

SRCC 92

ARC 10/1/92



Route 3, Box 7  
Gallup, New Mexico  
87301

505  
722-3833

September 23, 1992

Steve Alexander  
Water Resource Specialist  
Hazardous & Radioactive Materials Bureau  
New Mexico Environment Department  
P.O. Box 26110  
Santa Fe, New Mexico 87502



Re: Lysimeter/Tensiometer Function

Dear Mr. Alexander:

During the night of September 20, 1992, Giant Refining Company - Ciniza received .42" of rainfall precipitation.

It was decided to (once again) try to recover liquid from the lysimeter as per instructions in Module III, H.3.D. of the Part B Permit. No liquid was present in any of the lysimeter locations. A vacuum of 49.50 centibars was pumped at each lysimeter porous cup. All lysimeters held the initial vacuum and it was determined there were no leaks in the system. The vacuum's were left for 24 hours and rechecked. Four of the six lysimeter porous cups retained some vacuum. (See table below.)

<u>Lysimeter</u>	<u>9-21-92 Beginning Vacuum (Centibars)</u>	<u>9-22-92 End Vacuum (Centibars)</u>
#1 pc1	50	19
pc2	49	19
#2 pc1	50	17
pc2	51	23
#3 pc	49	0
#4 pc	51	0

Once again, an attempt was made to recover liquid from the lysimeters and again, no liquid was recovered. Tensiometers showed uniformly lower tensions, as follows:

#1 - 42, #2 - 32, #3 - 54, #4 - 28

In preparing this report to satisfy the referenced section of the Part B Permit, three important items were discovered that add a new dimension to this situation. Two items were narrative discussions from K.W. Brown and Associates in a report to Giant in September, 1989. The third item was a letter from Kirkland L. Jones, Deputy Director, NMEID, dated June 7, 1990 and addressed to John J. Stokes of Giant.

As stated in Mr. Jones' letter, Giant will comply by continuing to read the tensiometers weekly during the weekly inspections. This will satisfy the requirements of Mr. Jones' letter.

Giant submits this information to clarify the operation of the lysimeter/tensiometer units of the land treatment unit.

Sincerely,



Lynn Shelton  
Environmental Assistant  
Giant Refining Company - Ciniza

TLS:sp

cc w/attachments: Kim Bullerdick, Corporate Counsel  
Giant Industries Arizona, Inc.

### 5.3 DISCUSSION

Field tensiometers such as the ones installed at the Giant Refining LTU measure the tension with which water is held by soils. Their effectiveness is based on the principle that water in the tensiometer equilibrates through the porous cup with the surrounding soil water. Tensiometers are designed for use in irrigation situations where moisture is kept at or near field capacity (0.33 bar tension). The useful range of tensiometers is between 0 and 0.8 bars of tension (Brady, 1974). Moisture tensions of the soil at all tensiometer installation locations were in excess of 15 bars (Table 5-1). Therefore, it is unlikely that these tensiometers will ever function properly. At tensions of greater than 0.8 bars, tensiometers cease to function due to the breakage of the water column and/or passage of air into the tensiometer, thus releasing the vacuum. Once the vacuum within a tensiometer has been broken, the water is free to flow into soil with no resistance. At this point, the column of water in the tensiometer is actually applying head pressure to the porous tip driving water out of the tensiometer and into the surrounding soil. Saturated soil conditions can occur around the tensiometer due to excess water being induced by the tensiometer, thus giving very low (incorrect) tension readings once the unit has been reset.

SEP, 1989

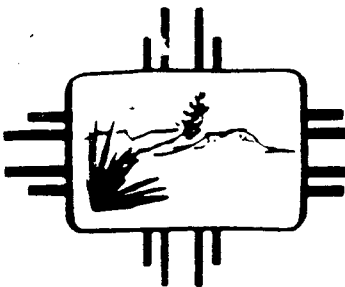
K.W. BROWN + ASSC.

### 6.3 DISCUSSION

Prior to the lysimeter installation conducted during this study, porous cup lysimeters were installed at the Giant Refining LTU in conjunction with the facility Land Treatment Demonstration (LTD). To date, attempts at sample collection from these soil-pore liquid samplers have failed. Soil moisture conditions encountered during the soils investigation and equipment installation, were too low for porous cups or glass brick lysimeters to collect samples. At the depths that the lysimeters were installed, moisture concentrations ranged from 16.79 to 12.59 percent (Table 6-1). The associated moisture tensions determined at these moisture levels were all greater than 15 bars. Since the effective working range for lysimeters is between 0 and 0.75 bars, soil moisture held at tensions greater than 0.75 bars is not available for sampling.

Porous cup lysimeters and glass brick lysimeters differ in the method of collecting a soil-pore liquid sample. The porous cup lysimeter operates only when a vacuum is applied. Soil-pore liquid will be collected only if sufficient moisture is present. A soil-pore liquid sample can only be collected if the vacuum applied to the porous cup lysimeter exceeds the capacity of the soil to retain the moisture which is present. **Typically, this means that soil moisture tension must be less than 0.75 bars. If the tension at which the soil moisture is held exceeds 0.75 bars, the porous cup will be ineffective in retrieving a sample.**

Glass brick lysimeters collect soil-pore liquid moving under the influence of gravity; no vacuum is required. Once the glass brick is installed in the soil profile, any moisture moving under the influence of gravity will be intercepted and stored. This is a passive system that is continuously available to collect sample, thus being available for any flux of soil-pore liquid that passes through the soil profile. Moreover, once a



New Mexico Health and Environment Department

June 7, 1990

GARREY CARRUTHERS  
Governor

DENNIS BOYD  
Secretary

MICHAEL J. BURKHART  
Deputy Secretary

RICHARD MITZELFELT  
Director

Mr. John Stokes  
Refinery Manager  
Giant Refining Company  
Route 3, Box 7  
Gallup, New Mexico 87301

Re: Letter of Clarification  
Operating Permit NMD000333211-2

Dear Mr. Stokes:

The Hazardous Waste Facility Permit (No. NMD000333211-2) issued to Giant Refining Company ("Giant") requires Giant to collect soil-pore liquid samples from your lysimeters quarterly "if moisture is present" (Module III.H.3.a). However, Giant has demonstrated that the clays in and under the unit are of such low conductivity that it is unlikely that surface applied water will ever pass through the treatment zone.

Thus, Giant shall read its tensiometers in the land treatment unit seven (7) to fourteen (14) days after a waste application or after the end of any precipitation event which exceeds 0.5 inch (Module III.H.3.d). EID suggests that Giant maintain a rain gauge at the landfarm and record rainfall amounts. Should either tensiometer indicate water within the range of function, generally a soil moisture tension of less than 100 centibars, Giant should attempt to collect samples with its four lysimeters. Giant must continue to record all tensiometer readings on the inspection sheets as indicated in the Permit.

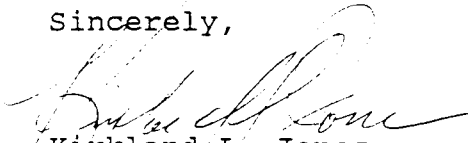
The tensiometers should be maintained as follows:

1. The liquid level in the tensiometer should be maintained with water only. No algacides should be used. Giant should keep its tensiometers covered with a light-proof box to prevent algal growth.
2. The tensiometers should be removed annually by about December 1st and reinstalled after about March 1st.
3. Prior to reinstallation each year, the tensiometers should be recalibrated according to the manufacturer's instruction.
4. Giant should record all tensiometer maintenance in the land treatment logbook.

Mr. John Stokes  
June 7, 1990  
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EID hopes this clarification if useful. If you have any questions regarding this matter, please contact Dr. Bruce Swanton of my staff at (505) 827-2935.

Sincerely,



Kirkland L. Jones  
Deputy Director

cc: Bruce Swanton  
Tracy Hughes  
Kim Bullerdick  
Claud Rosendale