KIOP FOREST AVENUE, L.P.
SITE SPECIFIC HEALTH AND SAFETY PLAN
FOR ENVIRONMENTAL WORK RELATED TO
VOLATILE ORGANIC COMPOUNDS
FORMER CHARLTON CLEANERS
FOREST AVENUE SHOPPERS TOWN
FOREST AVENUE
STATEN ISLAND, NEW YORK

Prepared For

KIOP Forest Avenue

May 2002
Revised: September 2003

LEGGETTE, BRASHEARS & GRAHAM, INC.
Professional Ground-Water and Environmental Engineering Services
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This Health and Safety Plan (HASP) is intended to provide a basic framework for the safe conduct of field investigations related to the Former Charlton Cleaners site. The procedures provided herein are intended as a guide for all Leggette, Brashears & Graham, Inc. (LBG) and subcontractor employees who will be involved in the performance of the project.

The primary objective of the HASP is to establish work-safety guidelines, requirements and procedures before field activities begin and during the field activities. The following information was prepared specifically for field operations by personnel to enforce and adhere to the established rules as specified in the HASP. The HASP will be provided to all personnel to aid in accomplishing the following objectives:

- monitoring the effectiveness of the HASP as it is conducted in the field by performing field operation audits;
- following up on any necessary corrective actions;
- interacting with regulatory agencies and/or client representatives regarding modifications of health and safety actions; and
- stopping work should work-site conditions warrant such action.

All personnel will have had health and safety training in accordance with OSHA Interim Final Standard 29 CFR 1910 or as may be amended. A copy of LBG's Corporate Safety Policy and Drug and Alcohol Policy is attached in Appendix A.

1.0 ORGANIZATION AND RESPONSIBILITIES

The organization and responsibilities for implementing safe site-investigation procedures, and specifically for the requirements contained in this manual, are described in this section.

1.1 Project Manager

The LBG Project Manager will be responsible for the overall implementation and monitoring of the health and safety program by:

- ensuring appropriate protective equipment is available and properly used by all personnel, in accordance with the HASP;
- ensuring personnel health and safety awareness by providing them with proper training and familiarity with procedures and contingency plans;
- ensuring all personnel are apprised of potential hazards associated with the site conditions and operations;
- supervising and monitoring the safety performance of all personnel to ensure their work practices are conducted in accordance with the HASP;
- correcting any work practices or conditions that would expose personnel to possible injury or hazardous condition;
- communications with the onsite Health and Safety Officer (HSO);
- ensuring sufficient protective equipment is provided and used;
- promptly initiating emergency alerts; and,
- communicating with the client and/or regulatory agency representatives.

1.2 Onsite Health and Safety Officer

The LBG HSO will be onsite during all field activities. The HSO will be accountable for the direct supervision of personnel from the subcontractors and other LBG personnel with regard to:

- health and safety program compliance;
- maintaining a high level of health and safety consciousness among employees at the work site;

- reporting accidents within LBG jurisdiction and undertaking corrective action; and,
- the Community Air Monitoring Plan which is described in Section 3.1 of this HASP.

1.3 Field Personnel

All field personnel will report directly to the onsite HSO, and will be required to:

- be familiar with, and conform to, provisions of the HASP;
- report any accidents or hazardous conditions to the onsite HSO; and,
- have complete familiarity with their job requirements and the health and safety procedures involved.

1.4 Reporting of Accidents and Unsafe Conditions

If an accident occurs, the HSO and the injured person(s) are to complete an Accident Report for submittal to the project manager, who will forward a copy to the principal-in-charge who should ensure that follow-up action is taken to correct the situation that caused the accident.

1.4.1 Disciplinary Actions for Safety Related Infractions

If an infraction of the Health and Safety Plan is discovered by the Project Manager or the onsite HSO, each case will be dealt with individually. The infraction will be investigated and a disciplinary meeting held with the offender. Disciplinary actions may include a performance deficiency evaluation entered into the employee's personnel file, correction of problem after the disciplinary meeting or removal of the offender from the project. Repeated infractions will not be tolerated and will be dealt with accordingly.

1.4.2 Safety Inspections

Safety inspections will be conducted periodically by the Project Manager. The Project Manager will be familiar with the Health and Safety Plan before performing an onsite visit. While onsite, the Project Manager will evaluate the effectiveness of the plan and offer any

suggestion for improvement. Although the Project Manager is responsible for periodic safety inspections and evaluation of the Health and Safety Plan, the onsite HSO is responsible for daily observation and evaluation of Health and Safety Plan effectiveness.

1.4.3 Safety Meetings

Prior to the start of field activities, a meeting will be held to discuss the potential hazards at the site, with a review of the required protective clothing and procedures observed at this site. As needed, daily meetings will be held to discuss any changes in the hazards. A site safety briefing form will be filled out each day the HSO holds a meeting and signed by all of the attendees of the briefing.

2.0 HAZARD EVALUATION

The exposure limits of chemical constituents which may be encountered are listed in table 1. These constituents would possibly be encountered in ground water and/or soil and comprise the major concerns for personal health. The protection of personnel and the public from exposure to these substances by inhalation, oral ingestion, dermal absorption or eye contact is included as a primary purpose of this plan.

The onsite HSO is responsible for determining the level of personal protection equipment required. The HSO will perform a preliminary evaluation to confirm personal protective equipment requirements once the site has been entered. When work-site conditions warrant, the onsite HSO will modify the level of protection to be utilized. The existence of a situation more hazardous than anticipated will result in the suspension of work until the Project Manager and volunteer have been notified and appropriate instructions have been provided to the field team.

3.0 MONITORING REQUIREMENTS

A photoionization detector (PID) will be used to continuously monitor ambient air quality at the drilling or excavation sites. Records of these data will be maintained by the onsite HSO. During drilling operations or excavation activities, air quality will be monitored, especially near the top of the boreholes as samples are taken and at the perimeters of any

excavations. Work operations which involve handling of potentially hazardous substances will include continuous contaminant monitoring using the PID. When deemed necessary or desirable by the onsite HSO, area monitoring will be used in potentially hazardous zones. Area monitoring will be performed as plans and conditions dictate, and in accordance with the HASP and with the goal of accident and hazardous condition prevention in mind. Instrument calibration information is included in Appendix B.

For the compounds previously identified to be most prevalent, the lowest 8-hour exposure limit is listed on table 1.

3.1 Community Air Monitoring Plan

During all field activities, a Community Air Monitoring Plan (CAMP) will be followed. The CAMP is outlined below.

Real-time air monitoring, for volatile compounds and particulate levels at the perimeter of the work area is necessary. The plan includes the following:

- Volatile organic compounds (VOCs) will be monitored at the downwind perimeter of the work area on a continuous basis using a PID. If total organic vapor levels exceed 5 ppm (parts per million) above background, work activities will be halted and monitoring continued under the provisions of a Vapor Emission Response Plan. All readings will be recorded and be available for State (DEC and DOH) personnel to review.
- Particulates will be continuously monitored upwind, downwind and within the work area at temporary particulate monitoring stations using a personal Data RAM Dust Meter capable of measuring particulate matter less than 10 micrometers in size. If the downwind particulate level is 150 ug/m^3 (micrograms per cubic meter) greater than the upwind particulate level, then dust suppression techniques will be employed and work will continue. All readings will be recorded and be available for State (DEC and DOH) personnel to review.

3.2 Vapor Emission Response Plan

If the ambient air concentration of organic vapors exceeds 5 ppm above background at the perimeter of the work area, activities will be halted and monitoring continued. If the organic vapor level decreases below 5 ppm above background, work activities can resume. If the organic vapor levels are greater than 5 ppm over background but less than 25 ppm over background at the perimeter of the work area, activities can resume provided:

- the organic vapor level 200 feet downwind of the work area or half the distance to the nearest residential or commercial structure, whichever is less, is below 5 ppm over background.

If the organic vapor level is above 25 ppm at the perimeter of the work area, activities will be shutdown. When work shutdown occurs, downwind air monitoring as directed by the Safety Officer will be implemented to ensure that vapor emission does not impact the nearest residential or commercial structure at levels exceeding those specified in the Major Vapor Emission section.

3.3 Major Vapor Emission

If any organic levels greater than 5 ppm over background are identified 200 feet downwind from the work area or half the distance to the nearest residential or commercial property, whichever is less, all work activities will be halted.

If, following the cessation of the work activities, or as the result of an emergency, organic levels persist above 5 ppm above background 200 feet downwind or half the distance to the nearest residential or commercial property from the work area, then the air quality will be monitored within 20 feet of the perimeter of the nearest residential or commercial structure (20 Foot Zone).

If efforts to abate the emission source are unsuccessful and if the following levels persist for more than 30 minutes in the 20 Foot Zone, then the Major Vapor Emission Response Plan shall automatically be placed into effect.

- if organic vapor levels are approaching 5 ppm above background.

However, the Major Vapor Emission Response Plan shall be immediately placed into effect if organic vapor levels are greater than 10 ppm above background.

3.4 Major Vapor Emission Response Plan

Upon activation, the following activities will be undertaken:

1. All Emergency Response Contacts as listed in the Health and Safety Plan of the Work Plan will be notified.
2. The local police authorities will immediately be contacted by the Safety Officer and advised of the situation.
3. Frequent air monitoring will be conducted at 30 minute intervals within the 20 Foot Zone. If two successive readings below action levels are measured, air monitoring may be halted or modified by the Safety Officer.

3.5 Hand-Auger Borings

If the organic vapor level is above 5 ppm above background at the work area in the Michael's basement, an exhaust fan will be operated and monitoring will continue with a monitoring point added outside, adjacent to the exhausted air from the basement. If the organic vapor levels at the work area persist even with the exhaust fan running, all work will be halted and procedures used to reduce organic vapors will be re-evaluated and submitted to New York State Department of Environmental Conservation (NYSDEC) for approval.

If the dust levels are greater than 150 ug/m^3 at the work area in the Michael's basement, dust suppression techniques will be utilized and monitoring will continue. If the dust levels at the work area persist even with the dust suppression technique, all work will be halted and procedures used for dust suppression will be re-evaluated and submitted to NYSDEC for approval.

In addition, during the hand-auger activities, only the LBG hydrogeologists will be present in the room. All of the employees will remain upstairs in the store itself.

4.0 LEVELS OF PROTECTION

The level of protection anticipated to perform work on this investigation is Level D, unless otherwise upgraded. Only protective equipment deemed suitable by the onsite HSO for use at the work site will be worn. Any changes in protection levels shall be documented by the onsite HSO. Field personnel should exercise informed judgment on protective equipment requirements at active work sites or at work sites that have been repeatedly entered or occupied without apparent harm. In any case where doubt exists, the safest course of action must be taken. The protective equipment to be used by field personnel is listed below.

4.1 Level D

- hard hat;
- safety glasses, shatter-proof prescription glasses or chemical splash goggles;
- boots/shoes, leather or chemical-resistant, steel toe and shank;
- coveralls; and,
- chemical resistant gloves.

At a minimum, protective headgear, including protective hearing devices, eyewear and footwear will be worn at all times by personnel working around the drilling equipment. When work-site conditions dictate, protective gloves and chemical-resistant boots shall be required for those personnel handling contaminated soils or water.

Should levels of organic vapor greater than the TLV/PEL exposure limits listed on table 1 above background levels be detected by the PID in the work area, work will stop and all personnel will leave the work area. Typically, for VOCs related work, a sustained level of 5 ppm above background or less as measured with a PID provides a large safety margin for the 8-hour exposure limit.

4.2 Level C

- hard hat;
- boots, leather, steel toe and shank;
- outer boots, chemical resistant;
- chemical-resistant gloves (solvex);

- Tyvek or Saranex suit; and,
- Air purifying respirator with organic vapor cartridge and dust and mist filter.

Level C protection will be considered for sustained PID readings of 5 to 100 ppm above background in the breathing zone.

Respirators for all personnel will be available with both particulate and organic vapor protection cartridges. The onsite HSO will direct when the protective clothing and respirators will be utilized based on the conditions encountered at the work site.

4.3 Level B

- pressure-demand, self-contained breathing apparatus;
- standby escape pack;
- chemical resistant clothing (Saranex suit);
- outer gloves (Solvex);
- inner gloves (surgical);
- outer boots (chemical resistant);
- inner boots (leather, steel shank and toe); and,
- hard hat.

Level B will be considered for sustained PID readings of 100 ppm above background in the breathing zone. In the event that the work space atmosphere contains in excess of 100 ppm of total ionizable compounds above background, colorimetric tubes or a portable gas chromatograph will be used to determine the levels of individual chemicals. The use of Level B equipment will be based on the specific compounds present and will include discussions with the regulatory authorities and/or the client representative.

Level A conditions will require specialized procedures to be formulated on a case-by-case basis.

5.0 SAFE WORK PRACTICES AND HYGIENE

In addition to the use of protective equipment, other procedures will be followed to minimize risk:

- all consumptive activities including eating, drinking or smoking are prohibited during the drilling, sampling and decontamination activities;
- an adequate source of potable water for emergency use will be available at the drilling sites (two liters per person per day);
- fire extinguishers will be available at the work sites for use on equipment or small fires when appropriate; and,
- an adequately stocked first-aid kit will be maintained at the work site at all times during operational hours.

5.1 Heat Stress

In order to avoid heat stress several preventative measures will be observed:

- Workers will be urged to drink a 16-ounce glass of water prior to work (in the morning and after lunch). Water will be contained in a cooler, maintained at a temperature below 60°F. Workers will be encouraged to drink approximately every 20 minutes during days of extreme heat.
- In extreme hot weather, field activities will be conducted in the early mornings and late afternoons.
- Rest breaks in cool or shaded areas will be enforced as needed.
- Toilet facilities will be made available to site workers, unless transportation is readily available to nearby toilet facilities.
- Good hygiene practices will be encouraged, stressing the importance of allowing the clothing to dry during rest periods. Anyone who notices skin problems should receive medical attention immediately.
- If there are support personnel available outside the work zone, they should observe the workers in the exclusion zone to monitor signs of stress, frequency of breaks, etc.

5.2 Cold Stress and Exposure

In order to avoid cold stress, several preventative measures will be observed;

- work will not take place when the temperature falls below -20°F. (The wind chill factor should be a major consideration);
- clothing should be worn in layers, so that personnel can adapt to changing conditions and various levels of physical stress;
- if possible, breaks should be taken in a heated vehicle or building, but care should be taken to remove outer clothing during the break;
- have on hand extra inner clothing in case perspiration builds up;
- keep insulated containers of warm liquids available for breaks outside of the exclusion zone;
- be aware of the signs of frostbite and take immediate remedial measures; and,
- take extra precautions around areas subject to ice buildup, such as sanding slippery surfaces.

6.0 WORK ZONE

To prevent unauthorized personnel from entering areas where active operations are being performed, the area enclosing the operation will be marked.

Typically, VOC projects such as this one involve installation of wells, monitoring of wells, installation and operation of treatment systems and observation of tank and trench excavation work. Safety issues with respect to this type of work are attached in Appendix C.

7.0 DECONTAMINATION

An area will be set aside within the work zone for decontamination. The type of decontamination procedures used will be based on the level of protection required. Decontamination of Level D protective wear will consist of brushing heavily soiled boots to remove soils, rinsing gloves and safety glasses (and overboots, if worn) with water, and removing and storing coveralls in plastic bags before leaving the work zone, if heavily soiled or suspected of having been in contact with site contaminants. For detailed decontamination, equipment and procedures, refer to Appendix D.

8.0 CONTINGENCY PLAN FOR EMERGENCIES

In the event of a safety or health emergency, appropriate corrective measures must immediately be taken to assist those who have been injured or exposed and to protect others from hazard. The onsite HSO will be notified of the incident immediately. If necessary, first aid will be rendered. A contact sheet showing the closest police, hospital and NYSDEC office will be maintained onsite within this HASP as Appendix E.

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TABLE

TABLE 1

Exposure Limits

COMPOUND	EXPOSURE STANDARDS			RECOGNITION QUALITIES		
	TLV/PEL (a) (ppm)	STEL (b) (ppm)	IDLH (c) (ppm)	Odor/Threshold (ppm)	LEL (d) (%)	Ionization Potential (eV)
Gasoline[1/]	300	500	1,400	–	1.4	–
Alachlor[2/]	–	–	–	No odor	–	–
Benzene[1/]	0.1	1	500	12	1.2	9.24
Butane	800	–	–	2,700	1.6	10.63
Chlorobenzene	75[3/]	–	1,000	Almonds	1.3	–
1,1-Dichloroethane	100	Ca[5/]	3,000	Chloroform	5.4	11.06
1,2-Dichloroethylene	200	–	1,000	Chloroform	5.6	9.65
EDB (Ethylene dibromide)[1/]	0.045	0.13	100	Sweet	–	9.45
EDC (Ethylene dichloride)[1/]	1	2	50	Chloroform	6.2	11.05
Ethylbenzene	100	125	800	Aromatic	0.8	8.76
Heptane	85	440	750	150	1.05	9.90
N-Hexane	50	–	1,100	Gasoline/130	1.1	10.18
Hexanes	100	510	–	Mild gasoline	–	–
Methyl ethyl ketone (MEK)	0.2[4/]	–	–	Characteristic odor	–	–
Octane	75	385	1,000	Gasoline/150	1.0	9.82
Pentane	120	610	1,500	Gasoline/1000	1.5	10.34
TBA (Tert-butyl alcohol)	100	150	1,600	Camphor	2.4	9.70
Tetrachloroethylene[1/]	Ca[5/]	Ca[5/]	150	Chloroform	–	9.32
Tetraethyl Lead	0.075*	–	40*	Sweet	1.8	11.10
Tetramethyl Lead	0.075*	–	40*	Fruity	–	8.50

TABLE 1
(continued)

Exposure Limits

COMPOUND	EXPOSURE STANDARDS			RECOGNITION QUALITIES		
	TLV/PEL (a) (ppm)	STEL (b) (ppm)	IDLH (c) (ppm)	Odor/Threshold (ppm)	LEL (d) (%)	Ionization Potential (eV)
Toluene	100	150	500	Sweet benzene like/2.9	1.1	8.82
1,1,2-Trichloroethane	Ca[5/]	10	100	Chloroform	6.0	11.00
Trichloroethylene	Ca[5/]	25	1,000	Chloroform	8.0	9.45
Vinyl Chloride	Ca[5/]	Ca[5/]	Not determined	Pleasant	3.6	9.99
Xylenes	100	150	900	Aromatic/1.1	0.9	8.56

Notes:

1/ Potential occupational carcinogen
2/ Alachlor manufacturer established internal exposure guideline of 10 ppb for 8-hour TWA
3/ OSHA guideline, NIOSH questions the adequacy of 75 ppm
4/ Ceiling REL, should not be exceeded at any time
5/ NIOSH recommends occupational exposures to carcinogens to be limited to the lowest feasible concentration
– = No published value
* mg/m3
(a) The more stringent of either: (1) Occupational Safety and Health Administration (OSHA) 1989 Permissible Exposure Limit (PEL), (2) American Conference Governmental Industrial Hygienists (ACGIH) Threshold Limit Value (TLV), or (3) National Institute for Occupational Safety and Health (NIOSH) recommended exposure limits (RELs), time-weighted average concentrations for up to a 10-hour work day.
(b) Short Term Exposure Limit - 15 minute exposure.
(c) Immediately dangerous to life and health.
(d) Lower Explosive Limit.

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FORMS

SITE SAFETY BRIEFING

Job Name: Monitor well installation and ground-water sampling
Date: _____
Site Location: Forest Avenue Shoppers Town, Forest Avenue, Staten Island, New York

SAFETY ISSUES (Circle appropriate information)

Tasks: Drilling, Ground-Water Monitoring, Treatment System O&M, UST or Trench Excavation

Protective Clothing/Equipment: Level D, Level C, Level B, Level A

Chemical Hazards: Gasoline, Diesel Fuel, Heating Oil, Number 2 Oil, Chlorinated Solvents

Physical Hazards: Car Traffic, Construction Equipment, Confined Space, Overhead Wires

Control Methods: Cones, Restricted Access, Traffic Control Personnel

Other: _____

Hospital Name/Address: _____

_____

_____

ATTENDEES

Print Name:	Sign Name:
_____	_____
_____	_____
_____	_____
_____	_____

Meeting conducted by: _____

_____

AIR MONITORING

General Information

Name(s): _____ Background Level: _____

Date: _____ Weather Conditions: _____

Time: _____

Project: Forest Avenue Shoppers Town
Staten Island, New York

Equipment Calibration

PID _____ CGI _____

Sample No.	Time	Location	PID Reading (ppm)	Comments	CGI Reading	
					$\%O_2$	%LEL
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						

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Air Monitoring Data

General Information

Name(s): _____

Project/Location: _____

Equipment Used: MINIRAM

Background Level: _____

Date	Weather	Total Time (min)	SA (mg/m^3)	TWA (mg/m^3)

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PLAN ACCEPTANCE FORM

PROJECT HEALTH & SAFETY PLAN

INSTRUCTIONS: This form is to be completed by each Leggette, Brashears & Graham, Inc. employee to work on the subject project work site and returned to the Office Safety Coordinator prior to site activities.

Client/Project: KIOP Forest Avenue, L.P.

Date: _____

I represent that I have read and understand the contents of the above Plan and agree to perform my work in accordance with it.

_____	_____
Signed	Signed
_____	_____
Print Name	Print Name
_____	_____
Date	Date
_____	_____
Signed	Signed
_____	_____
Print Name	Print Name
_____	_____
Date	Date

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APPENDIX A

LEGGETTE, BRASHEARS & GRAHAM, INC.
SAFETY POLICY

Job safety is a common-sense part of everyone's life, but requires constant alertness to possible dangers. When we work on industrial sites, LBG employees are expected to observe the safety rules of our Client hosts.

You are the first line of defense for your own personal safety. In the field, appropriate clothing should be worn at all times. Where appropriate, work shoes with hard toes and/or ankle protection should be worn at all times. **Sneakers/tennis shoes should never be worn in the field, regardless of the circumstances.**

LBG provides hard hats that should be worn around any drilling operations and in any other "hard hat zones". Where required, safety glasses, goggles, protective gloves, respirators, and other safety clothing or equipment should be worn and disposed of as specified by the Project Safety Officer.

Periodically, LBG provides special safety seminars which satisfy the OSHA requirements for work on hazardous waste sites. In-house safety training is conducted on an ongoing basis and as dictated by case-by-case needs. There is a Corporate Safety Officer in the Trumbull, Connecticut headquarters and a designated Safety Officer in each regional office to whom questions and problems relating to job safety should be referred.

Any project that involves or may involve hazardous or toxic waste or any potentially dangerous condition requires the preparation, filing, use and compliance with a Health and Safety Plan (HASP). LBG has a petroleum related work HASP that can be readily adapted to most petroleum jobs and has numerous site-specific HASPS that comply with state and federal CERCLA requirements that can be used for guidance in developing site-specific HASPS.

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LEGGETTE, BRASHEARS & GRAHAM, INC.
GENERAL DRUG AND ALCOHOL POLICY

In any company, certain common-sense rules of conduct and performance must be established for the employees to follow in order to avoid any misunderstanding and to protect the right of all concerned. Breaches of acceptable conduct which include, but are not limited to, abusive language, insubordination, intoxication, moral turpitude, or substance abuse/possession can lead to disciplinary action or to dismissal.

While performing any service for LBG or LBG's clients, employees, agents, and subcontractors of LBG shall not: (1) be under the influence of alcohol or any controlled substance; (2) use, possess, distribute, or sell illicit or unprescribed controlled drugs, drug paraphernalia, or alcoholic beverages; or (3) misuse legitimate prescription drugs.

LBG may remove from active project status any of its employees any time there is a reasonable basis for suspicion of alcohol/drug use, possession, or impairment involving such employee, and at any time an incident occurs where drug or alcohol use could have been a contributing factor. In such cases, employee may only be considered for return to work after LBG certifies as a result of a for-cause test, conducted immediately following removal, that said employee is in compliance with this policy.

LBG reserves the right to require drug and alcohol testing for its employees, either for its own purposes or at the direction of Clients. Such testing may take place periodically, or for specific projects. The testing will be in compliance with Department of Transportation drug testing regulations.

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APPENDIX B

LEGGETTE, BRASHEARS & GRAHAM, INC.
AIR MONITORING EQUIPMENT OPERATION

Instrument Calibration

All applicable instruments will be calibrated daily before use. Readings will be recorded on the Air Monitoring form.

Background Readings

Before any field activities commence, the background levels of the site must be read and noted. Daily background readings must be conducted away from areas of potential contamination to obtain accurate results.

Air Monitoring Frequency

All site readings must be noted on the Air Monitoring form along with the date, time, background level, weather conditions, wind direction and speed, and the location where the background level was recorded.

OVM 580B Calibration

- Turn the OVM on by pressing the ON/OFF switch.
- With the OVM running, press the MODE/STORE switch and then press the -/CRSR switch when the OVM reads if "logging is desired".
- Keep pressing the -/CRSR switch until OVM will display "reset to calibrate".
- Enter the calibration mode by pressing the RESET switch. The OVM will then display "restore backup + = Yes".
- Press the -/INC switch and the OVM will display "zero gas reset when ready".
- Connect zero gas to OVM and press RESET switch. The OVM will display "Model 580B zeroing".
- After the OVM calibrates the zero gas, it will display "span gas reset when ready".
- Connect span gas to OVM and press RESET switch.
- When OVM displays "reset to calibrate", the OVM has calibrated the span gas.
- To exit calibration mode, press MODE/STORE switch.

HNU PI-101 Calibration

- Battery check--The function switch should be turned to BATT. The needle should be in the green region; if not, recharge the battery.
- Zero set--The function switch should be turned to STANDBY. In this position, the lamp is OFF and no signal is generated. The zero point should be set with the ZERO set control.
- Gas standard--The standard should be connected to the probe. The function switch should be turned to the range position of the standard and the meter reading should be noted. The SPAN control setting should be adjusted, as required, to read the parts per million (ppm) concentration of the standard. The zero setting should be rechecked.
- Lamp cleaning--If the span setting from calibration is 0.0 or calibration cannot be achieved, then the lamp must be cleaned.
- Lamp replacement--If the lamp output is too low or if the lamp has failed, it must be replaced.

MSA Explosimeter Model 2A Calibration Instructions

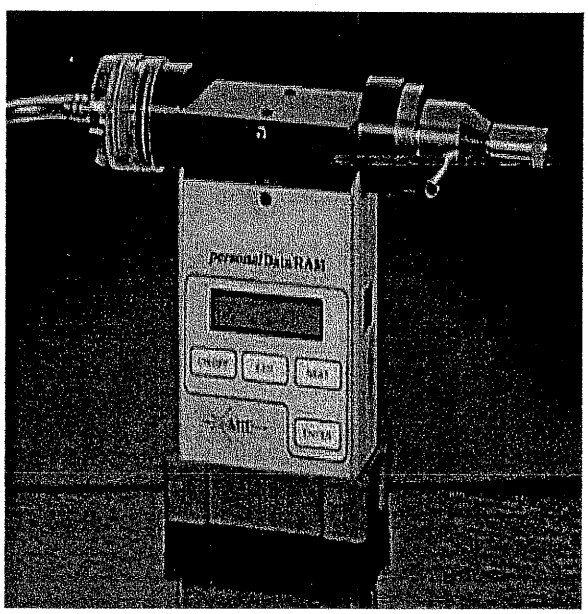
Before the calibration can be checked, the instrument and its aspirator sampling bulb must be in operating condition, as described in the instrument instruction manual.

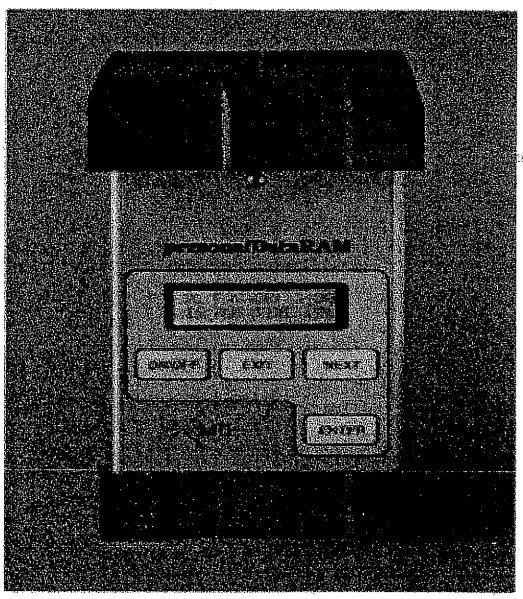
- The flow control should be attached to the calibration gas tank.
- The hose should be connected to the flow control and to the instrument inlet fitting.
- The control valve should be opened.
- The meter reading should be recorded after it stabilizes. Note: It is not necessary for the aspirator bulb to be operated for the calibration sample to be obtained. If the instrument does not read within the acceptable range, the detector filament unit should be replaced and the calibration check procedure should be repeated.
- The flow control valve should be closed.
- The hose should be removed from the flow control and from the inlet fitting on the instrument.
- The flow control should be removed from the calibration gas tank.

OPERATOR MANUAL

personalDataRAM
Model *p*DR-1000AN
and *p*DR-1200

January 23, 2001





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CONTENTS

ONE YEAR LIMITED WARRANTY

MIE warrants to the original Purchaser that the apparatus to be delivered hereunder will be of the kind designated or specified and free of defects in workmanship or material (excluding rechargeable batteries and rechargeable battery packs). MIE makes no other express warranty, and disclaims any implied warranty of merchantability or fitness for purpose.

If the apparatus fails to conform to the above warranty, and notice is received by MIE from Purchaser within one year from the date of shipment, MIE will, at its option, either repair the defective part or parts or make available a repaired or replacement part. This warranty extends to all parts and labor involved in the required repair to the extent that said repair was not caused by negligence in operation of the apparatus by the Purchaser. MIE will perform the repair at its plant with all shipping and insurance costs paid by the Purchaser or, upon mutual consent of the parties, at a site designated by the Purchaser except, in the latter circumstances, the Purchaser will be responsible to reimburse MIE for all costs associated with travel, per diem and travel time of those MIE individual(s) deemed appropriate to effectuate the repair.

Repair or replacement of the apparatus in the manner and for the time period specified above, is the Purchaser's exclusive remedy and will satisfy all liabilities of MIE to Purchaser arising out of the supply or use of the apparatus, whether based on contract, warranty, negligence or otherwise. In no event will MIE be liable for any incidental or consequential loss or damage resulting from any failure of the apparatus to conform to the contract of sale.

Rechargeable batteries and rechargeable battery packs shall be warranteed for 30 days to be free of defects in workmanship or material. During this 30 days rechargeable batteries and rechargeable battery packs that fail shall be returned to MIE for evaluation before warranty replacements are sent.

1.0 GENERAL DESCRIPTION

The MIE *personal*DataRAM™ (for Personal Data-logging Real-time Aerosol Monitor) is a technologically advanced instrument designed to measure the concentration of airborne particulate matter (liquid or solid), providing direct and continuous readout as well as electronic recording of the information.

The *personal*DataRAM is available in two versions: model *p*DR-1000AN and model *p*DR-1200. The model *p*DR-1000AN operates as a passive air sampler whereas the model *p*DR-1200 uses active air sampling. The user can convert from one to the other of these two versions by means of optional conversion kits offered by MIE, Inc. (see Sections 4.2 and 15.0 of this manual).

The model *p*DR-1000AN samples passively (i.e., without a pump) the air surrounding the monitor; air accesses freely the sensing chamber of the instrument by means of convection, diffusion, and adventitious air motion. The model *p*DR-1200, on the other hand, requires a separate air driver (not included) such as a personal-type pump for its operation.

In addition, the model *p*DR-1200 includes a particle size-selective inlet cyclone which permits size segregated measurements (i.e., PM_{10}, $PM_{2.5}$, respirable, etc.) as well as enables the user to perform aerodynamic particle sizing by varying the sampling flow rate. The model *p*DR-1200 incorporates, downstream of its photometric sensing stage, a standard 37-mm filter holder on which all sampled particles are collected for subsequent analysis or gravimetric referencing/calibration, if so desired.

The *personal*DataRAM is the result of many years of field experience acquired with thousands of units of its well known predecessor, the MIE MINIRAM, and embodies many technological advances made possible by the latest electronic hardware and software. The *personal*DataRAM is also a worthy miniaturized companion to the MIE DataRAM, a recognized paragon of portable aerosol monitors.

The *personal*DataRAM is a high sensitivity nephelometric (i.e. photometric) monitor whose light scattering sensing configuration has been optimized for the measurement of the respirable fraction of airborne dust, smoke, fumes and mists in industrial and other indoor environments.

The *personal*DataRAM is an ultra-compact, rugged and totally self-contained instrument designed for hand-held, belt-worn, as well as unattended operation. It is powered either by its internal replaceable battery, or by an optional attachable rechargeable battery pack, or by an AC supply (included as standard accessory). For the model *p*DR-1200, power to an adjunct pump must be provided separately.

Zeroing is accomplished by means of a hand-inflatable "zero air" pouch included with the model *p*DR-1000AN, and by an inlet filter cartridge provided with the model *p*DR-1200. In addition, the instrument automatically checks agreement with

its original factory calibration by checking its optical background during the zeroing sequence.

The *personal*DataRAM covers a wide measurement range: from 0.001 mg/m^3 (1 µg/m^3) to 400 mg/m^3, a 400,000-fold span, corresponding to very clean air up to extremely high particle levels.

In addition to the auto-ranging real-time concentration readout, the *personal*DataRAM offers the user a wide range of information by scrolling its two-line LCD screen, such as run start time and date, time averaged concentration, elapsed run time, maximum and STEL values with times of occurrence, etc.

Operating parameters selected and diagnostic information displays are also available. Furthermore, the *personal*DataRAM features complete, large capacity internal data logging capabilities with retrieval through an externally connected computer. The stored information (up to 13,000 data points) includes average concentration values, maximum and STEL values with time information as well as tag numbers.

Selectable alarm levels with built-in audible signal and switched output, a RS-232 communications port, and a programmable analog concentration output (voltage and current) are all part of this versatile instrument.

A custom software package is provided with the *personal*DataRAM to program operating/logging parameters (e.g. logging period, alarm level, concentration display averaging time, etc.) as well as to download stored or real-time data to a PC or laptop for tabular and/or graphic presentation. If required, the data can also be imported to standard spreadsheet packages (e.g. Microsoft Excel™, Lotus 1-2-3™, etc.).

2.0 SPECIFICATIONS

- Concentration measurement range (auto-ranging)[1]: 0.001 to 400 mg/m^3
- Scattering coefficient range: 1.5×10^{-6} to 0.6 m^{-1} (approx.) @ λ =880 nm
- Precision/repeatability over 30 days (2-sigma)[2]:
  ± 2% of reading or ±0.005 mg/m^3, whichever is larger, for 1-sec. averaging time
  ±0.5% of reading or ±0.0015 mg/m^3, whichever is larger, for 10-sec. averaging time
  ±0.2% of reading or ±0.0005 mg/m^3, whichever is larger, for 60-sec. averaging time
- Accuracy[1]: ±5% of reading ±precision
- Resolution: 0.1% of reading or 0.001 mg/m^3, whichever is larger
- Particle size range of maximum response: 0.1 to 10 µm
- Flow rate range (model *p*DR-1200 only): 1 to 10 liters/minute (external pump required)
- Aerodynamic particle sizing range (model*p*DR-1200 only): 1.0 to 10 µm
- Concentration display updating interval: 1 second
- Concentration display averaging time[3]: 1 to 60 seconds
- Alarm level adjustment range[3]: selectable over entire measurement range
- Alarm averaging time[3]: real-time (1 to 60 seconds), or STEL (15 minutes)
- Datalogging averaging periods[3]: 1 second to 4 hours
- Total number of data points that can be logged in memory: 13,391
- Number of data tags (data sets): 99 (maximum)
- Logged data:
  - Each data point: average concentration, time/date, and data point number
  - Run summary: overall average and maximum concentrations, time/date of maximum, total number of logged points, start

time/date, total elapsed time (run duration), STEL concentration and time/date of occurrence, averaging (logging) period, calibration factor, and tag number.

- Elapsed time range: 0 to 100 hours (resets to 0 after 100 hours)
- Time keeping and data retention: › 10 years
- Readout display: LCD 16 characters (4 mm height) x 2 lines
- Serial interface: RS-232, 4,800 baud
- Computer requirements: IBM-PC compatible, 486 or higher, Windows™ '95 or higher, ≥ 8 MB memory, hard disk drive, 3.5" floppy, VGA or higher resolution monitor
- Outputs:
  * Real-time digital signal (1 sec^{-1}): concentration, 16-character code
  * Real-time analog signal: 0 to 5 V and 4 to 20 mA. Selectable full scale ranges of^3: 0 - 0.1, 0 - 0.4, 0 - 1.0, 0 - 4.0, 0 - 10, 0 - 40, 0 - 100, and 0 - 400 mg/m^3.
    Minimum load impedance for voltage output: 200 kΩ.
    Maximum load impedance for current output: 300 Ω (when powered by AC power supply)
  * Alarm output: 1 Hz square wave, 5 V peak-to-peak amplitude. Load impedance > 100 kΩ
- Internal battery: 9V alkaline, 20-hour run time (typ.)
- Current consumption: 15 to 25 mA (in Run Mode); 10 to 20 mA (in Ready Mode)
- AC source: universal voltage adapter (included) 100-250 V~, 50-60 Hz (CE marked)
- Optional battery pack: model *p*DR-BP, rechargeable NiMH, 72-hour run time (typ.)
- Operating environment: -10° to 50° C (14° to 122° F), 10 to 95% RH, non condensing
- Storage environment: -20° to 70° C (-4° to 158° F)
- Dimensions (max. external):
  * Model *p*DR-1000AN: 153 mm (6.0 in) H x 92 mm (3.6 in) W x 63 mm (2.5 in) D

  * Model *p*DR-1200 (including cyclone and filter holder): 160 mm (6.3 in) H x 205 mm (8.1in) W x 60 mm (2.4 in) D

- Weight:
  * Model *p*DR-1000AN: 0.5 kg (18 oz)
  * Model *p*DR-1200: 0.68 kg (24 oz)

- Cyclone (included in model *p*DR-1200 only): BGI model GK 2.05

- Filter holder (included in model *p*DR-1200 only): Millipore type MAWP 037 AO (with 0.8 µm pore size filter)

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[1]Referred to gravimetric calibration with SAE Fine (ISO Fine) test dust (mmd = 2 to 3 µm, σ_g = 2.5, as aerosolized)

[2]At constant temperature and full battery voltage

[3]User selectable

3.0 USER GUIDELINES

3.1 Handling Instructions

The *personal*DataRAM is a sophisticated optical/electronic instrument and should be handled accordingly. Although the *personal*DataRAM is very rugged, it should not be subjected to excessive shock, vibration, temperature or humidity. As a practical guideline, the *personal*DataRAM should be handled with the same care as a portable CD player.

If the *personal*DataRAM has been exposed to low temperatures (e.g. in the trunk of a car during winter) for more than a few minutes, care should be taken to allow the instrument to return near room temperature before operating it indoors. This is advisable because water vapor may condense on the interior surfaces of the *personal*DataRAM causing temporary malfunction or erroneous readings. Once the instrument warms up to near room temperature, such condensation will have evaporated. If the *personal*DataRAM becomes wet (e.g. due to exposure to water sprays, rain, etc.), allow the unit to dry thoroughly before operating.

Whenever the *personal*DataRAM is shipped care should be taken in placing it in its carrying case and repackaging it with the original cardboard box with the factory provided padding.

3.2 Safety Instructions

- Read and understand all instructions in this manual.
- Do not attempt to disassemble the instrument. If maintenance is required, return unit to the factory for qualified service.
- The *personal*DataRAM should be operated only from the type of power sources described in this manual.
- When replacing the internal 9-V battery, follow the instructions provided on the back panel of the unit.
- Shut off *personal*DataRAM and any external devices (e.g. PC) before connecting or disconnecting them.
- Shut off *personal*DataRAM before replacing the internal battery, or when plugging in or disconnecting the AC power supply or the optional rechargeable battery pack.

3.3 Handling and Operation

3.3.1 Model *p*DR-1000AN

The model *p*DR-1000AN can be operated in any position or orientation. Exposure to high intensity fluctuating light of the interior of the sensing chamber, through the

front and back slotted air openings (see Section 5.5), should be avoided. Such large intensity transients may cause erroneous readings. Direct access of sunlight to the sensing chamber should be prevented.

Typical modes of instrument support/handling include:

- Hand-held. Do not obstruct or cover the sensing chamber opening slots on front and back of unit.
- Belt attached. Use belt clip provided as standard accessory. The unit can be worn on a waist belt, or with optional shoulder belt (model *p*DR-SS) for breathing zone monitoring.
- Table top operation. The *p*DR-1000AN can be placed on a table either in an upright position (i.e., resting on its lower protective bumper), or on its back (i.e., resting on the rear edges of its two protective bumpers).
- Tripod mounted. The unit can be attached to any standard tripod using the threaded bushing on the bottom of the monitor (see Figure 3).
- Fixed point operation. The model *p*DR-1000AN can be mounted at a fixed location (e.g., wall or post) using the optional wall mounting bracket, model *p*DR-WB.

3.3.2 Model *p*DR-1200

The *p*DR-1200 requires an external air suction device, such as a small diaphragm pump (e.g., model *p*DR-PU) for its sampling operation. The inlet of the pump must be connected by means of tubing to the hose fitting on the *p*DR-1200 filter holder attached to sensing chamber (see Figure 2).

The inlet metal tube of the cyclone can be oriented in any desired direction (i.e., upward, forward, downward or backward) by rotating the cyclone body within its holder cup on the right side of the sensing chamber (see Figure 2).

Always ensure unobstructed access to the cyclone inlet when sampling directly the air in the instrument's vicinity. Alternatively, tubing can be connected to the cyclone inlet in order to extract a sample stream from a duct, chamber or other enclosed volume.

Typical modes of instrument support/handling include:

- Hand-held. For example, using a personal type pump, clipped to the belt and using a tubing connection to the *p*DR-1200.
- Belt attached. Use belt clip kit provided as standard accessory. The unit can be worn on a waist belt, or with the optional shoulder belt (model *p*DR-SS) for breathing zone monitoring. A personal pump can then be belt-worn as well.
- Table top operation. The *p*DR-1200 can be placed on a table either in an upright position (i.e. resting on its lower protective bumper), or on its back (i.e. resting on its backside).
- Tripod mounted. The unit can be attached to any standard tripod using the

threaded opening on the bottom base (see accessory attachment fitting on Fig. 4).
- Wall mounted for fixed point monitoring. Use optional wall mounting bracket, model *p*DR-WB, either in combination with model *p*DR-PU pump module and model *p*DR-AC power supply (powering both the *p*DR-1200 and the *p*DR-PU), or with a separate pump.

3.4 Air Sampling Guidelines

Although the *personal*DataRAM is designed primarily for intramural use, i.e. for indoor air quality, in-plant, or mining environment monitoring, its active sampling version (model *p*DR-1200) also makes it compatible with extramural use (i.e. ambient monitoring). General ambient monitoring applications, however, are performed preferentially using an appropriate inlet configuration, in order to ensure representative particle sampling under conditions of variable wind speed and direction. Consult with MIE for such outdoor applications.

For typical area monitoring applications, the *personal*DataRAM should be placed and operated centrally within the area to be monitored, away from localized air currents due to fans, blowers, ventilation intakes/exhausts, etc. This is to ensure representative sampling within the area to be assessed.

3.5 Environmental Constraints and Certifications

The *personal*DataRAM is designed to be reasonably dust and splash resistant, however, it is not weatherproof. To operate the unit outdoors provisions should be made to protect it from environmental extremes outside its specified range, and from any exposure to precipitation.

The *personal*DataRAM is certified for compliance with the electromagnetic radiation limits for a Class A digital device, pursuant to part 15 of the FCC Rules. The unit also complies and is marked with the CE (European Community) approval for both immunity to electromagnetic radiation and absence of excessive emission interference.

4.0 ACCESSORIES

4.1 Standard Accessories

The *personal*DataRAM is provided to the user with the following standard accessories:

- Soft-shell carrying case (MIE model *p*DR-CC-1)
- Digital communications cable (MIE model *p*DR-DCC)
- Analog signal/alarm output cable (MIE model *p*DR-ANC)
- Communications software disk (MIE model *p*DR-COM)
- Z-Pouch zeroing kit (MIE model *p*DR-ZP)(for use with *p*DR-1000AN only)

- Zeroing filter cartridge and tubing (MIE model *p*DR-ZF)(for use with *p*DR-1200 only)
- Belt clip kit (MIE model *p*DR-CA)
- AC power supply (and charger for optional MIE model *p*DR-BP) (MIE model *p*DR-AC)
- Metal cyclone (MIE model *p*DR-GK2.05)(for use with *p*DR-1200 only)
- 37-mm filter holder and hose fitting (MIE model *p*DR-FH)(for use with *p*DR-1200 only)
- Instruction manual

4.2 Optional Accessories

The following optional accessories are available from MIE for use with the *personal*DataRAM:

- Rechargeable battery module (MIE model *p*DR-BP)
- Shoulder strap (MIE model *p*DR-SS)
- Remote alarm unit (MIE model *p*DR-RA)
- Wall mounting bracket (MIE model *p*DR-WB)
- Active sampling kit to convert model *p*DR-1000AN to model *p*DR-1200 (MIE model *p*DR-ASC)
- Upper bumper kit to convert model *p*DR-1200 to model *p*DR-1000AN (MIE model *p*DR-UB)
- Attachable pump unit (MIE model *p*DR-PU)(for use with *p*DR-1200 only)

5.0 INSTRUMENT LAYOUT

The user should become familiar with the location and function of all externally accessible controls, connectors and other features of the *personal*DataRAM. Refer to Figures 1 through 6.

All user related functions are externally accessible. All repair and maintenance should be performed by qualified MIE personnel. Please contact the factory if any problem should arise. Do not attempt to disassemble the *personal*DataRAM, except as described in Section 12.0 (Maintenance), **otherwise voiding of instrument warranty will result.**

5.1 Front Panel

Refer to Figures 1 (for model *p*DR-1000AN) or 2 (for model *p*DR-1200) for location of controls and display.

The front panel contains the four touch switches (keys) and the LCD screen required for the operation of the *personal*DataRAM.

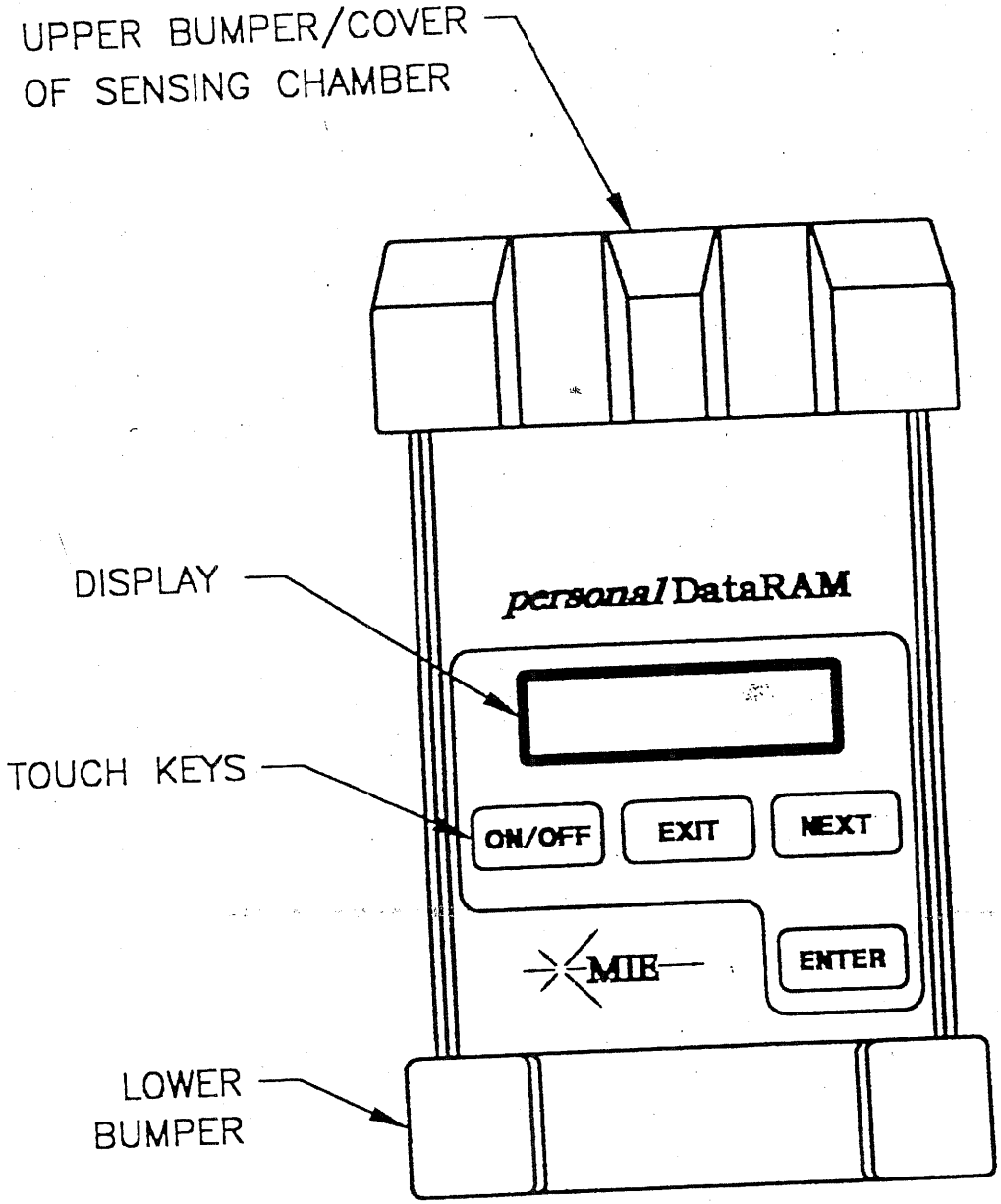


Figure 1 – FRONT PANEL (MODEL pDR–1000AN)

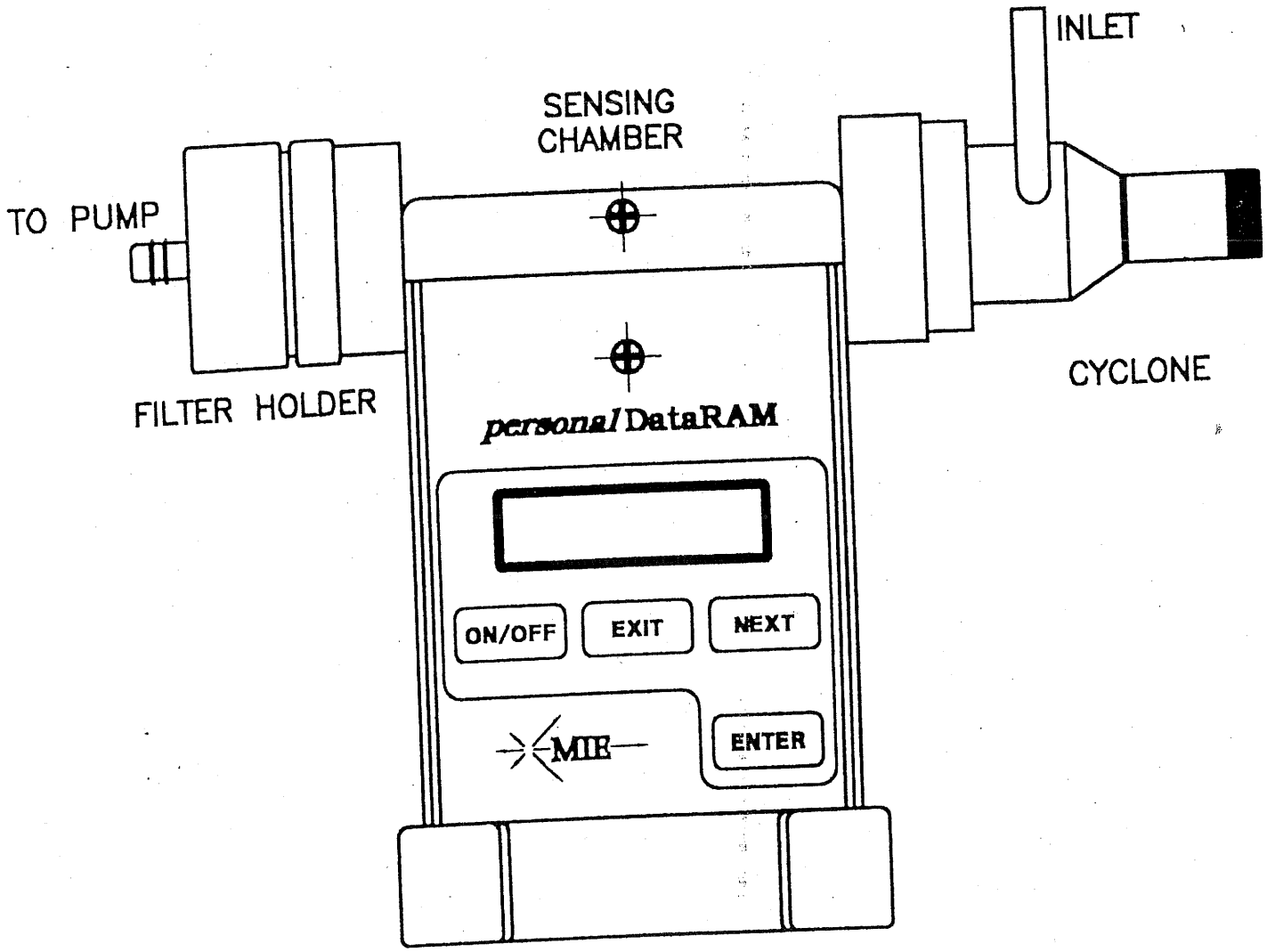


Figure 2. MODEL pDR-1200 WITH CYCLONE & 37MM FILTER HOLDER

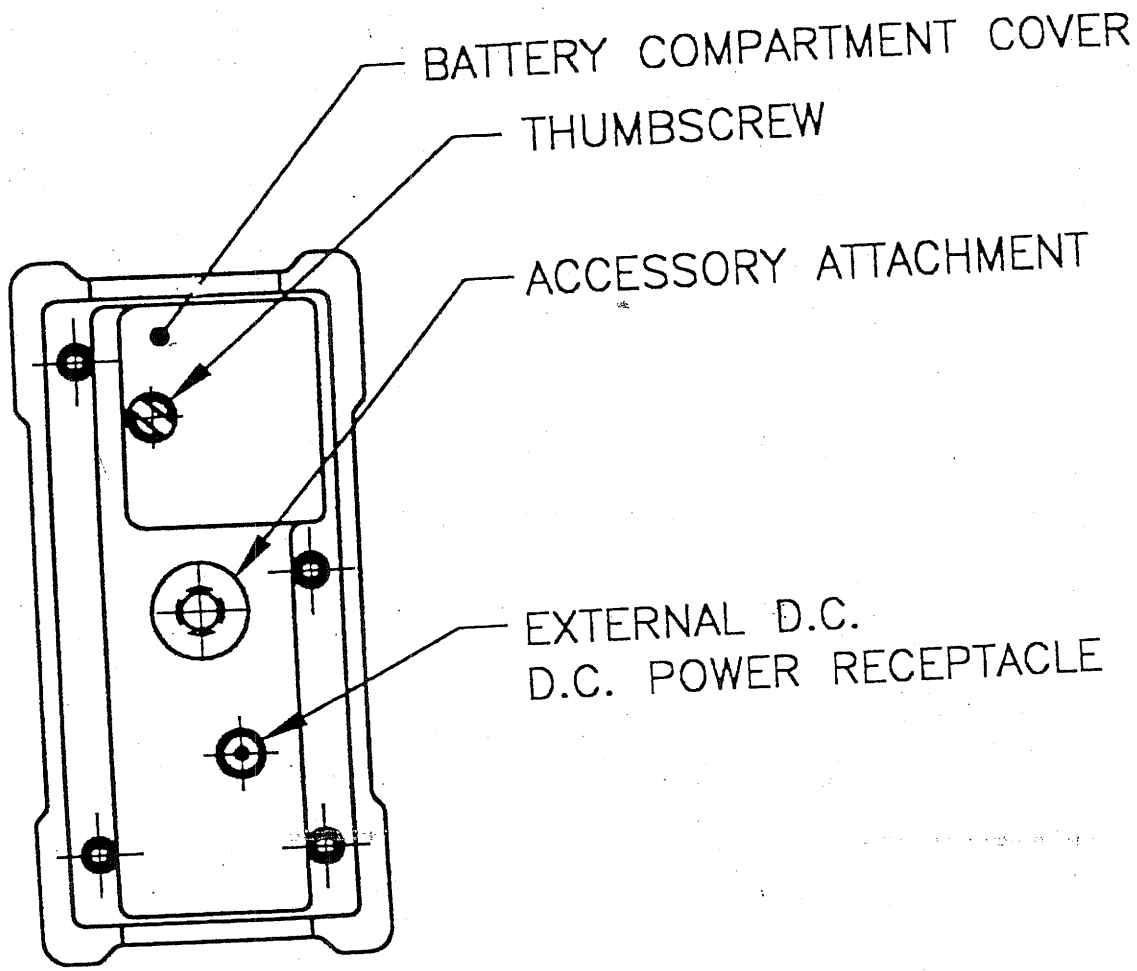


Figure 3 – BOTTOM BASE (MODEL pDR–1000AN)

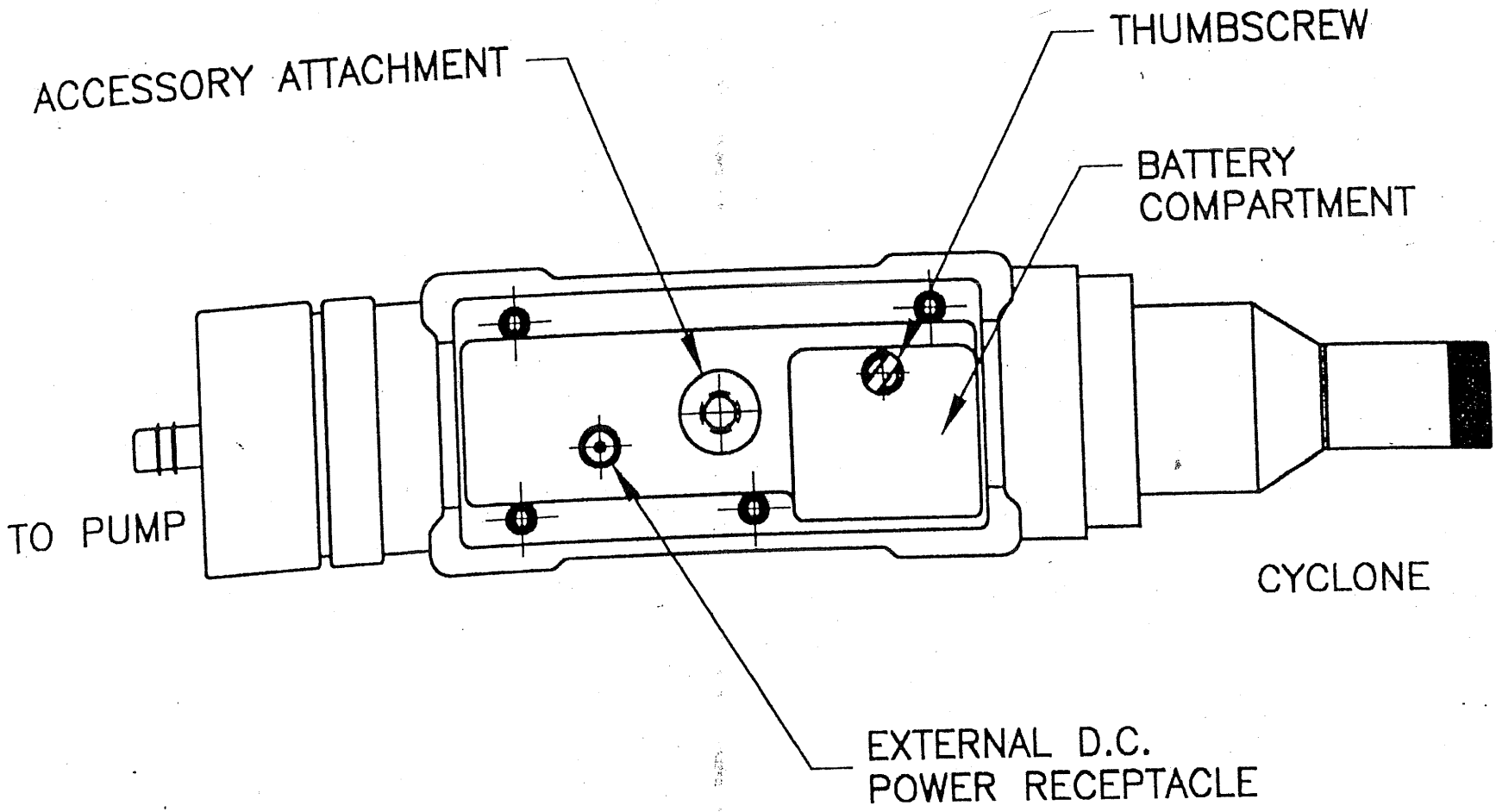


Figure 4 – BOTTOM VIEW (MODEL pDR–1200)

The four touch switches provide tactile ("popping") feedback when properly actuated.

The ON/OFF key serves only to turn on the unit (while it is in the off state), and to turn it off (when it is operating).

The EXIT and ENTER keys serve to execute specific commands that may be indicated on the screen, and the NEXT key generally serves to scroll the displayed information, e.g. to review the operating parameters that have been programmed, display maximum/STEL values, diagnostic values, etc.

If an incorrect command is keyed (e.g. ENTER when the *personal*DataRAM displays real-time concentration) a beep is heard to alert the user.

The two-line, 16-character per line LCD indicates either measured values of concentration (instantaneous and time averaged on the same screen), elapsed run time, maximum and STEL (short term excursion limit) values, operating and logging parameters, diagnostics, or other messages.

The acoustic alarm transducer is located directly behind the center of the MIE arrow logo on the front panel.

5.2 Bottom Base

Refer to Figures 3 (for model *p*DR-1000AN) or 4 (for model *p*DR-1200). The base of the *personal*DataRAM contains the following: a) internal battery compartment cover, b) external DC power input receptacle, and c) threaded bushing for the attachment of optional battery pack, tripod, or other mounting/support hardware.

Only the internal battery compartment cover should be opened by the user, for removal and replacement of the on-board 9-V battery. Removal of the base plate could result in voiding of instrument warranty.

5.3 Right Side Panel

Refer to Figures 5 (for model *p*DR-1000AN) or 6 (for model *p*DR-1200) which shows the manner of attachment of the belt clip assembly (belt clip should be attached only if required by the user). The right side panel (as viewed from front panel) contains the 6-contact modular jack connector receptacle for digital (RS-232) communications and analog signal output. This connector also provides the alarm output control for a remote/auxiliary alarm signal. The contacts (from top to bottom) are:

1: 4 - 20 mA analog output (positive)
2: Alarm output
3: Digital data transmission
4: Digital input
5: Common ground (signal returns)

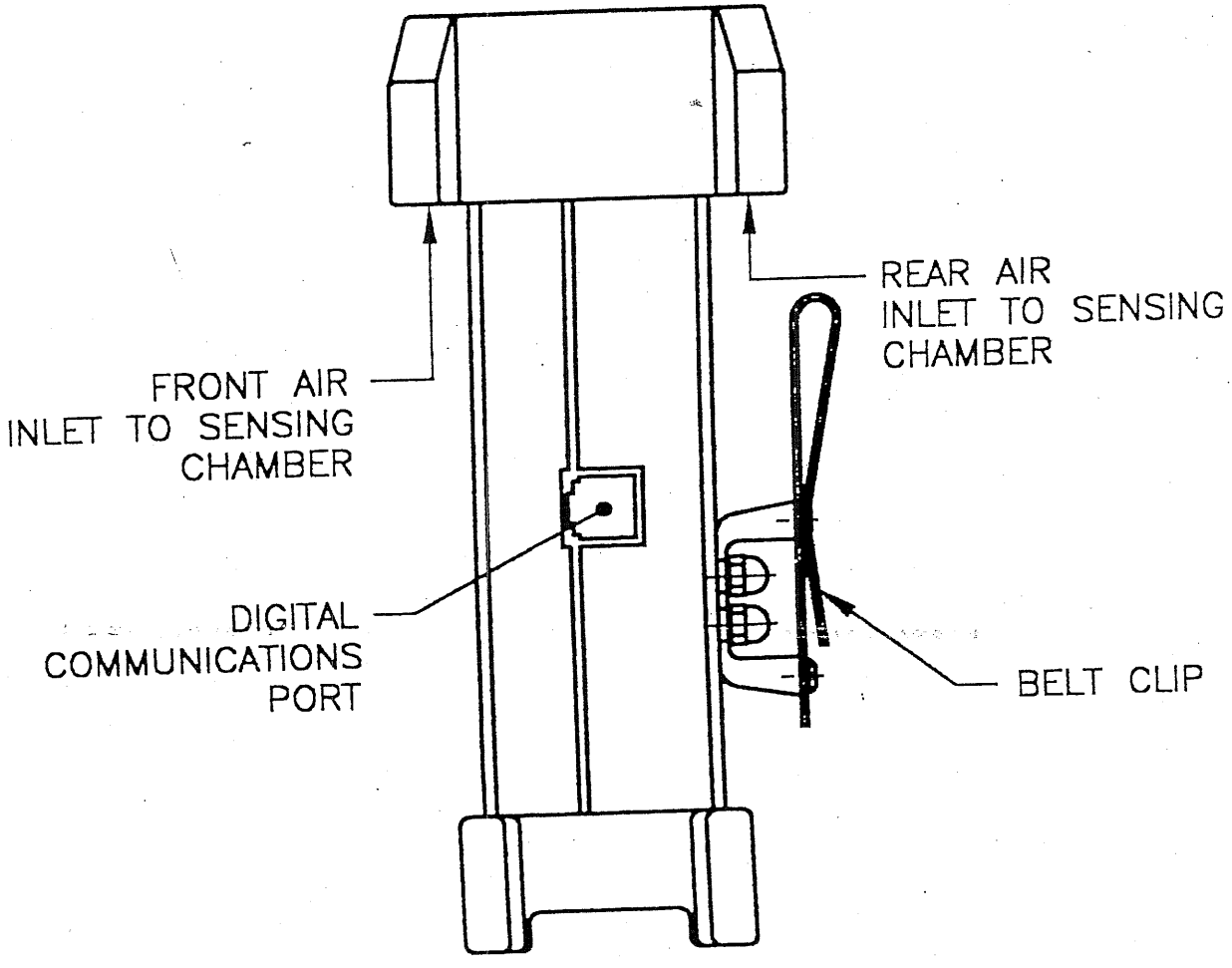


Figure 5 – RIGHT SIDE PANEL (MODEL pDR–1000AN)
(SHOWN WITH BELT CLIP ATTACHED)

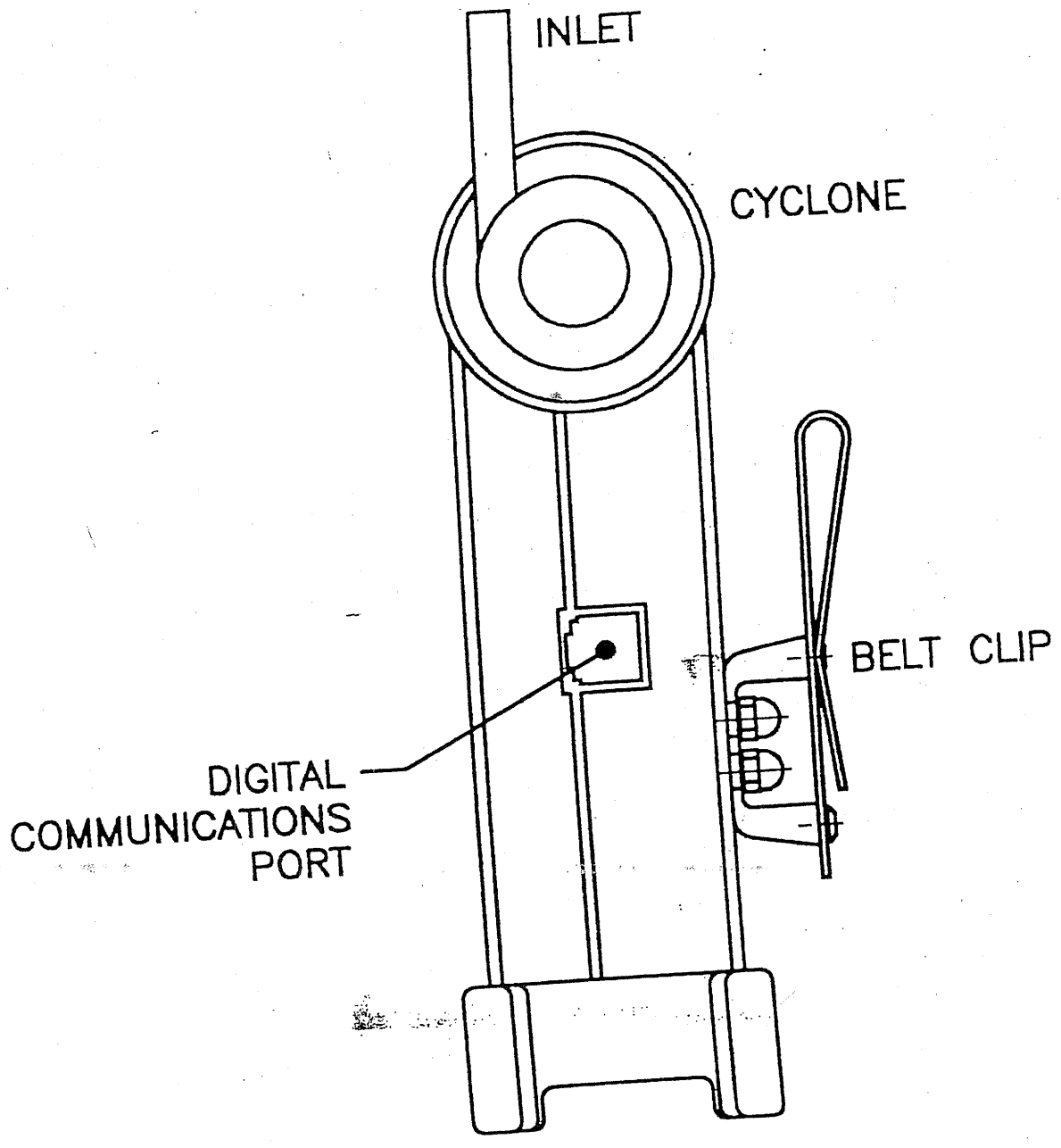


Figure 6 – RIGHT SIDE VIEW (MODEL pDR–1200)
(SHOWN WITH BELT CLIP ATTACHED)

6: 0 to 5 V analog output (positive)

The digital communications cable provided as a standard accessory is to be inserted into this receptacle for interconnection to a computer (for data downloading or to reprogram parameters). The analog output cable is provided with flying leads for interconnection with other data processing and/or control systems.

WARNING: The modular jack receptacle on the side of the *personal*DataRAM should be used only for communications with computers and alarm circuitry. **Do not, under any circumstance, connect any communications equipment (e.g., telephone) to this receptacle.**

5.4 Back Panel and Belt Clip

The back panel consists of a label with important user information on safety procedures and certifications, model and serial numbers, etc.

The back panel is provided with mounting hardware for the attachment of the belt clip kit (see Figures 5 or 6 for mounting configuration of the belt clip).

5.5 Sensing Chamber

Referring to Figure 1 or 2, the upper mid-section of the *personal*DataRAM contains the optical sensing chamber. This chamber is the only internal section that the user should access for maintenance purposes (see Section 12.2).

On the model *p*DR-1000AN, air enters the sensing chamber through the two slot shaped inlets (one on the front and other on the back) under the protective bumper. During instrument operation those two openings should remain unobstructed in order to ensure free access of the surrounding air. When the model *p*DR-1000AN is used as personal monitor, i.e., clipped to a person's belt, the rear air inlet opening may be partially obstructed, but care should be exercised in ensuring that the front air inlet remains free of any obstructions.

On the model *p*DR-1200, air enters the sensing chamber through the opening in the cyclone receptacle cup (black cup on right side of sensing chamber), passes through the photometric stage, and exits through the opening in the filter holder receptacle cup (black cup on left side of sensing chamber), after which the air passes through the filter.

6.0 PREPARATION FOR OPERATION

6.1 Battery Installation

When shipped from the factory, the *personal*DataRAM will arrive without its replaceable 9V battery installed. Two fresh alkaline batteries are factory packed

separately in the carrying case, one of which should be installed in the *personal*DataRAM when preparing it for operation.

NOTE: Whenever the *personal*DataRAM is to be left unused for an extended time (i.e. longer than a month), the 9V battery should be removed from the unit.

Removing the battery will lose neither the program, time/date keeping, nor stored data.

To install the battery proceed as follows:

- Hold the *personal*DataRAM upside down.
- Loosen thumbscrew that secures the battery compartment cover (see Figure 3 or 4), and remove that cover.
- Observe battery polarity and the back panel battery orientation pattern (the negative battery terminal is the one closer to the side of the instrument).
- Insert the battery by sliding it in until it bottoms out. It should protrude slightly above the bottom surface of the instrument.
- Place battery compartment cover over battery and, while pushing down the cover firmly (taking care that the cover seats flush on the bottom surface of the *personal*DataRAM), tighten thumbscrew securely.

6.2 Battery Replacement

Normally, only alkaline type 9V batteries (type 1604A, or equivalent) should be used with the *personal*DataRAM.

Only fresh batteries should be used in order to ensure the maximum operating time. The *personal*DataRAM shuts itself off whenever the battery voltage falls below 6 volts (while retaining all programming and data). A fresh 9V alkaline battery, at room temperature, should provide typically 20 hours of continuous operation (please note that not all manufacturers produce batteries of equal capacity). Intermittent operation should extend the total running time because of partial battery recovery effects.

The approximate remaining battery capacity is indicated by the *personal*DataRAM (see Section 8.2) in increments of 1%, starting from 99%. If the remaining battery capacity is 40% or less, immediate restarting after shut off is automatically inhibited to prevent incomplete runs. If, nevertheless, a new run is to be initiated with low remaining battery capacity, do not shut off the *personal*DataRAM at the end of the previous run (i.e., remain in the Ready Mode, see section 7.0).

When significantly extended operating times are required (beyond the typical 20 hours), the use of either lithium or zinc-air batteries can be considered. The use of such alternative battery types can provide about 2 to 3 times longer operation than alkaline batteries.

6.3 AC Power Supply

A universal line voltage AC to DC power supply (MIE model *p*DR-AC) is provided as standard accessory with the *personal*DataRAM. This power supply can be used with any line with a voltage between 100 and 240 VAC (50 to 60 Hz). When using that power supply, its output plug should be inserted into the external DC receptacle at the base of the *personal*DataRAM (see Figure 3 or 4). Insertion of that connector automatically disables the internal 9V battery of the instrument. Removal of the *p*DR-AC plug from the instrument automatically re-connects the internal 9V battery.

NOTE: Before plugging in or unplugging the external power supply, the *personal*DataRAM must be shut off.

6.4 Rechargeable Battery Module

A rechargeable battery pack (MIE model *p*DR-BP) is available as an optional accessory. This unit attaches directly to the base of the *personal*DataRAM.

The *p*DR-BP contains a sealed nickel-metal-hydride battery, which provides typically 72 hours of continuous operation between successive charges (for 3-hour charging).

The use of the *personal*DataRAM, in combination with the *p*DR-BP connected to the a.c. power line ensures totally uninterruptible operation over indefinitely long time. In this operating mode, line power interruptions lasting up to 72 hours have no effect on measurement run continuity.

To attach the *p*DR-BP to the *personal*DataRAM, the instrument should be shut off. Carefully plug the *p*DR-BP into the external DC RECEPTACLE on the *personal*DataRAM. Rotate the large thumbscrew at the opposite end of the *p*DR-BP tightening it firmly. The *p*DR-BP can be recharged by means of the AC power supply of the *personal*DataRAM.

Detailed instructions for the use of the rechargeable battery module are furnished with that accessory.

6.5 Zeroing the *personal*DataRAM

One of the most important steps to be performed by the user before initiating a measurement run with the *personal*DataRAM is to zero the instrument. This is required to ensure maximum accuracy of concentration measurements, especially at low levels, i.e. below about 0.1 mg/m^3.

During the 2-minute pre-run automatic zeroing sequence (see Section 8.1), the *personal*DataRAM registers its own optical background, stores that level in its

memory, and then subtracts that background from all measured concentration values, until the zero is updated again by the user.

Although zeroing can be performed as often as desired (e.g., before every run), in practice it should not be necessary to do so more than once-a-month or even less frequently, except if average particulate concentrations should exceed about 0.5 mg/m^3.

6.5.1 Zeroing the model *p*DR-1000AN

Zeroing of the model *p*DR-1000AN requires a particle-free environment such as a clean room, clean bench, duct or area directly downstream of a HEPA filter, or the *p*DR-1000AN Z-Pouch (standard accessory). In some cases, a very clean, well air conditioned office may offer a sufficiently low particle concentration environment (i.e., $\leq 5\ \mu g/m^3$) for zeroing, as determined by another monitor (e.g., MIE DataRAM).

To zero the model *p*DR-1000AN by means of its Z-Pouch, proceed as follows:

- Wipe the outside surfaces of the *p*DR-1000AN to remove as much dust from those surfaces as possible before placing the instrument inside the Z-Pouch.
- In a reasonably clean environment, open the zipper of the Z-Pouch and place the *p*DR-1000AN inside it. Close the zipper shut.
- Open the small nipple on the Z-Pouch, and insert the fitting of the hand pump/in-line filter unit into the nipple.
- Start pumping the hand-pump until the Z-Pouch begins to bulge, and proceed with the steps in Section 8.1, pressing the keys of the instrument through the wall of the Z-Pouch. Then continue pumping.
- After completing the zeroing (step 2. of Section 8.1) procedure, open the Z-Pouch zipper and remove the *p*DR-1000AN. Close the zipper and flatten the Z-Pouch while plugging its nipple, in order to prevent dust contamination of the interior of the Z-Pouch.
- The *p*DR-1000AN is now zeroed and ready for a measurement run.

6.5.2 Zeroing the model *p*DR-1200

To provide the particle-free air required to zero the *p*DR-1200, either of two methods can be used: a) place the instrument on a clean-air bench or in a clean room, or b) connect to the cyclone inlet the green zeroing filter cartridge supplied with the *p*DR-1200. In either case, proceed as follows:

- After implementing either of the two methods, above, run the attached pump for at least one minute (e.g., at 4 liters/minute), and then proceed as described in Section 8.1 of this instruction manual, while continuing to run the pump (or leaving the unit in the clean air environment).

- Once the CALIBRATION: OK message appears on the *p*DR-1200 display, stop the pump and disconnect the zeroing filter cartridge from the cyclone inlet (or remove *p*DR-1200 from clean bench/room).
- The *p*DR-1200 is now zeroed and ready for a measurement run.

Note: While the *p*DR-1200 is used to monitor high dust concentrations (≥ 0.5 mg/m³), the flow through its sensing chamber should not be stopped before purging it, which can be done by connecting the green zeroing filter to the cyclone inlet and continuing to run the pump for about 2 minutes before shutting it off. This is to prevent dust contamination of the sensing chamber.

6.6 *p*DR-1200 Filter Holder Installation

The 37-mm filter holder provided with the *p*DR-1200 must be installed before operation of the instrument, in order to connect a sampling pump. To install the filter holder, remove protective cover, and insert the open collar over the black attachment cup with the external o-ring, on the left side of the *p*DR-1200 sensing chamber. Ensure complete insertion.

To replace the membrane filter separate the two sections of the plastic holder prying them apart with screwdriver or a coin. Make sure to place backing under the membrane filter before rejoining the two plastic rings.

7.0 OPERATING MODES

The *personal*DataRAM has several different operating modes which will be described in what follows. The specific commands and displays within each of these operating modes will be explained in detail in Section 8.0. A complete flow chart of keystrokes and screens is provided in Section 16.0.

7.1 Start-Up Mode

The *personal*DataRAM enters the Start-Up Mode as soon as the instrument is switched on. The user then has the choice to:

a) Wait before proceeding;
b) Zero the instrument and check its readiness; or
c) Proceed directly to the Ready Mode.

7.2 Ready Mode

Once the *personal*DataRAM is in the Ready Mode, the user is presented with the following alternatives:

a) Start a run immediately, or after any of the subsequent steps;
b) Review (by scrolling the display) all operating parameters, status and diagnostic data;

c) Activate or deactivate the logging function; activate, select (instantaneous or STEL), or deactivate alarm;
d) Program parameters or output logged data through a computer.

7.3 Run and Logging Mode

The Run Mode is the measurement/logging mode. The user can operate the *personal*DataRAM in this mode either with or without data logging. For example, the instrument may be used first as a survey monitor without logging, for walk-through assessment of an industrial plant, before deciding where to set up the unit for continuous monitoring and logging.

7.3.1 Data Logging

In order to activate the logging function, the unit must be in (or returned to) the Ready Mode (see Section 8.2).

If data logging has been enabled, the data will be logged in the next free (unrecorded) tag or data set. For example, if data had been recorded previously in tags # 1, 2 and 3 then, when a new run is initiated, the new data will be stored in tag #4. The data can be separated into number of sets (tags) up to a total of 99.

Any number of individual data points can be stored in a given tag, i.e. up to a maximum of 13,000 points (i.e. the total memory capacity of the *personal*DataRAM) assuming that no other data had been logged in other tags. This means that the total memory capacity of 13,000 data points can be grouped into any number of the available 99 data sets (tags).

7.3.2 Clearing of Memory

Data recorded in the *personal*DataRAM memory can be erased either through an external PC command using the MIE *p*DR-COM Custom Communications software provided as a standard accessory, or resetting the instrument (see Section 8.5). The PC method permits to erase the data in any number of selected tags, whereas the resetting method results in the deletion of all data stored in the *personal*DataRAM.

7.3.3 Run Mode Display and Commands

When a measurement run has been initiated (see Section 8.3), the user has the following display choices:
a) Instantaneous and time-averaged concentrations (both on the same screen);
b) Elapsed run time, and run start time and date (both on the same screen);
c) Maximum displayed concentration from run start, and time/date at which current maximum occurred;
d) Short term excursion limit (STEL) from run start, and time/date at which current STEL occurred;
e) Remaining battery charge, and (if logging function is enabled) remaining free memory.
f) Analog output concentration range (if enabled)

The user can command the termination of the run at any time returning it to the Ready Mode. To download logged data into a PC, the *personal*DataRAM must be in the Ready Mode. No changes in the program parameters or operating conditions can be made while in the Run Mode.

The *personal*DataRAM can be shut off from any of the three operating modes. Even if shut off while in the Run Mode, the instrument will save all stored data.

8.0 OPERATION

8.1 Start-Up

	KEY	DISPLAY	NOTES
1.	ON/OFF	START ZERO:ENTER GO TO RUN: NEXT	Before starting a run with the *personal*DataRAM, zero it (see Section 6.5) and key **ENTER** while the unit is exposed to particle-free air. Alternatively, key **NEXT** to go to RUN/READY mode. If **ENTER** is keyed:
2.	ENTER	ZEROING V2.00	Keep clean air flowing while ZEROING is displayed* for 1.1 min., followed by one of these screens:
		CALIBRATION: OK	or,
		BACKGROUND HIGH	or,
		MALFUNCTION	If CALIBRATION: OK, then go to step 3. If one of the other two screens is displayed, consult Section 12.0.
3.	NEXT	START RUN: ENTER READY: NEXT	To start a measurement run key **ENTER** (Section 8.3, step 1). To set up for a run and scroll logging/ operating parameters, key **NEXT** (see Section 8.2).
4.	ON/OFF	TURN OFF PDR? Y:ENTER N:NEXT	Keying **ON/OFF** while the unit is operating will elicit this message to prevent accidental shut off. To confirm shut down, key **ENTER**. To continue operation, key **NEXT**.

*The number following the V on the screen refers to the installed firmware version.

8.2 Setting Up For A Run (Ready Mode)

	KEY	DISPLAY	NOTES
1.	NEXT	LOGGING DISABLED	This screen indicates the logging status. To enable the logging function, key ENTER. Toggling of the on/off logging status can be done by keying ENTER.
2.	ENTER	LOG INTRVL 600s TAG#: 4	This message indicates that logging is enabled. Example is for 10-min log period, selected through the PC (see Section 9.0), and next free tag is #4.
3.	NEXT	ALARM: OFF	This screen indicates the alarm status. Keying ENTER repeatedly toggles through the 3 alarm modes:
4.	ENTER	ALARM: INSTANT LEVEL:1.50 mg/m3	This enables the alarm based on the real-time concentration. The level (e.g. 1.50 mg/m3) must be set on the PC.
5.	ENTER	ALARM: STEL LEVEL:0.50 mg/m3	This enables the alarm based on the 15-min STEL value. The level (e.g. 0.50 mg/m3) must be set on the PC.
6.	NEXT	ANALOG OUTPUT: DISABLED	This screen indicates the analog signal output status. Keying ENTER will enable the analog output. Toggling the analog output on/off can be done by keying ENTER:
7.	ENTER	ANALOG OUTPUT: 0 - 0.400 mg/m3	This enables the analog output. The concentration range (e.g., 0 - 0.400 mg/m^3) must be set on the PC.
8.	NEXT	CAL FACTOR: 1.00 DIS AVG TIME 10s	This screen displays the calibration factor and the display averaging time. Both values can be edited via PC.

9.	NEXT	BATTERY LEFT 83% MEMORY LEFT 96%	This screen displays the remaining battery charge, and the remaining percentage of free memory.
10.	NEXT	CONNECT TO PC	When this screen has been selected, the operating parameters can be edited and/or the logged data can be downloaded via the PC (see Section 9.0). If **NEXT** is keyed again, the screen returns to RUN/READY:
11.	NEXT	START RUN: ENTER READY: NEXT	The instrument is now ready to run following the procedure in section 8.3.

8.3 Measurement Run Procedure

	KEY	DISPLAY	NOTES
1.	ENTER	LOGGING DISABLED	or, if logging was enabled:
		LOG INTRVL 600s TAG #: 4	Logging status will be displayed for 3 seconds.
		CONC*0.047 mg/m3 TWA 0.039 mg/m3	After a 3-second delay, the concentration screen appears (values shown here are examples). CONC is the real-time and TWA is the time-averaged concentration. **The * appears only if logging has been enabled.**
2.	EXIT	TERMINATE RUN? Y:ENTER N:EXIT	To terminate the current run and return to the Ready Mode, key **ENTER**. To continue the run, key **EXIT**.
3.	EXIT	CONC*0.047 mg/m3 TWA 0.039 mg/m3	Keying **NEXT** successively scrolls the display to show various run values (elapsed run time, maximum, STEL, etc.). Keying **EXIT** from any of those screens returns to the concentration display.

4.	**NEXT**	ET 06:12:49 ST 08:18:26MAY15	This screen shows the elapsed run time (ET) and the run start time/date (ST).
5.	**NEXT**	MAX: 0.113 mg/m3 T 10:08:44 MAY15	This screen shows the maximum concentration of current run and time/date of occurrence.
6.	**NEXT**	STEL:0.058 mg/m3 T 09:59:22 MAY15	This screen shows the 15-min STEL value of the current run and the time/date of occurrence.
7.	**NEXT**	BATTERY LEFT 83%	or, if logging was enabled:
		BATTERY LEFT 83% MEMORY LEFT 96%	This screen shows the amount of usable charge left in the battery and, if logging has been enabled, the overall amount of free memory left.
8.	**NEXT**	ANALOG OUTPUT: 0 - 0.400 mg/m3	This screen shows the status of the analog signal output, and the range, if this output has been enabled.
9.	**NEXT**	CONC*0.047 mg/m3 TWA 0.039 mg/m3	The last **NEXT** command returns the display to the concentration screen.
10.	**EXIT**	TERMINATE RUN? Y:ENTER N:NEXT	As indicated in step 2, to end current run, key **ENTER**, to return to the Ready Mode:
11.	**ENTER**	START RUN: ENTER READY: NEXT	This keystroke terminates the current run and returns the unit to the Ready Mode.

If during a run the instrument memory is filled completely, or if all 99 tags have been used, the run is automatically terminated and the display will indicate:

RUN TERMINATED
FULL MEMORY

If a new run is initiated after the memory has been filled, the *personal*DataRAM can be operated only as a monitor without logging. The memory must then be cleared (see Section 7.3.2) first before logging can be enabled again.

8.4 Abbreviated Run Start/Stop Instructions

To power-up and start a measurement run without zeroing and without logging, proceed as follows:

- Key sequentially ON/OFF, NEXT and ENTER.

To terminate run and shut down, proceed as follows starting from the concentration screen (otherwise key EXIT first):

- Key sequentially EXIT, ENTER, ON/OFF and ENTER.

8.5 Resetting Procedure

The *personal*DataRAM memory can be reset through commands entered on its own keypad (i.e. without requiring a PC).

Resetting accomplishes the following:

- Erases all stored data from memory;
- Resets all parameters and operating conditions to their default values and conditions; and
- Cancels the zero correction offset.

The procedure to reset the instrument is as follows:

Starting with the unit shut off, press the EXIT and ENTER keys at the same time, and while holding down those two keys, press ON. The screen will then indicate: PDR SELF-TEST... and several diagnostic screens will appear in rapid sequence (see Section 16.0, Resetting/Electronics Checking Mode), ending in the message TESTING COMPLETE. Shut off unit. When turned on again, the *personal*DataRAM memory will have been reset, as described above.

The **default** values and operating conditions of the *personal*DataRAM are:

- Logging period (LOG INTRVL): 60 seconds
- Logging status: disabled (LOGGING DISABLED)
- Alarm level: 1 mg/m^3
- Alarm status: disabled (ALARM: OFF)
- Analog output: 0 to 4 mg/m^3
- Analog output status: disabled (ANALOG OUTPUT :DISABLED)
- Real-time display averaging time (DIS AVG TIME): 10 seconds
- Calibration factor (CAL FACTOR): 1.00

When turning on the *personal*DataRAM after resetting the instrument, it should be zeroed (see steps 1. and 2. of Section 8.1) before a run is initiated. Otherwise, its internal optical background level will not be subtracted from the indicated concentration readings. Alternatively, if the instrument is not zeroed after resetting, it will indicate its unsubtracted optical background when run under particle free conditions.

9.0 COMMUNICATIONS WITH COMPUTER

9.1 Hardware and Software Requirements

The computer requirements to install the software provided with the *personal*DataRAM (MIE *p*DR-COM) are the following:

- IBM-PC compatible
- 486 or better processor
- Minimum operating system: Windows 95™ or better
- ≥ 8 MB of RAM
- 2 MB hard disk drive
- 3.5" floppy drive
- VGA or higher resolution monitor

NOTE: When large files are logged in the *personal*DataRAM in one single tag, a faster computer speed is required to handle the data. For example, if all 13,000 data points are logged in one tag, a Pentium I or II processor with a minimum speed of 166 MHz will be required. If, however, the maximum number of data points per tag is 1,000 or below, a 33 MHz, 486 DX processor will suffice.

MIE custom hardware and software (provided as standard accessories):

- Digital communications cable (MIE model *p*DR-DCC)
- Software floppy disk (3.5", MIE model *p*DR-COM)

9.2 Software Installation Procedure

To install the MIE provided software in the computer, proceed as follows:

1. Insert the 3.5" disk labeled "*p*DR-COM" into computer.

2. For Windows 95™ users, select **Start** and then **Run**. For Windows 3.1 and 3.11 users, from Program Manager select **File** and then **Run**.

3. Type in on the **Command Line: a: install** (or **b: install**, as required).

4. The message "Do you wish to install *p*DR-COM?" will appear. Click **OK** to continue, or Cancel.

5. A message appears allowing the option to change the default directory: "**C:\PDRCOM**". It is advisable to leave the default directory (unless you address the hard drive by a different letter), and select **OK**.

6. After a successful installation, the message "**Installation Complete!**" will appear.

9.3 Communication Between *personal*DataRAM and Computer

To effect the communication between the *personal*DataRAM (via the *p*DR-COM software installed in the computer as described in the preceding section) and the PC proceed as follows:

1. Connect the *personal*DataRAM to one of the computer's serial ports using the *p*DR-DCC cable provided by MIE. This cable has a 9-pin female connector for the computer port.

2. Key **ON** the *personal*DataRAM and then key **NEXT** repeatedly until CONNECT TO PC is displayed on the *personal*DataRAM.

3. On the computer, double click on the ***p*DR-COM** icon. A four-tabbed notebook display should appear. Click on the **Com Port Select** and select the port to which the *p*DR-DCC cable has been connected.

4. From the four-tabbed notebook displayed on the computer screen select the tab with the desired option. The options are:

- **Main**: This page allows the user to input the *personal*DataRAM serial number (or any other desired label), and select the Serial Com Port.

- **Logged data**: This page allows the user to download, tabulate, print data, or transfer to a CSV file the data stored in the *personal*DataRAM. This page also serves to display real-time numerical data when the computer is connected to the *personal*DataRAM in the Run Mode.

- **Graph data**: This page enables the downloading and graphing of stored data to the computer screen and to a printer. In the Run Mode, this page displays the real-time data in graphic format.

- **Configure pDR**: This screen allows the user to edit the operating/logging parameters. Click on the item to be edited and select or type in the new value. To review the parameter values currently programmed into the *personal*DataRAM, click on **Get configuration**. After editing the parameters, click on **Set configuration** to input the new values into the *personal*DataRAM program.

Most operations within *p*DR-COM are self-evidently labeled, including fly-over dialog boxes. In addition, instructions may be found in the On-line Help files by selecting **Help** and then **Contents**.

The following operating/logging parameters of the *personal*DataRAM are selected (edited) via the computer:

- Current date (month and day of the month)
- Current time (hour, minute and second)
- Display averaging time (1 to 60 seconds, in 1-second increments)
- Calibration factor (0.01 to 9.99, in 0.01 increments)
- Logging interval (1 to 14,400 seconds, in 1-second increments)
- Analog output full scale concentration (0.1, 0.4, 1, 4, 10, 40, 100, or 400 mg/m^3)
- Analog output status (enabled, or disabled) (can also be selected directly through *personal*DataRAM keyboard, see Section 8.2)
- Alarm level (0.001 to 409.599 mg/m^3, in 1-$\mu g/m^3$ increments)
- Alarm mode (Off, Instantaneous, or STEL) (can also be selected directly through *personal*DataRAM keyboard, see Section 8.2)

The serial number of the *personal*DataRAM is transferred automatically to the PC and displayed on its screen.

In addition, the user can input any other identification for the instrument (up to 20 characters).

Note: The year is entered as a two-digit number; year 2000 is treated correctly as a leap year (*personal*DataRAM version 1.70 or higher).

9.4 Real-Time RS-232 Output

During the RUN mode, the *personal*DataRAM can communicate real-time concentration data through its serial port via the *p*DR-COM software package. This software application decodes the data and displays it on the computer screen in both graphical and tabulated form.

In order to use this output with some other application, the following information will enable the user to decipher the encoded output signal.

The communication settings for the digital output of the *personal*DataRAM are:

- Baud rate: 4800 bps
- Data bits: 8
- Stop bits: 1
- Parity: none
- Flow control: Xon/Xoff

Every second during a run, the *personal*DataRAM serial port will output a sixteen-character code. It consists of two brackets with 14 hexadecimal digits between them, representing sum check (2 digits), sensed concentration (8 digits), and calibration factor (%, 4 digits). The concentration in $\mu g/m^3$ is obtained by multiplying the sensed concentration times the calibration factor and dividing by 100.

10.0 ANALOG SIGNAL OUTPUT

10.1 Analog Output Description

The *personal*DataRAM incorporates the capability to provide both a voltage and a current signal output directly proportional to the sensed concentration of airborne particulates. Both these analog signal outputs are concurrently available. These outputs are provided, principally, for fixed point applications with hard-wired installations, such as for continuous HVAC monitoring and control.

The particulate concentration range corresponding to the output voltage and current ranges (0 to 5 V and 4 to 20 mA) can be user selected (via a PC). The most sensitive range available is 0 to 0.100 mg/m^3, and the least sensitive range is 0 to 400 mg/m^3. For example, if the user selects the analog output range of 0 to 0.400 mg/m^3 then the analog output signal levels, at a concentration of 0.200 mg/m^3, would be 2.5 V and 12 mA.

Selection of the concentration range of the analog output must be performed on the PC. This range is independent of the digital display, data logging and real-time digital output range which are controlled automatically (auto-ranging).

Enabling the analog output increases the current consumption from the power source (battery or power supply) of the *personal*DataRAM by typically 5 mA when no load is connected to the analog signal current output. If such a load is connected then the current consumption of the *personal*DataRAM further increases by the magnitude of the output signal current (up to a maximum increment of 20 mA). Therefore, when not using the analog output, it is advisable to disable that output (see Section 8.2) in order to minimize power consumption (this is important only when powering the *personal*DataRAM from a battery source).

10.2 Analog Output Connection

The *personal*DataRAM is provided with a cable (model *p*DR-ANC) which has a 6-contact plug at one end and flying leads at the other. There are 4 leads for the analog and alarm outputs. The additional two contacts of the connector are used only for digital communication with a PC, for which a separate cable (model *p*DR-DCC) is provided.

Counting from top to bottom on the *personal*DataRAM connector receptacle, contact #1 is the positive 4 – 20 mA analog output, contact #2 is the alarm output, contact #5 is the common ground (return for all signals), and contact #6 is the positive 0 – 5 V analog output.

For the 0 - 5 V output signal, the externally connected load must have an impedance of more than 200 kilo-ohms. For the 4 - 20 mA output signal, the externally connected load must have an impedance of less than 200 ohms when powering the *personal*DataRAM with a battery, or less than 300 ohms when using the its AC supply.

Since both voltage and current outputs are present at the same time, both can be used concurrently, if so required.

The accuracy of the analog output signals is better than 1% of the reading with respect to the digital reading.

11.0 ALARM

11.1 Alarm Description and Operation

The *personal*DataRAM alarm function is provided both as an audible signal as well as an electrical output. The audible alarm consists of a series of beeps generated by an on-board piezo-transducer. The electrical output, available at the digital communications port, consists of a 1 Hz square wave signal which can be used to trigger/activate other equipment through an appropriate interface (consult with the factory).

The alarm function can be enabled/disabled by the user through the *personal*DataRAM keyboard (see Section 8.2). Setting of the alarm level must be performed on the PC (see Section 9.0).

The alarm is triggered whenever the preset alarm level is exceeded based either on : a) the displayed real-time concentration, if ALARM: INSTANT was selected (see Section 8.2), or b) a 15-minute running average concentration, if ALARM: STEL was selected. When the concentration falls below that level the alarm condition stops. While the alarm is on the user can stop it (i.e. silence the alarm) by pressing any key of the *personal*DataRAM. If the concentration continues to exceed the set alarm level after 10 seconds, however, the alarm restarts.

11.2 Alarm Output

A pulsed voltage output is available on the *personal*DataRAM in synchronism with the audible signal. This signal consists of a 1 Hz square wave with an amplitude of 5 V pp. An externally connected load should have an impedance of no less than 100 kilo-ohms. This alarm output signal is available at pins 2 and 5 (counting from top to bottom) of the 6-contact output/communications port on the side of the *personal*DataRAM (see Figure 5 or 6).

11.3 Remote Alarm Unit

An alarm relay unit (MIE model *p*DR-RA) is available as an optional accessory for the *personal*DataRAM. The *p*DR-RA, when connected to the alarm output of the

*personal*DataRAM, provides a switched output triggered by the alarm signal of the monitor. This switched output (up to 8 amperes, 250 volts) can be used to activate or deactivate other equipment (e.g. ventilation systems, machinery, etc.), or to control remotely located (by wire connection) alarm indicators (e.g. buzzers, lights, etc.).

12.0 MAINTENANCE

12.1 General Guidelines

The *personal*DataRAM is designed to be repaired at the factory. Access to the internal components of the unit by others than authorized MIE personnel voids warranty. The exception to this rule is the occasional cleaning of the optical sensing chamber.

Unless a MALFUNCTION message is displayed, or other operational problems occur, the *personal*DataRAM should be returned to the factory once every two years for routine check out, test, cleaning and calibration check.

12.2 Cleaning of Optical Sensing Chamber

Continued sampling of airborne particles may result in gradual build-up of contamination on the interior surfaces of the sensing chamber components. This may cause an excessive rate of increase in the optical background. If this background level becomes excessive, the *personal*DataRAM will alert the user at the completion of the zeroing sequence, as indicated in Section 8.1, by the display of a BACKGROUND HIGH message. If this message is presented, the *personal*DataRAM can continue to be operated providing accurate measurements. However, it is then advisable to clean the interior of the sensing chamber at the first convenient opportunity, proceeding as indicated below.

12.2.1 Model *p*DR-1000AN

- Remove the two screws on the top of the large protective bumper that covers the sensing chamber (see Figure 1);
- Remove the large protective bumper by lifting it firmly upwards and away from the sensing chamber;
- Remove the socket-head screws on the front and back black covers that were exposed by removal of the large top bumper. Lift away the freed front and back covers of the sensing chamber; set them aside carefully and such that they can be reattached in the same position as they were previously; avoid touching the dull black side of these plates;
- Using filtered (particle-free) pressurized air, blow the inside of the sensing chamber taking great care in not marring or scratching any of the exposed surfaces;
- Reposition the two sensing chamber cover plates in the same location (front and back) as they had been originally. Insert and tighten socket head screws firmly

making sure that the two plates are aligned perfectly with the top of the sensing chamber;

- Reposition large protective bumper over sensing chamber pushing down until properly seated. Insert the two top screws holding down the bumper and tighten gently (do not over-tighten);
- Check optical background by zeroing the *p*DR-1000AN as indicated in Section 8.1. If the sensing chamber cleaning was performed correctly, the message CALIBRATION: OK should be displayed at the end of the zeroing period.

12.2.2 Model *p*DR-1200

- Remove the two screws (one in the front and one in the back) holding the front and back gasketed covering plates of the sensing chamber, and set these plates aside, such that they may be reattached in the same location as they were previously.
- Using filtered (particle-free) pressurized air, blow the inside of sensing chamber taking great care in not marring or scratching any of the exposed surfaces.
- Reposition the two sensing chamber cover plates in the same location (front and back) as they had been originally. Insert and tighten socket head screws firmly making sure that the two plates are aligned perfectly with the top of the sensing chamber.
- Check optical background by zeroing the *p*DR-1200 as indicated in Section 8.1. If the sensing chamber cleaning was performed correctly, the message CALIBRATION: OK should be displayed at the end of the zeroing period.

12.3 Cyclone Cleaning (Model *p*DR-1200 only)

The cyclone will require occasional cleaning. It is advisable to do so whenever the sensing chamber of the *p*DR-1200 is cleaned (see above). To clean the cyclone, remove it from its black attachment cup on the sensing chamber , and unscrew the grit pot (narrower knurled end). Use clean pressurized air to blow out the grit pot and through all openings of cyclone body. Reattach grit pot to cyclone body and insert cyclone body into attachment cup making sure it is fully inserted.

13.0 CALIBRATION

13.1 Factory Calibration

Each *personal*DataRAM is factory calibrated against a set of reference monitors that, in turn, are periodically calibrated against a gravimetric standard traceable to the National Institute of Standards and Testing (NIST).

The primary factory reference method consists of generating a dust aerosol by means of a fluidized bed generator, and injecting continuously the dust into a mixing chamber from which samples are extracted concurrently by two reference filter collectors and by two master real-time monitors (MIE DataRAMs) that are used for the routine calibration of every *personal*DataRAM.

The primary dust concentration reference value is obtained from the weight increase of the two filters due to the dust collected over a measured period of time, at a constant and known flow rate. The two master real-time monitors are then adjusted to agree with the reference mass concentration value (obtained from averaging the measurements of the two gravimetric filters) to within ±1%.

Three primary, NIST traceable, measurements are involved in the determination of the reference mass concentration: the weight increment from the dust collected on the filter, the sampling flowrate, and the sampling time. Additional conditions that must be met are: a) suspended dust concentration uniformity at all sampling inlets of the mixing chamber; b) identical sample transport configurations leading to reference and instrument under calibration; and c) essentially 100% collection efficiency of filters used for gravimetric reference for the particle size range of the test dust.

The test dust used for the MIE factory calibration of the *personal*DataRAM is SAE Fine (ISO Fine) supplied by Powder Technology, Inc. It has the following physical characteristics (as dispersed into the mixing chamber):

- Mass median aerodynamic particle diameter: 2 to 3 µm
- Geometric standard deviation of lognormal size distribution: 2.5
- Bulk density: 2.60 to 2.65 g/cm^3
- Refractive index: 1.54

13.2 Field Gravimetric Calibration

If desired, the *personal*DataRAM can be calibrated gravimetrically for a particular aerosol (dust, smoke, mist, etc.) under field conditions (actual conditions of use). To effect such calibration in the particle environment of interest, proceed as indicated below.

For field calibration of the model *p*DR-1000AN, a personal type filter sampler is placed side-by-side (collocated) to the *p*DR-1000AN to be calibrated, and the two units should be started simultaneously. For the model *p*DR-1200, its own filter and attached pump can be conveniently used for the same purpose.

- Weigh and load into filter holder a fresh membrane filter.
- Start pump.
- Immediately turn on *personal*DataRAM and start a run such that the pump and the *personal*DataRAM are started nearly simultaneously.

The duration of this comparison run should be sufficient to collect a mass of at least 1 mg on the reference filter (in order to permit accurate weighing of the collected mass by means of an analytical balance). The time-weighted average (TWA) reading of the *personal*DataRAM can be used to estimate the required sampling time to collect the above-mentioned mass on the filter. To estimate the required sampling

time (ET as measured on the *personal*DataRAM) in minutes, read the TWA value (see Section 8.3) after an elapsed time (ET) of one minute or more, and apply the following relationship:

$$ET \geq 500/TWA$$

For example, if TWA = 2.5 mg/m^3, then ET ≥ 200 minutes (approximately 3 hours). If the TWA value changes significantly as the run proceeds, recalculate the required ET accordingly.

At the end of the run (after time ET has elapsed), record TWA, ET and the flow rate Q used to sample the air. Weigh the filter on an analytical balance and obtain Δm, the mass increment due to the collected particles.

Calculate the average gravimetric concentration C, as follows:

$$C = 1000\ \Delta m/ETxQ$$

Compare the recorded value of TWA and the calculated value C, and calculate the calibration factor to be programmed into the *personal*DataRAM (see Section 9.0) as follows:

$$CAL\ FACTOR = C/TWA$$

For example, if C was found to be 3.2 mg/m^3, and TWA had been determined to be 2.5 mg/m^3, the CAL FACTOR equals 1.28. Select this value on the PC, as described in Section 9.0. This completes the gravimetric calibration of the *personal*DataRAM for a specific aerosol.

13.3 Scattering Coefficient Calibration

Users interested in using the *personal*DataRAM for scattering coefficient measurements (e.g., for atmospheric visibility monitoring) should contact the factory. A special primary Rayleigh scattering calibration for such purpose can be performed by MIE.

13.4 Internal Span Check

The zeroing procedure (see Section 8.1) and the resulting normal diagnostic display of "CALIBRATION: OK" (step 2) informs the user that the instrument's calibration agrees with the original factory setting. This is an internal span check that consists of an automatic comparison between the initial (factory) optical background of the *personal*DataRAM (registered in its non-volatile memory), and the current optical background sensed during the zeroing sequence.

14.0 PARTICLE SIZE CLASSIFICATION (model *p*DR-1200 only)

The particle size selective cyclone of the *p*DR-1200 provides the user with two important capabilities: a) to measure the particulate matter concentration of a specific aerodynamic size fraction, and b) to determine the mass median size of a particle population. These two applications will be discussed in what follows. For both these applications, a variable measured flow rate pump is required, such as the MIE model *p*DR-PU (for which a separate instruction manual is provided).

14.1 Size Fractionated Monitoring

The *p*DR-1200 can be used to monitor a specific particle size fraction below a selectable cut off equivalent aerodynamic diameter. The particle size cut point can be selected by adjustment of the sampling flow rate. The higher this flow rate through the cyclone the smaller the cut off particle diameter. Figure 7 is a graph showing the dependence of the particle cut off size in micrometers as a function of the sampling flow rate in liters per minute. The cut off size is the particle aerodynamic diameter at which the collection efficiency of the cyclone is 50%, or conversely, the size at which the cyclone transmission is 50%. For example, to obtain a particle size cut off of 2.5 μm (i.e., $PM_{2.5}$), the required sampling flow rate is 4 liters/minute. A that flow rate only particles smaller than (approximately) 2.5 μm are allowed to pass into the *p*DR-1200 sensing stage, to be monitored and then to be collected on the filter.

As can be seen on Fig. 7, the lowest particle size cut for the GK 2.05 cyclone included with the *p*DR-1200 is about 1 μm, and the largest is about 12 μm. For particle size classification outside this range, consult with MIE.

14.2 Particle Sizing

The selectable particle size capability of the cyclone, in combination with the concentration measuring capability of the photometric system of the *p*DR-1200 permits the user to determine the mass median aerodynamic particle diameter of an aerosol, i.e., of the airborne particle population being sampled.

One simple procedure to determine the median particle size is as follows (please refer to the graph of Fig. 7):

- Remove cyclone from its black attachment cup and set cyclone aside
- Start pump and sample aerosol at a flow rate between 2 and 4 liters/minute
- Press **ON** key on *p*DR-1200 panel and after about one minute key **NEXT** and then **ENTER**
- After an elapsed time (ET) of about one minute, read and note TWA concentration

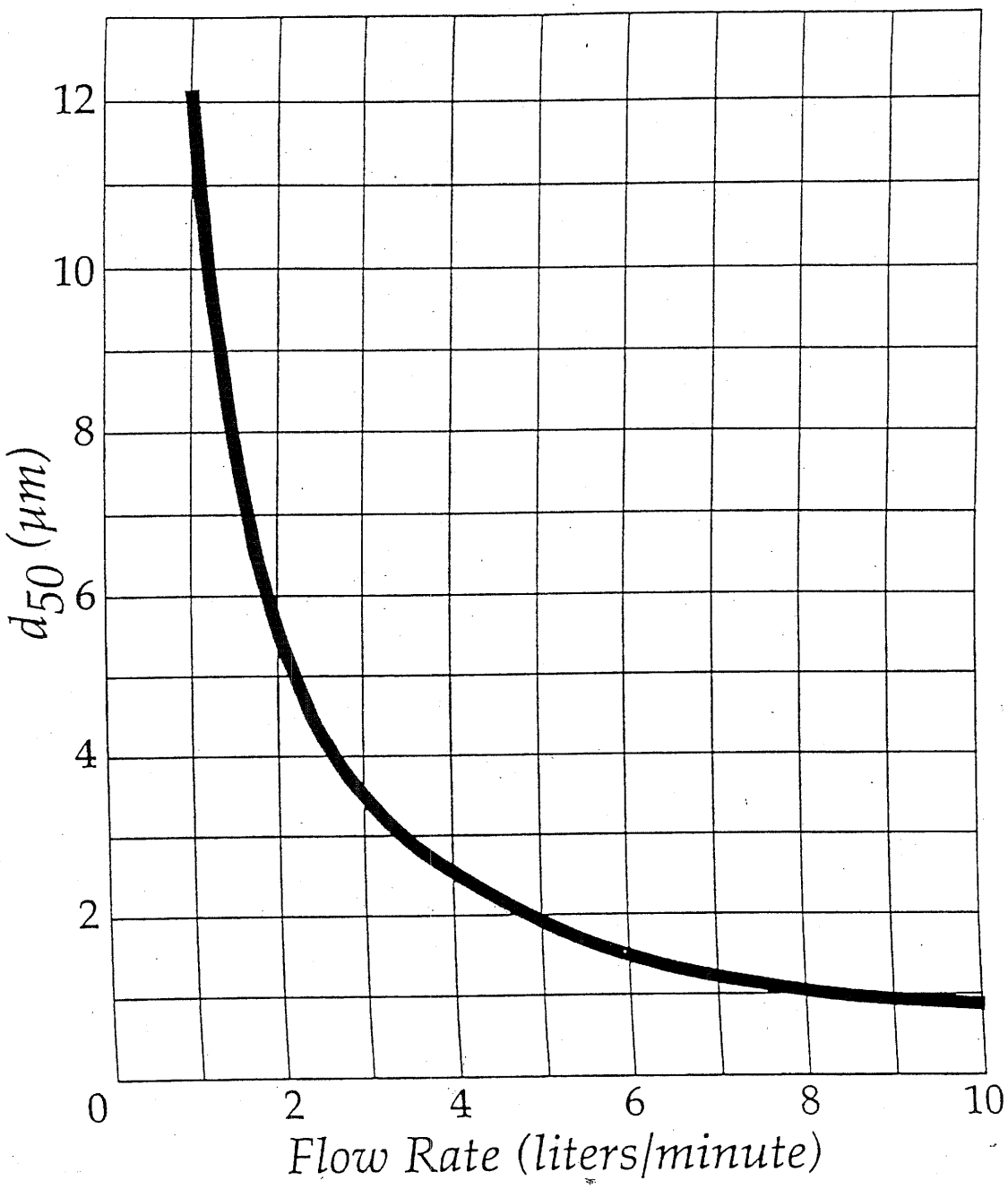


Figure 7. GK 2.05 Cyclone Cut Point (d_{50}) as a Function of Flow Rate

- Shut off pump
- Plug in cyclone into its attachment cup
- Start pump and run at about 1 liter/minute. Observe real-time concentration (CONC) reading
- Increase flow rate very slowly and gradually until CONC reading is one-half of the initial concentration measured without the cyclone. Continue sampling at this flow rate for about one minute and confirm that TWA reading is about one-half of the initial one. Otherwise readjust flow rate. Note final flow rate at which the TWA value has decreased to one-half the value noted without the cyclone.
- Enter the final flow rate for which the TWA value is one-half of the initial value into the graph of Fig. 7 and read the corresponding d50 particle size in micrometers. This represents the mass median particle diameter of the aerosol.

For example, if the TWA value without the cyclone was 0.8 mg/m^3, and the flow rate (with the cyclone attached) required to reduce the TWA to 0.4 mg/m^3 is 2 liters/minute, the mass median particle size (as obtained from the curve of Fig. 7) is approximately 5.5 μm.

15.0 CONVERSION BETWEEN *personal*DataRAM VERSIONS

The *personal*DataRAM user has the option to convert from a model *p*DR-1000AN to a model*p*DR-1200 or vice versa using the appropriate conversion kit. To convert from a *p*DR-1000AN to a *p*DR-1200 (i.e., from a passive air sampling configuration to an active one), the user requires the model *p*DR-ASC conversion kit. To convert from a *p*DR-1200 to a *p*DR-1000AN (i.e., from an active air sampling configuration to a passive one), the user requires the model *p*DR-UB conversion kit.

15.1 Conversion Procedure From *p*DR-1000AN to *p*DR-1200

To effect this conversion use model *p*DR-ASC conversion kit. As you remove parts from the *p*DR-1000AN, in order to attach the conversion kit components, store these parts carefully for possible future re-conversion. Proceed as follows:

- Remove the two screws on the top of the large protective bumper that covers the sensing chamber (see Figure 1). This bumper is not used on the *p*DR-1200;
- Remove the large protective bumper by lifting it firmly upwards and away from the sensing chamber;
- Reinsert in the upper two threaded holes and tighten the two screws that had held the protective bumper;
- Remove the socket-head screws on the front and back black covers that were exposed by removal of the large top bumper. Lift away the freed front and back

covers of the sensing chamber; store them carefully for future use, ensuring that their surface are not scratched or marred;

- Position one of the two gasketed (soft rubber) sensing chamber cover plates provided in the conversion kit on the front side of the sensing chamber. Insert and tighten the included socket head screw firmly making sure that the plate is aligned perfectly with the top of the sensing chamber. Similarly, attach the other cover plate on the back side of the sensing chamber;
- Identify the two black cups of the *p*DR-ASC conversion kit. One of them has an external o-ring (filter holder cup), and the other had no o-ring (cyclone cup); refer to Figure 2 and 4 for the location of these cups on the *p*DR-1200 sensing chamber. These cups can be installed on either side of the sensing chamber, i.e., the cyclone can be either on the left or the right side of the sensing chamber (Figure 2 shows the case where the cyclone is on the right side);
- Attach one cup to the left side of the sensing chamber using the two black socket head screws. Tighten screws firmly. Similarly, attach the other cup to the right side of the sensing chamber;
- Take the cyclone/filter holder unit provided as part of the conversion kit, and separate the 37-mm plastic filter holder from the metal cyclone by firmly pulling the two units apart;
- Carefully slide the large open end of the plastic filter holder over the cup with the external o-ring, previously attached to the sensing chamber. Ensure that the cup is fully inserted into the filter holder;
- Carefully insert the large diameter open end of the metal cyclone into the other cup on the opposite side if the sensing chamber. The cyclone inlet (small short metal tube on side of cyclone) can be oriented as desired (upwards, as shown in Figure 2, sideways, downwards, etc.). Ensure that the cyclone is fully inserted into the cup;
- When ready to operate, connect a length of tubing between the barbed fitting at the downstream end of the plastic filter holder and the pump to be used in combination with the *p*DR-1200.
- Perform a zeroing sequence (see Section 6.5.2 and 8.1) before starting a run. This competes the conversion of the *p*DR-1000AN to the *p*DR-1200.

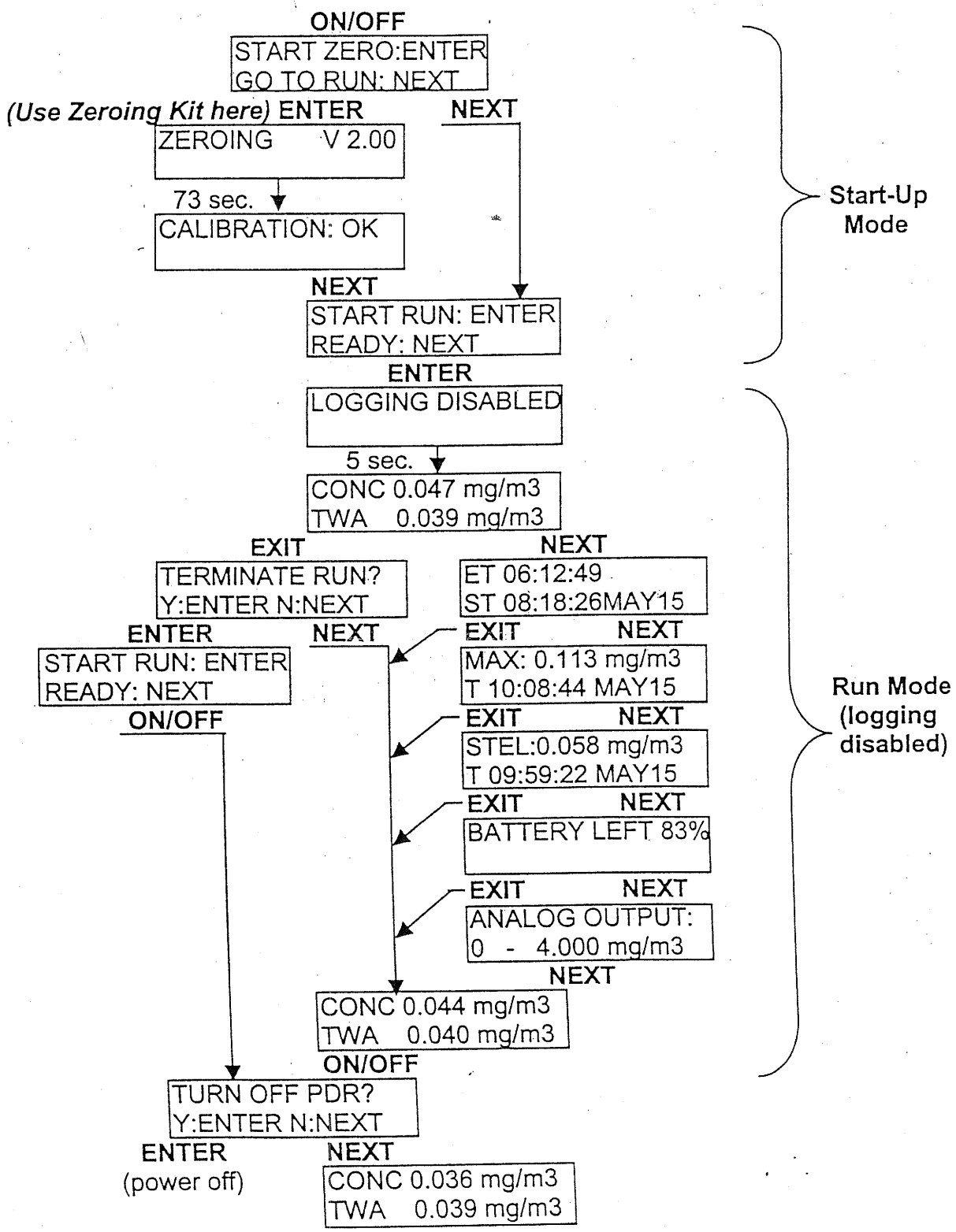
15.2 Conversion procedure from *p*DR-1200 to *p*DR-1000AN

To effect this conversion use model *p*DR-UB conversion kit. As you remove parts from the pDR-1200, in order to attach the conversion kit components, store these parts carefully for possible future re-conversion. Proceed as follows:

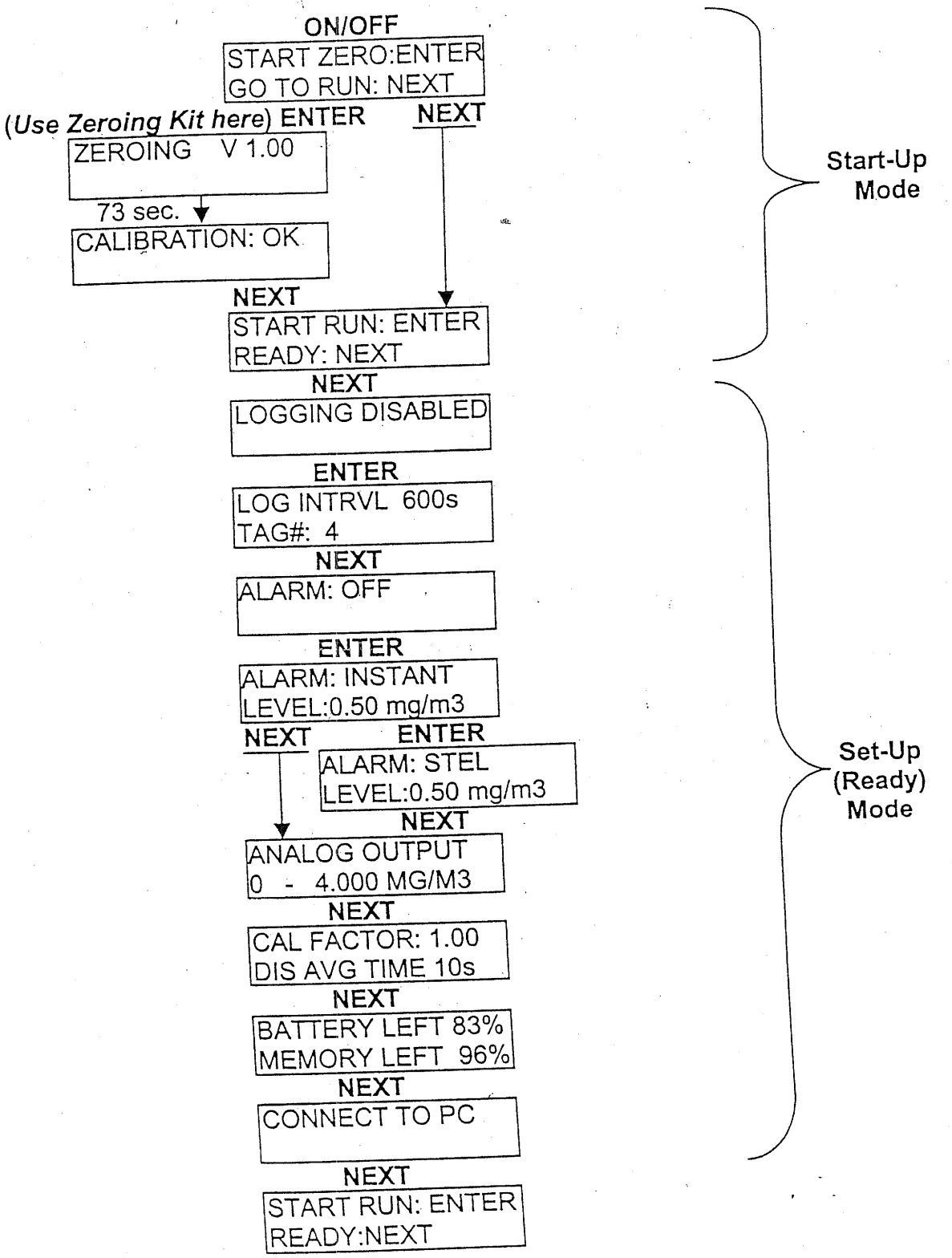
- Pull off both the cyclone and the filter holder from their respective cups on the two sides of the sensing chamber;
- Loosen the two screws that hold each of the two cups on the sides of the sensing chamber (total of 4 screws), and remove the two side cups;
- Loosen the single screw on each of the two (front and back) gasketed sealing covers enclosing the sensing chamber, and remove the two covers;

- Identify the two flat sensing chamber cover plates provided in the conversion kit; one face of each of each of these two plates has a dull black finish (antireflective); avoid touching those surface;
- Position one of the two sensing chamber cover plates over the open front of the sensing chamber with the dull surface on the inside, and such that the hole in the plate is aligned with the corresponding threaded mounting hole on the upper wall of the sensing chamber. Insert and tighten firmly black socket head screw provided with the conversion kit, making sure that the plate is aligned perfectly with the top of the sensing chamber. Similarly, attach the other cover plate to the rear of the sensing chamber, with the dull surface facing inward;
- Loosen and remove the two small screws on the top surface of the sensing chamber;
- Position large protective bumper (provided in the conversion kit) over sensing chamber pushing down until properly seated. Insert the two top screws (two shiny Phillips-head screws provided in the conversion kit) into the two holes in the bumper while holding down the bumper, and tighten gently (do not over-tighten) making sure that the heads of these screws are well inside their cavities in the bumper;
- Perform a zeroing sequence (see Sections 6.5.1 and 8.1) before starting a run. This completes the conversion from a *p*DR-1200 to a *p*DR-1000AN.

16.0 SEQUENCE OF KEYSTROKES AND SCREENS
(*p*DR-1000 AN, -1200, HPM-1000)
Start-Up and Survey Run Mode (*Without* Data Logging)



Start-Up, Set-Up and Run Mode (*With* Data Logging)



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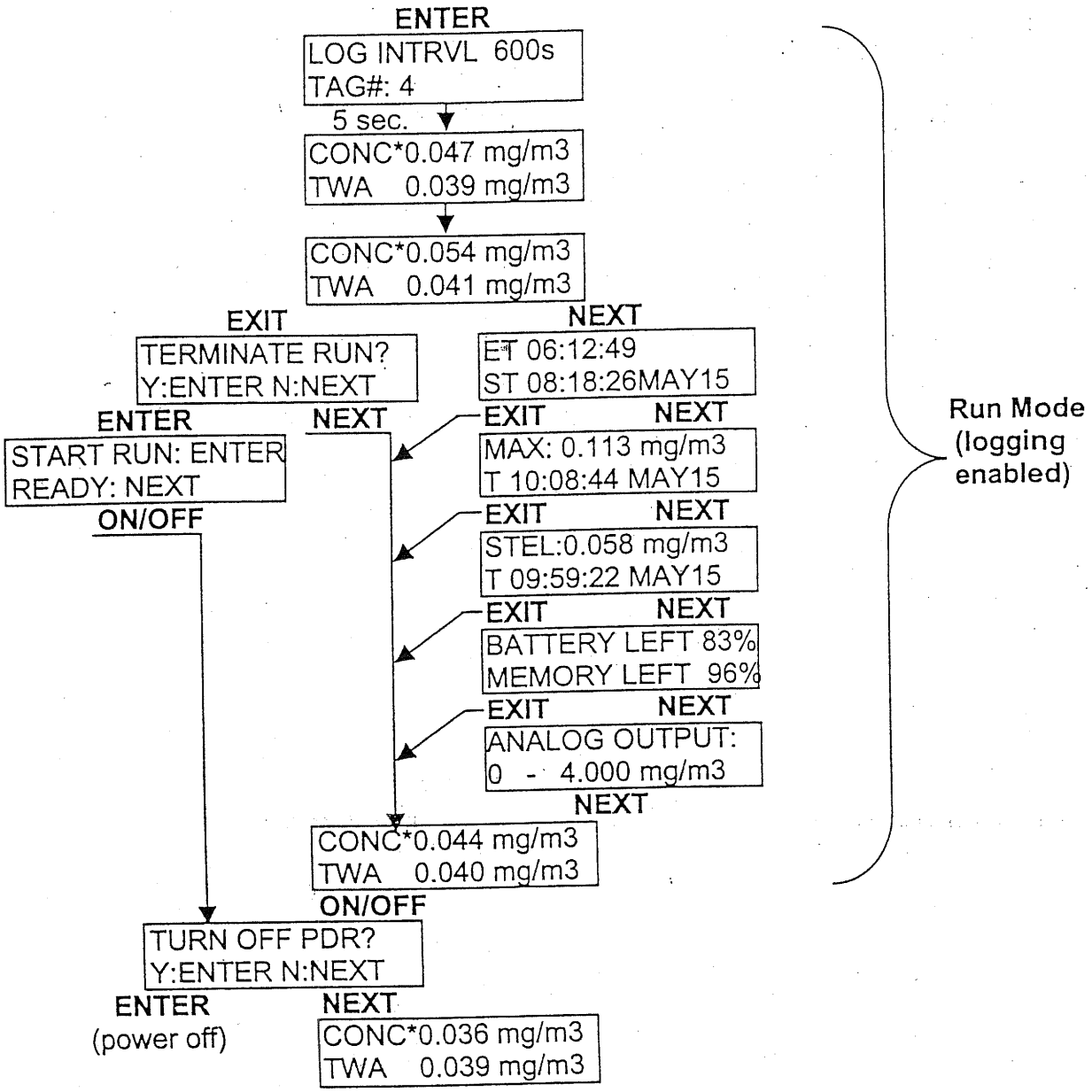
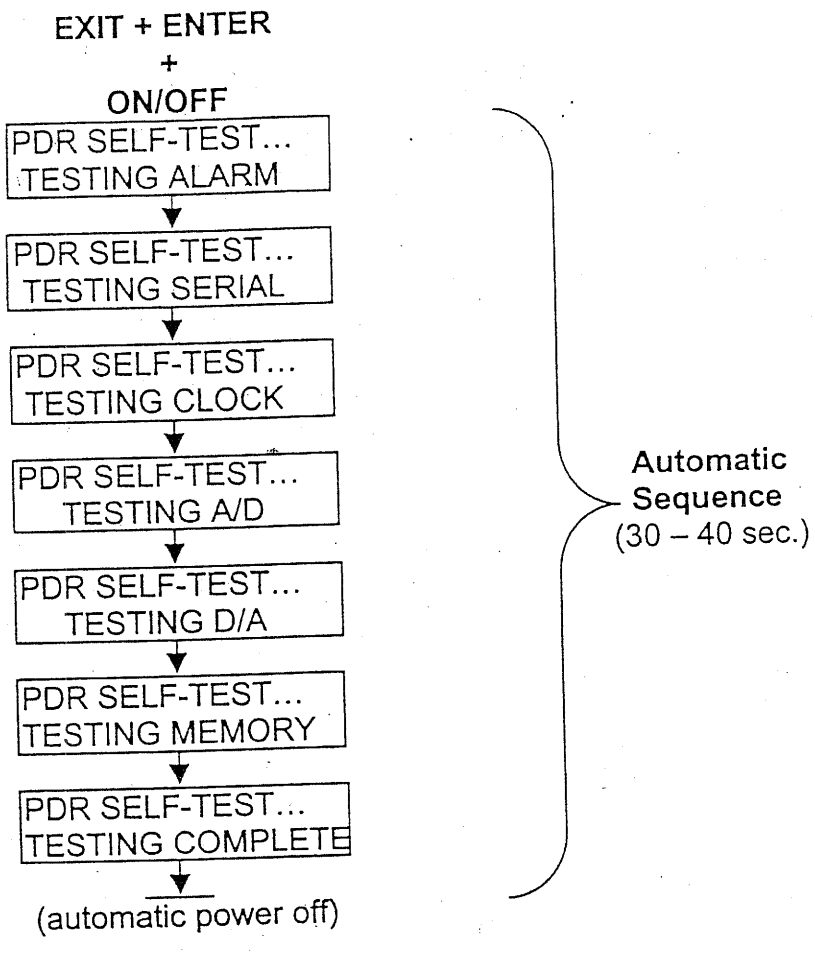


Resetting/Electronic Checking Mode



NOTE: After the preceding resetting sequence, the instrument should be zeroed, otherwise its optical background will remain unsubtracted.

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In the event that the pDR-1000 series instrument displays the error message "Malfunction" here are two steps that should be taken by the owner/operator of the unit. With unit attached to the computer proceed as follows:

1. Check the minimum background of unit. To do this you need to utilize pDR-COM software loaded into your computer. Click on 'Configure pDR'. Click on 'Get Configuration'. Press both ALT key and letter B key of computer keyboard and the following message will be displayed:

   PDRCOM.EXE

   Warning! Consult the manufacturer before editing MinBG, MaxBG or the serial number.

   Click on 'OK' box and you should see S/N, MinBG and MaxBG boxes. Set MinBG to 100 and click on 'Set Configuration'. Click on 'OK' then exit program. Now trying zeroing your pDR.

2. Alternatively you may try the Reset procedure for your pDR series instrument. Holding down both 'Exit' and 'Enter' keys press On/Off key and unit will go through a self test. *WARNING! THE RESET TEST WILL ERASE ALL DATA STORED IN MEMORY AND SET ALL PARAMETERS TO FACTORY DEFAULT SETTINGS.* Download any data before reset procedure. After unit has completed this test try zeroing unit. If unit still displays "Malfunction" refer to Step 1 above. If unit zero is now OK, proceed to use unit normally. If not, unit must be returned to MIE for repair.

Model: pDR-1000AN/1200

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APPENDIX C

LEGGETTE, BRASHEARS & GRAHAM, INC.

VOLATILE ORGANIC COMPOUNDS

PROJECT WORK ZONE CONSIDERATIONS

1.0 EXCAVATION

The following requirements, which apply to all types of excavation operations, except tunnels and shafts, are taken from the U.S. Department of the Interior, Bureau of Reclamation's Construction Safety Standards. They are not intended to be an exhaustive set of requirements, but rather, a summary of current practices that are being enforced at construction activities by Federal and state government agencies and private industry. The requirements were assembled in cooperation with the Associated General Contractors of America, the American National Standards Institute, labor unions, and other interested in improving safety.

1.1 Preliminary Inspection

Prior to excavation, the site should be thoroughly inspected to determine conditions that require special safety measures. The location of underground utilities, such as sewer, telephone, gas, water, and electric lines, must be determined and plainly staked. Necessary arrangements must be made with the utility company or owner for the protection, removal, or relocation of the underground utilities. In such circumstances, excavation will be done in a manner that does not endanger the employees engaged in the work or the underground utility. Utilities left in place should be protected by barricading, shoring, suspension, or other measures, as necessary.

1.2 Protection of the Public

Necessary barricades, walkways, lighting, and posting should be provided for the protection of the public prior to the start of excavation. Excavation operations on or near state, county, or city streets, accessways, or other locations where there is extensive interface with the public and/or motorized equipment will not start until all of the following actions have been taken:

- The contractor has contacted the authority having jurisdiction and obtained written permission to proceed with protective measures required.
- The contractor, using the authority's instructions and these standards, has developed an extensive and detailed standard operating plan.

- The plan has been discussed with affected employees, and applicable protective measures are in place and functioning.

1.3 Access and Lighting

Safe access will be provided for employees, including installation of walkways, stairs, ladders, etc. When operations are conducted during hours of darkness, adequate lighting will be provided at the excavation, borrow pits, and waste areas.

Where employees are required to enter excavations over 4 feet in depth, stairs, ladders, or ramps must be provided, so as to require no more than 25 feet of lateral travel. When access to excavations exceeds 20 feet vertically, ramps, stairs, or personnel hoists should be provided. Ladders extending from the bottom of the trench to at least 3 feet above the top must be placed within 25 feet of workers in the trench.

1.4 Personal Protective Equipment

PPE will be provided and used in accordance with the specific requirements set forth in the plan. Drillers and helpers must wear approved safety goggles or safety glasses with side shields, hearing protection, hard hats, and safety shoes.

1.5 Removal of Trees and Brush

Prior to excavation, trees, brush, boulders, and other surface obstacles that present a hazard to employees should be removed.

1.6 Slide Prevention and Trenching Requirements

All trench excavations over 5 feet in depth must be shored, shielded, or sloped to the angle of repose from the bottom of the trench, but never less than 3/4 horizontal to 1 vertical (i.e., 37 degrees from vertical), or supported by structures designed by a professional engineer. Excavations should be inspected following rainstorms or other hazardous events. Additional protection against possible slides or cave-ins shall be provided, as necessary.

1.7 Angle of Repose

The determination of the angle of repose and design of supporting systems should be based on a thorough evaluation of all pertinent factors, including depth of cut; possible variation in water content of the material; anticipated changes in the material from exposure to air, sun, water, or freezing; loading imposed by structures, equipment, or overlying or stored material; and vibrations from sources such as traffic, equipment, and blasting. The angle of repose for all excavations, including trenching, should be determined by a professional engineer, but in no event should the slope be less than 3/4 horizontal to 1 vertical (i.e., 37 degrees from vertical) from the bottom of the excavation.

1.8 Support Systems

Materials used for support systems, such as sheeting, piling, cribbing, bracing, shoring, and underpinning, should be in good serviceable condition, and timbers should be sound and free of large or loose knots. The design of support systems should be based on calculations of the forces and their directions, with consideration for surcharges, the angle of internal friction of materials, and other pertinent characteristics of the material to be retained.

When tight sheeting or sheet piling is used; full loading due to the ground-water table should be assumed unless relieved by weep holes, drains, or other means. Cross braces and trench jacks should be placed in true horizontal position and secured to prevent sliding, falling, or kickouts. Additional stingers, ties, and bracing should be provided to allow for any necessary temporary removal of individual supports. Support systems should be planned and designed by a professional engineer competent in the field.

Backfilling and removal of trench support systems should progress together from the bottom of the trench. Jacks or braces should be released slowly. In unstable soil, ropes or other safe means will be used to remove the braces from the surface after workers have left the trench.

Special precaution must be taken in sloping or shoring the sides of excavations adjacent to a previously backfilled excavation or fill area. The use of compacted backfill as backforms on slopes that are steeper than the angle of repose of the compacted material in its natural state is prohibited.

1.9 Structural Foundations and Footings

Except in hard rock, excavations below the level of the base of any foundation, footing, or retaining wall will not be permitted unless the wall is underpinned and all necessary precautions are taken to ensure the stability of adjacent walls. If the excavation endangers the stability of adjacent buildings or structures, shoring, bracing, or underpinning designed by a qualified person will be installed. Such supporting systems must be inspected at least daily by qualified persons to ensure that protection is adequate and effectively maintained.

Small diameter footings that workers are required to enter, including bell-bottomed footings over 4 feet deep, must be provided with a steel casing or support system of sufficient strength to support the earth walls and prevent cave-ins. The casing or support system shall be provided for the full depth, except for the bell portion of bell footings.

Fixed or portable ladders must be provided for access. A lifeline, securely attached to a shoulder harness, should be worn by every employee entering the footing. The lifeline should be manned from above and should be separate from any line used to raise or lower materials.

1.10 Vertical Cuts and Slopes

Before a slope or vertical cut is undercut, the residual material must be adequately supported and the undercutting method and support system must be inspected.

When exposed to falling, rolling, or sliding rocks, earth, or other materials, employees working below or on slopes or cuts should be protected in the following manner:

- By effective scaling performed prior to exposure and at intervals necessary to eliminate the danger.
- By the installation of rock bolting, wire mesh, or equivalent support if the material continues to ravel and fall after scaling.
- By the installation of protective timber or wire mesh barricades at the slope of the cut and at necessary intervals down the slope. Wherever practical, benching sufficient to retain falling material may be used in lieu of barricades.
- By ensuring that personnel do not work above one another where there is danger of falling rock or earth. Personnel performing work on vertical cuts or slopes

where balance depends on a supporting system must wear appropriate safety equipment.

1.11 Ground Water

Ground water should be controlled. Freezing, pumping, draining, and other major control measures should be planned. Full consideration should be given to the existing moisture balance in surrounding soil and the effects on foundations and structures if it is disturbed. When continuous operation of ground-water control equipment is necessary, an emergency power source should be provided.

1.12 Surface Water

The accumulation of surface water in excavations must not be permitted and should be controlled by diversion ditches, dikes, dewatering sumps, or other effective means.

1.13 Excavated Materials

Excavated materials should be laced and retained at least 2 feet from the depth of the excavation, or at a greater distance when required to prevent hazardous loading on the face of the excavation.

1.14 Protective Devices

Guardrails, fences, barricades, and warning lights or other illumination systems will be maintained from sunset to sunrise on excavations adjacent to walkways, driveways, and other pedestrian or vehicle thoroughfares. Walkways or bridges that are protected by standard guardrails should be provided where employees are required or permitted to cross over excavations.

Wells, calyx holes, pits, shafts, and all similar hazardous excavations must be effectively barricaded or covered and posted. All temporary excavations of this type should be backfilled as soon as possible. When mobile equipment is permitted adjacent to excavations with steep slopes or cuts, substantial stoplogs or barricades should be installed.

1.15 Equipment Operation

Equipment that is operated on loading or waste areas must be equipped with an automatic backup alarm. Additionally, when employees are on foot or otherwise endangered by equipment in dumping or waste areas, a competent signalman should be used to direct traffic. The signalman must have no other assignment that interferes with signaling duties. If the equipment or truck cab is not shielded, the operator should stand clear of the vehicle during loading. Excavating or hoisting equipment should not be allowed to raise, lower, or swing loads over workers unless effective overhead protection is provided.

1.16 Drilling Operations

When drilling in rock or other dust-producing material, the dust should be controlled within the OSHA Permissible Exposure Limits (PELs). Except in shaft and tunnel excavation, dust control devices are not required on jackhammers as long as the operators wear approved dust respirators.

2.0 DRILLING SAFETY

2.1 Basic Requirements

Employees will not proceed with work on, or in the proximity of, hazardous equipment until they have been properly trained and have received a safety briefing. If drilling is at a hazardous substance site, the site-specific safety plan must be reviewed onsite and discussed in the safety briefing.

Potential hazards (e.g., overhead or underground power, oil, or gas lines in the immediate vicinity of the drilling location) must be removed, avoided by relocating the drill site, or adequately barricaded to eliminate the hazard.

The use of unsafe or defective equipment is not permitted. Equipment must be inspected regularly and, if found to be defective, must be immediately removed from use and either repaired or replaced.

Employees will be familiar with the location of first-aid kits and fire extinguishers. Telephone numbers for emergency assistance must be prominently posted and kept current.

2.2 General Requirements at Drilling Operations

2.2.1 Housekeeping

Good housekeeping conditions should be observed in and around the work area. Suitable storage places should be provided for all materials and supplies. Pipe, drill rods, etc., must be securely stacked on solid, level sills.

Work surfaces, platforms, stairways, walkways, scaffolding, and accessways will be kept free of obstructions. All debris will be collected and stored in piles or containers for removal and disposal.

2.2.2 Salamander Heaters

Salamanders will be used only with approved fuels (e.g., do not use gasoline). Salamander heaters must not be refueled or moved until they have been extinguished and permitted to cool. Heaters will be equipped with exhaust stacks and will not be set on or placed near combustible material. They should be equipped with metal stands that will provide adequate stability and permit at least a 2-inch clearance under the unit.

Burning salamanders must be attended at all times, with suitable fire extinguishers available to each attendant. If tarpaulins or other flexible materials and used to form a heating enclosure, they must be fire resistant and installed to prevent contact with the heater. Worn salamanders that have developed holes or have been otherwise damaged will be replaced and removed from service.

2.2.3 Lighting

In addition to providing required or recommended illumination intensities of at least 5 foot-candles, consideration should be given to the selection and placement of lighting equipment. Proper lighting should provided minimum glare, eliminate harsh shadows, and provide adequate illumination to perform work efficiently and safely.

Light bulbs should be of the heavy duty, outdoor, nonshattering type.

All lighting circuits, including drop cords, should be grounded and have ground fault interrupters. Lighting circuits will be inspected periodically, and defective wiring or fixtures will be removed from service.

2.2.4 Flammable Liquids

All highly flammable liquids should be stored and handled only in approved containers. Portable containers must be the approved red safety containers equipped with flame arresters and self-closing lids.

Approved hand pumps will be used to dispense gasoline from barrels. Gasoline must not be used for degreasing or to start fires. Also, gasoline containers should be clearly labeled, and storage areas should be posted with "No Smoking" signs. Fire extinguishers should be installed in all areas that contain flammable liquids.

2.2.5 Public Safety

Work areas will be regulated so that the public will be protected from injury or accident. Adequate danger signs, barriers, etc., will be placed to effectively warn the public of hazards as well as to restrict access to dangerous areas.

2.3 Off-Road Movement of Drill Rigs

The following rules apply to the off-road movement of drill rigs:

- Before moving a drill rig, an inspection should be made of the route of travel for depressions, slumps, gullies, ruts, and similar obstacles.
- The brakes of a drill rig carrier should always be checked before traveling, particularly on rough, uneven, or hilly ground.
- All passengers should be discharged before a drill rig is moved on rough or hilly terrain.
- The front axle of 4 x 4 or 6 x 6 vehicles or carriers should be engaged when traveling off-road on hilly terrain.
- Caution should be used when traveling on a hillside. The hillside capability of drill rigs should be evaluated conservatively, because the addition of drilling tools may raise the center of mass. When possible, travel should be made directly uphill or downhill.
- Obstacles such as small logs, small erosion channels, or ditches should be crossed squarely, not at an angle.

- When lateral or overhead clearance is close, someone on the ground should act as a guide.
- After the drill rig has been moved to a new drilling site, all brakes or locks should be set. Wheels should be blocked on steep grades.
- The mast (derrick) of the drill rig should not be in the raised or partially raised position during off-road travel.
- Loads on the drill rig and supporting trucks should be tied down during transport.

2.4 Drilling Equipment

2.4.1 Skid-Mounted Units

Labels clearly indicating the function and direction of control levers should be posted on the lower unit controls of all drills.

An emergency safety power shutoff device should be installed within reach of the operator on all units. The device should be clearly labeled or otherwise made readily identifiable and checked daily to ensure that it is operable. The power unit should be operated only by authorized and qualified personnel.

Equipment will be shut down during manual lubrication and while repairs or adjustments are being made. Equipment such as internal combustion engines will not be refueled while running. Where practical, the gasoline tank should be positioned or shielded to avoid accidental spillage of fuel on the engine or exhaust manifold during refueling operations. Hazardous gears and moving parts also should be shielded to prevent accidental contact.

A dry chemical or carbon dioxide fire extinguisher, rated 5 pounds or larger, should be carried on the unit and removed to a position within 25 feet of the work site during drilling operations. Extinguishers will be inspected and tagged at least once every 3 months.

Engine exhaust systems should be equipped with spark arresters when operated in areas where sparks constitute a fire hazard.

2.4.2 Overhead and Underground Utilities

Special precaution must be taken when using a drill rig on a site within the vicinity of electrical power lines and other utilities. Electricity can shock, burn, and cause death.

Overhead and underground utilities should be located, noted, and emphasized on all boring location plans and assignment sheets. When overhead electrical power lines exist at or near a drilling site, all wires should be considered dangerous.

A check should be made for sagging power lines before a site is entered. Power lines should not be lifted to gain entrance. The appropriate utility company should be contacted and a request should be made that it lift or raise and cut off power to the lines.

The area around the drill rig should be inspected before the drill rig mast (derrick) is raised at a site in the vicinity of power lines. The minimum distance from any point on the drill rig to the nearest power line should be determined when the mast is raised or is being raised. The mast should not be raised and the drill rig should not be operated if this distance is less than 20 feet, because hoist lines and overhead power lines can be moved toward each other by the wind.

The existence of underground utilities, such as electric power, gas, petroleum, telephone, sewer, and water lines, should always be suspected. These underground electric lines are as dangerous as overhead lines, so a utility locating service should always be contacted.

There are generally two types of utility locating services. One is a "free" service that is paid for by companies with underground pipes, lines, etc., to protect the public and to prevent costly repairs. However, these services have access only to drawings for primary pipes or lines, typically on public property or right-of-way easements, but not to drawings showing supply or feeder lines from a primary system to the interior of a property. Therefore, they are not required, and in fact hesitate, to locate interior lines. Sites can be cleared for drilling by such services, but without the drill operator's knowledge of the locations of underground feeder or supply lines.

A second type of locating service is provided by a paid subcontractor who physically sweeps or clears interior locations using locating equipment. Locating costs can be minimized by obtaining all available maps, drawings, and employee interview information before contracting with the locating company. This is especially important at large industrial plants or military bases, which can have an intricate network of underground utilities. It is important that every location be cleared, even those for hand-auger borings.

If a sign warning of underground utilities is located on a site boundary, it should not be assumed that underground utilities are located on or near the boundary or property line under the

sign; they may be a considerable distance from the sign. The utility company should be contacted to check it out.

The owners of utility lines or the nearest underground utility location service should always be contacted before drilling is started. However, remember that some services provide information on utilities going to, but not within, a site. Metal detectors or other locating equipment may be necessary to determine the presence of shallow (surface) utilities onsite. The utility personnel should mark or flag the location of the underground lines and determine what specific precautions must be taken to ensure safety.

2.4.3 Site Selection and Working Platforms

In preparing a work site located on adverse topography, precautions must be taken against cave-ins, slides, and loose boulders. The drill platform should be stabilized by outriggers or adequate timbering.

Prior to drilling, adequate site clearing and leveling should be performed to accommodate the drill rig and supplies and to provide a safe working area. Drilling should not commence when tree limbs, unstable ground, or site obstructions result in unsafe tool-handling conditions.

Suitable storage locations should be provided that allow for the convenient handling of tools, materials, and supplies without danger that they could fall and injure anyone. Storing or transporting tools, materials, or supplies within or on the drilling mast (derrick) should be avoided. Pipes, drill rods, bits, casings, augers, and similar drilling tools should be securely stacked in an orderly manner on racks or sills.

Penetration hammers or other types of driving hammers should be placed at a safe location on the ground or secured when unattended on a platform. Work areas, platforms, walkways, scaffolding, and other accessways should be kept free of obstructions and substances such as ice, grease, or oil that could create a hazardous surface. All controls, control linkages, and warning and operation lights and lenses also should be kept free of ice, grease, or oil.

In the vicinity of power transmission or distribution lines, drills should be adequately grounded and set with at least a 15-foot clearance between any part of the drill or mast and the power lines.

Toilet facilities will be convenient to drill crews, or transportation will be readily available to nearby toilet facilities. Toilets will be either the chemical type or constructed over ground pits, which will be backfilled when abandoned. They should be fly tight and maintained in a sanitary condition.

Mud pits and drainage excavations should be safely sloped and located to provide minimum interference with work. Where necessary, suitable barricades, catwalks, etc., should be provided to reduce the possibility of personal injury. Ladders will be positioned in pits or excavations that are 5 or more feet deep. Such excavations should be periodically inspected to ensure safe operation and adequate maintenance.

Truck-mounted drills will be equipped with a "safetyline" or with clearly marked and conspicuously located emergency switches. The safetyline emergency stop consists of a taut wire that runs around the back of the machine and connects to a special switch that turns off the power unit when the line is contacted. When emergency switches are used in lieu of a safetyline, there should be a minimum of two switches--one located within easy reach of the operator, and one located within easy reach of workers at ground level near the drill or auger head.

Trucks should not be moved backward unless the driver has personally inspected the area behind the truck. In restricted or congested areas, or areas where workmen are located, the assistance of a "spotter" is mandatory. Also, trucks will be equipped with serviceable automatic backup alarms.

Before the mast is raised, personnel will be cleared from the immediate area--with the exception of the operator and a helper, when necessary. A check should be made to ensure safe clearance from energized power lines or equipment. Unsecured equipment must be removed from the mast, and cables, mud lines, and catline ropes must be adequately secured to the mast before raising. After it is raised, the mast must be secured to the rig in an upright position with steel pins.

Drill equipment will not be moved until a thorough inspection has been made to ensure that the mast, drill rods, tools, and other equipment are secured. A check will also be made of the steering mechanism, brakes, lights, load limits, and proper flagging and lighting of load extensions. Applicable traffic laws will be observed when moving drill equipment over public roads.

2.5 Surface Drilling Operations

Before the mast of a drill rig is raised and drilling is commenced, the drill rig must first be leveled and stabilized with leveling jacks and/or solid cribbing. The drill rig should be releveled if it settles after the initial setup. The mast should only be lowered when the leveling jacks are down, and the leveling jack pads should not be raised until the mast is completely lowered. Before drilling operations start, the mast should be secured or locked, if required by the drill's manufacturer.

Before the power unit is started, all gears should be disengaged, the cable drum brake should be set, and no rope should be in contact with the cathead.

Before the mast is raised, a check should be made for overhead obstructions. Everyone (with the exception of the operator) should be cleared from the areas immediately to the rear and sides of the mast and informed that the mast is being raised. The drill rig should not be driven from hole to hole with the mast in the raised position.

The drill rig should only be operated from the position of the controls. The operator should shut down the drill engine before leaving the vicinity of the drill. "Horsing around" in the vicinity of the drill rig and tool and supply storage areas is strictly prohibited, even when the drill rig is shut down. Caution should be taken when mounting/dismounting the platform.

Drill operations should be terminated during an electrical storm.

The consumption of alcoholic beverages, depressants, stimulants, or any other chemical substance while on the job is strictly prohibited. All unattended boreholes must be adequately covered or protected to prevent people or animals from stepping or falling into the hole. When the drilling project has been completed, all open boreholes should be adequately covered, protected, or backfilled, according to local or state regulations.

A safety chain and cable arrangement should be used to prevent water swivel and mud line whip. All water swivels and hoisting plugs should be checked for possible frozen bearings and should be properly lubricated before use. A frozen bearing could cause mud line whip, which could injure the operator.

Only drill operators should brake or set the chucks to prevent engagement of the transmission prior to removal of the chuck wrench. Also, the chuck jaws should be periodically checked and replaced as necessary.

A string of drill rods should not be braked by the chuck jaws during lowering into the hole. A catline or hoisting cable and plug should be used for braking prior to tightening of the chuck. Failure to follow this procedure could result in steel slivers on the rods, possible hand injuries, and loss of the rods into the hole. Following braking, drill rods should be allowed to drain completely before removal from the working area.

Drill rods will not be lowered into the hole with a pipe wrench. Serious back and hand injuries may result if the rods are lowered by this method.

When using drilling fluids, a rubber or other suitable wiper should be used to remove the material from the drill rods when removing them from the drill hole. When drilling with air, the exhaust and cuttings should be directed away from workers with devices such as diverter heads, the use of which should be stipulated on drilling agreements where appropriate.

Care must be exercised by the operator to avoid a sudden hoist release of the drill rod while the rod is being carried from the hole. The hoisting capacity and weight of the drill rod must be known to prevent collapse of the mast during drill string removal from the hole. The operating capacity of the mast and hoist also must be known and must not be exceeded.

When tool joints are broken on the ground or on a drilling platform, fingers should be positioned so they will not be caught between the wrench handle and the ground or the platform if the wrench slips or the joint suddenly lets go. Pipe wrench jaws should be checked periodically and replaced as they become worn.

2.6 Use of Augers

The use of mismatched auger sections should be avoided. Different brands and different weights should not be used in the same auger flight.

Because some pins lose their temper after very little use, causing the spring or clip section to fail, only tight-fitting pins designed for the auger should be used.

A daily inspection--to include a thorough check of the hydraulic hoses, connections, and valves--will be made before equipment is used. Deficiencies should be corrected or safe condition verified before the equipment is started.

A durable sign containing the following wording should be installed on all equipment in full view of the operator:

- All personnel must be clear before starting this machine
- Stop the auger to clean it
- Stop engine when repairing, lubricating, or refueling
- Do not wear loose-fitting clothing or gauntlet-type gloves.

The following general procedures should be used when advancing a boring with continuous flight or hollow-stem augers:

- An auger boring should be started with the drill rig level, the clutch or hydraulic rotation control disengaged, the transmission in low gear, and the engine running at low revolutions per minute (rpm).
- A system of responsibility should be established for the series of activities required for auger drilling, such as connecting or disconnecting auger sections and inserting or removing the auger fork. The operator must be sure that the tool handler is well away from the auger column and that the auger fork has been removed before rotation is started.
- Only the manufacturer's recommended method of securing the auger to the power coupling should be used. The coupling or the auger should not be touched with the hands, a wrench, or any other tool during rotation.
- Tool hoists should be used to handle auger sections whenever possible. Hands or fingers should never be placed under the bottom of an auger section when the auger is being hoisted over the top of the auger section in the ground or other hard surface, such as the drill rig platform. Feet should never be allowed to get under the auger section that is being hoisted.
- Workers should stay clear of the auger and other rotating components of the drill rig. Workers should never reach behind or around a rotating auger for any reason.
- Hands or feet should never be used to remove cuttings from the auger.
- Augers should be cleaned only when the drill rig is in neutral and the augers have stopped rotating. A special paddle should be designed for cleaning auger flights; if available, pressurized water is recommended for jet cleaning.

3.0 REMEDIATION SYSTEM EQUIPMENT

LBG operates remediation system equipment at various sites. Remediation equipment includes but is not limited to pump and treat, soil vapor extraction, two-phase vapor extraction, liquid and vapor phase granular activated carbon, thermal destruction and air stripping tower systems. This brief list of safety requirements cover hazards specific to this type of operation. The list assumes that safety requirements for standard operations inherent in SVE operations are already being followed, such as 29 CFR 1910.120 "Hazwoper" planning, training, and other requirements; or drilling, trenching, and shoring safety practices.

The components of a typical remediation system equipment can include an electric or gasoline powered motor, a carbo absorption bed, and various filters, piping, and controls.

3.1 Basic Requirements

3.1.1 General

Employees will not proceed with work on, or in the proximity of, the remediation equipment until they have been properly trained and have attended a safety briefing covering the hazards involved. This may in the form of a "tailgate" safety briefing or a more extensive session, depending upon the extent of the hazards, the employees' safety knowledge, and site-specific exposures.

The use of unsafe or defective equipment is not permitted. Equipment must be inspected regularly and, if found to be defective, immediately removed from use and repaired or replaced.

Employees should be familiar with the location of first-aid kits and fire extinguishers. Telephone numbers or radio frequencies for emergency assistance must also be prominently posted and kept current.

3.1.2 Housekeeping

Good housekeeping practices should be observed in and around the work area. Suitable storage should be provided for all materials and supplies.

Any work surfaces, platforms, stairways, walkways, scaffolding, or accessways should be kept free of obstructions. Any debris should be collected and stored in piles or containers for removal and proper disposal.

3.1.3 Flammable Liquids

All highly flammable liquids should be stored and handled only in approved containers. Portable containers must be of the approved, red safety container type, equipped with flame arresters and self-closing lids.

Approved hand pumps should be used to dispense gasoline from drums. Gasoline must not be used for degreasing or starting fires. Also, gasoline containers should be clearly labeled, and any storage areas should be posted with "No Smoking" signs. Fire extinguishers should be installed in all areas that contain flammable liquids.

3.1.4 Public Safety

Work areas should be regulated so that the public will be protected from injury or accident. Adequate danger signs, barriers, etc., should be placed to effectively warn the public of hazards as well as to restrict access to dangerous areas.

3.1.5 Drilling Safety

Construction of soil-vapor extraction systems requires installation of soil-vapor extraction wells and separate air inlet wells. Safety requirements for drilling operations should be followed.

3.2 Specific Requirements

3.2.1 Chemical Hazards

Some of the primary chemical hazards at remediation operations are site contaminants related to volatile organic compounds. Typically, contaminants are drawn from extraction wells and treated with carbon absorption units and/or are incinerated. Additional chemical hazards associated with these treatment technologies include fuel for the incinerator and activated carbon saturated with site contaminants. Manufacturers' Material Safety Data Sheets should be available on site for all neat chemical compounds used.

Personnel can be exposed to site contaminants during sampling and equipment maintenance. Because soil-vapor extraction systems are typically closed systems terminating in contaminant oxidization or absorption apparatus, chances of exposure incidents during normal operations are minimal. If chemical exposure occurs, however, it is most likely during sampling

or equipment maintenance. Sampling typically includes sampling of site soils or ground water to measure the long-term effectiveness of remediation activities, or sampling process water or vapors to determine the efficiency of treatment technologies in capturing or destroying the contaminants.

A potential for exposure exists during maintenance procedures because of cleaning sediment from knockout pots and from general piping system repairs.

In order to minimize the potential hazards associated with chemical exposure, all site workers should have a knowledge of particular site hazards and contaminants. Based upon site conditions, proper personal protective equipment should be worn such as hard hats, chemical protective clothing, and safety shoes.

3.2.2 Physical Hazards

Physical hazards can be managed by general housekeeping in work areas and routine equipment maintenance. Scaffolding may be erected around water stripping towers and incinerators and should be inspected periodically, as part of a routine maintenance procedure.

3.2.3 Pressure

Remediation systems typically recover soil vapors or ground water from beneath the ground surface. Remedial equipment should be shut off when maintenance activities or repairs occur.

3.2.4 Electric Hazards

Because several types of equipment in remediation systems are commonly powered by electricity, electrical hazards exist at these remedial sites. Liquid ring vacuum pumps, knockout pumps, air stripper holding tanks and pumps, and other elements of the treatment units are frequently powered by electricity. General housekeeping and equipment maintenance are necessary to prevent electrical safety hazards. Worn switches and wiring should be quickly repaired, use of water should be controlled, and unnecessary spills prevented. Ground fault interrupters (GFI) should be used on all circuits carrying power from a nearby indoor source to outdoor equipment or from an outdoor portable generator to equipment. Equipment should also

be properly grounded as a protection against shocks, static electricity, and lightning if an electrical storm occurs.

3.2.5 Lighting

In addition to providing required or recommended illumination intensities of at least 5 foot-candles for nighttime operation, consideration should be given to the selection and placement of lighting equipment. Proper lighting should provide minimum glare, eliminate harsh shadows, and provide adequate illumination to perform work efficiently and safely. Light bulbs should be of the heavy duty, outdoor, nonshattering type.

All lighting circuits, including extension cords, should be grounded and have GFI protection. Circuits and extension cords should be inspected periodically.

3.2.6 Incinerator/Treatment System

Thermal hazards exist with incinerators, and boundaries should be set up to prevent contact with headed surfaces. Additionally, proper thermal protection should be available for personnel working at the incinerator. Vapor extractor pumps should be set to shut off automatically if the incinerator shuts off, to prevent accumulation of high concentrations of volatile compounds that could result in an explosion hazard.

3.2.7 Carbon Bed Temperature

A hazard related to carbon absorption units is the heat of reaction, which is high for some materials, such as ketones, treated in high concentrations. SVE equipment should be designed to take this into account when carbon absorption is employed and the bed temperature must be monitored.

Typically, but not limited to, two carbon units will be piped in series to treat the recovered vapors. Carbon units will be changed out according to the air permit guidelines.

When carbon units are changed out, the primary unit will be taken off line, the secondary unit will become the primary unit, and a fresh carbon vessel will become the secondary unit.

All field activities will be initiated in Level D. If the action levels specified in Table 5-1 are reached, an upgrade will be made to Level C.

3.2.8 Vapor Emission Response Plan

If the air concentration of (chlorinated) organic vapors exceeds 5 ppm above background in the exhaust of the treatment system, the system exhaust will be continuously monitored and necessary actions will be taken to reduce system emissions to 5 ppm--for example, by bleeding air into the system, changing carbon canisters, etc. If the organic vapor levels measured in the treatment system exhaust are between 5 ppm and 50 ppm above background, continue site activities and perform continuous monitoring. If the organic vapor level exceeds 50 ppm above background in the treatment system exhaust, shut down work activities until the system is repaired.

Prior to beginning construction activities, notify fire departments and police as well as the local emergency facility of planned site activities. These organizations should be briefed on the nature of planned site work and given a schedule of the proposed tasks. Changes or modifications to the planned work or schedule which could affect the need for emergency services shall be communicated to these organizations. LBG shall communicate to the local hospital and fire department what types of materials may be encountered at the site.

Should the level of total (chlorinated) hydrocarbons exceed 100 ppm for any single reading, or should the explosimeter indicate in excess of 10 percent of the lower explosive limit on any single reading, work in that area will be shut down and personnel will be evacuated upwind. Work will not resume there until authorized by the Site Safety Officer.

3.2.9 System Start-Up and Initial Operating Period

The VE system is designed to operate unattended 24 hours per day, 7 days per week. Once the electrical connections are complete, LBG will begin system start-up.

LBG will monitor the system on a weekly basis during the month of operation. LBG field personnel will use a photoionization detector (PID) to monitor the VE system emissions before GAC treatment. LBG will monitor between GAC units and at the point of vapor emissions to determine GAC breakthrough and compare those concentrations to air emissions standards. These measurements will be used to estimate the amount of VOCs removed from the soil and the rate at which the GAC is being used to treat vapor phase emissions. As part of the daily monitoring, LBG will follow the Vapor Emission Response Plan.

3.2.10 Continued Operations and Maintenance

After the first month of operation, LBG will monitor the system biweekly for the second and third month. From the beginning of the fourth month to the remainder of the treatment period, LBG will monitor the system once a month. The following data will be recorded on each visit:

- Operating time
- Applied vacuum at blower inlet
- Induced vacuum at air inlet wells
- Vapor temperature at blower inlet
- Vapor temperature at blower outlet
- Pressure at blower outlet
- Concentrations of VOCs at blower outlet
- Concentrations of VOCs in treated emissions.

LBG field personnel will analyze and record the vapor-phase VOC concentrations before and after GAC treatment.

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APPENDIX D

DECONTAMINATION PROCEDURES

Procedure for Level C Decontamination

Level C decontamination, if required, will take place on plastic sheeting so all contaminated material can be contained for proper disposal.

Station 1: Segregated Equipment Drop

Deposit equipment used onsite (tools, sampling devices and containers, monitoring instruments, radios, clipboards, etc.) on plastic drop cloths or in different containers with plastic liners. Segregation at the drop reduces the probability of cross-contamination.

Equipment: various size containers
plastic liners
plastic drop cloths

Station 2: Suit/Safety Boot Wash

Thoroughly wash splash suit and safety boots. Scrub with long-handle, soft-bristle scrub brush and copious amounts of decon solution or detergent/water. Repeat as many times as necessary.

Equipment: container (30-50 gallons)
decon solution
or
detergent/water
2-3 long-handle, soft-bristle scrub brushes

Station 3: Suit/Safety Boot Rinse

Rinse off decon solution or detergent/water using copious amounts of water. Repeat as many times as necessary.

Equipment: container (30-50 gallons)
or
high-pressure spray unit
water
2-3 long-handle, soft-bristle scrub brushes

Station 4: Canister or Mask Change

If worker leaves Exclusion Zone to change canister (or mask), this is the last step in the decontamination procedure. Worker's canisters will be exchanged, depositing the old canisters in containers with plastic liners. The worker will enter the work area and return to duty.

Equipment: canister (or mask)
boot covers
gloves

Station 5:

Step 1 - Tape, Safety Boot and Outer Glove Removal

Remove safety boots and gloves and deposit in container with plastic liner.

Equipment: container (30-50 gallons)
plastic liners
bench or stool
boot jack

Step 2 - Splash Suit Removal

With assistance of helper, remove splash suit. Deposit in container with plastic liner.

Equipment: container (30-50 gallons)
bench or stool
liner

Step 3 - Facepiece Removal

Remove facepiece. Avoid touching face with gloves. Deposit facepiece in container with plastic liner.

Equipment: container (30-50 gallons)
plastic liners

Masks will be collected at a central location. Decontamination will be performed as follows:

- remove all cartridges, canisters and filters, plus gaskets or seals not affixed to their seats;
- remove elastic headbands;
- remove exhalation cover;
- remove speaking diaphragm or speaking diaphragm-exhalation valve assembly;
- remove inhalation valves;
- wash facepiece and breathing tube in cleaner mixed with warm water, preferably at 120°F to 140°F; wash components separately from the face mask; remove heavy soil from surfaces with a hand brush;
- remove all parts from the wash water and rinse twice in clean warm water;
- air dry parts in a designated clean area; and,
- wipe facepiece, valves and seats with a damp lint-free cloth to remove any remaining soap or other foreign materials.

Station 6: Inner Glove Removal

Remove inner gloves and deposit in container with plastic liner.

Equipment: container (20-30 gallons)
plastic liners

Station 7: Inner Clothing Removal (optional)

Remove clothing soaked with perspiration. Place in container with plastic liner. Do not wear inner clothing offsite if there is a possibility small amounts of contaminants might have been transferred in removing splash suit.

Equipment: container (30-50 gallons)
plastic liners

Station 8: Field Wash (optional)

Shower if highly toxic, skin-corrosive or skin-absorbable materials are known or suspected to be present. Wash hands and face if shower is not available.

Equipment: water
soap
tables
wash basins/buckets
field showers

Station 9: Redress

Put on clean clothes. A dressing trailer is needed in inclement weather.

Procedure for Level B Decontamination

Level B decontamination, if required, will take place on plastic sheeting so all contaminated material can be contained for proper disposal.

Station 1: Segregated Equipment Drop

Deposit equipment used onsite (tools, sampling devices and containers, monitoring instruments, radios, clipboards, etc.) on plastic drop cloths or in different containers with plastic liners. Each will be contaminated to a different degree. Segregation at the drop reduces the probability of cross-contamination.

Equipment: various size containers
plastic liners
plastic drop cloths

Station 2: Suit/Safety Boot Wash

Thoroughly wash chemical-resistant splash suit, SCBA, gloves, and safety boots. Scrub with long-handle, soft-bristle scrub brush and copious amounts of decon solution or detergent/water.

Wrap SCBA regulator (if belt-mounted type) with plastic to keep out water. Wash backpack assembly with sponges or cloths.

Equipment: container (30-50 gallons)
decon solution
or
detergent/water
2-3 long-handle, soft-bristle scrub brushes
sponges or cloths

Station 3: Suit/SCBA/Boot/Glove Rinse

Rinse off decon solution or detergent/water using copious amounts of water. Repeat as many times as necessary.

Equipment: container (30-50 gallons)
or
high-pressure spray unit
water
small buckets
2-3 long-handle, soft-bristle scrub brushes
sponges or cloths

Station 4: Tank Change

If worker leaves Exclusion zone to change air tank, this is the last step in the decontamination procedure. Worker's air tank is exchanged and worker returns to duty.

Equipment: air tanks
tape
boot covers
gloves

Station 5: Tape, Safety Boot and Outer Glove Removal

Remove safety boots and gloves and deposit in container with plastic liner.

Equipment: container (30-50 gallons)
plastic liners
bench or stool
boot jack

Station 6: SCBA Backpack Removal

While still wearing facepiece, remove backpack and place on table. Disconnect hose from regulator valve and proceed to next station.

Equipment: table

Station 7: Splash Suit Removal

With assistance of helper, remove splash suit. Deposit in container with plastic liner.

Equipment: container (30-to gallons)
plastic liners
bench or stool

Station 8: Facepiece Removal

Remove facepiece. Avoid touching face with gloves. Deposit in container with plastic liner.

Equipment: container (30-50 gallons)
plastic liners

Masks will be collected at a central location. Decontamination will be performed as follows:

- remove all cartridges, canisters and filters, plus gaskets or seals not affixed to their seats;
- remove elastic headbands;
- remove exhalation cover;
- remove speaking diaphragm or speaking diaphragm-exhalation valve assembly;

- remove inhalation valves;
- wash facepiece and breathing tube in cleaner mixed with warm water, preferably 120°F to 140°F; wash components separately from the face mask; remove heavy soil from surfaces with a hand brush;
- remove all parts from the wash water and rinse twice in clean warm water;
- air dry parts in a designated clean area; and,
- wipe facepiece, valves and seats with a damp lint-free cloth to remove any remaining soap or other foreign materials.

Station 9: Inner Glove Removal

Remove inner gloves and deposit in container with plastic liner.

Equipment: container (20-30 gallons)
plastic liners

Station 10: Inner Clothing Removal (optional)

Remove clothing soaked with perspiration. Place in container with plastic liner. Do not wear inner clothing offsite since there is a possibility small amounts of contaminants might have been transferred in removing fully encapsulating suit.

Equipment: container (30-50 gallons)
plastic liners

Station 11: Field Wash (optional)

Shower if highly toxic, skin-corrosive, or skin-absorbable materials are known or suspected to be present. Wash hands and face if shower is not available.

Equipment: water
soap
small tables
basins or buckets
field showers

Station 12: Redress

Put on clean clothes. A dressing trailer is needed in inclement weather.

Equipment: tables
chairs
lockers
clothes

Procedures for Level A Decontamination

(to be formulated on a case-by-case basis)

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APPENDIX E

CONTACT SHEET

Client	KIOP Forest Avenue, L.P.
	(212) 508-6700
Project:	Forest Avenue Shoppers Town
Location:	Staten Island, New York
Task:	Monitoring; drilling
Client Contact:	Mr. Scott Furman

Leggette, Brashears & Graham, Inc.

(914) 694-5711 (914) 694-5744 (fax)

Field Supervisor (HSO):	Jorma Weber
Project Manager:	Jorma Weber
Principal-in-Charge:	Dan C. Buzea

Local Police Headquarters:	120th Precinct, 78 Richmond Terrace, St. George, New York
	(718) 876-8500
Local Hospital:	Staten Island University Hospital, 475 Sea View Avenue, Staten Island, New York
Emergency Room:	(718) 226-9140
State Police:	Troop NYC, 2 Pennyfield Avenue, Bronx, New York
	(718) 319-5100
Miscellaneous:	New York State Department of Environmental Conservation (NYSDEC), Region II
	(718) 482-4933

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DIRECTIONS TO LOCAL HOSPITAL:

Staten Island University Hospital North
475 Sea View Avenue
Staten Island, New York 10305-3498

Total Distance: 5.0 miles
Total Estimated Time: 13 minutes

- Go northeast on Forest Avenue 0.9 miles
- Turn right onto Clove Road 3.2 miles
- Slight right onto Hylan Avenue 1.1 miles
- Turn left onto Sea View Avenue 0.4 miles
- Hospital is on the left

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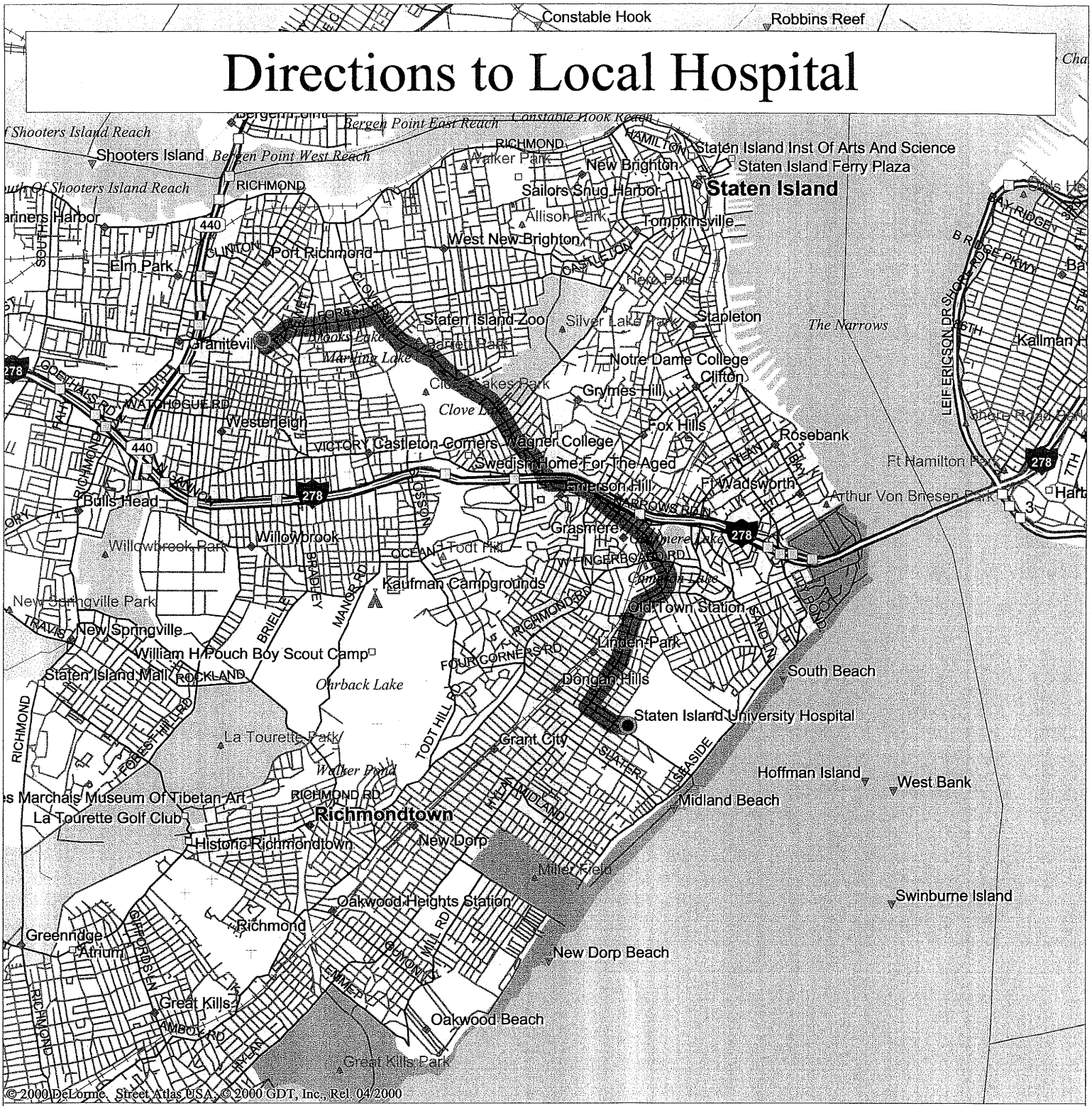
Directions to Local Hospital



Mag 13.00
Fri Mar 21 15:17 2003
Scale 1:62,500 (at center)

1 Miles

2 KM

- Local Road
- Major Connector
- State Route
- Ferry
- Trail
- Interstate/Limited Access
- Toll Highway
- Exit
- Railroad
- Point of Interest
- Small Town
- Large City
- Summit
- Geographic Feature
- Hospital
- Park/Reservation