APPENDIX 5.9
Landfill Gas Sampling Methodology

2.0 INTEGRATED LANDFILL SURFACE SAMPLING
Paragraph (d)(5) and (e)(2) Requirements of Rule 1150.1

2.1 Number of Samples

The number of samples collected will depend on the area of the landfill surface. The entire landfill disposal area shall be divided into individually identified 50,000 square foot grids. One monthly sample shall be collected from each grid for analysis. Any area that the Executive Officer deems inaccessible or dangerous for a technician to enter may be excluded from the sampling grids monitored by the landfill owner or operator. To exclude an area from monitoring, the landfill owner or operator shall file a written request with the Executive Officer. Such a request shall include an explanation of the requested exclusion and photographs of the area. The Executive Officer shall notify the landfill owner or operator in writing of the decision. Any exclusion granted shall apply only to the monitoring requirement. The 50 ppmv limit specified in paragraph (d)(5) of Rule 1150.1 applies to all areas.

2.2 Integrated Surface Sampling Conditions

2.2.1. The average wind speed during this sampling procedure shall be five miles per hour or less. Surface sampling shall be terminated when the average wind speed exceeds five miles per hour or the instantaneous wind speed exceeds ten miles per hour. Average wind speed is determined on a 15-minute average.

2.2.2. Surface sampling shall be conducted when the landfill is dry. The landfill is considered dry when there has been no measurable precipitation for the preceding 72 hours prior to sampling. Most major newspapers report the amount of precipitation that has fallen in a 24-hour period throughout the Southern California area. Select the nearest reporting station that represents the landfill location or provide for measurable precipitation collection at the MSW landfill wind monitoring station.

2.3 Integrated Surface Sampler Equipment Description

An integrated surface sampler is a portable self-contained unit with its own internal power source. The integrated sampler consists of a stainless steel collection probe, a rotameter, a pump, and a 10-liter Tedlar bag enclosed in a LIGHT-SEALED CONTAINER to prevent photochemical reactions from occurring during sampling and transportation. The physical layout of the sampler is shown in Figure 1.

An alternate integrated surface sampler may be used, provided that the landfill owner or operator can show an equivalency with the sampler specifications in Section 2.4 and shown in Figure 1. All alternatives shall be submitted as specified in subdivision (i) of Rule 1150.1.

2.4 Integrated Surface Sampler Equipment Specifications

2.4.1 Power: Batteries or any other power source.

2.4.2 Pump: The diaphragm shall be made of non-lubricated Viton (Dupont trade name for co-polymer of hexafluoropropylene and vinylidene fluoride) rubber.

2.4.3 Bag: One 10-liter Tedlar bag with a valve. The Tedlar bag shall be contained in a LIGHT-SEALED CONTAINER. The valve shall be leak free and constructed of aluminum, stainless steel, or non-reactive plastic with a Viton or Buna-N (butadiene acrylonitrile co-polymer) o-ring seal.

2.4.4 Rotameter: The rotameter shall be made of borosilicate glass or other non-reactive material and have a flow range of approximately 0-to-1 liter per minute. The scale shall be in milliliters or an equivalent unit. The graduations shall be spaced to facilitate accurate flow readings.

2.4.5 Air Flow Control Orifice: Needle valve in the rotameter.

2.4.6 Funnel: 316 stainless steel.

2.4.7 Fittings, Tubing and Connectors: 316 stainless steel or Teflon.

2.5 Integrated Surface Sampling Procedure

2.5.1 An integrated surface sampler as described in Section 2.4 shall be used to collect a surface sample approximately 8-to-10 liters from each grid.

2.5.2 During sampling, the probe shall be placed 0-to-3 inches above the landfill surface.

2.5.3 The sampler shall be set at a flow rate of approximately 333 cubic centimeters per minute

2.5.4 Walk through a course of approximately 2,600 linear feet over a continuous 25-minute period. Figure 2 shows a walk pattern for the 50,000 square foot grid.

2.6 Integrated Surface Sample Analytical Procedures

All samples collected shall be analyzed no later than 72 hours after collection for TOC using U.S. EPA Method 25, 40 CFR, Part 60, Appendix A analysis or a portable FID that meets the requirements in Section 3.2. In addition, the samples specified in Section 2.6.1 or 2.6.2 must be analyzed no later than 72 hours after collection for the TAC specified in Table 1 and upon written request, Table II, using U.S. EPA Compendium Method TO-14.

2.6.1 Ten percent of all samples which have a concentration of TOC greater than 50 ppmv as methane, or

2.6.2 Two samples if all samples are 50 ppmv or less of TOC or two samples if there are less than 20 samples above 50 ppmv.

The Executive Officer may require more samples to be tested for TAC if he determines there is a potential nuisance or public health problem.

2.7 Chain of Custody (Required for samples sent to the lab)

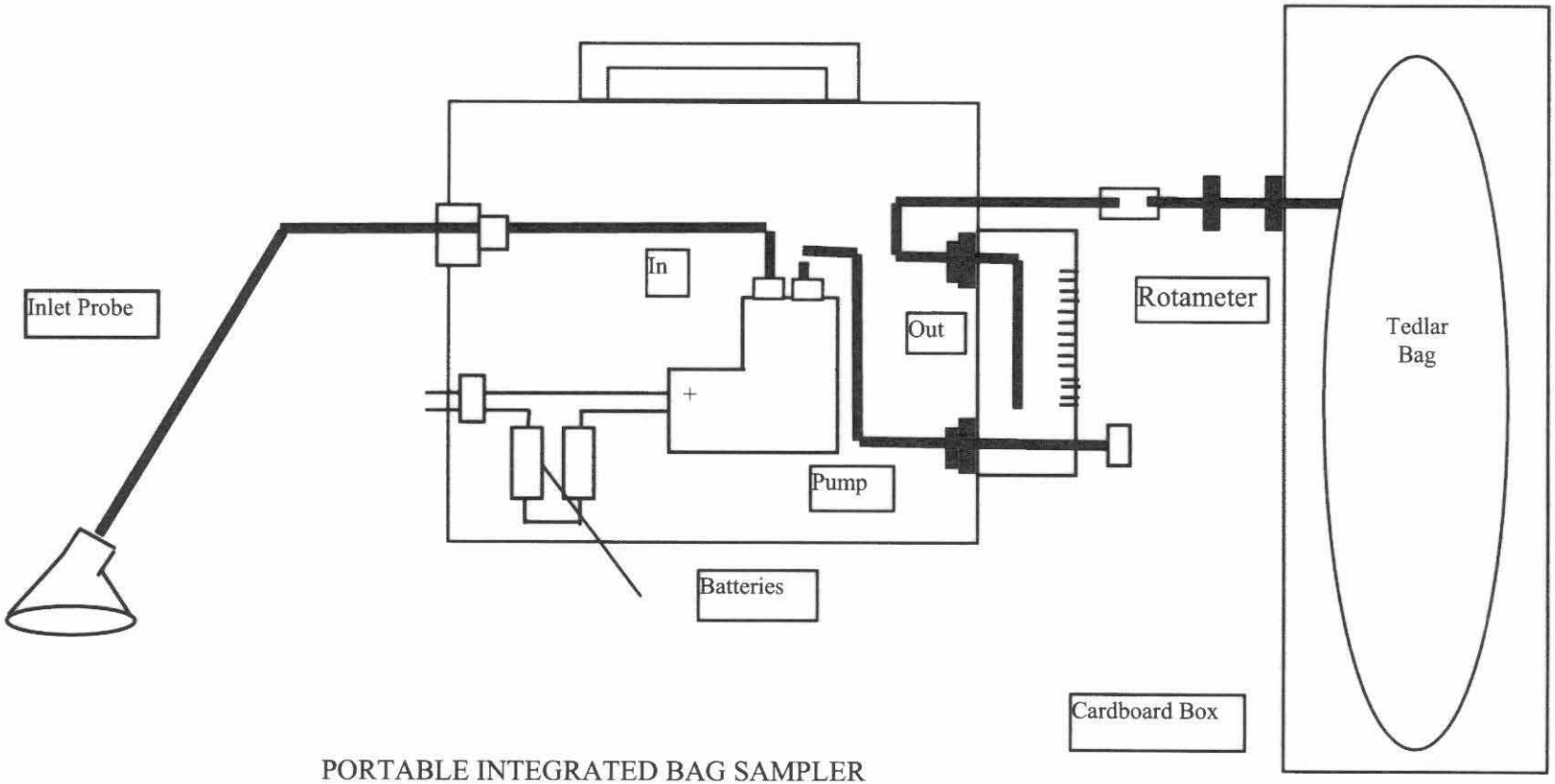
A custody sheet shall accompany the bag samples. Each time a bag changes hands, it shall be logged on the custody sheet with the time of custody transfer recorded. Laboratory personnel shall record the condition of the sample (full, three-fourths full, one-half full, one-fourth full, or empty). An example of a custody sheet is shown in Figure 4.

2.8 Recording the Results

2.8.1 Record the volume concentration of both TOC measured as methane for each grid and the volume concentration for the required TAC on a quality control sheet as shown in Figure 3. Include a topographic map drawn to scale with the location of the grids and the gas collection system clearly marked and identified.

2.8.2 Record the wind speed during the sampling period using the wind speed and direction monitoring system required in paragraph (d)(9) of Rule 1150.1.

2.8.3 Maintain and submit the results as specified in subdivision (f) of Rule 1150.1.



PORTABLE INTEGRATED BAG SAMPLER
Physical Layout

Figure 1

Typical Landfill Walk Pattern
for a 50,000 Square Foot Grid

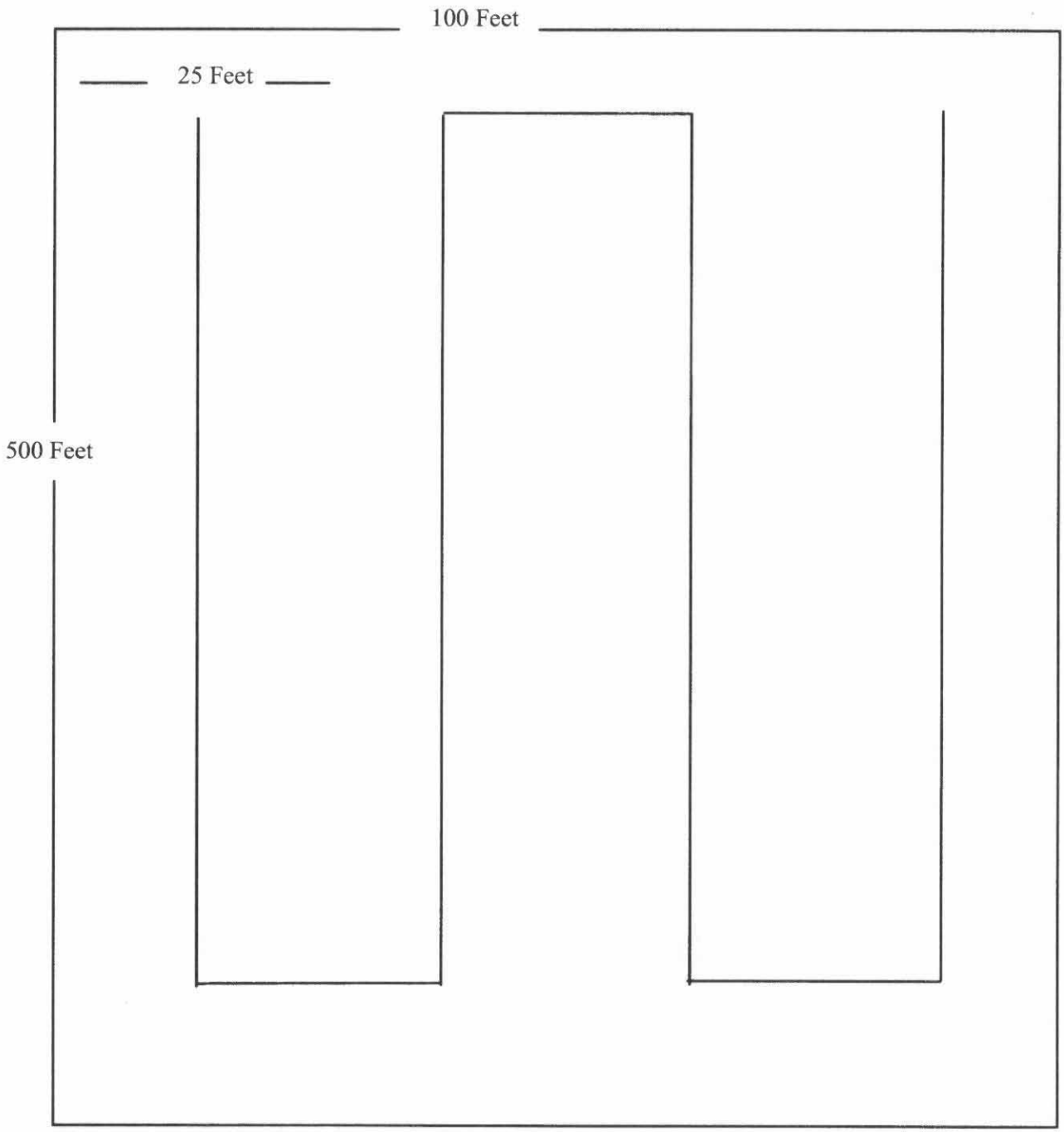


Figure 2

QUALITY CONTROL SHEET

- Prior to use, the Tedlar bag system shall be leak checked, evacuated and filled with purified nitrogen three times to flush out the old sample.
- All samples must be kept in LIGHT-SEALED CONTAINERS to avoid photochemical reactions.

OPERATION					BAG SAMPLES				COMMENTS
Grid or probe #	Date	Wind Speed	Time On	Time Off	I.D.#	Valve Open	Rotameter Reading	Pump (On/Off)	

Signature:

Figure 3

BAG SAMPLE CUSTODY FORM

Project _____ Date: _____

Bag (I.D. #)									
Condition Received in Lab*									

Bags Prepared By: _____ Time: _____

Date: _____

Bags Taken Out By: _____ Time: _____

Bags Taken to Lab By _____

Bags Received In Lab By: _____ Time _____

* F = 1/2 full to full, 0 = Overfull (Bulging), L = 1/4 to 1/2 full,
E = Less than 1/4 full but contains some sample, N = No sample at all.

Figure 4

5.0 AMBIENT AIR SAMPLES AT THE LANDFILL PROPERTY BOUNDARY Subparagraph (e)(5) Requirement of Rule 1150.1

5.1 Number of Samples

Monthly ambient air samples shall be collected for analysis at the landfill property boundary from both an upwind and downwind sampler sited to provide good meteorological exposure to the predominant offshore (drainage land breeze) and onshore (sea breeze) wind flow patterns. The upwind and downwind samples shall be collected simultaneously over two 12 hour periods beginning between 9:00 a.m. and 10:00 a.m., and 9:00 p.m. and 10:00 p.m. on the same day or different days.

5.2 Ambient Air Sampling Conditions

Ambient air sampling shall be conducted on days when stable (offshore drainage) and unstable (onshore sea breeze) meteorological conditions are representative for the season. Preferable sampling conditions are characterized by the following meteorological conditions:

5.2.1 Clear cool nights with wind speeds of two miles per hour or less, and

5.2.2 Onshore sea breezes with wind speeds ten miles per hour or less.

No sampling will be conducted if the following adverse meteorological conditions exist:

5.2.3 Rain,

5.2.4 Average wind speeds greater than 15 miles per hour for any 30-minute period, or

5.2.5 Instantaneous wind speeds greater than 25 miles per hour.

Continuously recorded on-site wind speed and direction measurements required in paragraph (d)(9) of Rule 1150.1 will characterize the micrometeorology of the site and serve to verify that the meteorological criteria have been met during sampling.

5.3 Ambient Air Sampler Equipment Description

An ambient air sampling unit consists of a 10-liter Tedlar bag, a DC-operated pump, stainless steel capillary tubing to control the sample rate to the bag, a bypass valve to control the sample flow rate (and minimize back pressure on the pump), a Rotameter for flow indication to aid in setting the flow, a 24-hour clock timer to shut off the sampler at the end of the 24-hour sampling period, and associated tubing and connections (made of stainless steel, Teflon, or borosilicate glass to minimize contamination and reactivity). The physical layout of the sampler is shown in Figure 5.

An alternate ambient air sampler may be used, provided that the landfill owner or operator can show an equivalency with the sampler specifications in Section 5.3 and

shown in Figure 5. All alternatives shall be submitted as specified in subdivision (i) of Rule 1150.1.

5.4 Ambient Air Sampler Equipment Specifications

The equipment used when conducting air samples at any landfill property boundary shall meet the following specifications:

5.4.1 Power: one 12V DC marine battery. The marine battery provides 12V DC to the pump and the clock.

5.4.2 Pump: one 12V DC pump. The diaphragm shall be made of non-lubricated Viton rubber. The maximum pump unloaded flow rate shall be 4.5 liters per minute.

5.4.3 Bag: One 10-liter Tedlar bag with a valve. The Tedlar bag shall be enclosed in a LIGHT-SEALED CONTAINER. The valve is a push-pull type constructed of aluminum and stainless steel, with a Viton or Buna-N (butadiene acrylonitrile co-polymer) o-ring seal.

5.4.4 Rotameter - made of borosilicate glass and has a flow range of 3-to-50 cubic centimeters per minute. The scale is in millimeters (mm) with major graduations (labeled) every 5 mm and minor graduations every 1 mm.

5.4.5 Air flow control orifice: 316 stainless steel capillary tubing.

5.4.6 Bypass valve.

5.4.7 Fittings, tubing, and connectors -- 315 stainless steel or Teflon.

5.4.8 Clock timer with an accuracy of better than 1%.

5.5 Ambient Air Sample Analytical Procedures

Samples collected must be analyzed no later than 72 hours after collection for TOC using U.S. EPA Method 25, 40 CFR, Part 60, Appendix A analysis or a portable FID that meets the requirements in Section 3.2 and for the TAC specified in Table 1 and upon written request, Table II, using U.S. EPA Compendium Method TO-14.

5.6 Chain of Custody (Required for samples sent to the lab)

A custody sheet shall accompany the bag samples. Each time a bag changes hands, it shall be logged on the custody sheet with the time of custody transfer recorded. Laboratory personnel shall record the condition of the sample (full, three-fourths full, one-half full, one-fourth full, or empty). An example of a custody sheet is shown in Figure 4.

5.7 Recording the Results

5.7.1 Record the volume concentration of TOC measured as methane and the volume concentration of TAC for each sample on a quality control sheet as shown in Figure 3. Include a topographic map drawn to scale with the location of both the upwind and downwind samplers and the gas collection and control system clearly marked and identified.

5.7.2 Record the wind speed and direction during the 24-hour sampling period using the wind speed and direction monitoring system required in paragraph (d)(9) of Rule 1150.1.

5.7.3 Maintain and submit the results as specified in subdivision (f) of Rule 1150.1.

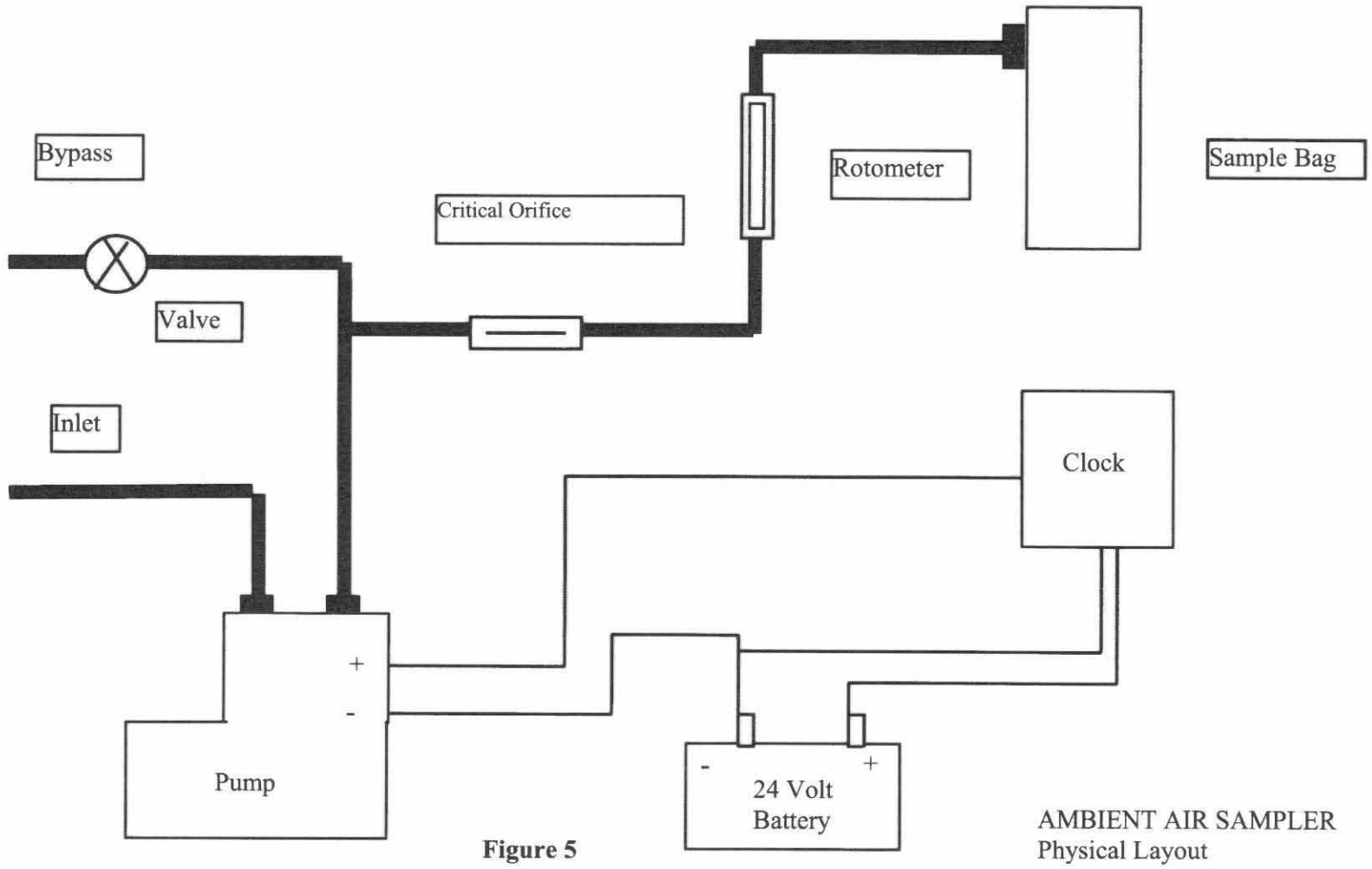


Figure 5

AMBIENT AIR SAMPLER
Physical Layout