GRCC89

KWB&A
ENVIRONMENTAL CONSULTANTS

January 17, 1989

Robert L. McClenahan Jr.
Environmental Coordinator
Giant Industries, Inc.
Route 3, Box 7
Gallup, NM 87301

Dear Bob:

Enclosed is the annotated outline of the steps associated with the soils investigation and lysimeter/tensiometer installation we discussed. At your request, we are submitting this outline in final format along with the associated cost estimates (Table 1). This document is intended to support the planned actions as they are presented to the EID.

Following your review of the enclosed, please contact us so that we can set up a time schedule for the work involved. Any comments you have concerning the enclosed information can be addressed by Sid or me.

Again, we would like to express our appreciation for having the opportunity to assist you in addressing these concerns and look forward to working with you on this project.

Respectfully,

Stephen M. Swetish
Stephen M. Swetish
Director of Field Services

SMS:ljc
Enclosures

Table 1. Cost Estimates for Soils Investigation and Lysimeter Installation(1)

Task Description		Cost Estimate
1.0 Detailed Soils Description		450
2.0 In-situ Hydraulic Conductivity(2)		3,250
3.0 Soil Moisture		250
4.0 Moisture Holding Capacity		380
5.0 Soil Texture		250
6.0 Water Balance		700
7.0 Lysimeter Installation(3)		850
8.0 Data Interpretation/Report Preparation		4,000
	Subtotal	10,130
DIRECT COSTS		
Travel and Per Diem		2,250
Analytical		960
Equipment Use		1,450
Shipping		350
Communication		500
Agency Liason		500
	Subtotal	6,010
TOTAL COSTS		16,140

(1) Costs associated with the installation of tensiometers is not included; if it is determined they are needed, the proposal will be ammended

(2) Estimate for 4 tests; 2 tests at 2 locations

(3) Estimate for the installation of 2 glass brick lysimeters

SOILS INVESTIGATION FOR THE GIANT REFINERY GALLUP, NEW MEXICO

prepared for

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by

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January, 1989

1.0 INTRODUCTION

The following text presents the technical approach to be used in determining the characteristics of local soils at the Giant Refinery land treatment unit and the suitability of using tensiometers to schedule sampling events for unsaturated zone monitoring. Information and a discussion on the installation of glass brick lysimeters to augment and/or replace the current soil-pore liquid sampling system installed at the site are provided.

The intent of the investigation is two-fold. First, physical parameters of the site, which include soil texture, soil hydraulic conductivity, soil moisture, and local water balance will be examined and defined. In conjunction with the first task, glass brick lysimeters will be installed which will serve as an interim monitoring system during the investigation. Second, based on the data generated, the suitability of using tensiometers or porous cup lysimeters will be determined. If the information generated from these two tasks is insufficient to completely define site characteristics, a third task, computer modeling, can be added.

1.1 PHASE I: SITE INVESTIGATION AND LYSIMETER INSTALLATION

As stated above, the first step of the evaluation process will be to collect site-specific data on the local soils which can be used to determine the suitability of using tensiometers to time the sampling of unsaturated zone monitoring equipment. Further, these data will be used to select the type of unsaturated zone monitoring equipment best suited to the local environment.

Specifically, the types of data which will be collected include a detailed soil description, *in situ* hydraulic conductivity, ambient soil moisture through the soil profile, moisture-holding capacity of the soil, and soil texture. Additionally, the local water balance will be examined and compared with the soils data.

1.1.1 Detailed Soil Description

The most fundamental task of the field investigation will be to describe the profile of the soils found at the land treatment site. To do this, pits will be excavated on the land treatment field and at a background location. A certified soil scientist will examine the soil profile and record a detailed description of the various horizons.

1.1.2 In situ Hydraulic Conductivity

To measure hydraulic conductivity, a double-ring infiltrometer will be set up at the site. Hydraulic conductivities of surface soils and soils deeper in the profile will be measured at locations in the land treatment field, as well as at a background location. Interpretation of the data will yield saturated hydraulic conductivities for the various horizons of the soil profile.

1.1.3 Ambient Soil Moisture

In conjunction with the soil pit descriptions, soil samples will be collected and analyzed for soil moisture. The samples will be collected on regular intervals from the sidewall of the pits used in the soil profile descriptions. Data from these samples will illustrate changes in soil moisture as a function of depth and will define the native moisture levels under which the tensiometers and the lysimeters will be operating.

1.1.4 Moisture-Holding Capacity

Moisture-holding capacity of the soil will be measured using a tension table and representative soil samples. The purpose of defining moisture-holding capacity using a tension table is to generate a site-specific soil desorption curve which illustrates soil moisture potential vs. moisture content. Once generated, this curve will graphically define the amount of moisture (percent) which must be present before a soil-pore liquid can be collected using a porous cup and will determine whether or not tensiometers will function properly.

1.1.5 Soil Texture

As part of the soil pit description, samples will be collected to numerically define the texture of the local soils. Samples will be collected from the various horizons of the soil profile and each will be analyzed.

1.1.6 Water Balance

To augment the soils data gathered from the site, the local water balance will be examined to assess the potential for moisture redistribution. Specifically, moisture-holding capacity of the soil will be compared with the amount of precipitation received.

1.1.7 Lysimeter Installation

Currently, porous cup lysimeters are installed at the land treatment field; to date, no samples have been collected. Part of the field investigation will be to assess whether the soils at the site are suited for soil-pore liquid sample collection using porous cup lysimeters. However, it is understood that until this assessment can be made, it will be necessary to install an unsaturated zone monitoring system which will collect soil-pore liquid if it is present. Therefore, during the field investigation, a minimum of two glass brick lysimeters will be installed. These lysimeters will be used as an interim system until a final assessment is made on the local soil properties. If it is determined that they represent the best monitoring system, then a permit modification may be sought to have the lysimeters replace the porous cups.

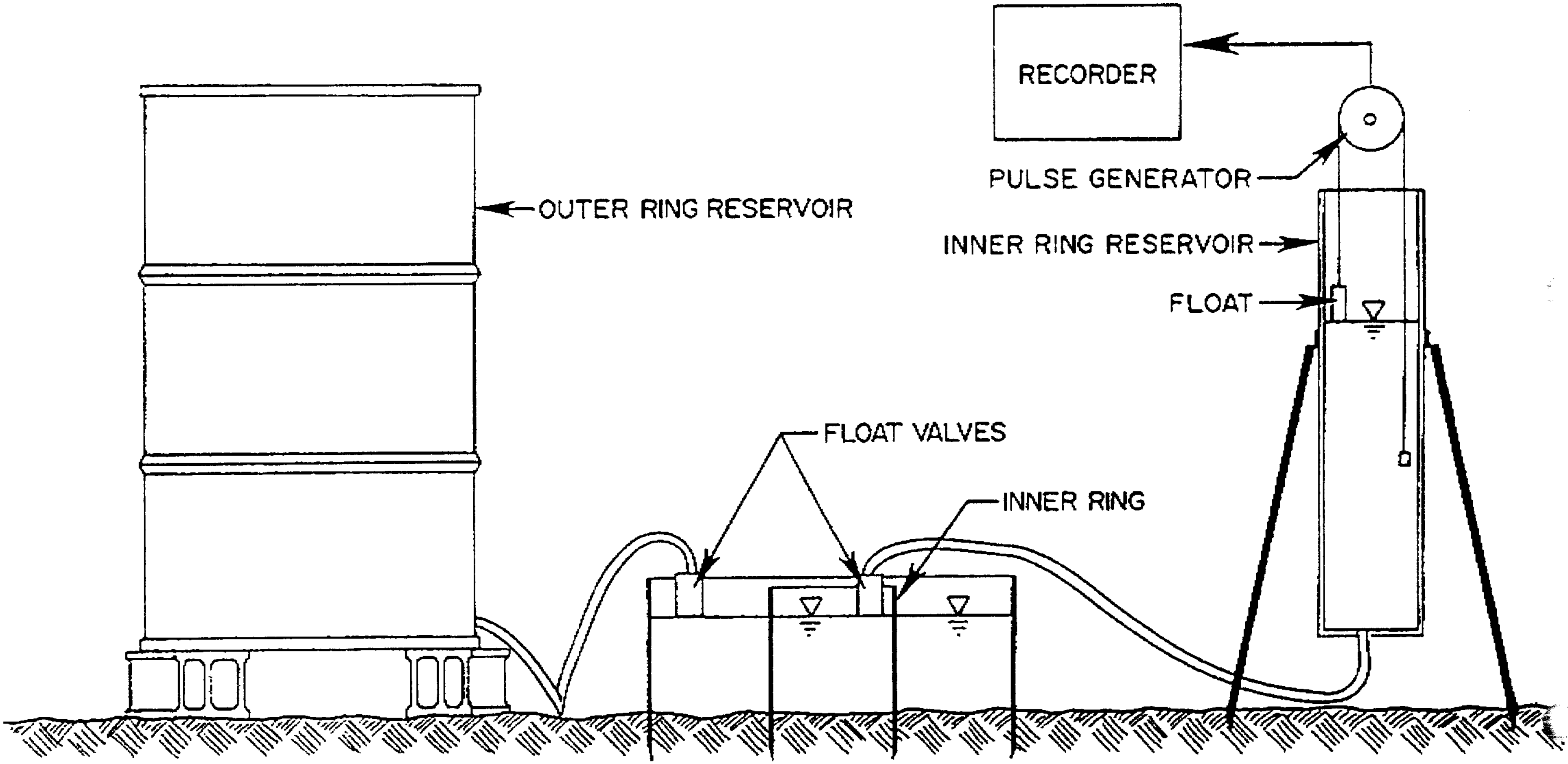
The main difference between a porous cup lysimeter and a glass brick lysimeter is the type of soil-pore liquid collected by each. The porous cup lysimeter operates only when a vacuum is applied. Further, a soil-pore liquid sample will only be collected if sufficient moisture is present. In other words, the vacuum applied by the porous cup lysimeters must exceed the capacity of the soil to retain the moisture which is present. Typically, this means that moisture must be present and the tension "applied" to the moisture by the soil must be between 0 and -2/3 bar. If the tension of the soil exceeds -2/3 bar, the porous cup will not be able to extract a sample.

The glass brick operates under the influence of gravity; no vacuum is required. Once the brick is installed in the profile, any moisture moving under the influence of gravity will be intercepted and stored. This is a passive system and does not require that sampling be timed with precipitation events. Moreover, once a sample is collected, it is not possible for the soil to re-absorb the moisture, which could occur if the vacuum was lost from a porous cup lysimeter.

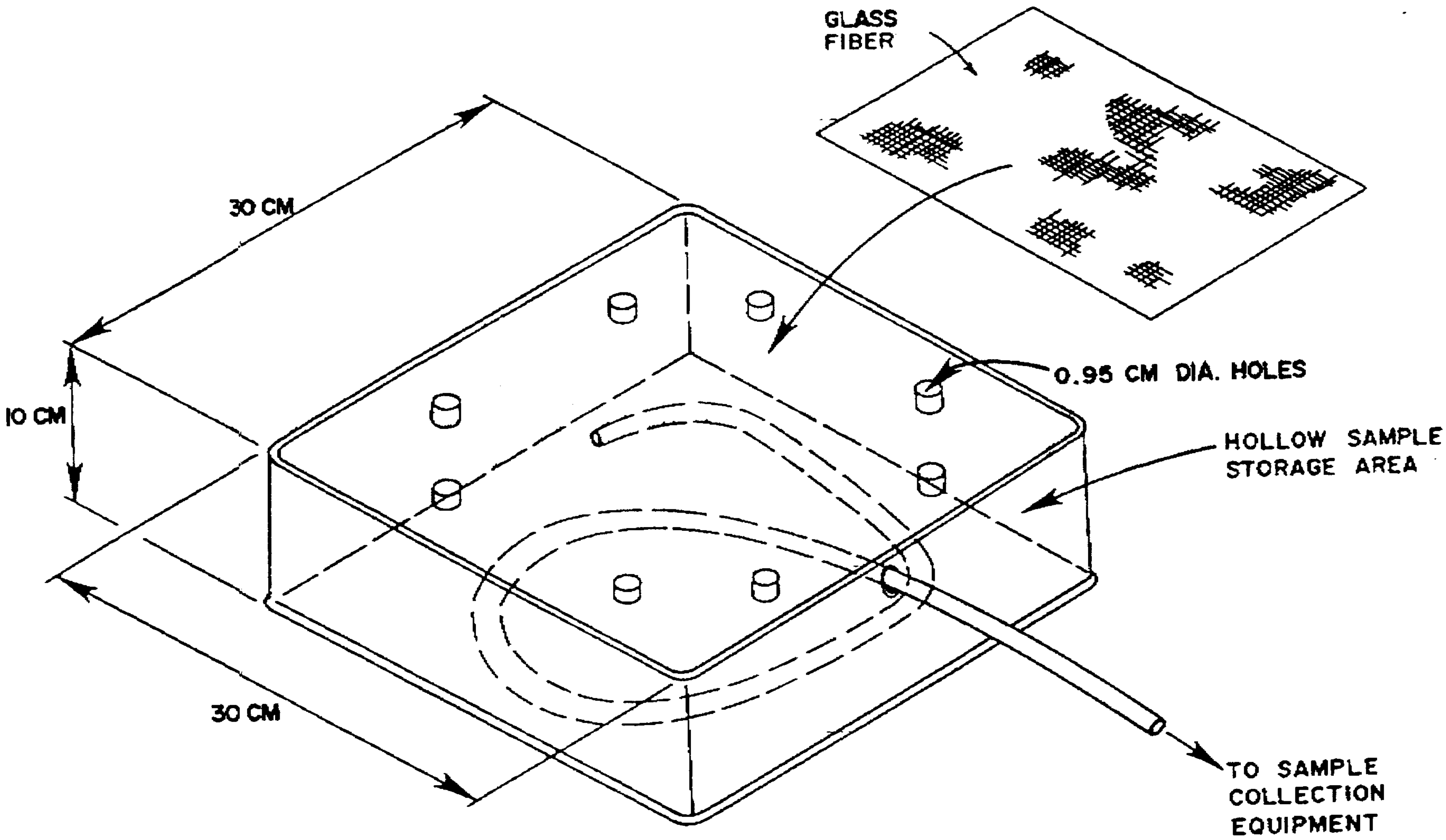
1.2 PHASE II: Report Preparation

Once all of the data have been collected and analyzed, a report will be prepared which defines the most suitable unsaturated zone soil-pore liquid sample system. The goal of this effort will be to select specific types of equipment to be used, and support the selection using site-specific data. Furthermore, if a system is deemed unsuitable, then justification will be offered.

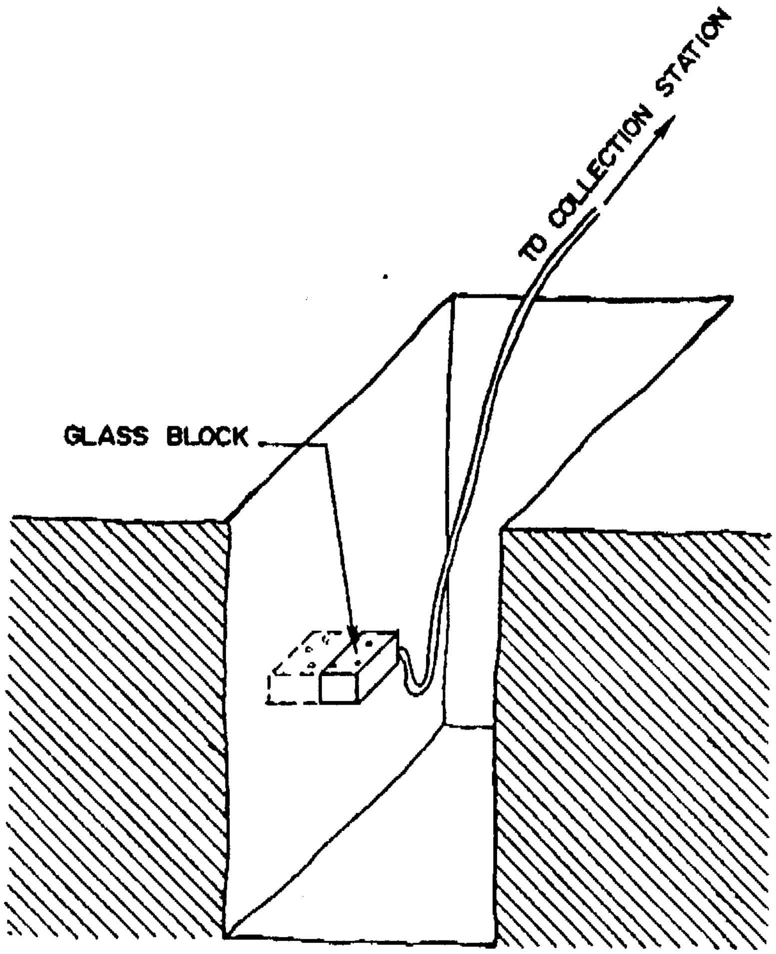
NOTE: Attached are Figures which illustrate the double-ring infiltrometer to be used, the glass brick lysimeters which will be installed, and the method which will be used to install them. Also attached is the protocol used to sample glass brick lysimeters.



MODIFIED DOUBLE-RING INFILTROMETER WITH A LEVEL RECORDER
(BROWN, 1985).



GLASS BRICK SOIL-PORE-LIQUID SAMPLER (PAN TYPE)



. INSTALLATION OF GLASS BLOCK SOIL-PORE-
LIQUID SAMPLER (TRENCH AND TUNNEL METHOD)

SOP No. 5.3

STANDARD OPERATING PROCEDURE FOR SAMPLE COLLECTION FROM GLASS BRICK LYSIMETERS

Equipment:

- Lysimeter pressure/vacuum pump
- Side arm flask with connecting hoses (see Figure 5.3.1)
- Rubber stopper with connecting hoses
- Filter funnel and filter paper (0.45 μ for metals)
- Sample collection/storage bottles (containers must have suitable preservatives)
- Distilled water and rinse bottle

Procedure:

1) Uncover sample station and assemble vacuum system as shown in Figure 5.3.1. Connect tubing from rubber stopper to glass brick port in the lysimeter sample station.

2) Apply vacuum as needed to pull sample from glass brick.

3) Allow the flask to fill to 2/3 of its capacity. CAUTION - Do not allow water to be sucked into the pump. Fill sample bottle(s) with liquid from flask so there is zero headspace in all sample containers.

4) Continue to pump the system to remove all water from the lysimeter (up to one brick volume).

5) Record the total volume removed in steps 3 and 4.

If a sample for metal analysis is required the following steps should be taken:

6) Rinse side arm flask and filter funnel with distilled water.

7) Apply filter paper to funnel and dampen with distilled water.

8) While applying a vacuum, pour sample into filter funnel. After a sufficient amount of sample has been filtered, remove filter funnel while still under vacuum. Pour sample into container that has been spiked with nitric acid.

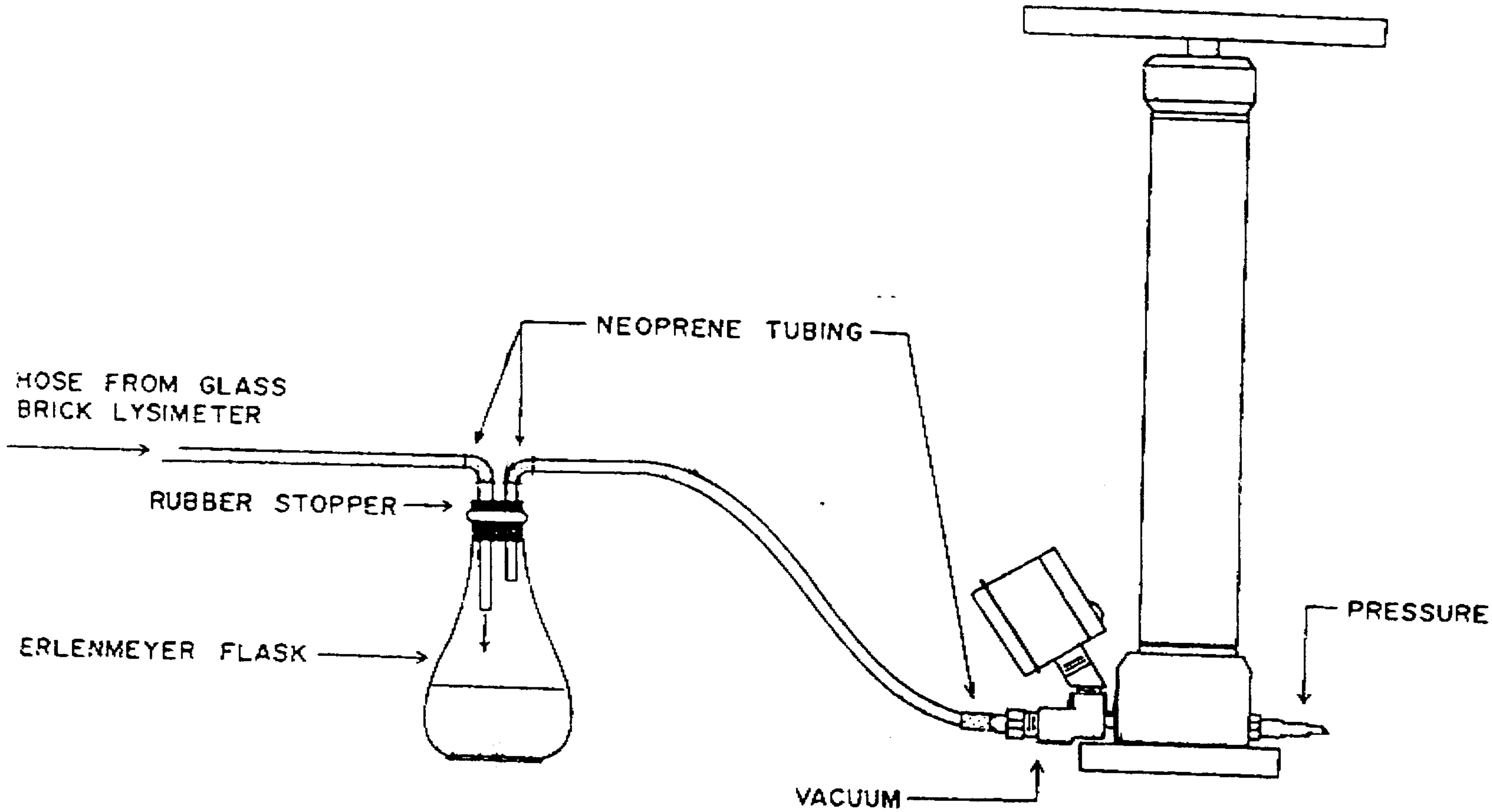
Quality Control:

Prior to sampling, all equipment must be thoroughly cleaned using reagent grade hexane, rinsed with distilled water and allowed to dry. Background lysimeters should be sampled first.

Promptly store all samples in ice-packed coolers and ship to laboratory using overnight courier.

Laboratory Director Date

QA/QC Officer Date



SAMPLE COLLECTION FROM GLASS BRICK LYSIMETER