- Storage areas shall be kept free from accumulation of materials that constitute hazards from tripping, fire, explosion, or pest harborage.
- Storage areas shall have provision to minimize manual lifting and carrying. Aisles and passageways shall provide for the movement of mechanical lifting and conveyance devices.
- Stored materials shall not block or obstruct access to emergency exits, fire extinguishers, alarm boxes, first aid equipment, lights, electrical control panels, or other control boxes.
- "NO SMOKING" signs shall be conspicuously posted, as needed, in areas where combustible or flammable materials are stored and handled.
- Cylindrical materials such as pipes and poles shall be stored in racks or stacked on the ground and blocked.

Special Precautions for Hazardous or Incompatible Materials Storage

Generally, materials are considered hazardous if they are ignitable, corrosive, reactive, or toxic. Manufacturers and suppliers of these materials must provide the recipient with MSDSs, which describe their hazardous characteristics and give instructions for their safe handling and storage.

Many hazardous materials are incompatible, which means they form mixtures that may have hazardous characteristics not described on the individual MSDSs. The following special precautions shall be followed regarding the storage of hazardous materials:

- Based on the information available on the MSDSs, incompatible materials shall be kept in separate storage areas.
- Warning signs shall be conspicuously posted, as needed, in areas where hazardous materials are stored.

Hoisting and Rigging

Wire ropes, chains, ropes, and other rigging equipment shall be inspected prior to each use and as necessary during use to assure their safety. Defective rigging equipment will be immediately removed from service.

Rigging shall not be used unless the weight of the load falls within the rigging's safe work operating range. This must be verified by the authorized rigger prior to any "pick" or lifting operation.

Only personnel trained in safe rigging procedures shall be authorized to engage in rigging procedures. Additionally, the rigger must understand and use recognized crane signals.

Job or shop hooks and links and other makeshift fasteners **shall not** be used. When U-bolts are used for eye splices, the U-bolt shall be applied so that the "U" section is in contact with the dead end of the rope.

Wire ropes, chains, ropes, and other rigging equipment shall be stored where they will remain clean, dry, and protected from the weather and corrosive fumes.

The proper length of rope or chain slings shall be used to avoid wide-angle lifts and dangerous slack. Knotted ropes or lengths of ropes reduced by bolts, knots, or other keepers shall not be used.

Cranes and Hoists

It should be noted that cranes will be used during project activities. There are many hazards associated with using cranes. Potential contact with overhead electrical lines and potential crushing of workers who may wander into the swing path radius of the crane are just two. When cranes are brought on Site for use, CRA will ensure that the following safety practices are enforced:

- Crane operators shall provide a copy of the crane's annual inspection report to the SS prior to initiating operations.
- Operators of cranes and hoists shall make visual and operational inspections of the equipment prior to use. Any discrepancies that would jeopardize the safe operation of the equipment will be corrected prior to use. These inspections are to be documented via a daily inspection checklist or equivalent.
- The posted capacity of the crane shall be adhered to and overloading of the equipment will not be allowed.
- The accessible swing radius of the crane shall be demarcated and/or barricaded to prevent employees from entering the area.
- The crane's load and boom shall be kept a minimum of 10 feet (3 m) away from utility lines and 20 feet (6 m) from power lines. **Any deviation must be approved by the PM in conjunction with the Regional SHM.**
- A competent person shall investigate the soil for stability and determine the necessary amount of "cribbing" to be placed under the outrigger pads or if crane mats are necessary.
- No personnel shall be permitted to work under a suspended load.
- The operator will only recognize signs and signals from one designated signal person. This signal person will serve as the crane operator's eyes in areas that the crane operator cannot see. This person shall be familiar with crane signals, operation of the crane, and safe methods of securing and handling a load.

L.3.2.6 MANUAL LIFTING

When lifting objects, use the following proper lifting techniques:

- Feet must be parted, with one foot alongside the object being lifted and one foot behind. When the feet are comfortably spread, a more stable lift can occur and the rear foot is in a better position for the upward thrust of the lift.
- Use the squat position and keep the back straight - but remember that straight does not mean vertical. A straight back keeps the spine, back muscles, and organs of the body in correct alignment. It minimizes the compression of the gut that can cause a hernia.
- Grip is one of the most important elements of correct lifting. The fingers and the hand are extended around the object you're going to lift - using the full palm. Fingers have very little power - use the strength of your entire hand.
- The load must be drawn close, and the arms and elbows must be tucked into the side of the body. Holding the arms away from the body increases the strain on the arms and elbows. Keeping the arms tucked in helps keep the body weight centered.

The body must be positioned so that the weight of the body is centered over the feet. This provides a more powerful line of thrust and also ensures better balance. Start the lift with a thrust of the rear foot. Do not twist.

L.3.2.7 HAND AND POWER TOOLS

Hand Tools

- Hand tools must meet the manufacturer's safety standards.
- Hand tools must not be altered in any way.
- At a minimum, eye protection must be used when working with hand tools.
- Wrenches (including adjustable, pipe, end, and socket wrenches) must not be used when jaws are sprung to the point that slippage occurs.
- Impact tools (such as drift pins, wedges, and chisels) must be kept free of mushroom heads.
- Wooden handles must be free of splinters or cracks and secured tightly to the tool.

Power Tools

- All power tools must be inspected regularly and used in accordance with the manufacturer's instructions and the tool's capabilities.
- Electric tools must not be used in areas subject to fire or explosion hazards, unless they are approved for that purpose.
- Portable electric tools must be connected to a Ground Fault Circuit Interrupter (GFCI) when working in wet areas.
- Proper eye protection must be used when working with power tools.
- Personnel must be trained in the proper use of each specific tool.
- Damaged or defective power tools must be immediately tagged and removed from service.

L.3.2.8 EXCAVATIONS

All CRA excavation and trenching operations, which employees will enter, will be observed by a designated competent person. The competent person shall be responsible for evaluating and inspecting excavation and trenching operations to prevent possible cave-in and entrapment, and to avoid other hazards presented by excavation activities.

Each employee in an excavation shall be protected from cave-ins by one of three systems:

- Sloping and benching systems.
- Shoring.
- Shielding systems.

All excavation and trenching operations shall be conducted in accordance and compliance with OSHA's Standards for the Construction Industry, specifically those outlined in CRA's Standard Operating Procedure (SOP) for excavation and trenching activities. At a minimum, the following safety guidelines shall be adhered to while conducting excavation and trenching activities:

- Excavation and trenching operations require pre-planning to determine whether sloping or shoring systems are required, and to develop appropriate designs for such

systems. Also, the estimated location of all underground installations must be determined before digging/drilling begins. Necessary clearances must be observed.

- If there are any nearby buildings, walls, sidewalks, trees, or roads that may be threatened or undermined by the excavation, or where the stability of any of these items may be endangered by the excavation, they must be removed or supported by adequate shoring, bracing, or underpinning.
- Excavations may **not** go below the base of footings, foundations, or retaining walls unless they are adequately supported or a CRA licensed professional engineer (PE) has determined that they will not be affected by the soil removal.

Access and Egress

Personnel access and egress from trench and/or excavations are as follows:

- A stairway, ladder, ramp, or other means of egress must be provided in trenches greater than 4 feet (1.2 m) deep and for every 25 feet (8 m) of lateral travel.
- All ladders shall extend 3 feet (1 m) above the top of the excavation.
- Structural ramps used for access or egress of equipment will be designed by a competent person qualified in structural design or by a licensed PE.

Atmosphere Monitoring and Testing

There are three parameters by which air quality is measured: 1) oxygen concentration, 2) flammability, and 3) the presence of hazardous substances.

Employees should not be exposed to atmospheres containing less than 19.5 percent oxygen, or having a combustible vapor concentration greater than 10 percent of the lower explosive limit, and employees should not be exposed to hazardous levels of atmospheric contaminants.

Whenever potentially hazardous atmospheres are suspected in excavations and trenches, the atmosphere shall be tested by a competent person. Detector tubes, gas monitors, and explosion meters are examples of monitoring equipment that may be used.

In the event that an unusual odor or liquid is observed or suspected in excavations and trenches, the competent person shall stop work on the Site and arrange for air quality assessment and mitigation, if necessary.

Atmospheric testing and monitoring shall be performed in excavations in or adjacent to landfill areas, in areas where hazardous materials are/were stored, or in areas where the presence of hazardous materials is suspected.

Daily Inspections

The competent person shall perform daily inspections of excavations, the adjacent areas, and all protective systems for situations that could potentially result in slope failure.

Additionally, the competent person shall be aware of the potential for confined space situations and other hazardous work conditions.

The competent person shall inspect, evaluate, and complete the excavation checklist at the following intervals:

- Prior to the start of work, after each extended halt in work, and as needed throughout the shift as new sections of the excavation or trench are opened.
- After every rainstorm and other natural or man-made event that may increase the load on the walls of the excavation or otherwise affect their stability.

The inspections shall be documented using the Safety Inspection Checklist for Excavations attached to this HASP.

The competent person shall stop the work and instruct all employees to leave the excavation or trench when any potential hazards are detected. The competent person has the authority to immediately suspend work if any unsafe condition is detected.

L.3.2.9 CONFINED SPACE ENTRY

Entry into a confined space will only be undertaken after remote methods have been tried and found not to be successful. If confined space entry is required, such work will only be undertaken following the guidelines presented in the CRA Confined Space Entry Program. If a subcontractor will be performing work at the Site and wishes to use

its own confined space SOP, then the subcontractor's SOP must minimally meet the requirements set forth in the CRA SOP.

No confined space entry will be conducted at the Site. In the event that confined space entry is determined to be necessary, an amendment to this HASP, including confined space entry procedures, will be made at that time.

L.3.2.10 COMPRESSED GAS CYLINDERS

Compressed gases present several hazards. The cylinder must be properly labeled, identifying the hazardous properties of the gas, such as toxicity, flammability, or if it is an oxidizer, and a MSDS must be supplied by the manufacturer. In addition to the gas hazards, compressed gas cylinders pose other hazards simply because they contain gas under pressure.

Regardless of the properties of the gas, any gas under pressure can explode if the cylinder is improperly stored or handled. Improperly releasing the gas from a compressed gas cylinder is extremely dangerous. A sudden release of the gas can cause a cylinder to become a missile-like projectile, destroying everything in its path. Cylinders have been known to penetrate concrete-block walls. To prevent such a dangerous situation, there are several general procedures to follow for the safe storage and handling of a compressed gas cylinder:

- Store cylinders in an area specifically designated for that purpose. This area must protect the cylinders from being struck by another object. The area must be well-ventilated and away from sources of heat. It must be at least 20 feet (6 m) away from highly combustible materials. Oxidizers must be stored at least 20 feet (6 m) away from flammable gases.
- Cylinders must not be dropped or allowed to fall. Chain and rack them in an upright position during use and storage. When transporting cylinders, they must be secured from falling.
- When moving a cylinder, even for a short distance, all the valves must be closed, the regulator removed, and the valve cap installed. Never use the valve cap to lift a cylinder. If you are using a crane or some other lifting device to move a cylinder, use a cradle or boat designed for that purpose. Never use a sling or a magnet to move a cylinder.

- Never permit cylinders to contact live electrical equipment or grounding cables.
- Cylinders must be protected from the sun's direct rays, especially in high-temperature climates. Cylinders must also be protected from ice and snow accumulation.
- Before the gas is used, install the proper pressure-reducing regulator on the valve. After installation, verify the regulator is working, that all gauges are operating correctly, and that all connections are tight to ensure that there are no leaks. When you are ready to use the gas, open the valve with your hands. Never use a wrench or other tool. If you cannot open it with your hands, do not use it.

L.3.2.11 SLIP/TRIP/HIT/FALL

Slip/trip/hit/fall injuries are the most frequent of all injuries to workers. They occur for a wide variety of reasons, but can be minimized by the following prudent practices:

- Spot check the work area to identify hazards.
- Establish and utilize a pathway that is most free of slip and trip hazards.
- Beware of trip hazards such as wet floors, slippery floors, and uneven surfaces or terrain.
- Carry only loads that you can see over.
- Keep work areas clean and free of clutter, especially in storage rooms and walkways.
- Communicate hazards to on-Site personnel.
- Secure all loose clothing and ties, and remove jewelry while around machinery.
- Report and/or remove hazards.
- Keep a safe buffer zone between workers using equipment and tools.

L.3.2.12 HEAT STRESS

Recognition and Symptoms

Temperature stress is one of the most common illnesses that project personnel face when working during periods when temperatures and/or humidity are elevated. Acclimatization and frequent rest periods must be established for conducting activities where temperature stress may occur. Below are listed signs and symptoms of heat

stress. Personnel should follow appropriate guidelines if any personnel exhibit these symptoms:

Heat Rash	Redness of skin. Frequent rest and change of clothing.
Heat Cramps	Painful muscle spasms in hands, feet, and/or abdomen. Administer lightly salted water by mouth, unless there are medical restrictions.
Heat Exhaustion	Clammy, moist, pale skin, along with dizziness, nausea, rapid pulse, fainting. Remove to cooler area and administer fluids.
Heat Stroke	Hot dry skin; red, spotted or bluish; high body temperature of 104°F; mental confusion; loss of consciousness; convulsions or coma. Immediately cool victim by immersion in cool water. Wrap with wet sheet while fanning, sponge with cool liquid while fanning; treat for shock. **DO NOT DELAY TREATMENT. COOL BODY WHILE AWAITING AMBULANCE.**

Work Practices

The following procedures will be carried out to reduce heat stress:

- Heat stress monitoring.
- Acclimatization.
- Work/rest regimes (schedule of breaks) – Mandatory breaks scheduled in summer months or during high risk activities for heat stress.
- Heat stress safety personal protective equipment (cool-vests, bandanas, etc.).
- Liquids that replace electrolytes, water, and salty foods available during rest.
- Use of buddy system.

Acclimatization

The level of heat stress at which excessive heat strain will result depends on the heat tolerance capabilities of the worker. Each worker has an upper limit for heat stress beyond which the resulting heat strain can cause the worker to become a heat casualty. In most workers, appropriate repeated exposure to elevated heat stress causes a series of physiologic adaptations called acclimatization, whereby the body becomes more efficient in coping with the heat stress. Work/rest regimes planned as a component of project preparation and discussed during the daily tailgate safety meetings.

Worker Information and Training

All new and current employees who work in areas where there is a reasonable likelihood of heat injury or illness should be kept informed through continuing education programs (hazards, effects, preventative measures, drug/alcohol interaction, etc.).

L.3.2.13 COLD STRESS

Cold stress is similar to heat stress in that it is caused by a number of interacting factors including environmental conditions, clothing, workload, etc., as well as the physical and conditioning characteristics of the individual. Fatal exposures to cold have been reported in employees failing to escape from low environmental air temperatures or from immersion in low temperature water. Hypothermia, a condition in which the body's deep core temperature falls significantly below 98.6°F (37°C), can be life threatening. A drop in core temperature to 95°F (35°C) or lower must be prevented.

Air temperature is not sufficient to determine the cold hazard of the work environment. The wind chill must be considered as it contributes to the effective temperature and insulating capabilities of clothing. The equivalent chill temperature should be used when estimating the combined cooling effect of wind and low air temperatures on exposed skin or when determining clothing insulation requirements to maintain the body's core temperature.

The body's physiologic defense against cold includes constriction of the blood vessels, inhibition of the sweat glands to prevent loss of heat via evaporation, glucose production, and involuntary shivering to produce heat by rapid muscle contraction.

The frequency of accidents increases with cold temperature exposures as the body's nerve impulses slow down, individuals react sluggishly, and numb extremities make for increased clumsiness. Additional safety hazards include ice, snow blindness, reflections from snow, and possible skin burns from contact with cold metal.

Pain in the extremities may be the first early warning of danger to cold stress. During exposure to cold, maximum severe shivering develops when the body temperature has fallen to 95°F (35°C). This must be taken as a sign of danger to the employees on Site,

and cold exposures should be immediately terminated for any employee when severe shivering becomes evident. Useful physical or mental work is limited when severe shivering occurs.

Predisposing Factors for Cold Stress

There are certain predisposing factors that make an individual more susceptible to cold stress. It is the responsibility of the project team members to inform the SS to monitor an individual, if necessary, or use other means of preventing/reducing the individual's likelihood of experiencing a cold related illness or disorder.

Predisposing factors that will increase an individual's susceptibility to cold stress are listed below:

- **Dehydration:** The use of diuretics and/or alcohol, or diarrhea can cause dehydration. Dehydration reduces blood circulation to the extremities.
- **Fatigue During Physical Activity:** Exhaustion reduces the body's ability to constrict blood vessels. This results in the blood circulation occurring closer to the surface of the skin and the rapid loss of body heat.
- **Age:** Some older and very young individuals may have an impaired ability to sense cold.
- **Poor Circulation:** Vasoconstriction of peripheral vessels reduces blood flow to the skin surface.
- **Heavy Work Load:** Heavy workloads generate metabolic heat and make an individual perspire even in extremely cold environments. If perspiration is absorbed by the individual's clothing and is in contact with the skin, cooling of the body will occur.
- **The Use of PPE:** PPE usage that traps sweat inside the PPE may increase an individual's susceptibility to cold stress.
- **Lack of Acclimatization:** Acclimatization, the gradual introduction of workers into a cold environment, allows the body to physiologically adjust to cold working conditions.
- **History of Cold Injury:** Previous injury from cold exposures may result in increased cold sensitivity.

Prevention of Cold Stress

There are a variety of measures that can be implemented to prevent or reduce the likelihood of employees developing cold related ailments and disorders. These include acclimatization, fluid and electrolyte replenishment, eating a well balanced diet, wearing warm clothing, the provision of shelter from the cold, thermal insulation of metal surfaces, adjusting work schedules, and employee education.

- **Acclimatization:** Acclimatization is the gradual introduction of workers into the cold environment to allow their bodies to physiologically adjust to cold working conditions. However, the physiological changes are usually minor and require repeated uncomfortably cold exposures to induce them.
- **Fluid and Electrolyte Replenishment:** Cold, dry air can cause employees to lose significant amounts of water through the skin and lungs. Dehydration affects the flow of blood to the extremities and increases the risk of cold injury. Warm, sweet, caffeine-free, non-alcoholic drinks and soup are good sources to replenish body fluids.
- **Eating a Well Balanced Diet:** Restricted diets including low salt diets can deprive the body of elements needed to withstand cold stress. Eat high-energy foods throughout the day.
- **Warm Clothing:** It is beneficial to maintain air space between the body and outer layers of clothing in order to retain body heat. However, the insulating effect provided by such air spaces is lost when the skin or clothing is wet.
- **Work/Rest Regimes:** Schedule work during the warmest part of the day, if possible. Rotate personnel and adjust the work/rest schedule to enable employees to recover from the effects of cold stress.

The parts of the body most important to keep warm are the feet, hands, head, and face. As much as 40 percent of body heat can be lost when the head is exposed.

L.3.2.14 ADVERSE WEATHER CONDITIONS

The SS shall decide on the continuation or discontinuation of work based on current and pending weather conditions. Electrical storms, heavy rains, tornado warnings, and sustained strong winds [approximately 40 mph (65 k/hr)] are examples of conditions that would call for the discontinuation of work and evacuation of the Site.

In addition, no work with elevated super structures (e.g., drilling, crane operations, etc.) will be permitted during any type of electrical storm or during wind events that have wind speeds exceeding 40 mph (65 k/hr).

L.3.2.15 WORKING OVER OR NEAR WATER

The procedures outlined in this section are to be implemented by all CRA and subcontractor personnel when there is potential to slip or fall into water that is greater than 3 feet (1 m) in depth. Additionally, these procedures are to be adhered to when water is flowing and has the potential to carry personnel away.

- When working at ground level, a 5-foot (1.5 m) "no entry zone" can be established between the work area and the water hazard. The "no entry zone" is to be clearly defined and/or demarcated. Personnel will not be permitted to enter into this area unless the other provisions of this section are in place.
- Standard guardrails are required on any walking/working surface over or near water.
- Where guardrails are not practical due to impairment of work being performed, other types of safeguarding, such as safety harnesses, lifelines, and lanyards may be used (see CRA's Fall Protection Program).
- If it is not feasible to provide fall protection due to the scope of work or location, personnel will be required to wear U.S. Coast Guard-approved life jackets or buoyant work vests. Prior to each use and after each use, the buoyant work vests and life preservers must be inspected for defects that would affect strength and/or buoyancy. Any damaged or defective buoyant work vest or life preserver cannot be used.
- Call in or make prearranged contacts after each activity posing a drowning hazard is completed.
- If it is necessary to work on wet/slippery surfaces above water, non-slip tape or other methods are to be used to increase traction.
- Ring buoys with a minimum of 90 feet (27 m) of line must be readily available for emergency operations. The distance between buoys cannot exceed 200 feet (61 m).

- Due to the anticipated scope of work, it is expected that a life saving skiff will be necessary. However, the SS in conjunction with the Regional SHM will evaluate current Site conditions to determine if a skiff is required.

L.3.2.16 BOATING SAFETY

This procedure outlined in this section provides the minimum requirements for safe work practices during the operation of boating equipment. Proper instruction, practice, and training are important. Boating equipment shall be used for work purposes only. No recreational use or horseplay is allowed.

- Make sure the boat is in top operating condition and that there are no tripping hazards. The boat should be free of fire hazards and have clean bilges.
- Ensure safety equipment, required by law, is on board, maintained in good condition, and you know how to properly use these devices. The requirements for the contents of the First Aid Kit and the required Safety Equipment are described in Appendix L-E.
- File a float and destination plan with the office and/or a co-worker who is ashore.
- The boat operator and passenger(s) are required to wear a US Coast Guard-approved personal floatation device while in the boat.
- Have a complete knowledge of the operation and handling characteristics of your boat.
- Know your position and know where you are going.
- Maintain a safe speed at all times to avoid collision.
- Keep an eye out for changing weather conditions, and act accordingly.
- Know and practice the Rules of the Road (Navigational Rules).
- Know and obey federal, provincial, and state regulations and waterway markers.
- Maintain a clear, unobstructed view forward at all times. "Scan" the water back and forth; avoid "tunnel" vision. Most boating collisions are caused by inattention.

Additional information is provided in CRA's Boating Policy, which is included as Appendix L-E.

L.3.3 BIOLOGICAL HAZARDS

CRA employees conduct numerous project activities that have the possibility of encountering biological hazards, which include blood-borne pathogens, insects, spiders, snakes, and large predators. This section identifies precautions to be taken if these hazards are encountered.

L.3.3.1 VEGETATION OVERGROWTH

Overgrown weeds, bushes, trees, grass, and other vegetation are fire and safety hazards.

There are a number of hidden hazards not immediately recognized due to the overgrowth of vegetation in areas where field activities may occur, including discarded junk, litter, and debris. Construction materials such as boards, nails, concrete, and other debris may be hidden beneath blades of tall grass, weeds, and bushes. Other hazards may include steep slopes, potholes, trenches, soft spots, and dips; all dangerously concealed from the view of the individual walking or operating motorized equipment in the area. Additionally, there are biological hazards such as snakes, ticks, chiggers, and mosquitoes that breed in overgrowth conditions.

Here are some simple actions you can take:

- Assess the work area and determine if the area requires vegetation clearance. Consider that overgrowth that extends above the lowest level of motorized equipment (i.e., bumper or fender) or 6 inches (15 cm) above your ankle has hidden hazards that you will not be able to readily identify.
- Determine if the area is safe to walk or whether you need motorized equipment. Consider the limitations of the equipment.
- Identify slip, trip, and fall hazards and remove from the general work area. Remember to give adequate clearance so that the items being removed do not pose future hazards.
- Adequately protect yourself against the hazards by wearing boots that protect the ankles, long pants, and using insecticides.
- Consider the limitations of manual or mechanical equipment for the clearance of overgrowth, particularly the safety hazards when using sling blades, machetes, weed eaters, bush hogs, or other brush removing equipment.

Before taking any action, determine whether there any ecological issues that would affect or prevent the removal of overgrowth in protected areas such as wetlands, wildlife habitats, or sanctuaries for endangered and/or protected species.

L.3.3.2 POISONOUS PLANTS

Common **Poison Ivy** grows as a small plant, a vine, and a shrub. Poison Ivy occurs in every state. The leaves always consist of three glossy leaflets. **Poison Sumac** grows as a woody shrub or small tree 5 to 25 feet (1.5 to 7.5 m) tall. It usually contains nine leaves, with eight paired leaves and one on top, and is common in swampy areas. The plants are potent sensitizers and can cause a mild to severe allergic reaction, referred to as "contact dermatitis".

Dermatitis, in Rhus-sensitive persons, may result from contact with the milky sap found in the roots, stems, leaves, and fruit, and may be carried by contacted animals, equipment or apparel.

The best form of prevention is to avoid contact. Wearing long sleeves and gloves, and disposable clothing, such as Tyvek, is recommended in high-risk areas to avoid exposure from contaminated apparel. Barrier creams and cleaners are also recommended.

L.3.3.3 INSECTS

Ticks

Ticks are blood-feeding external parasites of mammals, birds, and reptiles throughout the world. Some human diseases of current interest in the U.S. caused by tick-borne pathogens include Lyme disease, ehrlichiosis, babesiosis, Rocky Mountain Spotted Fever, tularemia, and tick-borne relapsing fever. Lyme disease is caused by a bacterial parasite called spirochete and is spread by infected ticks that live in and near wooded areas, tall grass, and brush. The ticks that cause the disease in the Northeast and Midwest are often no bigger than a poppy seed or a comma in a newsprint. The peak months for human infection are June through October. There are many other tick borne diseases such as Rocky Mountain Spotted Fever, which can be carried by a variety of

ticks. The prevention and treatment of these diseases are similar to those of Lyme disease.

Prevention

Preventative measures include wearing light-colored clothing, keeping clothing buttoned, tucking pant legs in socks, and keeping shirttails tucked in. Periodic checks for ticks should be made during the day, and especially at night. Hair should also be checked by parting it and combing through it to make sure that no ticks have attached to the scalp. Also, check clothing when it is first removed, before ticks have a chance to crawl off.

The most common repellent recommended for ticks is N,N-dimethyl-m-toluamide, or DEET. It is important to follow the manufacturer's instructions found on the container for use with all insecticides especially those containing DEET.

In general, DEET insect repellent should only be applied to clothing, not directly on the skin. Do not apply to sunburns, cuts, or abrasions. Use soap and water to remove DEET once indoors.

Removal

The best way to remove a tick is removal by tweezers. If tweezers are not available, cover your fingers (tissue paper) while grasping the tick. It is important to grasp the tick as close as possible to the Site of attachment and use a firm steady pull to remove it. When removing the tick, be certain to remove all the mouth parts from your skin so as not to cause irritation or infection. Wash hands immediately after with soap and water, and apply antiseptic to the area where tick was removed. Get medical attention if necessary.

Symptoms of Lyme Disease

The first symptoms of Lyme Disease usually appear from 2 days to a few weeks after a person is bitten by an infected tick. Symptoms usually consist of a ring-like red rash on the skin where the tick attached, and is often bulls eye like with red on the outside and clear in the center. The rash may be warm, itchy, tender, and/or "doughy" and appears in only 60 to 80 percent of infected persons. An infected person also has flu-like symptoms of fever, fatigue, chills, headaches, a stiff neck, and muscle aches and pains

(especially knees). Rashes may be found some distance away from original rash. Symptoms often disappear after a few weeks.

Bees, Wasps, and Yellow Jackets

Insects that sting are members of the order Hymenoptera of the class Insecta. There are two major subgroups: aphids (honeybees, bumblebees) and vespids (wasps, yellow jackets, hornets). Aphids are docile and usually do not sting unless provoked. The stinger of the honeybee has multiple barbs, which usually detaches after a sting. Vespids have few barbs and can inflict multiple stings.

Types of stinging insects that might be encountered on a Site may include:

- Carpenter Bees
- Bumblebees
- Mud Dauber Wasps
- Africanized Killer Bees
- Cicada Killer Wasps
- Giant Hornets
- Honeybees
- Paper Wasps
- Yellow Jackets

Symptoms

If you are stung there are three types of reactions you can have, a normal, a toxic, or an allergic reaction.

- Normal reaction - only lasts a few hours and consists of pain, redness, swelling, itching, and warmth near the sting area.
- Toxic reaction - will last for several days and results from multiple stings and may cause cramps, headaches, fever, and drowsiness.
- Allergic reaction - might cause hives, itching, swelling, tightness in the chest area and a possibility of breathing difficulties, dizziness, unconsciousness, and cardiac arrest.

The stingers of many Hymenoptera may remain in the skin and should be removed as quickly as possible without concern for the method of removal. An ice cube placed over the sting will reduce pain; aspirin may also be useful. Persons with known hypersensitivity to such stings should carry a kit containing epinephrine in a pre-filled syringe. Antihistamines may help decrease hives and angioedema. Persons who have severe symptoms of anaphylaxis, have positive venom skin test results, and are at risk

for subsequent stings should receive immunotherapy regardless of age or time since anaphylaxis.

Precautions

The following precautions can help you avoid stings. Try to wear light colored clothing and shy away from dark or floral prints. Avoid wearing perfumes, hairsprays, colognes, and scented deodorants while working outside. If eating outside, keep all food and drinks covered; sweet foods and strong scents attract stinging insects as well. Never swat or swing at the insect, it is best to wait for it to leave, softly blow it away, or gently brush it aside. Seek medical attention when the reaction to a sting includes swelling, itching, dizziness or shortness of breath.

If physical control measures are not effective, use a pesticide that will have a minimal impact on both you and the environment.

Mosquitoes

Mosquitoes are common pests that can be found in any state and any work environment where warm, humid conditions exist. Mosquitoes can pass along diseases such as West Nile virus and Malaria. Several different methods can be used to control adult mosquito populations: repellants such as DEET, mosquito traps, foggers, and vegetation and water management. Mosquitoes are found from the tropics to the Arctic Circle and from lowlands to the peaks of high mountains.

L.3.3.4 POISONOUS SPIDERS

Black Widow

Black Widow spiders are not usually deadly (especially to adults) and only the female is venomous. The female spider is shiny black, usually with a reddish hourglass shape on the underside of her spherical abdomen. Her body is about 1.5 inches (4 cm) long while the adult male's is approximately half that. The spider's span ranges between 1 and 3 inches (2.5 and 8 cm). The adult males are harmless, have longer legs, and usually have yellow and red bands and spots over their back, and the young black widows are colored orange and white. The bite of a black widow is often not painful and may go

unnoticed. However, the poison injected by the spider's bite can cause severe reactions in certain individuals.

Symptoms

Symptoms that may be experienced include abdominal pain, profuse sweating, swelling of the eyelids, pains to muscles or the soles of the feet, salivation and dry-mouth (alternating), and paralysis of the diaphragm. If a person is bitten, they should seek immediate medical attention. Clean the area of the bite with soap and water. Apply a cool compress to the bite location. Keep effected limb elevated to about heart level. Ask doctor if Tylenol or aspirin can be taken to relieve minor symptoms. Additional information can be obtained from the Poison Center (1-800-222-1222). Black widows are found throughout the tropics, U.S., and Canada.

Brown Recluse

Brown recluse spiders are usually light brown in color, but in some instances they may be darker. Brown recluse spiders are highly venomous spiders, native to the U.S. and found coast to coast. The brown recluse can vary in size, but some can obtain bodies of 5/8 inches (1.5 cm) in length with a leg span of 1 1/1 inches (4 cm) in diameter. They can be identified by the three pairs of eyes along the head area and the fiddle shaped markings on their back. Most brown recluse bites are defensive rather than offensive. They generally only bite when they feel threatened.

Symptoms

If bitten by a brown recluse, an individual may experience open, ulcerated sores, which when left untreated may become infected and cause tissue necrosis. If an individual believes a spider has bitten them, they need to seek medical attention as soon as possible. In order to minimize the occurrence of brown recluse bites, individuals should shake their clothing and shoes thoroughly, eliminate the presence of cluttered areas, and spray the building perimeters with pesticides. Brown recluse spiders are found throughout the U.S., Mexico, and Canada.

L.3.3.5 THREATENING DOGS

If you are approached by a frightened or menacing dog:

- Do not attempt to run and don't turn your back.
- Stay quiet, and remember to breathe.
- Be still, with arms at sides or folded over chest with hands in fists.
- Slowly walk away sideways.
- Don't stare a dog in the eyes, as this will be interpreted as a threat.
- Avoid eye contact.
- If you have a jacket, you could wrap it around your arm and should he snap, take the bite harmlessly.
- Try calling its bluff. Yell "sit!", "stay!", or "go home!". You might convince the dog that you are the stronger in the situation.

L.3.3.6 SNAKES

Snakes may be found in any region of North America. While many snakes encountered are not venomous, a few are; so it is best that you give a wide berth to all snakes. Of the 7,000 venomous snakebites reported each year, only about 15 prove to be fatal; so your chances of survival are extremely high. The usual snake encounter is one in which they see you before you see them, and they slither away from you quickly, startling you. If you see a snake, back away from it slowly and do not touch it. If you or someone you know are bitten, try to see and remember the color and shape of the snake, which can help with treatment of the snakebite.

Venomous snakes include the Coral Snake, Cobra, and Pit Vipers, such as the Cottonmouth (Water Moccasin), Copperhead, and Rattlesnake. The venom of pit vipers is primarily hematoxic because it acts upon the victim's blood system. This venom breaks down blood cells and blood vessels and affects heart action. Bite victims experience severe burning pain, localized swelling and discoloration for the first 3 to 30 minutes, followed by nausea, vomiting, and occasional diarrhea and usually shock.

Preventing Snakebites

Watching where you step, put your hands, or sit down is one of the best ways to prevent snakebites. Poisonous snakes live on or near the ground and often like rocks, woodpiles, and other spots that offer both a place to sun and a place to hide. Most bites occur in and around the ankle. About 99 percent of all bites occur below the knee, except when someone accidentally picks up or falls on the snake.

Watching where you step and wearing boots in tall grass can prevent most snakebites. Another means to protect against snakebites is snake chaps.

Emergency First Aid for Poisonous Snakebite

Although it is important to obtain medical aid immediately, emergency first aid can slow the spread of poison from the bite. Remain calm and avoid unnecessary movement, especially if someone is with you. The rate of venom distribution throughout your body will be slower if you are still and quiet. **Do not** use home remedies, and **do not** drink alcoholic beverages.

In addition, learn the following procedures so you do not waste time before getting medical attention.

- If less than 60 minutes is required to reach a hospital or other medical aid, follow this procedure:
  - Apply a constricting band 2 to 4 inches (5 to 10 cm) on each side of the bite. The band should be loose enough to slip your finger under without difficulty, so that you do not cut off circulation completely. Properly applied, the constricting band can be left safely in place for 1 hour without adjustment.
  - If ice is available, place some in a towel, shirt, or other piece of cloth and apply it to the bite area. Do not bind it to the bite, but keep it loosely in place. Do not use the ice pack for more than 1 hour. The objective is to cool the venom and slow its action, but not to freeze the tissue.
  - The primary function of the constricting band and ice pack is to slow the spread of venom through your body. Remove them slowly so there will not be a sudden rush of venom through your blood stream.

L.3.3.7 OTHER WILDLIFE

Bears

Black bears generally avoid contact with humans; however, this species quickly adapts to **any** source of food that humans provide (whether intentionally or accidentally). Black Bears should not be fed - avoid unnecessary bear encounters! Signs of bear presence include tracks, droppings or torn-up trees. Stay on established trails, hike only during daylight hours and use caution when traveling near natural bear foods (berries, fish, etc.). Its habitat ranges from the Tropics of Florida to the Arctic.

Cougars

The **Eastern Cougar** is the second largest cat (after the jaguar) found in the New World. The cougar, also puma or mountain lion, is a carnivore of North and South America with thick fur that ranges from reddish-brown in tropical forms to bluish-gray in northern forms. Its body is lithe, muscular, deep chested and compact; it has a rounded and shortened head, large eyes, and a distinctively long tail. The male can weigh up to 160 pounds (71 kg) and measure 6.5 feet (2 m) in length. Cougars are extremely elusive and usually avoid contact with people. However, they are known to stalk their prey, striking with full impact and most often kill by suffocating with a prolonged bite across the throat or by breaking the victim's neck.

Wolves

The wolf is a carnivore related to the jackal and domestic dog. All wolves are characterized by powerful teeth, bushy tails, and round pupils. Certain characteristics of the skull distinguish them from domestic dogs, some breeds of which they otherwise resemble.

There are two species of wolves: the **gray wolf**, or **timber wolf**, once widely distributed but now found only in Canada, Alaska, and northern Europe and Russia, except for a few isolated packs in other regions; and the **red wolf**, found only in Texas and the southeastern United States.

An adult gray wolf measures up to 6.5 feet (2 m) in length, including the tail (less than half the body length), and weighs up to 175 pounds (80 kg). The fur of the gray wolf is red-yellow or yellow-gray with black patches on its back and sides, and white on its

chest and abdomen. There are also black or brown gray wolves, and those in the far north may be pure white. The red wolf is smaller in size and usually darker in color.

L.3.4 BLOODBORNE PATHOGENS

Hepatitis B is largely transmitted through exposure to bodily fluids containing the virus, which could be found on refuse encountered in subsurface investigations. This includes medical wastes, contaminated needles and syringes, and so on. The primary method of transmission depends on the prevalence of the disease in a given area.

Prevention

Preventative measures include wearing appropriate PPE – leather work gloves, long sleeved shirt, and safety footwear. Several vaccines have been developed for the prevention of hepatitis B virus infection. These rely on the use of one of the viral proteins (hepatitis B surface antigen or HbsAg). The vaccine was originally prepared from plasma obtained from patients who had long-standing hepatitis B virus infection. However, currently these are more often made using recombinant technology, though plasma-derived vaccines continue to be used; the two types of vaccines are equally effective and safe.

L.4.0 PERSONAL PROTECTIVE EQUIPMENT

L.4.1 GENERAL

This section shall cover the applicable personal protective equipment (PPE) requirements, which shall include eye, face, head, foot, and respiratory protection.

The purpose of PPE is to shield or isolate individuals from the chemical and physical hazards that may be encountered during work activities.

L.4.2 TYPES OF PPE

The type of PPE for a project will vary based on the level of protection required to protect the employee from Site physical, chemical, biological, and thermal hazards.

L.4.2.1 TYPES OF PROTECTIVE MATERIAL

Protective clothing is constructed of a variety of different materials for protection against exposure to specific chemicals. No universal protective material exists. All will decompose, be permeated, or otherwise fail to protect under certain circumstances.

Fortunately, most manufacturers list guidelines for the use of their products. These guidelines usually concern gloves or coveralls and generally only measure rate of degradation (failure to maintain structure). It should be noted that a protective material may not necessarily degrade but may allow a particular chemical to permeate its surface. For this reason, guidelines must be used with caution. When permeation tables are available, they should be used in conjunction with degradation tables.

In order to obtain optimum usage from PPE, the following procedures are to be followed by all Site personnel using PPE:

- When using disposable coveralls, don a clean, new garment after each rest break or at the beginning of each shift.
- Inspect all clothing, gloves, and boots both prior to and during use for:
  - imperfect seams;
  - non-uniform coatings;

- tears; and
- poorly functioning closures.

- Inspect reusable garments, boots, and gloves both prior to and during use for:
  - visible signs of chemical permeation;
  - swelling;
  - discoloration;
  - stiffness;
  - brittleness;
  - cracks;
  - any sign of puncture; and
  - any sign of abrasion.

Reusable gloves, boots, or coveralls exhibiting any of the characteristics listed above shall be discarded. PPE used in areas known or suspected to exhibit elevated concentrations of chemicals shall not be reused.

L.4.3 RESPIRATORY PROTECTION

Respiratory protection may be required to be worn by personnel during project activities in certain areas of the Site. Personnel required to work in these areas shall wear an air-purifying respirator and follow the procedures and guidelines as described below and follow CRA's Respiratory Protection Program, which is included as Appendix L-F.

All personnel required to use this equipment shall first be instructed in how to properly fit a respirator to achieve the required face-piece-to-face seal for respiratory protective purposes. Conditions, which could affect this face seal, are the presence of beards, sideburns, eyeglasses, and the absence of upper or lower dentures.

The air-purifying respirator cartridges selected for use during project work at the Site are P-100 organic vapor/acid gas cartridges. These cartridges have the ability to protect against the known contaminant concentrations.

All cartridges shall be changed prior to breakthrough or at a minimum daily. Changes shall also be made when personnel begin to experience increased inhalation resistance or breakthrough of a chemical warning property.

L.4.3.1 RESPIRATOR CLEANING

Respiratory equipment and other non-disposable equipment shall be fully decontaminated and then placed in a clean storage area. Respirator decontamination shall be conducted at a minimum once daily. Face pieces shall be disassembled, the cartridges thrown away, and all other parts placed in a cleansing solution. After an appropriate amount of time in the solution, the parts shall be removed and re-seated with tap water.

Face pieces shall be allowed to air dry before being placed in sanitized bags, and then stored in a clean area.

L.4.4 LEVELS OF PROTECTION

The level of protection must correspond to the level of hazard known, or suspected, in the specific work area. PPE has been selected with specific considerations to the hazards associated with Site activities. The specific PPE to be used for each activity is outlined in each THA table located in Appendix L-C.

- All PPE shall be disposed of and/or decontaminated at the conclusion of each work day as described below. Decontamination procedures shall follow the concept of decontaminating the most contaminated PPE first.
- All disposable equipment shall be removed before meal breaks and at the conclusion of the workday and replaced with new equipment prior to commencing work.
- Eating, drinking, chewing gum or tobacco, and smoking are prohibited while working in areas where the potential for chemical and/or explosive hazards may be present. Personnel must wash thoroughly before initiating any of the aforementioned activities.

L.4.4.1 REASSESSMENT OF PROTECTION LEVELS

Protection levels provided by PPE selection shall be upgraded or downgraded based upon a change in Site conditions or the review of the results of air monitoring or the initial exposure assessment monitoring program, if one was conducted.

When a significant change occurs, the hazards shall be reassessed. Some indicators of the need for reassessment are:

- Commencement of a new work phase.
- Change in job tasks during a work phase.
- Change of season/weather.
- When temperature extremes or individual medical considerations limit the effectiveness of PPE.
- Chemicals other than those expected to be encountered are identified.
- Change in ambient levels of chemicals.
- Change in work scope, which affects the degree of contact with areas of potentially elevated chemical presence.

All proposed changes to protection levels and PPE requirements shall be reviewed and approved prior to their implementation by the SS.

L.5.0 AIR MONITORING PROGRAM

Inhalation hazards are caused from the intake of vapors and contaminated dust. Air monitoring shall be performed while intrusive activities are taking place to detect the presence and relative level of those air contaminants which are inhalation hazards. The purpose of air monitoring is to identify and quantify airborne contaminants in order to determine the level of worker protection needed. Initial screening for identification is often qualitative, but the determination of its concentration (quantification) must wait subsequent testing.

The data collected throughout the monitoring effort shall be used to determine the appropriate levels of protection.

L.5.1 EXPOSURE MONITORING

Air monitoring will be conducted during Site activities using a photoionization detector (PID), portable dust monitor, and a multi-gas meter [combustible gas indicator - lower explosive limit (LEL), oxygen (O_2), hydrogen sulfide (H_2S), and carbon monoxide (CO)]. Continuous monitoring will be employed at the start of all activities with chemical exposure potential. Where monitoring indicates that there is in fact no potential for chemical exposure to occur, continuous monitoring may be discontinued and periodic air monitoring will be employed if appropriate. Should conditions change such that the potential for chemical exposure increases, continuous monitoring shall be resumed.

Exposure to possible asbestos and/or contaminated dust at the Site will be monitored using a portable dust monitor, which will be operated during all activities with the potential to generate airborne dust or when upwind airborne dust (originating from the landfill) is observed. Personal asbestos monitors and a perimeter high-volume particulate sampler will also be used.

If the total dust concentrations measured by the portable monitors exceed the action level for particulate of 2 mg/m^3 [1], personal asbestos sampling will be conducted and the filters will be analyzed for asbestos. Personal asbestos cartridge monitors will also be used for workers conducting dust-disturbing activities in areas where asbestos is known to exist (once these areas, if any, are identified through sampling) or potentially exists

[1] A value of 1/5th the PEL for dust of 10 mg/L was chosen to be protective in instances where contaminants may be adhered to or present as solid particulate.

based on the visual identification of potential asbestos containing materials in the area. At a minimum, an asbestos monitor will be placed on the employee with the highest potential for exposure to asbestos. Monitors will be placed on additional workers if appropriate. If the total dust action level is not exceeded or asbestos is not detected during the Site clearing activities (expected to generate the most significant quantities of airborne dust), perimeter and personnel air monitoring for asbestos will be discontinued. Personal air monitoring for asbestos will be resumed during intrusive activities if the action level of 2 mg/m^3 is exceeded on the portable dust monitor, soil sample analytical results indicate the presence of asbestos in soils in an area, or visual evidence of potential friable asbestos is observed in an area.

If asbestos is positively identified at the Site, the PRP Group will comply with the requirements of Montgomery County Asbestos Regulation 153.15 for inactive landfill sites.

Exposure to possible low-level radiation at the Site shall be monitored with a low-level radiation meter (e.g., Victoreen survey meter). All radiation monitoring shall be conducted in the breathing zone. All areas will be screened initially for radiation before the work is performed. Radiation screening will also be conducted at all work areas where material resembling foundry sands is identified. If radiation levels above background are identified, radiation monitoring will be continued for the duration of activities at the location of the elevated readings. If the radiation level exceeds 0.6 mrem/hr, the area will be evacuated and the SHM and PM will be contacted.

Additional detail regarding monitoring frequency is provided in Section L.5.1.3 and in the task hazard analysis tables.

L.5.1.1 PHOTOIONIZATION DETECTORS

Exposure to VOCs shall be monitored with a PID with an 11.7 or 11.8 eV lamp. The PID has the ability to detect organic vapor concentrations from 1 part per million (ppm) to 2,000 ppm. All PID monitoring shall be conducted in the breathing zone.

L.5.1.2 MULTI-GAS METER (LEL/O_2/H_2S/CO METERS)

The multi-gas meter is a combination oxygen, carbon monoxide, hydrogen sulfide, and combustible gas indicator, which simultaneously analyzes concentrations of each contaminant in air. When used properly, the portable oxygen indicator will read the percent oxygen in the immediate atmosphere. The normal ambient oxygen concentration is 20.9 percent at sea level. It is necessary to be apprised of such readings as they impact LEL readings and vice versa.

The following table provides the action level for each contaminant being monitored.

Parameter	*Action Level*	
Oxygen	Less than 19.5 O_2 Greater than 23.5% O_2	Stop work and evacuate are if levels are less than 19.5% O_2 or greater than 23.5% O_2.
Hydrogen Sulfide	Less than 10 ppm H_2S	Continue work and evaluate work conditions.
	Greater than or equal to 10 ppm (ceiling) H_2S	Stop work and evacuate area if levels are greater than or equal to 10 ppm. Shut off or eliminate any ignition sources along perimeter of Site.
Carbon Monoxide	Less than 35 ppm CO	Continue work and evaluate work conditions.
	Greater than or equal to 35 ppm	Stop work and evacuate area if levels are greater than or equal to 35 ppm.
Combustible Gas	Less than 10% LEL	Continue work and evaluate work conditions.
	Greater than 10% LEL	Stop work and evacuate area if levels are greater than 10% LEL. Shut off or eliminate any ignition sources along perimeter of Site. Consult the Regional SHM and PM.

L.5.1.3 COLORIMETRIC DETECTOR TUBES

Detector tubes are one of the most frequently used measuring methods for detecting contaminants in the work area. The reason they are used so often is that no other simple system is currently able to cover such a wide range of gases and vapors quantitatively. The major limitation of detector tubes is that their accuracy is commonly taken as within 25 percent of the true concentration of the contaminants sampled. Detector tubes are also known as "colorimetric tubes" or "indicator tubes". Detector tubes are small glass

tubes filled with solid absorbents such as silica gel, activated alumina or inert granules, and impregnated with detecting chemicals through which air is aspirated at a controlled rate. Common types of Detector Tubes include: Draeger, Gastec, RAE, MSA, Sensidyne, etc.).

L.5.1.4 DUST MONITORS

The monitoring and control of investigation activities will be based on real-time particulate concentrations measured at, and downwind of, investigation activities. Site activities will be monitored with one real-time instrument at the primary work area.

A particulate monitor (MIE PDR Personal DataRam Monitor or appropriate alternative) will be used. The action level will be 2 mg/m^3 in the work area. Particulate emissions from investigation activities can usually be managed to limit air concentrations well below 2 mg/m^3. The MIE PDR Personal DataRam Monitor is a direct reading aerosol photometer. The DataRam monitor is designed to detect aerosol dust or respirable dust in the ambient air. Aerosol is a term to describe fine particulates (solid or liquid) suspended in air. Concentrations are evaluated by two scales, which read from 0.01 to 10.0 mg/m^3 and 0.1 to 100.0 mg/m^3, respectively.

If particulate is detected at concentrations greater than 2 mg/m^3 for over 15 minutes, then work will be stopped and measures to reduce particulate emissions will be implemented. Potential measures to reduce particulate emissions include:

- use of water or other suppression agents at excavation faces and unpaved vehicle travel areas;
- maintain excavation faces as small as possible to limit emissions; and
- reduce vehicle activity and speed.

Personal asbestos cartridge monitors will also be used for workers conducting dust-disturbing activities in areas where asbestos is known to exist (once these areas, if any, are identified through sampling) or potentially exists based on the visual identification of potential asbestos containing materials in the area. At a minimum, an asbestos monitor will be placed on the employee with the highest potential for exposure to asbestos. Monitors will be placed on additional workers if appropriate.

Long-term (approximately 8-hour) samples will be collected on absorbent filter media (dust), and the media will be sent to an accredited laboratory for particulate analysis. Particulate results will be directly compared to the Maximum Acceptable Ground-Level Concentration (MAGLC) for particulate calculated in accordance with Ohio EPA's Review of New Sources of Toxic Emissions guidance, i.e., 1/10th of the TLV adjusted for the exposure period (1.0 mg/m^3 for an 8-hour work day). If particulate concentrations on the filter media exceed the MAGLC, the filters will be analyzed for asbestos and the results compared to the MAGLC for asbestos. These data will allow the PRP Group to modify ongoing activities in order to prevent potential off-Site exposure. Site wind direction data will be recorded daily in order to document upwind and downwind locations and to interpret the measured data. If particulate concentrations measure at the fenceline monitor are suspected to be due in large part to background sources of particulate, additional upwind fenceline monitors may be added.

Samples will be collected in accordance with the method presented in Appendix B of Code of Federal Regulations Title 40 (40 CFR) Part 50. Samples will be collected on each day that intrusive, dust-disturbing activities are occurring. Long-term samples will not be collected during precipitation events. Ambient air monitoring will be conducted at a location that is approximately downwind of the Site activities to be completed on the day in question. The actual location of the sampling equipment will be determined based on meteorological conditions at the Site at the beginning of the day and a review of local weather forecast data. If the wind direction shifts during the day, the long-term sampling equipment will not be moved, as this would compromise the sample. However, the wind direction will be noted and the data interpreted accordingly with respect to upwind, downwind, and crosswind issues.

L.5.1.5 MONITORING FREQUENCY

A summary of the monitoring equipment and frequency for each work activity is presented in the task hazard analysis tables. As noted in the table, the monitoring equipment listed per work activity relates to the initial level of protection. The monitoring frequency may be decreased if the work areas and activities are unchanging, the result of the first hour of monitoring indicate contaminant concentrations are non-detect, and no differing conditions are observed.

L.5.1.6 HEALTH AND SAFETY ACTION LEVELS

An action level is a point at which increased protection or cessation of activities is required due to the concentration of contaminants in the work area. All activities shall be initiated in Modified Level D. The appropriate actions are to be taken at designated action levels. The initial organic vapor action level for Site work is 1 ppm due to the chance of vinyl chloride, benzene, 1,2-dichloroethane, and 1,1,2,2-tetrachloroethane being present. The initial action level for particulate is 2 mg/m^3 given the chance of some Site contaminants being adhered to or present as particulate. The action level for asbestos is 0.1 fibers per cubic centimeter (f/cm^3).

In addition to the action level, an upgrade to Level C is required if:

- Any symptoms occur, as described in Section L.3.0.
- Requested by an individual performing the task.
- Any irritation to eye, nose, throat, or skin occurs.

A work stoppage and evacuation (cease and desist) at the specific work area is required if levels in the breathing zone exceed the protection factor of the respirator.

L.5.1.7 PROCEDURES FOR MAINTENANCE OR CALIBRATION OF AIR SAMPLING INSTRUMENTS

All air sampling instruments will be calibrated in the field prior to the start of each day's activities. Calibration will be completed in accordance with the manufacturer's instructions and the requirements of CRA's Quality System and field sampling SOPs. Air sampling instruments will be recalibrate during the course of the day if calibration drift is noted or if the equipment malfunctions. CRA's SOPs regarding the control of monitoring and measuring equipment are included as Appendix L-G.

CRA's field equipment office will maintain the air sampling instruments and have the instruments shop-calibrated in accordance with the manufacturer's instructions and CRA's Quality System. The Field Equipment Manager ensures that all CRA-owned Equipment is shop-calibrated, as applicable, and maintained, and that these activities are documented. Specific procedures for the scheduling and performance of calibration activities and maintenance are specified in CRA's Inspection, Measurement, and Test Equipment Work Instructions and are available upon request.

L.6.0 SITE CONTROL

The purpose of Site control is to minimize potential contamination of workers and protect the public from hazards found on Site. Site control is especially important in emergency situations.

Site control and work area demarcation will be achieved through posting of signage and placement of barricades. All construction areas will have the appropriate signage posted. Barricades and warning signs will be placed to warn personnel of potential hazards. A standby person (spotter) may be utilized in place of barricades, where appropriate. The following materials may be used to barricade construction areas, crane swing radius, and control traffic, etc.:

- Temporary fence;
- High visibility tape, rope, or chains;
- Traffic cones;
- Sawhorses; and
- Wood or metal guardrails.

The majority of Site operations, as well as access to the Site, could be controlled from the support zone. The support trailer would provide for team communications and emergency response, and sanitary facilities (i.e., Porta-Potty). Appropriate safety and support equipment also will be located in this zone.

The support zone will be located upwind of Site operations, if possible, and would be used as a potential evacuation point, if appropriate. No potentially contaminated personnel or materials are allowed in this zone.

L.6.1 WORK ZONES

In general, there will be a three zone approach to contain the potential spread of contamination during Site activities. The three zones are the Exclusion Zone (EZ), the Contamination Reduction Zone, and the Support Zone. The need for and delineation of these three zones will be based on sampling and monitoring results, evaluation of potential routes, and the amount of contaminant dispersion in the event of a release.

Movement of personnel and equipment from one zone to another will be minimized and restricted to necessary personnel and equipment.

EXCLUSION ZONE

The Exclusion Zone, or "Hot Zone" is the area where the primary activity will occur such as mitigation or spill containment. The Exclusion Zone is the defined area where there is a possible respiratory and/or contact health hazard. An Exclusion Zone will be set up if in the judgment of the SS, a potential respiratory and/or contact health hazard exists, based on the following:

- previous analytical data;
- field air monitoring results; and
- the presence of drums or other containers, which if ruptured could result in a potential respiratory and/or contact health hazard.

The Exclusion Zone consists of the specific work area, or may be the entire area of suspected contamination. The area will be clearly delineated with hazard tape, safety (snow) fencing, or delineated by other means. Only personnel involved in the work activities are allowed in the Exclusion Zone. All employees entering the Exclusion Zone must use the required PPE, and must have the appropriate training and medical clearance for hazardous waste work.

Prior to entering the Exclusion Zone, personnel will be suited in the designated level of protection and a decontamination station will be established at the entrance to the Exclusion Zone. All personnel leaving the Exclusion Zone shall be decontaminated and shall dispose of all disposable garments.

The Exclusion Zone will be marked off during mobilization activities to specific areas of the Site where there is a possible respiratory and/or contact health hazard and prior to the commencement of intrusive activities in these areas. If necessary, the size of the Exclusion Zone may be increased to allow more working area or to incorporate greater area for higher levels of protection to avoid potential exposure to concentrations of hazardous chemicals.

There will be no eating, drinking, or smoking in any Exclusion Zone.

THE CONTAMINATION REDUCTION ZONE

The Contamination Reduction Zone, or "Warm Zone", is the transition area between the contaminated area and the clean area. Decontamination is the main focus in this area. The area will be clearly marked with hazard tape or delineated by other formal or informal means. A Contamination Reduction Corridor (CRC) will be set up and located within this zone. The CRC will be the location where decontamination takes place. One pathway will be established for equipment decontamination and another for personnel. This area also serves as an access control point for personnel entering the Exclusion Zone.

SUPPORT ZONE

The Support Zone, or "Cold Zone", is an uncontaminated zone that encompasses the majority of Site operations, as well as access to the Site. The support trailer would provide for team communications and emergency response, and sanitary facilities (i.e., Porta-Potty). Appropriate safety and support equipment also will be located in this zone.

The Support Zone will be located upwind of Site operations, if possible, and would be used as a potential evacuation point, if appropriate. No potentially contaminated personnel or materials will be allowed in this zone.

L.6.2 COMMUNICATION

Each member of the Site entry team will be able to communicate with another entry team member at all times. Communications may be by way of an air horn, walkie-talkie, telephone, or hand signals.

The primary means for external communication are telephones and radio. If telephone lines are not installed at a Site, all team members should:

- Know the location of the nearest telephone.
- Have the necessary telephone numbers readily available.

The following standard hand signals will be mandatory for all employees to understand regardless of other means of communication:

- Hand gripping throat - Cannot breathe.
- Hands on top of head - Need assistance.
- Thumbs up - OK, I'm all right, I understand.
- Thumbs down - No, negative.
- Gripping partner's wrist, or gripping both of your own hands on wrist (if partner is out of reach) - Leave area immediately.

L.6.3 BUDDY SYSTEM

L.6.3.1 RESPONSIBILITIES

A buddy system shall be implemented when conducting intrusive activities on the Site. This buddy shall be able to:

- Provide his or her partner with assistance.
- Observe his or her partner for signs of chemical exposure or temperature stress.
- Periodically check the integrity of his or her partner's protective clothing.
- Notify emergency personnel if emergency help is needed.

L.6.4 SITE SECURITY

Site security is necessary to prevent the exposure of unauthorized, unprotected people to Site hazards and to avoid interference with safe working procedures. Security shall be maintained outside of the actual work area(s) so as to prevent unauthorized entry into the work area(s). Members of the general public are to be protected from Site hazards.

L.6.5 DECONTAMINATION

It is the responsibility of the SS to ensure that all personnel and pieces of equipment coming off Site are properly decontaminated according to the procedures outlined

below. Documentation of decontamination must be made in the field logbook that will become part of the permanent project file.

L.6.5.1 PERSONNEL AND EQUIPMENT DECONTAMINATION PROCEDURES

All PPE shall be disposed of and/or decontaminated at the conclusion of each workday as described below and in Appendix L-H. Decontamination procedures shall follow the concept of decontaminating the most contaminated PPE first.

All disposable equipment shall be doffed before meal breaks and at the conclusion of the workday and replaced with new equipment prior to commencing work.

Procedures for decontamination must be followed to prevent the spread of contamination and to eliminate the potential for chemical exposure.

Personnel: Decontamination shall be initiated prior to exiting the contaminated work area and be completed in the Contamination Reduction Zone.

Modified Level D: First, remove outer protective wear. Remove gloves and properly dispose of in a designated waste container. Wash hands and face.

Level C: Wash and rinse outer gloves, boots and suit, and remove; then remove respirator; dispose of cartridges; wash respirator; remove inner gloves and dispose of them. Wash hands and face.

Handle all clothing inside out when possible.

Equipment: All equipment must be decontaminated with Alconox/Liquinox solution or discarded upon exit from the contaminated area in a well ventilated area. A temporary decon pad with a low-volume high-pressure washer will be set up on Site during drilling operations. All decon materials shall be drummed for subsequent disposal.

L.6.5.2 HEAVY EQUIPMENT DECONTAMINATION PROCEDURES

All heavy equipment will be decontaminated prior to commencing work, between areas of the Site as described below and in Appendix L-I:

i) Remove by hand (i.e., shovel, bar, scraper) excess visible dirt and debris from the equipment paying particular attention to track, cleats, tires, and other irregular surfaces.

ii) Clean the equipment using high pressure/low volume hot water or steam equipment.

iii) Clean/scrub the equipment with water and Alconox/Liquinox.

iv) Final rinse of equipment with high pressure/low volume hot water or steam equipment.

The cleaning procedure for liquid recirculation equipment (i.e., drilling pumps and hoses) shall be as follows:

- all exposed surfaces shall be surface cleaned as described above;
- a solution of natural soap (biodegradable-phosphate free, i.e., BIO-T-Max or equivalent) and water shall be circulated through the system for 15 minutes or appropriate duration; and
- potable water shall be circulated through the system for 15 minutes or appropriate duration.

Once the heavy equipment is cleaned and approved clean CRA personnel, the wash water, soil debris, and spent protective wear must be containerized, labeled, and properly staged in the approved area on the Site Pending proper disposal or treatment.

L.7.0 EMERGENCY PROCEDURES

L.7.1 ON-SITE EMERGENCIES

Emergencies can range from minor to serious conditions. Various procedures for responding to Site emergencies are listed in this section. The PM or SS is responsible for contacting local emergency services, if necessary, for specific emergency situations. Various individual Site characteristics will determine preliminary action to be taken to assure that these entry procedures are successfully implemented in the event of an emergency. Address necessary facility/client emergency protocols to ensure compatibility between this document and facility/client programs and/or expectations.

Radios or walkie-talkie enabled cellular telephones will be provided for contact purposes. All emergencies will be reported to the appropriate emergency responders. They may give CRA and/or the subcontractor further direction as to the responsibilities during any emergency situation. In general, CRA and subcontractor personnel will shut down equipment and evacuate to a safe pre-determined meeting area (rally point) during Site emergencies.

The CRA SS will contact and meet on-Site with local emergency response agencies (e.g., fire department, police department, etc.) prior to initiating Site activities. The purpose of this meeting is to inform these local authorities of the nature of the work and potential risks, to ensure that these responders are equipped to respond to a Site emergency, and to identify and resolve any potential problems, concerns, or conflicts.

An Emergency Information Sheet containing the hospital location, directions, government agency phone numbers, emergency phone numbers, and a map with directions to the hospital is located in Appendix L-B. The map to the hospital will also be posted on the trailer door at the Site and at the main gate entrance.

L.7.2 ACCIDENT, INJURY, AND ILLNESS REPORTING AND INVESTIGATION

Any work-related incident, accident, injury, illness, exposure, or property loss must be reported to your supervisor, the SS, and **within 1 hour** through the CRA Accident Reporting System. Motor vehicle accidents must also be reported through this system. CRA's Accident Report Form, located in Appendix L-B, must also be filled out and provided to the SS. The report must be filed for the following circumstances:

- Accident, injury, illness, or exposure of an employee.
- Injury of a subcontractor.
- Damage, loss, or theft of property.
- Any motor vehicle accident, regardless of fault, which involves a company vehicle, rental vehicle, or personal vehicle while the employee is acting in the course of employment.

Occupational accidents resulting in employee injury or illness will be investigated by the SS. This investigation will focus on determining the cause of the accident and modifying future work activities to eliminate the hazard.

All employees have the obligation and right to report unsafe work conditions, previously unrecognized safety hazards, or safety violations of others. If you wish to make such a report, it may be made orally to your supervisor or other member of management, or you may submit your concern in writing, either signed or anonymously.

L.7.3 EMERGENCY EQUIPMENT/FIRST AID

Safety equipment will be available for use by Site personnel, will be located within 30 feet (9 m) of the work area(s), and will be maintained at the Site. The safety equipment will include, but is not limited to, the following: a 10-unit first aid kit (dependent upon the number of personnel), emergency alarm (i.e., air horn), emergency eyewash, an ABC fire extinguisher (2A/10BC), potable water, anti-bacterial soap, and telephone.

1. **First-degree burns** are superficial but can be painful because these burns usually do not damage the nerves. These types of burns will cause outer layers of skin to redden or discolor and to swell slightly.
2. **Second-degree burns** penetrate skin more deeply and are more severe than first-degree burns. In addition, second-degree burns affect skin by creating a red or mottled appearance, blisters, and swelling. These burns are also very painful because the nerve endings are still intact.
3. **Third-degree burns** are the most severe burns and have the deepest penetration of the types of burns. Third-degree burns may appear white or charred. They

may even look like second-degree burns but they extend through all skin layers. In addition, third-degree burns destroy nerve endings, so third-degree burns can be less painful than second-degree burns.

Burns must be treated by medical personnel. However, you may need to provide first aid until professional help arrives. Listed below are several actions that you can take if someone is burned:

- Cool minor burns with water.
- Refrain from applying ice to any but the most minor first-degree burns.
- Refrain from breaking open blisters.
- Refrain from touching a burned area because touching the burned area increases the risk of infection.
- Refrain from applying ointment to a severe burn.
- Refrain from removing anything stuck to a burned area.

L.7.4 EMERGENCY PROCEDURES FOR CONTAMINATED PERSONNEL

Whenever possible, personnel should be decontaminated in the contamination reduction zone before administering first aid, without causing further harm to the patient.

Skin Contact: Remove contaminated clothing, wash immediately with water and use soap if available.

Inhalation: Remove victim from contaminated atmosphere. Remove any respiratory protection equipment. Initiate artificial respiration, if necessary. Transport to the hospital.

Ingestion: Remove from contaminated atmosphere. Do not induce vomiting if victim is unconscious. Also never induce vomiting when acids, alkalis, or petroleum products are suspected. Transport to the hospital, if necessary.

Any person transporting an injured/exposed person to a clinic or hospital for treatment should take with them directions to the hospital and a listing of the contaminants of concern to which they may have been exposed. CRA has contacted the Miami Valley

Hospital and confirmed that they are prepared to handle a hazardous material accident victim.

Any vehicle used to transport contaminated personnel shall be cleaned or decontaminated, as necessary.

L.7.5 SITE EVACUATION

In the event of an emergency situation such as fire, explosion, significant release of toxic gases, etc., an air horn or other appropriate device will be sounded for approximately 10 seconds indicating the initiation of evacuation procedures. Personnel in the field will be notified through established communications to evacuate the area. In the event of an emergency, CRA personnel shall gather at their primary mustering point for a head count. The mustering point location will be determined by the SS and will be communicated to the work crew(s) during the Site-specific training prior to commencement of work activities.

L.7.6 SPILL AND RELEASE CONTINGENCIES

If a spill has occurred, the first step is personal safety, then controlling the spread of contamination if possible. CRA personnel shall immediately contact Site management to inform them of the spill and activate emergency spill procedures.

GENERAL SPILL RESPONSE PROCEDURES

If a spill occurs, the following general procedures will be followed:

i) notify the SS:

ii) evacuate immediate area of spill;

iii) determine the needed level of PPE;

iv) don required level of PPE and prepare to make entry to apply spill containment and control procedures;

v) no entry will be made until atmosphere is less than 20 percent of the LEL;

vi) after obtaining the proper spill response tools (shovels, booms and pads, absorbent socks, etc.) and PPE, personnel will attempt to contain the spill so that

it does not enter any conveyance (sewer, drainage ditch, etc.) that eventually discharges to surface water;

vii) locate and abate source of spill;

viii) absorb or otherwise clean up the spill and containerize the material, sorbent, and affected soils;

ix) clean and decontaminate the affected area(s); and

x) replace used/spent spill kit contents.

All spill material and debris will be managed in a manner that complies with applicable federal, state, and local environmental rules regarding recycling or disposal of wastes.

The SS has the authority to commit resources as needed to contain and control released material and to prevent its spread to off-Site areas and to contact appropriate authorities in the event that this is required.

L.7.7 PROJECT PERSONNEL RESPONSIBILITIES DURING EMERGENCIES

SITE SUPERVISOR (SS)

As the administrator of the HASP, the SS has primary responsibility for responding to and correcting emergency situations. The SS will:

i) take appropriate measures to protect personnel including: posting of acceptable Site evacuation routes, withdrawal from the Exclusion Zone, total evacuation and securing of the Site or upgrading or downgrading the level of protective clothing and respiratory protection;

ii) take appropriate measures to protect the public and the environment including isolating and securing the Site, preventing runoff to surface waters, and ending or controlling the emergency to the extent possible;

iii) ensure that appropriate Federal, State, and local agencies are informed, and emergency response plans are coordinated. In the event of fire or explosion, the local fire department should be summoned immediately. In the event of an air release of toxic materials, the local authorities should be informed in order to assess the need for evacuation. In the event of a spill, sanitary districts and drinking water systems may need to be alerted depending on the nature of the spill;

iv) ensure that appropriate decontamination treatment or testing for exposed or injured personnel is obtained;

v) determine the cause of the incident and make recommendations to prevent the reoccurrence; and

vi) ensure that all required reports have been prepared.

L.8.0 RECORDKEEPING

The SS shall establish and maintain records of all necessary and prudent monitoring activities as described below:

- Name and job classification of the employees involved on specific tasks.
- Air monitoring/sampling results and instrument calibration logs.
- Records of training acknowledgment forms (Site-specific training, toolbox meetings, etc.)
- Documentation of Site inspections, results of inspections and corrective actions implemented.
- Records of OSHA Training Certifications for Site personnel (40-Hour HAZWOPER, 8-hour refreshers, etc.)
- Records of qualitative fit-testing and physical examination results for Site personnel (as necessary).
- Emergency reports describing any incidents or accidents.

L.9.0 MEDICAL SURVEILLANCE

This Site does not require Site-specific medical examinations beyond the requirements in 1910.120(f). CRA, authorized visitors and all contractors working within the EZ will comply with 29 CFR 1910.120(f) for medical programs. Appendix L-J contains CRA's SOP for Medical Surveillance applicable to any employee working within the EZ.

L.10.0 TRAINING

All employees and authorized visitors entering the Exclusion Zone or Contaminant Reduction Zone will have attended a 40-hour training course in accordance with 29 CFR 1926.65. If this training has occurred greater than 1 year ago, then the employee authorized visitor will have to have attended a current 8-hour refresher course. The SS will verify these certifications prior to anyone entering the Exclusion Zone or Contaminant Reduction Zone. The SS will have attended a supervisory training course.

Additionally, a Site briefing will be held for all employees and authorized visitors by the HSO during Site mobilization covering the following topics:

- Site hazards, history;
- list of contaminants involved;
- underground/overhead utilities;
- work zones;
- decontamination area and procedures;
- levels of protection;
- respiratory protection;
- location of emergency telephones;
- emergency alarm signals;
- emergency evacuation routes;
- hospital and route to hospital;
- fire extinguisher location(s);
- smoking and eating areas;
- heat/cold stress; and
- HASP sign-off.

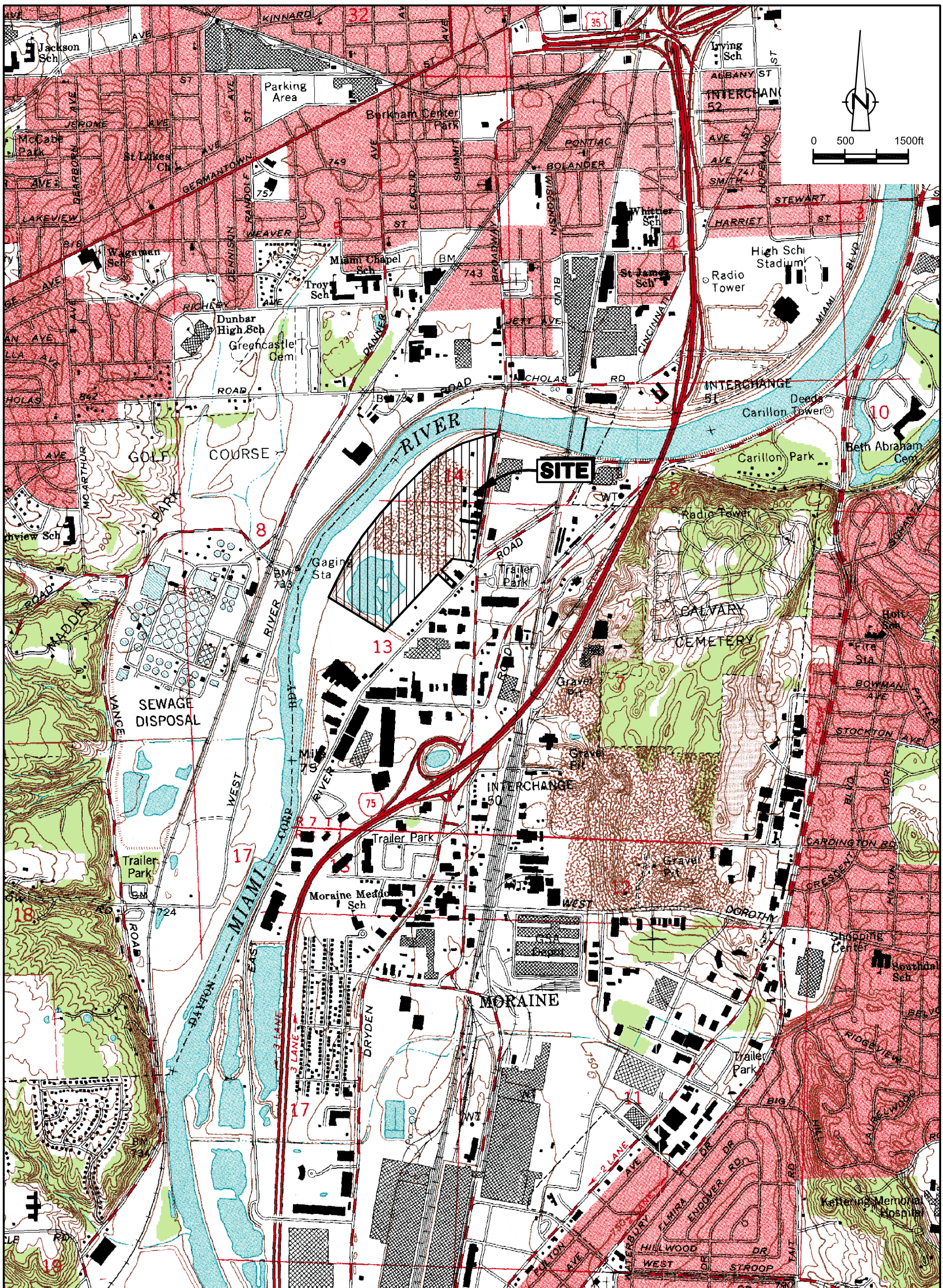
Employees and visitors will sign the Pre-Entry Briefing Form in Appendix L-B as a record of this training. Personnel not successfully completing this training will not be permitted to enter or work in potentially contaminated areas of the Site.

Management and Supervisor Training

In addition to the training requirements set forth in Section L.10 above, CRA requires all managers and supervisors directly responsible for, or who supervise employees engaged in hazardous waste operations, to receive an additional 8 hours of specialized supervisor training to include the following:

- CRA's internal behavior-based safety program entitled the SMART Program.
- PPE Program.
- Spill Containment Program
- Health hazard monitoring procedures and techniques.

Employees required to have the 40-hour training will also be subject to annual 8-hour refresher training. Documentation of the entire HAZWOPER Program is maintained in the CRA Niagara Falls, New York office.



SOURCE: USGS QUADRANGLE MAP
DAYTON SOUTH, OHIO

MORAINE
OHIO

figure L-1.1

SITE LOCATION MAP
SOUTH DAYTON DUMP AND LANDFILL SITE
Moraine, Ohio

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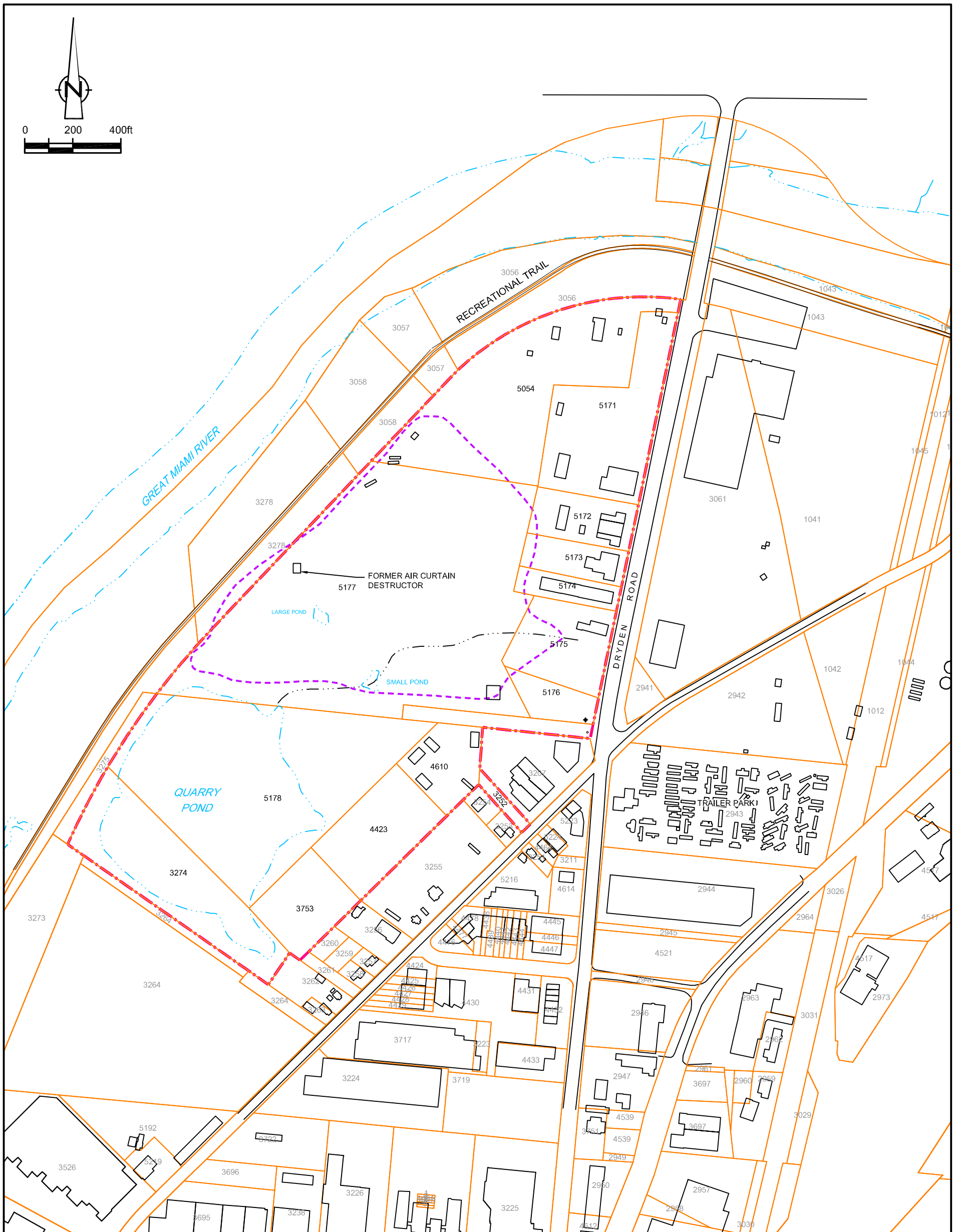

LEGEND

- SITE BOUNDARY (SOW 2006)
- PRELIMINARY DIRECT CONTACT RISK PRESUMPTIVE REMEDY AREA
- PARCEL BOUNDARY
- 3264 LOT NUMBER
- EDGE OF WATER

figure L-1.2

SITE PLAN
SOUTH DAYTON DUMP AND LANDFILL SITE
Moraine, Ohio

SOURCES:
THE PAYNE FIRM, INC., PROJECT 0279.44.05, FIGURE 1, DATED 9/12/05;
TETRA TECH EM INC., PROJECT L0312006-SOUTH DAYTON DUMP, FIGURE 2, SITE LAYOUT, 05/25/2004;
CITY OF MORAINE.

38443-06(008)GN-WA002 DEC 19/2006

TABLE L.3.1

PROPERTIES OF POTENTIAL SITE CONTAMINANTS

Chemical Name (Synonyms)	*Concentration at Site*	*Exposure Limits*	*Routes Of Entry*	*Symptoms/Health Effects*	*Chemical Properties*	*Physical Characteristics*
1,1,1-Trichloroethane Methyl chloroform Chlorothene CAS-71-55-6	0.016U ppm (surface soil) 0.029U ppm (sed) 0.010U ppm (gw)	TLV: 350 ppm PEL: 350 ppm STEL: 450 ppm IDLH: 700 ppm	Inhalation Ingestion Skin contact Eye contact	ACUTE: Irritating to eyes, skin and respiratory tract. May affect CNS, heart, liver and kidneys resulting in cardiac disorders and respiratory failure. High level exposure may cause death. CHRONIC: Defatting of the skin, may cause liver damage.	(FP) NE (VP) 100 mm (IP) 11.00 eV (UEL) 12.5% (LEL) 7.5%	Colorless liquid with a mild, chloroform-like odor.
Aluminium Aluminum metal Aluminum powder CAS-7429-90-5	14,300 ppm (surface soil) 9,750 ppm (sed) 10 ppm (gw)	TLV: 10 mg/m3 [Dust] PEL: TWA 15 mg/m3 STEL: NE IDLH: NE	Inhalation Skin contact Eye contact	ACUTE: Irritation eyes, skin, respiratory system. CHRONIC: Eyes, skin, respiratory system.	(FP) NE (VP) NE (IP) NE (UEL) NE (LEL) NE	Silvery-white, malleable, ductile, odorless metal. Combustible Solid, finely divided dust is easily ignited; may cause explosions.
Arsenic CAS-7440-38-2	141 ppm (surface soil) 12.6 ppm (sed) 0.547 ppm (gw)	TLV: 0.002 mg/m3 PEL: 0.010 mg/m3 STEL: NE IDLH: 5 mg/m3 (as As)	Inhalation Absorption Ingestion	ACUTE: Contact dermatitis, gastrointestinal disturbances, and respiratory irritation. CHRONIC: Hyperpigmentation of the skin and cancers of the skin, lungs, and lymphatic system.	(FP) NA (VP) 0 mm (approx.) (IP) NA (UEL) NA (LEL) NA	Silver-gray or tin-white, brittle, odorless, solid.
Asbestos Chrysoltile Amosite Tremolite Actinolite CAS-1332-21-4	unknown	TLV: 0.1 fibers/cc PEL: 0.1 fibers/cc STEL: NE IDLH: ND	Inhalation Ingestion	ACUTE: Eye, skin and respiratory irritation. Restricted pulmonary function. CHRONIC: Asbestosis, mesothelioma, and gastrointestinal and lung cancers.	(FP) NA (VP) 0 mm (IP) NA (UEL) NA (LEL) NA	White or greenish (chrysotile); blue (crocidolite); or blue-green (amosite) odorless solids. Known human carcinogen.
Barium CAS-7440-39-3	13,000 ppm (surface soil) 137 ppm (sed) 2.53 ppm (gw)	TLV: 0.5 mg/m^3 PEL: 0.5 mg/m^3 STEL: NE IDLH: 50 mg/m^3	Inhalation Skin contact Ingestion Eye Contact	ACUTE: Eye, skin and gastrointestinal irritation, muscular stimulation. CHRONIC: Eyes, skin, gastrointestinal	(FP) NA (VP) Low (IP) NA (UEL) NA (LEL) NA	White, odorless solid
Benzene Benzol CAS-71-43-2	0.016U ppm (soil) 0.029U ppm (sed) 0.0019 ppm (gw)	TLV: 0.1 ppm [skin] PEL: 1 ppm STEL: 5 ppm IDLH: 500 ppm	Inhalation Absorption (skin) Ingestion	ACUTE: Irritation to eyes, skin, respiratory tract; dizziness; headache; nausea; staggered gait; fatigue, abdominal pain. CHRONIC: Defatting of the skin, may have effects on bone marrow and immune system, decrease in blood cells. Carcinogenic to humans.	(FP) 12°F (VP) 75 mm (IP) 9.24 eV (UEL) 7.8% (LEL) 1.2%	Colorless to light-yellow liquid with an aromatic odor. Solid below 42°F.

TABLE L.3.1

PROPERTIES OF POTENTIAL SITE CONTAMINANTS

Chemical Name (Synonyms)	*Concentration at Site*	*Exposure Limits*	*Routes Of Entry*	*Symptoms/Health Effects*	*Chemical Properties*	*Physical Characteristics*
Beryllium (metal) CAS-7440-41-7	5.8 ppm (surface soil) 0.540B ppm (sed) 0.001U ppm (gw)	TLV: 0.0005 mg/m3 PEL: 0.002 mg/m3 STEL: 0.005 mg/m3 (C) IDLH: 4 mg/m3	Inhalation Skin Contact Eye Contact	ACUTE: Chest pain, cough, irritation of eyes; weight loss, lassitude (weakness, exhaustion). CHRONIC: Berylliosis, anorexia; clubbing of fingers, cyanosis, pulmonary insufficiency, dermatitis; (potential occupational carcinogen)	(FP) NA (VP) 0 mm (IP) NA (UEL) NA (LEL) NA	Hard, brittle, gray-white solid metal
Chromium (metal) Chrome CAS-7440-47-3	91.7 ppm (surface soil) 23.1 ppm (sed) 0.069 ppm (gw)	TLV: 0.5 mg/m3 PEL: 1.0 mg/m3 STEL: NE IDLH: 250 mg/m3	Inhalation Ingestion Skin contact Eye contact	ACUTE: Irritation to eyes, skin and lungs. CHRONIC: Skin sensitization, fibrosis (histologic)	(FP) NA (VP) NA (IP) NA (UEL) NA (LEL) NA	Blue-white to steel gray, lustrous, brittle, hard, odorless solid.
Cobalt Metal dust, Cobalt metal fume CAS-7440-48-4	22.1 ppm (surface soil) 7.2 ppm (sed) 0.0246B (gw)	TLV:0.02 mg/m3 PEL: 0.1 mg/m3 STEL: NE IDLH: 80 mg/m3 (C)	Inhalation Ingestion Skin Contact Eye Contact	ACUTE: Cough, dyspnea (breathing difficulty), wheezing, decreased pulmonary function. CHRONIC: Weight loss, dermatitis, diffuse nodular fibrosis, respiratory hypersensitivity, asthma.	(FP) NA (VP) 0 mm (IP) NA (UEL) NA (LEL) NA	Odorless, silver-gray to black solid
Copper (dust/mists/metal) CAS-7440-50-8	191,000 ppm (surface soil) 33.5 ppm (sed) 0.0305 ppm (gw)	TLV: 1 mg/m3 PEL: 1 mg/m3 STEL: NE IDLH: 100 mg/m3	Inhalation Ingestion Skin contact Eye contact	ACUTE: Irritation to eyes, nose and pharynx, metallic taste and nasal perforation. CHRONIC: Skin sensitization, increased risk with Wilson's disease.	(FP) NA (VP) NA (IP) NA (UEL) NA (LEL) NA	Red powder, turns green on exposure to moist air.
Dioxins	unknown	No contact. There are no OSHA or NIOSH standards.	Inhalation Ingestion Skin contact Eye contact	ACUTE: Chloracne is a severe skin disease with acne-like lesions that occur mainly on the face and upper body. Other skin effects noted in people exposed to high doses of 2,3,7,8-TCDD include skin rashes, discoloration, and excessive body hair. Changes in blood and urine that may indicate liver damage also are seen in people. CHRONIC: Carcinogenic. Exposure to high concentrations of CDDs may induce long-term alterations in glucose metabolism and subtle changes in hormonal levels.	(FP) NA (VP) NA (IP) NA (UEL) NA (LEL) NA	Colorless and odorless solid
Ethylbenzene Ethylbenzol EB CAS-100-41-4	0.016U ppm (soil) 0.029U ppm (sed) 0.0008 ppm (gw)	TLV: 100 ppm PEL: 100 ppm STEL: 125 ppm IDLH: 800 ppm	Inhalation Ingestion Skin contact Eye contact	ACUTE: Causes irritation of the eyes, skin, mucous membranes, and respiratory tract. Effects on CNS. CHRONIC: Defatting of the skin, narcosis, and coma.	(FP) 55°F (VP) 7 mm (IP) 8.76 eV (UEL) 6.7% (LEL) 0.8%	Colorless liquid with an aromatic odor.
Furans	unknown	No contact. There are no OSHA or NIOSH standards.	Inhalation Ingestion Skin contact Eye contact	ACUTE: Irritation to eyes (swollen eyelids with discharge from the eyes), skin irritation (chloracne and darkened skin color), and increased vulnerability to respiratory infection and nervous system effects such as numbness. CDF poisoning also caused vomiting and diarrhea, anemia and mild changes in the liver. CHRONIC: Children born to exposed mothers had skin irritation and more difficulty learning.	(FP) NA (VP) NA (IP) NA (UEL) NA (LEL) NA	Colorless and odorless solid
Hydrogen Sulfide Sulfur Hydride CAS-7783-06-4	unknown	TLV: 10 ppm PEL: 20 ppm (C) STEL: 15 ppm IDLH: 100 ppm	Inhalation Skin contact Eye contact	ACUTE: Irritation of eyes and respiratory tract. May effect CNS. Unconsciousness, death. CHRONIC: NA	(FP) NA (gas) (VP) 17.6 atm (IP) 10.46 eV (UEL) 44.0% (LEL) 4.0%	Colorless gas with a strong odor of rotten eggs. (Note: sense of smell becomes rapidly fatigued).

TABLE L.3.1

PROPERTIES OF POTENTIAL SITE CONTAMINANTS

Chemical Name (Synonyms)	*Concentration at Site*	*Exposure Limits*	*Routes Of Entry*	*Symptoms/Health Effects*	*Chemical Properties*	*Physical Characteristics*
Iron CAS-7439-89-6	92,300 ppm (surface soil) 16,400 ppm (sed) 3,800 ppm (gw)	TLV: 0.5 mg/m3 PEL: NE STEL: NE IDLH: NE	Absorption Inhalation Ingestion	ACUTE: Dust irritates eyes and respiratory tract CHRONIC:	(FP) NE (VP) NE (IP) NE (UEL) NE (LEL) NE	Grey crystalline powder
Lead CAS-7439-92-1	12,100 ppm (surface soil) 51.6 ppm (sed) 0.100 ppm (gw)	TLV: 0.05 mg/m3 PEL: 0.05 mg/m3 STEL: NE IDLH: 100 mg/m3	Inhalation Ingestion Skin contact Eye contact	ACUTE: Lead is a cummulative poison, however, it may cause eye and skin irritation. CHRONIC: Effects blood, bone marrow, CNS, PNS and kidneys resulting in anemia, convulsions, peripheral nerve disease and kidney impairment. Toxicity to human reproduction or development.	(FP) NA (VP) NA (IP) NA (UEL) NA (LEL) NA	A heavy, ductile, soft, gray solid. Turns tarnished on exposure to air.
Manganese CAS-7439-96-5	693 ppm (surface soil) 446 ppm (subsurface soil) 545 ppm (sed) 1.0 ppm (gw)	TLV: 1 mg/m3 PEL: 5 mg/m3 STEL: 3 mg/m3 IDLH: 500 mg/m3	Inhalation Ingestion	ACUTE: Manganism; asthenia, insomnia, mental confusion; metal fume fever: dry throat, cough, chest tightness, dyspnea (breathing difficulty), rales, flu-like fever; low-back pain; vomiting; malaise (vague feeling of discomfort); lassitude (weakness, exhaustion); kidney damage CHRONIC:	(FP) NA (VP) Low (IP) NA (UEL) NA (LEL) NA	A lustrous, brittle, silvery solid.
Methane Methyl hydride CAS-74-82-8	>1,000 ppm	TLV: NA - Simple Asphyxiant PEL: NA STEL: NA IDLH: NA	Inhalation	ACUTE: NA CHRONIC: Asphyxiation	(FP) -306°F (VP) NA (IP) 12.48 eV (UEL) 15.0% (LEL) 5.0%	Colorless, compressed or liquified gas, with no odor. Gas is LIGHTER than air.
Nickel (metal) CAS-7440-02-0	402 ppm (surface soil) 23.7 ppm (sed) 29.7B ppm (gw)	TLV: .015 mg/m3 PEL: 1 mg/m3 STEL: NE IDLH: 10 mg/m3	Inhalation Ingestion Skin contact Eye contact	ACUTE: May cause mechanical irritation, pneumonitis (fume inhalation). CHRONIC: Sensitization, asthma, damage to lungs. Possible human carcinogen.	(FP) NA (VP) NA (IP) NA (UEL) NA (LEL) NA	Lustrous, silvery, odorless, solid.
Particulate Dust	Not applicable	PEL: 10 mg/m3 [Total] PEL: 5 mg/m3 [Respirable]				
Polyaromatic Hydrocarbons PAHs Coal Tar Pitch Volatiles CAS-65996-93-2	94,360 ppb (surface soil)	TLV: 0.1 mg/m3 PEL: 0.2 mg/m3 STEL: NA IDLH: 80 mg/m3	Inhalation Ingestion	ACUTE: Bronchitis. CHRONIC: Dermatitis, may cause damage to bladder, kidneys and lungs.	(FP) Varies (VP) NA (IP) Varies (UEL) NA (LEL) NA	Black or dark brown amorphous residue. Properties vary depending upon specific compound.
Polychlorinated Biphenyls PCB (54%) Chlorodiphenyl (54% chlorine) Aroclor 1254 CAS-11097-69-1	7 ppm (surface soil), 75 ppm (in composite Valley Asphalt Drum Sample)	TLV: 0.001 mg/m3 [skin] PEL: 0.5 mg/m3 [skin] STEL: NA IDLH: 5 mg/m3	Inhalation Absorption (skin) Ingestion	ACUTE: Eye irritation. CHRONIC: Dermatitis, chloracne, liver damage.	(FP) NA (VP) 0.00006 mm (IP) NA (UEL) NA (LEL) NA	Colorless to pale yellow viscous liquid or solid (<50°F) with a mild hydrocarbon odor.

TABLE L.3.1

PROPERTIES OF POTENTIAL SITE CONTAMINANTS

Chemical Name (Synonyms)	*Concentration at Site*	*Exposure Limits*	*Routes Of Entry*	*Symptoms/Health Effects*	*Chemical Properties*	*Physical Characteristics*
Selenium CAS-7782-49-2	8.8 ppm (surface soil) 1.1B ppm (sed) 0.015 ppm (gw)	TLV: 0.2 mg/m3 PEL: 0.2 mg/m3 STEL: NE IDLH: 1 mg/m3	Inhalation Ingestion Skin Contact Eye Contact	ACUTE: Irritation eyes, skin, nose, throat; visual disturbance; headache; chills, fever, dyspnea (breathing difficulty). Metallic taste, garlic breath. CHRONIC: Bronchitis, , eye, skin burns; gastrointestinal disturbance, dermatitis.	(FP) NA (VP) 0 mm (IP) NA (UEL) NA (LEL) NA	Amorphous or crystalline, red to gray solid
Silver (metal) CAS-7440-22-4	7.6 ppm (surface soil) 2.1 ppm (sed) 0.001U ppm (gw)	TLV: 0.01 mg/m3 PEL: 0.01 mg/m3 STEL: NA IDLH: 10 mg/m3	Inhalation Ingestion Skin contact Eye contact	ACUTE: Inhalation of large amounts of vapors may cause lung damage, pulmonary edema. CHRONIC: Grey-blue discoloration of eyes, nose, throat and skin (argyria/argyrosis)	(FP) NA (VP) NA (IP) NA (UEL) NA (LEL) NA	White, lustrous solid.
Thallium (metal) CAS-7440-28-0	4.5 ppm (surface soil) 1.0 ppm (sed) 4.6B ppm (gw)	TLV: 0.1 mg/m3 [skin] PEL: 0.1 mg/m3 [skin] STEL: NE IDLH: 15 mg/m3	Inhalation Ingestion Skin contact Absorption Eye contact	ACUTE: May affect gastrointestinal tract, nervous system, kidneys and cardiovascular system. May cause hair loss and atrophy of nails. Ingestion may cause death. Effects may be delayed. CHRONIC: May affect nervous system, cardiovascular system and may cause hair loss.	(FP) NA (VP) NA (IP) NA (UEL) NA (LEL) NA	Bluish-white, very soft metal. Turns grey on exposure to air.
Toluene Methylbenzene Toluol CAS-108-88-3	0.010 J ppm (soil) 0.014 ppm (sed) 0.015 ppm (gw)	TLV: 100 ppm [skin] PEL: 200 ppm STEL: 150 ppm (C) IDLH: 500 ppm	Inhalation Ingestion Absorption	ACUTE: Irritation to eyes and respiratory tract. Ingestion may cause chemical pneumonitis. Affects CNS. Unconsciousness and cardiac dysrhythmia at high level exposures. CHRONIC: Defatting of the skin. Affects CNS. Enhanced hearing damage.	(FP) 40°F (VP) 21 mm (IP) 8.82 eV (UEL) 7.1% (LEL) 1.1%	Colorless liquid with a sweet, pungent, benzene-like odor.
Trichloroethene TCE Trichloroethylene Ethylene trichloride CAS-79-01-6	0.004 ppm (soil) 0.260 ppm (gw), 64 ppm (composite Valley Asphalt drum sample)	TLV: 50 ppm PEL: 100 ppm STEL: 100 ppm IDLH: 1,000 ppm	Inhalation Ingestion Absorption	ACUTE: Irritation to eyes and skin. Ingestion may cause chemical pneumonitis. Affects CNS. Unconsciousness due to exposure. CHRONIC: Dermatitis. Affects CNS, loss of memory. May damage liver and kidneys. Probable human carcinogen.	(FP) NE (VP) 58 mm (IP) 9.45 eV (UEL) 10.5% @ 77°F (LEL) 8.0% @ 77°F	Colorless liquid with a chloroform-like odor. Sometimes dyed blue.
Vanadium (oxide) dust CAS-1314-62-1	92.6 ppm (surface soil) 21.8 ppm (sed) 0.029B ppm (gw)	TLV: 0.05 mg/m3 (Resp) PEL: 0.5 mg/m3 (C)(Resp) STEL: NE IDLH: 35 mg/m3	Inhalation Ingestion Skin Contact Eye Contact	ACUTE: Irritation eyes, throat; green tongue, metallic taste, cough, fine rales, wheezing CHRONIC: Bronchitis, dyspnea (breathing difficulty); eczema	(FP) NA (VP) 0 mm (IP) NA (UEL) NA (LEL) NA	Yellow-orange powder or dark-grey, odorless flakes dispersed in air
Vinyl Chloride Chloroethene VCM Chloroethylene CAS-75-01-4	0.016U ppm (soil) 0.029 U ppm (sed) 0.150 ppm (gw)	TLV: 1 ppm PEL: 1 ppm STEL: 5 ppm (C) IDLH: NE	Inhalation Skin contact Eye contact	ACUTE: Irritation to eyes. Affects CNS. May cause unconsciousness. CHRONIC: Affects liver, spleen, blood and peripheral blood vessels, tissue and bones in fingers. Human carcinogen.	(FP) NA (gas) (VP) 3.3 atm (IP) 9.99 eV (UEL) 33.0% (LEL) 3.6%	Colorless gas or liquid (<7°F) with a pleasant odor at high concentrations.
Xylenes (o,m,p isomers) CAS-106-42-3	0.003 J ppm (soil) 0.029 U ppm (sed) 0.010U ppm (gw)	TLV: 100 ppm PEL: 100 ppm STEL: 150 ppm IDLH: 900 ppm	Inhalation Absorption Ingestion	ACUTE: Irritation to eyes and respiratory tract. Ingestion may cause chemical pneumonitis. Affects CNS. CHRONIC: Defatting of the skin, lung damage resulting in chronic bronchitis. Affects CNS and blood.	(FP) 90/82/81°F (IP) 7/9/9 mm (IP) 8.56/8.56/8.44eV (UEL) 7.0% (LEL) 0.9%	Colorless liquid with an aromatic odor. (p-isomer solid <56°F).

TABLE L.3.1

PROPERTIES OF POTENTIAL SITE CONTAMINANTS

Chemical Name (Synonyms)	*Concentration at Site*	*Exposure Limits*	*Routes Of Entry*	*Symptoms/Health Effects*	*Chemical Properties*	*Physical Characteristics*
Zinc (metal) CAS-7440-66-6	11,500 ppm (surface soil) 143 ppm (sed) 0.0897 ppm (gw)	TLV: 2 mg/m3 [respirable] PEL: 5 mg/m3 [respirable] STEL: 10 mg/m3 [respirable] IDLH: 500 mg/m3	Inhalation	ACUTE: Metal fume fever; muscle aches, nausea, fever, dry throat, weakness, and lassitude; metallic taste; headache; blurred vision; low back pain. Effects may be delayed. CHRONIC: Decreased pulmonary function. Tightness in chest.	(FP) NA (VP) NA (IP) NA (UEL) NA (LEL) NA	White, odorless solid. Slowly decomposed by water.

TABLE L.3.1

Notes:

FP	FP - Flash Point
IDLH	IDLH - Immediately Dangerous to Life ord Health
IP	IP - Ionization Potential
NE	NE - Not Established (Information Not Available)
NA	NA - Not Applicable
CNS	CNS - Central Nervous System
PNS	PNS - Peripheral Nervous System
ppm	ppm - parts per million
mg/m^3	mg/m^3 - milligrams per cubic meter
PEL	PEL - OSHA Permissible Exposure Limit
STEL	STEL - Short Term Exposure Limit
TLV	TLV - ACGIH Threshold Limit Value
VP	VP - Vapor Pressure
C	C - Ceiling Exposure Limit
[skin]	[skin] - potential for dermal absorption
mm	mm - millimeters Hg (mercury)
eV	eV - electrovolts

APPENDIX L-A

PERSONAL PROTECTIVE EQUIPMENT

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1.0 PERSONAL PROTECTIVE EQUIPMENT

CRA is responsible for maintaining an adequate supply of PPE to be provided to all CRA employees. The safety captain, equipment manager, or supervisor will orient employees on the local program, including where and how to obtain PPE for their use. Additional information on this topic may also be obtained from the project safety officer or the Regional SHM.

A PPE checklist is attached at the end of this section. The checklist provides guidelines to assist in identifying hazards and selecting the required PPE.

1.1 HEAD PROTECTION

The potential for head injuries is present during certain tasks at CRA project sites, and the prevention of head injuries is an important factor in the SMART Program. The vast majority of head injuries can be prevented by the consistent utilization of approved head protection.

A. POLICY

Protective headgear shall be provided and utilized in all situations where the use of such protection would reasonably prevent head injuries. Such situations include, but are not limited to:

- When working in an area where employees are subject to being struck by falling or flying objects or striking their head (i.e., construction projects, mobile work operations, material hoisting, excavating, trenching).
- In any work situation where the supervisor, due to the nature of the hazards, reasonably deems it appropriate that head protection should be worn.

Visitors shall be required to wear protective headgear in all areas where this policy applies to CRA employees.

B. REGULATORY BACKGROUND

Hard hats for use on construction projects must meet American National Standards Institute (ANSI) standard Z89.1-1986 - Industrial Protective Headwear.

C. SAFE WORK PRACTICES

Employees shall be instructed in the proper use of head protection and the requirements of this policy. Sufficient clearance at a minimum of 1.5 inches shall be maintained between the shell and the suspension of the hard hat. The hard hat and internal suspension shall not be altered in any way. Nothing shall be placed between the shell and the suspension while the hard hat is being worn. Hard hats shall not be worn backwards.

Inspection and Maintenance

Hard hats shall be visually inspected by the employee before each use for signs of dents, cracks, penetration, or other damage that might reduce the degree of safety originally provided. Any defects shall result in the immediate removal of the hard hat from service after notifying the immediate supervisor. Hard hats shall be cleaned by dipping the hats into warm water with a small amount of detergent, followed by rinsing with warm water. Strong cleaning materials shall not be used to clean hard hats. Stickers and other attachments shall not be placed on hard hats unless approved by the safety supervisor. Paints shall not be used on hard hats under any circumstances.

D. EMPLOYEE TRAINING

Affected employees shall receive training in the proper use, maintenance, inspection, and storage of protective equipment discussed in this chapter. Such training shall be repeated when workplace inspections indicate non-adherence to the requirements of this policy.

1.2 EYE AND FACE PROTECTION

The potential for eye injuries is present during certain tasks at CRA project sites, and the prevention of eye injuries is an important factor in the SMART Program.

A. POLICY

Protective eye and face protection will be provided and utilized in all situations where the use of such protection would reasonably prevent injuries. Such situations include, but are not limited to:

- When working in the presence of airborne dust, dirt, particles, or other debris, either driven by wind or propelled by machinery with such force that may cause injury.
- When working around power tools or other machinery which may generate flying particles.
- When working with acids and alkalis.
- When working with grinding, cutting, or milling tools.
- When using impact wrenches and compressed air tools.
- When using punches, chisels, or other impact tools.
- When cutting or breaking concrete.
- When cleaning dust or dirt from under machinery, vehicles, etc.
- When using or working in the immediate vicinity of those working with corrosive, reactive, irritating, or harmful chemicals (liquid, gas, vapor).
- When chipping, scraping, scaling paint, rust, or other materials.
- When working on any overhead surface or object, which requires the employee to look upward.
- When operating edgers, chippers, and chain saws, a full face shield shall be worn.
- When welding or working in the immediate area of a welder, employees shall wear either a face shield with the appropriate filter lens, welder's lens, or welder's goggles.
- In any other work situation where the supervisor, due to the nature of the hazards, reasonably deems it appropriate that eye and face protection be worn.

Visitors shall be required to wear protective eye and face gear in all areas where this policy applies to CRA employees.

B. REGULATORY BACKGROUND

All protective eye and face gear utilized will be approved by the safety supervisor, and shall meet the requirements and specifications of ANSI Z87.1-1989 - Standard Practice for Occupational and Educational Eye and Face Protection.

C. SAFE WORK PRACTICES

The use of contact lenses shall not be permitted in IDLH situations, or situations presenting eye hazards unless other approved eye protection is worn at all times.

Persons using corrective spectacles shall wear eye protection of one of the following types:

- Spectacles with protective lenses providing optical correction.
- Goggles worn over corrective spectacles without disturbing the adjustment of the spectacles or interfering with the seal of the goggles.
- Goggles that incorporate corrective lenses mounted behind the protective lenses.

Inspection and Maintenance

Eye and face protective devices shall be inspected by the employee before each use for signs of deterioration, cracks, or other damage that might reduce the degree of safety originally provided. Any defects shall result in the immediate removal of the device from service after immediately notifying the supervisor.

Eye and face protective devices shall be cleaned with soap and hot water, or with a cleaning solution and tissue, after each use.

D. EMPLOYEE TRAINING

Affected employees shall receive training in the proper use, maintenance, inspection, and storage of protective equipment discussed in this section. Such training shall be repeated when workplace inspections indicate non-adherence to the requirements of this policy.

Additional training shall be provided when changes, such as modification of tasks or procedures, affect the employee's exposure.

Employees shall receive training initially and whenever the following conditions apply:

- New hazards are introduced into the working environment.
- An injury or illness occurs.
- The supervisor has reason to believe that there are deficiencies in the employee's understanding of the hazards associated with eye and face protection.

1.3 HAND AND ARM PROTECTION

A variety of hazards are present in the workplace that requires proper controls to prevent hand and arm damage. A comprehensive assessment of such hazards shall be performed and the appropriate protection selected and utilized. The vast majority of hand and arm injuries can be prevented by the consistent utilization of approved hand and arm protection.

A. POLICY

Hand and arm protection shall be provided and utilized in all situations where employees are exposed to hazards such as those from skin absorption of harmful substances, severe cuts or lacerations, severe abrasions, punctures, chemical burns, thermal burns, and harmful temperature extremes. Such situations include, but are not limited to:

- Handling hot, heavy, sharp, jagged, or rough materials and objects.
- Working with brush, trash, lumber, or any debris that could cause injury to the hands.
- Welding.
- Handling corrosive, toxic, or harmful chemicals that may be absorbed through the skin.
- Loading or stacking heavy objects, or where a proper grip is necessary to safely do the task.
- Any other situation where, due to the hazards present, the supervisor deems it necessary that hand and arm protection be worn.

Visitors shall be required to wear protective hand and arm gear in all areas where this policy applies to CRA employees.

It is the policy of CRA that, at a minimum, short sleeve shirts are required. Tank tops are not permitted.

B. SAFE WORK PRACTICES

All hand and arm protection utilized will be approved by the safety supervisor, and the selection shall be based on the performance characteristics of the hand protection, relative to the task to be performed, conditions present, duration of use, and the hazards and potential hazards identified.

Fit and Use

Gloves shall not be worn when there is danger of the gloves being caught in moving machinery or rotating parts. Gloves shall be selected to provide the dexterity necessary to safely accomplish the work task. Employees shall be trained on the limitations of the provided arm and hand protection.

Inspection and Maintenance

Gloves shall be inspected before each use for signs of deterioration, cracks, or other damage that might reduce the degree of protection originally provided. Any defects shall result in the immediate removal of the gloves from service after immediately notifying the supervisor. Approved, re-useable chemical-resistant gloves used for chemical contact shall be properly decontaminated after use and prior to storage. Although all glove materials eventually permeate, they can be used safely for limited periods of time.

C. EMPLOYEE TRAINING

Affected employees shall receive training in the proper use, maintenance, inspection, and storage of protective equipment discussed in this chapter. Such training shall be repeated when workplace inspections indicate non-adherence to the requirements of this policy. Additional training shall be provided when changes, such as modification of tasks or procedures, affect the employee's exposure.

Employees shall receive refresher training whenever the following conditions apply:

- New hazards are introduced into the working environment.
- An injury or illness occurs.
- The supervisor has reason to believe that there are deficiencies in the employee's understanding of the hazards associated with hand and arm protection.

1.4 HEARING PROTECTION

Employees have the potential for noise exposure in many of CRA's project workplaces. Prolonged exposure to noise levels in excess of 90 decibels dB(A) has been shown to produce hearing loss. This policy is intended to address the issues of evaluating the

potential hazards of noise, communicating information concerning these hazards, and establishing appropriate protective measures for all employees.

A. POLICY

It is the policy of CRA that hearing protection be worn when working in noisy environments exceeding 85 decibels dB(A) which may include close proximity to earthmoving/drilling or other mechanical equipment and use of power tools.

B. REGULATORY BACKGROUND

Exposure to noise in the workplace is governed by rules promulgated by OSHA. The OSHA standard for noise, 29 CFR 1910.95, establishes permissible noise exposure in terms of duration (hours per day) and exposure as measured on the "A" scale of a standard sound level meter at slow response. The daily average dose of noise (8 hours) allowable under the OSHA regulation is 90 dB(A). From this point, the allowable duration of time exposed to the noise is halved for each increase of 5 dB(A) of sound.

In addition to the 90 dB(A), time weighted average (TWA) exposure limit, the OSHA noise standard requires the development of a Hearing Conservation Program for all employees whose noise exposure equals or exceeds an 8-hour TWA of 85 dB(A).

C. HEARING PROTECTION DEVICES

Hearing protectors will be made available to all employees exposed to 85 dB(A) or greater at no cost to the employees. Hearing protectors will be replaced at no cost as necessary. Such hearing protectors shall be worn by:

- Any employee who is required by previous testing to wear hearing protective equipment.
- Any employee who is exposed to 85 dB(A) or greater, and who has not yet had a baseline audiogram established, or has experienced a standard threshold shift.

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

Training will be provided in the use and care of all hearing protectors provided to employees.

Hearing protector attenuation will be evaluated for the specific noise environments in which the protector will be used.

D. EMPLOYEE TRAINING

A training program shall be instituted for all employees who are exposed to noise at or above 85 dB(A). The training program shall be repeated annually for each employee included in the Hearing Conservation Program. Information provided in the training program shall be updated to be consistent with changes in protective equipment and work processes. Each employee shall be informed of the following:

- The effects of noise on hearing.
- The purpose of hearing protectors; the advantages, disadvantages, and attenuation of various types; and instructions on selection, fitting, use, and care.
- The purpose of audiometric testing, and an explanation of the test procedures.

E. WRITTEN PROGRAM

A continuing, effective Hearing Conservation Program shall be administered whenever employee noise exposures equal or exceed 85 dB(A). For purposes of the Hearing Conservation Program, employee noise exposures will be computed without regard to any attenuation provided by the use of PPE.

The CRA Hearing Conservation Program is appended to this Appendix A.

1.5 RESPIRATORY PROTECTION

To control and/or minimize the threat of occupational diseases caused by breathing air contaminated with harmful dusts, fogs, fumes, mists, gases, smokes, sprays, particulates or vapors, the primary objective of this program shall be to prevent atmospheric contamination. This shall be accomplished as far as feasible by accepted engineering control measures (for example, enclosure or confinement of the operation, general and local ventilation, and substitution of less toxic materials). When effective engineering controls are not feasible, or while they are being instituted, appropriate respirators shall be used. Respirators shall be provided when such equipment is necessary to protect the health of the employee.

A. POLICY

This program applies to all CRA employees who are required to wear respirators during normal work operations. Currently, this program does not specifically address the voluntary use of respirators, as any utilization of respiratory devices is considered sanctioned under this current program.

This program does not apply to other contractors, subcontractors, or consultants, as they are responsible for providing their own respiratory protection programs, respiratory protective equipment, training, and fit testing.

B. REGULATORY BACKGROUND

OSHA regulates the use of respirators in construction. The OSHA regulations regarding respirators can be found at 29 CFR 1910.134. However, OSHA has several other regulations/standards for certain chemicals that require the use of respirators (i.e., benzene, vinyl chloride, ethylene oxide, etc.). This program will focus on the overall respiratory protection requirements of 29 CFR 910.134.

C. SAFE WORK PRACTICES

1. Only use respirators that have been selected by a qualified person to protect against the hazards.
2. Always check fit and operation upon donning a respirator.
3. Maintain clean shaven condition.
4. Refrain from having any object or material that would interfere with the seal of operation of the respirator.
5. Inspect respirator for damage and deterioration before and after use.
6. Ensure that respirators are cleaned, disinfected, and stored properly. Always store your respirator in a clean, sealed container when it is not being used to prevent contamination.
7. Remove from service any respirator deemed to be "defective" and report to supervisor.
8. Follow proper change-out schedule if using an air purifying respirator.
9. Follow the CRA Respiratory Protection Program located in Appendix G of the HASP.

D. EMPLOYEE TRAINING

For the safe use of any respirator, it is essential that employees be properly instructed in its selection, use, and maintenance. Both supervisors and employees shall be so instructed. Training shall be provided to each affected employee:

- Before the employee is first assigned duties that require respiratory protection.
- Before there is a change in assigned duties.
- Whenever there is a change in operations that present a hazard for which an employee has not previously been trained. Whenever the supervisor has reason to believe that there are deviations from established respiratory procedures required by this instruction or inadequacies in the employee's knowledge or use of these procedures.

This training shall be repeated on an annual basis. The training shall establish employee proficiency in the duties required by this program and shall introduce new or revised procedures, as necessary, for compliance with this instruction or when future revisions occur.

E. WRITTEN PROGRAM

CRA has established a Respiratory Protection Program to comply with 29 CFR 1910.134. This program is located in Appendix G of the HASP.

1.6 FOOT PROTECTION

Foot injuries can be caused by objects falling onto the foot, objects piercing the sole of the shoe, or by exposure to electrical hazards. The vast majority of foot injuries can be prevented by the consistent utilization of approved foot protection.

A. POLICY

Safety shoes with impact-resistant toes and slip-resistant soles shall be worn and utilized by employees under the following conditions:

- When working around objects which may expose the feet to abrasive, sharp, or piercing objects; impact from heavy, falling, or moving objects; molten metals or materials.

- Where employees may step on objects which may puncture the foot.
- Where necessary to protect employees from slipping on slick surfaces or where liquids have spilled, or are regularly present on the floor surface.
- Where traction or support is necessary in climbing, running, or working on inclined surfaces.
- In any other work situation where the supervisor, due to the nature of the hazards, reasonably deems it appropriate that foot protection be worn.

Visitors shall be required to wear protective footwear in all areas where this policy applies to CRA employees.

B. REGULATORY BACKGROUND

Steel-toed safety boots/shoes meeting ANSI Z41.1-1991 - American National Standard for Personal Protection - Protective Footwear requirements must be worn on all construction projects.

C. SAFE WORK PRACTICES

All foot protection utilized shall be approved by the safety supervisor, and the selection shall be based on the performance characteristics relative to the task to be performed, conditions present, duration of use, and the hazards and potential hazards identified.

Inspection, Maintenance, and Replacement

Protective footwear shall be inspected prior to each use by the employee for signs of deterioration, dents, or other damage that might reduce the level of protection originally provided. Any defects shall result in the immediate removal of the footwear from service after notifying the immediate supervisor.

Protective footwear shall be replaced immediately when use and deterioration has diminished the ability of the footwear to provide the intended protection.

D. EMPLOYEE TRAINING

Affected employees shall receive initial training in the proper use, maintenance, inspection, and storage of protective equipment discussed in this chapter.

Affected personnel shall be provided with training initially or at more frequent intervals whenever the following conditions apply:

- There is a job assignment change.
- There is a change in machinery or equipment, or processes that present new hazards.
- There is a change in foot protection procedures.

PPE HAZARD ASSESSMENT SELECTION

Name of Facility: _____ Location: _____

Job Task Description: _____

HAZARDS IDENTIFIED – CHECK ALL THAT APPLY

Head	Eye/Face	Hand	Foot
☐ Suspended hazards	☐ Chemical splashes	☐ Chemical exposure	☐ Heavy materials
☐ Overhead beams/poles	☐ Particulates/smoke/ fumes	☐ Temperature extremes	☐ Slippery conditions
☐ Employees working above	☐ UV light	☐ Sharp edges/splinters	☐ Mowing
☐ Sharp corners/objects (at head level)	☐ Welding operations	☐ Tools/machinery	☐ Construction
	☐ BBP splashes	☐ Biological agents	☐ Chemical exposure
	☐ Debris/flying debris	☐ Abrasions	☐ Hot work (heat/sparks)
		☐ Debris/flying debris	☐ Debris/sharp edges

Other: _____

PPE REQUIRED - CHECK ALL THAT APPLY

Head	Eye/Face	Hand	Foot
☐ Hard hat	☐ Safety glasses	☐ Chemical resistant	☐ Chemical resistant
	☐ Goggles	☐ Biohazard resistant	☐ Toe protection
	☐ Filtered/UV lenses	☐ Temperature resistant	☐ Metatarsal protection
	☐ Welding mask	☐ Abrasion resistant	☐ Puncture resistant
	☐ Face shield		☐ Electrical insulation/conductivity

Other: _____

Supervisor (print name)	**Signature**	**Date**
_____	_____	_____

APPENDIX L-B

FORMS

- EMERGENCY CONTACT SHEET
- HASP ACKNOWLEDGEMENT FORM
- TAILGATE SAFETY MEETING FORM
- SAFETY INSPECTION CHECKLIST FOR EXCAVATIONS
- CRA ACCIDENT REPORTING FORM
- PROPERTY ACCESS/UTILITY CLEARANCE DATA SHEET

EMERGENCY CONTACT SHEET
SOUTH DAYTON DUMP AND LANDFILL SITE
MORAINE, OHIO

EMERGENCY INFORMATION		
Contact	**Phone Number**	**Hospital Directions**
Local Police	911	• go north on Dryden Rd. toward Nicholas Rd. 0.4 miles; • turn right onto S Edwin C. Moses Blvd. 1.4 miles; • turn right onto W Stewart St. 0.4 miles; • turn left onto S Main St./ OH-48. 0.2 miles; and • end at 1 Wyoming St. the hospital is on the right-hand side of the street.
Fire Department	911	
Ambulance	911	
Local Hospital: Miami Valley Hospital 1 Wyoming Street, Dayton, Ohio 45409 CRA contacted the hospital and they are equipped to handle a hazardous materials accident victim.	937-208-2048	
National Poison Center	800-222-1222	
Project Manager Steve Quigley Work: Cell:	 519-884-0510 519-498-7997	Driving Time: 6 minutes Driving Distance: 2.54 miles Map is attached in Appendix L-B. The Hospital Map will be posted on the trailer door at the Site and at the main gate entrance to the Site.
Site Supervisor Jeroen Winterink Work: Cell:	 513-942-4750 513-919-4019	CRA – Accident Reporting System Please call (866) 529-4886 and provide: • Name and location of caller • Description of incident • Name of any injured persons • Description of injuries • Phone number for return call
CRA Regional SHM Jeff Maranciak Work: Cell:	 412-963-7313 412-225-6375	
Site Contact Ken Brown Work: Cell:	 847-657-4843 847-224-9003	
Client Contact Ken Brown Work: Cell:	 847-657-4843 847-224-9003	

EMERGENCY CONTACT SHEET
SOUTH DAYTON DUMP AND LANDFILL SITE
MORAINE, OHIO

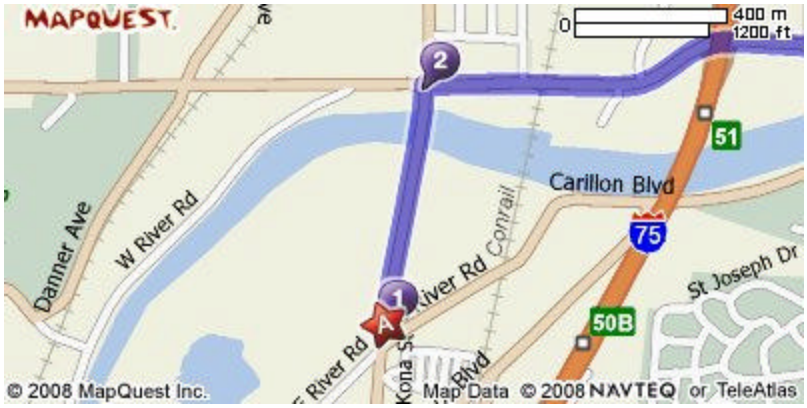
EMERGENCY INFORMATION		
Contact	**Phone Number**	**Hospital Directions**
Ohio Utilities Protection Service (OUPS)	800-362-2764	
Ohio EPA Project Manager Matt Justice Work:	937-285-6040	
U.S. EPA Remedial Project Manager Karen Cibulskis Work:	312-886-1843 Ext. 61843	
Other Contact U.S. EPA Region 5 Response Work:	(312) 353-2318	
National Spill Response Center	800-424-8802	
Ohio EPA Emergency Response:	800-282-9378	
Ohio EPA Southwest District Office (Dayton)	937-285-6357	
Ohio Department of Health	614-644-6447	
Alcohol, Tobacco, and Firearms (ATF)	800-424-9555	

Hospital route must be field validated before Site work commences.

MAPQUEST

A: 2153 Dryden Rd, Moraine, OH 45439-1739

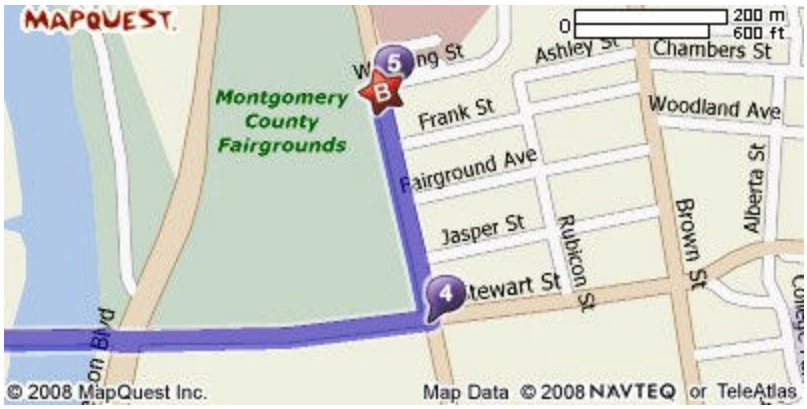
START **1:** Start out going NORTH on DRYDEN RD toward NICHOLAS RD. 0.5 mi



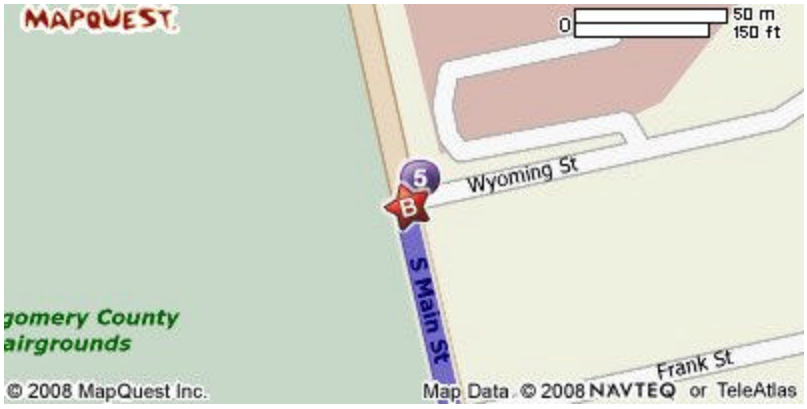
2: Turn RIGHT onto S EDWIN C MOSES BLVD. 1.4 mi

3: Turn RIGHT onto W STEWART ST. 0.4 mi

4: Turn LEFT onto S MAIN ST/OH-48. 0.2 mi



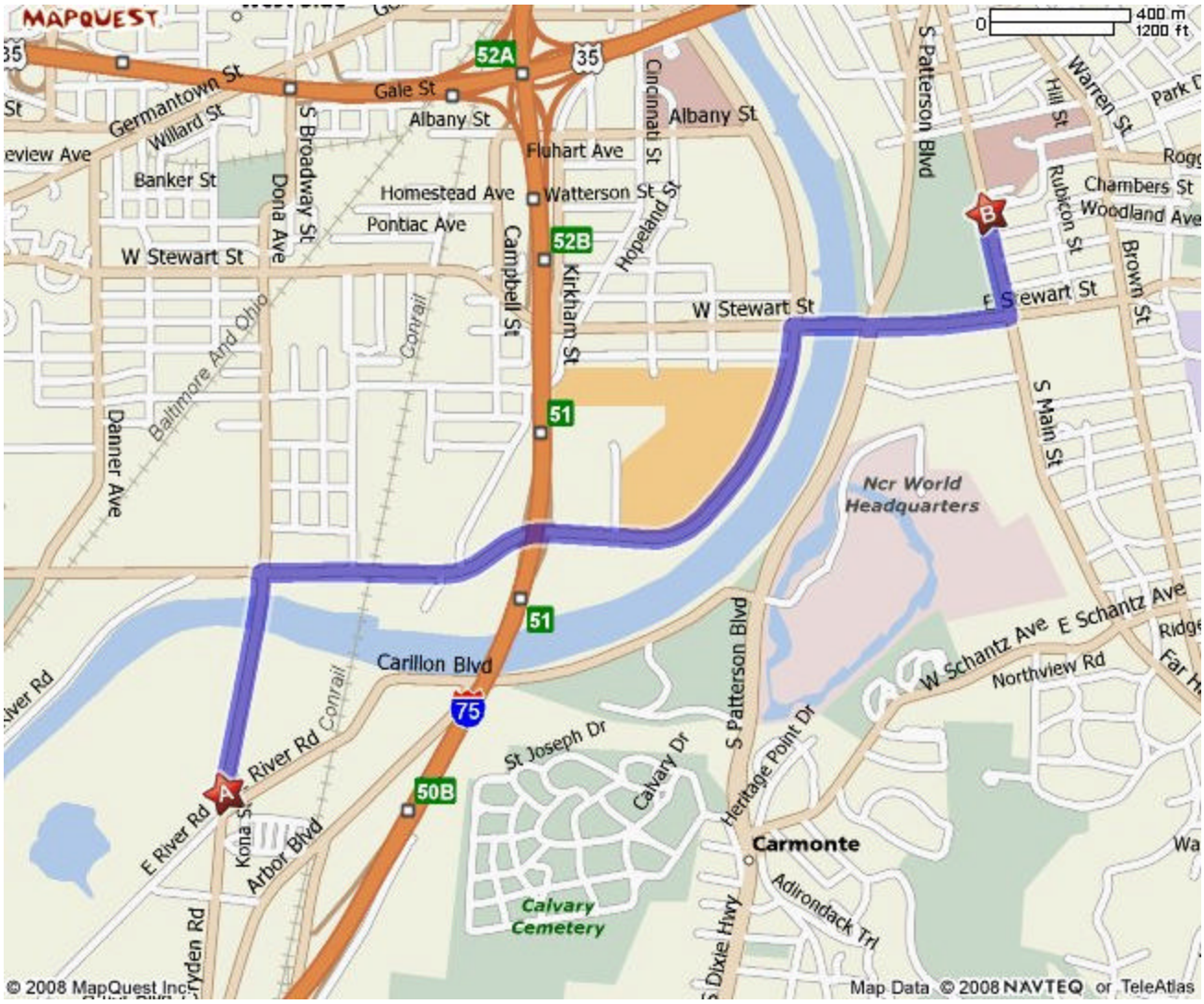
END **5:** End at 1 Wyoming St Dayton, OH 45409-2722



Estimated Time: 5 minutes Estimated Distance: 2.57 miles

B: 1 Wyoming St, Dayton, OH 45409-2722

Total Time: 5 minutes Total Distance: 2.57 miles



All rights reserved. Use subject to License/Copyright | Map Legend
Directions and maps are informational only. We make no warranties on the accuracy of their content, road conditions or route usability or expeditiousness. You assume all risk of use. MapQuest and its suppliers shall not be liable to you for any loss or delay resulting from your use of MapQuest. Your use of MapQuest means you agree to our Terms of Use

HASP ACKNOWLEDGMENT SHEET

This is to certify that I have received a pre-entry briefing regarding this HASP (CRA - South Dayton Dump and Landfill Site) and I understand its contents. My failure to follow and comply with the requirements contained in this plan may result in disciplinary action and/or termination.

Print Name	Signature	Date

This page must be available on Site during the project for review and filed with the project files upon project field work completion.

TAILGATE SAFETY MEETING FORM
SOUTH DAYTON DUMP AND LANDFILL SITE

Date: _____ Time: _____

Site Location: _____

Site Personnel in attendance:

Print Name	Signature	Company

Safety Topics/Items discussed:

_____

_____

_____

_____

_____

Supervisor

Name: _____ Date: _____

This page must be available on Site during the project for review and filed with the project files upon project field work completion.

38443 (8)

CRA 200016 QSF-013 - Rev. 6 – 10/24/2006

SAFETY INSPECTION CHECKLIST FOR EXCAVATIONS
REFERENCED BY OSHA STANDARDS

This checklist is to be completed by the competent person at the start of work and as needed throughout the shift (i.e., after rain events, etc.). ***(A competent person has been trained in the current OSHA excavation standard, is knowledgeable about soil analysis and protective systems, and has the authority to shut down the job.)***

Site Location: _____	Project #: _____
Date: _____ Time: _____	Competent Person: _____
Were visual soil tests made? If Yes, what type?	YES ☐ NO ☐ Type: _____
Were manual soil tests made? If yes, what type?	YES ☐ NO ☐ Type: _____
Soil Type: _____	Signature: _____
Soil Classification: _____	
Excavation Depth: _____	Excavation Width: _____
Protective System Used:	

In the following table, please place a Y for Yes, N for No, or N/A for Not Applicable in the right hand column for each item. If No, place the date of correction.

	Subject	*Y, N, or NA*	*Date Corrected*
GENERAL INSPECTION OF THE JOB SITE			
1.	Does the competent person have the authority to remove employees from the excavation immediately?		
2.	Are surface obstructions removed or supported?		
3.	Are employees protected from loose rock or soil that could pose a hazard by falling or rolling into the excavation?		
4.	Are hard hats worn by all employees?		
5.	Are excavated soil, materials, and equipment placed at least 2 feet from the edge of the excavation?		
6.	Are walkways and bridges over excavations 4 feet or more in depth equipped with standard guardrails and toe-boards?		
7.	Are warning vests or other highly visible clothing provided and worn by all employees exposed to public vehicular traffic?		
8.	Are employees required to stand away from vehicles being loaded or unloaded?		
9.	Is a warning system established and used when mobile equipment operates near the edge of the excavation?		
10.	Are employees prohibited from going beneath suspended loads?		
11.	Are employees prohibited from working on the faces of sloped or benched excavations above other employees?		
UTILITIES			
12.	Were utility companies contacted and/or utilities located?		
13.	Are the exact locations of the utilities marked?		
14.	Are underground installations protected, supported, or removed when excavation is opened?		

	Subject	*Y, N, or NA*	*Date Corrected*
MEANS OF ENTERING AND EXITING THE TRENCH			
15.	Is the distance along the trench to an exit no greater than 25 feet in excavations 4 feet or more in depth?		
16.	Is a support system, such as underpinning, being used?		
17.	Are ladders used in excavations secured and extended 3 feet above edge of the trench?		
18.	Are structural ramps used by employees designed by a competent person?		
19.	Are structural ramps used for equipment designed by a registered professional engineer?		
20.	Are employees protected from cave-ins when entering or exiting the excavation?		
WET CONDITIONS			
21.	Is water removal equipment monitored by a competent person?		
22.	Is surface water or runoff diverted or controlled to prevent accumulation in the excavation?		
23.	Are inspections made after every rainstorm or other hazard-increasing occurrence?		
HAZARDOUS ATMOSPHERE			
24.	Is the atmosphere within the excavation tested where there is a reasonable possibility of an oxygen deficiency, combustible, or other harmful contaminant exposing employees to a hazard?		
25.	Are adequate precautions taken to protect employees from exposure to an atmosphere containing less than 19.5% oxygen and/or other hazardous atmospheres?		
26.	Is ventilation provided to prevent employee exposure to an atmosphere containing flammable gas 10% above the lower explosive limit of a gas?		
27.	Is testing conducted often to ensure that the atmosphere remains safe?		
28.	Is emergency equipment, such as breathing apparatus, safety harness and lifeline, and/or basket stretcher readily available where hazardous atmospheres could or do exist?		
SUPPORT SYSTEMS			
29.	Are materials and/or equipment for support systems selected based on soil analysis, trench depth, and expected loads?		
30.	Are materials and equipment used for protective systems inspected and in good condition?		
31.	Are protective systems installed without exposing employees to the hazards of cave-ins (including end walls), collapses, or threat of being struck by materials or equipment?		
32.	Are excavations below the level of the base, or footing supported, approved by a registered professional engineer?		
33.	Does the removal of support systems progress from the bottom and members are released slowly? Note any indication of possible failure.		
34.	Is the excavation of material a level no greater than 2 feet below the bottom of the support system and only if the system is designed to support the loads calculated for the full depth?		
35.	Is there a shield system placed to prevent lateral movement?		

CONESTOGA-ROVERS & ASSOCIATES (CRA) ACCIDENT REPORTING FORM

Report all accidents immediately by calling 1-866-529-4886

Instructions: For Personal Injuries, Occupational Illnesses, and Property Damage, complete Sections 1 and 2.
For Vehicle Accidents, Complete Sections 1, 2, and 4. Form must be completed within 24 hours.

SECTION 1

A. Employee Identification	( ) CRA Employee	( ) Temporary Employee	( ) Subcontractor	
Employee No.	Last Name	First Name	Middle Name/Initial	M or F
Area Code ( )	Telephone Number	Address (Street, City, State, Province, Zip Code)		
Date of Hire / /	Position/Title	Supervisor	Employee's Company/Office Location	

B. General Information						
Where did the accident occur? ( ) Office ( ) Project Site ( ) Canada ( ) United States		Type of Occurrence ( ) Employee Injury/Illness ( ) Vehicle Accident ( ) Property Damage Only				
Date and Hour of Accident		Date and Hour Reported to Employer		Date and Hour Last Worked		Time Employee Began Work
Month Day Year	a.m. p.m.	Month Day Year	a.m. p.m.	Month Day Year	a.m. p.m.	a.m. p.m.
Normal Work Hours on Last Day Worked		Witnesses? ( ) Yes ( ) No		Witness Name and Telephone Number		
From: To:	a.m. p.m.					

C. Project Information (Project Related Accidents Only)				
Project #	Project Name	Project Manager	Site Telephone Number ( )	Employee Cell Number ( )
Was the Client Advised of the Accident? ( ) Yes ( ) No Name:		Project Address (Street, City, State, Province, Zip Code)		
		Specific Location of Accident		

SECTION 2

A. Details of the Accident
1. What job/task was being performed when the accident occurred? (Example: collecting groundwater samples).
2. Provide a detailed description of the employee's specific activities at the time of the accident. Include details of equipment/materials being used, including the size and weights of objects being handled. If necessary, attach additional pages to the report.
3. For injuries, identify the specific part of body injured, and specify left or right side. For illnesses, identify and describe the affected area/body part.
4. Identify the object or substance that directly injured employee and how. Include size and weight of object, quantity of substance, etc.
5. Identify property damaged and how it was damaged (include owner of property, nature and source of damage, model and serial number, if appropriate).

B. Health Care/Medical Treatment	
Employee received health care? ( ) Yes ( ) No	Identify the type of health care provided and where it was performed. (Check all that apply). ( ) First Aid ( ) Medical treatment other than first aid (sutures, etc.) ( ) Hospitalized ( ) Clinic ( ) Hospital emergency room ( ) On location by self or CRA employee) ( ) On Site by EMT
Name of Health Care Provider, Physician's Name, Address (Street, City, Province/State, and Postal/Zip Code)	

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Section 2 (Continued)

C. Accident Investigation	
H&S plan prepared and on Site? ( ) Yes ( ) Not applicable	Did the safety plan identify and provide safety procedures for the specific tasks the employee was conducting when injured? ( ) Yes ( ) No If no, why not? (Explain) Did the employee utilize the STAR process before initiating the task? ( ) Yes ( ) No If no, why not? (Explain)
Did the employee have the proper safety training to conduct these tasks or use the equipment? ( ) Yes ( ) No If not, why not?	
Identify all of the potential contributing factors and how they led to the occurrence of the accident. (Lack of attention, wrong use of equipment, lack of training, hurrying/rushing, sort-cutting, environmental conditions, time of day, etc.)	
What contributing factor(s) above was the underlying root cause of the accident.	
Is any training or retraining recommended? If yes, describe.	
What actions have been or will be taken to correct this accident from reoccurring? Verify that these actions will be taken with the PM and/or employee supervisor.	
Additional information: Attach photos, witness statement(s), affected employee statement, accident diagrams, as applicable, to the end of this document.	

Report Date Month Day Year	Report Prepared by: (please print)	Report Prepared by: (signature)

Fax Completed Form to CRA's Accident Reporting Fax: (716) 297-3389
Send Original to CRA's Accident Reporting Department, Niagara Falls, New York

SECTION 3

D. Agency Reporting and Recording Information (To be completed by the Regional Safety and Health Manager)			
CANADA			
Form 7 Sent to WSIB? ( ) Yes ( ) Not required	Employee Injury Information (Injury met the following criteria) ( ) First Aid ( ) Medical Treatment ( ) Critical Injury ( ) Modified Duty ( ) Lost Time Injury If medical treatment, what?		
Joint Safety and Health Committee Notified? ( ) Yes ( ) No	Total days of modified duty If exceeds 7 days, report to WSIB.	Total days of lost time (if any)	Date employee returned to work Month Day Year
UNITED STATES			
OSHA Recordable Injury? ( ) Yes ( ) No	Employee Injury Information (Injury met the following OSHA 300 Log criteria) ( ) First Aid ( ) Medical Treatment ( ) Restricted Duty ( ) Lost Time Injury If medical treatment, what?		
Total days of restricted duty	Total days of lost time (if any)		Date employee returned to work Month Day Year

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VEHICLE ACCIDENT SECTION

(Complete this Section for all Vehicle Accidents)

SECTION 4

A. CRA Vehicle

License Plate No.	State/Province	Police Department City State/Province	
Vehicle Year/Make/Model	Odometer Reading at Time of Accident	Police Report Number	Weather Conditions

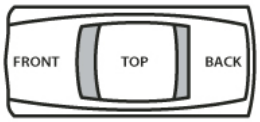
Name of Person Operating Vehicle

Address

City State/Province Zip Code

Telephone: Area Code ( )

"X" IN AREA OF VEHICLE DAMAGE



CIRCLE
0 No Damage
1 Light
2 Moderate
3 Heavy
4 Rolled
5 Burned

Vehicle Type: ( ) Personal ( ) Rental ( ) CRA-Own

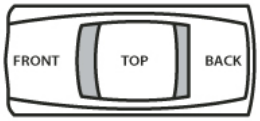
Description of Vehicle Damage:

B. Other Vehicles Involved

Name of Owner	Address	City/State/Prov./Zip	Area Code and Telephone Number ( )
Operator's Name (if different from above)	Address	City/State/Prov./Zip	Area Code and Telephone Number ( )

Year/Make/Model	Description of Property Damage:
Insurance Co. Name & Telephone	
License Plate No./State/Province	

"x" IN AREA OF VEHICLE DAMAGE



CIRCLE
0 No Damage
1 Light
2 Moderate
3 Heavy
4 Rolled
5 Burned

C. Injured Persons

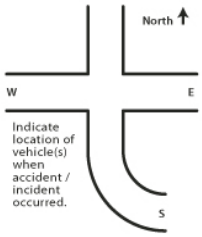
Name	Address Street, City, State/Prov./Zip Code	Phone Number	Nature of Injury	Indicate if Injured was a Vehicle Driver/ Passenger, CRA Employee, Other, or Pedestrian
1.				
2.				
3.				

D. Witnesses

Name	Address Street, City, State/Prov./Zip Code	Area Code and Telephone Number
1.		( )
2.		( )

E. Description of Accident

PLEASE COMPLETE OR ATTACH SEPARATE DIAGRAM



Was Ticket Issued:
Other Operator ☐
CRA Operator ☐

Reason: _____

Report Date Month Day Year	Report Prepared by: (please print)	Report Prepared by: (signature)

Note: If Additional Space is Required to Complete this Report, Use Separate Sheet of Paper and Attach.

Fax Completed form to CRA's Accident Reporting Fax: (716) 297-3389

Send Original to CRA's Accident Reporting Department, Niagara Falls, New York

PROPERTY ACCESS/UTILITY CLEARANCE DATA SHEET

(QSF-019)

PROJECT NAME: _____ PROJECT NUMBER: _____

CRA REPRESENTATIVE: _____

CLIENT: _____ CLIENT REPRESENTATIVE: _____ PHONE: _____

ON-SITE PROPERTY ACCESS APPROVAL _____ (OWNER OR AUTHORIZED AGENT SIGNATURE)

OFF-SITE PROPERTY ACCESS APPROVAL (if applicable) _____ (OWNER OR AUTHORIZED AGENT SIGNATURE)

UTILITY CLEARANCE APPROVAL _____ (OWNER OR AUTHORIZED AGENT SIGNATURE)

CONTRACTOR VERIFICATION APPROVAL _____ (OWNER OR AUTHORIZED AGENT SIGNATURE)

UTILITIES (INDICATE THAT LOCATION/UTILITY PRESENCE WAS CHECKED) *												
Borehole/ Excavation Location	Date (m/d/y)	Telephone	Water	Storm Sewer	Sanitary Sewer	Process Sewer	Gas	Electrical	Cable	Overhead Utilities	Other	Comments/Warnings

Additional Comments:

_____

_____

_____

* Note as appropriate, Contractor, Client or Owner, or Agent to sign, indicating no utilities are at the selected borehole/excavation locations.

THIS COMPLETED FORM IS A QUALITY RECORD

APPENDIX L-C

TASK HAZARD ANALYSIS TABLES

TASK HAZARD ANALYSIS
CRA

Activities Covered by THA:

Drilling soil borings and monitoring wells

Vertical aquifer sampling

Monitoring well installations in boreholes

Collecting soil samples from boreholes

Performing monitoring well development

Gas probe installation

Landfill gas/soil vapor screening

Description of Task	*Potential Hazards*	*Preventive Measures and Controls*	*Action Levels*
Installation of monitoring well and soil borings; collection of soil samples	Slip, trip, fall	Use three points to board machinery. Continuously inspect work areas for slip, trip & fall hazards. Be aware of surroundings. While drilling through the asphalt pile take special precautions such as driving slowly up the ramp using a spotter, maintaining a safe distance from the edge of the flat area at the top of the pile, and maintaining awareness of surroundings.	Initiate in Modified Level D STOP WORK if any of the following Action Levels are measured: O_2 <19.5% or >23.5%; H_2S <10 PPM; CO >35 PPM; or LEL >10%, STOP WORK. Upgrade to Level C if PID measurements reads greater than 1 ppm in the breathing zone and vinyl chloride is not present. Pull colorimetric tubes for vinyl chloride. If vinyl chloride is present work will stop and Level B will have to be utilized. If vinyl chloride is not present than level C can be utilized. The Action Level for Dust is 2 mg/m^3 and the action is to stop work, thoroughly wet the area, and monitor for dust. When dust is below 2 mg/m^3 then continue activities.
	Chemical hazard	Continuous monitoring when chemical hazards present with PID, multi-gas meter, landfill gas monitor, dust monitor during drilling operations and wear appropriate PPE. Exposure to possible low-level radiation at the Site shall be monitored with a low-level radiation meter (e.g., Victoreen survey meter). All radiation monitoring shall be conducted in the breathing zone. Screen for radiation upon mobilization to a new area and monitor continuously for radiation if elevated readings present or if foundry sands identified.	
	Noise	Wear appropriate hearing protection if noise levels exceed 85 dBA.	
	Utilities	Maintain proper utility clearances as specified in HASP.	
	Pinch points	Keep hands, feet, & clothing away from moving parts/devices.	
	Heavy lifting	Follow safe lifting practices outlined in HASP. Lift items within your capabilities. Ask for assistance with heavy items.	
	Use of hand and power tools	Follow manufacturers safety precautions, inspect tools regularly, replace defective tools, wear the appropriate eye and foot protection.	
	Operating drilling equipment	Keep clear of augers, do not wear loose clothing jewelry, instruct personnel on use of emergency kill switch, follow guidelines in HASP.	Cease operations in Level C if ppm levels reach 25 ppm or higher.
	Moving drilling equipment	Inspect work area and secure the drill rig before moving to other location.	
	Heat/cold stress	Dress appropriately and follow guidelines in the HASP.	If radiation exceeds 0.6 mrem/hr, area will be evacuated and SHM and PM will be contacted.
	Dangerous weather conditions	Consult local weather reports daily, watch for signs of severe weather, etc.	
	Biological hazards	Inspect work areas carefully, void contact with insects and poisonous plants. Follow procedures in HASP.	

TASK HAZARD ANALYSIS
CRA

Activities Covered by THA:

Drilling soil borings and monitoring wells

Vertical aquifer sampling

Monitoring well installations in boreholes

Collecting soil samples from boreholes

Performing monitoring well development

Gas probe installation

Landfill gas/soil vapor screening

Description of Task	*Potential Hazards*	*Preventive Measures and Controls*	*Action Levels*

Personal Protective Equipment	**Training Requirements**
Modified Level D: Hard hat, safety glasses, steel toed boots, hearing protection, Neoprene or Nitrile gloves and Neoprene or Butyl Rubber overboots.	Safety introduction/briefing, safety meetings HazCom Personal protective equipment Use of emergency kill switch on drill rig Respiratory protection
Level C: Modified Level D plus an air purifying respirator with a P-100 organic vapor/acid gas cartridge and a Polycoated Tyvek suit. Nitrile inner gloves and Outer Neoprene gloves.	

TASK HAZARD ANALYSIS
CRA

Activities Covered by THA:

Collection of groundwater samples from monitoring wells.

Collection of groundwater samples from private wells (if required).

Description of Task	*Potential Hazards*	*Preventive Measures and Controls*	*Action Levels*
Purge groundwater monitoring well, obtain water levels and collect groundwater sample	Slip, trip, fall	Use three points to board machinery. Continuously inspect work areas for slip, trip & fall hazards. Be aware of surroundings.	Initiate in Modified Level D STOP WORK if any of the following Action Levels are measured: O_2 <19.5% or >23.5%; H_2S <10 PPM; CO >35 PPM; or LEL >10%, STOP WORK. Upgrade to Level C if PID measurements reads greater than 1 ppm in the breathing zone and vinyl chloride is not present. Pull colorimetric tubes for vinyl chloride. If vinyl chloride is present work will stop and Level B will have to be utilized. If vinyl chloride is not present than level C can be utilized. The Action Level for Dust is 2 mg/m^3 and the action is to stop work, thoroughly wet the area, and monitor for dust. When dust is below 2 mg/m^3 then continue activities.
	Noise	Wear appropriate hearing protection if noise levels exceed 85 dBA.	
	Chemical hazard	Continuous monitoring when chemical hazards present with PID, multi-gas meter, landfill gas monitor, dust monitor and radiation monitor during well purging and prior to sampling to establish proper PPE levels and wear appropriate PPE. Exposure to possible low-level radiation at the site shall be monitored with a low-level radiation meter (e.g., Victoreen survey meter). All radiation monitoring shall be conducted in the breathing zone. Monitor continuously for radiation if elevated readings present during boring.	
	Pinch points	Keep hands, feet, & clothing away from moving parts/devices.	
	Heavy lifting	Follow safe lifting practices in HASP. Lift items within your capabilities. Ask for assistance with heavy items.	
	Use of hand and power tools	Follow manufacturers safety precautions, inspect tools regularly, replace defective tools, wear the appropriate eye and foot protection.	
	Operating generator	Use GFCI for all electrical connections and ensure generator is grounded.	Cease operations in Level C if PID levels reach 25 ppm or higher.
	Heat/cold stress	Dress appropriately and follow guidelines in HASP	
	Dangerous weather conditions	Consult local weather reports daily, watch for signs of severe weather, etc.	If radiation exceeds 0.6 mrem/hr, area will be evacuated and SHM and PM will be contacted.
	Biological hazards	Inspect work areas carefully, void contact with insects and poisonous plants. Follow procedures in HASP.	

Personal Protective Equipment	**Training Requirements**
Modified Level D: Safety glasses, steel toed boots, and Nitrile gloves for sampling.	Safety introduction/briefing, safety meetings HazCom Personal protective equipment Respiratory protection
Level C: Modified Level D plus an air purifying respirator with a P-100 organic vapor/acid gas cartridge and a Polycoated Tyvek suit. Nitrile inner gloves and Outer Neoprene gloves.	

TASK HAZARD ANALYSIS
CRA

Activities Covered by THA:

Mobilization of personnel, materials, and equipment to and from the Site

Description of Tasks	*Potential Hazards*	*Preventive Measures and Controls*	*Action Levels*
Mobilization of equipment to include set up of work zones, drill rig set up and staging.	Slip, trip, fall	Use three points to board machinery. Continuously inspect work areas for slip, trip & fall hazards. Be aware of surroundings.	Initiate in Level D STOP WORK if any of the following Action Levels are measured: O_2 <19.5% or >23.5%; H_2S <10 PPM; CO >35 PPM; or LEL >10%, STOP WORK. Upgrade to Level C if PID measurements reads greater than 1 ppm in the breathing zone and vinyl chloride is not present. Pull colorimetric tubes for vinyl chloride. If vinyl chloride is present work will stop and Level B will have to be utilized. If vinyl chloride is not present than level C can be utilized. The Action Level for Dust is 2 mg/m^3 and the action is to stop work, thoroughly wet the area, and monitor for dust. When dust is below 2 mg/m^3 then continue activities. Cease operations in Level C if PID levels reach 25 ppm or higher.
	Noise	Wear appropriate hearing protection if noise levels exceed 85 dBA.	
	Chemical hazard	Continuous monitoring when chemical hazards present with PID, multi-gas meter, landfill gas monitor, dust monitor and radiation monitoring prior to commencing Site activities and intermittently thereafter to establish proper PPE levels and wear appropriate PPE.	
	Utilities	Maintain proper utility clearances as specified in HASP.	
	Pinch points	Keep hands, feet, & clothing away from moving parts/devices.	
	Heavy lifting	Follow safe lifting practices outlined in HASP. Lift items within your capabilities. Ask for assistance with heavy items.	
	Use of hand and power tools	Follow manufacturers safety precautions, inspect tools regularly, replace defective tools, wear the appropriate eye and foot protection.	
	Set up of drill rig/heavy equipment and moving rig/heavy equipment	Raise and lower mast of drill rig slowly. Maintain proper utility clearances. Do not wear loose clothing jewelry. Follow guidelines in HASP. Inspect work area and secure drill rig before moving to another location.	

TASK HAZARD ANALYSIS
CRA

Activities Covered by THA:

Mobilization of personnel, materials, and equipment to and from the Site

Description of Tasks	*Potential Hazards*	*Preventive Measures and Controls*	*Action Levels*
Mobilization cont'd	Steam cleaning of equipment	Use Modified Level D PPE	If radiation exceeds 0.6 mrem/hr, area will be evacuated and SHM and PM will be contacted.
	Heat/cold stress	Dress appropriately and follow guidelines in HASP	
	Dangerous weather conditions	Consult local weather reports daily, watch for signs of severe weather, etc.	
	Biological hazards	Inspect work areas carefully, void contact with insects and poisonous plants. Follow procedures in HASP.	

Personal Protective Equipment	**Training Requirements**
Level D: Hard hat, safety glasses, steel toed boots and leather work gloves.	Safety introduction/briefing, safety meetings HazCom Personal protective equipment
Modified Level D: Hard hat, safety glasses, face shield, steel toed boots, hearing protection, Neoprene or Nitrile gloves and Neoprene or Butyl Rubber overboots.	

TASK HAZARD ANALYSIS
CRA

Activities Covered by THA:

Conducting a geophysical survey

Synoptic water level measurements

Bathymetry survey

Continuous hydraulic monitoring

Install and measure stream staff gauges;

Collecting sediment samples (if required)

Collecting surface water samples (if required)

Description of Tasks	*Potential Hazards*	*Preventive Measures and Controls*	*Action Levels*
Set up survey equipment and perform survey activities. Measure groundwater elevation in monitoring wells and in staff gauges in the GMR, Quarry Pond and other surface water bodies. Drive around the water in a boat to measure the depth to bottom for the water bodies.	Slip, trip, fall	Use three points to board machinery. Continuously inspect work areas for slip, trip & fall hazards. Be aware of surroundings.	Initiate in Level D STOP WORK if any of the following Action Levels are measured: O_2 <19.5% or >23.5%; H_2S <10 PPM; CO >35 PPM; or LEL >10%, STOP WORK. Upgrade to Level C if PID measurements reads greater than 1 ppm in the breathing zone and vinyl chloride is not present. Pull colorimetric tubes for vinyl chloride. If vinyl chloride is present work will stop and Level B will have to be utilized. If vinyl chloride is not present than level C can be utilized. The Action Level for Dust is 2 mg/m^3 and the action is to stop work, thoroughly wet the area, and monitor for dust. When dust is below 2 mg/m^3 then continue activities.
	Water Hazards	Follow CRA boating policy as outlined in the HASP and wear a personal floatation device (PFD).	
	Chemical hazard	Continuous monitoring when chemical hazards present with PID, multi-gas meter, landfill gas monitor, dust monitor and radiation monitoring prior to commencing Site activities and intermittently thereafter to establish proper PPE levels and wear appropriate PPE.	
	Heavy lifting	Follow safe lifting practices outlined in HASP. Lift items within your capabilities. Ask for assistance with heavy items.	
	Use of hand and power tools	Follow manufacturers safety precautions, inspect tools regularly, replace defective tools, wear the appropriate eye and foot protection.	

TASK HAZARD ANALYSIS
CRA

Activities Covered by THA:

Conducting a geophysical survey

Synoptic water level measurements

Bathymetry survey

Continuous hydraulic monitoring

Install and measure stream staff gauges;

Collecting sediment samples (if required)

Collecting surface water samples (if required)

Description of Tasks	*Potential Hazards*	*Preventive Measures and Controls*	*Action Levels*
Survey cont'd.	Heat stress	Dress appropriately and follow guidelines in HASP	Cease operations in Level C if PID levels reach 25 ppm or higher. If radiation exceeds 0.6 mrem/hr, area will be evacuated and SHM and PM will be contacted.
	Dangerous weather conditions	Consult local weather reports daily, watch for signs of severe weather, etc.	
	Biological hazards	Inspect work areas carefully, void contact with insects and poisonous plants. Follow procedures in HASP.	

Personal Protective Equipment	**Training Requirements**
Level D: Safety glasses, steel toed boots and leather work gloves. When within 3 feet of the water bodies wear PFDs.	Safety introduction/briefing, safety meetings HazCom Personal protective equipment

TASK HAZARD ANALYSIS
CRA

Activities Covered by THA:

Excavating test pits and test trenches

Collecting soil samples from test pits and test trenches

Seep characterization and sampling.

Surficial metallic debris collection/staging if excavator required

Description of Task	*Potential Hazards*	*Preventive Measures and Controls*	*Action Levels*
Soil excavations	Slip, trip, fall	Use three points to board machinery. Continuously inspect work areas for slip, trip & fall hazards. Be aware of surroundings. Temporary fencing will be put around any open excavation or stockpile at the end of each workday. No one is to enter a test trench unless a trench box is used. No personnel will be allowed inside the test pit or test trench.	Initiate in Modified Level D
	Chemical hazard	Continuous monitoring when chemical hazards present with PID, multi-gas meter, landfill gas monitor, dust monitor and radiation monitor during excavation activities and prior to excavating to establish proper PPE levels and wear appropriate PPE. Exposure to possible low-level radiation at the site shall be monitored with a low-level radiation meter (e.g., Victoreen survey meter). All radiation monitoring shall be conducted in the breathing zone. Screen for radiation upon mobilization to a new area and monitor continuously for radiation if elevated readings present or if foundry sands identified.	STOP WORK if any of the following Action Levels are measured: O_2 <19.5% or >23.5%; H_2S <10 PPM; CO >35 PPM; or LEL >10%, STOP WORK. Upgrade to Level C if PID measurements reads greater than 1 ppm in the breathing zone and vinyl chloride is not present. Pull colorimetric tubes for vinyl chloride. If vinyl chloride is present work will stop and Level B will have to be utilized. If vinyl chloride is not present than level C can be utilized. The Action Level for Dust is 2 mg/m^3 and the action is to stop work, thoroughly wet the area, and monitor for dust. When dust is below 2 mg/m^3 then continue activities.
	Noise	Wear appropriate hearing protection if noise levels exceed 85 dBA.	
	Utilities	Maintain proper utility clearances as specified in HASP.	
	Pinch points	Keep hands, feet, & clothing away from moving parts/devices.	
	Heavy lifting	Follow safe lifting practices in HASP. Lift items within your capabilities. Ask for assistance with heavy items.	
	Operating heavy equipment	Keep clear of boom and buckets, establish eye contact with operator prior to crossing in front of excavators.	Cease operations in Level C if PID levels exceed 25 ppm.
	Moving heavy equipment	Inspect work area, secure the equipment before moving to next location.	
	Heat/cold stress	Dress appropriately and follow guidelines presented in HASP	If radiation exceeds 0.6 mrem/hr, area will be evacuated and SHM and PM will be contacted.
	Dangerous weather conditions	Consult local weather reports daily, watch for signs of severe weather, etc.	
	Biological hazards	Inspect work areas carefully, void contact with insects and poisonous plants. Follow procedures in HASP.	

Personal Protective Equipment	**Training Requirements**
Modified Level D: Hard hat, safety glasses, steel toed boots, hearing protection, reflective safety vest and work gloves.	Safety introduction/briefing, safety meetings HazCom Personal protective equipment Respiratory protection
Level C: Modified Level D plus an air purifying respirator with a P-100 organic vapor/acid gas cartridge, a Tyvek suit and Nitrile gloves.	

TASK HAZARD ANALYSIS
CRA

Activities Covered by THA:

Decontamination of Personnel and Equipment

Description of Task	*Potential Hazards*	*Preventive Measures and Controls*	*Action Levels*
Cleaning of heavy equipment/vehicles, PPE, sampling equipment, etc.	Slip, trip, fall	Use three points to board machinery. Continuously inspect work areas for slip, trip & fall hazards. Be aware of surroundings.	Initiate in Modified Level D STOP WORK if any of the following Action Levels are measured: O_2 <19.5% or >23.5%; H_2S <10 PPM; CO >35 PPM; or LEL >10%, STOP WORK. Upgrade to Level C if PID measurements reads greater than 1 ppm in the breathing zone and vinyl chloride is not present. Pull colorimetric tubes for vinyl chloride. If vinyl chloride is present work will stop and Level B will have to be utilized. If vinyl chloride is not present than level C can be utilized. The Action Level for Dust is 2 mg/m^3 and the action is to stop work, thoroughly wet the area, and monitor for dust. When dust is below 2 mg/m^3 then continue activities.
	Noise	Wear appropriate hearing protection if noise levels exceed 85 dBA.	
	Chemical hazard	Continuous monitoring when chemical hazards present with PID, multi-gas meter, landfill gas monitor, dust monitor and radiation monitor during excavation activities and prior to excavating to establish proper PPE levels and wear appropriate PPE.	
	Electrical Hazards/Stored Energy	Use GFCIs to reduce electric shock. Inspect all equipment prior to use. Do not stand in water when using electrical equipment. Insure LOTO procedures are implemented.	
	Fueling Equipment	No smoking, allow equipment to cool before refueling, follow storage requirements (reference MSDS)	
	Moving Heavy Equipment	Inspect work area and be aware of surroundings at all times. Establish traffic patterns and wear safety vests. Use a spotter around moving equipment.	
	Pinch points	Keep hands, feet, & clothing away from moving parts/devices.	
	Heavy lifting	Follow safe lifting practices. Lift items within your capabilities. Ask for assistance with heavy items.	
	Use of hand and power tools	Follow manufacturers safety precautions, inspect tools regularly, replace defective tools, wear the appropriate eye and foot protection.	
	Steam cleaning	Use Modified Level D PPE	Cease operations in Level C if PID levels reach 25 ppm or higher.
	Heat stress	Dress appropriately and follow guidelines in HASP	
	Dangerous weather conditions	Consult local weather reports daily, watch for signs of severe weather, etc. Suspend or reduce operations during severe weather.	If radiation exceeds 0.6 mrem/hr, area will be evacuated and SHM and PM will be contacted.
	Biological hazards	Inspect work areas carefully, void contact with insects and poisonous plants.	

Personal Protective Equipment	**Training Requirements**
Modified Level D: Hard Hat, Face Shield, Nitrile/Rubber Gloves, Safety Glasses, Steel Toe Boots and Rain Gear	Safety introduction/briefing, safety meetings HazCom Personal protective equipment Respiratory protection
Level C: Modified Level D plus an air purifying respirator with a P-100 organic vapor/acid gas cartridge and a Polycoated Tyvek suit. Nitrile inner gloves and Outer Neoprene gloves.	

TASK HAZARD ANALYSIS
CRA

Activities Covered by THA:

Site reconnaissance

Visual seep inspections

Identify areas needing further investigation;

Surficial metallic debris collection/staging

Description of Tasks	*Potential Hazards*	*Preventive Measures and Controls*	*Action Levels*
Obtain site parameters; conduct visual site observations; locate existing wells and previous soil borings (if applicable).	Slip, trip, fall	Use three points to board machinery. Continuously inspect work areas for slip, trip & fall hazards. Be aware of surroundings.	Initiate in Level D STOP WORK if any of the following Action Levels are measured: O_2 <19.5% or >23.5%; H_2S <10 PPM; CO >35 PPM; or LEL >10%, STOP WORK. Upgrade to Level C if PID measurements reads greater than 1 ppm in the breathing zone and vinyl chloride is not present. Pull colorimetric tubes for vinyl chloride. If vinyl chloride is present work will stop and Level B will have to be utilized. If vinyl chloride is not present than level C can be utilized. The Action Level for Dust is 2 mg/m^3 and the action is to stop work, thoroughly wet the area, and monitor for dust. When dust is below 2 mg/m^3 then continue activities.
	Water Hazards	When close to water wear a PFD.	
	Chemical hazard	Continuous monitoring when chemical hazards present (i.e., when working in area of drums or drum debris) with PID, multi-gas meter, landfill gas monitor, dust monitor and radiation monitor during metal debris consolidation activities and prior to any intrusive activities to establish proper PPE levels and wear appropriate PPE.	
	Utilities	Maintain proper utility clearances.	

TASK HAZARD ANALYSIS
CRA

Activities Covered by THA:

Site reconnaissance

Visual seep inspections

Identify areas needing further investigation;

Surficial metallic debris collection/staging

Description of Tasks	*Potential Hazards*	*Preventive Measures and Controls*	*Action Levels*
Recon, cont'd.	Pinch Points	Keep hands, feet, & clothing away from moving parts/devices. Use proper tools and techniques when opening flush-mount wells.	Cease operations in Level C if PID levels reach 25 ppm or higher.
	Heavy lifting	Follow safe lifting practices outlined in HASP. Lift items within your capabilities. Ask for assistance with heavy items.	
	Heat /Cold stress	Dress appropriately and follow guidelines in HASP and SOPs.	
	Dangerous weather conditions	Consult local weather reports daily, watch for signs of severe weather, etc. Suspend or reduce operations during severe weather	If radiation exceeds 0.6 mrem/hr, area will be evacuated and SHM and PM will be contacted.
	Vehicle Traffic	Be aware of surroundings at all times, wear PPE, follow HASP and SOPs.	

Personal Protective Equipment	**Training Requirements**
Level D: safety glasses, steel toed boots and leather work gloves.	Safety introduction/briefing, safety meetings HazCom Personal protective equipment

APPENDIX L-D

MATERIAL SAFETY DATA SHEETS

Material Safety Data Sheet

SECTION 1 PRODUCT AND COMPANY IDENTIFICATION

CHEVRON REGULAR UNLEADED GASOLINE

Product Number(s): CPS201000 [See Section 16 for Additional Product Numbers]
Synonyms: Calco Regular Unleaded Gasoline

Company Identification
Chevron Products Company
Marketing, MSDS Coordinator
6001 Bollinger Canyon Road
San Ramon, CA 94583
United States of America

Transportation Emergency Response
CHEMTREC: (800) 424-9300 or (703) 527-3887
Health Emergency
ChevronTexaco Emergency Information Center: Located in the USA. International collect calls accepted. (800) 231-0623 or (510) 231-0623
Product Information
Technical Information: (510) 242-5357

SPECIAL NOTES: This MSDS applies to: Federal Reformulated Gasoline, California Reformulated Gasoline, Wintertime Oxygenated Gasoline, Low RVP Gasoline and Conventional Gasoline.

SECTION 2 COMPOSITION/ INFORMATION ON INGREDIENTS

COMPONENTS	CAS NUMBER	AMOUNT
Gasoline	86290-81-5	100 %volume
Benzene	71-43-2	0.1 - 4.9 %volume
Ethyl benzene	100-41-4	0.1 - 3 %volume
Naphthalene	91-20-3	0.1 - 2 %volume
Ethanol	64-17-5	0 - 10 %volume
Methyl tert-butyl ether (MTBE)	1634-04-4	0 - 15 %volume
Tertiary amyl methyl ether (TAME)	994-05-8	0 - 17 %volume
Ethyl tert-butyl ether (ETBE)	637-92-3	0 - 18 %volume

Motor gasoline is considered a mixture by EPA under the Toxic Substances Control Act (TSCA). The refinery streams used to blend motor gasoline are all on the TSCA Chemical Substances Inventory. The appropriate CAS number for refinery blended motor gasoline is 86290-81-5. The product specifications of motor gasoline sold in your area will depend on applicable Federal and State regulations.

SECTION 3 HAZARDS IDENTIFICATION

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EMERGENCY OVERVIEW

- EXTREMELY FLAMMABLE LIQUID AND VAPOR. VAPOR MAY CAUSE FLASH FIRE
- HARMFUL OR FATAL IF SWALLOWED - MAY CAUSE LUNG DAMAGE IF SWALLOWED
- VAPOR HARMFUL
- CAUSES SKIN IRRITATION
- CAUSES EYE IRRITATION
- LONG-TERM EXPOSURE TO VAPOR HAS CAUSED CANCER IN LABORATORY ANIMALS
- KEEP OUT OF REACH OF CHILDREN
- TOXIC TO AQUATIC ORGANISMS

****

IMMEDIATE HEALTH EFFECTS
Eye: Contact with the eyes causes irritation. Symptoms may include pain, tearing, reddening, swelling and impaired vision.
Skin: Contact with the skin causes irritation. Skin contact may cause drying or defatting of the skin. Symptoms may include pain, itching, discoloration, swelling, and blistering. Contact with the skin is not expected to cause an allergic skin response. Not expected to be harmful to internal organs if absorbed through the skin.
Ingestion: Because of its low viscosity, this material can directly enter the lungs, if swallowed, or if subsequently vomited. Once in the lungs it is very difficult to remove and can cause severe injury or death.
Inhalation: The vapor or fumes from this material may cause respiratory irritation. Symptoms of respiratory irritation may include coughing and difficulty breathing. Breathing this material at concentrations above the recommended exposure limits may cause central nervous system effects. Central nervous system effects may include headache, dizziness, nausea, vomiting, weakness, loss of coordination, blurred vision, drowsiness, confusion, or disorientation. At extreme exposures, central nervous system effects may include respiratory depression, tremors or convulsions, loss of consciousness, coma or death.

DELAYED OR OTHER HEALTH EFFECTS:
Reproduction and Birth Defects: This material is not expected to cause birth defects or other harm to the developing fetus based on animal data.
Cancer: Prolonged or repeated exposure to this material may cause cancer. Gasoline has been classified as a Group 2B carcinogen (possibly carcinogenic to humans) by the International Agency for Research on Cancer (IARC).

Contains benzene, which has been classified as a carcinogen by the National Toxicology Program (NTP) and a Group 1 carcinogen (carcinogenic to humans) by the International Agency for Research on Cancer (IARC).
Contains ethylbenzene which has been classified as a Group 2B carcinogen (possibly carcinogenic to humans) by the International Agency for Research on Cancer (IARC).
Contains naphthalene, which has been classified as a Group 2B carcinogen (possibly carcinogenic to humans) by the International Agency for Research on Cancer (IARC).

Whole gasoline exhaust has been classified as a Group 2B carcinogen (possibly carcinogenic to humans) by the International Agency for Research on Cancer (IARC).

Risk depends on duration and level of exposure. See Section 11 for additional information.

SECTION 4 FIRST AID MEASURES

Eye: Flush eyes with water immediately while holding the eyelids open. Remove contact lenses, if worn, after initial flushing, and continue flushing for at least 15 minutes. Get medical attention if irritation persists.
Skin: Wash skin with water immediately and remove contaminated clothing and shoes. Get medical attention if any symptoms develop. To remove the material from skin, use soap and water. Discard contaminated clothing and shoes or thoroughly clean before reuse.
Ingestion: If swallowed, get immediate medical attention. Do not induce vomiting. Never give anything by mouth to an unconscious person.
Inhalation: Move the exposed person to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention if breathing difficulties continue.
Note to Physicians: Ingestion of this product or subsequent vomiting may result in aspiration of light hydrocarbon liquid, which may cause pneumonitis.

SECTION 5 FIRE FIGHTING MEASURES

See Section 7 for proper handling and storage.

FIRE CLASSIFICATION:
OSHA Classification (29 CFR 1910.1200): Flammable liquid.

NFPA RATINGS: Health: 1 Flammability: 3 Reactivity: 0

FLAMMABLE PROPERTIES:
Flashpoint: (Tagliabue Closed Cup) < -45 °C (< -49 °F)
Autoignition: > 280 °C (> 536 °F)
Flammability (Explosive) Limits (% by volume in air): Lower: 1.4 Upper: 7.6

EXTINGUISHING MEDIA: Dry Chemical, CO2, AFFF Foam or alcohol resistant foam if >15% volume polar solvents (oxygenates).

PROTECTION OF FIRE FIGHTERS:
Fire Fighting Instructions: Use water spray to cool fire-exposed containers and to protect personnel. For fires involving this material, do not enter any enclosed or confined fire space without proper protective equipment, including self-contained breathing apparatus.
Combustion Products: Highly dependent on combustion conditions. A complex mixture of airborne solids, liquids, and gases including carbon monoxide, carbon dioxide, and unidentified organic compounds will be evolved when this material undergoes combustion.

SECTION 6 ACCIDENTAL RELEASE MEASURES

Protective Measures: Eliminate all sources of ignition in the vicinity of the spill or released vapor. If this material is released into the work area, evacuate the area immediately. Monitor area with combustible gas indicator.
Spill Management: Stop the source of the release if you can do it without risk. Contain release to prevent further contamination of soil, surface water or groundwater. Clean up spill as soon as possible, observing precautions in Exposure Controls/Personal Protection. Use appropriate techniques such as applying non-combustible absorbent materials or pumping. All equipment used when handling the product must be grounded. A vapor suppressing foam may be used to reduce vapors. Use clean non-sparking tools to collect absorbed material. Where feasible and appropriate, remove contaminated soil. Place contaminated materials in disposable containers and dispose of in a manner consistent with applicable regulations.
Reporting: Report spills to local authorities and/or the U.S. Coast Guard's National Response Center at (800) 424-8802 as appropriate or required. This material is covered by EPA's Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) Petroleum Exclusion. Therefore, releases to the environment may not be reportable under CERCLA.

SECTION 7 HANDLING AND STORAGE

Precautionary Measures: READ AND OBSERVE ALL PRECAUTIONS ON PRODUCT LABEL. This product presents an extreme fire hazard. Liquid very quickly evaporates, even at low temperatures, and forms vapor (fumes) which can catch fire and burn with explosive violence. Invisible vapor spreads easily and can be set on fire by many sources such as pilot lights, welding equipment, and electrical motors and switches. Never siphon gasoline by mouth.
Use only as a motor fuel. Do not use for cleaning, pressure appliance fuel, or any other such use. Do not store in open or unlabeled containers. Do not get in eyes, on skin, or on clothing. Do not taste or swallow. Do not breathe vapor or fumes. Wash thoroughly after handling. Keep out of the reach of children.
Unusual Handling Hazards: WARNING! Do not use as portable heater or appliance fuel. Toxic fumes may accumulate and cause death.
General Handling Information: Avoid contaminating soil or releasing this material into sewage and drainage systems and bodies of water.
Static Hazard: Electrostatic charge may accumulate and create a hazardous condition when handling this material. To minimize this hazard, bonding and grounding may be necessary but may not, by themselves, be sufficient. Review all operations which have the potential of generating an accumulation of electrostatic charge and/or a flammable atmosphere (including tank and container filling, splash filling, tank cleaning, sampling, gauging, switch loading, filtering, mixing, agitation, and vacuum truck operations) and use appropriate mitigating procedures. For more information, refer to OSHA Standard 29 CFR 1910.106, 'Flammable and Combustible Liquids', National Fire Protection Association (NFPA 77, 'Recommended Practice on Static Electricity', and/or the American Petroleum Institute (API) Recommended Practice 2003, 'Protection Against Ignitions Arising Out of Static, Lightning, and Stray Currents'. Improper filling of portable gasoline containers creates danger of fire. Only dispense gasoline into approved and properly labeled gasoline containers. Always place portable containers on the ground. Be sure pump nozzle is in contact with the container while filling. Do not use a nozzle's lock-open device. Do not fill portable containers that are inside a vehicle or truck/trailer bed.

General Storage Information: DO NOT USE OR STORE near heat, sparks or open flames. USE AND STORE ONLY IN WELL VENTILATED AREA. Keep container closed when not in use.
Container Warnings: Container is not designed to contain pressure. Do not use pressure to empty container or it may rupture with explosive force. Empty containers retain product residue (solid, liquid, and/or vapor) and can be dangerous. Do not pressurize, cut, weld, braze, solder, drill, grind, or expose such containers to heat, flame, sparks, static electricity, or other sources of ignition. They may explode and cause injury or death. Empty containers should be completely drained, properly closed, and promptly returned to a drum reconditioner or disposed of properly.

SECTION 8 EXPOSURE CONTROLS/PERSONAL PROTECTION

GENERAL CONSIDERATIONS:
Consider the potential hazards of this material (see Section 3), applicable exposure limits, job activities, and other substances in the work place when designing engineering controls and selecting personal protective equipment. If engineering controls or work practices are not adequate to prevent exposure to harmful levels of this material, the personal protective equipment listed below is recommended. The user should read and understand all instructions and limitations supplied with the equipment since protection is usually provided for a limited time or under certain circumstances.

ENGINEERING CONTROLS:
Use process enclosures, local exhaust ventilation, or other engineering controls to control airborne levels below the recommended exposure limits.

PERSONAL PROTECTIVE EQUIPMENT
Eye/Face Protection: No special eye protection is normally required. Where splashing is possible, wear safety glasses with side shields as a good safety practice.
Skin Protection: No special protective clothing is normally required. Where splashing is possible, select protective clothing depending on operations conducted, physical requirements and other substances in the workplace. Suggested materials for protective gloves include: Chlorinated Polyethylene (or Chlorosulfonated Polyethylene), Nitrile Rubber, Polyurethane, Viton.
Respiratory Protection: Determine if airborne concentrations are below the recommended exposure limits. If not, wear an approved respirator that provides adequate protection from measured concentrations of this

material, such as: Air-Purifying Respirator for Organic Vapors.
When used as a fuel, this material can produce carbon monoxide in the exhaust. Determine if airborne concentrations are below the occupational exposure limit for carbon monoxide. If not, wear an approved positive-pressure air-supplying respirator.
Use a positive pressure air-supplying respirator in circumstances where air-purifying respirators may not provide adequate protection.

Occupational Exposure Limits:

Component	Limit	TWA	STEL	Ceiling	Notation
Benzene	ACGIH_TLV	.5 ppm	2.5 ppm		Skin A1
Benzene	OSHA_PEL	1 ppm	5 ppm		
Benzene	OSHA_Z2	10 ppm		25 ppm	
Ethanol	ACGIH_TLV	1000 ppm			A4
Ethanol	OSHA_PEL	1000 ppm			
Ethyl benzene	ACGIH_TLV	100 ppm	125 ppm		A3
Ethyl benzene	OSHA_PEL	100 ppm	125 ppm		
Ethyl tert-butyl ether (ETBE)	ACGIH_TLV	5 ppm			
Gasoline	ACGIH_TLV	300 ppm	500 ppm		A3
Gasoline	OSHA_PEL	300 ppm	500 ppm		
Methyl tert-butyl ether (MTBE)	ACGIH_TLV	50 ppm			A3
Naphthalene	ACGIH_TLV	10 ppm	15 ppm		Skin A4
Naphthalene	OSHA_PEL	10 ppm	15 ppm		
Tertiary amyl methyl ether (TAME)	CHEVRON		50 ppm		

Refer to the OSHA Benzene Standard (29 CFR 1910.1028) and Table Z-2 for detailed training, exposure monitoring, respiratory protection and medical surveillance requirements before using this product.

SECTION 9 PHYSICAL AND CHEMICAL PROPERTIES

Attention: the data below are typical values and do not constitute a specification.

Color: Colorless to yellow
Physical State: Liquid
Odor: Petroleum odor
pH: NA
Vapor Pressure: 5 psi - 15 psi (Typical) @ 37.8°C (100°F)
Vapor Density (Air = 1): 3 - 4 (Typical)
Boiling Point: 37.8°C (100°F) - 204.4°C (400°F) (Typical)
Solubility: Insoluble in water; miscible with most organic solvents.
Freezing Point: NA
Melting Point: NA
Specific Gravity: 0.7 g/ml - 0.8 g/ml @ 15.6°C (60.1°F)
Viscosity: <1 SUS @ 37.8°C (100°F)

SECTION 10 STABILITY AND REACTIVITY

Chemical Stability: This material is considered stable under normal ambient and anticipated storage and handling conditions of temperature and pressure.
Incompatibility With Other Materials: May react with strong oxidizing agents, such as chlorates, nitrates, peroxides, etc.
Hazardous Decomposition Products: None known (None expected)
Hazardous Polymerization: Hazardous polymerization will not occur.

SECTION 11 TOXICOLOGICAL INFORMATION

IMMEDIATE HEALTH EFFECTS
Eye Irritation: The Draize eye irritation mean score in rabbits for a 24-hour exposure was: 0/110.
Skin Irritation: For a 4-hour exposure, the Primary Irritation Index (PII) in rabbits is: 4.8/8.0.
Skin Sensitization: This material did not cause sensitization reactions in a Modified Buehler guinea pig test.
Acute Dermal Toxicity: 24 hour(s) LD50: >3.75g/kg (rabbit).
Acute Oral Toxicity: LD50: >5 ml/kg (rat)
Acute Inhalation Toxicity: 4 hour(s) LD50: >2000ppm (rat).

ADDITIONAL TOXICOLOGY INFORMATION:
Gasolines are highly volatile and can produce significant concentrations of vapor at ambient temperatures. Gasoline vapor is heavier than air and at high concentrations may accumulate in confined spaces to present both safety and heath hazards. When vapor exposures are low, or short duration and infrequent, such as during refuelling and tanker loading/unloading, neither total hydrocarbon nor components such as benzene are likely to result in any adverse health effects. In situations such as accidents or spills where exposure to gasoline vapor is potentially high, attention should be paid to potential toxic effects of specific components. Information about specific components in gasoline can be found in Sections 2, 8 and 15 of this MSDS. More detailed information on the health hazard of specific gasoline components can be obtained calling the Chevron Emergency Information Center (see Section 1 for phone numbers).

NEUROTOXICITY: Pathological misuse of solvents and gasoline, involving repeated and prolonged exposure to high concentrations of vapor is a significant exposure on which there are many reports in the medical literature. As with other solvents, persistent abuse involving repeated and prolonged exposures to high concentrations of vapor has been reported to result in central nervous system damage and eventually, death. In a study in which ten human volunteers were exposed for 30 minutes to approximately 200, 500 or 1000 ppm concentrations of gasoline vapor, irritation of the eyes was the only significant effect observed, based on both subjective and objective assessments. In an inhalation study, groups of 6 Fischer rats (3 male. 3 female) were exposed to 2056 ppm of wholy vaporized unleaded gasoline for 6 hours perday, 5 day per week for up to 18 months. Histopathology of the peripheral nervous system and spinal cord revealed no distal axonal neuropthy of the type associated with exposure to n-hexane even though gasoline contained 1.9% n-hexane. The authors concluded that gasoline treatment may have amplified the incidence and prominence of some naturally occurring age-related (subclinical) in the nervous system. BIRTH DEFECTS AND REPRODUCTIVE TOXICITY: An inhalation study with rats exposed to 0, 400 and 1600 ppm of wholly vaporized unleaded gasoline, 6 hours per day on day 6 through 16 of gestation, showed no teratogenic effects nor indication of toxicity to either the mother

or the fetus. Another inhalation study in rats exposed to 3000, 6000, or 9000 ppm of gasoline vapor, 6 hours per day on day 6 through 20 of gestation, also showed no teratogenic effects nor indications of toxicity to either the mother or the fetus.

CHRONIC TOXICITY/CANCER: Wholly vaporized unleaded gasoline was used in a 3 month inhalation study. Groups of 40 rats (20 males, 20 female) and 8 squirrel monkeys (4 male, 4 female) were exposed 6 hours per day and 5 days per week for 13 weeks to 384 or 1552 ppm gasoline. One group of each species served as unexposed controls. The initial conclusion of this study was that inhalation of gasoline at airborne concentrations of up to 1522 ppm caused no toxicity in rats or monkeys. However, further histopathological examination of male rat kidneys on the highest dose group revealed an increased incidence and severity of regenerative epithelium and dilated tubules containing proteinaceous deposits. Lifetime inhalation of wholly vaporized unleaded gasoline at 2056 ppm has caused increased liver tumors in female mice. The mechanism of this response is still being investigated but it is thought to be an epigenetic process unique to the female mouse.

This exposure also caused kidney damage and eventually kidney cancer in male rats. No other animal model studied has shown these adverse kidney effects and there is no physiological reason to believe that they would occur in man. EPA has concluded that mechanism by which wholly vaporzied unleaded gasoline causes kidney damage is unque to the male rat. The effects in that species (kidney damage and cancer) should not be used in human risk assesment. In their 1988 review of carcinogenic risk from gasoline, The International Agency for Research on Cancer (IARC) noted that, because published epidemiology studies did not include any exposure data, only occupations where gasoline exposure may have ocurred were reviewed. These included gasoline service station attendants and automobile mechanics. IARC also noted that there was no opportunity to separate effects of combustion products from those of gasoline itself. Although IARC allocated gasoline a final overall classification of Group 2B, i.e. possibly carcinogenic to humans, this was based on limited evidence in experimental animals plus supporting evidence including the presence in gasoline of benzene and 1, 3-butadiene. The actual evidence for carcinogenicity in humans was considered inadequate.

MUTAGENICITY: Gasoline was not mutagenic, with or without activation, in the Ames assay (Salmonella typhimurium), Saccharamyces cerevisesae, or mouse lymphoma assays. In addition, point mutations were not induced in human lymphocytes. Gasoline was not mutagenic when tested in the mouse dominant lethal assay. Administration of gasoline to rats did not cause chomosomal aberrations in their bone marrow cells. EPIDEMIOLOGY: To explore the health effects of workers potentially exposed to gasoline vapors in the marketing and distribution sectors of the petroleum industry, the American Petroleum Institute sponsored a cohort mortality study (Publication 4555), a nested case-control study (Publication 4551), and an exposure assessment study (Publication 4552). Histories of exposure to gasoline were reconstructed for cohort of more than 18,000 employees from four companies for the time period between 1946 and 1985. The results of the cohort mortality study indicated that there was no increased mortality from either kidney cancer or leukemia among marketing and marine distribution employees who were exposed to gasoline in the petroleum industry, when compared to the general population. More importantly, based on internal comparisons, there was no association between mortality from kidney cancer or leukemia and various indices of gasoline exposure. In particular, neither duration of employment, duration of exposure, age at first exposure, year of first exposure, job category, cumulative exposure, frequency of peak exposure, nor average intensity of exposure had any effect on kidney cancer or leukemia mortality. The results of the nested case-control study confirmed the findings of the original cohort study. That is, exposure to gasoline at the levels experienced by this cohort of distribution workers is not a significant risk factor for leukemia (all cell types), acute myeloid leukemia, kidney cancer or multiple myeloma.

SECTION 12 ECOLOGICAL INFORMATION

ECOTOXICITY

The 96 hour(s) LC50 for rainbow trout (Oncorhynchus mykiss) is 2.7 mg/l.
The 48 hour(s) LC50 for water flea (Daphnia magna) is 3.0 mg/l.
The 96 hour(s) LC50 for sheepshead minnow (Cyprinodon variegatus) is 8.3 mg/l.
The 96 hour(s) LC50 for mysid shrimp (Mysidopsis bahia) is 1.8 mg/l.
This material is expected to be toxic to aquatic organisms. Gasoline studies have been conducted in the laboratory under a variety of test conditions with a range of fish and invertebrate species. An even more extensive database is available on the aquatic toxicity of individual aromatic constituents. The majority of published studies do not identify the type of gasoline evaluated, or even provide distinguishing characteristics such as aromatic content or presence of lead alkyls. As a result, comparison of results among studies using open

and closed vessels, different ages and species of test animals and different gasoline types, is difficult.

The bulk of the available literature on gasoline relates to the environmental impact of monoaromatic (BTEX) and diaromatic (naphthalene, methylnaphthalenes) constituents. In general, non-oxygenated gasoline exhibits some short-term toxicity to freshwater and marine organisms, especially under closed vessel or flow-through exposure conditions in the laboratory. The components which are the most prominent in the water soluble fraction and cause aquatic toxicity, are also highly volatile and can be readily biodegraded by microorganisms.

ENVIRONMENTAL FATE
This material is expected to be readily biodegradable. Following spillage, the more volatile components of gasoline will be rapidly lost, with concurrent dissolution of these and other constituents into the water. Factors such as local environmental conditions (temperature, wind, mixing or wave action, soil type, etc), photo-oxidation, biodegradation and adsorption onto suspended sediments, can contribute to the weathering of spilled gasoline.

The aqueous solubility of non-oxygenated unleaded gasoline, based on analysis of benzene, toluene, ethylbenzene+xylenes and naphthalene, is reported to be 112 mg/l. Solubility data on individual gasoline constituents also available.

SECTION 13 DISPOSAL CONSIDERATIONS

Use material for its intended purpose or recycle if possible. This material, if it must be discarded, may meet the criteria of a hazardous waste as defined by US EPA under RCRA (40 CFR 261) or other State and local regulations. Measurement of certain physical properties and analysis for regulated components may be necessary to make a correct determination. If this material is classified as a hazardous waste, federal law requires disposal at a licensed hazardous waste disposal facility.

SECTION 14 TRANSPORT INFORMATION

The description shown may not apply to all shipping situations. Consult 49CFR, or appropriate Dangerous Goods Regulations, for additional description requirements (e.g., technical name) and mode-specific or quantity-specific shipping requirements.

DOT Shipping Name: GASOLINE
DOT Hazard Class: 3 (Flammable Liquid)
DOT Identification Number: UN1203
DOT Packing Group: II

SECTION 15 REGULATORY INFORMATION

SARA 311/312 CATEGORIES:

1. Immediate (Acute) Health Effects: YES
2. Delayed (Chronic) Health Effects: YES
3. Fire Hazard: YES
4. Sudden Release of Pressure Hazard: NO
5. Reactivity Hazard: NO

REGULATORY LISTS SEARCHED:

4_I1=IARC Group 1 15=SARA Section 313

4_I2A=IARC Group 2A	16=CA Proposition 65
4_I2B=IARC Group 2B	17=MA RTK
05=NTP Carcinogen	18=NJ RTK
06=OSHA Carcinogen	19=DOT Marine Pollutant
09=TSCA 12(b)	20=PA RTK

The following components of this material are found on the regulatory lists indicated.

Benzene	15, 16, 17, 18, 20, 4_I1, 5, 6
Ethanol	17, 18, 20
Ethyl benzene	15, 17, 18, 20, 4_I2B
Gasoline	17, 18, 20
Methyl tert-butyl ether (MTBE)	15, 17, 18, 20, 9
Naphthalene	15, 16, 17, 18, 20, 4_I2B
Tertiary amyl methyl ether (TAME)	9

CERCLA REPORTABLE QUANTITIES(RQ)/SARA 302 THRESHOLD PLANNING QUANTITIES(TPQ):

Component	Component RQ	Component TPQ	Product RQ
Benzene	10 lbs	None	186 lbs
Ethanol	100 lbs	None	1961 lbs
Ethyl benzene	1000 lbs	None	34964 lbs
Methyl tert-butyl ether (MTBE)	1000 lbs	None	7513 lbs
Naphthalene	100 lbs	None	4000 lbs

CHEMICAL INVENTORIES:
CANADA: All the components of this material are on the Canadian DSL or have been notified under the New Substance Notification Regulations, but have not yet been published in the Canada Gazette.
UNITED STATES: All of the components of this material are on the Toxic Substances Control Act (TSCA) Chemical Inventory.

WHMIS CLASSIFICATION:
Class B, Division 2: Flammable Liquids
Class D, Division 2, Subdivision A: Very Toxic Material - Carcinogenicity
Class D, Division 2, Subdivision B: Toxic Material - Skin or Eye Irritation

SECTION 16 OTHER INFORMATION

NFPA RATINGS: Health: 1 Flammability: 3 Reactivity: 0

(0-Least, 1-Slight, 2-Moderate, 3-High, 4-Extreme, PPE:- Personal Protection Equipment Index recommendation, *- Chronic Effect Indicator). These values are obtained using the guidelines or published evaluations prepared by the National Fire Protection Association (NFPA) or the National Paint and Coating Association (for HMIS ratings).

Additional Product Number(s): CPS201023, CPS201054, CPS201055, CPS201075, CPS201090, CPS201105, CPS201106, CPS201120, CPS201121, CPS201122, CPS201126, CPS201128, CPS201131, CPS201136, CPS201141, CPS201142, CPS201148, CPS201153, CPS201158, CPS201161, CPS201162, CPS201168, CPS201181, CPS201185, CPS201186, CPS201188, CPS201216, CPS201217, CPS201218, CPS201236, CPS201237, CPS201238, CPS201266, CPS201267, CPS201268, CPS201277, CPS201278, CPS201279, CPS201286, CPS201287, CPS201289, CPS201296, CPS201297, CPS201298, CPS201849, CPS201850, CPS201855, CPS201856, CPS201857, CPS204000, CPS204001, CPS204002, CPS204003, CPS204010, CPS204011, CPS204022, CPS204023, CPS204046, CPS204047, CPS204070, CPS204071, CPS204088, CPS204089, CPS204104, CPS204105, CPS204116, CPS204117, CPS204140, CPS204141, CPS204164, CPS204165, CPS204188, CPS204189, CPS204200, CPS204201, CPS204212, CPS204213, CPS204224, CPS204225, CPS204248, CPS204249, CPS204272, CPS204273, CPS204290, CPS204291, CPS204322, CPS204323, CPS204324, CPS204350, CPS204352, CPS204354, CPS204356, CPS204358, CPS204359, CPS204364, CPS204365, CPS204370, CPS204371, CPS204376, CPS204377, CPS204382, CPS204383, CPS204388, CPS204389, CPS204394, CPS204395, CPS204400, CPS204401, CPS204406, CPS204407, CPS204412, CPS204413, CPS204418, CPS204419, CPS204424, CPS204425, CPS204430, CPS204431, CPS204436, CPS204437, CPS204442, CPS204446, CPS204450, CPS204454, CPS204458, CPS204462, CPS204466, CPS204467, CPS204484, CPS204485, CPS204502, CPS204503, CPS204520, CPS204521, CPS204538, CPS204539, CPS204556, CPS204557, CPS204574, CPS204575, CPS204592, CPS204593, CPS204610, CPS204611, CPS204628, CPS204629, CPS204646, CPS204647, CPS204664, CPS204665, CPS204682, CPS204690, CPS204691, CPS204696, CPS204697, CPS204702, CPS204703, CPS204708, CPS204709, CPS204721, CPS204722, CPS204727, CPS204728, CPS241765

REVISION STATEMENT: This revision updates the following sections of this Material Safety Data Sheet: Section 1 (Product Codes). This Material Safety Data Sheet has been prepared using the ProSteward MSDS system.

ABBREVIATIONS THAT MAY HAVE BEEN USED IN THIS DOCUMENT:

TLV	-	Threshold Limit Value	TWA	-	Time Weighted Average
STEL	-	Short-term Exposure Limit	PEL	-	Permissible Exposure Limit
			CAS	-	Chemical Abstract Service Number
NDA	-	No Data Available	NA	-	Not Applicable
<=	-	Less Than or Equal To	>=	-	Greater Than or Equal To

Prepared according to the OSHA Hazard Communication Standard (29 CFR 1910.1200) and the ANSI MSDS Standard (Z400.1) by the ChevronTexaco Energy Research & Technology Company, 100 Chevron Way, Richmond, California 94802.

The above information is based on the data of which we are aware and is believed to be correct as of the date hereof. Since this information may be applied under conditions beyond our control and with which we may be unfamiliar and since data made available subsequent to the date hereof may suggest modifications of the information, we do not assume any responsibility for the results of its use. This information is furnished upon condition that the person receiving it shall make his own determination of the suitability of the material for his particular purpose.

MSDS for CHEVRON DIESEL FUEL NO. 2

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1 PRODUCT IDENTIFICATION

SUPPLIER: WARNER PETROLEUM INC.
PO BOX 6759
CHICO, CA 95927
800-457-2022

PRODUCT NAME: CHEVRON DIESEL FUEL NO. W
COMMON SYNONYMS: N/A
PRODUCT CODES: CPS272102
EFFECTIVE: 3/17/90
REVISION:

PRECAUTIONARY LABELING

HEALTH - 2
FLAMMABILITY - 4
REACTIVITY - 0
CONTACT - 0
HAZARD RATINGS ARE 0 TO 4 (0 = NO HAZARD; 4 = EXTREME HAZARD).

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2 HAZARDOUS COMPONENTS

COMPONENT % CAS NO.
FUELS, DIESEL NO. W 68476346
HYDRODESULFURIZED MIDDLE DISTILLATE 64742809
STRAIGHT RUN MIDDLE DISTILLATES 64741442
KEROSENE 8008206
HYDRODESULFURIZED KEROSENE 64742810
DISTILATES, LIGHT CATALYTIC CRACKED 64741599
NAPHTHALENE 91203
N/A = NOT APPLICABLE; N/D = NOT DETERMINED

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3 PHYSICAL DATA

BOILING POINT: 176 VAPOR PRESSURE (MM HG): .04
PH RANGE: N/A VAPOR DENSITY (AIR=1): N/A
SPECIFIC GRAVITY: .84 EVAPORATION RATE: N/A
SOLUBILITY (H20): INSOLUBLE % VOLATILES BY VOLUME: N/A

APPEARANCE & ODOR: PALE YELLOW LIQUID

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4 FIRE AND EXPLOSION HAZARD DATE

FLASH POINT (CLOSED CUP): 125F
FLAMMABLE LIMITS: UPPER N/A% LOWER N/A%
FIRE EXTINGUISHING MEDIA

CO2, DRY CHEMICAL, FOAM, WATER FOG

SPECIAL FIRE-FIGHTING PROCEDURES

NIOSH APPROVED SELF CONTAINED BREATHING APPARTUS

TOXIC GASES PRODUCED

N/A

UNUSUAL FIRE AND EXPLOSION HAZARDS:

CONTAINERS MAY BURST IN HEAT

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5 HEALTH HAZARD DATA

TOXICITY: LD50 (ORAL-RAT) (MG/KG) - N/A
LD50 (IV-MOUSE) (MG/KG) - N/A
CARCIDOGENICITY: NTP: NO IARC: NO Z LIST: NO OSHA REG: NO
TARGET ORGANS: NONE IDENTIFIED
MEDICAL CONDITIONS GENERALLY AGGRAVATE BY EXPOSURE: NONE IDENTIFIED
ROUTES OF ENTRY: INHALATION, INGESTION, SKIN CONTACT, EYE CONTACT
SYMPTOMS OF OVEREXPOSURE:

EYE CONTACT: EYE IRRITANT. SKIN CONTACT: CAUSES IRRITATION INHALATION: IRRITANT. INGESTION: NOT EXPECTED TO BE HARMFUL

EMERGENCY AND FIRST AID PROCEDURES:

SKIN: FLUSH CONTAMINATED SKIN WITH PLENTY OF WATER. CONSULT A

PHYSICIAN IF IRRITATION DEVELOPS.

EYES: IMMEDIATELY FLUSH EYES WITH PLENTY OF WATER FOR AT LEAST 15

MINUTES, OCCASIONALLY LIFTING UPPER AND LOWER LIDS. GET

MEDICAL ATTENTION AT ONCE.

INHALE: MOVE EXPOSED PERSON TO FRESH AIR IF IRRITATION PERSISTS, GET

MEDICAL ATTENTION PROMPTLY.

INGEST: IF THIS PRODUCT IS SWALLOWED, DO NOT INDUCE VOMITING. IF VICTIM IS CONSCIOUS GIVE PLENTY OF WATER TO DRINK. GET MEDICAL ATTENTION AT ONCE.

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6 REACTIVITY DATA

STABILITY: STABLE HAZARDOUS POLYMERIZATION: WILL NOT OCCUR
CONDITIONS TO AVOID: NONE DOCUMENTED
INCOMPATIBLES: OXIDIZING AGENTS
DECOMPOSITION PRODUCT: WHEN EXPOSED TO FIRE, PRODUCES NORMAL PRODUCTS OF COMBUSTION.

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7 SPILL AND DISPOSAL PROCEDURES

STEPS TO BE TAKEN IN THE EVENT OF A SPILL OR DISCHARGE:

PLACE ALL CONTAMINATED MATERIAL IN A CLOSED CONTAINER FOR DISPOSAL.

DISPOSAL PROCEDURE:

DISCARD IN REGULAR TRASH COLLECTION IF ALLOWED BY LOCAL, STATE AND FEDERAL REGULATIONS.

CONTAINER DISPOSAL:

DISCARD IN REGULAR TRASH COLLECTION IF ALLOWED BY LOCAL, STATE AND FEDERAL REGULATIONS.

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8 PROTECTIVE EQUIPMENT

VENTILATION:

NORMAL

RESPIRATORY PROTECTION:

KEEP FACE AWAY FROM SPRAY MIST AND DO NOT BREATH VAPORS.

EYE PROTECTION:

SAFETY GOGGLES

SKIN PROTECTION:

WEARING NEOPRENE GLOVES IS RECOMMENDED WHEN PROLONGED EXCESSIVE CONTACT OCCURS.

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9 STORAGE AND HANDLING PRECAUTIONS

SPECIAL PRECAUTIONS:

STORE IN A COOL DRY PLACE.

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10 TRANSPORTATION DATA AND ADDITIONAL INFORMATION

PROPER SHIPPING NAME

NON REGULATED

AIR LIQUIDE AMERICA CORP-FMLY BIG THREE INDUS -- ISOBUTYLENE - CALIBRATION GAS CYLI
MATERIAL SAFETY DATA SHEET
NSN: 6665012148247
Manufacturer's CAGE: 17688
Part No. Indicator: A
Part Number/Trade Name: ISOBUTYLENE

General Information

Item Name: CALIBRATION GAS CYLINDER
Company's Name: AIR LIQUIDE AMERICA CORP-FMLY BIG THREE INDUSTRIES
Company's Street: 3535 W 12TH ST
Company's P. O. Box: 3047
Company's City: HOUSTON
Company's State: TX
Company's Country: US
Company's Zip Code: 77253
Company's Emerg Ph #: 800-424-9300 CHEMTREC
Company's Info Ph #: 713-868-0440 FAX: 800-231-1366
Distributor/Vendor # 1: HNU SYSTEMS INC
Distributor/Vendor # 1 Cage: 57631
Record No. For Safety Entry: 001
Tot Safety Entries This Stk#: 005
Status: SE
Date MSDS Prepared: 20FEB97
Safety Data Review Date: 19AUG97
Supply Item Manager: CX
MSDS Preparer's Name: UNKNOWN
Preparer's Company: CHEMICAL SAFETY ASSOCIATES, INC.
Preparer's St Or P. O. Box: 9163 CHESAPEAKE DR
Preparer's City: SAN DIEGO
Preparer's State: CA
Preparer's Zip Code: 92123-1002
MSDS Serial Number: CFCVY
Specification Number: NONE
Spec Type, Grade, Class: NONE
Hazard Characteristic Code: G3
Unit Of Issue: EA
Unit Of Issue Container Qty: 0.6 LB
Type Of Container: CYLINDER
Net Unit Weight: 0.6

Ingredients/Identity Information

Proprietary: NO
Ingredient: ISOBUTYLENE (CYLINDER CONTAINS 75 PPM IN AIR).
Ingredient Sequence Number: 01
Percent: <1
NIOSH (RTECS) Number: UD0890000
CAS Number: 115-11-7
OSHA PEL: NOT ESTABLISHED
ACGIH TLV: NOT ESTABLISHED
Other Recommended Limit: NONE RECOMMENDED

Proprietary: NO
Ingredient: AIR
Ingredient Sequence Number: 02
Percent: 99
NIOSH (RTECS) Number: 1005486AI
OSHA PEL: NOT ESTABLISHED
ACGIH TLV: NOT ESTABLISHED
Other Recommended Limit: NONE RECOMMENDED

Physical/Chemical Characteristics

Appearance And Odor: COLORLESS GAS: ODOR SIMILAR TO BURNING COAL.
Boiling Point: 19.6F,-6.9C
Melting Point: -220F,-140C
Vapor Pressure (MM Hg/70 F): 1233
Vapor Density (Air=1): 0.15LB/FT3
Specific Gravity: 1.997
Evaporation Rate And Ref: NOT APPLICABLE
Solubility In Water: INSOLUBLE
Autoignition Temperature: 869F

Fire and Explosion Hazard Data

Flash Point: 14F,-10C
Lower Explosive Limit: 1.8
Upper Explosive Limit: 9.6
Extinguishing Media: SHUT OFF SOURCE OF GAS. USE WATER SPRAY TO COOL FIRE EXPOSED CYLINDERS, STRUCTURES AND EQUIPMENT.
Special Fire Fighting Proc: STRUCTURAL FIREFIGHTERS MUST WEAR SELF-CONTAINED BREATHING APPARATUS. BECAUSE OF DANGER OF BLEVE, EVACUATION OF NON-EMERGENCY PERSONNEL IS ESSENTIAL.
Unusual Fire And Expl Hazrds: DANGER! FIRES IMPINGING ON OUTSIDE SURFACE OF UNPROTECTED CYLINDERS CAN BE VERY DANGEROUS. EXPOSURE TO FIRE CAN CAUSE CATASTROPHIC FAILURE OF THE CYLINDER.

Reactivity Data

Stability: YES
Cond To Avoid (Stability): CONTACT WITH INCOMPATIBLE MATERIALS AND EXPOSURE TO HEAT, SPARKS, OTHER SOURCES OF IGNITION.
Materials To Avoid: STRONG OXIDIZING AGENTS (EG. CHLORINE, BROMINE PENTAFLUORIDE, OXYGEN, OXYGEN DIFLUORIDE, NITROGEN TRIFLUORIDE).
Hazardous Decomp Products: WHEN IGNITED IN PRESENCE OF OXYGEN-CARBON MONOXIDE AND CARBON DIOXIDE.
Hazardous Poly Occur: NO
Conditions To Avoid (Poly): WILL NOT OCCUR.

Health Hazard Data

LD50-LC50 Mixture: LC50 (INHALATION, RAT)-620,000 MG/KG/4HR
Route Of Entry - Inhalation: YES
Route Of Entry - Skin: NO
Route Of Entry - Ingestion: NO
Health Haz Acute And Chronic: ISOBUTYLENE MAY CAUSE SOME IRRITATION OF MUCOUS MEMBRANES. IN ADDITION, CONTACT WITH RAPIDLY EXPANDING GASES CAN CAUSE FROSTBITE TO EXPOSED TISSUE. ISOBUTYLENE IS NOT KNOWN TO CAUSE SENSITIZATION IN HUMANS. CURRENTLY, BIOLOGICAL EXPOSURE INDICES (BEI'S) ARE NOT APPLICABLE FOR ISOBUTYLENE.
Carcinogenicity - NTP: NO
Carcinogenicity - IARC: NO
Carcinogenicity - OSHA: NO
Explanation Carcinogenicity: ISOBUYLENE IS NOT FOUND ON THE FOLLOWING LISTS: FEDERAL OSHA Z LIST, NTP, IARC, CAL/OSHA.
Signs/Symptoms Of Overexp: IRRITATION OF MUCOUS MEMBRANES; FROSTBITE TO EXPOSED TO TISSUE.
Med Cond Aggravated By Exp: ACUTE OR CHRONIC RESPIRATORY CONDITIONS MAY BE AGGRAVATED BY OVEREXPOSURE TO THE COMPONENTS OF THIS PRODUCT.
Emergency/First Aid Proc: ADMINISTER OXYGEN, IF NECESSARY; TREAT SYMPTOMS; REDUCE OR ELIMINATE EXPOSURE.

Precautions for Safe Handling and Use

Steps If Matl Released/Spill: EVACUATE IMMEDIATE AREA. UNCONTROLLED

RELEASES SHOULD BE RESPONDED TO BY TRAINED PERSONNEL USING PRE-PLANNED PROCEDURES. PROPER PROTECTIVE EQUIPMENT SHOULD BE USED. IN CASE OF GAS RELEASE, CLEAR THE AFFECTED AREA, PROTECT PEOPLE AND RESPOND.
Neutralizing Agent: NONE SPECIFIED BY MANUFACTURER.
Waste Disposal Method: WASTE DISPOSAL MUST BE IN ACCORDANCE WITH APPROPRIATE LOCAL, STATE AND FEDERAL REGULATIONS. RETURN CYLINDERS WITH ANY RESIDUAL PRODUCT TO AIR LIQUIDE. DO NOT DISPOSE OF LOCALLY.
Precautions-Handling/Storing: STORE UPRIGHT & FIRMLY SECURED TO PREVENT FALLING OR BEING KNOCKED OVER. STORE IN A COOL, DRY, WELL-VENTILATED PLACE AWAY FROM SOURCES OF HEAT.
Other Precautions: KEEP STORAGE AREA CLEAR OF MATERIALS WHICH MAY BURN. DO NOT ALLOW AREA WHERE CYLINDERS ARE STORED TO EXCEED 125F (52C). STORE CYLINDERS AWAY FROM HEAVILY TRAFFICKED AREAS AND EMERGENCY EXITS. PROTECT AGAINST PHYSICAL DAMAGE.

Control Measures

Respiratory Protection: MAINTAIN OXYGEN LEVELS ABOVE 19.5% IN THE WORKPLACE. USE SUPPLIED AIR RESPIRATORY PROTECTION IF OXYGEN LEVELS ARE BELOW 19.5% OR DURING EMERGENCY RESPONSE TO A RELEASE OF THIS PRODUCT. FOLLOW 29 CFR 1910.134 OR EQUIVALENT STATE STANDARDS.
Ventilation: USE EXPLOSION-PROOF LOCAL EXHAUST VENTILATION TO PREVENT ISOBUTYLENE CONCENTRATION FROM EXCEEDING LEL OF 1.8%.
Protective Gloves: LEATHER GLOVES WHEN HANDLING CYLINDERS.
Eye Protection: SAFETY GLASSES.
Other Protective Equipment: USE BODY PROTECTION APPROPRIATE FOR TASK. COTTON CLOTHING RECOMMENDED TO PREVENT STATIC BUILD-UP.
Work Hygienic Practices: WASH HANDS AFTER HANDLING AND BEFORE EATING, DRINKING, OR SMOKING. LAUNDER CONTAMINATED CLOTHES BEFORE REUSE.
Suppl. Safety & Health Data: HNU P/N IS: 101-350-N. MSDS BY MFR WRITTEN FOR "PURE" ISOBUTYLENE; PHYSICAL & FIRE DATA AREAS ARE FOR PURE IOSBUTYLENE. THIS NSN IS FOR A CYLINDER CONTAINING 75-150 PPM (<1%) OF ISOBUTYLENE.

Transportation Data

Trans Data Review Date: 97231
DOT PSN Code: DQQ
DOT Proper Shipping Name: COMPRESSED GASES, N.O.S.
DOT Class: 2.2
DOT ID Number: UN1956
DOT Label: NONFLAMMABLE GAS
IMO PSN Code: EQH
IMO Proper Shipping Name: COMPRESSED GAS, N.O.S. o
IMO Regulations Page Number: 2124
IMO UN Number: 1956
IMO UN Class: 2(2.2)
IMO Subsidiary Risk Label: -
IATA PSN Code: HDO
IATA UN ID Number: 1956
IATA Proper Shipping Name: COMPRESSED GAS, N.O.S. *
IATA UN Class: 2.2
IATA Label: NON-FLAMMABLE GAS
AFI PSN Code: HDO
AFI Prop. Shipping Name: COMPRESSED GAS, N.O.S.
AFI Class: 2.2
AFI ID Number: UN1956
AFI Basic Pac Ref: A6.3,A6.5,A6.7
N.O.S. Shipping Name: CONTAINS ISOBUTYLENE AND AIR
`ditional Trans Data: CYLINDER CONTAINS 75-150 PPM ISOBUTYLENE IN AIR. .GHT OF GAS MIXTURE IN EACH CYLINDER IS 0.6 LBS. WT OF EMPTY CYLINDER IS 2.4 LBS.

Disposal Data

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Label Data

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Label Required: YES
Technical Review Date: 19AUG97
Label Status: F
Common Name: ISOBUTYLENE
Chronic Hazard: NO
Signal Word: WARNING!
Acute Health Hazard-Slight: X
Contact Hazard-Slight: X
Fire Hazard-None: X
Reactivity Hazard-None: X
Special Hazard Precautions: CONTENTS UNDER PRESSURE! ISOBUTYLENE MAY CAUSE SOME IRRITATION OF MUCOUS MEMBRANES. IN ADDITION, CONTACT WITH RAPIDLY EXPANDING GASES CAN CAUSE FROSTBITE TO EXPOSED TISSUE. ISOBUTYLENE IS NOT KNOWN TO CAUSE SENSITIZATION IN HUMANS. CURRENTLY, BIOLOGICAL EXPOSURE RESPIRATORY SYSTEM. FIRST AID: ADMINISTER OXYGEN, IF NECESSARY; TREAT SYMPTOMS; REDUCE OR ELIMINATE EXPOSURE.
Protect Eye: Y
Protect Skin: Y
Protect Respiratory: Y
Label Name: AIR LIQUIDE AMERICA CORP-FMLY BIG THREE INDUSTRIES
Label Street: 3535 W 12TH ST
Label P.O. Box: 3047
Label City: HOUSTON
Label State: TX
Label Zip Code: 77253
Label Country: US
Label Emergency Number: 800-424-9300 CHEMTREC
Year Procured: 1995

KERR-MCGEE CORPORATION

Chemical MSDS - KM Hydrochloric acid

For more detailed information on the hazards of this product, contact Safety, Health and Environmental Department or Medical Services Department at the address below. Technical Information Bulletin is also available.

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT IDENTIFICATION			
Brand Name	KM hydrochloric acid	NFPA Rating	
Chemical Name	Hydrochloric acid	Health	3
Common Name	Muriatic acid	Fire	0
Formula	HCl	Reactivity	0
Molecular Weight	36.46 (hydrogen chloride)		

MANUFACTURER

Kerr-McGee Chemical LLC
Kerr-McGee Center
Oklahoma City, OK 73125

EMERGENCY TELEPHONE NUMBER

(405) 270-1313 (24 hours)

Return to the Hydrochloric acid MSDS table

2. COMPOSITION/INFORMATION ON INGREDIENTS

CHEMICAL NAME	CAS NUMBER	WEIGHT %
Hydrochloric Acid	7647-01-0	25 - 28.5
Water	7732-18-5	Balance

(Note: See Section 8 of this MSDS for Exposure Guidelines)

Return to the Hydrochloric acid MSDS table

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW

.orless or yellow liquid with a sharp, pungent odor; fumes in air. Causes severe burns to eyes and skin. Inhaling this material will cause coughing and choking, and may result in lung damage. Swallowing hydrochloric acid will cause inflammation and possibly burns of mucous membranes, esophagus, and stomach.

In case of a spill, wear full protective equipment (see Section 8).

Reacts with most metals to produce highly flammable hydrogen gas which may form an explosive mixture with air.

Will not burn in a fire, but may generate toxic chlorine fumes.

POTENTIAL HEALTH EFFECTS

PRIMARY ROUTE(S) OF ENTRY

Inhalation (breathing); eye and skin contact; ingestion (swallowing).

DANGER! Causes severe burns. This product is corrosive to eyes, skin, mucous membranes, respiratory tract, esophagus, and stomach. Chronic or prolonged exposure may impair breathing, or may cause chronic bronchitis, dermatitis, or loss of tooth enamel.

S' ' 'PTOMS OF EXPOSURE

Inhalation:	Breathing vapors or mist may cause coughing, burning in the throat, or choking. High or prolonged exposure may cause fluid in the lungs, chest discomfort, or difficulty in breathing. Extreme overexposure can cause collapse or death.
Eye Contact:	Severe burns.
Skin Contact:	Itching, severe irritation, or burns.
Ingestion:	Severe burning pain in mouth, throat, chest, and stomach. Swallowing may cause vomiting or diarrhea of dark blood.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE

Eye or skin disease, breathing or respiratory disorders, digestive tract disorders, or cardiovascular disease.

REPORTED AS CARCINOGEN OR POTENTIAL CARCINOGEN

☑ Not Applicable

___ National Toxicology Program (NTP)

___ OSHA

___ International Agency for Research on Cancer (IARC)

:turn to the Hydrochloric acid MSDS table

4. FIRST AID MEASURES

INHALATION

Remove from area to fresh air. If not breathing, clear airway and start mouth-to-mouth artificial respiration or use a bag-mask respirator. Get immediate medical attention. If victim is having trouble breathing, transport to medical care and, if available, give supplemental oxygen.

EYE CONTACT

Immediately rinse eyes with water. Remove any contact lenses. Hold eyelids apart to ensure rinsing of the entire surface of the eyes and lids with water. Continue flushing eyes with large amounts of running water for at least 15 minutes. If physician is not available, flush for an additional 15 minutes. Get immediate medical attention.

SKIN CONTACT

Wash affected areas with large amounts of running water, and soap if available, for 15 minutes. Remove contaminated clothing and shoes. Get immediate medical attention. Wash clothing and decontaminate shoes before reuse.

INGESTION

Give 3-4 glasses of water, but **DO NOT** induce vomiting. If vomiting occurs, give fluids again. Have physician determine if patient's condition allows induction of vomiting or evacuation of stomach. Do not give anything by mouth to an unconscious or convulsing person. Get immediate medical attention.

NOTE TO PHYSICIAN

Chemical of exposure is hydrochloric acid, and possibly hydrogen chloride, both of which are corrosive to eyes, skin, mucous membranes, and respiratory and gastroesophageal tracts.

◀ Return to the Hydrochloric acid MSDS table

5. FIRE FIGHTING MEASURES

Flash Point and Method.....N/A

GENERAL HAZARD

This product is not flammable but may be involved in a fire with other materials. Hydrogen chloride gas may be released under fire conditions. Thermal decomposition can produce poisonous chlorine gas.

EXTINGUISHING MEDIA

For small fires, use water spray, foam, CO_2, or dry chemical. For large fires, use water spray, fog, or alcohol foam.

SPECIAL FIREFIGHTING INSTRUCTIONS

Move containers from area if it can be done without risk. Cool fire-exposed containers with water from side. Stay away from storage tank ends. Isolate area until gas has dispersed.

FIREFIGHTING EQUIPMENT

As in any fire, wear NIOSH/MSHA approved, positive pressure self-contained breathing apparatus and full protective gear.

Return to the Hydrochloric acid MSDS table

6. ACCIDENTAL RELEASE MEASURES

Wear appropriate protective equipment (See Section 8). Do not touch or walk through spilled material. Stop leak if it can be done without risk. Evacuate leaker or personnel, or both, to safe area, if possible. Ventilate area. Determine whether spill notification must be made to the appropriate authorities.

ON LAND

Small Spills:: Absorb with vermiculite, fuller's earth, or sand. Neutralize with limestone, slaked lime, or soda ash. Shovel up and place in a non-metal waste container for disposal. Neutralize spill area, and wash with plenty of water.

Large Spills: Dike spill area with soil or sandbags to contain it and prevent its spread. Prevent liquid from entering sewers or waterways. Water spray can be used to knock down vapors.

Remove bulk of liquid, for example with a vacuum truck, for recovery or disposal. Then flush area with water, and neutralize washings with limestone, slaked lime, soda ash, or caustic. If permitted, flush neutralized washing to a waste treatment plant; otherwise transfer to a licensed waste disposal contractor.

Dispose of all contaminants according to federal, state, and local regulations.

IN WATER

Small pools of contaminant may be absorbed in a non-reactive absorbent and disposed of as outlined above. Spills into large bodies of water should be dispersed and neutralized with mild alkaline material.

Return to the Hydrochloric acid MSDS table

7. HANDLING AND STORAGE

HANDLING

Wear appropriate protective equipment (See Section 8). Do not get in eyes, on skin, on clothing. Avoid breathing vapor, mist, or gas. Keep container closed. Use with sufficient ventilation to keep area below established exposure levels. Wash thoroughly after handling.

Product will react with metals and form hydrogen gas which is flammable or explosive in air. Do not mix with cyanides, sulfides, or formaldehyde.

STORAGE

Keep container tightly closed. Store in a corrosion-proof area. Isolate from incompatible materials (see Section 10).

Return to the Hydrochloric acid MSDS table

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

ENGINEERING CONTROLS

Use local exhaust or general dilution ventilation system. In-plant operations should employ negative pressure (vacuum) techniques to keep vapors inside processing equipment.

PERSONAL PROTECTION

Respirator:	Use OSHA/MSHA approved equipment only. For exposure above the exposure limit and up to 50 ppm (75 mg/m^3) use a chemical cartridge respirator with acid gas cartridge that has been selected by an industrial hygienist or other technically qualified person for the specific work conditions.
Eye Protection:	Wear a face shield or vented safety goggles.
Gloves:	Wear natural rubber, neoprene, nitrile, chlorinated polyethylene, or polyvinyl chloride gloves.
Clothing:	Wear clothing that will protect the skin from exposure to this chemical. During emergency or while making repairs, wear clothing that will not allow this chemical to penetrate.
Other:	Eye wash; safety shower.

EXPOSURE CONTROLS

COMPONENT	OSHA PEL		ACGIH TLV	
	TWA	STEL	TWA	STEL
Hydrochloric Acid	7 mg/m^3 C	N/E	7 mg/m^3 C	N/E

Return to the Hydrochloric acid MSDS table

9. PHYSICAL AND CHEMICAL PROPERTIES

State	Liquid
Color	Colorless or yellow
Odor	Sharp, pungent
Melting Point °C	N/A
Boiling Point °C	97.0
Bulk Density, lb/cu. ft	N/A
Weight Per Gallon	9.49 lb/gal
Specific Gravity @ 20 °C	1.14
Water Solubility	Soluble
pH	Less than 0

Return to the Hydrochloric acid MSDS table

10. STABILITY AND REACTIVITY

REACTIVITY

Stable

INCOMPATIBILITIES

Contact with common metals, alkali metals or active metals produces highly flammable hydrogen which may form an explosive mixture with air. Reacts with oxidizers generating toxic chlorine gas; with cyanides or sulfides producing toxic hydrogen cyanide or hydrogen sulfide gas; and with formaldehyde forming bischloromethyl ether, an OSHA regulated carcinogen.

Amines, acetic anhydride, β-propiolactone, vinyl acetate, calcium phosphide, alkalies, carbonates, strong bases, oleum, chlorsulfonic acid.

HAZARDOUS DECOMPOSITION PRODUCTS

Thermal decomposition may release corrosive fumes of hydrogen chloride or toxic chlorine gas.

CONDITIONS TO AVOID

Avoid contact with common metals, alkali metals or active metals and heat.

Return to the Hydrochloric acid MSDS table

11. TOXICOLOGICAL INFORMATION

RTECS MW4025000:

Inhalation LC_{Lo} (human).....1300 ppm/30 min.
Unknown route LD_{Lo} (man).....81 mg/kg
Inhalation LC_{50} (rat).....3124 ppm/1 hour
Inhalation LC_{50} (mouse).....2142 ppm/30 min
Oral LD_{50} (rabbit).....900 mg/kg

Hydrogen chloride is a severe pulmonary, skin, and eye irritant.

Return to the Hydrochloric acid MSDS table

12. ECOLOGICAL INFORMATION

Hazardous Substances Data Bank

LC_{50} (trout).....10 mg/l/24 hr.
LC_{50} (bluegill sunfish).....pH 3.0-3.5/96 hr.
LC_{50} (shrimp).....100-330 ppm/48 hr.

Return to the Hydrochloric acid MSDS table

13. DISPOSAL CONSIDERATIONS

RCRA Classification D002

Do not allow material to enter sewer systems. Hydrochloric acid, including spill cleanups, is prohibited from land disposal without prior treatment. Observe all applicable federal, state, and local regulations.

Return to the Hydrochloric acid MSDS table

14. TRANSPORT INFORMATION

DOT Proper Shipping Name	Hydrochloric acid, solution
DOT Hazard Class	8 (Corrosive)
DOT I.D. Number	UN 1789
Packing Group	II
Label(s)	Corrosive
Emergency Response Guidebook - Guide No.	60

Return to the Hydrochloric acid MSDS table

15. REGULATORY INFORMATION

OSHA HAZARD COMMUNICATION STANDARD (29 CFR 1910.1200)

☑ Hazardous ___ Non-Hazardous

CERCLA/SUPERFUND (40 CFR 117, 302)

Chemical Name	RQ (lbs)
Hydrochloric acid	5,000

SARA EXTREMELY HAZARDOUS SUBSTANCES (40 CFR 355)

Chemical Name	TPQ (lbs)	RQ (lbs)
Hydrogen chloride (gas)	500	5000

SARA HAZARD CATEGORIES (40 CFR 370)

☑ Acute ☑ Chronic ___ Fire ___ Pressure ___ Reactive ___ None

SARA TOXIC SUBSTANCES (40 CFR 372)

Chemical Name	CAS Number	%
Hydrochloric Acid	7647-01-0	25 - 28.5

TOXIC SUBSTANCES CONTROL ACT

T hemical is listed on the TSCA inventory.

STATE REGULATIONS

Florida Hazardous Substance List	Present
Massachusetts Right To Know List	Extraordinarily hazardous
Minnesota Hazardous Substance List	Present
New Jersey Right To Know List	Substance No.: 1012; Special Health Hazard: Corrosive
Pennsylvania Right To Know List	Environmental Hazard

Return to the Hydrochloric acid MSDS table

16. OTHER INFORMATION

ABBREVIATIONS

C - Ceiling limit
N/A - Not applicable
N/D - Not determined
N/E - Not established
N/K - Not known
RQ - Reportable Quantity
TPQ - Threshold Planning Quantity

Return to the Hydrochloric acid MSDS table

MSDS No. B-5003
Date Revised: September 8, 1994
Date of Issue: September 8, 1994
Replaces: September, 1991

Return to the MSDS index

BACHARACH -- CALIBRATION GAS,METHANE 2.5% IN AIR
MATERIAL SAFETY DATA SHEET
NSN: 683000D000172
Manufacturer's CAGE: 05083
Part No. Indicator: A
Part Number/Trade Name: CALIBRATION GAS,METHANE 2.5% IN AIR

General Information

Company's Name: BACHARACH INC
Company's Street: 625 ALPHA DR
Company's City: PITTSBURG
Company's State: PA
Company's Country: US
Company's Zip Code: 15238
Company's Emerg Ph #: 412-963-2223/800-424-9300(CHEMTREC)
Company's Info Ph #: 412-963-2223
Record No. For Safety Entry: 001
Tot Safety Entries This Stk#: 002
Status: SE
Date MSDS Prepared: 03FEB92
Safety Data Review Date: 14SEP94
Supply Item Manager: CX
MSDS Preparer's Name: UNKNOWN
MSDS Serial Number: BTWMP
Specification Number: UNKNOWN
Spec Type, Grade, Class: UNKNOWN
Hazard Characteristic Code: G3
Unit Of Issue: EA
Unit Of Issue Container Qty: UNKNOWN
Type Of Container: CYLINDER
Net Unit Weight: UNKNOWN
NRC/State License Number: NOT RELEVENT

Ingredients/Identity Information

Proprietary: NO
Ingredient: METHANE
Ingredient Sequence Number: 01
Percent: 2.5
NIOSH (RTECS) Number: PA1490000
CAS Number: 74-82-8
OSHA PEL: NOT ESTABLISHED
ACGIH TLV: ASPHYXIANT; 9394
Other Recommended Limit: NONE RECOMMENDED

Proprietary: NO
Ingredient: AIR, REFRIGERATED LIQUID; AIR COMPRESSED (UN1002, DOT); AIR REFRIGERATED LIQUID (CRYOGENIC LIQUID) (UN1003) (DOT)
Ingredient Sequence Number: 02
Percent: 97.5
NIOSH (RTECS) Number: AX5271000
OSHA PEL: UNKNOWN
ACGIH TLV: UNKNOWN
Other Recommended Limit: NONE RECOMMENDED

Physical/Chemical Characteristics

Appearance And Odor: COLORLESS, ODORLESS, TASTELESS COMPRESSED GAS IN CYLINDER
Boiling Point: -260F (CH4)
Vapor Pressure (MM Hg/70 F): GAS @ 20C
Vapor Density (Air=1): 0.991
Specific Gravity: 0.673 KG/M3
Decomposition Temperature: UNKNOWN
Evaporation Rate And Ref: GAS
Solubility In Water: NEGLIGIBLE
Percent Volatiles By Volume: 100
Corrosion Rate (IPY): UNKNOWN

Fire and Explosion Hazard Data

Flash Point: -306F,-188C(CH4)
Flash Point Method: CC
Lower Explosive Limit: 5% (METHANE)
Upper Explosive Limit: 15% (METHAN)
Extinguishing Media: THIS GAS IS NOT FLAMMABLE (2.5% METHANE IN AIR; LEL= 5%). COOL FIRE-EXPOSED CONTAINERS WITH WATER.
Special Fire Fighting Proc: WEAR PROTECTIVE CLOTHING & NIOSH-APPROVED SELF-CONTAINED BREATHING APPARATUS OPERATED IN + PRESSURE MODE. USE SHIELDING TO PROTECT FROM CYLINDER EXPLOSION.
Unusual Fire And Expl Hazrds: COMPRESSED AIR/METHANE MIXTURES AT HIGH PRESSURE WILL ACCELERATE BURNING OF OTHER MATERIALS. GAS CYLINDERS EXPOSED TO FIRE MAY VENT RAPIDLY OR EXPLODE.

Reactivity Data

Stability: YES
Cond To Avoid (Stability): HEAT, FLAMES
Materials To Avoid: UNKNOWN
Hazardous Decomp Products: UNKNOWN
Hazardous Poly Occur: NO
Conditions To Avoid (Poly): NOT RELEVENT

Health Hazard Data

LD50-LC50 Mixture: UNKNOWN
Route Of Entry - Inhalation: NO
Route Of Entry - Skin: NO
Route Of Entry - Ingestion: NO
Health Haz Acute And Chronic: TARGET ORGANS:NONE. ACUTE- EYE/SKIN:NONE KNOWN OR EXPECTED. INHALATION:NONE. METHANE IS A NON-TOXIC SIMPLE ASPHYXIANT. THE CONCENTRATION OF METHANE IN THIS MIXTURE IS TOO LOW TO DEPRESS OXYGEN CONCENTRATION. INGESTION:NOT APPLICABLE. THIS IS A GAS. CHRONIC- NONE KNOWN OR EXPECTED. METHANE IS A NON-TOXIC GAS.
Carcinogenicity - NTP: NO
Carcinogenicity - IARC: NO
Carcinogenicity - OSHA: NO
Explanation Carcinogenicity: NONE
Signs/Symptoms Of Overexp: NONE
Med Cond Aggravated By Exp: NONE KNOWN OR EXPECTED.
Emergency/First Aid Proc: NONE NEEDED.

Precautions for Safe Handling and Use

Steps If Matl Released/Spill: NONE NEEDED. THIS MATERIAL IS NON-TOXIC AND NON-FALMMABLE.
Neutralizing Agent: NOT RELEVENT
Waste Disposal Method: DISPOSE OF IN ACCORDANCE WITH ALL LOCAL, STATE AND FEDERAL REGULATIONS.
Precautions-Handling/Storing: STORE CYLINDERS SECURE, AWAY FROM HEAT & FLAME. STORE IN COOL AREA. STORAGE TEMPERATURE SHOULD NOT EXCEED 130F(54C).
Other Precautions: DO NOT DROP CYLINDERS. WASH HANDS AFTER HANDLING CYLINDERS. PROTECT FROM PHYSICAL DAMAGE. FOR ADDITIONAL HANDLING RECOMMENDATION ON COMPRESSED CYLINDERS, CONSULT COMPRESSED GAS ASSOCIATION PAMPHELET P-1.

Control Measures

Respiratory Protection: NONE NEEDED.
Ventilation: NO SPECIAL VENTILATION REQUIRED.
Protective Gloves: LEATHER RECOMMENDED FOR HANLING CYLINDER
Eye Protection: APPROVED SAFETY GLASSES RECOMMENDED.
Other Protective Equipment: SAFETY SHOES AND HEARING PROTECTION
Work Hygienic Practices: USE PROPER CARE WHEN HANDLING CYLINDERS. CLOSE CYLINDER VALVES WHEN NOT IN USE/EMPTY. DO NOT DEFACE CYLINDERS OR LABELS.
Suppl. Safety & Health Data: CONTENTS UNDER PRESSURE. DO NOT PUNCTURE. NEVER THROW CONTAINER INTO FIRE OR INCINERATOR. USE A PRESSURE REGULATOR WHEN CONNECTING TO LOWER PRESSURE PIPING SYSTEMS. USE A CHECK VALVE TO PREVENT BACKFLOW.

Transportation Data

Trans Data Review Date: 94257
DOT PSN Code: DQQ
DOT Proper Shipping Name: COMPRESSED GASES, N.O.S.
DOT Class: 2.2
DOT ID Number: UN1956
DOT Label: NONFLAMMABLE GAS
IMO PSN Code: EQH
IMO Proper Shipping Name: COMPRESSED GAS, N.O.S. o
IMO Regulations Page Number: 2124
IMO UN Number: 1956
IMO UN Class: 2(2.2)
IMO Subsidiary Risk Label: -
IATA PSN Code: HDO
IATA UN ID Number: 1956
IATA Proper Shipping Name: COMPRESSED GAS, N.O.S. *
IATA UN Class: 2.2
IATA Label: NON-FLAMMABLE GAS
AFI PSN Code: HDO
AFI Prop. Shipping Name: COMPRESSED GAS, N.O.S.
AFI Class: 2.2
AFI ID Number: UN1956
AFI Basic Pac Ref: 6-6,6-8,6-10
N.O.S. Shipping Name: METHANE (2.5%, AIR (97.5%)
Additional Trans Data: THE MIXTURE IS NOT FLAMMABLE.

Disposal Data

Label Data

Label Required: YES
Technical Review Date: 14SEP94
MFR Label Number: NOT RELEVENT
Label Status: F
Common Name: CALIBRATION GAS,METHANE 2.5% IN AIR
Chronic Hazard: NO
Signal Word: NONE
Acute Health Hazard-None: X
Contact Hazard-None: X
Fire Hazard-None: X
Reactivity Hazard-None: X
Special Hazard Precautions: TARGET ORGANS:NONE. ACUTE- EYE/SKIN:NONE KNOWN OR EXPECTED. INHALATION:NONE. METHANE IS A NON-TOXIC SIMPLE ASPHYXIANT. THE CONCENTRATION OF METHANE IN THIS MIXTURE IS TOO LOW TO DEPRESS OXYGEN CONCENTRATION. INGESTION:NOT APPLICABLE. THIS IS A GAS. CHRONIC- NONE KNOWN OR EXPECTED. METHANE IS A NON-TOXIC GAS. STORE CYLINDERS SECURE, AWAY FROM HEAT & FLAME. STORE IN COOL AREA. STORAGE TEMPERATURE SHOULD NOT EXCEED 130F(54C). IN CASE OF SPILL: NONE NEEDED. THIS MATERIAL IS NON-TOXIC AND NON-FALMMABLE. FIRST AID- NONE NEEDED.
Protect Eye: Y
Label Name: BACHARACH INC
Label Street: 625 ALPHA DR
Label City: PITTSBURG
Label State: PA
Label Zip Code: 15238
Label Country: US
Label Emergency Number: 412-963-2223/800-424-9300(CHEMTREC)

**** MATERIAL SAFETY DATA SHEET ****

Nitric Acid
16550

**** SECTION 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION ****

MSDS Name: Nitric Acid
Catalog Numbers:
S71972, S71972-1, S75623-2, S75623-3, S76523, A198C 212, A198C-212, A198C212, A198C4X 212, A198C4X212, A200 212, A200 500, A200 612GAL, A200-212, A200-500, A200-612G, A200-612GAL, A200-612GL, A200212, A200500, A200612GAL, A200C-2.5, A200C-212, A200C4X 212, A200C4X212, A200C4X212 1, A200C4X2121, A200C4X2122, A200C4X212L, A200FP 500, A200FP500, A200J500, A200S 500, A200S-2.5, A200S-212, A200S-500, A200S4X212, A200S4X2123, A200S4X212L, A200S500, A200SI 212, A200SI-21, A200SI-212, A200SI212, A200SI21201, A200SI212LC, A206C 212, A206C-212, A206C212, A206C4X 212, A206C4X212, A467 500, A467-1, A467-2, A467-250, A467-500, A4672, A467500, A483 212, A483-212, A483212, A509 212, A509 212 002, A509 500, A509-212, A509-500, A509212, A509212 002, A509212001, A509212002, A509212003, A509212004, A5092122005, A509212LC, A509500, A509SK212, S71972-1MF*, S719721, S719721MF, S71972MF, S71972MF*, S71972SC
Synonyms:
Azotic acid, engravers nitrate, hydrogen nitrate.
Company Identification: Fisher Scientific
1 Reagent Lane
Fairlawn, NJ 07410
For information, call: 201-796-7100
Emergency Number: 201-796-7100
For CHEMTREC assistance, call: 800-424-9300
For International CHEMTREC assistance, call: 703-527-3887

**** SECTION 2 - COMPOSITION, INFORMATION ON INGREDIENTS ****

CAS#	Chemical Name	%	EINECS#
7697-37-2	Nitric acid	69-71%	231-714-2
7732-18-5	Water	29-31%	231-791-2

Hazard Symbols: O C
Risk Phrases: 35 8

**** SECTION 3 - HAZARDS IDENTIFICATION ****

EMERGENCY OVERVIEW

Appearance: clear to yellow.
Danger! Strong oxidizer. Contact with other material may cause a fire. Corrosive. Causes eye and skin burns. Causes digestive and respiratory tract burns.
Target Organs: None.

Potential Health Effects
Eye:
Causes severe eye burns. May cause irreversible eye injury.
Skin:
May cause severe skin irritation. Causes skin burns. May cause deep, penetrating ulcers of the skin.
Ingestion:
Causes gastrointestinal tract burns. May cause perforation of the digestive tract.

Inhalation:
May be fatal if inhaled. Effects may be delayed. May cause irritation of the respiratory tract with burning pain in the nose and throat, coughing, wheezing, shortness of breath and pulmonary edema.
Chronic:
Repeated inhalation may cause chronic bronchitis. Repeated exposure may cause erosion of teeth.

**** SECTION 4 - FIRST AID MEASURES ****

Eyes:
Flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower lids. Get medical aid immediately. Do NOT allow victim to rub or keep eyes closed.
Skin:
Get medical aid immediately. Flush skin with plenty of soap and water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse.
Ingestion:
Do NOT induce vomiting. If victim is conscious and alert, give 2-4 cupfuls of milk or water. Never give anything by mouth to an unconscious person. Get medical aid immediately.
Inhalation:
Remove from exposure to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical aid.
Notes to Physician:
Treat symptomatically and supportively.

**** SECTION 5 - FIRE FIGHTING MEASURES ****

General Information:
As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. Strong oxidizer. Contact with combustible materials may cause a fire. Use water spray to keep fire-exposed containers cool. Substance is noncombustible.
Extinguishing Media:
Substance is noncombustible; use agent most appropriate to extinguish surrounding fire.
Autoignition Temperature: Not available.
Flash Point: Not available.
NFPA Rating: Not published.
Explosion Limits, Lower: Not available.
Upper: Not available.

**** SECTION 6 - ACCIDENTAL RELEASE MEASURES ****

General Information: Use proper personal protective equipment as indicated in Section 8.
Spills/Leaks:
Absorb spill with inert material, (e.g., dry sand or earth), then place into a chemical waste container. Neutralize spill with sodium bicarbonate. A vapor suppressing foam may be used to reduce vapors.

**** SECTION 7 - HANDLING and STORAGE ****

Handling:
Wash thoroughly after handling. Remove contaminated clothing and wash before reuse. Use with adequate ventilation. Do not get in eyes, on skin, or on clothing. Keep container tightly closed. Do not ingest or inhale.
Storage:
Store in a tightly closed container. Store in a cool, dry,

well-ventilated area away from incompatible substances.

**** SECTION 8 - EXPOSURE CONTROLS, PERSONAL PROTECTION ****

Engineering Controls:
Use adequate general or local exhaust ventilation to keep airborne concentrations below the permissible exposure limits.

Exposure Limits

Chemical Name	ACGIH	NIOSH	OSHA - Final PELs
Nitric acid	2 ppm ; 5.2 mg/m3; 4 ppm STEL; 10 mg/m3 STEL	2 ppm TWA; 5 mg/m3 TWA; 4 ppm STEL; 10 mg/m3 STEL	2 ppm TWA; 5 mg/m3 TWA
Water	none listed	none listed	none listed

OSHA Vacated PELs:
Nitric acid:
2 ppm TWA; 5 mg/m3 TWA; 4 ppm STEL; 10 mg/m3 STEL
Water:
No OSHA Vacated PELs are listed for this chemical.

Personal Protective Equipment

Eyes:
Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133.

Skin:
Wear appropriate protective gloves and clothing to prevent skin exposure.

Clothing:
Wear appropriate protective clothing to prevent skin exposure.

Respirators:
Follow the OSHA respirator regulations found in 29CFR 1910.134. Always use a NIOSH-approved respirator when necessary.

**** SECTION 9 - PHYSICAL AND CHEMICAL PROPERTIES ****

Physical State:	Liquid
Appearance:	clear to yellow
Odor:	strong odor, acrid odor
pH:	1.0
Vapor Pressure:	6.8 mm Hg
Vapor Density:	Not available.
Evaporation Rate:	Not available.
Viscosity:	Not available.
Boiling Point:	186.8 deg F
Freezing/Melting Point:	-43.6 deg F
Decomposition Temperature:	Not available.
Solubility:	Soluble in water.
Specific Gravity/Density:	1.50
Molecular Formula:	HNO3
Molecular Weight:	63.0119

**** SECTION 10 - STABILITY AND REACTIVITY ****

Chemical Stability:

Decomposes when in contact with air, light, or organic matter.
Conditions to Avoid:
High temperatures, incompatible materials, moisture, reducing agents.
Incompatibilities with Other Materials:
Reacts with over 150 chemical combinations. Refer to NFPA Fire Protection Guide for specifics. Reacts explosively with organic materials and combustibles.
Hazardous Decomposition Products:
Nitrogen oxides.
Hazardous Polymerization: Has not been reported.

**** SECTION 11 - TOXICOLOGICAL INFORMATION ****

RTECS#:
CAS# 7697-37-2: QU5775000 QU5900000
CAS# 7732-18-5: ZC0110000
LD50/LC50:
CAS# 7732-18-5: Oral, rat: LD50 = >90 mL/kg.
CAS# 7732-18-5: Oral, rat: LD50 = >90 mL/kg.
Carcinogenicity:
Nitric acid -
Not listed by ACGIH, IARC, NIOSH, NTP, or OSHA.
Water -
Not listed by ACGIH, IARC, NIOSH, NTP, or OSHA.
Epidemiology:
No information available.
Teratogenicity:
Effects on newborn: biochemical and metabolic, Oral-rat TDLo=2345 mg/kg (female 18D post). Fetotoxicity: Stunted fetus, Oral-rat TDLo=21150 mg/kg (female 1-21D post).
Reproductive Effects:
No information available.
Neurotoxicity:
No information available.
Mutagenicity:
No information available.
Other Studies:
None.

**** SECTION 12 - ECOLOGICAL INFORMATION ****

Ecotoxicity:
Mosquito fish: TLm=72 ppm/96H (fresh water) Cockle: LC50=330-1000 ppm/48H (salt water)
Environmental Fate:
No information reported.
Physical/Chemical:
No information available.
Other:
None.

**** SECTION 13 - DISPOSAL CONSIDERATIONS ****

Dispose of in a manner consistent with federal, state, and local regulations.
RCRA D-Series Maximum Concentration of Contaminants: Not listed.
RCRA D-Series Chronic Toxicity Reference Levels: Not listed.
RCRA F-Series: Not listed.
RCRA P-Series: Not listed.
RCRA U-Series: Not listed.
Not listed as a material banned from land disposal according to RCRA.

**** SECTION 14 - TRANSPORT INFORMATION ****

US DOT

Shipping Name: NITRIC ACID
Hazard Class: 8
UN Number: UN2031
Packing Group: II

IMO
No information available.

IATA
No information available.

RID/ADR
No information available.

Canadian TDG
Shipping Name: NITRIC ACID
Hazard Class: 8(9.2)
UN Number: UN2031

**** SECTION 15 - REGULATORY INFORMATION ****

US FEDERAL

TSCA
CAS# 7697-37-2 is listed on the TSCA inventory.
CAS# 7732-18-5 is listed on the TSCA inventory.

Health & Safety Reporting List
None of the chemicals are on the Health & Safety Reporting List.

Chemical Test Rules
None of the chemicals in this product are under a Chemical Test Rule.

Section 12b
None of the chemicals are listed under TSCA Section 12b.

TSCA Significant New Use Rule
None of the chemicals in this material have a SNUR under TSCA.

SARA

Section 302 (RQ)
final RQ = 1000 pounds (454 kg)

Section 302 (TPQ)
CAS# 7697-37-2: TPQ = 1000 pounds

SARA Codes
CAS # 7697-37-2: acute, chronic, flammable.

Section 313
This material contains Nitric acid (CAS# 7697-37-2, 69-71%),which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR Part 373.

Clean Air Act:
This material does not contain any hazardous air pollutants.
This material does not contain any Class 1 Ozone depletors.
This material does not contain any Class 2 Ozone depletors.

Clean Water Act:
CAS# 7697-37-2 is listed as a Hazardous Substance under the CWA.
None of the chemicals in this product are listed as Priority Pollutants under the CWA.
None of the chemicals in this product are listed as Toxic Pollutants under the CWA.

OSHA:
CAS# 7697-37-2 is considered highly hazardous by OSHA.

STATE

Nitric acid can be found on the following state right to know lists: California, New Jersey, Florida, Pennsylvania, Minnesota, Massachusetts.
Not present on state lists from CA, PA, MN, MA, FL, or NJ.
California No Significant Risk Level:
None of the chemicals in this product are listed.

European/International Regulations

European Labeling in Accordance with EC Directives
Hazard Symbols: O C
Risk Phrases:
R 35 Causes severe burns.

R 8 Contact with combustible material may cause fire.

Safety Phrases:

WGK (Water Danger/Protection)

CAS# 7697-37-2: 1

CAS# 7732-18-5:

Canada

CAS# 7697-37-2 is listed on Canada's DSL/NDSL List.
CAS# 7732-18-5 is listed on Canada's DSL/NDSL List.
This product has a WHMIS classification of C, D1A, E.
CAS# 7697-37-2 is listed on Canada's Ingredient Disclosure List.
CAS# 7732-18-5 is not listed on Canada's Ingredient Disclosure List.

Exposure Limits

CAS# 7697-37-2:. OEL-ARAB Republic of Egypt:TWA 2 ppm (5 mg/m3). OEL-AUSTRALIA:TWA 2 ppm (5 mg/m3);STEL 4 ppm (10 mg/m3). OEL-BELGIUM:TWA 2 ppm (5.2 mg/m3);STEL 4 ppm (10 mg/m3). OEL-CZECHOSLOVAKIA:TWA 2.5 mg/m3;STEL 5 mg/m3. OEL-DENMARK:TWA 2 ppm (5 mg/m3). OEL-FINLAND:TWA 2 ppm (5 mg/m3);STEL 5 ppm (13 mg/m3);Skin. OEL-FRANCE:TWA 2 ppm (5 mg/m3);STEL 4 ppm (10 mg/m3). OEL-GERMANY:TWA 10 ppm (25 mg/m3). OEL-HUNGARY:STEL 5 mg/m3. OEL-JAPAN:TWA 2 ppm (5.2 mg/m3). OEL-THE PHILIPPINES:TWA 2 ppm (5 mg/m3). OEL-POLAND:TWA 10 mg/m3. OEL-RUSSIA:TWA 2 ppm;STEL 2 mg/m3;Skin. OEL-SWEDEN:TWA 2 ppm (5 mg/m3);STEL 5 ppm (13 mg/m3). OEL-SWITZERLAND:TWA 2 ppm (5 mg/m3);STEL 4 ppm (1 mg/m3). OEL-THAILAND:TWA 2 ppm (5 mg/m3). OEL-TURKEY:TWA 2 ppm (5 mg/m3). OEL-UNITED KINGDOM:TWA 2 ppm (5 mg/m3);STEL 4 ppm (10 mg/m3). OEL IN BULGARIA, COLOMBIA, JORDAN, KOREA check ACGIH TLV. OEL IN NEW ZEALAND, SINGAPORE, VIETNAM check ACGI TLV

**** SECTION 16 - ADDITIONAL INFORMATION ****

MSDS Creation Date: 12/20/1994 Revision #14 Date: 9/02/1997

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no way shall Fisher be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if Fisher has been advised of the possibility of such damages.

PROSCITECH
Microscopy & Electron Beam Instrument Supplies

Address P.O. Box 111, Thuringowa Central, Qld 4817 Australia

37 Framara Drive, Kelso, Queensland 4815 Australia

Phone National (077) 740 370 International +61 77 740 370

Facsimile National (077) 892 313 International +61 77 892 313

MATERIAL SAFETY DATA SHEET

Date of Issue: October 1997

Sodium Hydroxide

STATEMENT OF HAZARDOUS NATURE

H lous according to criteria of Worksafe Australia

IDENTIFICATION SECTION	
Product Name	Sodium Hydroxide
Other Names	Caustic Soda, Sodium Hydrate, Lye
Product Code	C200, C2005
U.N. Number	UN1823
Dangerous Goods Class	8
and Subsidiary Risk	
Hazchem Code	2R
Poison Schedule	None allocated
Use	Common caustic solution

Physical Description and Properties

Appearance	White, odourless solid
Boiling Point/Melting Point	bp 1390°C mp 318°C
Vapour Pressure	0
Specific Gravity	2.13
F' Point	No data
Flammability Limits	Not determined

Solubility in water 1111g/L

Other Properties

Ingredients

Chemical Name	CAS Number	Proportion
Sodium hydroxide	90-100	1310-73-2

HEALTH HAZARD INFORMATION

Health Effects:

Acute

Swallowed:	Harmful and may be fatal. May cause severe burning of mouth and stomach. May cause nausea and vomiting
Eye:	May cause severe irritation or burns
Skin:	May cause severe irritation or burns.
Inhaled:	Excessive inhalation of dust is irritating and may be severely damaging to respiratory passages and/or lungs

First Aid:

Swallowed:	Do not induce vomiting. If conscious, give large amounts of water. Follow with diluted vinegar, fruit juice or whites of eggs, beaten with water.
Eye:	Immediately flush eyes with plenty of water for at least 15 minutes.
Skin:	Immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before re-use.
Inhaled:	Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen.

First Aid Facilities:

PRECAUTIONS FOR USE

Exposure Standards:	TLV/TWA 2mg/m^3. Permissible exposure limit (PEL) 2mg/m^3
Engineering Controls:	Use general or local exhaust ventilation to meet TLV requirements.
Personal Protection:	Respiratory protection required if airborne concentration exceeds TLV. At concentrations up to 60ppm, a high-efficiency particulate respirator is recommended. Above this level, a self-contained breathing apparatus is advised. Safety goggles, uniform, apron, rubber gloves are recommended.
Flammability:	Contact with moisture or water may generate sufficient heat to ignite combustible materials.

SAFE HANDLING INFORMATION

Storage and Transport:	Keep container tightly closed. Store in corrosion-proof area. Store in a dry area. Isolate from incompatible materials. UN1823. DG Class 8. Labels: corrosive.

Spills and Disposal:	Wear self-contained breathing apparatus and full protective clothinng. With clean shovel, carefully place material into clean, dry container and cover; remove from area. Flush spill area with water. J. T. Baker Neutracit-2(R) caustic neutraliser is recommended for spills of this product. Dispose in accordance with all applicable federal, state and local environmental regulations.
Fire/Explosion Hazard:	Use extinguishing media appropriate for surrounding fire. Flood with water, do not splatter or splash this material. Reacts with most metals to produce hydrogen gas, which can form an explosive mixture with air.

OTHER INFORMATION	
Incompatibilities **(Materials to avoid)**	Water, strong acids, most common metals, combustible materials, organic materials, zinc, aluminium, magnesium, halogenated hydrocarbons.
Animal Toxicity Data:	LD50 Ipr-mouse, 40mg/kg

The information published in this Material Safety Data Sheet has been compiled from data in various technical publications. It is the user's responsibility to determine the suitability of this information for adoption of necessary safety precautions. We reserve the right to revise material Safety Data Sheets as new information becomes available. Copies may be made for non-profit use.

se e@proscitech.com.au

Please reduce your browser font size for better viewing and printing.

MSDS Material Safety Data Sheet

24 Hour Emergency Telephone: 908-859-2151
CHEMTREC: 1-800-424-9300

National Response in Canada
CANUTEC: 613-996-6666

Outside U.S. and Canada
Chemtrec: 202-483-7616

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

From: Mallinckrodt Baker, Inc.
222 Red School Lane
Phillipsburg, NJ 08865

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.

ZINC ACETATE

MSDS Number: Z1140 --- *Effective Date: 12/08/96*

1. Product Identification

Synonyms: Acetic acid, zinc salt, dihydrate; zinc diacetate; zinc acetate dihydrate
CAS No.: 557-34-6 (Anhydrous)
Molecular Weight: 219.50
Chemical Formula: (CH3COO)2Zn 2H2O
Product Codes:
J.T. Baker: 4296, 4297, 4304, 5658
Mallinckrodt: 8740

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Zinc Acetate	557-34-6	98 - 100%	Yes

3. Hazards Identification

Emergency Overview

WARNING! HARMFUL IF SWALLOWED OR INHALED. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT.

J.T. Baker SAF-T-DATA(tm) Ratings (Provided here for your convenience)

Health Rating: 1 - Slight
Flammability Rating: 1 - Slight
Reactivity Rating: 0 - None
Contact Rating: 2 - Moderate
Lab Protective Equip: GOGGLES; LAB COAT
Storage Color Code: Orange (General Storage)

Potential Health Effects

Inhalation:
Causes irritation to the respiratory tract. Symptoms may include coughing, shortness of breath.
Ingestion:
Irritation of the mucous membranes due to hydrolysis and formation of acid in the stomach can occur. Large amounts can produce stomach cramps, stricture of the esophagus, nausea, and vomiting.
Skin Contact:
Causes irritation to skin. Symptoms include redness, itching, and pain.
Eye Contact:
Causes irritation, redness, and pain.
Chronic Exposure:
No information found.
Aggravation of Pre-existing Conditions:
Persons with pre-existing skin disorders or impaired respiratory function may be more susceptible to the effects of the substance.

4. First Aid Measures

Inhalation:
Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.
Ingestion:
Induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person. Get medical attention.
Skin Contact:
Immediately flush skin with plenty of water for at least 15 minutes. Remove contaminated clothing and shoes. Get medical attention. Wash clothing before reuse. Thoroughly clean shoes before reuse.
Eye Contact:
Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

5. Fire Fighting Measures

Fire:
Not considered to be a fire hazard.

Explosion:
Not considered to be an explosion hazard.
Fire Extinguishing Media:
Use any means suitable for extinguishing surrounding fire.
Special Information:
In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode.

6. Accidental Release Measures

Ventilate area of leak or spill. Wear appropriate personal protective equipment as specified in Section 8. Spills: Pick up and place in a suitable container for reclamation or disposal, using a method that does not generate dust. US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

7. Handling and Storage

Keep in a tightly closed container, stored in a cool, dry, ventilated area. Protect against physical damage. Isolate from incompatible substances. Containers of this material may be hazardous when empty since they retain product residues (dust, solids); observe all warnings and precautions listed for the product.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:
None established.
Ventilation System:
A system of local and/or general exhaust is recommended to keep employee exposures as low as possible. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.
Personal Respirators (NIOSH Approved):
For conditions of use where exposure to the dust or mist is apparent, a half-face dust/mist respirator may be worn. For emergencies or instances where the exposure levels are not known, use a full-face positive-pressure, air-supplied respirator. WARNING: Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.
Skin Protection:
Wear protective gloves and clean body-covering clothing.
Eye Protection:
Use chemical safety goggles. Maintain eye wash fountain and quick-drench facilities in work area.

9. Physical and Chemical Properties

Appearance:
White crystals or powder.
Odor:
Slight acetic acid (vinegar) odor.
Solubility:
43g in 100g water.
Density:
1.74
pH:
No information found.
% Volatiles by volume @ 21C (70F):
0
Boiling Point:
Decomposes.
Melting Point:
237C (459F)
Vapor Density (Air=1):
No information found.
Vapor Pressure (mm Hg):
No information found.
Evaporation Rate (BuAc=1):
No information found.

10. Stability and Reactivity

Stability:
Loses water of hydration above 100C.

Hazardous Decomposition Products:
Freshly-formed zinc oxide or zinc oxide fumes at high temperatures (over 800C).
Hazardous Polymerization:
Will not occur.
Incompatibilities:
No incompatibility data found. Oxidizing agents, zinc salts in general, alkalis and their carbonates, oxalates, phosphates, sulfides.
Conditions to Avoid:
Heat, flames, ignition sources and incompatibles.

11. Toxicological Information

Oral rat: LD50: 2510 mg/kg. Reproductive effects cited. Mutation references cited.

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-----\Cancer Lists\----------------------------------------------------
                                    ---NTP Carcinogen---
```

Ingredient	Known	Anticipated	IARC Category
Zinc Acetate (557-34-6)	No	No	None

12. Ecological Information

Environmental Fate:
No information found.
Environmental Toxicity:
No information found.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be managed in an appropriate and approved waste disposal facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Not regulated.

15. Regulatory Information

--------\Chemical Inventory Status - Part 1\--------

Ingredient	TSCA	EC	Japan	Australia
Zinc Acetate (557-34-6)	Yes	Yes	Yes	Yes

--------\Chemical Inventory Status - Part 2\--------

Ingredient	Korea	--Canada-- DSL	NDSL	Phil.
Zinc Acetate (557-34-6)	Yes	Yes	No	Yes

--------\Federal, State & International Regulations - Part 1\--------

Ingredient	-SARA 302- RQ	TPQ	------SARA 313------ List	Chemical Catg.
Zinc Acetate (557-34-6)	No	No	No	Zinc compoun

--------\Federal, State & International Regulations - Part 2\--------

Ingredient	CERCLA	-RCRA- 261.33	-TSCA- 8(d)
Zinc Acetate (557-34-6)	1000	No	No

```
Chemical Weapons Convention:  No     TSCA 12(b):  No     CDTA:  No
SARA 311/312:  Acute: Yes      Chronic: No   Fire: No  Pressure: No
R  tivity: No          (Mixture / Solid)
```

Australian Hazchem Code: No information found.
Poison Schedule: No information found.
WHMIS:
This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

---

16. Other Information

NFPA Ratings: Health: **1** Flammability: **0** Reactivity: **0**
Label Hazard Warning:
WARNING! HARMFUL IF SWALLOWED OR INHALED. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT.
Label Precautions:
Avoid contact with eyes, skin and clothing.
Avoid breathing dust.
Keep container closed.
Use only with adequate ventilation.
Wash thoroughly after handling.
Label First Aid:
In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes. Remove contaminated clothing and shoes. Wash clothing before reuse. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. If swallowed, induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person. In all cases, get medical attention.
Product Use:
Laboratory Reagent.
Revision Information:
New 16 section MSDS format, all sections have been revised.
Disclaimer:
****

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****

Prepared by: Strategic Services Division
Phone Number: (314) 539-1600 (U.S.A.)

Material Safety Data Sheet

IMC AGRICO

Sulfuric Acid (98% & 93%) H_2SO_4

NFPA Codes
& Hazard Rating
Scale

EMERGENCY NUMBER: Transportation: (CHEMTREC) 800.424.9300 • Health: 800.282.9024

Identification | Fire & Explosion | Spill • Leak • Disposal
Composition | Reactivity Data | Special Protection
Physical Data | Health Hazard | Special Precaution

identification

PRODUCT NAME — Sulfuric Acid, Concentrated
CAS NO. — 7664-93-9
CHEMICAL FAMILY — Inorganic Acid
MOLECULAR WEIGHT — 98
CHEMICAL NAME — Sulfuric Acid
FORMULA — H_2SO_4
SYNONYMS — Oil of Vitriol, Battery Acid
DOT CLASS — Corrosive Material, UN1830

Composition

Hazardous Ingredients (Typical)	%	Cas No.
Sulfuric Acid	93-98	7664-93-9
Other Ingredients (Typical)		
Water, approximate	2 - 7	7732-28-5

NOTE: Contains sulfuric acid, which is subject to the reporting requirements of Section 313 of the Emergency Planning Community Right-To-Know Act of 1986 and of 40 CFR Part 372.

Physical Data

BOILING POINT — 535 - 586 —F
SPECIFIC GRAVITY (H_2O=1) — 1.84
VAPOR PRESSURE, mm Hg , 77 —F — Less than 1
PERCENT VOLATILE — 0 at 77 —F
SOLUBILITY IN WATER — Complete
pH, 1% Solution — Approx.1
APPEARANCE AND ODOR - Clear, colorless, odorless oily liquid

Fire & Explosion

FLASH POINT — Not applicable.
FLAMMABLE LIMITS — Not applicable.

Reacts with many metals to form flammable and explosive hydrogen gas. Reacts violently with water and many organic materials. Contact with water causes evolution of heat, and may cause spattering. Heat of a fire could cause evolution of sulfuric acid mist or sulfuric trioxide. Use water spray to cool sulfuric acid containers to prevent rupture, or to flush acid spills from the area. Firefighters and emergency personnel should use self-contained breathing apparatus and full acid-resistant clothing.

Reactivity Data

STABILITY — Sulfuric acid is stable under normal conditions.

INCOMPATIBILITY (Materials to avoid) — Reaction with many metals may cause evolution of flammable and explosive hydrogen gas. Contact with strong alkalis, strong oxidizers, or combustible materials may cause spattering of the acid and liberation of heat. Contact with sulfides or cyanides may cause release of toxic gases.

HAZARDOUS DECOMPOSITION PRODUCTS — At very high temperatures may release sulfuric dioxide or sulfur trioxide.

HAZARDOUS POLYMERIZATION — Will not occur.

Health Hazard

OSHA PERMISSIBLE EXPOSURE LIMIT OR ACGIH TLV — is a time-weighted-average of 1 mg/mp. The ACGIH Short Term Exposure Limit (STEL) is 3 mg/mp. Sulfuric acid is not considered to be a cancer-causing material by OSHA, NIOSH, or IARC.

ROUTES OF ENTRY — Lungs (breathing), ingestion (swallowing), skin contact.

EFFECTS OF OVEREXPOSURE — ***Short Term:*** Causes deep, severe burns to all tissue. Contact with eyes may cause severe injury or blindness. Swallowing causes severe injury or death. Inhalation of acid mist may cause severe damage to lungs and upper respiratory tract. ***Long Term:*** Repeated or prolonged exposure may cause irritation to the skin or eyes, lung congestion, or chemical bronchitis. May attack the enamel of the teeth.

SKIN AND EYE IRRITATION DATA — ***Eye:*** Rabbit, 250 mg - Severe irritation.

TOXICITY DATA — Oral, rat LD50: 2,140 mg/kg. Inhalation, rat LD50: 510 mg/mp/2 hours.

EMERGENCY AND FIRST AID PROCEDURES — ***Eyes:*** Flush thoroughly immediately with large amounts of water for at least 15 minutes, including under the eyelids. Get medical attention immediately. ***Skin:*** Flush immediately with water for 15 minutes while removing contaminated clothing. Get medical attention if irritation or pain persist. ***Ingestion:*** DO NOT INDUCE VOMITTING or give bicarbonate to neutralize. If conscious, give large amounts of water or milk. Never give anything by mouth to an unconscious person. Get medical attention immediately. ***Inhalation:*** Remove to fresh air. If irritation or breathing difficulties occur, get medical attention immediately.

Spill, Leak & Disposal

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED — Stop leak if without risk. Restrict access to the area until completion of cleanup. Do not touch or allow anyone to touch spilled or leaked material. Use acid suits and acid-resistant footwear. Contain spill with dike if necessary. Collect as much of the spilled material as possible in acid-resistant containers for possible reuse. Absorb the remaining material with sand, vermiculite, or other absorbent material, or neutralize with soda ash, sodium bicarbonate, limestone, or lime, until acidity is neutralized.

WASTE DISPOSAL METHOD — Consult State or Federal Environmental Protection Agency for accepted disposal procedures and disposal locations. Disposal in streams or sewers may be contrary to regulations.

Special Protection

RESPIRATORY PROTECTION — Should not normally be required at normal temperatures. If acid mist is formed, use NIOSH- approved full facepiece high-efficiency particulate filter respirator or self-contained breathing apparatus.

EYE PROTECTION — Use tight-fitting chemical safety goggles or face shields and chemical safety goggles, to protect the eyes from splashes of acid.

VENTILATION — If acid mist is present, use local exhaust or other ventilation that will reduce acid mist concentrations to less tha e recommended exposure limit.

OTHER PROTECTIVE EQUIPMENT — Impervious, acid-resistant clothing and boots should be used when handling sulfuric

acid to prevent contact of the skin with splashed or sprayed material. Neoprene or PVC material is recommended.

SAFETY SHOWERS and eyewash stations should be present where sulfuric acid is handled.

Special Precaution

Impervious acid-resistant clothing, boots, goggles, and face shields should be used when handling sulfuric acid to prevent contact with the skin and eyes. Any clothing contaminated with sulfuric acid should be laundered before reuse. Do not wear contact lenses when working with sulfuric acid.

IMC-Agrico Company
2345 Waukegan Road
Suite E-200
Bannockburn, IL 60015
Phone: 847.607.3000

Revised March, 1995.

Return to Products

APPENDIX L-E

BOATING SAFETY

APPENDIX L-E

CONESTOGA-ROVERS & ASSOCIATES BOATING SAFETY

This procedure provides the minimum requirements for safe work practices during the operation of boating equipment. Proper instruction, practice, and training are important. Boating equipment shall be used for work purposes only. No recreational use or horseplay is allowed.

A. POLICY

This procedure applies to all CRA personnel utilizing these pieces of equipment on navigable waterways. Additionally, CRA subcontractors must adhere to this procedure unless they have an operating procedure as stringent or more stringent than this program.

Boating activities that will be conducted on non-navigable bodies of water (i.e., lagoons, sludge ponds, settling ponds, etc.) shall be exempt from all the requirements stated in this policy except the PPE requirements and the boating safety checklists.

B. REGULATORY BACKGROUND

Authority for regulatory enforcement for boating safety comes from the safe work practices outlined in this section, prescribed by federal, provincial, state, and/or local laws and applicable U.S. Coast Guard Regulations, as well as Transport Canada's Office for Boating Safety and the Canadian Coast Guard.

- Ontario Regulation 851, Section 86.
- Alberta OHSA Code, Sections 240-241.
- Quebec RSQ, Chapter S-2.1, Regulation 6, Section 2.10.13.
- Newfoundland CNLR 1165/96, Section 109.
- Transport Canada Safe Boating Guide, TP-511-E.

C. REGULATORY REQUIREMENTS

There are many issues to be aware of when project activities include working in or from a boat. It is required that all operators of small boats or vessels complete a boating safety course. The training must be documented. Some of these courses can now be

taken on-line. In addition, in the U.S. there are a few states that require operators to be licensed.

The following list summarizes key guidelines for the safe operation of boats:

- The operator of the boat must be in possession of a Pleasure Craft Competency Card in accordance with Transport Canada Office of Safe Boating Guidelines.
- There must be an approved Type I, II, III, or V personal floatation device (PFD) available onboard for each person on the boat. PFDs shall be worn when working in the smaller boats that we use for collecting samples from bodies of water.
- Before and after each use, PFDs shall be inspected for defects that would alter its strength or buoyancy. A defective device shall be removed from service.
- Vessels longer than 4.8 m (16 feet) in length shall also have an approved Type IV throwable ring buoy or buoyant cushion onboard.
- Throwable devices and ring buoys shall have at least 21.3 m (70 feet) of 0.95 cm (3/8-inch) solid braid polypropylene or equivalent line attached.
- No vessel shall be operated in a reckless or negligent manner. Examples of reckless or negligent operation include:
  - excessive speed in regulated or congested areas;
  - operating in a manner that may cause an accident;
  - operating in a swimming area with bathers present;
  - operating while under the influence of alcohol; and
  - operation of a personal watercraft which endangers life or property.
- Every vessel shall display the lights and shapes required by the navigation rules.
- Accidents should be reported immediately to a law enforcement agency.
- It is a good idea for all vessels with a motor to have an approved, fully charged fire extinguisher on board.

D. SAFE WORK PRACTICES

Operator's Responsibilities

- Make sure the boat is in top operating condition and that there are no tripping hazards. The boat should be free of fire hazards and have clean bilges.
- Ensure safety equipment, required by law, is on board, maintained in good condition, and you know how to properly use these devices. See the attachment at the end of this section for Contents of First Aid Kit and Safety Equipment Required.

- File a float and destination plan with the office and/or a co-worker who is ashore.
- Have a complete knowledge of the operation and handling characteristics of your boat.
- Know your position and know where you are going.
- Maintain a safe speed at all times to avoid collision.
- Keep an eye out for changing weather conditions, and act accordingly.
- Know and practice the Rules of the Road (Navigational Rules).
- Know and obey federal, provincial, and state regulations and waterway markers.
- Maintain a clear, unobstructed view forward at all times. "Scan" the water back and forth; avoid "tunnel" vision. Most boating collisions are caused by inattention.

Overloading

Never overload your boat with passengers and cargo beyond its safe carrying capacity. Too many people and/or gear will cause the boat to become unstable. Always balance the load so that the boat maintains proper trim. Here are some things to remember when loading your boat:

- Distribute the load evenly fore and aft from side to side.
- Keep the load low.
- Keep passengers seated (do not stand up in a small boat!).
- Fasten gear to prevent shifting.
- Do not exceed the "Canada Coast Guard Maximum Capacities" information label (commonly called the capacity plate). This plate displays three important items: a) the maximum weight of persons on board in pounds; b) the maximum carrying weight of the vessel in pounds; and c) the maximum horsepower recommended for the boat.

If there is no capacity plate, use the following chart as a guide to determine the maximum number of persons you can safely carry in calm weather. The chart is applicable only to mono-hull boats less than 3 m (10 feet) in length. A mono-hull is a boat, which makes a single "footprint" in the water when loaded to its rated capacity. For example, a catamaran, trimaran, or a pontoon boat is not a mono-hull boat.

Maximum Persons	1	2	2	3	4	5	6	7
Boat Length (m)	1.8	2.4	3	3.7	4.3	4.9	5.5	6
Boat Length (feet)	6	8	10	12	14	16	18	20

Or use the following formula to determine the safe loading capacity when a capacity plate is not available.

FORMULAS FOR SAFE LOADING			
Horsepower Capacity: For small, flat-bottom boats: Multiply boat length (feet) times transom width (feet)		**Person Capacity:** Average weight per person is 150 lbs (68 kg)	
If answer is: 35 or less 36-39 40-42 43-45 46-52	Maximum HP is: 3 5 7.5 10 15	(Boat length X Boat width) 15	= Number of People
Note: for flat-bottom, hard chine boats, with an answer of 52 or less, reduce one increment (e.g., 5 to 3).		Boat length and width are measured in feet. Round fractions down to next lower number.	

Always check the capacity plate to make sure you are not overlooking or over-powering the vessel. A motor larger than recommended will make the stern too heavy and can cause the boat to flip. The transom will ride too low in the water and you could be swamped by your own wake or a passing boat's wake. Your boat will not sit properly in the water and will be difficult to handle.

Too many people (and/or gear) will also cause the boat to become unstable. Always balance the load so that your vessel maintains proper trim. Too much weight to one side or the other will cause the boat to list and increase the chance of taking on water. Too much weight in the bow causes the vessel to plough through the water and too much weight in the stern will create a large wake. All of these situations make the vessel difficult to handle and susceptible to swamping.

Anchoring

Anchoring is done for two principal reasons: first, to stop and stay in one location and secondly, to keep you from running aground in bad weather as a result of engine failure. Anchoring can be a simple task if you follow these guidelines:

- Make sure you have the proper type of anchor (danforth/plough/mushroom).
- A 1 to 2 m (3 to 6 feet) length of galvanized chain should be attached to the anchor. The chain will stand up to the abrasion of sand, rock, or mud on the bottom much better than a fiber line.

- A suitable length of nylon anchor line should be attached to the end of the chain (this combination is called the "Rode"). The nylon will stretch under heavy strain cushioning the impact of the waves or wind on the boat and the anchor.
- Determine depth of water and type of bottom (preferably sand or mud).
- Calculate the amount of anchor line you will need. General rule: 5 to 7 times as much anchor line as the depth of water plus the distance from the water to where the anchor will attach to the bow. For example, if the water depth is 2.4 m (8 feet) and it is 0.6 m (2 feet) from the top of water to your bow cleat, you would multiply 3 m (10 feet) by 5 to 7 to get the amount of anchor line to put out.
- Secure the anchor line to the blow cleat at the point you want it to stop.
- Bring the bow of the vessel into the wind or current.
- When you get to the spot you want to anchor, place the engine in neutral.
- When the boat comes to a stop, slowly lower the anchor. Do not throw the anchor over, as it will tend to entangle the anchor.
- When all anchor line has been let out, back down on the anchor with engine in idle reverse to help set the anchor.
- When anchor is firmly set, use reference points (landmarks) in relation to the boat to make sure you are not drifting. Check these points frequently.
- **Do not anchor by the stern!!**
- Anchoring a small boat by the stern has caused many to capsize and sink. The transom is usually squared off and has less freeboard than the bow. In a current, the force of the water can pull the stern under. The boat is also vulnerable to swamping by wave action. The weight of a motor, fuel tank, or other gear in the stern increases the risk.

Fuelling Precautions

Most fires and explosions happen during or after fuelling. To prevent an accident follow these rules:

- Portable tanks should be refueled ashore.
- Close all hatches and other openings before fuelling.
- Extinguish all smoking materials.
- Turn off engines, all electrical equipment, radios, stoves, and other appliances.
- Remove all passengers.
- Keep the fill nozzle in contact with the tank and wipe up any spilled fuel.

- Open all ports, hatches, and doors to ventilate.
- Run the blower for at least 4 minutes.
- Check the bilges for fuel vapours before starting the engine.
- Do the "sniff test". Sniff around to make sure there is no odour of gasoline anywhere in the boat.

Fuel Management

Practice the "One-Third Rule" by using:

1. One-third of the fuel going out.
2. One-third to get back.
3. One-third in reserve.

E. WEATHER

You should never leave the dock without first checking the local weather forecast. You can get the weather information from the TV, radio, local newspaper, on-line, or from one of the weather channels on your VHF radio.

At certain times of the year, weather can change rapidly and you should continually keep a "weather eye" out. While you are out in a boat, here are a few signs you can look for that indicate an approaching weather change:

- Weather changes generally come from the west. Scan the sky, especially to the west.
- Watch for cloud build-up, especially rapid vertically rising clouds.
- Sudden drop in temperature.
- Sudden change in wind direction and/or speed.
- If you have a barometer on your boat, check it every 2 to 3 hours. A rising barometer indicates fair weather and rise in wind velocity; a falling barometer indicates stormy or rainy weather.

What To Do in Severe Weather

- Reduce speed, but keep just enough power to maintain headway.
- Put on your PFD.
- Turn on running lights.

- Head for nearest shore that is safe to approach, if possible.
- Head bow of boat into the waves at about a 45-degree angle.
- Keep bilges free of water.
- Seat passengers on bottom of boat near centerline.
- If your engine fails, trail a sea anchor on a line from the bow to keep the boat headed into the waves. A bucket will work as a sea anchor in an emergency.
- Anchor the boat if necessary.

F. MAINTENANCE

Preventive Maintenance

Keeping a boat in good working order is essential. Almost all elements of safety revolve around the fact that the boat has been maintained and all its parts and systems are able to perform as they were designed. Negligence in this area will eventually lead to an unsafe or disastrous experience.

Engine

It is important to inspect and check all the engine components and fluids each and every time the boat is used; however, some time must be spent doing periodic maintenance.

Engine maintenance tips include:

- Change oil frequently - following the manufacturer's minimum recommendations or once each season.
- Check and replace belts or hoses that appear to be deteriorating.
- Check for oil and/or water leaks every time before leaving the dock.
- Flush your engine with fresh water after operating in salt water.
- Check impellers and pumps to anticipate a failure.
- Watch for the beginning of corrosion and take measures to stop it before it becomes a problem.
- Check and service transmissions and lower units according to the manufacturer's recommendations.
- Change fluids on a recommended schedule or at least once each season.
- Keep shafts and propellers in clean and good working order.

General Maintenance

Keep the hull and decks of the boat clean and properly waxed. This not only protects the hull from deterioration from the sun but a clean hull will give you better fuel efficiency. Fiberglass should be cleaned with fresh water and a non-abrasive soap. If necessary, a soft brush should be used to help remove debris caught in crevices. Patch any cracks which may occur due to stress, age, or accident.

Keep all aluminum and stainless parts clean and polished with a good metal wax. Metals on boats corrode quickly, especially in a salt-water environment, if not adequately maintained. Check all screws, bolts, and other fittings to keep secure.

The majority of failures in modern day boats are caused by corroded electrical systems. Keep all electrical fittings dry, free of corrosion, and coat with water-repelling, non-conductive grease or corrosion inhibitor such as Pertox.

If at all possible, keep the boat under cover in a garage, warehouse, or boat storage unit. At minimum, keep a cover on the boat to protect the topsides, floors, seats, etc. from the effects of the sun and rain.

Systems

Especially important in larger vessels is the continual maintenance of each system on the boat. An adequate and properly working system, which does what it was designed to do, will make each boating experience a pleasant one. Provide preventive maintenance according to the manufacturer's recommendation to the following:

- Fuel system.
- Fresh water system.
- Generator.
- Electrical.
- Batteries.
- Air conditioning.
- Refrigeration.
- Head and waste system.
- Cooking facilities.

G. TRAINING

Participation in a Boating Safety Training Program will be required for those individuals operating a CRA-owned or rented boat. This program shall adhere to DOT, Coast Guard, provincial and state requirements and must be approved by the Regional SHM.

Qualified Individual List

A Qualified Individual List shall be maintained by each office indicating who has been trained, in accordance with the requirements of this standard, and qualified to operate a CRA-owned or rented boat. The Qualified Individual List shall be updated on an annual basis.

Refresher training shall be conducted on an as-needed basis for those showing deficiencies in the safe work practices outlined above or if involved in an accident.

H. CHECKLISTS AND ATTACHMENTS

- Pre-Departure Boating Checklist.
- Boating Safety Equipment Requirements.

PRE-DEPARTURE BOATING CHECKLIST

Name of Employee Performing Inspection: _____

Trailer Destination: _____ Date: _____

PERSONAL FLOTATION DEVICES (PFDs)			
At least one Coast Guard approved device per passenger and a minimum of two on board.	☐ Yes	☐ No	
An additional throwable device is required if the vessel is more than 4.9 m (16 feet) long.	☐ Yes	☐ No	
Explain the location and use of all PFDs to passengers and crew that may be new to the vessel.	☐ Yes	☐ No	
SOUND PRODUCING DEVICES (WHISTLE)			
Must have a horn capable of producing a 4-second blast audible for at least 0.8 km (½ mile).	☐ Yes	☐ No	☐ NA
If a portable air horn, have a spare can of air or an alternate device.	☐ Yes	☐ No	☐ NA
LIGHTS AND SHAPES			
All navigation lights as required.	☐ Yes	☐ No	☐ NA
Instrumental lights working.	☐ Yes	☐ No	☐ NA
If you intend to engage in an activity that requires a day shape, have the required shapes.	☐ Yes	☐ No	☐ NA
Flashlight on board.	☐ Yes	☐ No	☐ NA
DISTRESS SIGNALS			
Accessible flares, day signals, etc., stored in a dry location.	☐ Yes	☐ No	☐ NA
Carry signals at all times even if not required by the Coast Guard.	☐ Yes	☐ No	☐ NA
Inform the crew and passengers of their location and their use.	☐ Yes	☐ No	☐ NA
TOOLS AND SPARES			
Basic tool box on board.	☐ Yes	☐ No	☐ NA
Box of spares aboard, e.g., fuel filter, light bulbs, head parts, through hull plugs, etc.	☐ Yes	☐ No	☐ NA
VENTILATION			
On any powered vessel or auxiliary powered sailboat, or vessels using LPG for cooking or heat, check that all interior spaces are well ventilated before departure.	☐ Yes	☐ No	☐ NA
If fuel smells are detected before ventilating, check after running the blowers for several minutes before starting.	☐ Yes	☐ No	☐ NA
If odour persists, stop and look for the source of the leak.	☐ Yes	☐ No	☐ NA

FIRE EXTINGUISHERS			
Accessible fire extinguisher. Do you have at least those required by the USCG?	☐ Yes	☐ No	☐ NA
Check to be sure mounts are secure and functional before departure.	☐ Yes	☐ No	☐ NA
Take the time to point out locations to passengers and crew.	☐ Yes	☐ No	☐ NA
FUEL AND OIL			
Are your tanks topped-off?	☐ Yes	☐ No	☐ NA
If not, have enough fuel to provide a reasonable margin of safety for your return.	☐ Yes	☐ No	☐ NA
Check the engine oil and coolant level.	☐ Yes	☐ No	☐ NA
BILGES			
Check to be sure bilges are reasonably dry and that pumps are not running excessively.	☐ Yes	☐ No	☐ NA
Clean up any spilled oil or waste in bilges so as to prevent overboard discharge.	☐ Yes	☐ No	☐ NA
BATTERY CARE			
If you have a dual charging system, is the selector switch in the proper position?	☐ Yes	☐ No	☐ NA
Is the power on to the entire vessel?	☐ Yes	☐ No	☐ NA
Spare batteries for accessories such as a handheld radio, flashlight, portable navigational aid, etc.	☐ Yes	☐ No	☐ NA
If they are rechargeable, are they charged?	☐ Yes	☐ No	☐ NA
WEATHER FORECAST			
Did you check the weather forecast?	☐ Yes	☐ No	
Radio on board to receive weather updates.	☐ Yes	☐ No	☐ NA
DOCKING AND ANCHORING			
At least one anchor set up and bent-on to your anchor line.	☐ Yes	☐ No	☐ NA
Two or three extra docklines in case of unusual conditions dockside.	☐ Yes	☐ No	☐ NA
Visually inspect the lines you use for chafe or wear.	☐ Yes	☐ No	☐ NA
At least two fenders on board for docking or towing if required.	☐ Yes	☐ No	☐ NA
DOCUMENTATION			
Have the ship's papers, radio license, fishing permit, etc. on board.	☐ Yes	☐ No	☐ NA
Have the chart or charts for the area you intend to cruise in, regardless of your level of local knowledge	☐ Yes	☐ No	☐ NA

BOATING SAFETY EQUIPMENT REQUIREMENTS

Items that should be on board at all times:

- Life jackets for each person on board
- Flares
- Paddle
- Anchor
- Tie-down straps for stern
- Flashlight or spotlight
- 2-cycle motor oil
- Fire extinguisher (attached to boat near steering wheel)
- Throwable floating cushion
- Signal horn (canister)
- Tow rope
- First aid kit
- VHF radio
- Jack (truck)
- Boat registration papers

Things to check for before leaving office:

- Trailer lights
- Boat bow and stern light
- Bilge pump
- Wheel bearings (periodically need to add bearing grease)
- Trailer tires

Other good things to have on board:

- Maps of area
- Insect repellent
- Ice chest with water
- Communication Device (cell phone, walkie-talkie, etc.)
- Sun screen
- Small tool box
- Knife

A general float plan shall be discussed with at least one person in the CRA office prior to departure.

Periodic communication via cell phone is recommended when launching boat.

APPENDIX L-F

RESPIRATORY PROTECTION

CONESTOGA-ROVERS & ASSOCIATES

RESPIRATORY PROTECTION PROGRAM

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1.0 PURPOSE

It is the policy of Conestoga-Rovers & Associates (CRA) to provide safe and healthful working conditions for its employees and to comply with both state and Federal Occupational Safety and Health Administration (OSHA) requirements. As part of this policy, this written respiratory protection program has been developed to ensure proper administration of the CRA Respiratory Protection Program, adherence to regulatory and contractual requirements, and preservation of the health and well being of CRA employees.

It must always be kept in mind that the use of any kind of a respirator is the **last** choice in employee protection. CRA will investigate all feasible engineering and administrative controls to control airborne contaminates prior to use of respirators to minimize the reliance on respiratory protective devices.

2.0 SCOPE

This program establishes the Respiratory Protection Program for CRA. All CRA employees, subcontractors, or any other individuals falling under CRA responsibility are required to adhere to the guidelines and requirements of this program.

3.0 REGULATORY BACKGROUND

This program has been prepared to comply with the requirements of Title 29, Section 1910.134 of the Code of Federal Regulations (29 CFR 1910.134), the Respiratory Protection Standard. This program contains CRA's policies and procedures for the following:

- Respirator selection;
- Medical evaluations;
- Fit testing procedures;
- Proper use of respirators;
- Inspection, cleaning, and storage of respirators;
- Air quality, quantity, and flow for supplied air respirators; and
- Training.

4.0 PROGRAM ADMINISTRATION

The Respiratory Protection Standard (29 CFR 1910.134(c)(3)) requires "The employer shall designate a program administrator who is qualified by appropriate training or experience that is commensurate with the complexity of the program to administer or oversee the respiratory protection program and conduct the required evaluations of program effectiveness."

The Corporate Safety and Health Manager (CSHM) will serve as the overall administrator of this program. In addition, the Safety Supervisors (SS) for each project under their responsibility will ensure the following:

- Verify that CRA employees have received the proper training in respiratory protection;
- Ensure that employees have been provided appropriate respiratory devices;
- Ensure that employees, when leaving the work area, wash and change out cartridges at the end of shifts, at break time and if break-through has occurred;
- Ensure that employees have been fit tested with respiratory devices; and
- Ensure that employees have proper medical clearance to wear respiratory devices.

The cost for administering this program will be paid for solely by CRA. This includes the cost of all respirators, respiratory protection supplies, training and medical evaluations.

5.0 DUTIES AND RESPONSIBILITIES

5.1 SUPERVISORS AND PROJECT MANAGERS

Due to the varying nature of CRA projects and work locations, it is project management's responsibility (through consultation with the SS) to coordinate the requirements of CRA's Respiratory Protection Program as applicable to their project(s).

Supervisors and project managers have the following duties and responsibilities with respect to this program:

- Ensure that respiratory protective devices are available to employees for their use against harmful vapors and oxygen deficient atmospheres;
- Ensure that employees are wearing respiratory protective devices as appropriate; and
- Ensure that employees are provided annual training, medical evaluations and fit tests.

5.2 EMPLOYEES

Employees are responsible for the following:

- Wearing proper respiratory protective devices as applicable;
- Using engineering controls to reduce airborne exposure when possible;
- Participating and assisting in employee exposure assessment studies; and
- Complying with the CRA Respiratory Protection Program requirements.

6.0 PROGRAM ELEMENTS

6.1 SELECTION PROCEDURES

A number of factors must be considered in the selection of the appropriate respiratory protection device. This section outlines these factors.

Once the need for a respirator has been identified, the basic steps for selecting a respirator are:

1. Choose only approved respirators.
2. Evaluate the anticipated respiratory hazards such as:
   - 2.1 Physical state (vapor or particulate).
   - 2.2 Contaminant type and concentration.
   - 2.3 Oxygen levels.
3. Determine if the atmosphere is Immediately Dangerous to Life and Health (IDLH):
   - 3.1 If IDLH, you must use the most protective supplied-air devices.
   - 3.2 If not IDLH, you may use equipment other that the most protective supplied-air devices provided they are appropriate for the contaminant and concentration in question.

6.2 RESPIRATOR APPROVAL

Only respirators certified by the National Institute of Occupational Safety and Health (NIOSH) shall be used by CRA employees (29 CFR 1910.134(d)(1)(i)). The certification must include the exact style of mask used, and approval of the cartridge type for air purifying respirators.

6.3 TYPES OF RESPIRATORS

When respirators are used, the predominate type employed by CRA is the air-purifying device. Infrequently, CRA utilizes air-supplied respirators. These devices are used when United States Environmental Protection Agency (USEPA) Level B is specified in a

health and safety plan (HASP). However, it is CRA's policy **NOT** to use compressors for the purpose of supplying breathing air.

6.3.1 AIR-PURIFYING RESPIRATORS

These respirators remove air contaminants by filtering, absorbing, adsorbing, or chemical reaction with the contaminants as they pass through the respirator canister or cartridge. This respirator is to be used only where adequate oxygen (19.5 to 23.5 percent by volume) is available. Air-purifying respirators can be classified as follows:

- Particulate removing respirators, which filter out dusts, fibers, fumes, and mists. These respirators may be single-use disposable respirators or respirators with replaceable filters;
- Gas- and vapor-removing respirators, which remove specific individual contaminants or a combination of contaminants by absorption, adsorption, or by chemical reaction. Gas masks and chemical-cartridge respirators are examples of gas- and vapor-removing respirators; and
- Combination particulate/gas- and vapor-removing respirators, which combine the respirator characteristics of both kinds of air-purifying respirators.

6.3.2 SUPPLIED-AIR RESPIRATORS

These respirators provide breathing air independent of the environment. Such respirators are to be used when the contaminant has insufficient odor, taste, or irritating warning properties, or when the contaminant is of such high concentration or toxicity that an air-purifying respirator is inadequate. Supplied-air respirators, also called air-line respirators, are classified as follows:

- Demand - This respirator supplies air to the user on demand (inhalation) which creates a negative pressure within the facepiece. Leakage into the facepiece may occur if there is a poor seal between the respirator and the user's face. CRA does not own or use this type of device;
- Pressure-Demand - This respirator maintains a continuous positive pressure within the facepiece, thus preventing leakage into the facepiece; and

- Continuous Flow - This respirator maintains a continuous flow of air through the facepiece and prevents leakage into the facepiece.

6.3.3 SELF-CONTAINED BREATHING APPARATUS

This type of respirator allows the user complete independence from a fixed source of air and offers the greatest degree of protection but is also the most complex. Training and practice in its use and maintenance is essential. This type of device will be used in emergency situations or where United States Environmental Protection Agency (USEPA) Level A or B protection is required.

6.4 AIR QUALITY FOR SUPPLIED-AIR RESPIRATORS

When any form of supplied-air respirator is used, the breathing air supply shall meet or exceed the American National Standard Institute (ANSI)/Compressed Gas Association (CGA-G7.1-1989) Standards for Grade D breathing air. This air quality must be verified with the air supplier for quality control purposes. This is accomplished by reviewing the paperwork from each supplier to make sure that the breathing air has been approved as Grade D. Copies of this paperwork are maintained with the Equipment Manager in each CRA office that utilizes breathing air.

6.5 HAZARD EVALUATION

The selection of the appropriate respirator to use must be appropriate for the respiratory hazards to which the employee is exposed (29 CFR 1910.134(d)(1)(i)). This involves conducting a workplace assessment and selecting a respirator based on the hazards identified.

At a minimum, the following data must be determined or reasonably estimated:

- Oxygen concentration;
- Presence and concentration of airborne contaminants; and
- Physical form of airborne contaminants; either gasses, vapors, mists, or particulates.

6.5.1 IDLH ATMOSPHERES

An IDLH atmosphere is an atmosphere that poses an immediate threat to life, would cause irreversible adverse health effects, or would impair an individual's ability to escape from a dangerous atmosphere (29 CFR 1910.134(b)).

Oxygen Deficiency

Air Purifying Respirators (APRs) cannot be used at oxygen concentrations below 19.5 percent; a Supplied Air Respirator (SAR) must be used. The atmosphere is considered to be IDLH if the oxygen content is or may fall below the limits shown in Table 621 (29 CFR 1910.134(d)(2)(iii)).

TABLE 6-1 OXYGEN DEFICIENT IDLH LEVELS

Altitude (feet)	*Any Type of SAR*	*Atmosphere Considered IDLH**
Less than 3,001[A]	19.5%	16.0%
3,001 - 4,000	19.5%	16.4%
4,001 - 5,000	19.5%	17.1%
5,001 - 6,000	19.5%	17.8%
6,001 - 7,000	19.5%	18.5%
7,001 - 8,000	19.5%	19.3%
Over 8,000	19.5%	19.5%
Over 14,000	19.5%; breathing air that is enriched in oxygen must be supplied	

* IDLH requires positive pressure SCBA or airline respirator with and escape bottle.

6.5.2 NON-IDLH ATMOSPHERES

The respirator chosen for protection against airborne contaminants in a non-IDLH setting must protect the health of the employee under routine and reasonably foreseeable emergency conditions (29 CFR 1910.134(d)(3)(i)). To properly select a respirator in this situation, the contaminant, the concentration, and physical form of contaminant must be known.

Concentration

Respirators work by reducing, not eliminating, the concentration of contaminants in the worker's breathing zone. The measure of how efficient a given respirator is in any situation is dependent on many variables, including the breathing rate and volume of the user, the fit of the respirator, and the efficiency of the cartridge. Most practitioners use the concept of Assigned Protection Factors (APFs) to estimate how efficient a respirator is. An APF is the measure of how efficient a particular respirator is in reducing worker exposure to an inhalation hazard. For example, if the concentration of substance outside the respirator was 90 parts per million (ppm), and the respirator reduced the levels to 9 ppm, the respirator would have an APF of 10.

OSHA, in the revisions to the Respiratory Protection Standard, reserved references to APFs for a future rulemaking. In the interim, OSHA "...expects employers to take the best available information into account in selecting respirators. OSHA itself will continue to refer to the NIOSH APFs..." (Federal Register Volume 63, No. 5, page 1204).

NIOSH considers half-face APRs to have an APF of 10 and full face respirators to have an APF of 50. Therefore, half-face APRs cannot be used in situations where the concentration exceeds ten times the permissible level, and full-face APRs cannot be used in atmospheres over 50 times this concentration.

Physical Form

APRs work by filtering contaminants out of the air breathed by the user. This is why they cannot be used in areas of oxygen deficiency. If an APR can be used, the selection of the correct cartridge to use on an APR depends on the form of the contaminant. Contaminants can either be gasses, like carbon monoxide or hydrogen sulfide, or particulates such as lead dust or asbestos.

For protection against gasses and vapors, the following types of respirators may be used at CRA:

- An APR that meets the following conditions:
  - The APR is equipped with an End of Service Life Indicator (ESLI) certified by NIOSH for the contaminant; or

- A cartridge change-out policy (Section 3.5) has been developed and implemented.

For protection against dusts, fumes, and mists, the following types of respirators may be used:

- An air purifying respirator with a filter certified by NIOSH as a High Efficiency Particulate Air (HEPA) filter.

6.6 RESPIRATOR USE GUIDELINES

The following sections contain minimum requirements for the safe and effective use of respirators.

Respirator Sealing Problems

CRA employees may not use tight-fitting respirators when certain conditions prevent achieving a satisfactory seal (29 CFR 1910.134(g)(1)):

- Any facial hair that comes between the sealing surface of the facepiece and the face or that interferes with valve function;
- The wearing of a spectacle, a goggle, a face shield, a welding helmet, or other eye and face protective device that interferes with the seal; and
- Scars, hollow temples, excessively protruding cheekbones, deep creases in facial skin, the absence of teeth or dentures, or unusual facial configurations that prevent sealing a respirator facepiece to a wearer's face.

Respirator Sealing Tests

CRA employees who plan to use a respirator equipped with a tight-fitting facepiece must check the seal of the respirator using a positive or negative pressure seal check, or equivalent means recommended by the manufacturer, before entering the potentially hazardous work area (29 CFR 1910.134(g)(1)(iii)). Procedures for the seal check are included in Appendix D.

Facepiece Seal Protection

The following minimum procedures must be followed to ensure that respirator seals are not compromised.

- Employees with facial hair, scars, or any other condition that might interfere with the seal may not use a tight fitting respirator facepiece;
- Corrective glasses or protective equipment cannot interfere with the respirator seal or function; and
- If the seal should break in a hazardous area, the user shall exit the area to re-don the respirator and check the seal. If the user experiences frequent seal breaks the respirator does not fit and the user must select and be fit tested for another.

Evacuation Requirements

Employees using respirators will return to an area of known clean air in the following conditions:

- If the seal should break in a hazardous area, the user shall exit the area to re-don the respirator and check the seal. If the user experiences frequent seal breaks the respirator does not fit and the user must select and be fit tested for another;
- To wash their faces and respirator facepieces as necessary to prevent skin or eye irritation;
- If vapor or gas breakthrough occurs, or changes in breathing resistance are noted, or signs of exposure are observed;
- Monitoring instruments document changes in contamination concentrations that result in the need to upgrade protective equipment; and
- Any sign of respirator damage or malfunction is noted.

If breakthrough, damage, or malfunction has occurred, the employee cannot reenter the hazardous area without first servicing, repairing, or replacing, the respirator.

Work In IDLH Atmospheres

CRA will not be permitted to work in IDLH atmospheres.

6.6.1 CARTRIDGE CHANGE-OUT

Manufacturers provide APR cartridges to protect against a variety of typical airborne contaminants. The types most often used at CRA are organic vapor cartridges, either alone or in combination with an acid gas cartridge, and HEPA cartridges.

OSHA requires (29 CFR 1910.134(d)(3)(iii)(B)(2)) "If there is no ESLI appropriate for conditions in the employer's workplace, the employer implements a change schedule for canisters and cartridges that is based on objective information or data that will ensure that canisters and cartridges are changed before the end of their service life."

The purpose of the cartridge change out policy is to prevent breakthrough or saturation of the cartridge absorbent or filter from occurring.

CRA Cartridge Change-out Policy

CRA will use the following procedures for cartridge changes:

- The cartridge has exceeded the ESLI for the contaminant;
- Cartridges have become damaged or defective; and
- Cartridges will be changed/replaced in accordance with the site-specific HASP.

Ultimately, the cartridge manufacturer has to be consulted to calculate/predict cartridge change-out procedures based on the chemicals of concern and the variable factors listed above. This potentially will differ with each brand of respirator used at CRA.

6.4 MEDICAL SURVEILLANCE

CRA personnel required to wear a respirator will be evaluated prior to initial use of respirators and then annually thereafter to determine their capability to wear a respirator. The evaluation will be conducted by a physician or other licensed health care physician (PLHCP).

Medical Clearance

CRA 's consulting PLHCP reviews the clinical data and any other required data and issues an opinion as to the employee's suitability to use a respirator.

Additional Medical Evaluations

Employees are provided with additional evaluations (29 CFR 1910.134(e)(7)) if:

- The employee reports medical signs or symptoms that are related to ability to use a respirator;
- Information from the Respiratory Protection Program, including observations made during fit tests and program evaluation, indicates a need for reevaluation; and
- A change in workplace conditions that may result in a substantial increase in the physiological burden placed on an employee.

6.5 RECORD KEEPING

A qualitative or quantitative fit test (QLFT or QNFT) must be used to determine the ability of employees to obtain a satisfactory fit with any tight-fitting facepiece prior to assignment (29 CFR 1910.134(f)). The results of fit tests will then be used to select specific types, makes, and models of respirators appropriate for the wearers. Employees may not use any tight-fitting facepiece without passing a fit test for that exact make and model of facepiece.

Appendix C contains the OSHA required QLFT and QNFT protocols.

Frequency of Testing

Employees will be fit tested prior to initial use of a respirator, whenever a different size, style, make or model of facepiece is used, and at least annually thereafter (29 CFR 1910.134(f)(2)).

Additional fit testing will be performed (29 CFR 1910.134(f)(3)) whenever the employee, the employee's supervisor, or the program administrator observes changes to the

employee's physical condition (scarring, facial hair, dental changes, significant weight changes, etc.) that might affect the fit of the respirator.

If, subsequent to a successful fit test, the employee later determines the fit of the respirator to be unacceptable, the employee will be provided with a reasonable opportunity to select another respirator (29 CFR 1910.134(f)(4)).

Qualitative Respirator Fit Tests

A QLFT test determines the *quality* of the fit of a facepiece - either good or bad. It cannot determine the actual protection factor of the equipment. OSHA (29 CFR 1910.134(f)(6)) only allows QLFT testing for situations where a respirator fit factor of 100 or less is required. The Protection Factor for a respirator is determined by dividing the fit factor by a safety margin of 10, so passing a QLFT qualifies a person as having a Protection Factor of 10 for that respirator.

Therefore, any tight-fitting facepiece may be tested to an Assigned Protection Factor of 10 using QLFT. If a tight-fitting supplied air respirator is tested with a QLFT protocol, the respirator cannot be used in atmospheres over 10 times the permissible exposure level, and cannot be used in IDLH atmospheres, regardless of the type of respirator.

Irritant Smoke Test

The irritant smoke test can be used for both air-purifying respirators and atmosphere-supplying respirators. When an air-purifying respirator is tested, it should be equipped with a HEPA filter. The irritant smoke is produced by air flowing through a commercially available smoke tube normally used to check the performance of ventilation systems.

Isoamyl Acetate Test

The odorous vapor test can be used for both air-purifying respirators and atmosphere-supplying respirators. When an air-purifying respirator is tested, it should be equipped with an organic vapor cartridge. The person being fit tested will smell the banana-like odor of the isoamyl acetate if the fit of the respirator is unsatisfactory and report same to the test administrator.

Quantitative Respirator Fitting Test

For a QNFT, the individual wears a respirator in an atmosphere containing a test agent in the form of an aerosol, vapor, or gas. Instrumentation, which samples the test atmosphere and the air inside the respirator, is used to measure the penetration of the test agent into the respirator. This method of testing determines the exact fit factor of the respirator on the person being tested. For example, if the instruments measure a concentration of 1,000 ppm outside the facepiece and 1 ppm inside, that facepiece on that individual has a fit factor of 1,000.

Any QNFT documenting a fit factor of 500 or greater may be used to validate the equipment to its maximum use concentration. For example, NIOSH assigns an airline respirator without an escape bottle, operated in positive pressure mode, a Protection Factor of 1,000. Any QNFT that documents the wearer exceeding a fit factor of 500 would allow use of this respirator up to the 1,000 times the action level.

Facial Hair

OSHA mandates (29 CFR 1910.134 Appendix A) that fit testing cannot be done if there is any hair growth between the skin and the sealing surface of the respirator. This includes stubble, beards, mustaches, or sideburns.

Fit Test Procedures

The following procedures must be followed when providing any QLFT of QNFT (Appendix A to 29 CFR 1910.134). The test specific procedures are provided in Appendix C.

1. The employee will be allowed to select a facepiece from a sufficient array of size, makes, and models of NIOSH certified respirators to ensure a correctly fitting and acceptable respirator. The employee will be asked to select the facepiece with the most acceptable fit.
2. The tester will then review respirator donning and doffing procedures with the employee. A mirror is recommended to assist the employee in evaluating the fit of the respirator.

3. The employee will wear the facepiece for at least 5 minutes. The employee will be furnished with written instructions for the exercise regimen during this period.
4. If the respirator is a model unfamiliar to the employee, the tester will assist the employee in donning and doffing the facepiece several times to familiarize them with the unit.
5. The tester and employee will check the following items for fit and comfort: Position and fit of mask on the nose; room for eye protection; room to talk; position of mask on face and cheeks; chin properly placed; appropriate strap tension; and slipping tendency.
6. Employee will then conduct negative and positive pressure seal checks (Appendix D). For a negative check, cover the inhalation valves and breathe in; the facepiece should collapse slightly. For the positive check, cover the exhalation valve and breath out slightly (normally); the mask should bulge outward. The employee should not feel any air escaping or entering the mask.
7. If the employee routinely uses any safety equipment that might interfere with respirator fit (such as safety glasses with half-face respirators), it must be worn during the fit testing.
8. The following test exercises will be conducted for 1 minute while standing, except for the grimace exercise that is conducted for 15 seconds:
   - Normal breathing;
   - Deep breathing;
   - Turn head slowly side to side;
   - Nod head slowly up and down; inhale when looking upwards;
   - Talk slowly and loudly enough to be heard by the instructor. The employee can recite a story, count backwards from 100, read the 'rainbow passage' or another prepared script, etc.;
   - Grimace (smile or frown). (NOTE: OSHA states that this is required only for QNFT testing);
   - If possible, bend over from the waist. Jogging in place may be used if the test conditions prevent bending; and
   - Normal breathing.
9. If, at any time during the test the employee reports exposure to the challenge substance or the computerized QNFT test indicates failure, the test is to be

stopped, and the employee will be offered the opportunity to adjust the respirator or select a different one.

Respirator Fit Test Records

CRA will maintain records of respirator fit tests until the next test is taken (see Appendix F for form). The following information will be documented during the fit test:

- Name of employee being tested;
- Type of fit test used;
- Specific make, model, style, and size of respirator tested;
- Date of test; and
- Pass/Fail test results for QLFTs, or the fit factor and strip charts or other record for QNFTs.

7.0 RESPIRATOR MAINTENANCE

CRA employees will be responsible for cleaning and maintaining their personally assigned respirators.

Cleaning and Sanitizing

Employees shall clean and sanitize personally assigned respirators in accordance with the procedures outlined in Appendix E. Non-personally assigned respirators shall be cleaned after each use by the user.

Respirators used in fit testing shall be cleaned and sanitized between each use.

Storage

Respirators must be stored in a manner that will protect them against damage, contamination, dust, sunlight, extreme temperatures, excessive moisture, or damaging chemicals. Respirators should also be stored to prevent distortion of rubber or other elastomeric parts. Respirators must not be stored in such places as lockers and toolboxes unless they are protected as stated above.

Inspection

Each respirator must be inspected before each use and during cleaning to ensure it is in proper working condition. These inspections are documented on the Inspection Record Form that is provided in Appendix G.

A respirator inspection must include a check for respirator function; connection tightness; for the condition of the respiratory inlet covering, head harness, valves, connecting tubes, harness assemblies, filters, cartridges, canisters, ESLI, and shelf life date(s); and for the proper function of regulators, alarms, and other warning systems.

Each rubber or other elastomeric part must be inspected for pliability and signs of deterioration.

Part Replacement and Repair

Parts replacement may be performed by the employee to whom the respirator is assigned in accordance with the manufacturer's procedures. Replacement parts must be only those designed for the specific respirator being repaired.

Respirator repair, beyond user-serviceable parts, will be performed by trained and authorized third parties. Reducing or admission valves must be returned to the manufacturer or to a trained technician for repair or adjustment. Instrumentation for valve tests must be approved by the manufacturer.

8.0 EMPLOYEE TRAINING

CRA will provide training to all employees participating in the Respiratory Protection Program. This training will be provided at:

- The time of initial employment;
- Annually;
- Whenever changes in respiratory protective equipment or respiratory hazards in the workplace occur;
- Whenever inadequate employee knowledge or use of the respirator indicates that the employee has not retained the requisite understanding or skills required to wear respiratory protection equipment; and
- Whenever any other situation in which retraining appears necessary to ensure safe respirator usage.

The training program shall include the following elements:

- The basic elements of the CRA Respiratory Protection Program;
- Responsibilities of managers and employees;
- The criteria for selecting respirators;
- Proper inspection procedures for respirators;
- Maintenance and storage of respirators;
- Regulations concerning respirator use, including a review of 29 CFR 1910.134;
- A review of forms to be used for respirator fit tests, training records, and respirator inspection records;
- The reason(s) respiratory protection is required on the work sites;
- The general nature, extent, and effects of respiratory hazards to which the person may be exposed;
- A discussion of possible engineering controls as they relate to the types of work sites with which CRA employees are involved;
- An explanation of the operation, capabilities, and limitations of the respirator selected; and
- Instruction in donning, checking the fit of, wearing, and use of respirators.

The successful completion of the training program shall be documented and kept on file.

9.0 PROGRAM EVALUATION AND DOCUMENT CONTROL

Evaluations of our workplaces are conducted periodically to ensure compliance with CRA's Respiratory Protection Program and its effectiveness. Employees are questioned about fitting, selection, use and maintenance of the respirators that they wear. This program will be reviewed and updated as necessary, at a frequency necessary to maintain its effectiveness. The responsibility for maintenance of this program belongs to the Corporate Safety and Health Manager.

APPENDIX A –DEFINITIONS AND ABBREVIATIONS

ACGIH	American Conference of Governmental Industrial Hygienists
Aerodynamic diameter	The diameter of a unit density sphere having the same settling velocity as the particle in question, whatever the shape and density.
Aerosol	A system consisting of particles, solid or liquid, suspended in air.
Air-regulating valve	An adjustable valve used to regulate, but which cannot completely shut off, the airflow to the facepiece, helmet, hood, or suit of an air-line respirator.
Air-supply device	A hand- or motor-operated blower for the hose mask, or a compressor or other source of respirable air for the air-line respirator.
Anesthetic	A substance that causes loss of feeling and sensation with unconsciousness and death possible (for example: nitrous oxide, hydrocarbons, and ethers). Some anesthetics injure body organs (for example: Carbon tetrachloride (liver and kidneys), chloroform (liver and heart), benzene (bone marrow), and carbon disulfide (nervous system)).
ANSI	American National Standards Institute
Approved	Tested and listed as satisfactory by the National Institute of Occupational Safety and Health (NIOSH) of the U.S. Department of Health and Human Services
Asphyxiant	A substance that interferes with utilization of oxygen in the body.
Asphyxiant - chemical	A substance that in low concentrations interferes with supply or utilization of oxygen in the body (for example: carbon monoxide, hydrogen cyanide, cyanogen, and nitriles).
Asphyxiant - simple	A physiologically inert substance that dilutes oxygen in the air (for example: nitrogen, hydrogen, helium, and methane).
Breathing tube	A tube through which air or oxygen flows to the facepiece, mouthpiece, helmet, hood, or suit.
Canister (air-purifying)	A container with a filter, sorbent, or catalyst, or any combination thereof, that removes specific contaminants from the air drawn through it.

Carcinogen	A substance known to produce cancer in some individuals following a latent period (for example: Asbestos, chromates, or radioactive particulates).
Cartridge	A small, air-purifying, canister.
Catalyst	In respirator use, a substance that converts a toxic gas (or vapor) into a less toxic gas (or vapor).
Ceiling concentration	The concentration of an airborne substance that must not be exceeded.
Confined space	Any space with limited means of egress subject to toxic or flammable contaminant accumulation or to an oxygen deficient atmosphere. Confined spaces include but are not limited to storage tanks, process vessels, bins, boilers, ventilation or exhaust ducts, sewers, underground utility vaults, tunnels, pipelines and open top spaces more than 4 feet deep, such as pits, tubes, vaults and vessels.
Contaminant	A harmful, irritating, or nuisance material that is foreign to the normal atmosphere.
Demand	A type of self-contained breathing apparatus or air-line respirator that functions due to negative pressure created by inhalation (i.e., air flow into the facepiece on "demand").
DOP	Dioctyl phthalate, a particulate with a fairly uniform size of about 0.3 micrometers and used in testing HEPA filters.
Dust	A solid particle suspended in air, generated by handling, drilling, crushing, grinding, rapid impact, detonation, or decrepitation of organic or inorganic materials such as rock, ore, metal, coal, wood, grain, and etc.
Emergency respirator	A respirator available to be worn when a hazardous atmosphere suddenly occurs that requires immediate use of a respirator either for escape from the hazardous atmosphere or for entry into the hazardous atmosphere.
Exhalation valve	A device that allows exhaled air to leave a respirator and prevents outside air from entering through the valve.
Eyepiece	A gas-tight, transparent window(s) in a full facepiece, helmet, hood, or suit, through which the wearer may see.
Face shield	A device worn in front of the eyes and a portion of, or all of, the face, whose predominant function is protection of the eyes and the face.

Facepiece	That portion of a respirator that covers the wearer's nose and mouth in quarter-mask (above the chin) or half-mask (under the chin) facepiece or that covers the nose, mouth, and eyes in a full facepiece. It is designed to make a gas-tight or particle-tight fit with the face and includes the headbands, exhalation valve(s), and connections for an air-purifying device or respirable gas source, or both.
Fibrosis (producing dust)	Dust that, when inhaled, deposited, and retained in the lungs, may result in fibrotic growth that may cause reduced pulmonary function.
Filter	A media component used in respirators to remove solid or liquid particles from inspired air.
Fog	A mist of sufficient concentration to perceptibly obscure vision.
Fume	Solid particles suspended in air, generated by condensation from the gaseous state, generally after volatilization from molten metals, etc., and often accompanied by a chemical reaction such as oxidation.
Gas	An aeriform fluid that is in the gaseous state at ordinary temperature and pressure.
Goggle	A device with contour-shaped eyecups and glass or plastic lenses worn over eyes and held in place by a headband or other suitable means for protection of the eyes and eye sockets.
Hazardous atmosphere	Any atmosphere, either immediately or not immediately dangerous to life or health, which is oxygen deficient or contains a toxic or disease-producing contaminant.
Head harness	That part of a facepiece assembly that secures the facepiece to the wearer.
Helmet	That portion of a respirator that shields the eyes, face, neck, and other parts of the head.
HEPA	High-efficiency particulate air filter
HEPA	High efficiency particulate air filter that removes 99.97 percent or more of monodisperse dioctyl phthalate (DOP) particles with a mean particle diameter of 0.3 micrometer from air.
Hood	That portion of a respirator that completely covers the head, neck, and portions of the shoulders.
HSM	Area Health and Safety Manager

IDLH	Immediately dangerous to life or health
IDLH	Immediately dangerous to life or health. Any atmosphere that poses an immediate hazard to life or produces immediate irreversible debilitating effects on health.
Inhalation valve	A device that allows respirable air to enter a respirator and prevents exhaled air from leaving the respirator through the valve.
Irrespirable	Unfit for breathing.
Irritant	Corrosive in action. May cause irritation and inflammation of parts of the respiratory system (also skin and eyes) and pulmonary edema.
Maximum use limit	Refers to filters, cartridges, or canisters. The maximum concentration of a contaminant for which an air-purifying filter, cartridge, or canister is approved for use.
Mist	Liquid droplets suspended in air, generated by condensation from the gaseous to the liquid state or by breaking up a liquid into a dispersed state, such as by splashing, foaming, or atomizing.
Mouthpiece	That portion of a respirator that is held in the wearer's mouth and is connected to an air-purifying device or respirable gas source, or both. It is designed to make a gas-tight or particle-tight fit with the mouth.
MPCa	Maximum permissible air-borne concentration. These concentrations are set by the National Committee on Radiation Protection. They are recommended maximum average concentrations of radionuclides to which a worker may be exposed, assuming that he/she works 8 hours a day, 5 days a week, and 50 weeks a year.
MSHA	Mines Safety and Health Administration
Negative pressure respirator	A respirator in which the air pressure inside the respiratory inlet covering is positive during exhalation in relation to the air pressure of the outside atmosphere and negative during inhalation in relation to the air pressure of the outside atmosphere.
NIOSH	National Institute of Occupational Safety & Health
Nonroutine respirator use	Wearing a respirator when carrying out a special task that occurs infrequently.
Nose clamp	A device used to close the nostrils of a worker wearing a respirator equipped with a mouthpiece (sometimes called a nose clip).

Not IDLH	Not immediately dangerous to life or health. Any hazardous atmosphere that may produce physical discomfort immediately, chronic poisoning after repeated exposure, or acute adverse physiological symptoms after prolonged exposure.
Odor threshold limit	The lowest concentration of a contaminant in air that can be detected by the olfactory sense.
OSHA	Occupational Safety and Health Administration
Oxygen deficiency-not IDLH	An atmosphere having an oxygen concentration below the minimum legal requirement of 19.5 percent by volume for respirable air at sea-level conditions, but above that which is immediately dangerous to life or health.
PAPR	Powered air purifying respirator
Particulate matter	A suspension of fine solid or liquid particles in air, for example: Dust, fog, fume, mist, smoke, or spray. Particulate matter suspended in air is commonly known as an aerosol.
PEL	Permissible exposure limit
Permissible exposure limit (PEL)	The legally established time-weighted average (TWA) concentration or ceiling concentration of a contaminant that shall not be exceeded.
Pneumoconiosis-producing dust	Dust that, when inhaled, deposited, and retained in the lungs, may produce signs, symptoms, and findings of pulmonary disease.
Positive-pressure respirator	A respirator in which the air pressure inside the respiratory inlet covering is positive in relation to the air pressure of the outside atmosphere during exhalation and inhalation.
Pressure demand	Similar to a demand-type respirator but designed to maintain positive pressure in the facepiece at all times.
Protection factor	The ratio of the ambient concentration of an airborne substance to the concentration of the substance inside the respirator at the breathing zone of the wearer. The protection factor is a measure of the degree of protection provided to the wearer by a respirator.
Resistance	Opposition to the flow of air, as through a canister, cartridge, particulate filter, orifice, valve, or hose.
Respirable	Suitable for breathing.

Respirator	A device designed to protect the wearer from the inhalation of harmful atmospheres.
Respiratory inlet covering	That portion of a respirator that connects the wearer's respiratory tract to an air-purifying device or respirable gas source, or both. It may be a facepiece, helmet, hood, suit, or mouthpiece/nose clamp.
Routine respirator use	Wearing a respirator as a normal procedure when carrying out a regular and frequently repeated task.
Sanitization	The removal of dirt and the inhibiting of the action of agents that cause infection or disease.
SAR	Supplied air respirators
SCBA	Self-contained breathing apparatus
Sensitizers	Substances that cause increased probability of physiological reactions (for example, isocyanates or epoxy resins systems).
Service life	The period of time that a respirator provides adequate protection to the wearer - for example, the period of time that an air-purifying device is effective for removing a harmful substance from inspired air.
Smoke	A system that includes the products of combustion, pyrolysis, or chemical reaction of substances in the form of visible and invisible solid and liquid particles and gaseous products in air. Smoke is usually of sufficient concentration to perceptibly obscure vision.
Sorbent	A material contained in cartridge or canister that removes toxic gases and vapors from the inhaled air.
Spray	A liquid, mechanically produced, particle with sizes generally in the visible or macroscopic range.
STEL	A STEL is defined as a 15-minute time-weighted average exposure that should not be exceeded at any time during a work day even if the 8-hour time-weighted average is within the TLV. Exposures at the STEL should not be longer than 15 minutes and should not be repeated more than four times per day. There should be at least 60 minutes between successive exposures at the STEL.
Supplied-air suit	A suit impermeable to most particulate and gaseous contaminants and provided with an adequate supply of respirable air.

Systemic poisons	Substances that damage organs and systems in the body (for example: Mercury (nervous system and various organs), phosphorus (bone), hydrogen sulfide (respiratory paralysis), and arsine (red blood cells and liver).
Time-weighted average	The average concentration of a contaminant in air during a specific time period.
TLV	Threshold limit value
TLV	Threshold Limit Value. Refers to the airborne concentration of a substance and represents conditions to which it is believed nearly all workers may be repeatedly exposed day after day without adverse effect. Due to the wide variation in individual susceptibility, usually a small percentage of workers may experience discomfort from some substances at or below the threshold limit.
TLV-C	Threshold limit value - ceiling
TLV-c	A listed value bearing a "c" designation refers to a "ceiling" value that should NOT be exceeded without appropriate respiratory protection. ALL values should fluctuate below this listed value. This, in effect, makes the "c" designation a maximum allowable concentration.
TLV-STEL	Threshold limit value - short term exposure limit
TLV-STEL	Threshold limit value - short-term exposure limit. The concentration to which workers can be exposed continuously for a short period of time without suffering from 1) irritation, 2) chronic or irreversible tissue damage, or 3) narcosis of sufficient degree to increase the likelihood of accidental injury, impair self-rescue, or materially reduce work efficiency, and provided that the daily TLV-TWA is not exceeded.
TLV-TWA	Threshold limit value - time weighted average
TLV-TWA	Threshold limit value - time weighted average. The time-weighted average concentration for a normal 8-hour workday and a 40-hour work week to which nearly all workers may be repeatedly exposed, day after day, without adverse effect.
Valve	A device that controls the pressure, direction, or rate of flow of air or oxygen.
Vapor	The gaseous state of a substance that is solid or liquid at ordinary temperature and pressure.

Welding helmet	A device designed to provide protection for the eyes and face against intense radiant energy and molten metal splatter encountered in the welding and cutting of metals.
Window indicator	A device on a cartridge or canister that visually denotes the service life of the cartridge or canister.

APPENDIX B – OSHA RESPIRATORY PROTECTION PROGRAM REGULATIONS

29 CFR 1910.134 Respiratory Protection.

[Added at 63 FR 1270, Jan. 8, 1998]

This section applies to General Industry (part 1910), Shipyards (part 1915), Marine Terminals (part 1917), Longshoring (part 1918), and Construction (part 1926).

(a) *Permissible practice.*

(1) In the control of those occupational diseases caused by breathing air contaminated with harmful dusts, fogs, fumes, mists, gases, smokes, sprays, or vapors, the primary objective shall be to prevent atmospheric contamination. This shall be accomplished as far as feasible by accepted engineering control measures (for example, enclosure or confinement of the operation, general and local ventilation, and substitution of less toxic materials). When effective engineering controls are not feasible, or while they are being instituted, appropriate respirators shall be used pursuant to this section.

(2) Respirators shall be provided by the employer when such equipment is necessary to protect the health of the employee. The employer shall provide the respirators which are applicable and suitable for the purpose intended. The employer shall be responsible for the establishment and maintenance of a respiratory protection program which shall include the requirements outlined in paragraph (c) of this section.

(b) *Definitions.* The following definitions are important terms used in the respiratory protection standard in this section.

Air-purifying respirator means a respirator with an air-purifying filter, cartridge, or canister that removes specific air contaminants by passing ambient air through the air-purifying element.

Assigned protection factor (APF) [Reserved]

Atmosphere-supplying respirator means a respirator that supplies the respirator user with breathing air from a source independent of the ambient atmosphere, and includes supplied-air respirators (SARs) and self-contained breathing apparatus (SCBA) units.

Canister or cartridge means a container with a filter, sorbent, or catalyst, or combination of these items, which removes specific contaminants from the air passed through the container.

Demand respirator means an atmosphere-supplying respirator that admits breathing air to the facepiece only when a negative pressure is created inside the facepiece by inhalation.

Emergency situation means any occurrence such as, but not limited to, equipment failure, rupture of containers, or failure of control equipment that may or does result in an uncontrolled significant release of an airborne contaminant.

Employee exposure means exposure to a concentration of an airborne contaminant that would occur if the employee were not using respiratory protection.

End-of-service-life indicator (ESLI) means a system that warns the respirator user of the approach of the end of adequate respiratory protection, for example, that the sorbent is approaching saturation or is no longer effective.

Escape-only respirator means a respirator intended to be used only for emergency exit.

Filter or air purifying element means a component used in respirators to remove solid or liquid aerosols from the inspired air.

Filtering facepiece (dust mask) means a negative pressure particulate respirator with a filter as an integral part of the facepiece or with the entire facepiece composed of the filtering medium.

Fit factor means a quantitative estimate of the fit of a particular respirator to a specific individual, and typically estimates the ratio of the concentration of a substance in ambient air to its concentration inside the respirator when worn.

Fit test means the use of a protocol to qualitatively or quantitatively evaluate the fit of a respirator on an individual. (See also Qualitative fit test QLFT and Quantitative fit test QNFT.)

Helmet means a rigid respiratory inlet covering that also provides head protection against impact and penetration.

High efficiency particulate air (HEPA) filter means a filter that is at least 99.97% efficient in removing monodisperse particles of 0.3 micrometers in diameter. The equivalent NIOSH 42 CFR 84 particulate filters are the N100, R100, and P100 filters.

Hood means a respiratory inlet covering that completely covers the head and neck and may also cover portions of the shoulders and torso.

Immediately dangerous to life or health (IDLH) means an atmosphere that poses an immediate threat to life, would cause irreversible adverse health effects, or would impair an individual's ability to escape from a dangerous atmosphere.

Interior structural firefighting means the physical activity of fire suppression, rescue or both, inside of buildings or enclosed structures which are involved in a fire situation beyond the incipient stage. (See 29 CFR 1910.155)

Loose-fitting facepiece means a respiratory inlet covering that is designed to form a partial seal with the face.

Maximum use concentration (MUC) [Reserved].

Negative pressure respirator (tight fitting) means a respirator in which the air pressure inside the facepiece is negative during inhalation with respect to the ambient air pressure outside the respirator.

Oxygen deficient atmosphere means an atmosphere with an oxygen content below 19.5% by volume.

Physician or other licensed health care professional (PLHCP) means an individual whose legally permitted scope of practice (*i.e.,* license, registration, or certification) allows him or her to independently provide, or be delegated the responsibility to provide, some or all of the health care services required by paragraph (e) of this section.

Positive pressure respirator means a respirator in which the pressure inside the respiratory inlet covering exceeds the ambient air pressure outside the respirator.

Powered air-purifying respirator (PAPR) means an air-purifying respirator that uses a blower to force the ambient air through air-purifying elements to the inlet covering.

Pressure demand respirator means a positive pressure atmosphere-supplying respirator that admits breathing air to the facepiece when the positive pressure is reduced inside the facepiece by inhalation.

Qualitative fit test (QLFT) means a pass/fail fit test to assess the adequacy of respirator fit that relies on the individual's response to the test agent.

Quantitative fit test (QNFT) means an assessment of the adequacy of respirator fit by numerically measuring the amount of leakage into the respirator.

Respiratory inlet covering means that portion of a respirator that forms the protective barrier between the user's respiratory tract and an air-purifying device or breathing air source, or both. It may be a facepiece, helmet, hood, suit, or a mouthpiece respirator with nose clamp.

Self-contained breathing apparatus (SCBA) means an atmosphere-supplying respirator for which the breathing air source is designed to be carried by the user.

Service life means the period of time that a respirator, filter or sorbent, or other respiratory equipment provides adequate protection to the wearer.

Supplied-air respirator (SAR) or airline respirator means an atmosphere-supplying respirator for which the source of breathing air is not designed to be carried by the user.

This section means this respiratory protection standard.

Tight-fitting facepiece means a respiratory inlet covering that forms a complete seal with the face.

User seal check means an action conducted by the respirator user to determine if the respirator is properly seated to the face.

(c) *Respiratory protection program.* This paragraph requires the employer to develop and implement a written respiratory protection program with required worksite-specific procedures and elements for required respirator use. The program must be administered by a suitably trained program administrator. In addition, certain program elements may be required for voluntary use to prevent potential hazards associated with the use of the respirator. The Small Entity Compliance Guide contains criteria for the selection of a program administrator and a

sample program that meets the requirements of this paragraph. Copies of the Small Entity Compliance Guide will be available on or about April 8, 1998 from the Occupational Safety and Health Administration's Office of Publications, Room N 3101, 200 Constitution Avenue, NW, Washington, DC, 20210 (202-219-4667).

(1) In any workplace where respirators are necessary to protect the health of the employee or whenever respirators are required by the employer, the employer shall establish and implement a written respiratory protection program with worksite-specific procedures. The program shall be updated as necessary to reflect those changes in workplace conditions that affect respirator use. The employer shall include in the program the following provisions of this section, as applicable:

(i) Procedures for selecting respirators for use in the workplace;

(ii) Medical evaluations of employees required to use respirators;

(iii) Fit testing procedures for tight-fitting respirators;

(iv) Procedures for proper use of respirators in routine and reasonably foreseeable emergency situations;

(v) Procedures and schedules for cleaning, disinfecting, storing, inspecting, repairing, discarding, and otherwise maintaining respirators;

(vi) Procedures to ensure adequate air quality, quantity, and flow of breathing air for atmosphere-supplying respirators;

(vii) Training of employees in the respiratory hazards to which they are potentially exposed during routine and emergency situations;

(viii) Training of employees in the proper use of respirators, including putting on and removing them, any limitations on their use, and their maintenance; and

(ix) Procedures for regularly evaluating the effectiveness of the program.

(2) Where respirator use is not required:

(i) An employer may provide respirators at the request of employees or permit employees to use their own respirators, if the employer determines that such respirator use will not in itself create a hazard. If the employer determines that any voluntary respirator use is permissible, the employer shall provide the respirator users with the information contained in Appendix D to this section ("Information for Employees Using Respirators When Not Required Under the Standard"); and

(ii) In addition, the employer must establish and implement those elements of a written respiratory protection program necessary to ensure that any employee using a respirator voluntarily is medically able to use that respirator, and that the respirator is cleaned, stored, and maintained so that its use does not present a health hazard to the user. Exception: Employers

are not required to include in a written respiratory protection program those employees whose only use of respirators involves the voluntary use of filtering facepieces (dust masks).

(3) The employer shall designate a program administrator who is qualified by appropriate training or experience that is commensurate with the complexity of the program to administer or oversee the respiratory protection program and conduct the required evaluations of program effectiveness.

(4) The employer shall provide respirators, training, and medical evaluations at no cost to the employee.

(d) *Selection of respirators.* This paragraph requires the employer to evaluate respiratory hazard(s) in the workplace, identify relevant workplace and user factors, and base respirator selection on these factors. The paragraph also specifies appropriately protective respirators for use in IDLH atmospheres, and limits the selection and use of air-purifying respirators.

(1) *General requirements.*

(i) The employer shall select and provide an appropriate respirator based on the respiratory hazard(s) to which the worker is exposed and workplace and user factors that affect respirator performance and reliability.

(ii) The employer shall select a NIOSH-certified respirator. The respirator shall be used in compliance with the conditions of its certification.

(iii) The employer shall identify and evaluate the respiratory hazard(s) in the workplace; this evaluation shall include a reasonable estimate of employee exposures to respiratory hazard(s) and an identification of the contaminant's chemical state and physical form. Where the employer cannot identify or reasonably estimate the employee exposure, the employer shall consider the atmosphere to be IDLH.

(iv) The employer shall select respirators from a sufficient number of respirator models and sizes so that the respirator is acceptable to, and correctly fits, the user.

(2) *Respirators for IDLH atmospheres.*

(i) The employer shall provide the following respirators for employee use in IDLH atmospheres:

(A) A full facepiece pressure demand SCBA certified by NIOSH for a minimum service life of thirty minutes, or

(B) A combination full facepiece pressure demand supplied-air respirator (SAR) with auxiliary self-contained air supply.

(ii) Respirators provided only for escape from IDLH atmospheres shall be NIOSH-certified for escape from the atmosphere in which they will be used.

(iii) All oxygen-deficient atmospheres shall be considered IDLH. Exception: If the employer demonstrates that, under all foreseeable conditions, the oxygen concentration can be

maintained within the ranges specified in Table II of this section (i.e., for the altitudes set out in the table), then any atmosphere-supplying respirator may be used.

(3) *Respirators for atmospheres that are not IDLH.*

(i) The employer shall provide a respirator that is adequate to protect the health of the employee and ensure compliance with all other OSHA statutory and regulatory requirements, under routine and reasonably foreseeable emergency situations.

(A) *Assigned Protection Factors (APFs)* [Reserved]

(B) *Maximum Use Concentration (MUC)* [Reserved]

(ii) The respirator selected shall be appropriate for the chemical state and physical form of the contaminant.

(iii) For protection against gases and vapors, the employer shall provide:

(A) An atmosphere-supplying respirator, or

(B) An air-purifying respirator, provided that:

Table II

Altitude (ft.)	Oxygen deficient Atmospheres (%0_2) for which the employer may rely on atmosphere-supplying respirators
Less than 3,001	16.0 - 19.5
3,001 - 4,000	16.4 - 19.5
4,001 - 5,000	17.1 - 19.5
5,001 - 6,000	17.8 - 19.5
6,001 - 7,000	18.5 - 19.5
7,001-8,000[1]	19.3 - 19.5

(1) The respirator is equipped with an end-of-service-life indicator (ESLI) certified by NIOSH for the contaminant; or

(2) If there is no ESLI appropriate for conditions in the employer's workplace, the employer implements a change schedule for canisters and cartridges that is based on objective information or data that will ensure that canisters and cartridges are changed before the end of their service life. The employer shall describe in the respirator program the information and data relied upon and the basis for the canister and cartridge change schedule and the basis for reliance on the data.

(iv) For protection against particulates, the employer shall provide:

(A) An atmosphere-supplying respirator; or

(B) An air-purifying respirator equipped with a filter certified by NIOSH under 30 CFR part 11 as a high efficiency particulate air (HEPA) filter, or an air-purifying respirator equipped with a filter certified for particulates by NIOSH under 42 CFR part 84; or

(C) For contaminants consisting primarily of particles with mass median aerodynamic diameters (MMAD) of at least 2 micrometers, an air-purifying respirator equipped with any filter certified for particulates by NIOSH.

TABLE I.—ASSIGNED PROTECTION FACTORS [Reserved]

[1] Above 8,000 feet the exception does not apply. Oxygen-enriched breathing air must be supplied above 14,000 feet.

(e) *Medical evaluation.* Using a respirator may place a physiological burden on employees that varies with the type of respirator worn, the job and workplace conditions in which the respirator is used, and the medical status of the employee. Accordingly, this paragraph specifies the minimum requirements for medical evaluation that employers must implement to determine the employee's ability to use a respirator.

(1) *General.* The employer shall provide a medical evaluation to determine the employee's ability to use a respirator, before the employee is fit tested or required to use the respirator in the workplace. The employer may discontinue an employee's medical evaluations when the employee is no longer required to use a respirator.

(2) *Medical evaluation procedures.*

(i) The employer shall identify a physician or other licensed health care professional (PLHCP) to perform medical evaluations using a medical questionnaire or an initial medical examination that obtains the same information as the medical questionnaire.

(ii) The medical evaluation shall obtain the information requested by the questionnaire in Sections 1 and 2, Part A of Appendix C of this section.

(3) *Follow-up medical examination.*

(i) The employer shall ensure that a follow-up medical examination is provided for an employee who gives a positive response to any question among questions 1 through 8 in Section 2, Part A of Appendix C or whose initial medical examination demonstrates the need for a follow-up medical examination.

(ii) The follow-up medical examination shall include any medical tests, consultations, or diagnostic procedures that the PLHCP deems necessary to make a final determination.

(4) *Administration of the medical questionnaire and examinations.*

(i) The medical questionnaire and examinations shall be administered confidentially during the employee's normal working hours or at a time and place convenient to the employee. The

medical questionnaire shall be administered in a manner that ensures that the employee understands its content.

(ii) The employer shall provide the employee with an opportunity to discuss the questionnaire and examination results with the PLHCP.

(5) *Supplemental information for the PLHCP.*

(i) The following information must be provided to the PLHCP before the PLHCP makes a recommendation concerning an employee's ability to use a respirator:

(A) The type and weight of the respirator to be used by the employee;

(B) The duration and frequency of respirator use (including use for rescue and escape);

(C) The expected physical work effort;

(D) Additional protective clothing and equipment to be worn; and

(E) Temperature and humidity extremes that may be encountered.

(ii) Any supplemental information provided previously to the PLHCP regarding an employee need not be provided for a subsequent medical evaluation if the information and the PLHCP remain the same.

(iii) The employer shall provide the PLHCP with a copy of the written respiratory protection program and a copy of this section.

Note to Paragraph (e)(5)(iii): When the employer replaces a PLHCP, the employer must ensure that the new PLHCP obtains this information, either by providing the documents directly to the PLHCP or having the documents transferred from the former PLHCP to the new PLHCP. However, OSHA does not expect employers to have employees medically reevaluated solely because a new PLHCP has been selected.

(6) *Medical determination.* In determining the employee's ability to use a respirator, the employer shall:

(i) Obtain a written recommendation regarding the employee's ability to use the respirator from the PLHCP. The recommendation shall provide only the following information:

(A) Any limitations on respirator use related to the medical condition of the employee, or relating to the workplace conditions in which the respirator will be used, including whether or not the employee is medically able to use the respirator;

(B) The need, if any, for follow-up medical evaluations; and

(C) A statement that the PLHCP has provided the employee with a copy of the PLHCP's written recommendation.

(ii) If the respirator is a negative pressure respirator and the PLHCP finds a medical condition that may place the employee's health at increased risk if the respirator is used, the employer

shall provide a PAPR if the PLHCP's medical evaluation finds that the employee can use such a respirator; if a subsequent medical evaluation finds that the employee is medically able to use a negative pressure respirator, then the employer is no longer required to provide a PAPR.

(7) *Additional medical evaluations.* At a minimum, the employer shall provide additional medical evaluations that comply with the requirements of this section if:

(i) An employee reports medical signs or symptoms that are related to ability to use a respirator;

(ii) A PLHCP, supervisor, or the respirator program administrator informs the employer that an employee needs to be reevaluated;

(iii) Information from the respiratory protection program, including observations made during fit testing and program evaluation, indicates a need for employee reevaluation; or

(iv) A change occurs in workplace conditions (e.g., physical work effort, protective clothing, temperature) that may result in a substantial increase in the physiological burden placed on an employee.

(f) *Fit testing.* This paragraph requires that, before an employee may be required to use any respirator with a negative or positive pressure tight-fitting facepiece, the employee must be fit tested with the same make, model, style, and size of respirator that will be used. This paragraph specifies the kinds of fit tests allowed, the procedures for conducting them, and how the results of the fit tests must be used.

(1) The employer shall ensure that employees using a tight-fitting facepiece respirator pass an appropriate qualitative fit test (QLFT) or quantitative fit test (QNFT) as stated in this paragraph.

(2) The employer shall ensure that an employee using a tight-fitting facepiece respirator is fit tested prior to initial use of the respirator, whenever a different respirator facepiece (size, style, model or make) is used, and at least annually thereafter.

(3) The employer shall conduct an additional fit test whenever the employee reports, or the employer, PLHCP, supervisor, or program administrator makes visual observations of, changes in the employee's physical condition that could affect respirator fit. Such conditions include, but are not limited to, facial scarring, dental changes, cosmetic surgery, or an obvious change in body weight.

(4) If after passing a QLFT or QNFT, the employee subsequently notifies the employer, program administrator, supervisor, or PLHCP that the fit of the respirator is unacceptable, the employee shall be given a reasonable opportunity to select a different respirator facepiece and to be retested.

(5) The fit test shall be administered using an OSHA-accepted QLFT or QNFT protocol. The OSHA-accepted QLFT and QNFT protocols and procedures are contained in Appendix A of this section.

(6) QLFT may only be used to fit test negative pressure air-purifying respirators that must achieve a fit factor of 100 or less.

(7) If the fit factor, as determined through an OSHA-accepted QNFT protocol, is equal to or greater than 100 for tight-fitting half facepieces, or equal to or greater than 500 for tight-fitting full facepieces, the QNFT has been passed with that respirator.

(8) Fit testing of tight-fitting atmosphere-supplying respirators and tight-fitting powered air-purifying respirators shall be accomplished by performing quantitative or qualitative fit testing in the negative pressure mode, regardless of the mode of operation (negative or positive pressure) that is used for respiratory protection.

(i) Qualitative fit testing of these respirators shall be accomplished by temporarily converting the respirator user's actual facepiece into a negative pressure respirator with appropriate filters, or by using an identical negative pressure air-purifying respirator facepiece with the same sealing surfaces as a surrogate for the atmosphere-supplying or powered air-purifying respirator facepiece.

(ii) Quantitative fit testing of these respirators shall be accomplished by modifying the facepiece to allow sampling inside the facepiece in the breathing zone of the user, midway between the nose and mouth. This requirement shall be accomplished by installing a permanent sampling probe onto a surrogate facepiece, or by using a sampling adapter designed to temporarily provide a means of sampling air from inside the facepiece.

(iii) Any modifications to the respirator facepiece for fit testing shall be completely removed, and the facepiece restored to NIOSH-approved configuration, before that facepiece can be used in the workplace.

(g) *Use of respirators.* This paragraph requires employers to establish and implement procedures for the proper use of respirators. These requirements include prohibiting conditions that may result in facepiece seal leakage, preventing employees from removing respirators in hazardous environments, taking actions to ensure continued effective respirator operation throughout the work shift, and establishing procedures for the use of respirators in IDLH atmospheres or in interior structural firefighting situations.

(1) *Facepiece seal protection.*

(i) The employer shall not permit respirators with tight-fitting facepieces to be worn by employees who have:

(A) Facial hair that comes between the sealing surface of the facepiece and the face or that interferes with valve function; or

(B) Any condition that interferes with the face-to-facepiece seal or valve function.

(ii) If an employee wears corrective glasses or goggles or other personal protective equipment, the employer shall ensure that such equipment is worn in a manner that does not interfere with the seal of the facepiece to the face of the user.

(iii) For all tight-fitting respirators, the employer shall ensure that employees perform a user seal check each time they put on the respirator using the procedures in Appendix B-1 or

procedures recommended by the respirator manufacturer that the employer demonstrates are as effective as those in Appendix B-1 of this section.

(2) *Continuing respirator effectiveness.*

(i) Appropriate surveillance shall be maintained of work area conditions and degree of employee exposure or stress. When there is a change in work area conditions or degree of employee exposure or stress that may affect respirator effectiveness, the employer shall reevaluate the continued effectiveness of the respirator.

(ii) The employer shall ensure that employees leave the respirator use area:

(A) To wash their faces and respirator facepieces as necessary to prevent eye or skin irritation associated with respirator use; or

(B) If they detect vapor or gas breakthrough, changes in breathing resistance, or leakage of the facepiece; or

(C) To replace the respirator or the filter, cartridge, or canister elements.

(iii) If the employee detects vapor or gas breakthrough, changes in breathing resistance, or leakage of the facepiece, the employer must replace or repair the respirator before allowing the employee to return to the work area.

(3) *Procedures for IDLH atmospheres.* For all IDLH atmospheres, the employer shall ensure that:

(i) One employee or, when needed, more than one employee is located outside the IDLH atmosphere;

(ii) Visual, voice, or signal line communication is maintained between the employee(s) in the IDLH atmosphere and the employee(s) located outside the IDLH atmosphere;

(iii) The employee(s) located outside the IDLH atmosphere are trained and equipped to provide effective emergency rescue;

(iv) The employer or designee is notified before the employee(s) located outside the IDLH atmosphere enter the IDLH atmosphere to provide emergency rescue;

(v) The employer or designee authorized to do so by the employer, once notified, provides necessary assistance appropriate to the situation;

(vi) Employee(s) located outside the IDLH atmospheres are equipped with:

(A) Pressure demand or other positive pressure SCBAs, or a pressure demand or other positive pressure supplied-air respirator with auxiliary SCBA; and either

(B) Appropriate retrieval equipment for removing the employee(s) who enter(s) these hazardous atmospheres where retrieval equipment would contribute to the rescue of the employee(s) and would not increase the overall risk resulting from entry; or

(C) Equivalent means for rescue where retrieval equipment is not required under paragraph (g)(3)(vi)(B).

(4) *Procedures for interior structural firefighting.* In addition to the requirements set forth under paragraph (g)(3), in interior structural fires, the employer shall ensure that:

(i) At least two employees enter the IDLH atmosphere and remain in visual or voice contact with one another at all times;

(ii) At least two employees are located outside the IDLH atmosphere; and

(iii) All employees engaged in interior structural firefighting use SCBAs.

Note 1 to paragraph (g): One of the two individuals located outside the IDLH atmosphere may be assigned to an additional role, such as incident commander in charge of the emergency or safety officer, so long as this individual is able to perform assistance or rescue activities without jeopardizing the safety or health of any firefighter working at the incident.

Note 2 to paragraph (g): Nothing in this section is meant to preclude firefighters from performing emergency rescue activities before an entire team has assembled.

(h) *Maintenance and care of respirators.* This paragraph requires the employer to provide for the cleaning and disinfecting, storage, inspection, and repair of respirators used by employees.

(1) *Cleaning and disinfecting.* The employer shall provide each respirator user with a respirator that is clean, sanitary, and in good working order. The employer shall ensure that respirators are cleaned and disinfected using the procedures in Appendix B-2 of this section, or procedures recommended by the respirator manufacturer, provided that such procedures are of equivalent effectiveness. The respirators shall be cleaned and disinfected at the following intervals:

(i) Respirators issued for the exclusive use of an employee shall be cleaned and disinfected as often as necessary to be maintained in a sanitary condition;

(ii) Respirators issued to more than one employee shall be cleaned and disinfected before being worn by different individuals;

(iii) Respirators maintained for emergency use shall be cleaned and disinfected after each use; and

(iv) Respirators used in fit testing and training shall be cleaned and disinfected after each use.

(2) *Storage.* The employer shall ensure that respirators are stored as follows:

(i) All respirators shall be stored to protect them from damage, contamination, dust, sunlight, extreme temperatures, excessive moisture, and damaging chemicals, and they shall be packed or stored to prevent deformation of the facepiece and exhalation valve.

(ii) In addition to the requirements of paragraph (h)(2)(i) of this section, emergency respirators shall be:

(A) Kept accessible to the work area;

(B) Stored in compartments or in covers that are clearly marked as containing emergency respirators; and

(C) Stored in accordance with any applicable manufacturer instructions.

(3) *Inspection.*

(i) The employer shall ensure that respirators are inspected as follows:

(A) All respirators used in routine situations shall be inspected before each use and during cleaning;

(B) All respirators maintained for use in emergency situations shall be inspected at least monthly and in accordance with the manufacturer's recommendations, and shall be checked for proper function before and after each use; and

(C) Emergency escape-only respirators shall be inspected before being carried into the workplace for use.

(ii) The employer shall ensure that respirator inspections include the following:

(A) A check of respirator function, tightness of connections, and the condition of the various parts including, but not limited to, the facepiece, head straps, valves, connecting tube, and cartridges, canisters or filters; and

(B) A check of elastomeric parts for pliability and signs of deterioration.

(iii) In addition to the requirements of paragraphs (h)(3)(i) and (ii) of this section, self-contained breathing apparatus shall be inspected monthly. Air and oxygen cylinders shall be maintained in a fully charged state and shall be recharged when the pressure falls to 90% of the manufacturer's recommended pressure level. The employer shall determine that the regulator and warning devices function properly.

(iv) For respirators maintained for emergency use, the employer shall:

(A) Certify the respirator by documenting the date the inspection was performed, the name (or signature) of the person who made the inspection, the findings, required remedial action, and a serial number or other means of identifying the inspected respirator; and

(B) Provide this information on a tag or label that is attached to the storage compartment for the respirator, is kept with the respirator, or is included in inspection reports stored as paper or electronic files. This information shall be maintained until replaced following a subsequent certification.

(4) *Repairs.* The employer shall ensure that respirators that fail an inspection or are otherwise found to be defective are removed from service, and are discarded or repaired or adjusted in accordance with the following procedures:

(i) Repairs or adjustments to respirators are to be made only by persons appropriately trained to perform such operations and shall use only the respirator manufacturer's NIOSH-approved parts designed for the respirator;

(ii) Repairs shall be made according to the manufacturer's recommendations and specifications for the type and extent of repairs to be performed; and

(iii) Reducing and admission valves, regulators, and alarms shall be adjusted or repaired only by the manufacturer or a technician trained by the manufacturer.

(i) *Breathing air quality and use.* This paragraph requires the employer to provide employees using atmosphere-supplying respirators (supplied-air and SCBA) with breathing gases of high purity.

(1) The employer shall ensure that compressed air, compressed oxygen, liquid air, and liquid oxygen used for respiration accords with the following specifications:

(i) Compressed and liquid oxygen shall meet the United States Pharmacopoeia requirements for medical or breathing oxygen; and

(ii) Compressed breathing air shall meet at least the requirements for Grade D breathing air described in ANSI Compressed Gas Association Commodity Specification for Air, G-7.1-1989, to include:

[1910.134(i)(1)(ii) corrected at 63 FR 20098, April 23, 1998]

(A) Oxygen content (vv) of 19.5- 23.5%;

(B) Hydrocarbon (condensed) content of 5 milligrams per cubic meter of air or less;

(C) Carbon monoxide (CO) content of 10 ppm or less;

(D) Carbon dioxide content of 1,000 ppm or less; and

(E) Lack of noticeable odor.

(2) The employer shall ensure that compressed oxygen is not used in atmosphere-supplying respirators that have previously used compressed air.

(3) The employer shall ensure that oxygen concentrations greater than 23.5% are used only in equipment designed for oxygen service or distribution.

(4) The employer shall ensure that cylinders used to supply breathing air to respirators meet the following requirements:

(i) Cylinders are tested and maintained as prescribed in the Shipping Container Specification Regulations of the Department of Transportation (49 CFR part 173 and part 178);

(ii) Cylinders of purchased breathing air have a certificate of analysis from the supplier that the breathing air meets the requirements for Grade D breathing air; and

[1910.134(i)(4)(ii) corrected at 63 FR 20098, April 23, 1998]

(iii) The moisture content in the cylinder does not exceed a dew point of -50° F (-45.6° C) at 1 atmosphere pressure.

(5) The employer shall ensure that compressors used to supply breathing air to respirators are constructed and situated so as to:

(i) Prevent entry of contaminated air into the air-supply system;

(ii) Minimize moisture content so that the dew point at 1 atmosphere pressure is 10 degrees F (5.56° C) below the ambient temperature;

(iii) Have suitable in-line air-purifying sorbent beds and filters to further ensure breathing air quality. Sorbent beds and filters shall be maintained and replaced or refurbished periodically following the manufacturer's instructions.

(iv) Have a tag containing the most recent change date and the signature of the person authorized by the employer to perform the change. The tag shall be maintained at the compressor.

(6) For compressors that are not oil-lubricated, the employer shall ensure that carbon monoxide levels in the breathing air do not exceed 10 ppm.

(7) For oil-lubricated compressors, the employer shall use a high-temperature or carbon monoxide alarm, or both, to monitor carbon monoxide levels. If only high-temperature alarms are used, the air supply shall be monitored at intervals sufficient to prevent carbon monoxide in the breathing air from exceeding 10 ppm.

(8) The employer shall ensure that breathing air couplings are incompatible with outlets for nonrespirable worksite air or other gas systems. No asphyxiating substance shall be introduced into breathing air lines.

(9) The employer shall use breathing gas containers marked in accordance with the NIOSH respirator certification standard, 42 CFR part 84.

(j) *Identification of filters, cartridges, and canisters.* The employer shall ensure that all filters, cartridges and canisters used in the workplace are labeled and color coded with the NIOSH approval label and that the label is not removed and remains legible.

(k) *Training and information.* This paragraph requires the employer to provide effective training to employees who are required to use respirators. The training must be comprehensive, understandable, and recur annually, and more often if necessary. This paragraph also requires the employer to provide the basic information on respirators in Appendix D of this section to employees who wear respirators when not required by this section or by the employer to do so.

(1) The employer shall ensure that each employee can demonstrate knowledge of at least the following:

(i) Why the respirator is necessary and how improper fit, usage, or maintenance can compromise the protective effect of the respirator;

(ii) What the limitations and capabilities of the respirator are;

(iii) How to use the respirator effectively in emergency situations, including situations in which the respirator malfunctions;

(iv) How to inspect, put on and remove, use, and check the seals of the respirator;

(v) What the procedures are for maintenance and storage of the respirator;

(vi) How to recognize medical signs and symptoms that may limit or prevent the effective use of respirators; and

(vii) The general requirements of this section.

(2) The training shall be conducted in a manner that is understandable to the employee.

(3) The employer shall provide the training prior to requiring the employee to use a respirator in the workplace.

(4) An employer who is able to demonstrate that a new employee has received training within the last 12 months that addresses the elements specified in paragraph (k)(1)(i) through (vii)is not required to repeat such training provided that, as required by paragraph (k)(1), the employee can demonstrate knowledge of those element(s). Previous training not repeated initially by the employer must be provided no later than 12 months from the date of the previous training.

(5) Retraining shall be administered annually, and when the following situations occur:

(i) Changes in the workplace or the type of respirator render previous training obsolete;

(ii) Inadequacies in the employee's knowledge or use of the respirator indicate that the employee has not retained the requisite understanding or skill; or

(iii) Any other situation arises in which retraining appears necessary to ensure safe respirator use.

(6) The basic advisory information on respirators, as presented in Appendix D of this section, shall be provided by the employer in any written or oral format, to employees who wear respirators when such use is not required by this section or by the employer.

(l) *Program evaluation.* This section requires the employer to conduct evaluations of the workplace to ensure that the written respiratory protection program is being properly implemented, and to consult employees to ensure that they are using the respirators properly.

(1) The employer shall conduct evaluations of the workplace as necessary to ensure that the provisions of the current written program are being effectively implemented and that it continues to be effective.

(2) The employer shall regularly consult employees required to use respirators to assess the employees' views on program effectiveness and to identify any problems. Any problems that are identified during this assessment shall be corrected. Factors to be assessed include, but are not limited to:

(i) Respirator fit (including the ability to use the respirator without interfering with effective workplace performance);

(ii) Appropriate respirator selection for the hazards to which the employee is exposed;

(iii) Proper respirator use under the workplace conditions the employee encounters; and

(iv) Proper respirator maintenance.

(m) *Recordkeeping.* This section requires the employer to establish and retain written information regarding medical evaluations, fit testing, and the respirator program. This information will facilitate employee involvement in the respirator program, assist the employer in auditing the adequacy of the program, and provide a record for compliance determinations by OSHA.

(1) *Medical evaluation.* Records of medical evaluations required by this section must be retained and made available in accordance with 29 CFR 1910.1020.

(2) *Fit testing.*

(i) The employer shall establish a record of the qualitative and quantitative fit tests administered to an employee including:

(A) The name or identification of the employee tested;

(B) Type of fit test performed;

(C) Specific make, model, style, and size of respirator tested;

(D) Date of test; and

(E) The pass/fail results for QLFTs or the fit factor and strip chart recording or other recording of the test results for QNFTs.

(ii) Fit test records shall be retained for respirator users until the next fit test is administered.

(3) A written copy of the current respirator program shall be retained by the employer.

(4) Written materials required to be retained under this paragraph shall be made available upon request to affected employees and to the Assistant Secretary or designee for examination and copying.

(n) *Dates.*

(1) *Effective date.* This section is effective April 8, 1998. The obligations imposed by this section commence on the effective date unless otherwise noted in this paragraph. Compliance with obligations that do not commence on the effective date shall occur no later than the applicable start-up date.

(2) *Compliance dates.* All obligations of this section commence on the effective date except as follows:

(i) The determination that respirator use is required (paragraph (a)) shall be completed no later than September 8, 1998.

(ii) Compliance with provisions of this section for all other provisions shall be completed no later than October 5, 1998.

(3) The provisions of 29 CFR 1910.134 and 29 CFR 1926.103, contained in the 29 CFR parts 1900 to 1910.99 and the 29 CFR part 1926 editions, revised as of July 1, 1997, are in effect and enforceable until October 5, 1998, or during any administrative or judicial stay of the provisions of this section.

[1910.134(n)(3) corrected at 63 FR 20098, April 23, 1998]

(4) *Existing Respiratory Protection Programs.* If, in the 12 month period preceding April 8, 1998, the employer has conducted annual respirator training, fit testing, respirator program evaluation, or medical evaluations, the employer may use the results of those activities to comply with the corresponding provisions of this section, providing that these activities were conducted in a manner that meets the requirements of this section.

(o) *Appendices.*

(1) Compliance with Appendix A, Appendix B-1, Appendix B-2, and Appendix C of this section is mandatory.

(2) Appendix D of this section is non-mandatory and is not intended to create any additional obligations not otherwise imposed or to detract from any existing obligations.

APPENDIX C - OSHA FIT TESTING PROCEDURES

APPENDIX A TO §1910.134: FIT TESTING PROCEDURES (Mandatory)

Part I. OSHA-Accepted Fit Test Protocols

A. Fit Testing Procedures – General Requirements

The employer shall conduct fit testing using the following procedures. The requirements in this appendix apply to all OSHA-accepted fit test methods, both QLFT and QNFT.

1. The test subject shall be allowed to pick the most acceptable respirator from a sufficient number of respirator models and sizes so that the respirator is acceptable to, and correctly fits, the user.

2. Prior to the selection process, the test subject shall be shown how to put on a respirator, how it should be positioned on the face, how to set strap tension and how to determine an acceptable fit. A mirror shall be available to assist the subject in evaluating the fit and positioning of the respirator. This instruction may not constitute the subject's formal training on respirator use, because it is only a review.

3. The test subject shall be informed that he/she is being asked to select the respirator that provides the most acceptable fit. Each respirator represents a different size and shape, and if fitted and used properly, will provide adequate protection.

4. The test subject shall be instructed to hold each chosen facepiece up to the face and eliminate those that obviously do not give an acceptable fit.

5. The more acceptable facepieces are noted in case the one selected proves unacceptable; the most comfortable mask is donned and worn at least five minutes to assess comfort. Assistance in assessing comfort can be given by discussing the points in the following item A.6. If the test subject is not familiar with using a particular respirator, the test subject shall be directed to don the mask several times and to adjust the straps each time to become adept at setting proper tension on the straps.

6. Assessment of comfort shall include a review of the following points with the test subject and allowing the test subject adequate time to determine the comfort of the respirator:

   (a) Position of the mask on the nose

   (b) Room for eye protection

   (c) Room to talk

(d) Position of mask on face and cheeks

7. The following criteria shall be used to help determine the adequacy of the respirator fit:

   (a) Chin properly placed;

   (b) Adequate strap tension, not overly tightened;

   (c) Fit across nose bridge;

   (d) Respirator of proper size to span distance from nose to chin;

   (e) Tendency of respirator to slip;

   (f) Self-observation in mirror to evaluate fit and respirator position.

8. The test subject shall conduct a user seal check, either the negative and positive pressure seal checks described in Appendix B-1 of this section or those recommended by the respirator manufacturer which provide equivalent protection to the procedures in Appendix B-1. Before conducting the negative and positive pressure checks, the subject shall be told to seat the mask on the face by moving the head from side-to-side and up and down slowly while taking in a few slow deep breaths. Another facepiece shall be selected and retested if the test subject fails the user seal check tests.

9. The test shall not be conducted if there is any hair growth between the skin and the facepiece sealing surface, such as stubble beard growth, beard, mustache or sideburns which cross the respirator sealing surface. Any type of apparel which interferes with a satisfactory fit shall be altered or removed.

10. If a test subject exhibits difficulty in breathing during the tests, she or he shall be referred to a physician or other licensed health care professional, as appropriate, to determine whether the test subject can wear a respirator while performing her or his duties.

11. If the employee finds the fit of the respirator unacceptable, the test subject shall be given the opportunity to select a different respirator and to be retested.

12. Exercise regimen. Prior to the commencement of the fit test, the test subject shall be given a description of the fit test and the test subject's responsibilities during the test procedure. The description of the process shall include a description of the test exercises that the subject will be performing. The respirator to be tested shall be worn for at least 5 minutes before the start of the fit test.

13. The fit test shall be performed while the test subject is wearing any applicable safety equipment that may be worn during actual respirator use which could interfere with respirator fit.

14. Test Exercises.

(a) The following test exercises are to be performed for all fit testing methods prescribed in this appendix, except for the CNP method. A separate fit testing exercise regimen is contained in the CNP protocol. The test subject shall perform exercises, in the test environment, in the following manner:

(1) Normal breathing. In a normal standing position, without talking, the subject shall breathe normally.

(2) Deep breathing. In a normal standing position, the subject shall breathe slowly and deeply, taking caution so as not to hyperventilate.

(3) Turning head side to side. Standing in place, the subject shall slowly turn his/her head from side to side between the extreme positions on each side. The head shall be held at each extreme momentarily so the subject can inhale at each side.

(4) Moving head up and down. Standing in place, the subject shall slowly move his/her head up and down. The subject shall be instructed to inhale in the up position (i.e., when looking toward the ceiling).

(5) Talking. The subject shall talk out loud slowly and loud enough so as to be heard clearly by the test conductor. The subject can read from a prepared text such as the Rainbow Passage, count backward from 100, or recite a memorized poem or song.

Rainbow Passage

When the sunlight strikes raindrops in the air, they act like a prism and form a rainbow. The rainbow is a division of white light into many beautiful colors. These take the shape of a long round arch, with its path high above, and its two ends apparently beyond the horizon. There is, according to legend, a boiling pot of gold at one end. People look, but no one ever finds it. When a man looks for something beyond reach, his friends say he is looking for the pot of gold at the end of the rainbow.

(6) Grimace. The test subject shall grimace by smiling or frowning. (This applies only to QNFT testing; it is not performed for QLFT)

(7) Bending over. The test subject shall bend at the waist as if he/she were to touch his/her toes. Jogging in place shall be substituted for this exercise in those test environments such as shroud type QNFT or QLFT units that do not permit bending over at the waist.

(8) Normal breathing. Same as exercise (1).

(b) Each test exercise shall be performed for one minute except for the grimace exercise which shall be performed for 15 seconds. The test subject shall be questioned by the test conductor regarding the comfort of the respirator upon completion of the protocol. If it has become unacceptable, another model of respirator shall be tried. The respirator shall not be adjusted once the fit test exercises begin. Any adjustment voids the test, and the fit test must be repeated.

B. Qualitative Fit Test (QLFT) Protocols

1. General

(a) The employer shall ensure that persons administering QLFT are able to prepare test solutions, calibrate equipment and perform tests properly, recognize invalid tests, and ensure that test equipment is in proper working order.

(b) The employer shall ensure that QLFT equipment is kept clean and well maintained so as to operate within the parameters for which it was designed.

2. Isoamyl Acetate Protocol

Note: This protocol is not appropriate to use for the fit testing of particulate respirators. If used to fit test particulate respirators, the respirator must be equipped with an organic vapor filter.

(a) (Odor Threshold Screening

Odor threshold screening, performed without wearing a respirator, is intended to determine if the individual tested can detect the odor of isoamyl acetate at low levels.

(1) Three 1 liter glass jars with metal lids are required.

(2) Odor-free water (e.g., distilled or spring water) at approximately 25° C (77° F) shall be used for the solutions.

(3) The isoamyl acetate (IAA) (also known at isopentyl acetate) stock solution is prepared by adding 1 ml of pure IAA to 800 ml of odor-free water in a 1 liter jar, closing the lid and shaking for 30 seconds. A new solution shall be prepared at least weekly.

(4) The screening test shall be conducted in a room separate from the room used for actual fit testing. The two rooms shall be well-ventilated to

prevent the odor of IAA from becoming evident in the general room air where testing takes place.

(5) The odor test solution is prepared in a second jar by placing 0.4 ml of the stock solution into 500 ml of odor-free water using a clean dropper or pipette. The solution shall be shaken for 30 seconds and allowed to stand for two to three minutes so that the IAA concentration above the liquid may reach equilibrium. This solution shall be used for only one day.

(6) A test blank shall be prepared in a third jar by adding 500 cc of odor-free water.

(7) The odor test and test blank jar lids shall be labeled (e.g., 1 and 2) for jar identification. Labels shall be placed on the lids so that they can be peeled off periodically and switched to maintain the integrity of the test.

(8) The following instruction shall be typed on a card and placed on the table in front of the two test jars (i.e., 1 and 2): "The purpose of this test is to determine if you can smell banana oil at a low concentration. The two bottles in front of you contain water. One of these bottles also contains a small amount of banana oil. Be sure the covers are on tight, then shake each bottle for two seconds. Unscrew the lid of each bottle, one at a time, and sniff at the mouth of the bottle. Indicate to the test conductor which bottle contains banana oil."

(9) The mixtures used in the IAA odor detection test shall be prepared in an area separate from where the test is performed, in order to prevent olfactory fatigue in the subject.

(10) If the test subject is unable to correctly identify the jar containing the odor test solution, the IAA qualitative fit test shall not be performed.

(11) If the test subject correctly identifies the jar containing the odor test solution, the test subject may proceed to respirator selection and fit testing.

(b) Isoamyl Acetate Fit Test

(1) The fit test chamber shall be a clear 55-gallon drum liner suspended inverted over a 2-foot diameter frame so that the top of the chamber is about 6 inches above the test subject's head. If no drum liner is available, a similar chamber shall be constructed using plastic sheeting. The inside top center of the chamber shall have a small hook attached.

(2) Each respirator used for the fitting and fit testing shall be equipped with organic vapor cartridges or offer protection against organic vapors.

(3) After selecting, donning, and properly adjusting a respirator, the test subject shall wear it to the fit testing room. This room shall be separate from the room used for odor threshold screening and respirator selection, and shall be well-ventilated, as by an exhaust fan or lab hood, to prevent general room contamination.

(4) A copy of the test exercises and any prepared text from which the subject is to read shall be taped to the inside of the test chamber.

(5) Upon entering the test chamber, the test subject shall be given a 6-inch by 5-inch piece of paper towel, or other porous, absorbent, single-ply material, folded in half and wetted with 0.75 ml of pure IAA. The test subject shall hang the wet towel on the hook at the top of the chamber. An IAA test swab or ampule may be substituted for the IAA wetted paper towel provided it has been demonstrated that the alternative IAA source will generate an IAA test atmosphere with a concentration equivalent to that generated by the paper towel method.

(6) Allow two minutes for the IAA test concentration to stabilize before starting the fit test exercises. This would be an appropriate time to talk with the test subject; to explain the fit test, the importance of his/her cooperation, and the purpose for the test exercises; or to demonstrate some of the exercises.

(7) If at any time during the test, the subject detects the banana-like odor of IAA, the test is failed. The subject shall quickly exit from the test chamber and leave the test area to avoid olfactory fatigue.

(8) If the test is failed, the subject shall return to the selection room and remove the respirator. The test subject shall repeat the odor sensitivity test, select and put on another respirator, return to the test area and again begin the fit test procedure described in (b) (1) through (7) above. The process continues until a respirator that fits well has been found. Should the odor sensitivity test be failed, the subject shall wait at least 5 minutes before retesting. Odor sensitivity will usually have returned by this time.

(9) If the subject passes the test, the efficiency of the test procedure shall be demonstrated by having the subject break the respirator face seal and take a breath before exiting the chamber.

(10) When the test subject leaves the chamber, the subject shall remove the saturated towel and return it to the person conducting the test, so that there is no significant IAA concentration buildup in the chamber during subsequent tests. The used towels shall be kept in a self-sealing plastic bag to keep the test area from being contaminated.

3. Saccharin Solution Aerosol Protocol

The entire screening and testing procedure shall be explained to the test subject prior to the conduct of the screening test.

(a) Taste threshold screening. The saccharin taste threshold screening, intended to determine whether the individual being tested can detect the taste of saccharin.

(1) During threshold screening as well as during fit testing, subjects shall wear an enclosure about the head and shoulders that is approximately 12 inches in diameter by 14 inches tall with at least the front portion clear and that allows free movements of the head when a respirator is worn. An enclosure substantially similar to the 3M hood assembly, parts # FT 14 and # FT 15 combined, is adequate.

(2) The test enclosure shall have a ¾ -inch (1.9 cm) hole in front of the test subject's nose and mouth area to accommodate the nebulizer nozzle.

(3) The test subject shall don the test enclosure. Throughout the threshold screening test, the test subject shall breathe through his/her slightly open mouth with tongue extended. The subject is instructed to report when he/she detects a sweet taste.

(4) Using a DeVilbiss Model 40 Inhalation Medication Nebulizer or equivalent, the test conductor shall spray the threshold check solution into the enclosure. The nozzle is directed away from the nose and mouth of the person. This nebulizer shall be clearly marked to distinguish it from the fit test solution nebulizer.

(5) The threshold check solution is prepared by dissolving 0.83 gram of sodium saccharin USP in 100 ml of warm water. It can be prepared by putting 1 ml of the fit test solution (see (b)(5) below) in 100 ml of distilled water.

(6) To produce the aerosol, the nebulizer bulb is firmly squeezed so that it collapses completely, then released and allowed to fully expand.

(7) Ten squeezes are repeated rapidly and then the test subject is asked whether the saccharin can be tasted. If the test subject reports tasting the

sweet taste during the ten squeezes, the screening test is completed. The taste threshold is noted as ten regardless of the number of squeezes actually completed.

(8) If the first response is negative, ten more squeezes are repeated rapidly and the test subject is again asked whether the saccharin is tasted. If the test subject reports tasting the sweet taste during the second ten squeezes, the screening test is completed. The taste threshold is noted as twenty regardless of the number of squeezes actually completed.

(9) If the second response is negative, ten more squeezes are repeated rapidly and the test subject is again asked whether the saccharin is tasted. If the test subject reports tasting the sweet taste during the third set of ten squeezes, the screening test is completed. The taste threshold is noted as thirty regardless of the number of squeezes actually completed.

(10) The test conductor will take note of the number of squeezes required to solicit a taste response.

(11) If the saccharin is not tasted after 30 squeezes (step 10), the test subject is unable to taste saccharin and may not perform the saccharin fit test.

(b) **Note to paragraph 3. (a):** If the test subject eats or drinks something sweet before the screening test, he/she may be unable to taste the weak saccharin solution.

(12) If a taste response is elicited, the test subject shall be asked to take note of the taste for reference in the fit test.

(13) Correct use of the nebulizer means that approximately 1 ml of liquid is used at a time in the nebulizer body.

(14) The nebulizer shall be thoroughly rinsed in water, shaken dry, and refilled at least each morning and afternoon or at least every four hours.

(c) Saccharin solution aerosol fit test procedure.

(1) The test subject may not eat, drink (except plain water), smoke, or chew gum for 15 minutes before the test.

(2) The fit test uses the same enclosure described in 3. (a) above.

(3) The test subject shall don the enclosure while wearing the respirator selected in section I. A. of this appendix. The respirator shall be properly adjusted and equipped with a particulate filter(s).

(4) A second DeVilbiss Model 40 Inhalation Medication Nebulizer or equivalent is used to spray the fit test solution into the enclosure. This

nebulizer shall be clearly marked to distinguish it from the screening test solution nebulizer.

(5) The fit test solution is prepared by adding 83 grams of sodium saccharin to 100 ml of warm water.

(6) As before, the test subject shall breathe through the slightly open mouth with tongue extended, and report if he/she tastes the sweet taste of saccharin.

(7) The nebulizer is inserted into the hole in the front of the enclosure and an initial concentration of saccharin fit test solution is sprayed into the enclosure using the same number of squeezes (either 10, 20 or 30 squeezes) based on the number of squeezes required to elicit a taste response as noted during the screening test. A minimum of 10 squeezes is required.

(8) After generating the aerosol, the test subject shall be instructed to perform the exercises in section I. A. 14. of this appendix.

(9) Every 30 seconds the aerosol concentration shall be replenished using one half the original number of squeezes used initially (e.g., 5, 10 or 15).

(10) The test subject shall indicate to the test conductor if at any time during the fit test the taste of saccharin is detected. If the test subject does not report tasting the saccharin, the test is passed.

(11) If the taste of saccharin is detected, the fit is deemed unsatisfactory and the test is failed. A different respirator shall be tried and the entire test procedure is repeated (taste threshold screening and fit testing).

(12) Since the nebulizer has a tendency to clog during use, the test operator must make periodic checks of the nebulizer to ensure that it is not clogged. If clogging is found at the end of the test session, the test is invalid.

4. BitrexTM (Denatonium Benzoate) Solution Aerosol Qualitative Fit Test Protocol

The Bitrex™ (Denatonium benzoate) solution aerosol QLFT protocol uses the published saccharin test protocol because that protocol is widely accepted. Bitrex is routinely used as a taste aversion agent in household liquids which children should not be drinking and is endorsed by the American Medical Association, the National Safety Council, and the American Association of Poison Control Centers. The entire screening and testing procedure shall be explained to the test subject prior to the conduct of the screening test.

(a) Taste Threshold Screening.

The Bitrex taste threshold screening, performed without wearing a respirator, is intended to determine whether the individual being tested can detect the taste of Bitrex.

(1) During threshold screening as well as during fit testing, subjects shall wear an enclosure about the head and shoulders that is approximately 12 inches (30.5 cm) in diameter by 14 inches (35.6 cm) tall. The front portion of the enclosure shall be clear from the respirator and allow free movement of the head when a respirator is worn. An enclosure substantially similar to the 3M hood assembly, parts # FT 14 and # FT 15 combined, is adequate.

[Corrected at 63 FR 20098, April 23, 1998]

(2) The test enclosure shall have a ¾ inch (1.9 cm) hole in front of the test subject's nose and mouth area to accommodate the nebulizer nozzle.

(3) The test subject shall don the test enclosure. Throughout the threshold screening test, the test subject shall breathe through his or her slightly open mouth with tongue extended. The subject is instructed to report when he/she detects a bitter taste.

(4) Using a DeVilbiss Model 40 Inhalation Medication Nebulizer or equivalent, the test conductor shall spray the Threshold Check Solution into the enclosure. This Nebulizer shall be clearly marked to distinguish it from the fit test solution nebulizer.

(5) The Threshold Check Solution is prepared by adding 13.5 milligrams of Bitrex to 100 ml of 5% salt (NaCl) solution in distilled water.

(6) To produce the aerosol, the nebulizer bulb is firmly squeezed so that the bulb collapses completely, and is then released and allowed to fully expand.

(7) An initial ten squeezes are repeated rapidly and then the test subject is asked whether the Bitrex can be tasted. If the test subject reports tasting the bitter taste during the ten squeezes, the screening test is completed. The taste threshold is noted as ten regardless of the number of squeezes actually completed.

(8) If the first response is negative, ten more squeezes are repeated rapidly and the test subject is again asked whether the Bitrex is tasted. If the test subject reports tasting the bitter taste during the second ten squeezes, the

screening test is completed. The taste threshold is noted as twenty regardless of the number of squeezes actually completed.

(9) If the second response is negative, ten more squeezes are repeated rapidly and the test subject is again asked whether the Bitrex is tasted. If the test subject reports tasting the bitter taste during the third set of ten squeezes, the screening test is completed. The taste threshold is noted as thirty regardless of the number of squeezes actually completed.

(10) The test conductor will take note of the number of squeezes required to solicit a taste response.

(11) If the Bitrex is not tasted after 30 squeezes (step 10), the test subject is unable to taste Bitrex and may not perform the Bitrex fit test.

(12) If a taste response is elicited, the test subject shall be asked to take note of the taste for reference in the fit test.

(13) Correct use of the nebulizer means that approximately 1 ml of liquid is used at a time in the nebulizer body.

(14) The nebulizer shall be thoroughly rinsed in water, shaken to dry, and refilled at least each morning and afternoon or at least every four hours.

(b) Bitrex Solution Aerosol Fit Test Procedure.

(1) The test subject may not eat, drink (except plain water), smoke, or chew gum for 15 minutes before the test.

(2) The fit test uses the same enclosure as that described in 4. (a) above.

(3) The test subject shall don the enclosure while wearing the respirator selected according to section I. A. of this appendix. The respirator shall be properly adjusted and equipped with any type particulate filter(s).

(4) A second DeVilbiss Model 40 Inhalation Medication Nebulizer or equivalent is used to spray the fit test solution into the enclosure. This nebulizer shall be clearly marked to distinguish it from the screening test solution nebulizer.

(5) The fit test solution is prepared by adding 337.5 mg of Bitrex to 200 ml of a 5% salt (NaCl) solution in warm water.

(6) As before, the test subject shall breathe through his or her slightly open mouth with tongue extended, and be instructed to report if he/she tastes the bitter taste of Bitrex.

(7) The nebulizer is inserted into the hole in the front of the enclosure and an initial concentration of the fit test solution is sprayed into the enclosure using the same number of squeezes (either 10, 20 or 30 squeezes) based on the number of squeezes required to elicit a taste response as noted during the screening test.

(8) After generating the aerosol, the test subject shall be instructed to perform the exercises in section I. A. 14. of this appendix.

(9) Every 30 seconds the aerosol concentration shall be replenished using one half the number of squeezes used initially (e.g., 5, 10 or 15).

(10) The test subject shall indicate to the test conductor if at any time during the fit test the taste of Bitrex is detected. If the test subject does not report tasting the Bitrex, the test is passed.

(11) If the taste of Bitrex is detected, the fit is deemed unsatisfactory and the test is failed. A different respirator shall be tried and the entire test procedure is repeated (taste threshold screening and fit testing).

5. Irritant Smoke (Stannic Chloride) Protocol

This qualitative fit test uses a person's response to the irritating chemicals released in the "smoke" produced by a stannic chloride ventilation smoke tube to detect leakage into the respirator.

(a) General Requirements and Precautions

(1) The respirator to be tested shall be equipped with high efficiency particulate air (HEPA) or P100 series filter(s).

(2) Only stannic chloride smoke tubes shall be used for this protocol.

(3) No form of test enclosure or hood for the test subject shall be used.

(4) The smoke can be irritating to the eyes, lungs, and nasal passages. The test conductor shall take precautions to minimize the test subject's exposure to irritant smoke. Sensitivity varies, and certain individuals may respond to a greater degree to irritant smoke. Care shall be taken when performing the sensitivity screening checks that determine whether the test subject can detect irritant smoke to use only the minimum amount of smoke necessary to elicit a response from the test subject.

(5) The fit test shall be performed in an area with adequate ventilation to prevent exposure of the person conducting the fit test or the build-up of irritant smoke in the general atmosphere.

(b) Sensitivity Screening Check

The person to be tested must demonstrate his or her ability to detect a weak concentration of the irritant smoke.

(1) The test operator shall break both ends of a ventilation smoke tube containing stannic chloride, and attach one end of the smoke tube to a low flow air pump set to deliver 200 milliliters per minute, or an aspirator squeeze bulb. The test operator shall cover the other end of the smoke tube with a short piece of tubing to prevent potential injury from the jagged end of the smoke tube.

(2) The test operator shall advise the test subject that the smoke can be irritating to the eyes, lungs, and nasal passages and instruct the subject to keep his/her eyes closed while the test is performed.

(3) The test subject shall be allowed to smell a weak concentration of the irritant smoke before the respirator is donned to become familiar with its irritating properties and to determine if he/she can detect the irritating properties of the smoke. The test operator shall carefully direct a small amount of the irritant smoke in the test subject's direction to determine that he/she can detect it.

(c) Irritant Smoke Fit Test Procedure

(1) The person being fit tested shall don the respirator without assistance, and perform the required user seal check(s).

(2) The test subject shall be instructed to keep his/her eyes closed.

(3) The test operator shall direct the stream of irritant smoke from the smoke tube toward the faceseal area of the test subject, using the low flow pump or the squeeze bulb. The test operator shall begin at least 12 inches from the facepiece and move the smoke stream around the whole perimeter of the mask. The operator shall gradually make two more passes around the perimeter of the mask, moving to within six inches of the respirator.

(4) If the person being tested has not had an involuntary response and/or detected the irritant smoke, proceed with the test exercises.

(5) The exercises identified in section I.A. 14. of this appendix shall be performed by the test subject while the respirator seal is being continually challenged by the smoke, directed around the perimeter of the respirator at a distance of six inches.

(6) If the person being fit tested reports detecting the irritant smoke at any time, the test is failed. The person being retested must repeat the entire sensitivity check and fit test procedure.

(7) Each test subject passing the irritant smoke test without evidence of a response (involuntary cough, irritation) shall be given a second sensitivity screening check, with the smoke from the same smoke tube used during the fit test, once the respirator has been removed, to determine whether he/she still reacts to the smoke. Failure to evoke a response shall void the fit test.

(8) If a response is produced during this second sensitivity check, then the fit test is passed.

C. *Quantitative Fit Test (QNFT) Protocols*

The following quantitative fit testing procedures have been demonstrated to be acceptable: Quantitative fit testing using a non-hazardous test aerosol (such as corn oil, polyethylene glycol 400 [PEG 400], di-2-ethyl hexyl sebacate [DEHS], or sodium chloride) generated in a test chamber, and employing instrumentation to quantify the fit of the respirator; Quantitative fit testing using ambient aerosol as the test agent and appropriate instrumentation (condensation nuclei counter) to quantify the respirator fit; Quantitative fit testing using controlled negative pressure and appropriate instrumentation to measure the volumetric leak rate of a facepiece to quantify the respirator fit.

1. General

(a) The employer shall ensure that persons administering QNFT are able to calibrate equipment and perform tests properly, recognize invalid tests, calculate fit factors properly and ensure that test equipment is in proper working order.

(b) The employer shall ensure that QNFT equipment is kept clean, and is maintained and calibrated according to the manufacturer's instructions so as to operate at the parameters for which it was designed.

2. Generated Aerosol Quantitative Fit Testing Protocol

(a) Apparatus.

(1) Instrumentation. Aerosol generation, dilution, and measurement systems using particulates (corn oil, polyethylene glycol 400 [PEG 400], di-2-ethyl hexyl sebacate [DEHS] or sodium chloride) as test aerosols shall be used for quantitative fit testing.

(2) Test chamber. The test chamber shall be large enough to permit all test subjects to perform freely all required exercises without disturbing the test agent concentration or the measurement apparatus. The test chamber shall be equipped and constructed so that the test agent is effectively isolated from the ambient air, yet uniform in concentration throughout the chamber.

(3) When testing air-purifying respirators, the normal filter or cartridge element shall be replaced with a high efficiency particulate air (HEPA) or P100 series filter supplied by the same manufacturer.

(4) The sampling instrument shall be selected so that a computer record or strip chart record may be made of the test showing the rise and fall of the test agent concentration with each inspiration and expiration at fit factors of at least 2,000. Integrators or computers that integrate the amount of test agent penetration leakage into the respirator for each exercise may be used provided a record of the readings is made.

(5) The combination of substitute air-purifying elements, test agent and test agent concentration shall be such that the test subject is not exposed in excess of an established exposure limit for the test agent at any time during the testing process, based upon the length of the exposure and the exposure limit duration.

(6) The sampling port on the test specimen respirator shall be placed and constructed so that no leakage occurs around the port (e.g., where the respirator is probed), a free air flow is allowed into the sampling line at all times, and there is no interference with the fit or performance of the respirator. The in-mask sampling device (probe) shall be designed and used so that the air sample is drawn from the breathing zone of the test subject, midway between the nose and mouth and with the probe extending into the facepiece cavity at least 14 inch.

(7) The test setup shall permit the person administering the test to observe the test subject inside the chamber during the test.

(8) The equipment generating the test atmosphere shall maintain the concentration of test agent constant to within a 10 percent variation for the duration of the test.

(9) The time lag (interval between an event and the recording of the event on the strip chart or computer or integrator) shall be kept to a minimum. There shall be a clear association between the occurrence of an event and its being recorded.

(10) The sampling line tubing for the test chamber atmosphere and for the respirator sampling port shall be of equal diameter and of the same material. The length of the two lines shall be equal.

(11) The exhaust flow from the test chamber shall pass through an appropriate filter (i.e., high efficiency particulate filter) before release.

[Corrected at 63 FR 20099, April 23, 1998]

(12) When sodium chloride aerosol is used, the relative humidity inside the test chamber shall not exceed 50 percent.

(13) The limitations of instrument detection shall be taken into account when determining the fit factor.

(14) Test respirators shall be maintained in proper working order and be inspected regularly for deficiencies such as cracks or missing valves and gaskets.

(b) Procedural Requirements.

(1) When performing the initial user seal check using a positive or negative pressure check, the sampling line shall be crimped closed in order to avoid air pressure leakage during either of these pressure checks.

(2) The use of an abbreviated screening QLFT test is optional. Such a test may be utilized in order to quickly identify poor fitting respirators that passed the positive and/or negative pressure test and reduce the amount of QNFT time. The use of the CNC QNFT instrument in the count mode is another optional method to obtain a quick estimate of fit and eliminate poor fitting respirators before going on to perform a full QNFT.

(3) A reasonably stable test agent concentration shall be measured in the test chamber prior to testing. For canopy or shower curtain types of test units, the determination of the test agent's stability may be established after the test subject has entered the test environment.

(4) Immediately after the subject enters the test chamber, the test agent concentration inside the respirator shall be measured to ensure that the peak penetration does not exceed 5 percent for a half mask or 1 percent for a full facepiece respirator.

(5) A stable test agent concentration shall be obtained prior to the actual start of testing.

(6) Respirator restraining straps shall not be over-tightened for testing. The straps shall be adjusted by the wearer without assistance from other persons to give a reasonably comfortable fit typical of normal use. The respirator shall not be adjusted once the fit test exercises begin.

(7) The test shall be terminated whenever any single peak penetration exceeds 5 percent for half masks and 1 percent for full facepiece respirators. The test subject shall be refitted and retested.

(8) Calculation of fit factors.

(i) The fit factor shall be determined for the quantitative fit test by taking the ratio of the average chamber concentration to the concentration measured inside the respirator for each test exercise except the grimace exercise.

(ii) The average test chamber concentration shall be calculated as the arithmetic average of the concentration measured before and after each test (i.e., 7 exercises) or the arithmetic average of the concentration measured before and after each exercise or the true average measured continuously during the respirator sample.

(iii) The concentration of the challenge agent inside the respirator shall be determined by one of the following methods:

(A) Average peak penetration method means the method of determining test agent penetration into the respirator utilizing a strip chart recorder, integrator, or computer. The agent penetration is determined by an average of the peak heights on the graph or by computer integration, for each

exercise except the grimace exercise. Integrators or computers that calculate the actual test agent penetration into the respirator for each exercise will also be considered to meet the requirements of the average peak penetration method.

(B) Maximum peak penetration method means the method of determining test agent penetration in the respirator as determined by strip chart recordings of the test. The highest peak penetration for a given exercise is taken to be representative of average penetration into the respirator for that exercise.

(C) Integration by calculation of the area under the individual peak for each exercise except the grimace exercise. This includes computerized integration.

(D) The calculation of the overall fit factor using individual exercise fit factors involves first converting the exercise fit factors to penetration values, determining the average, and then converting that result back to a fit factor. This procedure is described in the following equation:

Overall Fit Factor = (Number of exercises)/$(1/ff_1+1/ff_2+1/ff_3+1/ff_4+...1/ff_n)$

Where ff_1 , ff_2 , ff_3 , etc. are the fit factors for exercises 1, 2, 3, etc.

(9) The test subject shall not be permitted to wear a half mask or quarter facepiece respirator unless a minimum fit factor of 100 is obtained, or a full facepiece respirator unless a minimum fit factor of 500 is obtained.

(10) Filters used for quantitative fit testing shall be replaced whenever increased breathing resistance is encountered, or when the test agent has altered the integrity of the filter media.

3. Ambient aerosol condensation nuclei counter (CNC) quantitative fit testing protocol.

The ambient aerosol condensation nuclei counter (CNC) quantitative fit testing (Portacount™) protocol quantitatively fit tests respirators with the use of a probe. The probed respirator is only used for quantitative fit tests. A probed respirator has a special sampling device, installed on the respirator, that allows the probe to sample the air from inside the mask. A probed respirator is required for each make, style, model, and size that the employer uses and can be obtained from the respirator manufacturer or distributor. The CNC instrument manufacturer, TSI Inc., also provides probe attachments (TSI sampling adapters) that permit fit testing in an employee's own respirator. A minimum fit factor pass level of at least 100 is necessary for a half-mask respirator and a minimum fit factor pass level of at least 500 is required for a full facepiece negative pressure respirator. The entire screening and testing procedure shall be explained to the test subject prior to the conduct of the screening test.

(a) Portacount Fit Test Requirements.

(1) Check the respirator to make sure the sampling probe and line are properly attached to the facepiece and that the respirator is fitted with a particulate filter capable of preventing significant penetration by the ambient particles used for the fit test (e.g., NIOSH 42 CFR 84 series 100, series 99, or series 95 particulate filter) per manufacturer's instruction.

[Revised at 63 FR 20099, April 23, 1998]

(2) Instruct the person to be tested to don the respirator for five minutes before the fit test starts. This purges the ambient particles trapped inside the respirator and permits the wearer to make certain the respirator is comfortable. This individual shall already have been trained on how to wear the respirator properly.

(3) Check the following conditions for the adequacy of the respirator fit: Chin properly placed; Adequate strap tension, not overly tightened; Fit across nose bridge; Respirator of proper size to span distance from nose to chin; Tendency of the respirator to slip; Self-observation in a mirror to evaluate fit and respirator position.

(4) Have the person wearing the respirator do a user seal check. If leakage is detected, determine the cause. If leakage is from a

poorly fitting facepiece, try another size of the same model respirator, or another model of respirator.

(5) Follow the manufacturer's instructions for operating the Portacount and proceed with the test.

(6) The test subject shall be instructed to perform the exercises in section I. A. 14. of this appendix.

(7) After the test exercises, the test subject shall be questioned by the test conductor regarding the comfort of the respirator upon completion of the protocol. If it has become unacceptable, another model of respirator shall be tried.

(b) Portacount Test Instrument.

(1) The Portacount will automatically stop and calculate the overall fit factor for the entire set of exercises. The overall fit factor is what counts. The Pass or Fail message will indicate whether or not the test was successful. If the test was a Pass, the fit test is over.

(2) Since the pass or fail criterion of the Portacount is user programmable, the test operator shall ensure that the pass or fail criterion meet the requirements for minimum respirator performance in this Appendix.

(3) A record of the test needs to be kept on file, assuming the fit test was successful. The record must contain the test subject's name; overall fit factor; make, model, style, and size of respirator used; and date tested.

4. Controlled negative pressure (CNP) quantitative fit testing protocol.

The CNP protocol provides an alternative to aerosol fit test methods. The CNP fit test method technology is based on exhausting air from a temporarily sealed respirator facepiece to generate and then maintain a constant negative pressure inside the facepiece. The rate of air exhaust is controlled so that a constant negative pressure is maintained in the respirator during the fit test. The level of pressure is selected to replicate the mean inspiratory pressure that causes leakage into the respirator under normal use conditions. With pressure held constant, air flow out of the respirator is equal to air flow into the respirator. Therefore, measurement of the exhaust stream that is required to hold the pressure in the temporarily sealed respirator constant yields a direct measure of leakage air flow into the respirator. The CNP fit test method measures leak rates through the

facepiece as a method for determining the facepiece fit for negative pressure respirators. The CNP instrument manufacturer Dynatech Nevada also provides attachments (sampling manifolds) that replace the filter cartridges to permit fit testing in an employee's own respirator. To perform the test, the test subject closes his or her mouth and holds his/her breath, after which an air pump removes air from the respirator facepiece at a pre-selected constant pressure. The facepiece fit is expressed as the leak rate through the facepiece, expressed as milliliters per minute. The quality and validity of the CNP fit tests are determined by the degree to which the in-mask pressure tracks the test pressure during the system measurement time of approximately five seconds. Instantaneous feedback in the form of a real-time pressure trace of the in-mask pressure is provided and used to determine test validity and quality. A minimum fit factor pass level of 100 is necessary for a half-mask respirator and a minimum fit factor of at least 500 is required for a full facepiece respirator. The entire screening and testing procedure shall be explained to the test subject prior to the conduct of the screening test.

(a) CNP Fit Test Requirements.

(1) The instrument shall have a non-adjustable test pressure of 15.0 mm water pressure.

(2) The CNP system defaults selected for test pressure shall be set at -15 mm of water (-0.58 inches of water) and the modeled inspiratory flow rate shall be 53.8 liters per minute for performing fit tests.

[Corrected at 63 FR 20099, April 23, 1998]

(**Note:** CNP systems have built-in capability to conduct fit testing that is specific to unique work rate, mask, and gender situations that might apply in a specific workplace. Use of system default values, which were selected to represent respirator wear with medium cartridge resistance at a low-moderate work rate, will allow inter-test comparison of the respirator fit.)

(3) The individual who conducts the CNP fit testing shall be thoroughly trained to perform the test.

(4) The respirator filter or cartridge needs to be replaced with the CNP test manifold. The inhalation valve downstream from the manifold either needs to be temporarily removed or propped open.

(5) The test subject shall be trained to hold his or her breath for at least 20 seconds.

(6) The test subject shall don the test respirator without any assistance from the individual who conducts the CNP fit test.

(7) The QNFT protocol shall be followed according to section I. C. 1. of this appendix with an exception for the CNP test exercises.

(b) CNP Test Exercises.

(1) Normal breathing. In a normal standing position, without talking, the subject shall breathe normally for 1 minute. After the normal breathing exercise, the subject needs to hold head straight ahead and hold his or her breath for 10 seconds during the test measurement.

(2) Deep breathing. In a normal standing position, the subject shall breathe slowly and deeply for 1 minute, being careful not to hyperventilate. After the deep breathing exercise, the subject shall hold his or her head straight ahead and hold his or her breath for 10 seconds during test measurement.

(3) Turning head side to side. Standing in place, the subject shall slowly turn his or her head from side to side between the extreme positions on each side for 1 minute. The head shall be held at each extreme momentarily so the subject can inhale at each side. After the turning head side to side exercise, the subject needs to hold head full left and hold his or her breath for 10 seconds during test measurement. Next, the subject needs to hold head full right and hold his or her breath for 10 seconds during test measurement.

(4) Moving head up and down. Standing in place, the subject shall slowly move his or her head up and down for 1 minute. The subject shall be instructed to inhale in the up position (i.e., when looking toward the ceiling). After the moving head up and down exercise, the subject shall hold his or her head full up and hold his or her breath for 10 seconds during test measurement. Next, the subject shall hold his or her head full down and hold his or her breath for 10 seconds during test measurement.

(5) Talking. The subject shall talk out loud slowly and loud enough so as to be heard clearly by the test conductor. The subject can read

from a prepared text such as the Rainbow Passage, count backward from 100, or recite a memorized poem or song for 1 minute. After the talking exercise, the subject shall hold his or her head straight ahead and hold his or her breath for 10 seconds during the test measurement.

(6) Grimace. The test subject shall grimace by smiling or frowning for 15 seconds.

(7) Bending Over. The test subject shall bend at the waist as if he or she were to touch his or her toes for 1 minute. Jogging in place shall be substituted for this exercise in those test environments such as shroud-type QNFT units that prohibit bending at the waist. After the bending over exercise, the subject shall hold his or her head straight ahead and hold his or her breath for 10 seconds during the test measurement.

(8) Normal Breathing. The test subject shall remove and re-don the respirator within a one-minute period. Then, in a normal standing position, without talking, the subject shall breathe normally for 1 minute. After the normal breathing exercise, the subject shall hold his or her head straight ahead and hold his or her breath for 10 seconds during the test measurement. After the test exercises, the test subject shall be questioned by the test conductor regarding the comfort of the respirator upon completion of the protocol. If it has become unacceptable, another model of a respirator shall be tried.

(c) CNP Test Instrument.

(1) The test instrument shall have an effective audio warning device when the test subject fails to hold his or her breath during the test. The test shall be terminated whenever the test subject failed to hold his or her breath. The test subject may be refitted and retested.

(2) A record of the test shall be kept on file, assuming the fit test was successful. The record must contain the test subject's name; overall fit factor; make, model, style and size of respirator used; and date tested.

Part II. New Fit Test Protocols

A. Any person may submit to OSHA an application for approval of a new fit test protocol. If the application meets the following criteria, OSHA will initiate a rulemaking proceeding under section 6(b)(7) of the OSH Act to determine whether to list the new protocol as an approved protocol in this Appendix A.

B. The application must include a detailed description of the proposed new fit test protocol. This application must be supported by either:

   1. A test report prepared by an independent government research laboratory (e.g., Lawrence Livermore National Laboratory, Los Alamos National Laboratory, the National Institute for Standards and Technology) stating that the laboratory has tested the protocol and had found it to be accurate and reliable; or

   2. An article that has been published in a peer-reviewed industrial hygiene journal describing the protocol and explaining how test data support the protocol's accuracy and reliability.

C. If OSHA determines that additional information is required before the Agency commences a rulemaking proceeding under this section, OSHA will so notify the applicant and afford the applicant the opportunity to submit the supplemental information. Initiation of a rulemaking proceeding will be deferred until OSHA has received and evaluated the supplemental information.

APPENDIX D – OSHA USER SEAL CHECK PROCEDURES

APPENDIX B-1 TO §1910.134: USER SEAL CHECK PROCEDURES (Mandatory)

The individual who uses a tight-fitting respirator is to perform a user seal check to ensure that an adequate seal is achieved each time the respirator is put on. Either the positive and negative pressure checks listed in this appendix, or the respirator manufacturer's recommended user seal check method shall be used. User seal checks are not substitutes for qualitative or quantitative fit tests.

I. *Facepiece Positive and/or Negative Pressure Checks*

A. *Positive pressure check.* Close off the exhalation valve and exhale gently into the facepiece. The face fit is considered satisfactory if a slight positive pressure can be built up inside the facepiece without any evidence of outward leakage of air at the seal. For most respirators this method of leak testing requires the wearer to first remove the exhalation valve cover before closing off the exhalation valve and then carefully replacing it after the test.

B. *Negative pressure check.* Close off the inlet opening of the canister or cartridge(s) by covering with the palm of the hand(s) or by replacing the filter seal(s), inhale gently so that the facepiece collapses slightly, and hold the breath for ten seconds. The design of the inlet opening of some cartridges cannot be effectively covered with the palm of the hand. The test can be performed by covering the inlet opening of the cartridge with a thin latex or nitrile glove. If the facepiece remains in its slightly collapsed condition and no inward leakage of air is detected, the tightness of the respirator is considered satisfactory.

II. Manufacturer's Recommended User Seal Check Procedures

The respirator manufacturer's recommended procedures for performing a user seal check may be used instead of the positive and/or negative pressure check procedures provided that the employer demonstrates that the manufacturer's procedures are equally effective.

APPENDIX E - OSHA RESPIRATOR CLEANING PROCEDURES

APPENDIX B-2 TO §1910.134: RESPIRATOR CLEANING PROCEDURES (Mandatory)

These procedures are provided for employer use when cleaning respirators. They are general in nature, and the employer as an alternative may use the cleaning recommendations provided by the manufacturer of the respirators used by their employees, provided such procedures are as effective as those listed here in Appendix B-2. Equivalent effectiveness simply means that the procedures used must accomplish the objectives set forth in Appendix B-2, i.e., must ensure that the respirator is properly cleaned and disinfected in a manner that prevents damage to the respirator and does not cause harm to the user.

I. *Procedures for Cleaning Respirators*

A. Remove filters, cartridges, or canisters. Disassemble facepieces by removing speaking diaphragms, demand and pressure-demand valve assemblies, hoses, or any components recommended by the manufacturer. Discard or repair any defective parts.

B. Wash components in warm (43° C [110° F] maximum) water with a mild detergent or with a cleaner recommended by the manufacturer. A stiff bristle (not wire) brush may be used to facilitate the removal of dirt.

C. Rinse components thoroughly in clean, warm (43° C [110° F] maximum), preferably running water. Drain.

D. When the cleaner used does not contain a disinfecting agent, respirator components should be immersed for two minutes in one of the following:

1. Hypochlorite solution (50 ppm of chlorine) made by adding approximately one milliliter of laundry bleach to one liter of water at 43° C (110° F); or,

2. Aqueous solution of iodine (50 ppm iodine) made by adding approximately 0.8 milliliters of tincture of iodine (6-8 grams ammonium and/or potassium iodide100 cc of 45% alcohol) to one liter of water at 43° C (110° F); or,

3. Other commercially available cleansers of equivalent disinfectant quality when used as directed, if their use is recommended or approved by the respirator manufacturer.

E. Rinse components thoroughly in clean, warm (43° C [110° F] maximum), preferably running water. Drain. The importance of thorough rinsing cannot be overemphasized. Detergents or disinfectants that dry on facepieces may result in dermatitis. In addition, some disinfectants may cause deterioration of rubber or corrosion of metal parts if not completely removed.

F. Components should be hand-dried with a clean lint-free cloth or air-dried.

G. Reassemble facepiece, replacing filters, cartridges, and canisters where necessary.

H. Test the respirator to ensure that all components work properly.

APPENDIX F - FIT TEST RECORD

FIT TEST RECORD

TEST RECIPIENT

Name: _____

Company/Office Location: _____

Test Recipient Signature: _____

RESPIRATOR TESTED

Type: _____

Manufacturer: _____

Size: _____

TEST ADMINISTRATOR

Name: _____

Company: _____

Position: _____

TEST USED

QLFT (Qualitative: Verifies to a Fit Factor of 100)

Isoamyl Acetate Irritant Smoke Bitrex® Other: _____

QNFT (Quantitative: Must achieve a minimum Fit Factor of 500)

Portacount® (attach printout) Other: _____

Measured Fit Factor: _____

CERTIFICATION

Comments: _____

Test Administrator Signature: _____

Date: _____

APPENDIX G - INSPECTION RECORD

INSPECTION RECORD

Each respirator should be inspected during cleaning and sanitizing. This form should be completed and enclosed with the respirator, and should be discarded the next time the respirator is used. In addition, respirators maintained on-site for emergency use to escape toxic atmospheres must be inspected monthly.

Inspected by: _____ Date: _____

Type of Respirator: _____

Part	Not Applicable	Approved	Defective*
ALL RESPIRATORS			
Facepiece			
Inhalation Valve			
Exhalation Valve			
Headbands			
Harness Assembly			
Speaking Diaphragm			
Gaskets			
Connections			
APRs/PAPRs			
Cartridge Holder			
Hose Assembly			
SCBAs or Airline Respirators			
Regulator			
Low Pressure Alarm			
Air Supply			

***Immediately remove any respirator with a Defective finding from service.**

APPENDIX L-G

CONTROL OF MEASURING AND MONITORING EQUIPMENT

APPENDIX L-G

CONTROL OF MONITORING AND MEASURING EQUIPMENT

1.0 PURPOSE

To ensure monitoring and measuring equipment (Equipment) typically used in the field is controlled, calibrated, and maintained when used by CRA to generate data for Professional Services.

2.0 RESPONSIBILITIES

i) Users of Equipment are responsible to ensure that they are adequately trained in the Equipment's use and that data, including calibration records, are recorded and filed.

ii) The Field Equipment Manager is responsible for the supply of well maintained and, if applicable, calibrated Equipment. The Field Equipment Manager is responsible for the training of employees in Equipment care or arranging for such training to be provided by others. The Field Equipment Manager is responsible for CRA-owned Equipment only.

3.0 CONTROL AND ADMINISTRATION

i) The general CRA employee procedures for the control, selection, use, and return of CRA-owned Equipment are shown on Figure 7.4 (Procedures for Use of Field Equipment).

ii) The assignment of Field Equipment Managers at each CRA office (where CRA-owned equipment is available for use), is recorded on Part 2 of List QSL-001 (Quality System Team Member Assignments).

iii) All CRA-owned Equipment is identified with a control number and its maintenance/calibration status using a white label as shown below.

CRA	
Control No.:	_____
Cal./Main. By:	_____
Date:	_____
Next Cal./Main. Due:	_____
	QSF-200

iv) Technical information pertaining to CRA-owned Equipment (such as owner's manuals), is maintained by the Field Equipment Manager. At a Client's request, any information pertaining to Equipment is provided.

v) The Field Equipment Manager at each CRA office is familiar with the proper operation of monitoring and measuring equipment, or has access to others who are familiar with the proper operation of this Equipment.

vi) Procedures for the Field Equipment Manager with respect to the identification, calibration, maintenance, and tracking of Equipment are provided in the Inspection, Measurement, and Test Equipment Work Instructions (QSWI-003).

4.0 SELECTION AND USE OF EQUIPMENT FROM AN OUTSIDE SOURCE

i) The user is responsible for contacting the outside source (i.e., rental company, Client, etc.), determining availability of Equipment, and arranging for the receipt of Equipment.

ii) When using Equipment from an outside source, the user ensures all necessary training is provided to them in the proper use of the requisitioned Equipment upon receipt. If Equipment from an outside source is similar to CRA-owned Equipment, training by the rental company/Client is not required.

iii) Whenever possible, the user requests a certificate of calibration to a national or equivalent standard is included with the Equipment upon receipt, and files this in the project field file.

5.0 CALIBRATION OF EQUIPMENT

i) The Field Equipment Manager ensures that all CRA-owned Equipment is shop-calibrated, as applicable, and maintained, and that these activities are documented. Specific procedures for the scheduling and performance of calibration activities and maintenance are specified in the Inspection, Measurement, and Test Equipment Work Instructions (QSWI-003).

ii) Where required, field calibration activities are conducted on site by field personnel. Calibration is conducted in accordance with the manufacturer's instructions or procedures established by CRA. Field calibration procedures are independent of shop services, and are documented on the Field Data Record Forms (QSF-200 Series D, QSF-400 Series D, and QSF-500 Series D) or in some other suitable manner (e.g., field book).

iii) When using Equipment from an outside source, documentation of Equipment calibrated to a national or equivalent standard must be requested by the user. In addition, field calibration must also be completed and documented prior to generating data. Where no such standards exist, and therefore, no calibration certification is available from the outside source, this will be documented by the user along with a description of the steps taken (i.e., field calibrations or checks), to ensure that accurate measurements are taken.

6.0 DATA RECORDING

i) Data gathered using Equipment is recorded on Field Data Record Forms (QSF-200 Series D, QSF-400 Series D, and QSF-500 Series D), or in some other suitable manner (e.g., field book). If a Field Data Record Form is not used, all of the information listed on this type of form must still be documented (e.g., field calibration, control number, user, etc.). Field Data Record Forms are available electronically on CRA's intranet website.

ii) If a Field Data Record Form (QSF-200 Series D, QSF-400 Series D, and QSF-500 Series D) does not already exist for Equipment used from an outside source, then calibration and data gathered must be recorded in a field book.

iii) Completed Field Data Record Forms (QSF-200 Series D, QSF-400 Series D, and QSF-500 Series D) and calibration certificates for Equipment are filed in the Project field file. Field books and any other records of field data are filed in the Project field file, or in a designated area by Project number. If field books are used for longer periods of time, data gathered should be photocopied and forwarded to the Project field file periodically, ensuring Project Team members can access pertinent information generated in the field from time to time. Where appropriate, field data is included in Deliverables.

APPENDIX L-H

PERSONNEL DECONTAMINATION

APPENDIX L-H

DECONTAMINATION

Procedure

A decontamination procedure shall be developed for each work Site where there exists a possibility that employees may come in contact with hazardous substances. The procedure shall be set forth in the Site-specific HASP and be communicated to all Site employees prior to work beginning at the Site.

Decontamination procedures shall be designed to assure the following:

- Employee contact with hazardous substances or equipment that has contacted hazardous substances is minimized.
- All employees leaving the contaminated area are decontaminated.
- All contaminated clothing and equipment leaving a contaminated area are appropriately disposed of or decontaminated.
- All equipment and solvents used for decontamination are decontaminated or disposed of properly.
- Personal protective clothing and equipment are decontaminated, cleaned, laundered, maintained, or replaced as needed to maintain their effectiveness.

Location

Decontamination shall be performed in geographical areas that minimize the exposure of uncontaminated employees and/or equipment to contaminated employees and/or equipment.

Showers and Change Rooms

When required, the decontamination procedure shall provide for regular showers and change rooms outside of the contaminated area. Employees wearing non-permeable clothing (e.g., work clothes, uniforms, or undergarments) coming into direct contact with hazardous substances shall immediately remove contaminated clothing and proceed to the shower. Showers and change rooms must meet the requirements of

OSHA 29 CFR 1910.141. If temperature conditions prevent the effective use of water, other effective means for cleansing shall be provided and used.

Contaminated clothing shall be disposed of or decontaminated before it is removed from the work zone. Unauthorized employees shall not remove protective clothing or equipment from change rooms.

Responsibility

The Site safety supervisor shall constantly monitor all decontamination procedures to determine their effectiveness. When such procedures are found to be ineffective, appropriate steps shall be taken to correct deficiencies.

APPENDIX L-I

DECONTAMINATION OF HEAVY EQUIPMENT

DECONTAMINATION OF HEAVY EQUIPMENT

1.0 GENERAL

The following guideline presents decontamination procedures for heavy equipment/vehicles that have been used in areas which are within the exclusion zones or restricted access areas due to chemical presence. Decontamination of equipment and vehicles is required to eliminate spreading of chemical presence and prevent chemical cross-contamination from site to site.

Equipment exiting an exclusion zone must adhere to the site contaminant reduction zone/decontamination zone protocols. The zone configuration and protocols are defined in Section L.6.1 of the HASP.

Decontamination methods for heavy equipment include physical removal of dirt/debris, and both physical/chemical means to clean surfaces. The types of chemicals at a site and their concentration and state will determine the appropriate method of decontamination to be employed.

2.0 PRIOR PLANNING AND PREPARATION

Cleaning of heavy equipment is commonly outlined in the site-specific Work Plan or the contractual documents which apply to the activities being conducted. Consequently, CRA must often oversee and possibly approve the cleaning adequacy of others and does not physically perform the cleaning tasks. Common scenarios which frequently occur are cleaning of backhoes and dump trucks from soil excavation and drum removal projects or cleaning of a drilling rig and the associated drilling equipment (i.e., augers, rods, split spoons, tools). The following describes preparatory tasks prior to implementation of heavy equipment decontamination:

i) Assembly and inventory of necessary cleaning equipment and supplies.

ii) Review Work Plan, HASP, and specific equipment cleaning protocols.

iii) Check on acquisition, storage, and transportation of solvents/potable water source.

iv) Evaluate disposition of cleaning fluids upon completion of the work.

v) Evaluate the area where the cleaning of heavy equipment will be performed to determine if the area is adequate or if an upgrade required.

3.0 FIELD PROCEDURE

The drill rig, augers, split-spoon samplers, Rotosonic core barrels and casings, and drill rods will be steam-cleaned before startup of field operations and, after each boring, using a high-pressure, high-temperature, hot water cleaner. The potable water used will come from an off-Site source free of contamination (a fire hydrant may be used). One sample of potable water will be analyzed for VOCs to verify water quality. In the event that the potable water source is changed, a sample will be collected from the new source.

Split-spoon samplers will be washed before each sample is collected using a brush and non-phosphate laboratory-grade detergent, such as Alconox®/LiquiNox®, rinsed with potable water, and rinsed again with distilled water.

The following cleaning procedures are applicable to heavy equipment decontamination:

i) Remove by hand (i.e., shovel, bar, scraper) excess visible dirt and debris from the equipment paying particular attention to tracks, cleats, tires, and other irregular surfaces.

ii) Clean the equipment using high pressure/low volume hot water or steam equipment.

iii) Clean/scrub the equipment with water and natural soap (biodegradable-phosphate free, i.e., Alconox®/LiquiNox® or equivalent) solution.

iv) Final rinse of equipment with high pressure/low volume hot water or steam equipment.

The cleaning procedure for liquid recirculation equipment (i.e., drilling pumps and hoses) shall be as follows:

- all exposed surfaces shall be surface cleaned as described above;
- a solution of natural soap (biodegradable-phosphate free, i.e., Alconox®/LiquiNox® or equivalent) and water shall be circulated through the system for 15 minutes or appropriate duration; and
- potable water shall be circulated through the system for 15 minutes or appropriate duration.

Once the heavy equipment is cleaned and approved clean (by CRA personnel), the wash water, soil debris, and spent protective wear must be containerized, labeled, and properly staged in the approved area on the Site. The materials will be disposed of/treated in accordance with the procedures detailed in the Field Sampling Plan for handling investigation-derived wastes.

4.0 FOLLOW-UP ACTIVITIES

The activities completed for each heavy equipment decontamination event shall be documented in writing in the field book. Included in the field book will be following information:

i) Site location, date, time, weather.

ii) Equipment use location.

iii) Location where decontamination was performed.

iv) Personnel performing decontamination.

v) Decontamination procedures.

vi) Sources of materials (solutions) used for decontamination.

vii) Volume of decontamination fluids generated.

viii) Location where decontamination fluids have been stored.

ix) Individuals approving adequacy of decontamination.

x) QA/QC sampling performed (if required).

The field book will be stored in the CRA office located at the Site.

The wash waters, soil debris, and spent protective wear will be properly segregated, containerized, labeled, stored, and, ultimately, treated or disposed of.

APPENDIX L-J

MEDICAL SURVEILLANCE

APPENDIX L-J

MEDICAL SURVEILLANCE

A CRA Medical Surveillance Program for field staff has been established in both the U.S. and Canada to preserve employee health and wellbeing. The Medical Surveillance Program has been structured to meet the requirements of U.S. OSHA regulations for hazardous waste site work, the use of respiratory protective equipment, and substance-specific health standards such as for benzene and asbestos. The program is also structured to comply with other U.S. and Canadian regulations, where applicable. Records associated with the administration of the Medical Surveillance Program are maintained in accordance with the requirements of both U.S. and Canadian legislation.

A. ENROLLMENT CRITERIA

All employees meeting one or more of the following criteria are required to enroll in the Medical Surveillance Program:

- An employee working in a job description that requires 30 days or more per year of field work where there is potential exposure above a published exposure limit to hazardous chemicals.
- An employee working in a job description that requires the use of respiratory protective equipment.
- An employee working on a project where the client requires participation in a Medical Surveillance Program.
- Other situations as deemed necessary by the Corporate SHM on a case-by-case basis.

B. EXAMINATIONS

CRA personnel who meet the enrolment criteria shall have taken a pre-employment examination prior to their first day of employment with CRA. Employees enrolled in the program will also be required to take an examination either annually or biennially, based on job description and field activity. CRA personnel enrolled in the program who leave the company will be offered an exit exam. Exit exams are provided for employees participating in the annual and biannual surveillance programs that have not had an exam within 6 or 12 months, respectively, from their departure date.

C. WRITTEN PROGRAMS

OSHA requires that a written program be provided for specific medical surveillance activities, as applicable to the work being performed. Listed below are the Medical Surveillance Programs applicable to CRA work activities. The written programs are appended to this Appendix F.

- Medical Surveillance for Cadmium.
- Medical Surveillance for Lead.

MEDICAL SURVEILLANCE FOR CADMIUM

This standard outlines the minimum medical surveillance requirements for employees participating in the medical surveillance program for cadmium as established under the OSHA standard for cadmium (29 CFR 1910.1027).

A. POLICY

This policy applies to any work where CRA employees may be exposed to cadmium-containing materials. At-risk activities may include:

- Demolition or salvage of structures where cadmium-containing materials may be present;
- Removal or encapsulation of materials containing cadmium (e.g., piping);
- New construction, alteration, repair or renovation of items containing cadmium;
- Installation of materials containing cadmium;
- Cadmium contamination or emergency cleanup;
- Maintenance operations involving the disturbance of cadium-containing materials; and
- Welding activities.

B. HAZARD DATA

Cadmium is a very toxic heavy metal. It is estimated to have a biologic half-life in humans of approximately 20 to 30 years. Cadmium may cause local skin or eye irritation and can affect long-term health if inhaled or ingested. The main exposure routes are through inhalation of dust and fumes and the incidental ingestion of dust from contaminated hands, food, or cigarettes. The kidneys are considered to be the most sensitive target organs in cadmium exposure.

Acute Exposures. High exposures may cause mild irritation of the upper respiratory tract, a sensation of throat constriction, a metallic taste in the mouth and/or cough. Up to ten (10) hours later, exposed persons may notice a progressive shortness of breath, chest pain and flu-like symptoms (weakness, fever, headache, chills, sweating and muscular pain). Acute pulmonary edema may also develop.

Chronic Exposures. Repeated long-term exposure to cadmium may result in kidney damage and an increased risk of lung or prostate cancer. Cadmium may cause local skin or eye irritation and can affect long-term health if inhaled or ingested.

Cadmium affects a variety of tissues and biologic systems and has been associated with such diverse ailments as hypertension and carcinogenesis. The concentration of cadmium in blood or urine may reflect the cadmium level in the whole body and predict the level of renal dysfunction. Symptoms of exposure to cadmium include upper respiratory symptoms (see acute exposures above), chest pain, nausea and dizziness.

C. DEFINITIONS

Cadmium – a naturally occurring element that is a soft, silver-white metal. Cadmium is most often found in combination with other elements, such as oxygen (cadmium oxide), chlorine (cadmium chloride), or sulfur (cadmium sulfide). Most cadmium used in the United States is a soft, bluish metal or grayish powder obtained as a by-product from the treatment of copper, lead and iron ores.

Action Level – The concentration of a chemical in air, calculated as an 8-hour time weighted average, which initiates certain required activities such as exposure monitoring and medical surveillance. For cadmium, an airborne concentration of 2.5 micrograms per cubic meter of air (2.5 $\mu g/m^3$), measured as an 8-hour time weighted average.

Permissible Exposure Level – The maximum amount or concentration, calculated as an 8-hour time weighted average, of a chemical that a worker may be exposed to under OSHA regulations, without experiencing adverse health effects. For all cadmium compounds, dust, and fumes, an airborne concentration of 5.0 micrograms per cubic meter of air (5.0 $\mu g/m^3$), measured as an 8-hour time weighted average.

D. MEDICAL SURVEILLANCE

Prior to each job where an employee exposure exceeds the Action Level of 2.5 $\mu g/m^3$ as an 8–hour TWA on 30 or more calendar days per year, CRA shall

establish medical surveillance requirements based on the OSHA cadmium standard, 29 CFR 1910.1027. Medical surveillance includes an initial surveillance, on-going surveillance (e.g., biological monitoring, medical exam and consultation) medical treatment and medical removal. See Attachment A for the medical surveillance requirements.

E. AIR MONITORING

Personal and area air monitoring shall be conducted for each job activity, which may emit airborne concentrations of cadmium.

The OSHA Action Level (AL) for cadmium of 2.5 $\mu g/m^3$ (8-hr TWA), without regard to the use of a respirator, will determine when an employer must begin a medical surveillance program and certain compliance activities. The Permissible Exposure Limit (PEL) of 5.0 $\mu g/m^3$ (8-hr TWA) sets the maximum worker exposure to cadmium. These concentrations will indicate the range of airborne cadmium concentrations for that performed function.

If the initial determination proves that employee exposure is below the action level, further exposure determination need not be repeated unless there is a change in processes or controls.

If employee exposure is at or above the AL, but at or below the PEL, monitoring will be performed at least every 6 months and continue until a repeat measurement - taken at least 7 days after - is below the AL.

If new equipment is added, raw materials are changed, new personnel are hired, work practices and final products are altered that may result in additional employees being exposed to cadmium at or above the action level, additional monitoring must be performed.

If periodic air monitoring shows levels of exposure below the action level and a repeat test at least 7 days later also shows levels below the action level, the semi-annual monitoring may be discontinued for those employees whose exposures are represented by the monitoring data.

Within fifteen working days after completion of the exposure assessment, each employee shall be notified in writing of the results, which represent that employee's exposure.

Whenever the results indicate that the employee exposure, without regard to respirator use, is at or above the PEL, a written notice shall be included that confirms the employee's exposure was at or above that level and a description of the corrective action taken or to be taken to reduce exposure below that level.

CRA shall provide affected employees or their designated representatives an opportunity to observe any monitoring techniques and procedures of employee cadmium exposure.

F. COMPLIANCE PROGRAM

Where any employee is exposed to cadmium above the Permissible Exposure Limit (PEL) of 5.0 $\mu g/m^3$ for more than 30 days per year, CRA shall establish and implement a written compliance program to reduce employee exposure to the PEL or below. (see Attachment B.) The written program must be revised and updated annually, or more often, to reflect significant changes in CRA's compliance status.

CRA shall implement engineering and/or work practice controls including administrative controls to reduce and maintain employee exposure to cadmium at or below the PEL to the extent that such controls are feasible. Whenever all feasible engineering and work practices controls that can be instituted are not sufficient to reduce employee exposure at or below the PEL, CRA shall use them nonetheless to reduce employee exposure to the lowest feasible level and shall supplement them by the use of respiratory protection. Refer to Section 4.5 of the Safety Manual, the "Respiratory Protection Program", and Attachment D, "Respiratory Protection for Cadmium".

G. TRAINING, RECORDKEEPING, AND SIGNAGE

Training

All employees whose job classification requires them to come in contact cadmium-containing materials, fumes, or dusts shall be trained by the Safety Department, prior to or at the time of their initial assignment, in the following:

1. The content of the standard and its appendices;

2. The specific nature of the operations that could result in exposure to cadmium above the Action Level;
3. The purpose, proper selection, fitting, use and limitations of respirators;
4. The purpose and a description of the medical surveillance program and the medical removal protection program;
5. The engineering controls and work practices to reduce exposure associated with the employee's job assignments (See Attachment C);
6. Signs and symptoms of exposure;
7. The contents of the compliance program in effect;
8. Measures employees can take to protect against cadmium exposure (e.g., modification of smoking, personal hygiene precautions, and appropriate work practices). Eating, drinking, smoking, chewing tobacco or gum, and applying cosmetics is prohibited in work areas where cadmium may exist;
9. Instructions for handling spills and emergency procedures; and
10. The right to access employee records.

This training must be completed, at a minimum, on an annual basis. A training certification record must be created showing that the employee has been training, the name of trained employee, the signature of the trainer, and the date the training was completed. These records must be retained for 1 year after the training.

All contractors shall also be responsible for meeting these OSHA training requirements.

Recordkeeping

CRA shall establish and maintain accurate records of the following:

1. All monitoring and other data used in conducting employee exposure assessments;
2. Written physician's opinion;
3. Training records;
4. Each employee subject to medical surveillance;
5. Any employee medical complaints related to cadmium exposure;

6. Medical removal records; and
7. A record of any employee refusals of biological monitoring or medical exams and consultations made available under the Medical Surveillance Program for Cadmium.

All records, including training, exposure monitoring and medical records, as well as the written program, are available upon request to the OSHA Assistant Secretary, the Director of the National Institute for Occupational Safety and Health, affected employees, former employees and their designated representatives.

Signage

The following warning signs shall be posted in each work area where an employee's exposure to cadmium is above the PEL.

DANGER
CADMIUM
CANCER HAZARD
CAN CAUSE LUNG AND KIDNEY DISEASE
AUTHORIZED PERSONNEL ONLY
RESPIRATORS REQUIRED IN AREA
NO SMOKING OR EATING

These signs shall be illuminated and cleaned as necessary so that the legend is readily visible. Signs that contradict or detract from the meaning of the sign are prohibited. Signs should not be removed or defaced.

H. EMERGENCY RESPONSE

The following emergency guidelines are to be used in emergency situations involving substantial release of airborne cadmium. Clouds of finely-divided dust are a fire and explosion hazard. Freshly formed cadmium fume is an intense pulmonary irritant and may result in development of pulmonary edema several hours after exposure. Inhalation or ingestion of dust or fumes may produce both acute and chronic health effects.

Evacuation

- Evacuate all employees from area immediately impacted by the cadmium release;
- Isolate area for at least 25 to 50 meters (80 to 160 feet) in all directions. Stay upwind;
- Only authorized personnel, members of the emergency response team, or local/state/federal emergency responders may enter the area;
- Ventilate enclosed areas;
- Eliminate all ignition sources (no smoking, sparks, or flames in immediate area);
- Call 911 if emergency medical service is needed; and
- Employees may not reenter the work area until air monitoring has been completed rendering the area safe and an all-clear has been given by an authorized individual.

Personal Protective Equipment

- NiOSH approved respirator, when exposure limits are known. See Attachment D;
- Wear a positive pressure self-contained breathing apparatus (SCBA) when exposure levels are unknown;
- Wear chemical protective clothing and gloves;
- Eye protective required when not wearing a full-face respirator; and
- A self-containing breathing apparatus (SCBA) and full protective clothing are required for all emergency response personnel when cadmium is involved in a fire.

Hygiene

- Do not eat, drink, or smoke in area;
- Decontamination protocols must be in place to deal with employee and response team exposure;
- Remove contaminated clothing immediately and dispose of properly; and

- Thoroughly wash hands before eating drinking, or smoking in appropriate designated area.

First Aid

- Move victim to fresh air;
- Call 911 or emergency medical service;
- Apply artificial respiration if victim is not breathing;
- Do no use mouth to mouth if victim ingested or inhaled the substance; induce artificial respiration with the aid of a pocket mask with a one-way valve or other proper respiratory medical device;
- For skin contact, remove and isolate contaminated clothing and shoes; wash affected area with soap and warm water;
- For eye contact, flush with warm, running water, including under eyelids, for at least 15 minutes;
- If ingested and victim is conscious, dilute stomach contents with 204 cupfuls of water or milk. Do not induce vomiting. If vomitting occurs naturally, rinse mouth and repeat administration of fluids. Seek medical attention immediately; and
- Provide required medical examinations, as soon as possible, to any employee who may have acutely been exposed to cadmium because of an emergency.

Fire

- Do NOT use water or foam when fighting fires involving cadmium; and
- Apply dry chemical, dry sand or special powder extinguishing media.

ATTACHMENT A

MEDICAL SURVEILLANCE PROGRAM

The medical surveillance program must begin when an employee meets the action level. The action level (AL) means employee exposure to an airborne concentration for cadmium of 2.5 μg/m^3 calculated as an 8-hour Time Weighted Average (TWA).

Initial Medical Surveillance

Initial Medical Surveillance is used to check the amount of cadmium in an employee's blood and urine stream. This is referred to as biological monitoring. The tests will include:

- Cadmium in urine (CdU), standardized to grams of creatinine (g/Cr);
- Beta-2-microglobulin in urine (β2-M), standardized to grams of creatinine (g/Cr), with PH specified; and
- Cadmium in blood (CdB), standardized to liters of whole blood (lwb).

Initial medical surveillance shall be provided at no cost to the employee involved in cadmium-related tasks, as listed previously in this policy, or if an employee is exposed to cadmium on the job any one day at or above the action level.

On-going Medical Surveillance

The following parameters will determine what level of medical surveillance will follow the initial examination. Levels at or below the levels specified below require only the minimum level of periodic medical surveillance, which includes a follow-up exam within one year of the initial exam and a periodic exam every two years thereafter. Biological sampling must be provided at least annually.

Criteria for ongoing medial surveillance:

- CdU level – at or below 3 μg/g Cr;
- β2-M level – at or below 300 μg/g Cr; and
- CdB level – at or below 5 μg/lwb.

If the initial biological monitoring tests for an employee show levels exceeding any of the above parameters, then the employee's occupational exposure to cadmium must be reassessed within two weeks of receiving the results of the tests. The reassessment must include a reevaluation and reassessment of:

- the employee's work practices and personal hygiene;
- respirator use and respirator program;
- smoking history and current usage; and
- available hygiene facilities and engineering controls in use.

Any deficiencies noted must be corrected within 30 days.

Additionally, an employee with levels exceeding the above criteria must receive a full medical examination within 90 days after receiving the results from the initial testing. A decision to medically remove the employee may be made by the physician at this point and biological monitoring must continue on a semiannual basis along with an annual medical exam.

Medical Exam and Consultation

All employees have the right to a medical exam and consultation whenever the employee will be working with cadmium at or above the action level for 30 days or more and:

- anytime the employee is working with cadmium and feels sick with any of the signs and symptoms of exposure; and
- if the employee has difficulty breathing while wearing a respirator.

Employees must notify their employer of the desire for a medical exam and consultation. The contents of this medical exam and consultation are determined by the physician.

Medical Removal

Medical removal means that the employee is temporarily removed from the cadmium exposure job based on the results of the biological monitoring tests or the written opinion of a physician determining that the employee must be removed as a result of:

- Biological monitoring results at or above the "Criteria for ongoing surveillance";
- Employee's inability to wear a respirator;
- Evidence of illness or other signs or symptoms of cadmium related dysfunction; or
- Any other reason deemed medically appropriate by the physician.

Inability to wear a respirator requires removal of the employee from work where exposure to cadmium is above the PEL; any other reason for removal requires removal of the worker from work where exposure to cadmium is below the action level.

Follow-up biological monitoring must be provided for any employee removed from duty at least every three months with follow-up medical examination semiannually until the examining physician provides a written opinion that the employee may be returned to the former job status or that the employee must be permanently removed from excess cadmium exposure.

Periodic Medical Surveillance

The minimum level of medical surveillance for employees who face exposure to cadmium but who do not test above the "Criteria for ongoing surveillance" includes an exam within one year after the initial exam and thereafter an exam at least every two years.

This exam must include:

- Detailed medical and work history;
- Complete physical examination, emphasizing blood pressure, the respiratory system, and the urinary system;
- Posterior-anterior view and lateral view chest x-ray;
- Pulmonary function tests;
- Blood analysis;
- Urinalysis;
- Prostate exam for males over 40 years old.; and
- Other tests deemed appropriate by the physician.

Annual biological sampling is required, either as part of the medical exam or separately as periodic biological monitoring. When an employee who has been previously

provided with medical surveillance is terminated or voluntarily leaves employment, a medical examination shall be provided that includes a chest x-ray. If the last periodic or other required exam was less than 6 months prior to the date of termination or departure, no further exam is required.

In the case of an emergency that may result in acute cadmium exposure, a medical examination equivalent to the standard periodic medical exam will be provided as soon as possible.

ATTACHMENT B

COMPLIANCE PROGRAM

The compliance program must provide for frequent and regular inspections of job sites, materials and equipment by a competent person. The written program must be revised and updated annually (more often, if necessary) and shall include the following:

1. A description of each activity in which cadmium is emitted (e.g., equipment used, material involved, controls in place, crew size, employee job responsibilities, operating procedures, and maintenance practices);
2. Specific plans to achieve compliance and engineering plans and studies where engineering controls are required;
3. Information on the technology considered to meet the PEL;
4. Air monitoring data that documents:
   - the source of cadmium emissions;
   - the date, duration, and results of air monitoring tests (8 hr TWA);
   - the name, social security number, and job classification of the employee monitored, as well as all employees the monitoring is intended to represent;
   - a description of the sampling and analytical methods used and evidence in their accuracy;
   - the type, if any, of respiratory protection worn y the monitored employee; and
   - a notation of any conditions that may affect the outcome of the monitoring results
5. A detailed schedule for implementing the program, including copies of documentation (e.g., purchase orders for equipment, construction contracts);
6. A work practice program including regulations for the use of protective work clothing and equipment and housekeeping and hygiene facility guidelines;
7. An administrative control schedule for job rotation, if used;
8. A description of arrangements made among contractors on multi-contractor sites to inform affected employees of potential exposure to cadmium and their responsibility to comply with this standard; and
9. Any other relevant information.

Engineering Controls

Engineering controls reduce employee exposure in the workplace either by removing or isolating the hazard or isolating the worker from exposure through the use of technology. Mechanical ventilation may be used to control cadmium exposure. If used, CRA shall evaluate, as necessary, the mechanical performance of the system in controlling exposure to maintain its effectiveness. Any change in production processes or controls that might increase cadmium exposure requires the system to be reevaluated for effectiveness within five working days of the change.

If air is recirculated from exhaust ventilation into the workplace, the system must be equipped with a high efficiency filter and be monitored periodically to ensure effectiveness. In order to minimize employee exposure during maintenance and filter changes, this activity should be performed during non-peak work hours where there is minimal risk of exposures to employees. Filters should be carefully removed from service and double bagged for disposal.

Administrative Controls

Administrative controls can be used to reduce employee exposure by removing the employee from the hazard (e.g., job rotation). If administrative controls are used to reduce employee exposure to cadmium, the Department of the affected employee shall establish and implement a job rotation schedule. The program shall identify by name or number each affected employee, specify the duration and exposure level at each job or work station where each affected employee is located, and include other information useful to assess the reliability of administrative controls to reduce employee cadmium exposures.

Work Practice Controls

Work practice controls reduce the likelihood of exposure by altering the manner in which a task is performed. Safe work practices include, but are not limited to, maintaining separate hygiene facilities (e.g., change rooms, showers, hand washing facilities and lunch areas) and requiring proper housekeeping practices (e.g., cleanup methods).

Housekeeping

All surfaces shall be maintained as free as practicable from the accumulations of cadmium.

Compressed air shall not be used to cleanup floors and other surfaces where cadmium accumulates unless it is used in conjunction with a ventilation system designed to capture the airborne dust created by the compressed air. Shoveling, dry or wet sweeping, and brushing shall be used only where vacuuming and other equally effective methods have been tried and found to be ineffective. Vacuums shall be equipped with high-efficiency particulate air (HEPA) filters and used and emptied in a manner that minimizes the re-entry of cadmium into the workplace.

Hygiene Facilities and Practices

Personal hygiene is critical in the control of cadmium exposure for employees working with cadmium containing materials.

To prevent the accidental ingestion of cadmium, employees are prohibited from eating, drinking, smoking, chewing tobacco or gum, or applying cosmetics of any kind in all areas where exposure to cadmium is at or above the PEL; regardless of respirator use.

CRA shall provide the following for employees who are exposed to cadmium above the PEL:

1. Clean change areas equipped with separate storage facilities for protective work clothing and equipment to prevent cross-contamination of street cloths;
2. Shower and hand washing facilities (with soap and disposable towels); and
3. Lunchroom facilities or eating areas that are as free as practicable from cadmium contamination. Employees shall wash their hands and face prior to eating, drinking, smoking or applying cosmetics in these areas.

Personal Protective Equipment

CRA shall provide at no cost to the employee and ensure the proper use of personal protective equipment where employees are exposed to cadmium above the PEL or are exposed to cadmium compounds that may cause skin or eye irritation. Appropriate

personal protective work clothing and equipment which prevent contamination of employees and their garments include but are not limited to the following:

1. Disposable coveralls or similar full-body suit;
2. Gloves, hats and disposable shoe coverlets; and
3. Face shields, vented goggles or other appropriate protective equipment, if necessary.

All Personal Protective Equipment (PPE) must be inspected by employees prior to each use. Personal Protective Equipment must be stored in a clean and sanitary manner.

Respirators

If employee exposures are found to exceed the PEL, respirators will be provided until feasible engineering or administrative controls can be implemented. Respirator use and type will be determined by the Safety Department, based on air monitoring results. If respirator use is necessary, employees must be medically cleared to wear a respirator, fit-tested, and trained before the respirator is used. Training and fit-testing will be done every six (6) months for those employees exposed to cadmium. Respirators should be inspected each month to ensure they are being used, stored, and cleaned properly.

Emergency Eyewash and Shower

If there is a possibility that the employees' skin or eyes may be splashed by cadmium-containing materials, fumes or dust, an emergency shower/drench hose and plumbed emergency eyewash should be provided in the work area. Employees must be instructed on the proper use of the eyewash and emergency showers. If the employees' eyes or skin is splashed, the employee must flush them immediately and continue for 15 minutes. The employee should then seek medical attention.

Disposal of Waste Materials

Cadmium-containing materials, dust and debris will generally be classified as hazardous waste and must be properly disposed. Because of hazardous waste costs, efforts should be made to minimize the generation of cadmium contaminated waste.

Dusts and contents from HEPA vacuums (including HEPA filters) should be collected and containerized to allow for testing and handling as a possible hazardous waste.

Some items contaminated as part of an abatement process may be cleaned and classified as non-hazardous waste. Polyethylene used to protect items may be cleaned using HEPA vacuuming and wet wiping, then disposed of as non-hazardous waste.

ATTACHMENT C

CLASSIFICATION OF WORK AND WORK PROCEDURES

Cadmium has been used as a paint ingredient and it should be assumed that all painted contains cadmium unless sampling or a manufacturer's specifications show otherwise. Industrial coatings often contain other hazardous ingredients in addition to or in place of cadmium. These might include, but are not limited to, chromium, lead, and mercury. Piping may also contain cadmium as a component of the material. When welding and/or cutting metal or metal with coated surfaces, powered air purifying respirators (PAPRs) with HEPA filters are required. PAPRs are recommended for all welding and cutting operations unless ventilation is in place to control contaminants. If welding or cutting is done in an occupied building, proper exhaust ventilation must be supplied. Similar guidelines apply to soldering of sheet metal, tubing, piping, or sewer piping involving cadmium-containing materials.

Welding Exterior Surfaces

Exterior operations and maintenance activities are prohibited on windy days (Winds greater than 15 miles per hour or the chips and dust are blowing off the plastic sheeting) as determined by the supervisor or project manager in charge of the job.

Welding on exterior surfaces (e.g., pipelines) covered with coatings or paint containing cadmium, shall be conducted as follows:

1. Contact Safety to obtain a Hot Work Permit, Refer to the Welding, Cutting and Brazing policy;
2. The operator shall be trained and ensure that the apparatus used for the work is operational, fire fighting equipment is available, and the welder is protected;
3. Provide portable and or mechanical ventilation (e.g., local exhaust) capable of keeping the levels of fumes, dust and gases below exposure limits;
4. If welding shall be conducted near air intakes, building ventilation systems shall be shut down;
5. Wear respirators when engineering controls are not feasible;
6. Wear proper PPE - gloves, apron and/or jacket that are made of a material which is a insulator from heat and electricity;
7. Wear welders helmet equipped with proper filter plate and cover lenses;

8. Place a fire resistant tarp below the work area;
9. Cover any combustibles in the path with a fire resistant tarp;
10. Provide a fire watch on ground level;
11. Restrict access to work area with barrier tape;
12. Provide a Class A fire extinguisher;
13. At break periods or when finished, workers must immediately proceed to decontamination area;
14. Decontamination area must be within the barricaded area and must have polyethylene drop cloths or plastic tarpaulins as a floor;
15. Keep adjacent and surrounding windows within 25 feet of the work area closed for the duration of the activity;
16. Limit access through the work area to workers utilizing barricade tape around the area;
17. Mist the work area;
18. Use a putty knife or scraper to scrape loose paint flakes and deteriorated subsurfaces;
19. Wash immediate area and tools with a spic-and-span/water solution;
20. Rinse the area with clean water;
21. HEPA vacuums, disposable towels and wash-up facilities should be made available to employees at the work site. All reusable equipment (HEPA vacuums, scrapers, screw drivers, etc.) must be properly cleaned at the end of the day's work and before leaving the job site;
22. Gently roll drop cloth inward from the outside edges to the center;
23. Dispose of drop cloth, personal protective equipment and used towels into a plastic bag labeled "Cadmium Contaminated Waste";
24. All work areas shall be visually inspected after clean-up procedures to ensure that no visible dust or debris is left in the work area;
25. Dispose of all plastic bags inside drums provided at a designated location; and
26. Contact Safety and/or the Supervisor for a pick up as needed.

Cadmium Removal Methods

A) ACCEPTABLE METHODS

The removal methods listed below are acceptable for operations and maintenance or abatement activities by personnel that have had the proper training, medical surveillance, and have completed the appropriate work area set-up.

1. Operations and Maintenance Removal Methods:
   - Manual scrapers and wire brushes
   - Limited manual sanding (preferably wet sanding) with accompanied ventilation (e.g., HEPA vacuum)
2. Abatement Removal Methods:
   - Chemical formulations that are approved by EH&S (e.g., methylene chloride-free solutions)
   - Heat guns not exceeding 700 degrees Fahrenheit
   - Manual scraping with the aid of approved chemical solvents (e.g., not containing methylene chloride)
   - Paste formulations containing potassium or sodium hydroxide
   - Mechanized sanding equipment with dedicated HEPA filtered exhaust systems

B) PROHIBITED METHODS

The following list of removal methods for either operations and maintenance or abatement activities are prohibited and will not be allowed.

- Use of a heat gun generating temperatures exceeding 700 degrees Fahrenheit;
- Open flame torching;
- Dry abrasive blasting using sand, grit or any other particulate;
- Use of chemical strippers not approved by EH&S; and
- Mechanized sanding without HEPA filtered collection systems.

ATTACHMENT D

RESPIRATORY PROTECTION FOR CADMIUM

Airborne Concentration	*Required Respirator Type*
Less than 10 times the PEL	A full mask, air purifying equipped with a high-efficiency particulate air (HEPA) filter.
Up to 25 times the PEL	A powered air-purifying respirator (PAPR) with a loose-fitting hood or helmet equipped with a HEPA filter or a supplied-air respirator with a loose-fitting hood or helmet face piece operated in the continuous flow mode.
Up to 50 times the PEL	A full face piece air-purifying respirator equipped with a HEPA filter or a powered air-purifying respirator with a tight-fitting half mask equipped with a HEPA filter or a supplied-air respirator with a tight-fitting half mask operated in the continuous flow mode
Up to 250 times the PEL	A powered air-purifying respirator with a tight fitting full face piece equipped with a HEPA filter or a supplied-air respirator with a tight-fitting full face piece operated in the continuous flow mode.
Up to 1,000 times the PEL	A supplied air respirator with half mask or full face piece operated in the pressure demand or other positive pressure mode.
More than 1,000 times a the PEL or unknown levels of concentration	A self-contained breathing apparatus with a full face piece operated in the pressure demand or other positive pressure mode, or a supplied air respirator with a full face piece operated in the pressure demand or other positive pressure mode and equipped with an auxiliary escape type self-contained breathing apparatus operated in the pressure demand mode.
Fire Fighting	A self-contained breathing apparatus with full face piece operated in the pressure demand or other positive pressure mode.

MEDICAL SURVEILLANCE FOR LEAD

The purpose of medical surveillance is for the early identification of conditions, if any, that could present an increased risk of adverse health effects related to the task being performed. Based on the type of work being performed, including consideration of factors such as the duration of the task, the materials being used, and the potential for exposure, medical surveillance is either recommended or required for the job.

Employees working under conditions and with materials that have an identifiable health risk at or above the percentage amounts determined by OSHA must be included in the Medical Surveillance Program. These risks may include, but are not limited to, carcinogens, biological agents, toxic chemicals, noise, and lasers.

By federal law, employees have the right to request copies of their medical or exposure records at any time by contacting their supervisor or Human Resources.

1.0 MEDICAL SURVEILLANCE FOR LEAD

This standard outlines the minimum medical surveillance requirements for employees participating in the medical surveillance program for lead as established under the OSHA standard for lead (29 CFR 1910.1025).

A. POLICY

This policy applies to any work where CRA employees may be exposed to lead or lead-containing materials. At-risk activities may include:

- Demolition or salvage of structures where lead-containing materials may be present;
- Removal or encapsulation of materials containing lead (e.g., paint);
- New construction, alteration, repair or renovation of items containing lead;
- Installation of materials containing lead;
- Lead contamination or emergency cleanup;
- Maintenance operations involving the disturbance of lead or lead-containing materials; and
- Welding activities.

B. HAZARD DATA

Lead can enter your body through inhalation and ingestion. Some organic lead compounds, such as tetraethyl lead, can be absorbed through the skin, but for inorganic lead compounds this is not a common route of exposure. Absorbed lead is carried through the blood stream and is stored in various organs and tissues. Even if you don't experience immediate symptoms, lead stored in tissues can cause irreversible damage.

Acute Exposures. If large enough doses are absorbed in a short period of time, encephalopathy (disease of the brain) can develop. This may lead to coma and death. Occupational exposures of this magnitude are rare.

Chronic Exposures. Chronic overexposure to lead may damage your blood-forming, nervous, urinary and reproductive systems. Overexposure to lead can cause kidney disease or anemia. Lead adversely affects the reproductive systems of both men and women. In men, lead exposure may cause decreased sex drive, impotence and sterility. In women, it can cause decreased fertility and abnormal menstrual cycles. Lead can also harm a developing fetus causing birth defects, mental retardation, miscarriages, and stillbirths.

Symptoms of exposure to lead include loss of appetite, metallic taste in the mouth, anxiety, constipation, nausea, pallor, excessive tiredness, weakness, insomnia, headache, nervous irritability, muscle and joint pain or soreness, fine tremors, numbness, dizziness, hyperactivity and severe abdominal pain. Paralysis, detected by a characteristic "wrist drop" or "foot drop" is another sign of exposure.

C. DEFINITIONS

Lead – Metallic lead, all inorganic lead compounds, and organic lead soaps. All other organic lead compounds are excluded from this definition (29 CFR 1910.1025(b))

Action Level – The concentration of a chemical in air, calculated as an 8-hour time weighted average, which initiates certain required activities such as exposure monitoring and medical surveillance. For lead, an airborne concentration of 30 micrograms per cubic meter of air (30 $\mu g/m^3$), measured as an 8-hour time weighted average.

Permissible Exposure Level – The maximum amount or concentration, calculated as an 8-hour time weighted average, of a chemical that a worker may be exposed to under

OSHA regulations, without experiencing adverse health effects. For lead, an airborne concentration of 50 micrograms per cubic meter of air (30 $\mu g/m^3$), measured as an 8-hour time weighted average.

D. MEDICAL SURVEILLANCE

Prior to each job where an employee exposure exceeds the Action Level of 30 $\mu g/m^3$ as an 8–hour TWA and 30 calendar days per year, CRA shall establish medical surveillance requirements based on the OSHA lead standard, 29 CFR 1910.1030. Medical surveillance includes an initial surveillance, on-going surveillance (e.g., biological monitoring, six-part medical exam, medical exam and consultation) medical treatment and medical removal. See Attachment A for the medical surveillance requirements.

E. AIR MONITORING

Personal and area air monitoring shall be conducted for each job activity, which may emit airborne concentrations of lead.

The OSHA Action Level (AL) for lead of 30 $\mu g/m^3$ (8-hr TWA), without regard to the use of a respirator, will determine when an employer must begin a medical surveillance program and certain compliance activities. The Permissible Exposure Limit (PEL) of 50 $\mu g/m^3$ (8-hr TWA) sets the maximum worker exposure to lead. These concentrations will indicate the range of airborne lead concentrations for that performed function.

If the initial determination proves that employee exposure is below the action level, further exposure determination need not be repeated unless there is a change in processes or controls.

If employee exposure is at or above the AL, but at or below the PEL, monitoring will be performed at least every six months and continue until at least two consecutive measurements - taken at least seven days apart - are below the AL.

If the employee exposure is above the PEL, monitoring will be performed quarterly and continue until at least two consecutive measurements - taken at least seven days apart - are at or below the PEL but at or above the AL. Monitoring shall be repeated and continued every six months to bring the exposure to or below the AL as described above.

Within five working days after completion of the exposure assessment, each employee shall be notified in writing of the results, which represent that employee's exposure.

Whenever the results indicate that the employee exposure, without regard to respirator use, is at or above the PEL, a written notice shall be included that confirms the employee's exposure was at or above that level and a description of the corrective action taken or to be taken to reduce exposure below that level.

CRA shall provide affected employees or their designated representatives an opportunity to observe any monitoring techniques and procedures of employee lead exposure.

F. COMPLIANCE PROGRAM

Where any employee is exposed to lead above the Permissible Exposure Limit (PEL) of 50 $\mu g/m^3$ for more than 30 days per year, CRA shall establish and implement a written compliance program to reduce employee exposure to the PEL or below. (See Attachment B.) The written program must be revised and updated every 6 months.

CRA shall implement engineering and/or work practice controls including administrative controls to reduce and maintain employee exposure to lead at or below the PEL to the extent that such controls are feasible. Whenever all feasible engineering and work practices controls that can be instituted are not sufficient to reduce employee exposure at or below the PEL, CRA shall use them nonetheless to reduce employee exposure to the lowest feasible level and shall supplement them by the use of respiratory protection. Refer to Section 4.5 of the Safety Manual, the Respiratory Protection Program.

G. TRAINING, RECORDKEEPING, AND SIGNAGE

Training

All employees whose job classification requires them to come in contact with lead-based paint, lead-containing materials, or airborne lead concentrations shall be trained by the Safety Department, prior to initial assignment, in the following:

1. The content of the standard and its appendices;
2. The specific nature of the operations that could result in exposure to lead above the Action Level;

3. The purpose, proper selection, fitting, use and limitations of respirators;
4. The purpose and a description of the medical surveillance program and the medical removal protection program;
5. The engineering controls and work practices to reduce exposure associated with the employee's job assignments (see Attachment C);
6. Signs and symptoms of exposure, and the effects on reproductive systems;
7. The contents of the compliance program in effect;
8. Instructions to employees that special drugs (e.g., chelating agents) must not be used routinely to remove lead from their bodies and when necessary used only under medical supervision;
9. Instructions for handling spills and emergency procedures; and
10. The right to access employee records.

This training must be completed, at a minimum, on an annual basis. All contractors shall also be responsible for meeting these OSHA training requirements.

Recordkeeping

CRA shall establish and maintain accurate records of the following:

1. All monitoring and other data used in conducting employee exposure assessments;
2. Written physician's opinion;
3. Training records;
4. Each employee subject to medical surveillance;
5. Any employee medical complaints related to lead exposure;
6. Medical removal records; and
7. A record of any employee refusals of biological monitoring or medical exams and consultations made available under the Medical Surveillance Program for Lead.

All records including exposure monitoring, medical removal and medical records are available upon request to affected employees, former employees and their designated representatives and shall be maintained for at least 30 years.

Signage

The following warning signs shall be posted in each work area where an employee's exposure to lead is above the PEL.

WARNING
LEAD WORK AREA
POISON
NO SMOKING OR EATING

These signs shall be illuminated and cleaned as necessary so that the legend is readily visible. Signs that contradict or detract from the meaning of the sign are prohibited. Signs should not be removed or defaced.

ATTACHMENT A

MEDICAL SURVEILLANCE PROGRAM

The medical surveillance program must begin when an employee meets the action level. The action level (AL) means employee exposure to an airborne concentration for lead of 30 μg/m^3 calculated as an 8-hour Time Weighted Average (TWA).

Initial Medical Surveillance

Initial Medical Surveillance is used to check the amount of lead in an employee's blood stream. This is referred to as biological monitoring. The two blood tests used in the biological monitoring are the blood lead level test and the zinc protoporphyrin (ZPP) test. Initial medical surveillance shall be provided at no cost to the employee involved in lead tasks, as listed previously in this policy, or if an employee is exposed to lead on the job any one day at or above the action level.

On-going Medical Surveillance

Employees shall be placed in an on-going medical surveillance program if it is anticipated that the employee will be exposed to lead on the job at or above the action level for more than 30 days in any continuous 12-month period.

The on-going medical surveillance program consists of three exams:

1. Blood test and Biological Monitoring

   The blood lead level and ZPP tests are required:

   - When the employee begins working with lead and every 2 months for the first 6 months and every 6 months thereafter for employees exposed at or above the action level for more than 30 days annually;
   - When the employee's blood lead level results are at or above micrograms per deciliter (μg/dl) of blood and at least every two months for employees whose last blood sampling and analysis indicated a blood lead level at or above 40 μg/dl; and
   - When an employee's blood lead level results are at or above 50 μg/dl, the employee shall be tested again within two weeks to confirm that medical removal is necessary. If the second test result is at or above 50 μg/dl, the employee must be medically removed and tested at least every month until a

blood lead level of 40 μg/dl or less on two separate testing dates is reached. The tests must be taken at least 30 days apart.

Within 5 days of receiving biological monitoring results, CRA must notify each employee, in writing, of his/her blood lead levels.

2. Six-part Medical Exam

The required six-part medical exam in the medical surveillance program shall be made available to the employee whenever the employee will be working with lead at or above the action level for 30 or more days a year and your blood lead level results are 40 μg/dl or above.

This medical exam shall consist of the following:

- Interview about the employee's work and medical history;
- Complete physical exam;
- Blood pressure check;
- Blood tests which will show blood level, ZPP, hemoglobin and hematocrit (anemia test), blood urea nitrogen and serum creatinine (kidney test);
- Routine urinalysis (kidney and protein check); and
- Any additional test that the physician recommends in order to determine how lead has or could affect the employee.

3. Medical Exam and Consultation

All employees have the right to a medical exam and consultation whenever the employee will be working with lead at or above the action level for 30 days or more and:

- Anytime the employee is working with lead and feels sick with any of the signs and symptoms of lead poisoning;
- Whenever the employee is concerned about having a healthy baby; and
- If the employee has difficulty breathing while wearing a respirator.

Employees must notify their employer of the desire for a medical exam and consultation. The contents of this medical exam and consultation are determined by the physician.

Medical Treatment

Under certain limited circumstances, special drugs called chelating agents may be administered to remove circulating blood lead. Using chelation as a preventive measure

- that is, to lower blood level but continue to expose a worker - is prohibited and therapeutic or diagnostic chelations of lead that are required must be done under the supervision of a licensed physician in a clinical setting. The employee must be notified in writing prior to treatment.

Medical Removal

Medical removal means that the employee is removed from the lead exposure job. Removing the employee from the lead exposure gives the body time to eliminate the lead.

If the employee's blood lead level reaches 50 μg/dl, for the periodic blood test and the follow-up blood test, the employee must be removed from exposure to lead. The employee will not be allowed to wear a respirator to lower the exposure when the blood lead level is at this level.

Employees shall be returned to their former job status when two consecutive blood-sampling tests indicate a blood lead level at or below 40 μg/dl.

Final medical determination means the physician has provided a written medical opinion to remove the employee from lead exposure. This means:

- The physician believes that the employee has a medical problem that will be affected by lead exposure; and
- The physician believes that the risk to the employee's health is high.

The physician must inform the employer of the medical recommendation regarding working with lead. The employee may return to working with lead when the doctor determines that he/she no longer has risk of exposure at the action level and per the requirements of the standard.

ATTACHMENT B

COMPLIANCE PROGRAM

The compliance program must provide for frequent and regular inspections of job sites, materials and equipment by a competent person. The written program must be revised and updated at least every six months, shall include the following:

1. A description of each activity in which lead is emitted (e.g., equipment used, material involved, controls in place, crew size, employee job responsibilities, operating procedures, and maintenance practices);
2. Specific plans to achieve compliance and engineering plans and studies where engineering controls are required;
3. Information on the technology considered to meet the PEL;
4. Air monitoring data that documents the source of lead emissions;
5. A detailed schedule for implementing the program, including copies of documentation (e.g., purchase orders for equipment, construction contracts);
6. A work practice program including regulations for the use of protective work clothing and equipment and housekeeping and hygiene facility guidelines;
7. An administrative control schedule for job rotation, if used;
8. A description of arrangements made among contractors on multi-contractor sites to inform affected employees of potential exposure to lead and their responsibility to comply with this standard; and
9. Any other relevant information.

Engineering Controls

Engineering controls reduce employee exposure in the workplace either by removing or isolating the hazard or isolating the worker from exposure through the use of technology. Mechanical ventilation may be used to control lead exposure. If used, CRA shall evaluate, as necessary, the mechanical performance of the system in controlling exposure to maintain its effectiveness.

Administrative Controls

Administrative controls can be used to reduce employee exposure by removing the employee from the hazard (e.g., job rotation). If administrative controls are used to

reduce employee exposure to lead, the Department of the affected employee shall establish and implement a job rotation schedule. The program shall identify by name or number each affected employee, specify the duration and exposure level at each job or work station where each affected employee is located, and include other information useful to assess the reliability of administrative controls to reduce employee lead exposures.

Work Practice Controls

Work practice controls reduce the likelihood of exposure by altering the manner in which a task is performed. Safe work practices under the lead in construction standard include, but are not limited to, maintaining separate hygiene facilities (e.g., change rooms, showers, hand washing facilities and lunch areas) and requiring proper housekeeping practices (e.g., cleanup methods).

Housekeeping

All surfaces shall be maintained as free as practicable from the accumulations of lead.

Compressed air shall not be used to cleanup floors and other surfaces where lead accumulates unless it is used in conjunction with a ventilation system designed to capture the airborne dust created by the compressed air. Shoveling, dry or wet sweeping, and brushing shall be used only where vacuuming and other equally effective methods have been tried and found to be ineffective. Vacuums shall be equipped with high-efficiency particulate air (HEPA) filters and used and emptied in a manner that minimizes the re-entry of lead into the workplace.

Hygiene Facilities and Practices

Personal hygiene is critical in the control of lead exposure for employees working with lead containing materials.

To prevent the accidental ingestion of lead, food, beverages, tobacco products, and cosmetics are prohibited in all areas where employees are exposed to lead above the PEL regardless of respirator use.

CRA shall provide the following for employees who are exposed to lead above the PEL:

1. Clean change areas equipped with separate storage facilities for protective work clothing and equipment to prevent cross-contamination of street cloths;
2. Shower and hand washing facilities (with soap and disposable towels); and
3. Lunchroom facilities or eating areas that are as free as practicable from lead contamination. Employees shall wash their hands and face prior to eating, drinking, smoking or applying cosmetics in these areas.

Personal Protective Equipment

CRA shall provide at no cost to the employee and ensure the proper use of personal protective equipment where employees are exposed to lead above the PEL or are exposed to lead compounds that may cause skin or eye irritation. Appropriate personal protective work clothing and equipment which prevent contamination of employees and their garments include but are not limited to the following:

1. Disposable coveralls or similar full-body suit;
2. Gloves, hats and disposable shoe coverlets; and
3. Face shields, vented goggles or other appropriate protective equipment, if necessary.

All Personal Protective Equipment (PPE) must be inspected by employees prior to each use. Personal Protective Equipment must be stored in a clean and sanitary manner.

Respirators

If employee exposures are found to exceed the PEL, respirators will be provided until feasible engineering or administrative controls can be implemented. Respirator use and type will be determined by the Safety Department, based on air monitoring results. If respirator use is necessary, employees must be medically cleared to wear a respirator, fit-tested, and trained before the respirator is used. Training and fit-testing will be done every six (6) months for those employees exposed to lead. Respirators should be inspected each month to ensure they are being used, stored, and cleaned properly.

CRA shall provide a NIOSH-certified powered, air-purifying respirator in lieu of any negative-pressure respirator, at no cost to the employee, whenever an employee chooses

to use this type of respirator and this respirator will provide adequate protection to the employee.

Emergency Eyewash and Shower

If there is a possibility that the employees' skin or eyes may be splashed by lead, an emergency shower/drench hose and plumbed emergency eyewash should be provided in the work area. Employees must be instructed on the proper use of the eyewash and emergency showers. If the employees' eyes or skin is splashed, the employee must flush them immediately and continue for 15 minutes. The employee should then seek medical attention.

Disposal of Waste Materials

Lead paint chips, dust and debris will generally be classified as hazardous waste and must be properly disposed. Because of hazardous waste costs, efforts should be made to minimize the generation of lead contaminated waste.

Paint chips, dusts and contents from HEPA vacuums (including HEPA filters) should be collected and containerized to allow for testing and handling as a possible hazardous waste. Demolition materials painted with lead based paint will be disposed of as regular demolition waste.

Some items contaminated as part of an abatement process may be cleaned and classified as non-hazardous waste. Polyethylene used to protect items may be cleaned using HEPA vacuuming and wet wiping, then disposed of as non-hazardous waste.

ATTACHMENT C

CLASSIFICATION OF WORKAND WORK PROCEDURES

All painted surfaces shall be assumed to be lead-containing unless sampling or a manufacturer's specifications show otherwise. Industrial coatings often contain other hazardous ingredients in addition to or in place of lead. These might include, but are not limited to, chromium, cadmium, and mercury. When welding and/or cutting lead painted surfaces, powered air purifying respirators (PAPRs) with HEPA filters are required. PAPRs are recommended for all welding and cutting operations unless ventilation is in place to control contaminants. If welding or cutting is done in an occupied building, proper exhaust ventilation must be supplied. Similar guidelines apply to soldering of sheet metal, tubing, piping, or sewer piping involving lead solder or other lead containing materials.

Welding Exterior Surfaces

Exterior operations and maintenance activities are prohibited on windy days (Winds greater than 15 miles per hour or the chips and dust are blowing off the plastic sheeting) as determined by the supervisor or project manager in charge of the job.

Welding on exterior surfaces (e.g., pipelines) covered with lead coatings or paint shall be conducted as follows:

1. Contact Safety to obtain a Hot Work Permit, Refer to the Welding, Cutting and Brazing policy;
2. The operator shall be trained and ensure that the apparatus used for the work is operational, fire fighting equipment is available, and the welder is protected;
3. Provide portable and or mechanical ventilation (e.g., local exhaust) capable of keeping the levels of fumes, dust and gases below exposure limits;
4. If welding shall be conducted near air intakes, building ventilation systems shall be shut down;
5. Wear respirators when engineering controls are not feasible;
6. Wear proper PPE - gloves, apron and/or jacket that are made of a material which is a insulator from heat and electricity;
7. Wear welders helmet equipped with proper filter plate and cover lenses;
8. Place a fire resistant tarp below the work area;

9. Cover any combustibles in the path with a fire resistant tarp;
10. Provide a fire watch on ground level;
11. Restrict access to work area with barrier tape;
12. Provide a Class A fire extinguisher;
13. At break periods or when finished, workers must immediately proceed to decontamination area;
14. Decontamination area must be within the barricaded area and must have polyethylene drop cloths or plastic tarpaulins as a floor;
15. Keep adjacent and surrounding windows within 25 feet of the work area closed for the duration of the activity;
16. Limit access through the work area to workers utilizing barricade tape around the area;
17. Mist the work area;
18. Use a putty knife or scraper to scrape loose paint flakes and deteriorated subsurfaces;
19. Wash immediate area and tools with a spic-and-span/water solution;
20. Rinse the area with clean water;
21. HEPA vacuums, disposable towels and wash-up facilities should be made available to employees at the work site. All reusable equipment (HEPA vacuums, scrapers, screw drivers, etc.) must be properly cleaned at the end of the day's work and before leaving the job site.
22. Gently roll drop cloth inward from the outside edges to the center;
23. Dispose of drop cloth, personal protective equipment and used towels into a plastic bag labeled "Lead Contaminated Waste";
24. All work areas shall be visually inspected after clean-up procedures to ensure that no visible dust or debris is left in the work area;
25. Dispose of all plastic bags inside drums provided at a designated location; and
26. Contact Safety and/or the Supervisor for a pick up as needed.

Lead Removal Methods

A) ACCEPTABLE METHODS

The removal methods listed below are acceptable for operations and maintenance or abatement activities by personnel that have had the proper

training, medical surveillance, and have completed the appropriate work area set-up.

1. Operations and Maintenance Removal Methods:
   - Manual scrapers and wire brushes; and
   - Limited manual sanding (preferably wet sanding) with accompanied ventilation (e.g., HEPA vacuum).
2. Abatement Removal Methods:
   - Chemical formulations that are approved by EH&S (e.g., methylene chloride-free solutions);
   - Heat guns not exceeding 700 degrees Fahrenheit;
   - Manual scraping with the aid of approved chemical solvents (e.g., not containing methylene chloride);
   - Paste formulations containing potassium or sodium hydroxide; and
   - Mechanized sanding equipment with dedicated HEPA filtered exhaust systems.

B) PROHIBITED METHODS

The following list of removal methods for either operations and maintenance or abatement activities are prohibited and will not be allowed.

- Use of a heat gun generating temperatures exceeding 700 degrees Fahrenheit;
- Open flame torching;
- Dry abrasive blasting using sand, grit or any other particulate;
- Use of chemical strippers not approved by EH&S; and
- Mechanized sanding without HEPA filtered collection systems.

Lead Abatement Jobs

Activities resulting in the disturbance of lead paint for the purpose of removing lead based paint or "de-leading" surfaces will require special conditions and considerations not outlined in this document. At minimum, abatement of lead paint will be performed by personnel who:

1. Are participating in a complete medical surveillance program;
2. Have successfully completed a lead abatement training course that includes the hazards of lead, proper abatement procedures, personal protective equipment, and cleanup and clearance procedures; and

3. Are under the direct supervision of a supervisor who has successfully completed a lead abatement supervisor training course.

Lead abatement in general will be conducted by private sector contractors.