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AUG 05 1990

DEPT. OF ECOLOGY

August 3, 1990

Mr. Mac Davis
Washington Department of Labor and Industry
300 W. Harrison
Seattle, Washington 98119-4081

Dear Mr. Davis:

Please find enclosed a copy of MK Environmental Services' Health and Safety Plan for the Maralco Site. I am sending this to you per Mr. David South's instructions, Washington Department of Ecology. MK Environmental Services is the RI/FS Contractor at the Maralco site and Mr. South is the Washington Department of Ecology Site Manager.

Mr. Mark Soltow, L&I CIH Consultant, toured the Maralco site on June 5, 1990 and may be able to assist in the review of our Health and Safety Plan.

Very truly yours,

MK-ENVIRONMENTAL SERVICES

Alan M. Parker
Project Manager

AMP:dmd

Enclosures

cc: Dave South, WDOE W/Attachments
Phil Stansfeld, IAI W/Attachments
Eric Creagh, MK W/O Attachments
File

2 COPIES

**ATTACHMENT 1
MARALCO ALUMINUM
SECONDARY ALUMINUM REFINERY**

KENT, WA.

SITE SAFETY PLAN

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MK Work Order Number: 2121
Project Manager: Alan Parker
Site Safety Officer: Erik M. Creagh
Date of Issue: 12/21/89

1.0 INTRODUCTION

This draft project safety plan delineates the basic safety requirements for Phase I of the Remedial Investigation/Feasibility Study at the Maralco Secondary Aluminum Smelter Site located in Kent, Washington (Figures 1 & 2). It will be refined as additional information becomes available.

The provisions set forth in this plan will apply to the employees of MK-Environmental Services, their subcontractors working on this project, and any authorized visitors. The subcontractors may elect to modify these provisions, but only with the written concurrence of MK-Environmental Services.

This project safety plan will address the expected potential hazards that may be encountered for this project. Field activities are planned to begin in April or May 1990 with the duration estimated at approximately six months. If unanticipated changes in site or working conditions occur as the activities progress, written addenda to this plan will be provided by MK-Environmental Services.

Effectiveness of the plan will be evaluated on a weekly basis in consultation with the Project Manager and a Certified Industrial Hygienist.

2.0 PROJECT SAFETY AUTHORITY

Personnel responsible for the project safety are the Project Manager and the Site Safety Officer.

The Project Safety Officer is responsible for the development and submittal of this plan to the Project Staff, and for advising the Project Staff on health and safety matters. He or she has the authority to provide for the auditing of compliance with the provisions of this plan to, suspend or modify work practices, and to initiate enforcement or dismissal action for individuals whose conduct does not meet the requirements set forth herein.

The Project Safety Officer is responsible for the dissemination of the information contained in this plan to all MK Environmental Services personnel assigned to the project, to the responsible representative of each subcontractor firm, and to authorized visitors. The Project Safety Officer will also act as the Site Safety Officer and as such, is responsible for ensuring that the following elements are addressed:

- Safety Supplies and Equipment Inventory
- Medical Surveillance Program/Physical examinations
- Training Programs/Hazard Communication
- Accident/Incident Reporting Procedures
- Decontamination/Contamination Reduction Procedures
- Air Monitoring Programs
- Emergency Response Procedures

The Site Safety Officer has the authority to suspend work at any time if there is an imminent threat to the health and safety of project personnel or the general public. The Site Safety Officer will also inform the Project Manager of the conduct of individuals that is not in conformance with the requirements of the plan.

3.0 MEDICAL SURVEILLANCE

For regulatory compliance purposes, MK-Environmental Services personnel and sub-contractors engaged in project execution will participate in the Medical Surveillance program, and must be approved by the examining physician(s) to wear respiratory protection devices and protective clothing for protection from exposure to hazardous materials. The applicable requirements under the appropriate sections of the final rule governing Hazardous Waste Operations 29 CFR 1910.120(f) and WAC 296-62-3050 will be observed.

Medical surveillance testing will be required for personnel both pre-project and post-project. The specific test parameters will be consistent with the contaminants anticipated to be encountered and will be so delineated by the physicians responsible for administering the medical testing.

An episodic examination will be required if any worker develops signs or symptoms related to over-exposure to hazardous substances on-site or in the event an unprotected worker is potentially exposed in an emergency situation. The scope of any episodic examinations will be left to the discretion of the examining physician.

4.0 TRAINING

4.1 Basic OSHA Training

For regulatory compliance purposes, all personnel will have received the health and safety training as described in this section before being allowed to participate in field activities that could expose them to hazardous substances, safety hazards, or health hazards. This training is required pursuant to 29 CFR 1910.120(e) and WAC 296-62-3040.

- Forty-Hour Hazardous Waste Operations Health and Safety Training
Forty hours of classroom instruction and simulated field exercises regarding the following topics: 1) biology, chemistry, and physics of hazardous materials; 2) toxicology; 3) industrial hygiene; 4) hazard evaluation and control; 5) personal protective equipment (PPE); 6) medical surveillance; 7) decontamination; 8) legal and regulatory aspects; 9) emergency response.
- Eight-Hour Manager/Supervisor Hazardous Waste Operations Health and Safety Training
Eight hours of additional specialized instruction on managing/supervising employees engaged in hazardous waste operations. Required of on-site supervisors who are directly responsible for or

who supervise employees engaged in hazardous waste activities.

- Eight-Hour Annual Hazard Waste Operations Health and Safety Refresher Training
Eight hours of refresher training annually, as necessary.

4.2 Additional Training/Documentation Requirements

- Submit evidence for three days of actual field experience under the direct supervision of a trained, experienced supervisor.
- Submit evidence of appropriate or sufficient training for heavy equipment operations.
- Contingency measurements for control of runoff and flooding during rainstorms.

4.3 Site and Task Specific Training

Field personnel from MK-Environmental Services and their subcontractors will attend a project-specific training program for safety issues and project work task review before beginning work. The meeting will be conducted by the Site Safety Officer. Periodic safety briefings (or tail-gate sessions) will be conducted before the start of work. All training programs, safety meetings, and daily safety briefings will be documented by agenda and signature of each attendee.

4.4 First Aid and CPR Training

There will be at least two workers at the site with current, valid certification in first aid and cardiopulmonary resuscitation (CPR) training from the American Red Cross (or the equivalent).

5.0 HAZARD ANALYSIS AND CONTROL

The site investigation is conducted to assist in determining the nature and extent of hazardous substances at the site.

Historical information regarding the types of wastes that exist at the site will be utilized in establishing requirements for the medical surveillance program, monitoring/sampling equipment, and personal protective equipment. As the site investigation proceeds, and more detailed information regarding the type, quantities, and extent of hazardous substances becomes known, the Health and Safety Plan will be modified accordingly.

It will be necessary to perform certain evaluations of airborne contaminants prior to a final decision on the level of protection required for the RI/FS field work.

5.1 Chemical Hazards

According to a site assessment report prepared by Ecology and Environment, Inc. (October 1987), the major repositories exhibiting concentrations of priority pollutant metals exceeding background soil

concentrations are as follows: black dross piles, Kawecki-Berylco, Inc. (KBI) dross, "aluminum oxide" pile, and baghouse dusts. These compounds are generally characterized by high concentrations of antimony, chromium, copper, nickel, and zinc.

Airborne exposure to heavy metal dusts have been implicated in a variety of occupational illnesses such as lung cancer, lung fibrogenesis, mucus membrane inflammation and contact dermatitis. In these instances, the principle exposure pathways are through lung inhalation and skin contact.

As one may expect, the exposure potential is directly related to quantities of dust generated by any given activity. Weather conditions such as wind velocity and rainfall will also have an important bearing on worker exposure.

Under dry conditions while in performance of activities generating substantial dust (operation of heavy equipment), workers should attempt to position themselves upwind of the dust cloud when feasible.

Most of the black dross generated by Maralco is located in a 50,000 ton pile to the south east of the refinery building. Ten tons of KBI dross are located in a concrete bin inside the refinery in the southwest corner of the building.

The aluminum oxide pile, weighing approximately 5,000 tons, is located about 60 feet due east of the refinery building at the north end of the black dross pile.

Baghouse dusts are located in each of eight metal ash receptacles below the baghouse hoppers in the southwest corner of the refinery. These dusts are considered to be corrosive in nature.

Other potentially hazardous substances that have been identified on the Maralco premises are a pile of grey, sandy material (appearance similar to that of black dross) located at the northeast quadrant of the site (approximately 40 yards east of a housing residence); brine solution noted in the salt saver holding ponds on the east side of the refinery building; and yellow colored patches of unknown chemical composition randomly distributed throughout the black dross pile.

The black dross, KBI dross, aluminum oxide and baghouse dusts will be suspect in representing an airborne inhalation hazard until background air monitoring has shown otherwise.

An underground diesel storage tank lies at the northwest quadrant of the property. Its contents and condition are unknown. A specific health & safety work plan will be drawn up to support investigative activities. Approval from the Site Safety Officer is required before any RI/FS activities can occur in the tank vicinity.

There is also the possibility that some areas within the site may contain patches or small spills of unknown organic chemicals. Metal drums of unknown contents may also be found. Old lead vehicle batteries have also been found on-site.

5.2 Physical Hazards

There are various physical hazards that project personnel may be exposed to during the field investigation. These include brambles, uneven terrain, falling objects, slippery surfaces, marshy ground, ditches, holes, sharp objects, tools, and heavy machinery/equipment.

Weather conditions may expose personnel to cold temperatures. The principal hazards of cold stress are frostbite, hypothermia and impaired ability to work. Wind will lower the effective temperature. Low illumination levels may exist inside the building and produce a vision hazard.

The use of power tools and equipment often creates excessive noise. Chronic over-exposure can lead to loss of hearing. At the least, excessive noise can annoy or distract workers and increase the risk of other accidents due to interference with communication.

5.3 Hazard Control

Engineering controls are the preferred method to control health and safety hazards whenever such controls are available and practical. The use of dust suppression techniques, equipment guards, and work procedures that minimize worker exposure to hazardous substances or situations are examples of engineering controls.

Only equipment that is used for its intended task and is in safe operating condition will be used. Personnel will be familiar with the hazards associated with the use of the tools and equipment and methods to mitigate the hazards.

Personal protective equipment will be utilized when engineering and administrative controls are not feasible or practical. Personal protective equipment may consist of boots, clothing, gloves, head, eye, and hearing protection. Respirators may be utilized if concentrations of airborne contaminants warrant it. All respirators will be NIOSH/MSHA approved.

6.0 WORK ZONES AND MONITORING

6.1 Work Zones

At those sites where there is a potential for the accidental spread of hazardous substances from contaminated or potentially contaminated sites to clean areas, work zones will be established where different types of operations will occur, and the flow of personnel and equipment will be controlled. The establishment of work zones will help ensure that personnel are properly protected against hazards present where they are working, that work activities and contamination are confined to the appropriate areas, and that personnel can be located and evacuated in an emergency.

Prior to the commencement of field activities within areas of concern, work zones will be established as needed to meet operational and safety objectives.

Exclusion (Control) Zone

The exclusion zone is the area where contamination does or could occur. Entry into this area is limited to those personnel wearing the specified personal protective equipment who have completed the required health and safety training, and who are participating in the medical surveillance program. The boundary of the exclusion zone will be determined for each site individually and may change depending on site activities and conditions. The exclusion zone will be clearly delineated through the use of signs, barricade tape, and/or fences. Access control points will be established to regulate the flow of personnel and equipment into and out of the zone and to help verify that proper procedures for entering and exiting are followed (Figure 3). The required level of personal protective equipment in the exclusion zone depends

upon the job assignment and detailed information known regarding types, quantities and extent of hazardous substances. Table I provides a chart of known RI/FS activity to be carried out on site at the time of this writing, and anticipated levels of required personal protective equipment. As additional tasks become known, they will be added to the list and the chart modified accordingly.

Contamination Reduction Zone

The contamination reduction zone is the transition area between the exclusion zone and the clean zone. This zone is designed to reduce the probability that the support (clean) zone will become contaminated or affected by other site hazards. Decontamination of personnel and equipment will occur in the contamination reduction zone. Personnel and equipment will not be allowed to leave the contamination reduction and exclusion zones without being properly decontaminated except in emergency situations.

Support (Clean) Zone

The support zone is all areas outside the exclusion and contamination reduction zones. An access control log will be maintained at the access control point into the exclusion and contamination reduction zones. The access control log will record the names and the time of personnel entering/exiting the exclusion zone.

Figure 3 illustrates the zonation principle of the exclusion, contamination reduction and support zones in hazardous waste site clean-ups.

7.0 MONITORING

Monitoring will be performed to assess the potential exposure to hazardous substances and to ensure that the proper level of personal protective equipment has been selected. It will also be performed to delineate areas where protection is needed and to assist in determining specific medical monitoring requirements (if necessary).

Air monitoring/sampling will be performed using two approaches, as necessary; the use of direct-reading real-time instruments and the collection of air samples in a suitable collection media and subsequent laboratory analysis.

Direct-reading instruments will be calibrated daily before use according to the manufacturer's instructions. Air samples will be collected and analyzed according to the NIOSH Manual of Analytical Methods, Third Edition (as applicable). Air sampling pumps will be calibrated before and after sample collection.

Direct-reading instrumentation will be used for monitoring the following air contaminants and conditions, as necessary: organic vapors, combustible gases and oxygen-deficient atmospheres.

Monitoring for priority pollutant metals through use of filter collection media will be implemented using the following sampling scheme for compliance with WAC 296-62-3070:

Initial Entry-prior to initial mobilization of personnel on-site, background air monitoring will be conducted to identify potential exposures above permissible exposure limits. As results become available, these data will be used for PPE determination during start up activity.

Periodic - periodic monitoring will be conducted when there is indication that exposures may have risen above permissible exposure limits. Situations under consideration are as follows:

- When work begins at a different portion of the site.
- Handling of previously unidentified contaminants.
- Initiation of a new operation.
- Sufficient passage of a time interval such that exposures may have increased.

When levels of any of the Priority Pollutant metals reach the Permissible Exposure Level (Site Action Level), mandatory respirator use at Level C will be enforced until air monitoring has determined concentrations have subsided.

Table II lists the Permissible Exposure Limits for the Priority Pollutant metals of concern at the work site and required procedures to be implemented at concentrations less than, equal to, or greater than the action levels.

8.0 PERSONAL PROTECTIVE EQUIPMENT (PPE)

This section describes the personal protective equipment program for the project. The level of PPE required will be dependent upon the work task, site hazards, and current level of hazard assessment within the area. Modifications (i.e. upgrading/downgrading) of the specified level of PPE may be made at the discretion of the Site Safety Officer as more information regarding site hazards becomes known. Engineering controls and work practices will be the primary methods of protecting site workers. Only when such controls and practices are not feasible will PPE be utilized.

Based upon information obtained from the Ecology and Environment, Inc. site assessment report, the site visit and walk-through, and the absence of air sampling data currently available at the time of this writing, Level C PPE will be implemented during initial phases of the RI.

Level C

Level C to be selected when the concentration and type of air contaminants is known and the criteria for selection of air-purifying respirators are met.

Level C equipment; (used as appropriate)

- Full-face respirator with appropriate cartridges/canisters
- Chemical-resistant coveralls (polyethylene coated Tyvek, or equivalent)
- Gloves, outer, chemical-resistant (nitrile, or equivalent)
- Gloves, inner, chemical-resistant (vinyl, or equivalent)
- Boots, chemical-resistant, steel toe (PVC, or equivalent)
- Cotton coveralls
- Safety glasses with side shields

Following an assessment of background air monitoring data, the Site Safety Officer may elect to downgrade to a Modified Level C (full-face air-purifying respirators with HEPA cartridges, not necessarily worn, but readily available).

For regulatory compliance purposes (29 CFR 1910.134), a written respiratory protection program is attached as Appendix A of this plan.

9.0 DECONTAMINATION

All personnel, clothing, equipment, and samples leaving a control zone (contaminated or potentially contaminated area) shall be decontaminated to remove any harmful substances that may have adhered to them. Some equipment/clothing may be disposed of rather than decontaminated. This section gives guidelines regarding the decontamination procedures to be implemented at the site.

9.1 Personnel Decontamination

A decontamination (decon) station will be established in the contamination reduction zone. The decon station will consist of the following, as appropriate:

- Equipment drop
- Boot wash station; a tub of water and detergent with brushes for cleaning and another tub of water for rinsing
- Glove wash station (similar to boot wash station)
- Disposable clothing barrel; all contaminated or potentially contaminated disposable clothing shall be placed into barrels (or equivalent) for disposal as contaminated waste. The drums will be clearly labeled, stored on pallets inside the building and kept separate from other old drums scattered throughout the building

9.2 Equipment Decontamination

All equipment/tools used in the control zone will be inspected for contamination prior to removal from the site. Any equipment/tools with visible contamination will be required to be cleaned. A water and detergent solution will be used as necessary for highly contaminated equipment. All water used during decontamination will be containerized (as described above) for proper disposal. If necessary, cleaning solvents may be used on a case-by-case basis.

10.0 GENERAL PROJECT SAFETY REQUIREMENTS

The project operations shall be conducted with the following minimum safety requirements employed:

- Eating, drinking, and smoking will be restricted to a designated area.
- All personnel shall be required to wash hands and face before eating, drinking, or smoking.
- Gross decontamination and removal of all personal protective equipment shall be performed prior to exiting the facility. Contaminated clothing will be removed and collected for disposal.
- Shaking or blowing of potentially contaminated clothing or equipment to remove dust or other materials is not permitted.
- The Project Manager and Site Safety Officer will be responsible to take necessary steps to ensure that employees are protected from physical hazards, which would include:
 - Falling objects such as tools or equipment
 - Falls from elevations
 - Tripping over hoses, pipes, tools, or equipment
 - Slipping on wet or oily surfaces

- Insufficient or faulty protective equipment
- Insufficient or faulty operation, equipment or tools
- Field operations personnel shall be cautioned to inform each other of non-visual effect of the presence of toxics, such as:
 - Headaches
 - Dizziness
 - Nausea
 - Blurred Vision
 - Cramps
 - Irritation of eyes, skin, or respiratory tract
 - Changes in complexion or skin discoloration
 - Changes in apparent motor coordination
 - Changes in personality or demeanor
 - Excessive salivation or changes in papillary response
 - Changes in speech ability or pattern

11.0 EMERGENCY RESPONSE PROCEDURES

In the event of an accident resulting in physical injury, First Aid will be administered and the Project Manager and the Site Safety Officer will be notified. The injured worker will be transported to Valley Medical Center for emergency treatment. A physician's attention is required regardless of the severity of the injury.

In the event of fire, explosion, or property damage, the local emergency response agencies will be immediately notified.

Emergency Telephone Numbers:

- Fire, Police, Ambulance. 911
- Hospital (Valley Medical Center)
400 S. 43rd, Renton
Emergency. 251-5185
- Directions from Kent - take I-5-N to 405N. Exit on SW 43rd Street going south.
Hospital will be off to the left.
- Additional Contingency Telephone Numbers
 - MK-Environmental Services, Bellevue, WA. 453-1110
 - Washington Dept. of Ecology
 - Redmond, WA. 867-7200
 - Olympia, WA. 459-6418

TABLE 1

**TASK CHART
MARALCO ALUMINUM - PHASE 1 - RI/FS**

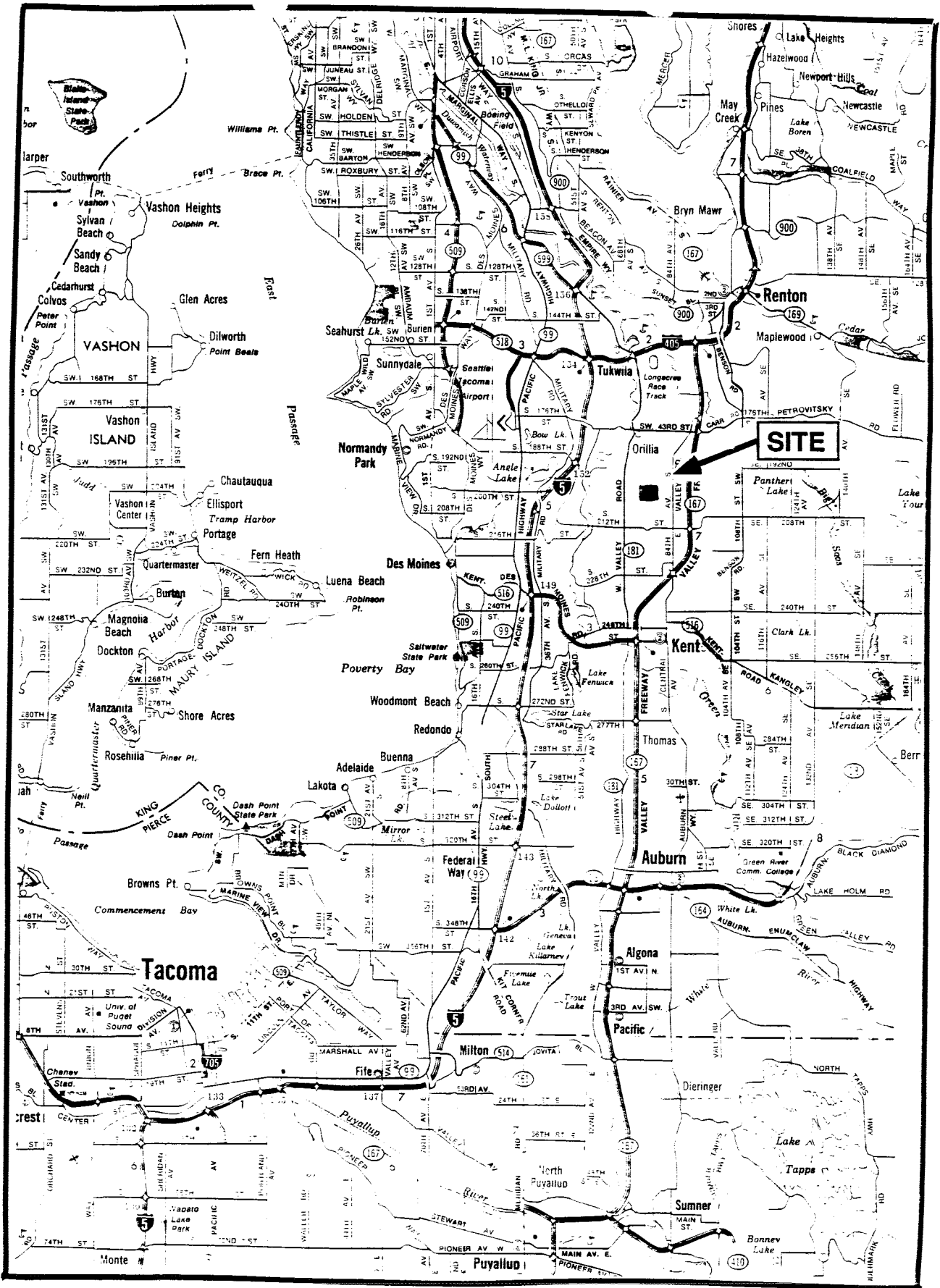
TASK	LEVEL OF PROTECTION
Land Survey of Plate 25 and 26	* Modified Level C (Full-face air purifying respirators with HEPA cartridges, not necessarily worn but readily available)
Planimetric and Topographic Site Survey	
Soil/Groundwater Sampling	
Well Drilling	

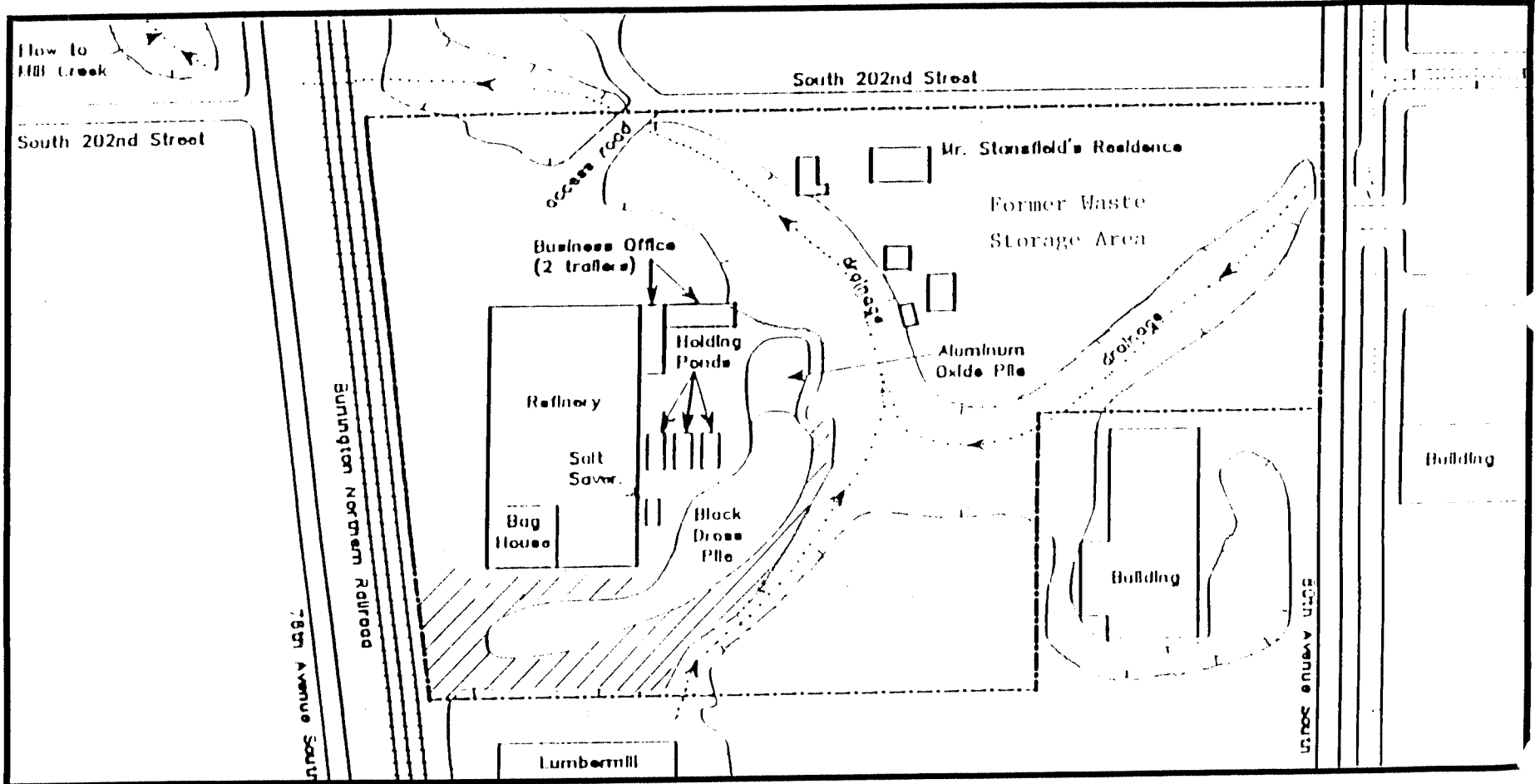
* Assumes availability of air sampling data which indicate concentrations of airborne heavy metals below the Action Level. if data are not available at time initial RI/FS activity, Level C protection will be required.

TABLE II
AIR MONITORING ACTION LEVELS




<u>PRIORITY POLLUTANT METAL</u>	<u>WISHA PEL*/ACTION LEVEL</u>
Antimony	0.5 mg/M ³
Chromium (Total, Cr VI)	0.5 mg/M ³ , 0.05 mg/M ³
Copper	1.0 mg/M ³
Nickel	1.0 mg/M ³
Zinc (oxide, chromate)	10 mg/M ³ , 0.05 mg/M ³
 Total Particulate Exposure (nuisance dusts)	 10 mg/M ³
 <u>breathing Zone Level</u>	 <u>Required Action</u>
Less than Action Level	<ul style="list-style-type: none"> - modified Level C protection - respirators optional but must be available
Equal to or Greater than Action Level	<ul style="list-style-type: none"> - Level C protection with mandatory respirator use - Evacuate downwind personnel without respirators - Establish causative factors - Implement corrective action if possible

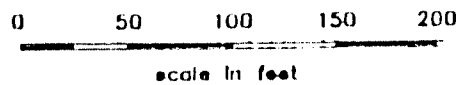
* WAC 296-62-075(H)





LEGEND

-  Site Boundary
-  Drainage Direction
-  Depressed Area



 Surface Area Covered by Black Dress



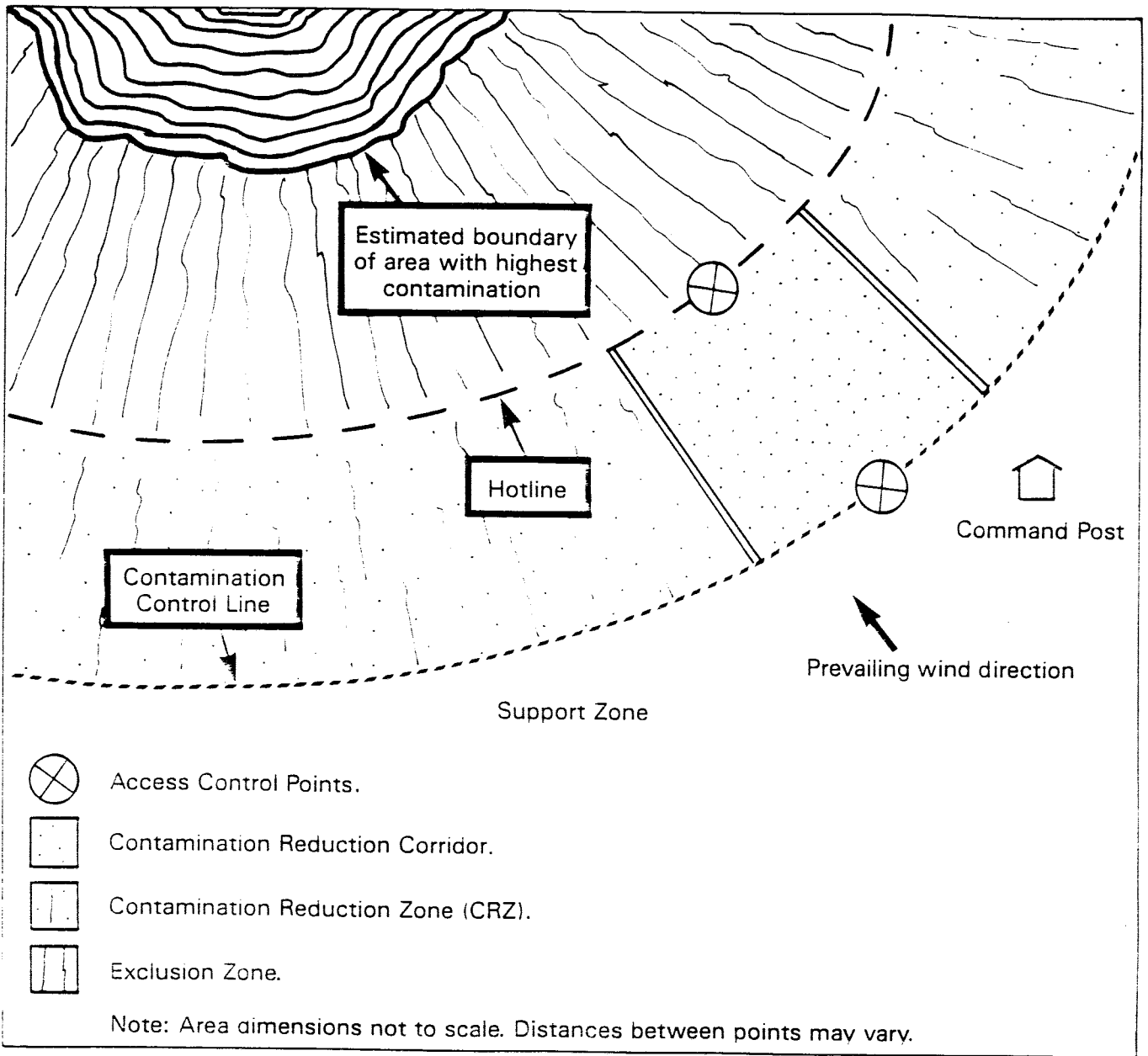
MK-ENVIRONMENTAL SERVICES
BELLEVUE, WASHINGTON

FIGURE NO.:

2

**MARALCO SITE
GENERAL SITE LAYOUT**

Figure 3



Site Work Zones. (Note that decontamination facilities are located in the Contamination Reduction Zone.)

APPENDIX A
RESPIRATORY PROTECTION
PROGRAM

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RESPIRATORY PROTECTION PROGRAM

PURPOSE

This procedure shall be used to provide minimum standards for respirator training and respirator use during performance of jobsite work. Because no safe level of exposure to asbestos fibers has been established, respiratory protection is used in conjunction with good work practices in ~~abatement work~~. Since respirators are essential in the protection of worker health, the establishment and maintenance of an effective program is necessary.

This procedure shall apply to all personnel required to use respiratory protective devices as prescribed by the U.S. Department of Labor Occupational Safety and Health Standards for Construction 29 CFR 1926, for General Industry 29 CFR 1910 and/or all local authorities.

RESPIRATORY PROGRAM ELEMENTS

Certain tasks performed by employees will require the use of a respirator to assure that a healthful breathing environment is maintained at all times. The law requires that if respirators are used, a very comprehensive set of requirements be met. The minimal acceptable program is detailed in OSHA 1910.134(b) (1-11), and elaborated below:

- A. Written standard operating procedures governing the selection and use of respirators shall be established.
- B. Respirators shall be selected on the basis of the hazards to which the worker is exposed.
- C. The user shall be instructed and trained in the proper use of respirators and their limitations,
- D. Where practical, the respirators should be assigned to individual workers for their exclusive use.
- E. Respirators shall be regularly cleaned and disinfected. Those issued for the exclusive use of one worker should be cleaned after each day's use, or more often if necessary. Those used by more than one worker shall be thoroughly cleaned and disinfected after each use.
- F. Respirators shall be stored in a convenient, clean and sanitary location.
- G. Respirators used routinely shall be inspected during cleaning. Worn or deteriorated parts shall be replaced. Respirators for emergency use, such as self-contained devices, shall be thoroughly inspected at least once a month and after each use.

- H. Appropriate surveillance of work area conditions and degree of employee exposure or stress shall be maintained.
- I. There shall be regular inspection and evaluation to determine the continued effectiveness of the program.
- J. Persons should not be assigned to tasks requiring use of respirators unless it has been determined that they are physically able to perform the work and use the equipment. The consulting physician shall determine what health and physical conditions are pertinent. The respirator user's medical status should be reviewed periodically (usually, annually).
- K. Approved or accepted respirators shall be used when they are available. The respirator furnished shall provide adequate respiratory protection against the particular hazard for which it was designed in accordance with standards established by competent authorities.

This document specifies protocol to meet/exceed the minimal requirements of the law. As part of the program, a certification procedure shall be used for all respirator users. Certification checklists, essentially similar to Appendix J, shall be used to document that all training, fitting, and medical requirements have been met before a respirator is issued. These requirements shall be described in greater detail in the appropriate sections of this report.

TYPES OF RESPIRATORS

Respirators can be classified into the following categories:

A. Air-Purifying Respirators

1. These devices function by filtering the air before it reaches the breathing zone of the wearer.
2. Several different filter types have been approved (by the National Institute for Occupational Safety and Health) for protection against asbestos dusts. However, most contractors use high efficiency particulate air (HEPA) filters. These filters are capable of filtering 99.97% of a 0.3 micron monodispersed aerosol of dioctyl phthalate (DOP).
3. These respirators are made in quarter-, half-, and full-face configurations. They are manufactured in sizes small, medium, and large to better fit the face of the wearer. To have the optimum seal, the worker must have no facial hair.
4. Prior to issuing any air-purifying respirator, the seal of the facepiece must be checked. This is done by conducting a qualitative fit test. The procedures for various tests are included in Appendix D.

B. Powered-Air Purifying Respirators

1. This type of respirator also purifies air by passing it through filters before it reaches the breathing zone of the worker.
2. Battery powered, it decreases the negative pressure inside the facepiece. This results in a higher level of protection for the wearer because the wearer is not drawing air from around the face seal.

C. Air-Supplied Respirators

1. These devices provide a fresh supply of air to the wearer. The protection of the worker does not depend upon the filtration of contaminated air.
2. Unlike air-purifying respirators, a positive pressure is maintained inside the facepiece in Type C, airline devices. This provides a higher level of protection for the worker.
3. Breathable air (Grade D) must be supplied to workers. This is usually done through delivery of air from compressors or cylinders of compressed air.
4. If oil-lubricated compressors are used, a high temperature shut-off and/or carbon monoxide alarm must be placed inline. In the event the compressor overheats, the oil could burn, resulting in an influx of carbon monoxide into the breathing air.
5. Fit testing is required only if the type of airline respirator has a face-to-facepiece seal.
6. Caution must be taken to assure free movement of the hose supplying air.

RESPIRATOR SELECTION

- A. Respirators must be selected on the basis of the hazards to which employees are exposed. Considerations include the type and concentration of contaminant, as well as regulatory intent. The selection shall be made by an industrial hygienist.
- B. The National Institute for Occupational Safety and Health (NIOSH) is the government agency responsible for testing and certifying respirators. Only NIOSH certified respirators, filters, and cartridges should be used.
- C. Only the respirator type individually assigned and fitted by the industrial hygienist should be used.
- D. Appendix A contains an outline to assist with the selection of the appropriate respiratory protective device.

MEDICAL DETERMINATION OF ABILITY TO WEAR RESPIRATORS (all types)

- A. Prior to respirator certification, the employee shall receive a medical evaluation by a designated occupational medicine physician. Additionally, examinations shall be made at least annually and within 30 days after the termination of employment to determine that there are no signs of disease. These evaluations shall be coordinated through the project manager and the designated project physician.
- B. The following information shall be provided to the physician by the industrial hygienist prior to the employee examinations:
 - 1. Type of respirator to be used.
 - 2. Tasks employee will perform.
 - 3. Energy requirements of the task.
 - 4. Visual and hearing requirement related to the task.
 - 5. Substances to which employee will be exposed.
- C. The medical evaluation shall include both a medical history and a physical examination.
- . Prior to beginning work on an asbestos project, the worker should undergo the following medical examinations (OSHA requirements) provided or made available by employer:
 - a. A chest roentgenogram (posterior-anterior 14 x 17 inches);
 - b. A history to elicit symptomatology of respiratory disease;
 - c. Pulmonary function tests to include forced vital capacity (FVC) and forced expiratory volume at 1 second (FEV_{1.0})

EMPLOYEE TRAINING

- A. The user and supervisor shall be trained in the proper use and maintenance and limitations of their respirators.
- B. A training protocol for air purifying and supplied air respirators can be found in Appendix C.
- C. Training shall include a written and/or practical examination as part of the respirator certification process.

FIT TESTING OF RESPIRATORS

- A. The following tests shall initially be performed by an industrial hygienist to certify adequacy of respirator fit:

1. Irritant smoke and/or isoamyl acetate
2. Negative pressure test
3. Positive pressure test

Specific fit testing procedures to be followed are found in Appendix D.

- B. Prior to each entry of the work environment, a fit test will be performed to insure integrity of the filters, proper filter seating and/or a satisfactory face seal. Such tests will be documented and acknowledged by each employee.
- C. Employees not able to demonstrate a good facial seal shall not be certified to wear a respirator.

RESPIRATOR USE FOR ASBESTOS WORK

- A. Adequate respiratory protection will be worn:
 1. During all pre-removal activities when the possibility of exposure to airborne asbestos fiber exists;
 2. During all removal activities;
 3. During all clean-up, decontamination, and disposal activities, until the final clearance level has been met;
 4. During disposal at the landfill to avoid exposure if an asbestos container ruptures.
- B. Procedures for wearing respirators.
 1. Air-Purifying Respirators.
 - a. Only a clean and sanitized respirator, which has been inspected, will be worn.
 - b. The device will be properly donned in the Clean Area, prior to putting on disposable hoods or any other articles which will be worn on the head or neck.
 - c. A positive or negative pressure check will be performed. If this check is successful, any remaining clothing and equipment can be donned, and the worker can proceed with his duties. If the check is not successful, the worker will contact his supervisor or assistant supervisor. A smoke test may be required at any time.
 - d. Each time the worker exits the work area, the respirator is worn into the shower, and the respirator is thoroughly soaked before it is removed.
 - e. The respirator is then removed and the filters placed in the labeled receptacle.

- f. Any visible contamination is washed from the respirator, and the respirator is then placed in the labeled receptacle.
- g. The worker then showers and proceeds to the Clean Area.

2. Powered-Air Purifying Respirators

- a. Only a clean and sanitized respirator, which has been inspected, will be worn.
- b. The device will be properly donned in the Clean Area, prior to putting on disposable hoods or any other articles which will be worn on the head or neck.
- c. A positive or negative pressure check will be performed. If this check is successful, any remaining clothing and equipment can be donned, and the worker can proceed with his duties. If the check is not successful, the worker will check the respirator, redon the device, and again perform a negative or positive pressure check. If successful, the worker will don any remaining clothing and equipment and proceed with his duties. If the check is still unsuccessful, the worker must contact his supervisor for assistance.
- d. Each time the worker exits the work area, the battery pack is unfastened from the respirator and carefully held while the worker removes his disposable clothing in the Equipment Room.
- e. The worker then shuts off the battery pack and places it into the designated plastic bag. The battery pack is still connected to the respirator. Clean air is still being supplied to the worker, but the respirator is now a negative-pressure device.
- f. The worker proceeds into the shower and carefully holds close the plastic bag at the point where the breathing tube connects to the battery pack.
- g. The worker then soaks the respirator and exposed breathing tube.
- h. After the exposed respirator parts are soaked, the respirator is removed, and the breathing tube is carefully disconnected from the battery pack, while holding the top shut.
- i. The battery pack is secured with the closure provided and placed in the labeled receptacle.
- j. Any visible contamination is washed from the respirator, and the respirator is then placed in the labeled receptacle.
- k. The worker then showers and proceeds to the Clean Area.

3. Airline Respirators

- a. Only a clean, disinfected, and inspected respirator will be worn.
- b. The device will be properly donned in the Clean Area.
- c. The airline will be connected to the respirator prior to the worker leaving the Clean Area.
- d. Whenever the work area will be exited, the worker will proceed to the Equipment Room, remove his clothing, and proceed to the shower, while still wearing the respirator connected to the airline.
- e. The respirator is thoroughly soaked and is then removed.
- f. All visible contamination is washed from the device, the airline is disconnected, and the respirator is placed into the labeled receptacle.
- g. The worker then showers and proceeds to the Clean Area.

STORAGE AND MAINTENANCE OF RESPIRATORS (all types)

- A. All respirators will be stored in a clean and sanitary location convenient to the area requiring their use.
- B. All respirators, when not in use shall be kept in an approved storage location.
- C. Respirators shall be maintained and inspected in accordance with procedures outlined in Appendix F.

SUPPLIED AIR RESPIRATORS

- A. Breathing air tanks will be refilled after each use.
- B. Air used in supplied air respirators shall, minimally, meet Grade D specifications for breathing air (Compressed Gas Association Commodity Specifications G-7. 1-1966).
- C. Compressed oxygen will not be used in supplied air respirators designed for using compressed air.
- D. Supplied air respirators shall be maintained according to the maintenance schedule in Appendix F.
- E. Periodic cleaning, changing and maintenance of filters for breathing air compressors shall be conducted to ensure they are functioning properly.

- F. Compressors supplying breathing air shall be designed, constructed and located to prohibit entry of contaminated air into the system.
- G. Oil lubricated compressors must be equipped with a carbon monoxide alarm, and/or a high temperature shutoff.
- H. Air line couplings shall be incompatible with other gas or compressed air systems to prevent accidental hook-up to non-respirable gas or oxygen.

EMERGENCY PROCEDURES (supplied air respirators)

- A. Appropriate respiratory protection will be utilized, by certified users only, upon entering contaminated atmospheres to perform rescue or maintenance operations.
- B. When it is determined that rescue or emergency maintenance operations will be required on a process or in an area, suitable personal protective equipment will be provided for such purposes.
- C. Such equipment shall be easily accessible to personnel but located outside the area in question.
- D. Whenever operations require an individual to enter an immediately dangerous to life and health (IDLH) atmosphere wearing a supplied air respirator for rescue or maintenance, standby personnel must be present wearing suitable rescue equipment. Standby personnel shall be in such a position so that they would be unaffected by any toxic or oxygen deficient atmospheres encountered.
- E. Airline respirators may only be used in IDLH atmospheres in pressure-demand mode and with the use of an accessory egress bottle.
- F. Additional safety equipment can be used (such as safety harnesses and safety lines for lifting and removing individuals) as needed. The requirements for this additional equipment shall be properly documented in emergency response procedures.

LIMITATIONS

- A. Air purifying respirators are to be used only in:
 - 1. Atmospheres that are not oxygen-deficient;
 - 2. Atmospheres that are not immediately dangerous to life or health (IDLH);
 - 3. Atmospheres that do not exceed the protection factors of the type of respirator chosen.

- B. Powered-air purifying respirators are to be used only in:
1. Atmospheres that are not oxygen-deficient;
 2. Atmospheres that are not immediately dangerous to life or health (IDLH);
 3. Atmospheres that do not exceed the protection factors of the type of respirator chosen.
- C. Airline respirators are to be used only in:
1. Atmospheres that are not immediately dangerous to life or health (IDLH);
 2. Atmospheres that do not exceed the protection factors of the type of respirator chosen.

RESPONSIBILITIES

- A. The industrial hygienist or designee shall be responsible for:
1. Documenting and maintaining the respirator program on file.
 2. Updating the program as needed.
 3. Conducting or arranging for training and fit testing.
 4. Certifying and maintaining on file a list of certified respirator users and their certification forms. (Appendix J)
 5. Conducting random inspections of all areas using respirators to ensure compliance with the program.
 6. Specifying the type of respiratory protection required.
 7. Conducting periodic evaluations to determine the need for respirators on a continuous basis.
 8. Providing examining physicians with pertinent information regarding potential respirator users.
 9. Repairing respirators or arranging for repairs as needed.
 10. Performing air measurements on all breathing air compressors to assure Grade D specifications.
 11. Arranging to have breathing air tanks refilled within one day after their use.
 12. Arranging to have hydrostatic tests performed on compressed air cylinders, as required.

B. The employee shall be responsible for:

1. Wearing appropriate respirators, as well as required personal protective equipment, for performing assigned tasks.
2. Informing their supervisor of any health conditions that may be aggravated by the use of a respirator.
3. Storing and maintaining respirators in a clean, sanitary condition.
4. Reporting to their supervisors any maintenance needs of their respirator.
5. Cleaning and sanitizing respirators after each use and returning them to their storage location properly bagged and sealed.
6. Performing self administered fit tests prior to the use of respirators.
7. Using only clean, assigned respirators, which are in good condition.

C. Supervisors shall be responsible for:

1. Interfacing with the industrial hygienist regarding potential contaminants in their area.
2. Ensuring that all respirator users are certified.
3. Ensuring that employees maintain respirators in a clean, sanitary condition.
4. Ensuring that only approved respirators are utilized by employees.
5. Maintaining a list of respirator users in their areas, including type of respirator used, dates of training, fit testing and medical examinations.
6. Conducting frequent (daily/weekly) inspections of respirator storage areas and noting condition of respirators.
7. Informing the industrial hygienist of any changes in workplace conditions or new employees who might be required to use respirators.
8. Stocking and issuing approved replacement cartridges for air purifying respirators.
9. Returning defective respirators for repair.

D. Area managers will be responsible for informing the industrial hygienist of any future work which may require the use of a respirator. Additionally, area managers will ensure that a respiratory protection program is maintained as required.

APPENDICES

APPENDIX A

RESPIRATOR SELECTION GUIDE

HAZARD:	RESPIRATOR:
Oxygen Deficiency	Self-contained breathing apparatus. Hose mask with blower. Combination air-line respirator with auxiliary self-contained air supply or an air-storage receiver with alarm.
Gas and Vapor Contaminants: Immediately dangerous to life or health.	Self-contained breathing apparatus. Hose mask with blower. Air purifying, full facepiece respirator with chemical canister (gas mask). Self-rescue mouthpiece respirator (for escape only). Combination air-line respirator with auxiliary self-contained air supply or an air-storage receiver with alarm.
Not immediately dangerous to life or health.	Air-line respirator. Hose mask without blower. Air-purifying, half mask or mouthpiece respirator with chemical cartridge.
Particulate Contaminants: Immediately dangerous to life or health.	Self-contained breathing apparatus. Hose mask with blower. Air-purifying, full facepiece respirator with appropriate filter. Self rescue mouthpiece respirator (for escape only). Combination air-line respirator with auxiliary self-contained air supply or an air-storage receiver with alarm.
Not immediately dangerous to life or health.	Air-purifying, half-mask or mouthpiece with filter pad or cartridge. Air-line respirator. Air-line abrasive-blasting respirator. Hose mask without blower.
Combination Gas, Vapor and Particulate Contaminants: Immediately dangerous to life or health.	Self-contained breathing apparatus. Hose mask with blower. Air-purifying, full facepiece respirator with chemical canister and appropriate filter (gas mask with filter). Combination air-line respirator with auxiliary self-contained air supply or an air-storage receiver with alarm.

Not immediately dangerous
to life or health.

Air-line respirator. Hose mask without
blower. Air-purifying, half mask or
mouthpiece respirator with chemical
cartridge and appropriate filter.

Reference:

U.S. Department of Labor Construction Safety Standards 29 CFR 1926
Respiratory protection. Table E-4.

APPENDIX C

EMPLOYEE TRAINING (Air Purifying Respirators)

- I. Training shall be conducted prior to the use of respirators on the job, and shall cover at least the following items:
 1. Reason for wearing respirator
 2. Type to be worn and how it works
 3. Components of the respirators to be used
 4. Inspection of the respirator
 5. Cleaning and maintenance procedures
 6. Self administered fit tests prior to use, stressing the importance of a good seal
 7. Proper storage procedures
 8. Replacement of cartridges (frequency procedure)
 9. Employee responsibilities
 10. Emergency use (if applicable)
 11. Limitations of respirators
 12. User certification procedures

- II. A written and/or practical exam shall be passed by all respirator users before certification.

EMPLOYEE TRAINING

(Supplied Air Respirators)

- I. All supplied air respirator users will be trained and fit tested prior to using such equipment. This includes any individuals who may be required to use such respiratory equipment for maintenance, emergency or rescue activities.
- II. Training shall minimally consist of the following items:
 - A. The function and components of the unit, including theory of operation.
 - B. Pre-use inspection:
 1. Check tank for air (if applicable)
 2. Perform stretch test to check mask, headstraps and breathing tube
 3. Check harness straps
 - C. Demonstration:
 1. How to don the unit (posture and sequence of strap tightening)
 2. Proper adjustment of headstraps
 3. How to operate unit
 - D. Demonstration of good fit and factors that may affect facial seal:
 1. Positive and negative pressure test (Appendix D)
 2. How facial hair affects fit
 3. Self administered fit tests
 - E. Proper removal of supplied air respirator
 - F. Care, maintenance and cleaning of supplied air respirator (instruction will vary depending on type used).
 - G. Procedures to be followed and factors to be considered when using supplied air respirators in contaminated environments:
 1. Length of air supply (SCBA)
 2. Air supply warning bell
 3. Use of standby personnel in atmospheres Immediately Dangerous to Life and Health (IDLH)
 - H. Limitations of Supplied Air Respirators
- IV. A written and practical exam shall be passed by all supplied air respirator users before certification.

APPENDIX D

FORMAL FIT TESTING

- I. The following tests will be performed on all individuals required to wear a respirator prior to issuance:
 - A. Negative Pressure Test
 - B. Positive Pressure Test
 - C. Irritant Smoke/Isoamyl Acetate Vapor Test
- II. Negative Pressure Test
 - A. The procedure for the negative pressure tests is as follows:
 1. Put on respirator without cartridges.
 2. Cover cartridge inlets with hands.
 3. Breath in gently and hold for 5 seconds.
- III. Positive Pressure Test
 - A. The positive pressure test is similar to the negative pressure test, the difference being the exhalation valve is covered and the employee exhales into the mask gently. If no leakage occurs, adequate fit is indicated.
 - B. At this point, employees will be reminded to conduct positive and negative pressure tests prior to each use of the respirator.
 - C. Once the negative and positive pressure tests are satisfactorily performed, the isoamyl acetate and/or irritant smoke test may be conducted.
- IV. Irritant Smoke Test
 - A. Supply the type of respirator to be worn with appropriate cartridges.
 - B. Have the individual put the respirator on as he normally would (during this time observe the technique, and correct if necessary).
 - C. Score a smoke tube and place in bulb.
 - D. Instruct user to close his eyes (necessary if using a quarter or half mask respirator) and breath regularly.
 - E. Blow smoke along entire facial seal. If the irritant smoke produces an involuntary cough, stop the test. In this case, the respirator is either rejected, readjusted and retested, or another respirator is selected and tested.

F. In addition to normal breathing, test using the above methods while:

1. Employee swings head from side to side and up and down
2. During deep breathing
3. While bending over several times
4. While talking

G. If all tests prove satisfactory, the type of respirator worn is recorded, and a permanent respirator of that type is issued.

V. Isoamyl Acetate (Banana Oil) Fit Test

This is performed similarly to the irritant smoke test with the following exceptions:

- A. Organic vapor cartridges are used on the respirators.
- B. The user is instructed to indicate to the tester if he can smell the vapor (banana oil scent), as an involuntary response will not be elicited.

Generally, the banana oil test should precede the smoke test for the comfort of the respirator user.

APPENDIX F

INSPECTION OF AIR PURIFYING RESPIRATORS

- I. Air purifying respirators shall be inspected by employees before each use and after cleaning for the following items:
 - A. Rubber facepiece:
 1. Excessive dirt
 2. Cracks, tears or holes
 3. Distortion of facepiece
 - B. Headstraps:
 1. Breaks or tears
 2. Loss of elasticity
 3. Missing, broken, or malfunctioning buckles or straps
 4. Excessively worn serrations on the head harness
 - C. Inhalation and exhalation valves:
 1. Detergent residue, dust particles or dirt on valve or valve seat
 2. Cracks, tears or distortion of valves
 3. Missing or defective valve covers
 - D. Filter cartridges:
 1. Proper filter (approved by industrial hygienist)
 2. Missing or worn gaskets
 3. Worn threads
 4. Cracks or dents in filter housing
- II. Correct deficiencies or notify the industrial hygienist who will issue a new respirator.

MONTHLY PREVENTIVE MAINTENANCE FOR SUPPLIED-AIR RESPIRATORS

I. The following inspection shall be performed monthly by qualified personnel on Self-Contained Breathing Apparatus and after each use:

A. Rubber facepiece, check for:

1. Excessive dirt
2. Cracks, tears or holes
3. Distortion of facepiece (allow facepiece to "sit" freely, if distortion does not disappear, replace facepiece)
4. Loose fitting, cracked or scratched facepiece

B. Headstraps, check for:

1. Breaks or tears
2. Loss of elasticity
3. Condition of buckles
4. Worn serrations on head harness which would allow facepiece to slip
5. Fully extended in front of mask

C. Corrugated breathing tube, check for:

1. Cracks or holes
2. Missing or loose hose clamps
3. Broken or missing end connectors

D. Harness, check for:

1. Straps in fully extended position
2. All straps on unit
3. Straps not torn or frayed
4. Missing or broken buckles

E. Air cylinder, check for:

1. "Full" pressure reading on cylinder (if not full, refill tank)
2. Condition of tank
3. Date of last hydrostatic test (if over 5 years, make arrangements to have test performed)

F. Air tightness:

1. With main-line (yellow) closed, open cylinder valve to pressurize regulator and hose.
2. Place hand over regulator outlet and block it until leaktight
3. Open main-line handwheel fully and observe the pressure gauge on the pressure demand regulator and compare to cylinder pressure

4. Close the cylinder valve and observe regulator pressure gauge for drop in pressure. Remove hand from regulator outlet and check for function of audi-larm (375-560 PSI). If leakage is noted or alarm malfunctions, remove unit from service and contract the industrial hygienist.
- G. Main-line and by-pass valves:
 1. Test by donning the apparatus and operating normally. The regulator should follow the normal breathing pattern. Open by-pass and ensure a rush of air is delivered to the facepiece.
 - H. Log inspection results
 - I. If any unit is not ready for service it should be tagged "DO NOT OPERATE".
- II. Airline respirators used for periodic maintenance operations shall be inspected prior to each use as follows:
- A. If the device is a tight-fitting facepiece, use the procedures outlined under AIR PURIFYING RESPIRATORS, except those relating to the purifying elements.
 - B. If the device is a hood, helmet or blouse, use the following procedures:
 1. Examine for rips, tears and seam integrity
 2. Examine headgear, if appropriate, for general condition with emphasis on the suspension
 3. Examine faceshield for cracks, breaks or impaired vision
 - C. Check air supply for:
 1. Integrity and condition of air supply lines and hoses
 2. Operation and condition of regulators, valves or other air flow regulators

APPENDIX G

CLEANING AND STORAGE PROCEDURES

A. Cleaning

1. Labeled receptacles, which contain the manufacturer's recommended cleaning solution, are maintained in the shower.
2. The facepieces are removed from the receptacles and are disassembled.
3. All parts are washed in warm soapy water, and visible residue is removed with a brush.
4. The parts are rinsed in clean water and allowed to air-dry.

B. Inspection

1. All parts are inspected for dirt, residue, pliability of rubber, deterioration and cracks, tears, and holes.
2. The valves are checked for holes, warpage, cracks, and dirt.
3. Check hoods, helmets, and faceshields for cracks, tears, abrasions, and distortions.
4. Check air supply for air quality, breaks or kinks in the supply hoses and detachable coupling attachments, tightness of connectors, and manufacturer's recommendations concerning the proper setting of regulators and valves.
5. Check that couplings are compatible with other couplings used on the site.
6. Check the air purifying elements, carbon monoxide alarm, and high temperature shut-off.

C. Storage

1. All cleaned and inspected respirators are stored in plastic bags in the Clean Area.
2. The devices are stored in a normal position.

APPENDIX H

SPECIAL PROCEDURES FOR AIRLINE RESPIRATORS

- A. Air pumps are routinely used for airline respirators. The intake must be located in a clean, temperate air source.
- B. Compressed breathing air is tested weekly with a Draeger Aerotest Kit to insure that the following air purity standards are met:
 - 1. Oxygen 19-23%
 - 2. Carbon Monoxide 20 ppm
 - 3. Hydrocarbon 5 mg/m³
 - 4. Carbon Dioxide 1,000 ppm
- C. The individual performing the tests will be technically competent.
- D. The test results are recorded in the Test Log.
- E. To avoid freezing of parts in cold weather, the dewpoint of the air is maintained at least 10° F below the lowest recorded temperature.

AIR PURIFYING RESPIRATOR-----CERTIFICATION CHECKLIST

NAME: EMPLOYEE #:
DEPT. #: SHIFT: SUPERVISOR:

JOB TITLE:

TYPE OF RESPIRATOR:

POTENTIAL CONTAMINANT(S):

CONDITIONS OF USE (JOB DESC., LOCATION, PROCESS):

MEDICAL EXAM

COMMENTS:

DATE:

Physician's Signature:

WRITTEN/PRACTICAL EXAM

COMMENTS:

Date:

Examiner:

FIT TEST

COMMENTS:

Date:

I.H. Signature:

The person named above has fulfilled the requirements for using the respirator(s) stated under specified conditions. This certification shall expire in one year.

Date:

Expiration Date:

I.H. Signature:

I acknowledge that I have received instruction, been medically examined and have been fit tested to wear the respirator(s) stated above.

Date:

Employee Signature:

APPENDIX J