AER ADVANCED ENVIRONMENTAL REDEVELOPMENT, LLC

904 Madison Avenue - Room 213, Bridgeport, Connecticut 06606 Tel: 203-333-2767 Fax: 203-333-4770

HEALTH AND SAFETY PLAN
YONKERS DOWNTOWN SOIL REMEDIATION
WATERFRONT DEVELOPMENT
PARCELS E AND F
YONKERS, NEW YORK
PROJECT #214

Prepared for:

On its own behalf and on behalf of
Hudson Park Investors, LLC
C/O Collins Enterprises, LLC
2001 West Main Street
Stamford, Connecticut 06902

Prepared by:

AER/ Advanced Environmental Redevelopment
904 Madison Avenue – Suite 213
Bridgeport, Connecticut

November 2001

Christopher J. Kopley, L.E.P., P.G.
Principal

TABLE OF CONTENTS

TABLES

FIGURES

APPENDICES

LOCATION

Name of Facility: Yonkers Downtown Waterfront Development
City of Yonkers, Westchester County, New York

Site Contact: Mr. Michael Marcante
Collins Enterprises, LLC
Telephone: 203-358-0004

Yonkers Downtown Waterfront Development, Parcels E and F, is located within the area lying west of the Metro-North Railroad Track, north of the Condominium Development known as Scrimshaw House, east of the Hudson River and south of the Saw Mill River outlet.

1.0 INTRODUCTION

The Health and Safety Plan (HASP) applies only to those personnel who may encounter or do encounter native, semi-volatile and metal containing soils. The HASP document defines general applicability and responsibilities with respect to compliance with health and safety programs. The soil remediation is being conducted as part of the 1996 Clean Water/Clean Air Bond Act, Environmental Restoration Projects – Title 5, Project Number B00045-3. The purpose of the Site HASP is to define the requirements and designate protocols to be followed during soil remediation at the Yonkers Downtown Waterfront Development Site, Parcels E and F, Yonkers, New York.

Semi-volatile compounds and metals have been defined in on-site soils at a level above the New York State Department of Environmental Conservation (NYSDEC) Recommended Cleanup Criteria. These affected soils will be sampled, excavated, stockpiled, backfilled, graded, loaded and disposed of off-site as necessary.

Applicability extends to employees, contractors and subcontractors working with affected soils on-site. On-site personnel must review the appropriate Site HASP and sign an agreement to comply with the requirements prior to entering a work area or contamination reduction zone. Current safety standards as defined by OSHA/NIOSH, health effects and standards for known contaminants, and procedures designed to account for the potential for exposure to unknown substances were considered during development of this plan. Specifically, the following reference sources have been consulted:

- OSHA 29 CFR 1910.120 and 40 CFR
- U.S. EPA, OERR Environmental Response Team (ERT) Standard Operating Safety Guidelines

- OSHA/NIOSH/EPA Coast Guard, "Occupational Health and Safety Guidelines for activities at Hazardous Waste Sites"
- NIOSH Pocket Guide to Chemical Hazards
- ACGIH Threshold Limit Values – 91-92 edition
- OSHA 29 CFR 1910.1000
- OSHA 29 CFR 1910.1025

A separate Community Air Monitoring Plan has been prepared for this site that addresses dust and particulate monitoring.

2.0 SAFETY ASSIGNMENTS, RESPONSIBILITIES AND MEETINGS

2.1 Site Specific Health and Safety Personnel

The following personnel are designated to carry out the stated job functions on-site. (One person may occupy more than one position.)

- Project Manager (PM) – Mr. Chris Kopley

  The Project Manager for the project has overall responsibility for the safety of operations and the health and safety of site personnel. He will have the final decision regarding the application of Health and Safety policy.

- Health and Safety Officer (HSO) – Mr. Todd Snowden or Mr. Craig Smolin

  Responsibilities include the daily implementation of this HASP. The Site HSO will be responsible for the implementation and enforcement of the HASP, overseeing the safety of daily operations and coordinating safety with subcontractors. In particular, he will:

  - Monitor the environment and the compliance of workers relative to pre-established personnel protection levels;
  - Notify the PM of discrepancies or violations of the HASP;
  - Evaluate weather and chemical hazard information and recommend to the HSC and PM necessary modifications to work plans or personnel protection levels;
  - The Site HSO has total responsibility for ensuring that the provisions of the HASP are adequate in the field. Changing field conditions may require the decisions to be made

concerning adequate protection programs. Therefore, it is vital that personnel assigned as HSO be experienced and meet the additional training requirements specified by OSHA in 29 CFR 1910.120.

The HSO identified in the HASP can be contacted at the following address and telephone number:

Advanced Environmental Redevelopment (AER)
904 Madison Avenue – Suite 213
Bridgeport, Connecticut 06606
phone: 203-333-2767 fax: 203-333-4770

- Daily Safety Meetings

Prior to the start of each work day where affected soil maybe exposed or handled, the HSO will conduct a brief safety meeting. Items to be discussed included but are not limited to: proposed activities for the day; potential safety hazards for the day; field change orders; and field team evaluation (compliance/non-compliance, approved field changes).

- Record Keeping

The HSO will have the responsibility to maintain permanent logs of personnel in and out times with notations of their activities and levels of protection throughout the day where affected soils are managed.

- Field Team Members

Construction workers managing the affected soils will be considered field team members for this project. Their responsibilities include execution of daily activities and compliance with this HASP and the directives of the HSO. Construction workers directly managing affected soils must be trained in OSHA 29 CFR 1910.120.

2.2 Safety Information

Safety Instructions

The contractors managing the affected soils will work in accordance with OSHA 29 CFR 1910.120 and the "General Safety and Health Rules" for the site developed by the contractor. Incoming contractor personnel shall participate in a safety orientation at the site before starting work by the contractor. An acknowledgment sheet must be signed by contract employees to show they received proper site orientation.

Safety Program

The construction workers involved in handling affected soils shall be required to follow this program while on the site.

Safe Work Practices (Mandatory):

- Eating, drinking and smoking are prohibited on-site, unless otherwise stipulated. Wash hands and face, at a minimum, before lunch and completion of the work day.
- Contact lenses shall not be worn when full-face respiratory protection is required. Respiratory protection is not anticipated for these remedial actions.
- Work in pairs (Buddy System).
- Avoid contact with contaminated objects and materials.
- Do not climb over obstacles.
- Wear proper head, foot, eye and body protection.
- OSHA guidelines and regulations shall be followed at a minimum for site activities.
- If new hazards are encountered, work activities shall be evaluated.
- The Health and Safety Officer shall discuss safety matters with site personnel at least once a day.
- Precautions shall be taken to minimize heat stress.
- Beards or other facial hair that interfere with respirator fit shall preclude admission to the hot zone if respiratory protection is required.

Protective Clothing

Personnel handling affected soils are required to wear hard hats, industrial quality side-shield safety glasses and steel toe safety shoes as minimum requirements while on the site. Proper work clothes are required to be worn by site workers. Long sleeved shirts shall be worn. (No sleeveless shirts, tank tops, shorts, sneakers or sandals allowed on-site.)

Site Facilities

AER personnel will be permitted to use site facilities as directed by the site contractor. Construction equipment shall not be left unattended unless the equipment is shut down and secured so as to prevent unintentional movement (i.e., wheel chocks). Access to fire extinguishers, safety showers, eye wash and any other emergency equipment shall not be blocked at any time. Roadways shall not be blocked without first gaining specific approval from the site contractor and AER.

Assured Grounding

The site contractor shall ensure ground fault circuit interrupter protection is in-place to cover the use of electrical tools. OSHA's lock and tag out policy will be utilized where appropriate.

Tripping Hazards

Personnel shall be aware of the presence of surface debris, uneven surfaces and piles of soil which contribute to tripping hazards.

Gas Cylinder

Compressed gas cylinders shall be properly secured in an upright position. Unless the individual cylinders are equipped with regulating devices, they shall have the safety cap secured in-place.

OSHA Compliance

The special safety requirements listed do not in any way relieve the site contractor of its responsibility in regard to compliance with OSHA and/or any other contractual agreement noted to highlight potential problem areas.

Safety Violations

In the event of safety violations or unsafe acts the HSO shall notify the PM and take immediate actions to correct the problem.

Emergency and Disaster Alarms

Emergency signals will be used to alert people of an emergency. In such an emergency, contract employees must place their equipment in a safe condition and report to the designated site-specific rally point for head count.

Decontamination of Equipment

If equipment becomes contaminated it must be cleaned before it leaves the site. Soil debris will be physically removed from construction equipment used, and disposed of off-site or placed under the protective layer.

Noise Exposure

Work activities will be conducted at location with high noise levels from the operation of heavy equipment. In accordance with OSHA Regulations 29 CFR 1910.95 hearing protection will be used when noise levels exceed 80 dBA averaged over an 8 hour day; hearing protection is required to be worn for exposures of greater than 100 dBA for any length of time. In the absence of instrumentation, an appropriate rule of thumb is that when normal conversation is difficult at a distance of two to three feet, hearing protection is required.

3.0 HAZARD IDENTIFICATION AND CONTROL

The hazard evaluation is based upon a review of work tasks to be accomplished in conjunction with soil contamination. Contaminants of concerns identified by previous studies are listed below:

Parcel E: benzo[a]anthracene, chrysene, benzo[b]fluoranthene, benzo[k]fluoranthene, benzo[a]pyrene, dibenzo[a,h]anthracene, total arsenic, total beryllium, total copper, total iron, total mercury, total nickel and total zinc.

Parcel F: benzo[a]anthracene, chrysene, benzo[b]fluoranthene, benzo[k]fluoranthene, benzo[a]pyrene, dibenzo[a,h]anthracene, total arsenic, total beryllium, total copper, total iron, total mercury, total nickel and total zinc.

These contaminants were detected in soils located on the parcels, and will likely be excavated for new buildings and possibly disposed of off-site.

Standard construction hazards including slip-trip-fall, electrocution, machine-related accidents, pinch points, manual lifting, noise and toxic/pharmacological effects (metals and semi-volatile compounds) are of concern during remediation activities.

The following table describes likely major steps, potential hazards and protective measures to be encountered during soil remediation activities:

Activity Hazard Analysis Soil Remediation		
Project: Yonkers Waterfront Development Site		**Location: Yonkers, New York**
Activities: Soil Remediation		
Major Steps	**Potential Hazards**	**Protective Measures**
Verify utilities have been disconnected	Electric shock	Ensure utilities have bee identified, removed, marked or locked and tagged out.
Manual lifting of equipment or materials	Back Injury	Use buddy system and use proper lifting techniques. Brief works on physical limitation (daily).
Excavation	Machine Related Accidents	HSO to brief machine operator daily to insure proper communication/visual contact of all personnel located on work zone.
Handling equipment or material	Pinch points	Workers shall wear leather palm gloves.
General operation and support	Slip, trip, fall	HSO to brief personnel of proper housekeeping practices and site awareness.
Operation of construction equipment	Noise	Hearing protection
Excavation sampling, disposal activities	Exposure to metals and semi-volatile soils	Proper air monitoring methods and PPE
Equipment/Products Used	**Inspection Requirements**	**Training Requirements**
Equipment:	Perform initial and daily inspections of heavy equipment. Maintain equipment per manufacturer's instructions. Inspect personal protection equipment prior to use.	Construction Safety Orientation. Skilled craftsmen
Products:		

Special precautions must be taken when operating machinery (i.e., earth moving equipment) in the vicinity of overhead electrical power lines. Contact with electricity can shock, burn and result in death. Overhead electrical power lines are to be considered energized and dangerous. Walk completely around the machine and look up before beginning work at a site in the vicinity of power lines. Determine what the minimum distance from any point on the machine to the nearest power line will be when operating. The following minimum distance from overhead electrical lines will be maintained while operating machinery:

Nominal Systems Voltage	Required Clearance
0-50 kV	10 feet
51-100 kV	12 feet
101-200 kV	15 feet
201-300 kV	20 feet
301-500 kV	25 feet
501-750 kV	35 feet
751-1000 kV	45 feet

The Chemical Exposure Limits and Health Effects (reference: NIOSH Pocket Guide to Chemical Hazards) for the compounds of concern identified on-site are listed on Table 1; MSDS sheets for reference information for each compound of concern is included in Appendix A.

4.0 PROJECT WORK SCOPE TASKS

The project work scope tasks will include sampling, excavation, stockpiling, grading, backfilling, loading and off-site disposal of metals and semi-volatile containing soil. AER will inform site personnel in the daily planning of work activities, which will enhance productivity and job safety. Please refer to AER's Remedial Work Plan for information regarding specific site remediation tasks.

5.0 PERSONNEL PROTECTION INFORMATION

This section describes the requirements for Levels of Protection, and the specific levels of protection required for the following site tasks:

- SAMPLING
- EXCAVATION
- BACKFILLING
- GRADING
- WASTE TRANSPORTATION/STOCKPILE/DISPOSAL

5.1 Levels of Protection

Personnel protective equipment will be worn when remedial activities involve handling affected soils; suspected atmospheric contamination; or when vapors, gases or particulates may be generated by site activities, or when direct contact with skin affecting substances may occur. Full-face respirators protect lungs, gastrointestinal tract and eyes against airborne toxicants. Chemical resistant clothing protects the skin from contact with skin-destructible chemicals. The specific levels of respiratory protection and necessary components have been divided into three categories according to the degrees of protection afforded as listed below. AER expects that this remedial work will be conducted in modified Level D protection.

- Level B Respiratory Protection

  Supplied air-respirator (MSHA/NIOSH) approved). Respirators may be positive pressure-demand, self-contained breathing apparatus (SCBA), or positive, pressure-demand, airline respirator (with escape bottle for IDLH or potential IDLH atmosphere). Other protection requirements include the following:

  - Chemical resistant suit (tyvek, poly tyvek)
  - Gloves: inner (surgical)
  - Gloves: outer (nitrile)
  - Boots: chemical resistant with steel toe and shank
  - Hard helmet
  - Safety glasses or face shield

- Company uniform

- Level C Respiratory Protection

  Air purifying respirator, full-face, cartridge equipped (MSHA/NIOSH approved) Combination cartridge GMC-P100 MSA

  - Acid suits
  - Chemical resistant suit (tyvek, poly tyvek Nomax)
  - Nomax
  - Gloves: inner (surgical)
  - Gloves: outer (PVC)
  - Boots: chemical resistant with steel toe and shank
  - Hard helmet
  - Safety glasses or face shield
  - Company uniform

- Modified Level D Respiratory Protection

  No respiratory protective equipment required, but area will be monitored.

  - Work clothes
  - Gloves: leather palm or PVC
  - Boots: leather work boots with steel toe and shank
  - Hard helmets
  - Safety glasses or face shield

- Ancillary Safety Gear

  The following list of safety gear may be appropriate as necessary:

  - Long cotton underwear
  - Gloves (chemical resistant)
  - Chemical resistant overboots
  - Disposable gloves and boot covers
  - Two-way radio communications (intrinsically safe)

- Additional Considerations – Although metals and semi-volatile compounds have been detected, other contaminants, such as petroleum products, may become a site concern. Additional safe work practices are listed below.

  - Foot protection is needed on a site. If the ground is contaminated with liquid, some sort of protective yellow latex "booties" can be worn over the Level D boots. They are designed with soles to help prevent them from slipping. If non-

liquids are to be encountered, tyvek booties could be used. Based upon previous site investigations, AER does not anticipate heavily contaminated soils to exist on the ground surface. Booties are disposable and, if necessary, can be discarded in 55-gallon drums for disposal.

- The site requires the use of hard hats. Respirator straps (if necessary) will not be placed over hard hats. This could affect the fit of the respirator.

- Some types of protective materials conduct heat and cold readily. In cold conditions, natural material clothing will be worn under the protective clothing. Protective clothing will be removed prior to allowing a person "to get warm". Applying heat, such as a space heater, to the outside of the protective clothing may drive the contaminants through. In hot weather, under clothing will absorb sweat.

- Body protection will be worn over the boots and taped. In the case of a splash, this will prevent anything from running into the top of the boot. Gloves will be worn outside the sleeves and taped if appropriate. This will prevent substances from entering the top of the glove.

- Atmospheric conditions such as stability, temperature, wind direction, wind velocity and pressure determine the behavior of contaminants in air or the potential for volatile material getting in the air. These parameters will be considered in determining the need for and level of protection required.

- AER shall implement an air-monitoring program for periodic monitoring of the air during site operations. The air monitoring plan is described in the Community Air Monitoring Plan document.

- For operations in contact with affected soils, different levels of protection may be selected, and various types of chemical-resistant clothing may be worn. This selection would be based not only on the measured air concentrations, but also on the job function or reason for being in the area and the potential for skin contact or inhalation of the materials present.

- Modifications to levels of protection are permitted, and routinely employed during work activities to maximize protection and efficiency. These modifications include, but are not limited to changes in the ambient levels of contaminants, or a change in the work scope, which affects the degree of contact with contaminants. The level of required protection will be based upon the following:

  - Type and measured concentration of the chemical substance in the ambient atmosphere and its toxicity. Level of protection will be based upon on-site air monitoring readings.

- Potential for exposure to substances in air, splashes of liquids, or other direct contact with material due to work being done.

- Knowledge of chemicals on-site along with properties such as toxicity, route of exposure and contaminant matrix.

- Reassessment of Protection Program

  The level of personal protection provided shall be upgraded or downgraded based upon a change in site conditions or findings during site remediation. When a significant change occurs, the hazards will be reassessed. Some indicators of the need for reassessment are:

  - Change of season/weather
  - When specific temperature extremes or individual medical considerations
  - Change in ambient levels of contaminants
  - Change in work scope which affects the degree of contact with contaminants

5.2 Personal Protective Equipment Information

Selection of the personal protection equipment (PPE) is based on the toxicity or physical dangers associated with hazardous materials and route of exposure. Based on known or anticipated hazards, field personnel will be required to wear a minimum of Modified Level D protection (Modified Level D is the anticipated level of protection for site workers).

- Modified Level D – Criteria for Use

  PID meter - <10 ppm above background level
  PDR – <1 mg/m^3 above background
  Equipment: Work clothes
  Gloves - leather
  Footwear - Steel-toed leather work boots
  Goggles/Face shield
  Hard hat

- Level C – Criteria for Use

  PID meter - >10 ppm but <50 ppm Total Organic Vapors
  PDR - 1 mg/m^3 but <15 mg/m^3 total particulates
  Equipment: Respirator - air purifying (MSHA/NIOSH approved) organic vapor acid gas/high efficiency dust cartridge
  Coveralls - tyvek
  Gloves - Surgical gloves inner/nitrile gloves outer
  Footwear - Steel-toed work boots outer/chemical protected
  Goggles/Face shield

Hard hat

- Level B – Criteria for Use

PID meter - >50 ppm Total Organic Vapors
PDR – > 15 mg/m^3 total particulates

Equipment:	Respirator -	open circuit, positive pressure (MSHA/NIOSH approved)
		Or Type C hoseline positive pressure
	Coveralls -	tyvek
	Gloves -	Surgical gloves inner/nitrile gloves outer
	Footwear -	Steel-toed work boots outer/chemical protected
	Goggles/Face shield	
	Hard hat	

Respiratory protection selection used shall meet the requirement of the established 29 CFR 1910.134, (ANSI, NIOSH).

- Monitoring Equipment

The following equipment or equivalent may be employed at the site:

Make/Model	Calibration Schedule	Setting Probe
PID Model 580 EZ	Daily	10.6 eV lamp
Abacus 301 Particle Counter	Daily	N/a

If PID readings in the Work Area exceed 10 ppm over background for more than one minute, work will be stopped in that area to allow upgrading to Level C. If conditions stabilize below 10 ppm, work will proceed under this condition using full-face respirators with organic vapor/acid cartridges/HEPA cartridges. When conditions stabilize below 10 ppm for thirty minutes or longer, respirator protection for workers will be downgraded to Level "D".

At 50 ppm, the Project Manager will continue air monitoring. If levels are detected greater than 50 ppm, supplied air, Level B protection will be necessary. The Project Manager will monitor the perimeter of the Work Area and around the Clean Zone for possible migration outside the Contamination Zone. If any migration of the contaminants is observed, the Project Manager will take action immediately. Readings will be obtained from the breathing zone.

- Air Purifying Respirator (APR)

These units filter contaminants out of the surrounding air through a mechanical filter medium, a gas-absorbent cartridge or a combination of the two. They cannot be used in oxygen deficient atmospheres, or for air contaminants without breakthrough tests or warning properties of smell or taste. The purifying elements are specific in their

protection; therefore, knowledge of the type of contaminant and approximate concentrations are essential to safe use of air-purifying respirators.

Cartridge respirator facepieces must be cleaned, sanitized and inspected before each use. This is the responsibility of the user or the individual authorized to service respirators. A respirator facepiece in the same employee's custody need not be sanitized between uses. Cleaning and inspection are adequate. Sanitizing requires complete immersion in an approved sanitizing agent (e.g., MSA sanitizing agent). Towelettes (PDI, etc.) do not sanitize effectively.

Respirators and cartridges will be stored in clean, dry locations when out of use and in a protective bag or pouch when carried around in the working environment. Cartridges must always be stored in sealed plastic bags to prevent absorption of water vapor, gases or other vapors and to keep them clean. The facepiece will be stored in a plastic bag as long as it is considered ready to wear.

6.0 SITE ACCESS AND CONTROL

A primary means of maintaining site control in order to ensure safe, efficient work and to prevent migration of hazardous materials into uncontaminated areas is by designating work areas. The work areas serve to limit site access, contain gross contamination, provide site security and place a buffer zone between the affected soil site and the community. There are typically three types of work zones established

Support Zone

The support zone is the area furthest away from the work area where remedial activities are not expected to take place. Besides being located in a known non-contaminated area, several factors are considered in designating this work zone. Wind direction and speed is a prime consideration when locating the command post. Ideally, the support area should be upwind of the work area with no more than twenty degrees deviation in direction on either side of a straight line to the exclusion zone. Wind speed variations can create turbulence and/or swirling depending upon site topography.

Contamination Reduction Zone

The Contamination Reduction Zone is located between the Support Zone and the work area, and is where all preparations for site work in the work area and decontamination activities, if any take place. The Contamination Reduction Zone has separate non-contaminated and contaminated areas. Typically there are also separate areas for the decontamination of site workers and their personal protective equipment, and the decontamination of machines, tools, etc.

Work Area

The work area is the area where remedial activities occur. It should be located downwind of the Support Zone and the Contamination Reduction Zone. The work area will move as site construction progresses.

7.0 DECONTAMINATION

Decontamination involves physically removing contaminants and/or converting them chemically into innocuous substances. How extensive decontamination must be depends on a number of factors, the most important being the types of contaminants involved. The more harmful the contaminant, the more extensive and thorough decontamination must be. Combining decontamination with the correct doffing of protective equipment and the zoning of site work areas minimizes cross-contamination from protective clothing to wearer, equipment to personnel, and one area to another. Only general guidance can be given on methods and techniques for decontamination. The exact procedure is determined by evaluation of a number of factors specific to the type of contaminant and tasks to be performed.

7.1 Preliminary Concerns

The initial decontamination plan is based on the assumption that the personnel and equipment leaving the work area (area of potential contamination) are grossly contaminated. The plan includes a system for washing and rinsing foot and respirator protection. The washing and rinsing are done in combination with a sequential removal of equipment, starting at the first station with the most heavily contaminated article. Each piece of clothing or operation requires a separate station.

The spread of contaminants during the washing and removal process is further reduced by separating each decontamination station by a minimum of three feet. Ideally, contamination will decrease as a person moves from one station to another along the line. Outer protective clothing, if used, and disposable boots will be removed and disposed of, which will not require decontamination. This will also include inner and outer hand protection. Respirators will be wiped down and properly stored in individual respirator bags. The cartridges will be removed and disposed along with disposable garments.

An area within the Contamination Reduction Zone is designated the Contamination Reduction Corridor (CRC). The CRC controls access into and out of the work area, and confines personnel decontamination activities to a limited area. The CRC boundaries will be conspicuously marked, with entry and exit restricted. The far end is the boundary between the work area and the Contamination Reduction Zone. Personnel exiting the work area must go through the CRC. Another corridor may be required for the entrance and exit of heavy equipment needing decontamination. Within the CRC, distinct areas are set aside for the decontamination of

personnel, portable field equipment, removed clothing, etc. These areas will be marked and restricted to those personnel wearing the appropriate level of protection.

Protective clothing, respirators, monitoring equipment, sampling supplies and other equipment are maintained outside of the CRC. Personnel don their protective equipment away from the CRC and enter the Exclusion Zone through a separate access control point at the hotline.

7.2 Decontamination Requirements and Procedures

The decontamination plan will be adapted to site specific conditions. AER does not expect extensive decontamination to be necessary beyond typical good work practices.

- Type of Contaminant

  The extent of personal decontamination depends on the effects the contaminants have on the body. Contaminants do not exhibit the same degree of toxicity (or other hazard). The more toxic a substance is, the more extensive or thorough decontamination must be. Whenever it is known or suspected that personnel may become contaminated with highly toxic or skin-destructive substances, a full decontamination procedure will be followed. AER notes that the contaminants of concern defined on-site will require typical good work practices such as hand washing, removal of loose debris, etc.

- Amount of Contamination

  The amount of contamination on protective clothing is usually determined visually. Field personnel working within the work area will likely have a greater amount of contamination. If the clothing is badly contaminated, a thorough decontamination is generally required. Gross material remaining on the protective clothing for any extended period of time may delegate or permeate it. This likelihood increases with higher air concentrations and greater amounts of liquid contamination. Gross contamination also increases the probability of personal contact. Swipe tests may help determine the type and quantity of surface contaminants.

  Based upon the tasks described in AER's Remedial Work Plan, AER does not expect any personnel to become grossly contaminated. Most personnel will be on mechanical equipment and any personnel in direct contact with affected material will take care. If necessary, disposable suits and gloves will be provided by the site contractor.

- Level of Protection

  The Level of Protection and specific pieces of clothing worn determine on a preliminary basis the layout of the decontamination line. Each Level of Protection presents different problems with respect to the decontamination and doffing of the equipment. For example, the decontamination of the harness straps and backpack assembly of the self-

contained breathing apparatus (SCBA) is difficult. A butyl rubber apron worn over the harness makes decontamination easier. Clothing variations and different Levels of Protection may require the addition or deletion of stations used in the original decontamination procedure.

- Work Function

  Field personnel working within the work area must exit through the decontamination line. The type of work that each person does determines the potential for contact with affected materials. In turn, this dictates the layout of the decontamination line. Observers, photographers, operators of air samplers or others in the work area performing tasks that will not bring them in contact with contaminants may not need, for example, to have their garments washed and rinsed. Others in the work area with a potential for direct contact with the affected soil will require more thorough decontamination.

- Location of Contamination

  Contamination on the upper areas of protective clothing poses a greater risk to the work because semi-volatile and volatile compounds could make breathing hazardous both for the worker and for the decontamination personnel. There is also an increased probability of contaminant contact with the skin when the worker is doffing the upper part of the clothing.

- Decontamination Solution

  Protective equipment, sampling tools and other equipment are usually decontaminated by scrubbing with detergent water (Alconox solution) using a soft-bristle brush, followed by rinsing with copious amounts of water. This solution will be appropriate for the type, degree and amount of contamination expected on the equipment.

- Establishment of Procedures

  Once decontamination procedures have been established, the personnel requiring decontamination must be given precise instructions (and practice, if necessary). Compliance with the procedures must be frequently checked. The time it takes for decontamination must be ascertained.

7.3 Decontamination During Medical Emergencies

Part of the overall planning for incident response is managing medical emergencies. The plan will provide for the following:

- Response Team members certified in First Aid/cardiopulmonary resuscitation.

- Arrangements with the nearest medical facility for transportation and treatment of the injured, and for the treatment of personnel suffering from exposure to chemicals.
- Emergency eye washes.
- First aid kits, blankets and a resuscitator.
- In addition, the plan will have established method for decontaminating personnel with medical problems and injuries. There is the possibility that decontamination may aggravate a health problem or cause more serious problems.
- If prompt life-saving first aid and/or medical treatment is required, decontamination procedures will be amended. Whenever possible, response personnel will accompany contaminated victims to the medical facility to advise on matters involving decontamination. For instance, coveralls, hand protection and respirators can be removed immediately without jeopardizing medical equipment.

- Physical Injury

Physical injuries can range from a sprained ankle to a compound fracture, or from a minor cut to massive bleeding. Depending on the seriousness of the injury, treatment may be given at the site by trained response personnel. For some serious injuries, treatment may be required at the site, or the victim may have to be treated at a medical facility.

Life-saving care will be instituted immediately without considering decontamination. The outside garments can be removed (depending on the weather) if this does not cause delays, interfere with treatment, or aggravate the problem. Respiratory masks and backpack assemblies must always be removed. Fully encapsulating suits or chemical-resistant clothing can be cut away. If the outer contaminated garments cannot be safely removed, the individual will be wrapped in plastic, rubber or blankets to help prevent contaminating medical personnel and/or the inside of ambulances. This equipment will likely be stored in the first aid area. Outside garments are then removed at the medical facility. No attempt will be made to wash or rinse the victim unless it is known that he has been contaminated with an extremely toxic or corrosive material that could also cause injury or loss of life. For minor medical problems or injuries, the normal decontamination procedure should be followed.

- Heat Stress Control

Adverse climate conditions, primarily heat, are important considerations in planning and conducting site operations. The effects of ambient temperature can cause physical

discomfort, loss of efficiency, personal injury and increased accident probability. In particular, heat stress due to protective clothing decreasing body ventilation is an important factor. Liquids will be provided to replace loss of body fluids. Employees will replace water and salts lost from sweating. A work schedule will be established to provide sufficient rest period for cooling down. This will require shifts of workers when wearing Level C and Level B equipment during elevated ambient temperatures.

- Heat Exhaustion

Heat exhaustion usually begins with muscular weakness, dizziness, nausea and staggering; vomiting is frequent and the bowels may move involuntarily. The victim is very pale, the skin is clammy, and the victim may perspire profusely. The pulse is weak and fast, with breathing shallow; fainting may occur. Some or all symptoms may pass, but sometimes they remain and could progress to heat stroke. First aid includes immediately removing the victim to the Decontamination Reduction Zone in a shady or cool area with good air circulation. Remove all outer wear. Call a physician. Treat the victim for shock. Make the victim lie down, raising their feet 6-12 inches, and keep them warm but loosen the clothing. If the victim is conscious, it may be helpful to give him sips of a water solution. Transport the victim to a medical facility.

- Heat Stroke

This is the most serious stage of heat stress casualties due to the fact that the body excessively overheats. Body temperatures often are between 107 - 110°F. First there is pain in the head, dizziness, nausea, oppression and a dryness of the skin and mouth. Unconsciousness follows quickly and death is imminent if exposure continues. The attack will usually occur suddenly.

- Chemical Exposure

Exposure to chemicals can be divided into two categories: direct contact through touch or inhalation, or indirect contact through gross contamination of clothing or equipment. Injuries from contaminant inhalation can only be treated by qualified physicians. If the contaminant is on the skin or in the eyes, immediate measures must be taken to counteract its effect. First aid treatment usually involves flooding the affected area with water; however, for a few chemicals, water may cause more severe problems. When protective clothing is grossly contaminated, contaminants may be transferred to the wearer or to treatment personnel and cause injuries. Unless severe medical problems could be caused by splashing, the protective clothing should be washed off as rapidly as possible and carefully removed.

7.4 Decontamination of Equipment and Materials

Decontamination equipment, materials and supplies are generally selected on the basis of availability and appropriateness. Hand tools will be manually decontaminated; personal protective equipment other than respirators will be disposed. Soft-bristle scrub brushes or long-handle brushes are used to remove contaminants off hand tools. Buckets of water or garden sprayers are used for rinsing equipment if necessary. Large galvanized wash tubs may be used as containers for wash and rinse solutions. Large plastic garbage cans or similar containers lined with plastic garbage bags are useful for the storage of contaminated clothing and equipment; metals or plastic cans or drums are convenient for the temporary storage of contaminated liquids.

All possible measures will be taken to prevent the contamination of sampling and monitoring equipment. Sampling devices become contaminated, but monitoring instruments, unless they are splashed, usually do not. Once contaminated, instruments are difficult to clean without damaging their integrity. Any delicate instrument that cannot be decontaminated easily will be protected while it is being used. The instrument will be bagged, and the bag should be taped and secured around the instrument. Openings are made in the bag for sample intake.

Decontamination procedures vary according to the equipment in question. Sampling devices should be cleaned using Towelettes wipes. Wooden tools are difficult to decontaminate because they absorb chemicals. They will be kept on the site and handled only by protected workers and used only when necessary. At the end of the response, such tools will be discarded. For decontaminating tools, Alconox and water solution will be utilized. Certain parts of contaminated respirators, such as the harness assembly and leather or cloth components, are difficult to decontaminate. If grossly contaminated, they may have to be discarded. Rubber components can be soaked in soap and water and scrubbed with a brush. Regulators must be maintained according to the manufacturer's recommendations. Persons responsible for decontaminating respirators will be thoroughly trained in respirator maintenance.

In addition to being decontaminated, respirators, protective clothing and other personal articles must be sanitized before they can be used again. The insides of masks and clothing become soiled from exhalation, body oils and perspiration. The manufacturer's instructions will be followed in sanitizing the respirator mask. If practicable, protective clothing will be machine washed after a thorough decontamination; otherwise it will be cleaned by hand.

The materials and equipment used for decontamination must be disposed of properly. Clothing, tools, buckets, brushes and other equipment that is contaminated must be secured in drums or other containers and labeled. Clothing not completely decontaminated on the site will be secured in plastic bags before it is removed from the site.

Contaminated wash and rinse solutions can be kept temporarily in a step-in container (for example, child's wading pool) or in a plastic-lined trench about four inches deep. Such solutions are ultimately transferred to labeled drums and disposed of with other substances on the site.

8.0 EMERGENCY RESPONSE/CONTINGENCY PLAN

This section describes general contingencies and emergency planning procedures that may be necessary during soil remediation. During the site briefing held periodically or daily, employees will be trained in and reminded of provisions of the emergency response plan, communication systems and evacuation routes. During project orientation, field personnel will be aware of lines of communication as it relates to field emergencies. The field crew will be made aware of emergency phone numbers. The phone number list will be posted in the support zone.

As the administrator of the project, the Site Safety Officer's (SSO) primary responsibility is responding to and correcting emergency situations. This includes taking appropriate measures to ensure safety of site personnel and the public. Possible actions may involve evacuation of personnel from the site area and evacuation of adjacent residents. The SSO is additionally responsible for ensuring that corrective measures have been implemented, appropriate authorities notified and follow-up reports completed.

- Personnel Injury in the Work Zone

  Upon notification of an injury in the work area, the designated emergency signal 3 short-3 long-3 short blasts of a horn shall be sounded. In addition, the field supervisor will verbally alert personnel of an emergency. Due to the close proximity of the work area, communication can be visual awareness. Site personnel shall assemble at the decontamination line. The rescue team will enter the work area (if required) to remove the injured person to the hotline. The Project Team Leader shall evaluate the nature of the injury, and the affected person will be decontaminated to the extent possible prior to movement to the support zone. The Health and Safety Officer or his designee shall contact the designated medical facility for an ambulance (if required). No persons shall re-enter the work area until the cause of the injury or symptoms is determined.

- Personnel Injury in the Support Zone

  Upon notification of an injury in the support zone, Health and Safety Officer will assess the nature of the injury. If the cause of the injury or loss of the injured person does not affect the performance of the site personnel, operations may continue, with the on-site Health and Safety Officer initiating the appropriate first aid necessary follow-up as stated above. If the injury increases the risk to others, site personnel shall move to the decontamination line for further instructions. Activities on-site will stop until the added risk is removed or minimized.

- Medical Emergencies

  Any person who becomes ill or injured in the work area must be decontaminated to the maximum extent possible. If the injury or illness is minor, full decontamination should be completed and first aid administered prior to transport. If the patient's condition is

serious, at least partial decontamination will be completed (i.e., complete disrobing or removal of protective garment and redressing in clean coveralls or wrapping in blanket). First aid will be administered while awaiting an ambulance.

Any injuries and illnesses must be reported immediately to the Health and Safety Officer. Any person being transported to a medical facility will take with them information on the identity of the chemical(s) to which the have been exposed (if possible). Any vehicle used to transport contaminated personnel will be treated and cleaned as necessary.

- Fires, Explosions, Spills or Leaks

  In the event of a fire or an explosion, and if it is safe do so, area personnel may use fire-fighting equipment available on-site to control or extinguish the fire. Area personnel should also remove or isolate the flammable or hazardous materials, which may contribute to the fire.

  In the event of a spill or leak, area personnel with proper emergency response training will inform their supervisor immediately, and locate the source of the spill and stop the flow if it can be done safely. The following equipment and materials should be available on the site on immediate standby during material handling operations: overpack drum; spill absorbent material; absorbent wipes; spill boom; miscellaneous shovels and brooms; fire extinguisher and plastic rolls.

- Personal Protective Equipment Failure

  If any site worker experiences a failure or alteration of protective equipment that affects the protection factor, that person and his buddy shall immediately leave the work area. Re-entry shall not be permitted until the equipment has been repaired or replaced.

  If any other safety equipment associated with affected soil management on site fails to operate properly, the Health and Safety Officer shall be notified and then determine the effect of this failure on continuing operations on-site. If the failure affects the safety of personnel or prevents completion of the work plan tasks, personnel shall leave the work area until the situation is evaluated and appropriate actions taken.

- Significant, Prolonged Wind Shifts

  Significant wind shifts are those conditions in which the result of on-site activity produces air contaminants of high concentration that are carried beyond the basin area, and as a consequence, threatens unprotected persons at the plant or community. Such occurrences will dictate cessation of on-site activity. AER's Community Air Monitoring Plan addresses these concerns more thoroughly.

9.0 PERSONNEL TRAINING REQUIREMENTS

Consistent with OSHA's 29 CFR 1910.120 regulation covering Hazardous Waste operations and Emergency Response, site personnel in contact with affected soil will be trained in accordance with the requirements below. At a minimum, personnel will be trained to recognize the potential hazards on-site, the provisions of this plan and the responsible personnel.

- Pre-Assignment and Annual Refresher Training

  Prior to arrival on-site, each employer (contractor) will be responsible for certifying that his employees meet the requirements of a 40-hour pre-assignment training. Each employee will be able to document dates of attendance at 40 hour training or "grandfather" equivalent, and annual refresher training equaling 8 hours.

- Site Supervisor Training

  Consistent with OSHA 29 CFR 1910.120 paragraph (e) (4), individuals designated as site supervisors require an additional 8 hours of training.

- Training and Briefing Topics

  The following items will be discussed by a qualified individual at the site-specific training meeting, daily or periodically.

Daily Work Plan and Site Specific Safety Concerns			
Items	**Site Specific Training Meeting**	**Daily**	**Periodically**
Physical hazards	X	X	
Chemical hazards	X	X	
Symptoms of overexposure to hazards; (29 CFR 1910.120 (e), (VI))	X		X
Animal bites and stings	X		
Site Control, (29 CFR 1910.120 (d))	X		X
Training Requirements, (29 CFR 1910.120 (e))	X		
Protective Controls and work practices, (29 CFR 1910.120 (g))	X		X
Overhead and underground utilities	X		
Personal protective equipment (29 CFR 1910.120 (g), 29 CFR 1910.134)	X	X	
Respiratory protection, (29 CFR 1910.134, 29 CFR 1910.120 (g), ANSI Sec. 88.2, 1980)	X		X
Air monitoring (29 CFR 1910.120 (h))	X		
Decontamination (29 CFR 1910.120 (k))	X		X
Emergency Response Plan (29 CFR 1910.120 (l))	X	X	

10.0 EMERGENCY RESPONSE CONTACT NUMBERS

The following phone numbers are to be used in the event of an emergency. A map outlining the emergency route from the study site to St. Joseph's Hospital is found on Figure 1.

Poison Control	800-962-1253
US EPA National Response Center	800-438-2427
Fire	911
Ambulance	911
Police	911
St. Joseph's Hospital	914-378-7000
Hospital Emergency Phone Number	911
Project Manager	Chris Kopley
Health and Safety Representative	Todd Snowden/Craig Smolin
AER office	203-333-2767

TABLES

TABLE 1
CHEMICAL EXPOSURE LIMITS AND HEALTH EFFECTS
YONKERS DOWNTOWN SOIL REMEDIATION
WATERFRONT DEVELOPMENT
PARCELS E AND F
YONKERS, NEW YORK

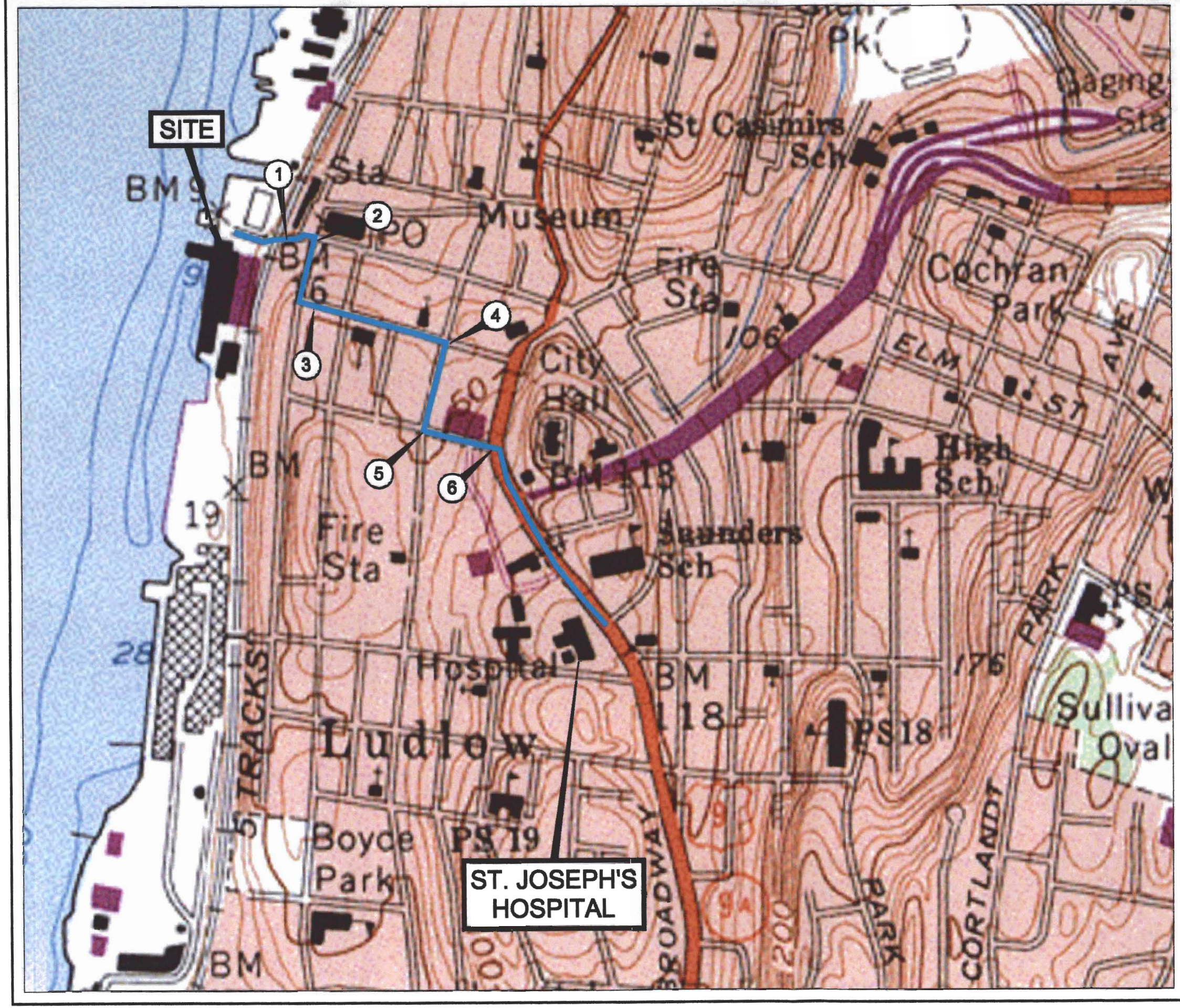
Chemicals	NIOSH REL	OSHA PEL	IDLH Limit	Exposure Routes	Exposure Symptoms
Semi-Volatiles					
Benzo[a]anthracene	NE	NE	NE	inhalation, skin absorption, skin and/or eye contact ingestion	This substance is probably carcinogenic to humans.
Benzo[a]pyrene	0.002 mg/m^3	NE	NE	inhalation, skin absorption, skin and/or eye contact ingestion	This substance is probably carcinogenic to humans. May cause genetic damage in humans. May cause reproductive toxicity in humans.
Benzo[b]fluoranthene	NE	NE	NE	inhalation, skin absorption, skin and/or eye contact ingestion	This substance is probably carcinogenic to humans.
Benzo[k]fluoranthene	NE	NE	NE	inhalation, skin absorption, skin and/or eye contact ingestion	This substance is probably carcinogenic to humans.
Chrysene	NE	NE	NE	inhalation, skin absorption, skin and/or eye contact ingestion	This substance is probably carcinogenic to humans.
Dibenzo[a,h]anthracene	NE	NE	NE	inhalation, skin absorption, skin and/or eye contact ingestion	The substance may have effects on the skin , resulting in photosensitization. This substance is probably carcinogenic to humans.

NE – no standard has been established

TABLE 1 *(continued)*
CHEMICAL EXPOSURE LIMITS AND HEALTH EFFECTS
YONKERS DOWNTOWN SOIL REMEDIATION
WATERFRONT DEVELOPMENT
PARCELS E AND F
YONKERS, NEW YORK

Chemicals	NIOSH REL	OSHA PEL	IDLH Limit	Exposure Routes	Exposure Symptoms
Metals					
Arsenic	0.002 mg/m^3	0.010 mg/m^3	5 mg/m^3	inhalation, skin absorption, skin and/or eye contact ingestion	Ulceration of nasal septum, dermatitis, gastrointestinal disturbances, peripheral neuropathy, respiratory irritation, hyperpigmentation of skin, [Potential occupational carcinogen]
Beryllium	0.0005 mg/m^3	0.002 mg/m^3	4 mg/m^3	inhalation, skin and/or eye contact	Berylliosis (chronic exposure): anorexia, weight loss, weakness, chest pain, cough, clubbing of fingers, cyanosis, pulmonary insufficiency; irritation eyes; dermatitis; [Potential occupational carcinogen]
Copper	1 mg/m^3	1 mg/m^3	100 mg/m^3	inhalation, ingestion, skin and/or eye contact	irritation eyes, nose, pharynx; nasal septum perforation; metallic taste; dermatitis; in animals: lung, liver, kidney damage; anemia
Iron	5 mg/m^3	10 mg/m^3	2500 mg/m^3	inhalation	Benign pneumoconiosis with X-ray shadows indistinguishable from fibrotic pneumoconiosis (siderosis)
Mercury	0.05 mg/m^3	0.1 mg/m^3	10 mg/m^3	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation eyes, skin; cough, chest pain, dyspnea (breathing difficulty), bronchitis pneumonitis; tremor, insomnia, irritability, indecision, headache, fatigue, weakness; stomatitis, salivation; gastrointestinal disturbance, anorexia, weight loss; protcinuria
Nickel	0.015 mg/m^3	1 mg/m^3	10 mg/m^3	inhalation, ingestion, skin and/or eye contact	sensitization dermatitis, allergic asthma, pneumonitis; [Potential occupational carcinogen]
Zinc	5 mg/m^3	5 mg/m^3	500 mg/m^3	inhalation	Metal fume fever: chills, muscle ache, nausea, fever, dry throat, cough; weakness, lassitude (weakness, exhaustion); metallic taste; headache; blurred vision; low back pain; vomiting; fatigue; malaise (vague feeling of discomfort); tightness chest; dyspnea (breathing difficulty), rales, decreased pulmonary function

FIGURES



EMERGENCY ROUTE

1. Head East on MAIN STREET towards BUENA VISTA AVE. by Turning LEFT
2. Turn RIGHT onto BUENA VISTA AVE.
3. Turn LEFT onto HUDSON STREET
4. Turn RIGHT onto RIVERDALE AVE.
5. Turn LEFT onto PROSPECT STREET
6. Turn RIGHT onto US-9/S BROADWAY / NY-9A

0 250 500 750 1000

Scale in Feet

AER ADVANCED ENVIRONMENTAL REDEVELOPMENT, LLC
904 MADISON AVENUE – SUITE 213
BRIDGEPORT, CONNECTICUT 06606

YONKERS DOWNTOWN WATERFRONT DEVEL.
127 SOUTH BROADWAY, YONKERS, NY

ROUTE TO NEAREST HOSPITAL

DRAWN BY:	JJS
APPROVED BY:	CK
REVISION DATE:	11/7/01
FILE No.	0214-1A
DATE CREATED	11/7/01
SCALE	AS SHOWN
PROJECT No.	0214
FIGURE No.	1

APPENDIX A
MSDS REFERENCE INFORMATION

NIOSH Pocket Guide to Chemical Hazards

Arsenic (inorganic compounds, as As)	**CAS** 7440-38-2 (metal)
As (metal)	**RTECS** CG0525000 (metal)
Synonyms & Trade Names Arsenic metal: Arsenia Other synonyms vary depending upon the specific As compound. [Note: OSHA considers "Inorganic Arsenic" to mean copper acetoarsenite & all inorganic compounds containing arsenic except ARSINE.]	**DOT ID & Guide** 1558 152 (metal) 1562 152 (dust)

Exposure Limits	NIOSH REL: Ca C 0.002 mg/m^3 [15-minute] See Appendix A
	OSHA PEL: [1910.1018] TWA 0.010 mg/m^3

IDLH Ca [5 mg/m^3 (as As)] See: IDLH INDEX	**Conversion**

Physical Description
Metal: Silver-gray or tin-white, brittle, odorless solid.

MW: 74.9	BP: Sublimes	MLT: 1135°F (Sublimes)	Sol: Insoluble
VP: 0 mmHg (approx)	IP: NA		Sp.Gr: 5.73 (metal)
Fl.P: NA	UEL: NA	LEL: NA	

Metal: Noncombustible Solid in bulk form, but a slight explosion hazard in the form of dust when exposed to flame.

Incompatibilities & Reactivities
Strong oxidizers, bromine azide [Note: Hydrogen gas can react with inorganic arsenic to form the highly toxic gas arsine.]

Measurement Method
Filter; Acid; Hydride generation atomic absorption spectrometry; IV [#7900] [Also #7300, Elements] See: NMAM INDEX

Personal Protection & Sanitation Skin: Prevent skin contact Eyes: Prevent eye contact Wash skin: When contaminated/Daily Remove: When wet or contaminated Change: Daily Provide: Eyewash, Quick drench	**First Aid** (See procedures) Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately

Respirator Recommendations NIOSH
At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration: (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode/(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure

mode in combination with an auxiliary self-contained positive-pressure breathing apparatus Escape: (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted acid gas canister having a high-efficiency particulate filter/Any appropriate escape-type, self-contained breathing apparatus
Exposure Routes inhalation, skin absorption, skin and/or eye contact ingestion
Symptoms Ulceration of nasal septum, dermatitis, gastrointestinal disturbances, peripheral neuropathy, respiratory irritation, hyperpigmentation of skin, [Potential occupational carcinogen]
Target Organs Liver, kidneys, skin, lungs, lymphatic system **Cancer Site** [lung & lymphatic cancer]
See also: INTRODUCTION

International Chemical Safety Cards

BENZ(a)ANTHRACENE

ICSC: 0385

BENZ(a)ANTHRACENE
1,2-Benzoanthracene
Benzo(a)anthracene
2,3-Benzphenanthrene
Naphthanthracene
$C_{18}H_{12}$
Molecular mass: 228.3

CAS # 56-55-3
RTECS # CV9275000
ICSC # 0385
EC # 601-033-00-9

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Combustible.		Water spray, powder. In case of fire in the surroundings: all extinguishing agents allowed.
EXPLOSION	Finely dispersed particles form explosive mixtures in air.	Prevent deposition of dust; closed system, dust explosion-proof electrical equipment and lighting.	
EXPOSURE		AVOID ALL CONTACT!	
• **INHALATION**		Local exhaust or breathing protection.	Fresh air, rest.
• **SKIN**		Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse and then wash skin with water and soap.
• **EYES**		Safety goggles, face shield, or eye protection in combination with breathing protection.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
• **INGESTION**		Do not eat, drink, or smoke during work. Wash hands before eating.	Rinse mouth.

SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING
Sweep spilled substance into sealable containers; if appropriate, moisten first to prevent dusting. Carefully collect remainder, then remove to safe place (extra personal protection: complete protective clothing including self-contained breathing apparatus).	Well closed.	T symbol R: 45 S: 53-45

SEE IMPORTANT INFORMATION ON BACK

ICSC: 0385

International Chemical Safety Cards

BENZ(a)ANTHRACENE

ICSC: 0385

IMPORTANT DATA

PHYSICAL STATE; APPEARANCE:
COLOURLESS TO YELLOW-BROWN FLUORESCENT FLAKES OR POWDER.

PHYSICAL DANGERS:
Dust explosion possible if in powder or granular form, mixed with air.

CHEMICAL DANGERS:

OCCUPATIONAL EXPOSURE LIMITS (OELs):
TLV not established.

ROUTES OF EXPOSURE:
The substance can be absorbed into the body by inhalation, through the skin and by ingestion.

INHALATION RISK:
Evaporation at 20°C is negligible; a harmful concentration of airborne particles can, however, be reached quickly.

EFFECTS OF SHORT-TERM EXPOSURE:

EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:
This substance is probably carcinogenic to humans.

PHYSICAL PROPERTIES	Sublimation point: 435°C Melting point: 162°C Relative density (water = 1): 1.274	Solubility in water: none Vapour pressure, Pa at 20°C: 292 Octanol/water partition coefficient as log Pow: 5.61
ENVIRONMENTAL DATA	In the food chain important to humans, bioaccumulation takes place, specifically in seafood.	

NOTES

This substance is one of many polycyclic aromatic hydrocarbons - standards are usually established for them as mixtures, e.g., coal tar pitch volatiles. However, it may be encountered as a laboratory chemical in its pure form. Insufficient data are available on the effect of this substance on human health, therefore utmost care must be taken. Do NOT take working clothes home. Tetraphene is a common name.

ADDITIONAL INFORMATION

ICSC: 0385 **BENZ(a)ANTHRACENE**

International Chemical Safety Cards

BENZO(a)PYRENE

ICSC: 0104

BENZO(a)PYRENE
Benz(a)pyrene
3,4-Benzopyrene
$C_{20}H_{12}$
Molecular mass: 252.3

CAS # 50-32-8
RTECS # DJ3675000
ICSC # 0104
EC # 601-032-00-3

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Combustible.	NO open flames.	Water spray, powder.
EXPLOSION			
EXPOSURE		AVOID ALL CONTACT! AVOID EXPOSURE OF (PREGNANT) WOMEN!	IN ALL CASES CONSULT A DOCTOR!
• INHALATION		Local exhaust or breathing protection.	Fresh air, rest. Artificial respiration if indicated. Refer for medical attention.
• SKIN	MAY BE ABSORBED!	Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse and then wash skin with water and soap. Refer for medical attention.
• EYES		Safety goggles, or eye protection in combination with breathing protection.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
• INGESTION		Do not eat, drink, or smoke during work.	Induce vomiting (ONLY IN CONSCIOUS PERSONS!). Refer for medical attention.

SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING
Evacuate danger area! Sweep spilled substance into sealable containers; if appropriate, moisten first to prevent dusting. Carefully collect remainder, then remove to safe place (extra personal protection: P3 filter	Separated from strong oxidants.	T symbol R: 45-46-60-61 S: 53-45

respirator for toxic particles).		

SEE IMPORTANT INFORMATION ON BACK

ICSC: 0104

Prepared in the context of cooperation between the International Programme on Chemical Safety & the Commission of the European Communities © IPCS CEC 1993 No modifications to the International version have been made except to add the OSHA PELs, NIOSH RELs and IDLH values.

International Chemical Safety Cards

BENZO(a)PYRENE

ICSC: 0104

IMPORTANT DATA

PHYSICAL STATE; APPEARANCE:
ODOURLESS PALE-YELLOW CRYSTALS OR POWDER.

PHYSICAL DANGERS:

CHEMICAL DANGERS:
Reacts with nitro derivatives and strong oxidants.

OCCUPATIONAL EXPOSURE LIMITS (OELs):
TLV: ppm; mg/m^3 A2 (ACGIH 1997).
MAK: TRK List 0.002 mg/m^3; (1996)

ROUTES OF EXPOSURE:
The substance can be absorbed into the body by inhalation and through the skin, and by ingestion.

INHALATION RISK:
A harmful contamination of the air can be reached very quickly on evaporation of this substance at 20°C.

EFFECTS OF SHORT-TERM EXPOSURE:

EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:
This substance is probably carcinogenic to humans. May cause genetic damage in humans. May cause reproductive toxicity in humans.

PHYSICAL PROPERTIES

Boiling point at 1.3 kPa: 310-312°C
Melting point: 179°C
Relative density (water = 1): 1.4

Solubility in water: none (<0.1 g/100 ml)
Relative vapour density (air = 1): 8.7
Octanol/water partition coefficient as log Pow: 6.04

ENVIRONMENTAL DATA

NOTES

Do NOT take working clothes home.

ADDITIONAL INFORMATION

IMPORTANT LEGAL NOTICE:	Neither NIOSH, the CEC or the IPCS nor any person acting on behalf of NIOSH, the CEC or the IPCS is responsible for the use which might be made of this information. This card contains the collective views of the IPCS Peer Review Committee and may not reflect in all cases all the detailed requirements included in national legislation on the subject. The user should verify compliance of the cards with the relevant legislation in the country of use. The only modifications made to produce the U.S. version is inclusion of the OSHA PELs, NIOSH RELs and IDLH values.

International Chemical Safety Cards

BENZO(B)FLUORANTHENE

ICSC: 0720

BENZO(B)FLUORANTHENE
Benzo(e)acephenanthrylene
2,3-Benzofluoroanthene
$C_{20}H_{12}$
Molecular mass: 252.3

CAS # 205-99-2
RTECS # CU1400000
ICSC # 0720

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Combustible.	NO open flames.	Water spray, powder.
EXPLOSION			
EXPOSURE		PREVENT DISPERSION OF DUST! STRICT HYGIENE! AVOID ALL CONTACT!	IN ALL CASES CONSULT A DOCTOR!
• INHALATION		Local exhaust or breathing protection.	Fresh air, rest.
• SKIN	MAY BE ABSORBED!	Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse and then wash skin with water and soap. Refer for medical attention. Wear protective gloves when administering first aid.
• EYES		Safety goggles or eye protection in combination with breathing protection.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
• INGESTION		Do not eat, drink, or smoke during work.	Wear protective gloves when inducing vomiting. Induce vomiting (ONLY IN CONSCIOUS PERSONS!). Refer for medical attention.

SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING
Sweep spilled substance into containers. Carefully collect remainder, then remove to safe place. Do NOT let this chemical enter the environment.	Provision to contain effluent from fire extinguishing. Tightly closed.	Unbreakable packaging; put breakable packaging into closed unbreakable container.

SEE IMPORTANT INFORMATION ON BACK

ICSC: 0720

International Chemical Safety Cards

BENZO(B)FLUORANTHENE

ICSC: 0720

IMPORTANT DATA

PHYSICAL STATE; APPEARANCE:
COLOURLESS TO YELLOW CRYSTALS.

PHYSICAL DANGERS:

CHEMICAL DANGERS:
Upon heating, toxic fumes are formed.

OCCUPATIONAL EXPOSURE LIMITS (OELs):
TLV not established.

ROUTES OF EXPOSURE:
The substance can be absorbed into the body by inhalation of its aerosol and through the skin.

INHALATION RISK:
Evaporation at 20°C is negligible; a harmful concentration of airborne particles can, however, be reached quickly.

EFFECTS OF SHORT-TERM EXPOSURE:

EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:
This substance is possibly carcinogenic to humans.

PHYSICAL PROPERTIES

Melting point: 168°C
Solubility in water: none

Vapour pressure, Pa at 20°C: <10
Octanol/water partition coefficient as log Pow: 6.04

ENVIRONMENTAL DATA

This substance may be hazardous to the environment; special attention should be given to the total environment. In the food chain important to humans, bioaccumulation takes place, specifically in oils and fats.

NOTES

Depending on the degree of exposure, periodic medical examination is indicated. Data are insufficiently available on the effect of this substance on human health, therefore utmost care must be taken. Do NOT take working clothes home.

ADDITIONAL INFORMATION

ICSC: 0720 **BENZO(B)FLUORANTHENE**

IMPORTANT LEGAL NOTICE:	Neither NIOSH, the CEC or the IPCS nor any person acting on behalf of NIOSH, the CEC or the IPCS is responsible for the use which might be made of this information. This card contains the collective views of the IPCS Peer Review Committee and may not reflect in all cases all the detailed requirements included in national legislation on the subject. The user should verify compliance of the cards with the relevant legislation in the country of use. The only modifications made to produce the U.S. version is inclusion of the OSHA PELs, NIOSH RELs and IDLH values.

International Chemical Safety Cards

BENZO(K)FLUORANTHENE

ICSC: 0721

BENZO(K)FLUOROANTHENE
11,12-Benzofluoroanthene
Dibenzo(b,j,k)fluorene
$C_{20}H_{12}$
Molecular mass: 252.3

CAS # 207-08-9
RTECS # DF6350000
ICSC # 0721

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Combustible.	NO open flames.	Water spray, powder.
EXPLOSION			
EXPOSURE		PREVENT DISPERSION OF DUST! STRICT HYGIENE! AVOID ALL CONTACT!	IN ALL CASES CONSULT A DOCTOR!
• **INHALATION**		Local exhaust or breathing protection.	Fresh air, rest. Refer for medical attention.
• **SKIN**	MAY BE ABSORBED!	Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse and then wash skin with water and soap. Refer for medical attention. Wear protective gloves when administering first aid.
• **EYES**		Safety goggles or eye protection in combination with breathing protection if powder.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
• **INGESTION**		Do not eat, drink, or smoke during work.	Wear protective gloves when inducing vomiting. Induce vomiting (ONLY IN CONSCIOUS PERSONS!). Refer for medical attention.

SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING
Sweep spilled substance into containers. Carefully collect remainder, then remove to safe place. Do NOT let this chemical enter the environment.	Provision to contain effluent from fire extinguishing. Separated from strong oxidants. Tightly closed.	

SEE IMPORTANT INFORMATION ON BACK

ICSC: 0721

International Chemical Safety Cards

BENZO(K)FLUORANTHENE

ICSC: 0721

IMPORTANT DATA	**PHYSICAL STATE; APPEARANCE:** YELLOW CRYSTALS. **PHYSICAL DANGERS:** **CHEMICAL DANGERS:** Upon heating, toxic fumes are formed. Reacts with strong oxidants. **OCCUPATIONAL EXPOSURE LIMITS (OELs):** TLV not established.	**ROUTES OF EXPOSURE:** The substance can be absorbed into the body by inhalation of its aerosol and through the skin. **INHALATION RISK:** Evaporation at 20°C is negligible; a harmful concentration of airborne particles can, however, be reached quickly. **EFFECTS OF SHORT-TERM EXPOSURE:** **EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:** This substance is possibly carcinogenic to humans.
PHYSICAL PROPERTIES	Boiling point: 480°C Melting point: 215.7°C	Solubility in water: none Octanol/water partition coefficient as log Pow: 6.84
ENVIRONMENTAL DATA	This substance may be hazardous to the environment; special attention should be given to the total environment. In the food chain important to humans, bioaccumulation takes place, specifically in oils and fats. 	

NOTES

Data are insufficiently available on the effect of this substance on human health, therefore utmost care must be taken. Do NOT take working clothes home.

ADDITIONAL INFORMATION

ICSC: 0721 **BENZO(K)FLUORANTHENE**

IMPORTANT LEGAL NOTICE:	Neither NIOSH, the CEC or the IPCS nor any person acting on behalf of NIOSH, the CEC or the IPCS is responsible for the use which might be made of this information. This card contains the collective views of the IPCS Peer Review Committee and may not reflect in all cases all the detailed requirements included in national legislation on the subject. The user should verify compliance of the cards with the relevant legislation in the country of use. The only modifications made to produce the U.S. version is inclusion of the OSHA PELs, NIOSH RELs and IDLH values.

NIOSH Pocket Guide to Chemical Hazards

Beryllium & beryllium compounds (as Be)	**CAS** 7440-41-7 (metal)
Be (metal)	**RTECS** DS1750000 (metal)
Synonyms & Trade Names Beryllium metal: Beryllium Other synonyms vary depending upon the specific beryllium compound.	**DOT ID & Guide** 1566 154 (compounds) 1567 134 (powder)

Exposure Limits	NIOSH REL: Ca Not to exceed 0.0005 mg/m^3 See Appendix A
	OSHA PEL: TWA 0.002 mg/m^3 C 0.005 mg/m^3 0.025 mg/m^3 [30-minute maximum peak]

IDLH Ca [4 mg/m^3 (as Be)] See: IDLH INDEX	**Conversion**

Physical Description
Metal: A hard, brittle, gray-white solid.

MW: 9.0	BP: 4532°F	MLT: 2349°F	Sol: Insoluble
VP: 0 mmHg (approx)	IP: NA		Sp.Gr: 1.85 (metal)
Fl.P: NA	UEL: NA	LEL: NA	

Metal: Noncombustible Solid in bulk form, but a slight explosion hazard in the form of a powder or dust.

Incompatibilities & Reactivities
Acids, caustics, chlorinated hydrocarbons, oxidizers, molten lithium

Measurement Method
Filter; Acid; Graphite furnace atomic absorption spectrometry; IV [#7102] [Also #7300, Elements]
See: NMAM INDEX

Personal Protection & Sanitation Skin: Prevent skin contact Eyes: Prevent eye contact Wash skin: Daily Remove: When wet or contaminated Change: Daily Provide: Eyewash	**First Aid** (See procedures) Eye: Irrigate immediately Breathing: Fresh air

Respirator Recommendations NIOSH
At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration: (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode/(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus
Escape: (APF = 50) Any air-purifying, full-facepiece respirator with a high-efficiency particulate filter/Any appropriate escape-type, self-contained breathing apparatus

Exposure Routes inhalation, skin and/or eye contact
Symptoms Berylliosis (chronic exposure): anorexia, weight loss, weakness, chest pain, cough, clubbing of fingers, cyanosis, pulmonary insufficiency; irritation eyes; dermatitis; [Potential occupational carcinogen]
Target Organs Eyes, skin, respiratory system **Cancer Site** [lung cancer]
See also: INTRODUCTION

Safety data for chrysene

General

Synonyms: 1,2-benzophenanthrene, benzo(a)phenanthrene, 1,2-benzphenanthrene, coal tar pitch, benz(a)phenanthrene, 1,2,5,6-dibenzonaphthalene
Molecular formula: $C_{18}H_{12}$
CAS No: 218-01-9
EC No: 205-923-4

Physical data

Appearance:
Melting point: 253 C
Boiling point: 448 C
Vapour density:
Vapour pressure:
Density (g cm^{-3}):
Flash point:
Explosion limits:
Autoignition temperature:
Water solubility:

Stability

Stable. Combustible. Incompatible with strong oxidising agents.

Toxicology

Toxic. Confirmed animal carcinogen. Possible human carcinogen. Harmful if swallowed, inhaled or absorbed through the skin.

Toxicity data
(The meaning of any abbreviations which appear in this section is given here.)
IPR-MUS LD50 >320 mg kg^{-1}

Risk phrases
(The meaning of any risk phrases which appear in this section is given here.)
R20 R21 R22 R45 R46.

Transport information

UN No 2811. Packing group I. Major hazard class 6.1. CDG UK Transport category 1. EMS No 6.1-04.

Personal protection

Safety glasses, good ventilation, gloves. **Handle as a carcinogen. A COSHH assessment is required.**

Safety phrases
(The meaning of any safety phrases which appear in this section is given here.)
S3 S7 S9 S36 S37 S39 S45.

[Return to Physical & Theoretical Chemistry Lab. Safety home page.]

NIOSH Pocket Guide to Chemical Hazards

Copper (dusts and mists, as Cu)			CAS 7440-50-8
Cu			RTECS GL5325000
Synonyms & Trade Names Copper metal dusts, Copper metal fumes			**DOT ID & Guide**
Exposure Limits	NIOSH REL*: TWA 1 mg/m^3 [*Note: The REL also applies to other copper compounds (as Cu) except Copper fume.]		
	OSHA PEL*: TWA 1 mg/m^3 [*Note: The PEL also applies to other copper compounds (as Cu) except copper fume.]		
IDLH 100 mg/m^3 (as Cu) See: 7440508		**Conversion**	
Physical Description Reddish, lustrous, malleable, odorless solid.			
MW: 63.5	BP: 4703°F	MLT: 1981°F	Sol: Insoluble
VP: 0 mmHg (approx)	IP: NA		Sp.Gr: 8.94
Fl.P: NA	UEL: NA	LEL: NA	
Noncombustible Solid in bulk form, but powdered form may ignite.			
Incompatibilities & Reactivities Oxidizers, alkalis, sodium azide, acetylene			
Measurement Method Filter; Acid; Flame atomic absorption spectrometry; IV [#7029] See: NMAM INDEX			
Personal Protection & Sanitation Skin: Prevent skin contact Eyes: Prevent eye contact Wash skin: When contaminated Remove: When wet or contaminated Change: Daily		**First Aid** (See procedures) Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately	

Respirator Recommendations NIOSH/OSHA

Up to 5 mg/m^3: (APF = 5) Any dust and mist respirator*

Up to 10 mg/m^3: (APF = 10) Any dust and mist respirator except single-use and quarter-mask respirators*^/(APF = 10) Any supplied-air respirator*

Up to 25 mg/m^3: (APF = 25) Any supplied-air respirator operated in a continuous-flow mode*/(APF = 25) Any powered, air-purifying respirator with a dust and mist filter*

Up to 50 mg/m^3: (APF = 50) Any air-purifying, full-facepiece respirator with a high-efficiency particulate filter/(APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and a high-efficiency particulate filter*/(APF = 50) Any self-contained breathing apparatus with a full facepiece/(APF = 50) Any supplied-air respirator with a full facepiece

Up to 100 mg/m^3: (APF = 2000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
Emergency or planned entry into unknown concentrations or IDLH conditions: (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode/(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus
Escape: (APF = 50) Any air-purifying, full-facepiece respirator with a high-efficiency particulate filter/Any appropriate escape-type, self-contained breathing apparatus

Exposure Routes inhalation, ingestion, skin and/or eye contact

Symptoms irritation eyes, nose, pharynx; nasal septum perforation; metallic taste; dermatitis; in animals: lung, liver, kidney damage; anemia

Target Organs Eyes, skin, respiratory system, liver, kidneys (increase(d) risk with Wilson's disease)

See also: INTRODUCTION See ICSC CARD: 0240 See MEDICAL TESTS: 0057

International Chemical Safety Cards

DIBENZ(a,h)ANTHRACENE

ICSC: 0431

DIBENZO(a,h)ANTHRACENE
1,2:5,6-Dibenzanthracene
$C_{22}H_{14}$
Molecular mass: 278.4

CAS # 53-70-3
RTECS # HN2625000
ICSC # 0431
EC # 601-041-00-2

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Combustible.	NO open flames.	Water spray, powder.
EXPLOSION			
EXPOSURE		AVOID ALL CONTACT!	
• **INHALATION**		Local exhaust or breathing protection.	Fresh air, rest.
• **SKIN**	Redness. Swelling. Itching.	Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse and then wash skin with water and soap.
• **EYES**	Redness.	Face shield, or eye protection in combination with breathing protection.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
• **INGESTION**		Do not eat, drink, or smoke during work. Wash hands before eating.	Rinse mouth.

SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING
Sweep spilled substance into sealable containers; if appropriate, moisten first to prevent dusting. Carefully collect remainder, then remove to safe place (extra personal protection: P3 filter respirator for toxic particles).	Well closed.	T symbol R: 45 S: 53-45

SEE IMPORTANT INFORMATION ON BACK

ICSC: 0431

International Chemical Safety Cards

DIBENZ(a,h)ANTHRACENE

ICSC: 0431

IMPORTANT DATA	**PHYSICAL STATE; APPEARANCE:** COLOURLESS CRYSTALLINE POWDER.	**ROUTES OF EXPOSURE:** The substance can be absorbed into the body by inhalation, through the skin and by ingestion.
	CHEMICAL DANGERS:	**INHALATION RISK:** Evaporation at 20°C is negligible; a harmful concentration of airborne particles can, however, be reached quickly.
	OCCUPATIONAL EXPOSURE LIMITS (OELs): TLV not established.	**EFFECTS OF SHORT-TERM EXPOSURE:**
		EFFECTS OF LONG-TERM OR REPEATED EXPOSURE: The substance may have effects on the skin , resulting in photosensitization. This substance is probably carcinogenic to humans.
PHYSICAL PROPERTIES	Boiling point: 524°C Melting point: 267°C Relative density (water = 1): 1.28	Solubility in water: none Octanol/water partition coefficient as log Pow: 6.5
ENVIRONMENTAL DATA	In the food chain important to humans, bioaccumulation takes place, specifically in seafood. 	

NOTES

This is one of many polycyclic aromatic hydrocarbons - standards are usually established for them as mixtures, e.g., coal tar pitch volatiles. However, it may be encountered as a laboratory chemical in its pure form. Insufficient data are available on the effect of this substance on human health, therefore utmost care must be taken. Do NOT take working clothes home. DBA is a commonly used name. This substance is one of many polycyclic aromatic hydrocarbons (PAH).

ADDITIONAL INFORMATION

IMPORTANT LEGAL NOTICE:	Neither NIOSH, the CEC or the IPCS nor any person acting on behalf of NIOSH, the CEC or the IPCS is responsible for the use which might be made of this information. This card contains the collective views of the IPCS Peer Review Committee and may not reflect in all cases all the detailed requirements included in national legislation on the subject. The user should verify compliance of the cards with the relevant legislation in the country of use. The only modifications made to produce the U.S. version is inclusion of the OSHA PELs, NIOSH RELs and IDLH values.

NIOSH Pocket Guide to Chemical Hazards

Iron oxide dust and fume (as Fe)	**CAS** 1309-37-1
Fe_2O_3	**RTECS** NO7400000 NO7525000 (fume)
Synonyms & Trade Names Ferric oxide, Iron(III) oxide	**DOT ID & Guide** 1376 135 (spent)

Exposure Limits	NIOSH REL: TWA 5 mg/m^3
	OSHA PEL: TWA 10 mg/m^3

IDLH 2500 mg/m^3 (as Fe) See: 1309371	**Conversion**

Physical Description
Reddish-brown solid. [Note: Exposure to fume may occur during the arc-welding of iron.]

MW: 159.7	BP: ?	MLT: 2664°F	Sol: Insoluble
VP: 0 mmHg (approx)	IP: NA		Sp.Gr: 5.24
Fl.P: NA	UEL: NA	LEL: NA	

Noncombustible Solid

Incompatibilities & Reactivities
Calcium hypochlorite

Measurement Method
Filter; Acid; Inductively coupled plasma; IV [#7300, Elements] See: NMAM INDEX

Personal Protection & Sanitation Skin: N.R. Eyes: N.R. Wash skin: N.R. Remove: N.R. Change: N.R.	**First Aid** (See procedures) Breathing: Respiratory support

Respirator Recommendations NIOSH

Up to 50 mg/m^3: (APF = 10) Any dust, mist, and fume respirator/(APF = 10) Any supplied-air respirator

Up to 125 mg/m^3: (APF = 25) Any supplied-air respirator operated in a continuous-flow mode/(APF = 25) Any powered, air-purifying respirator with a dust, mist, and fume filter

Up to 250 mg/m^3: (APF = 50) Any air-purifying, full-facepiece respirator with a high-efficiency particulate filter/(APF = 50) Any supplied-air respirator that has a tight-fitting facepiece and is operated in a continuous-flow mode/(APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and a high-efficiency particulate filter/(APF = 50) Any self-contained breathing apparatus with a full facepiece/(APF = 50) Any supplied-air respirator with a full facepiece

Up to 2500 mg/m^3: (APF = 1000) Any supplied-air respirator operated in a pressure-demand or other positive-pressure mode
Emergency or planned entry into unknown concentrations or IDLH conditions: (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode/(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus
Escape: (APF = 50) Any air-purifying, full-facepiece respirator with a high-efficiency particulate filter/Any appropriate escape-type, self-contained breathing apparatus

Exposure Routes inhalation

Symptoms Benign pneumoconiosis with X-ray shadows indistinguishable from fibrotic pneumoconiosis (siderosis)

Target Organs respiratory system

See also: INTRODUCTION See MEDICAL TESTS: 0122

NIOSH Pocket Guide to Chemical Hazards

Mercury compounds [except (organo) alkyls] (as Hg)	**CAS** 7439-97-6 (metal)
Hg (metal)	**RTECS** OV4550000 (metal)
Synonyms & Trade Names Mercury metal: Colloidal mercury, Metallic mercury, Quicksilver Synonyms of "other" Hg compounds vary depending upon the specific compound.	**DOT ID & Guide** 2809 172 (Metal)

Exposure Limits	NIOSH REL: Hg Vapor: TWA 0.05 mg/m^3 [skin] Other: C 0.1 mg/m^3 [skin]
	OSHA PEL†: C 0.1 mg/m^3

IDLH 10 mg/m^3 (as Hg) See: IDLH INDEX	**Conversion**

Physical Description
Metal: Silver-white, heavy, odorless liquid. [Note: "Other" Hg compounds include all inorganic & aryl Hg compounds except (organo) alkyls.]

MW: 200.6	BP: 674°F	FRZ: -38°F	Sol: Insoluble
VP: 0.0012 mmHg	IP: ?		Sp.Gr: 13.6 (metal)
Fl.P: NA	UEL: NA	LEL: NA	

Metal: Noncombustible Liquid

Incompatibilities & Reactivities
Acetylene, ammonia, chlorine dioxide, azides, calcium (amalgam formation), sodium carbide, lithium, rubidium, copper

Measurement Method
Hopcalite; Acid; AA cold; IV [#6009, Mercury] See: NMAM INDEX

Personal Protection & Sanitation Skin: Prevent skin contact Eyes: N.R. Wash skin: When contaminated Remove: When wet or contaminated Change: Daily	**First Aid** (See procedures) Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately

Respirator Recommendations Mercury vapor:
NIOSH
Up to 0.5 mg/m^3: (APF = 10) Any chemical cartridge respirator with cartridge(s) providing protection against the compound of concern†/(APF = 10) Any supplied-air respirator
Up to 1.25 mg/m^3: (APF = 25) Any supplied-air respirator operated in a continuous-flow mode/

(APF = 25) Any powered, air-purifying respirator with cartridge(s) providing protection against the compound of concern†(canister)

Up to 2.5 mg/m^3: (APF = 50) Any chemical cartridge respirator with a full facepiece and cartridge (s) providing protection against the compound of concern†/(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern†/(APF = 50) Any supplied-air respirator that has a tight-fitting facepiece and is operated in a continuous-flow mode/PAPRTS(canister)/(APF = 50) Any self-contained breathing apparatus with a full facepiece/(APF = 50) Any supplied-air respirator with a full facepiece

Up to 10 mg/m^3: (APF = 1000) Any supplied-air respirator operated in a pressure-demand or other positive-pressure mode

Emergency or planned entry into unknown concentrations or IDLH conditions: (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode/(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape: (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern/Any appropriate escape-type, self-contained breathing apparatus

Other mercury compounds:

NIOSH/OSHA

Up to 1 mg/m^3: (APF = 10) Any chemical cartridge respirator with cartridge(s) providing protection against the compound of concern†/(APF = 10) Any supplied-air respirator

Up to 2.5 mg/m^3: (APF = 25) Any supplied-air respirator operated in a continuous-flow mode/ (APF = 25) Any powered, air-purifying respirator with cartridge(s) providing protection against the compound of concern†(canister)

Up to 5 mg/m^3: (APF = 50) Any chemical cartridge respirator with a full facepiece and cartridge(s) providing protection against the compound of concern†/(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern†/(APF = 50) Any supplied-air respirator that has a tight-fitting facepiece and is operated in a continuous-flow mode/PAPRTS(canister)/(APF = 50) Any self-contained breathing apparatus with a full facepiece/(APF = 50) Any supplied-air respirator with a full facepiece

Up to 10 mg/m^3: (APF = 1000) Any supplied-air respirator operated in a pressure-demand or other positive-pressure mode

Emergency or planned entry into unknown concentrations or IDLH conditions: (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode/(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape: (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern/Any appropriate escape-type, self-contained breathing apparatus

Exposure Routes inhalation, skin absorption, ingestion, skin and/or eye contact

Symptoms irritation eyes, skin; cough, chest pain, dyspnea (breathing difficulty), bronchitis pneumonitis; tremor, insomnia, irritability, indecision, headache, fatigue, weakness; stomatitis, salivation; gastrointestinal disturbance, anorexia, weight loss; proteinuria

Target Organs Eyes, skin, respiratory system, central nervous system, kidneys

See also: INTRODUCTION

NIOSH Pocket Guide to Chemical Hazards

Nickel metal and other compounds (as Ni)	**CAS** 7440-02-0 (Metal)
Ni (Metal)	**RTECS** QR5950000 (Metal)
Synonyms & Trade Names Nickel metal: Elemental nickel, Nickel catalyst Synonyms of other nickel compounds vary depending upon the specific compound.	**DOT ID & Guide**

Exposure Limits	NIOSH REL*: Ca TWA 0.015 mg/m^3 See Appendix A [*Note: The REL does not apply to Nickel carbonyl.]
	OSHA PEL*†: TWA 1 mg/m^3 [*Note: The PEL does not apply to Nickel carbonyl.]

IDLH Ca [10 mg/m^3 (as Ni)] See: IDLH INDEX	**Conversion**

Physical Description
Metal: Lustrous, silvery, odorless solid.

MW: 58.7	BP: 5139°F	MLT: 2831°F	Sol: Insoluble
VP: 0 mmHg (approx)	IP: NA		Sp.Gr: 8.90 (Metal)
Fl.P: NA	UEL: NA	LEL: NA	

Metal: Combustible Solid; nickel sponge catalyst may ignite SPONTANEOUSLY in air.

Incompatibilities & Reactivities
Strong acids, sulfur, selenium, wood & other combustibles, nickel nitrate

Measurement Method
Filter; Acid; Inductively coupled plasma; IV [#7300, Elements] See: NMAM INDEX

Personal Protection & Sanitation Skin: Prevent skin contact Eyes: N.R. Wash skin: When contaminated/Daily Remove: When wet or contaminated Change: Daily	**First Aid** (See procedures) Skin: Water flush immediately Breathing: Respiratory support Swallow: Medical attention immediately

Respirator Recommendations NIOSH
At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration: (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode/(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus
Escape: (APF = 50) Any air-purifying, full-facepiece respirator with a high-efficiency particulate

Escape: (APF = 50) Any air-purifying, full-facepiece respirator with a high-efficiency particulate filter/Any appropriate escape-type, self-contained breathing apparatus
Exposure Routes inhalation, ingestion, skin and/or eye contact
Symptoms sensitization dermatitis, allergic asthma, pneumonitis; [Potential occupational carcinogen]
Target Organs Nasal cavities, lungs, skin **Cancer Site** [lung and nasal cancer]
See also: INTRODUCTION

NIOSH Pocket Guide to Chemical Hazards

Zinc oxide	**CAS** 1314-13-2
ZnO	**RTECS** ZH4810000
Synonyms & Trade Names Zinc peroxide	**DOT ID & Guide** 1516 143

Exposure Limits	NIOSH REL: Dust: TWA 5 mg/m^3 C 15 mg/m^3 Fume: TWA 5 mg/m^3 ST 10 mg/m^3
	OSHA PEL†: TWA 5 mg/m^3 (fume) TWA 15 mg/m^3 (total dust) TWA 5 mg/m^3 (resp dust)

IDLH 500 mg/m^3 See: 1314132	**Conversion**

Physical Description
White, odorless solid.

MW: 81.4	BP: ?	MLT: 3587°F	Sol(64°F): 0.0004%
VP: 0 mmHg (approx)	IP: NA		Sp.Gr: 5.61
Fl.P: NA	UEL: NA	LEL: NA	

Noncombustible Solid

Incompatibilities & Reactivities
Chlorinated rubber (at 419°F), water [Note: Slowly decomposed by water.]

Measurement Method
Filter; none; X-ray diffraction spectrometry; IV [#7502] See: NMAM INDEX

Personal Protection & Sanitation Skin: N.R. Eyes: N.R. Wash skin: N.R. Remove: N.R. Change: N.R.	**First Aid** (See procedures) Breathing: Respiratory support

Respirator Recommendations NIOSH/OSHA

Up to 50 mg/m^3: (APF = 10) Any dust, mist, and fume respirator/(APF = 10) Any supplied-air respirator

Up to 125 mg/m^3: (APF = 25) Any supplied-air respirator operated in a continuous-flow mode/(APF = 25) Any powered, air-purifying respirator with a dust, mist, and fume filter

Up to 250 mg/m^3: (APF = 50) Any air-purifying, full-facepiece respirator with a high-efficiency particulate filter/(APF = 50) Any supplied-air respirator that has a tight-fitting facepiece and is operated in a continuous-flow mode/(APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and a high-efficiency particulate filter/(APF = 50) Any self-contained breathing apparatus with a full facepiece/(APF = 50) Any supplied-air respirator with a full

facepiece

Up to 500 mg/m^3: (APF = 1000) Any supplied-air respirator operated in a pressure-demand or other positive-pressure mode

Emergency or planned entry into unknown concentrations or IDLH conditions: (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode/(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape: (APF = 50) Any air-purifying, full-facepiece respirator with a high-efficiency particulate filter/Any appropriate escape-type, self-contained breathing apparatus

Exposure Routes inhalation

Symptoms Metal fume fever: chills, muscle ache, nausea, fever, dry throat, cough; weakness, lassitude (weakness, exhaustion); metallic taste; headache; blurred vision; low back pain; vomiting; fatigue; malaise (vague feeling of discomfort); tightness chest; dyspnea (breathing difficulty), rales, decreased pulmonary function

Target Organs respiratory system

See also: INTRODUCTION See ICSC CARD: 0208 See MEDICAL TESTS: 0246