

THE EFFECTS OF LEACHATE ON THE HYDRAULIC CONDUCTIVITY OF BENTOMAT®

Compatibility testing was performed to determine the effects of solid waste landfill leachate on the permeability of Bentomat over a prescribed time period. Testing was performed in accordance with United States Environmental Protection Agency (USEPA) Method 9100, as provided in SW846.

Hydration of specimens was conducted using de-aired tap water for approximately 48 hours. Saturation was also conducted using de-aired tap water until a minimum B value of 0.95 was achieved. Following hydration and saturation, baseline hydraulic conductivity was performed using water. After the baseline hydraulic conductivity was established, the permeant was switched to leachate. Testing continued for an additional 30 days to allow a sufficient number of pore volumes to permeate the specimen to establish a hydraulic conductivity with leachate.

Results show that the hydraulic conductivity of Bentomat was unaffected when permeated with this leachate.

FINAL REPORT

LABORATORY TESTING OF BENTOMAT

Prepared for

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2. TEST PROCEDURES

2.1 Task 1: EPA 9100 Compatibility Testing

Compatibility testing on the Bentomat was performed to measure the effect of leachate on the hydraulic conductivity of the mat product over a prescribed period of time. Testing was performed in accordance with the United States Environmental Protection Agency (USEPA) Method 9100 SW-846, Revision 1, 1987. The test conditions for Task 1 were as follows:

- Testing was conducted using flexible-wall triaxial permeameters, as shown in Photograph 2.1-1.
- Three replicate samples of the Bentomat were tested.
- Each sample was trimmed to a diameter of 2.8 in. (70 mm) and assembled in the following test configuration (from bottom to top): porous stone/filter paper/sand layer/Bentomat/sand layer/filter paper/porous stone.
- Hydration and saturation of the samples using de-aired tap water was conducted at an effective stress of 2.0 psi (14 kPa) for a time period of approximately 48 hours. Saturation was defined as a minimum Skempton's B-parameter of 0.95.
- Consolidation of the saturated test samples was performed at an effective stress of 5.0 psi (35 kPa). Pore-water displacement was monitored until primary consolidation was complete.
- To determine the baseline hydraulic conductivity, the samples were permeated using de-aired tap water. The average hydraulic gradient used for baseline permeation was approximately 50. For this testing program, initial hydration and saturation was

conducted using de-aired tap water. Hydration with leachate may or may not yield different results.

- After establishing the baseline hydraulic conductivity, the permeant was switched to the leachate. Because of the slow permeation rates and the objective to increase the volume of leachate in contact with the Bentomat, the sand layer was replaced on all samples by an Amoco 4516 geotextile after approximately three weeks of testing. Permeation of the samples with the leachate continued for an additional 30 days. The hydraulic conductivity of the sample was monitored and reported daily during this period.
- Permeation of the test specimens with the leachate was initially conducted at an average hydraulic gradient of approximately 50. In order to increase flow through the Bentomat during the prescribed time period, the average hydraulic gradient was increased to approximately 160.
- Because the final hydrated thickness of the Bentomat is unknown until the completion of testing and for comparison of the test data, the hydraulic conductivity was calculated using 0.4 in. (1.0 cm) for the Bentomat. These values were used in all calculations of hydraulic conductivity in Tasks 1 through 7.

TABLE 3.1-1

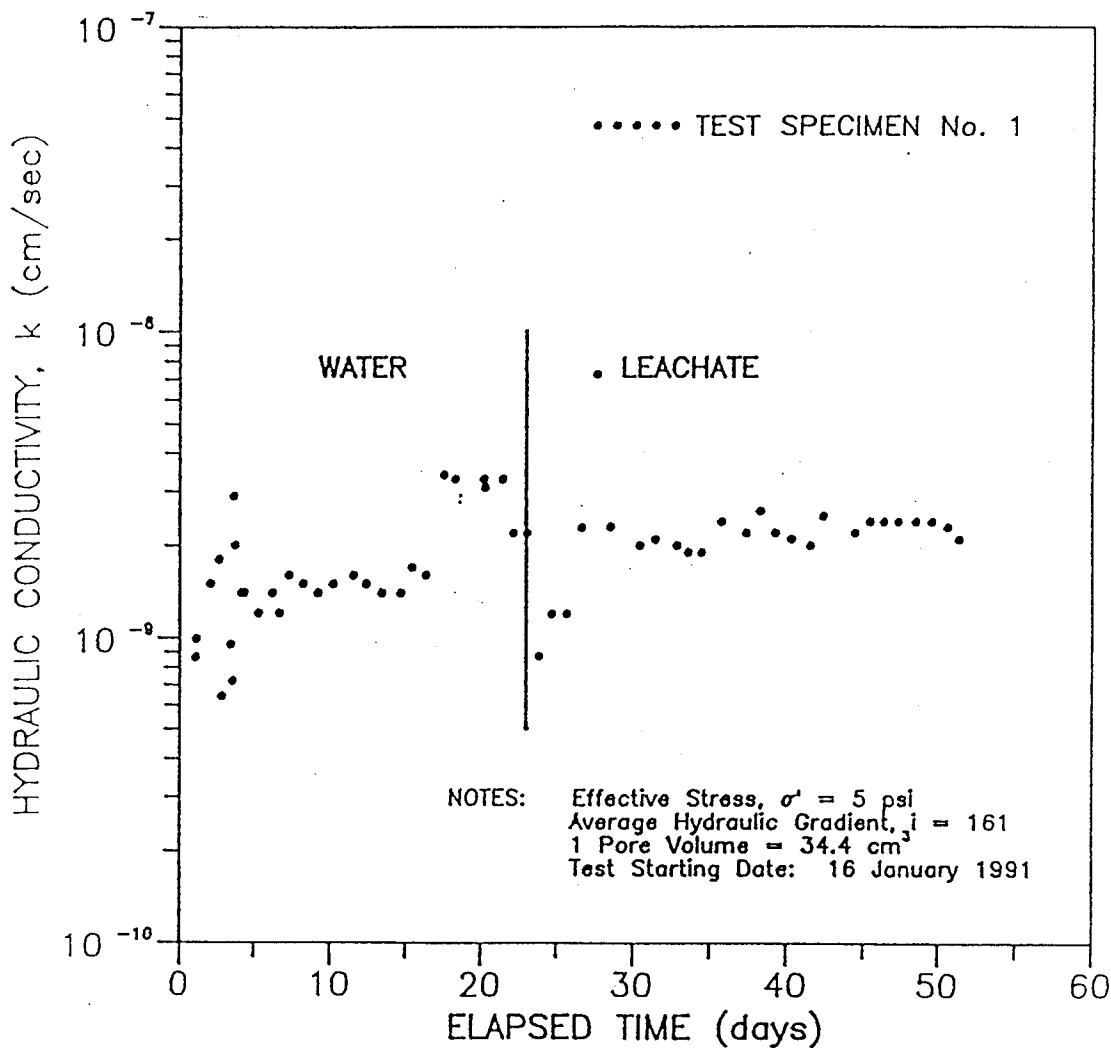
**EPA 9100 COMPATIBILITY TESTING
BENTOMAT SPECIMEN CONDITIONS**

American Colloid Company

Parameters	Specimen No. 1		Specimen No. 2		Specimen No. 3	
	Initial	Final	Initial	Final	Initial	Final
Thickness, in.	0.29	0.39	0.33	0.43	0.28	0.36
Diameter, in.	3.01	3.14	3.19	3.30	3.11	3.18
¹ Dry Mass, g	30.8	24.4	38.3	31.4	34.4	26.1
² Mass/Area, lb/ft ²	1.37	1.00	1.54	1.16	1.44	1.05
Water Content, %	18.8	170.1	15.7	169.4	10.9	167.4

- Notes: ¹ The dry mass includes the dry weight of the bentonite and the geotextiles bonded to the specimen.
- ² The mass/area is determined using the dry mass of the material normalized with respect to the cross-sectional area of the test specimen before drying.

EPA 9100 COMPATIBILITY TESTING BENTOMAT SAMPLE #EL005



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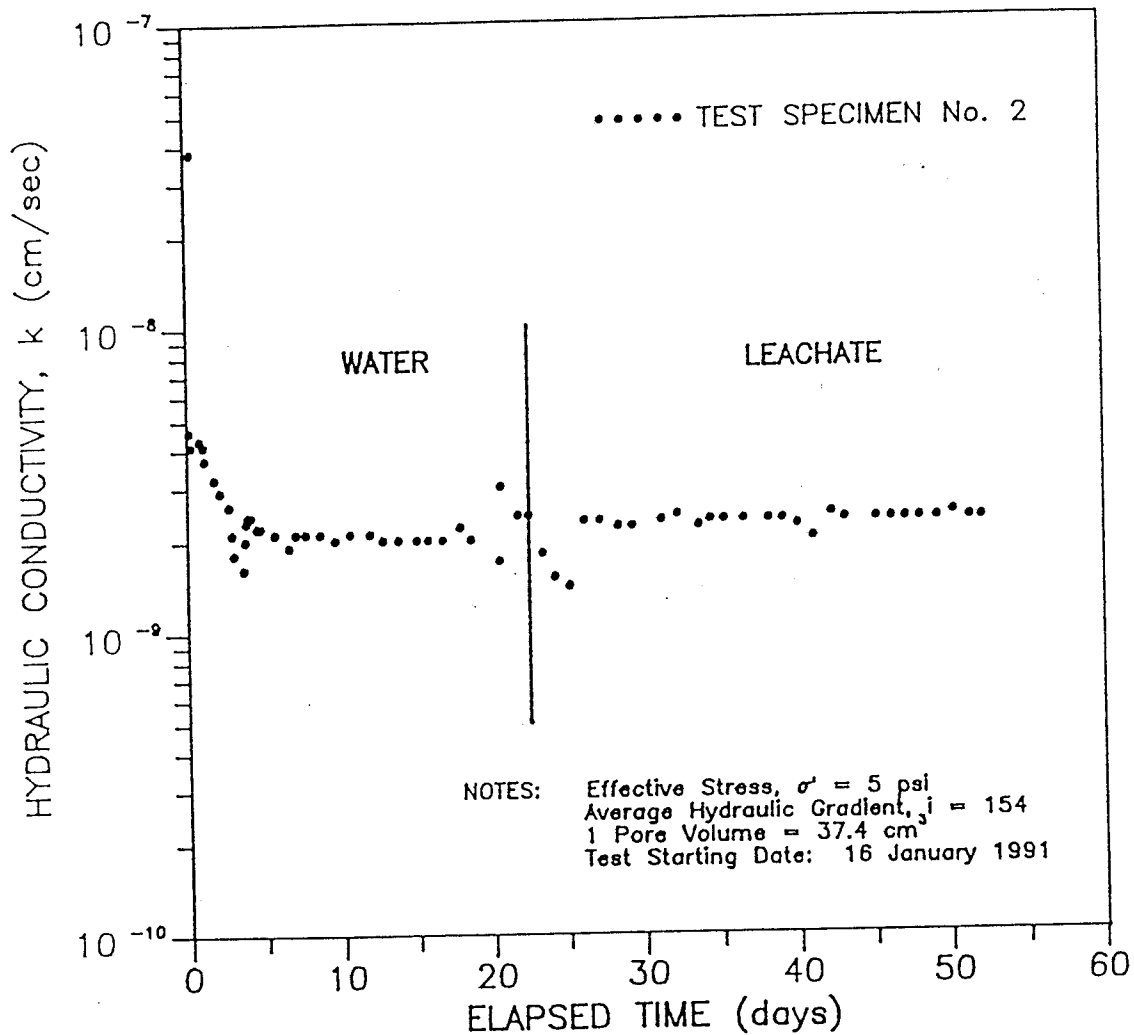
FIGURE NO. 3.1-1

PROJECT NO. GL1614

DOCUMENT NO. GEL91066

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EPA 9100 COMPATIBILITY TESTING BENTOMAT SAMPLE #ELO05

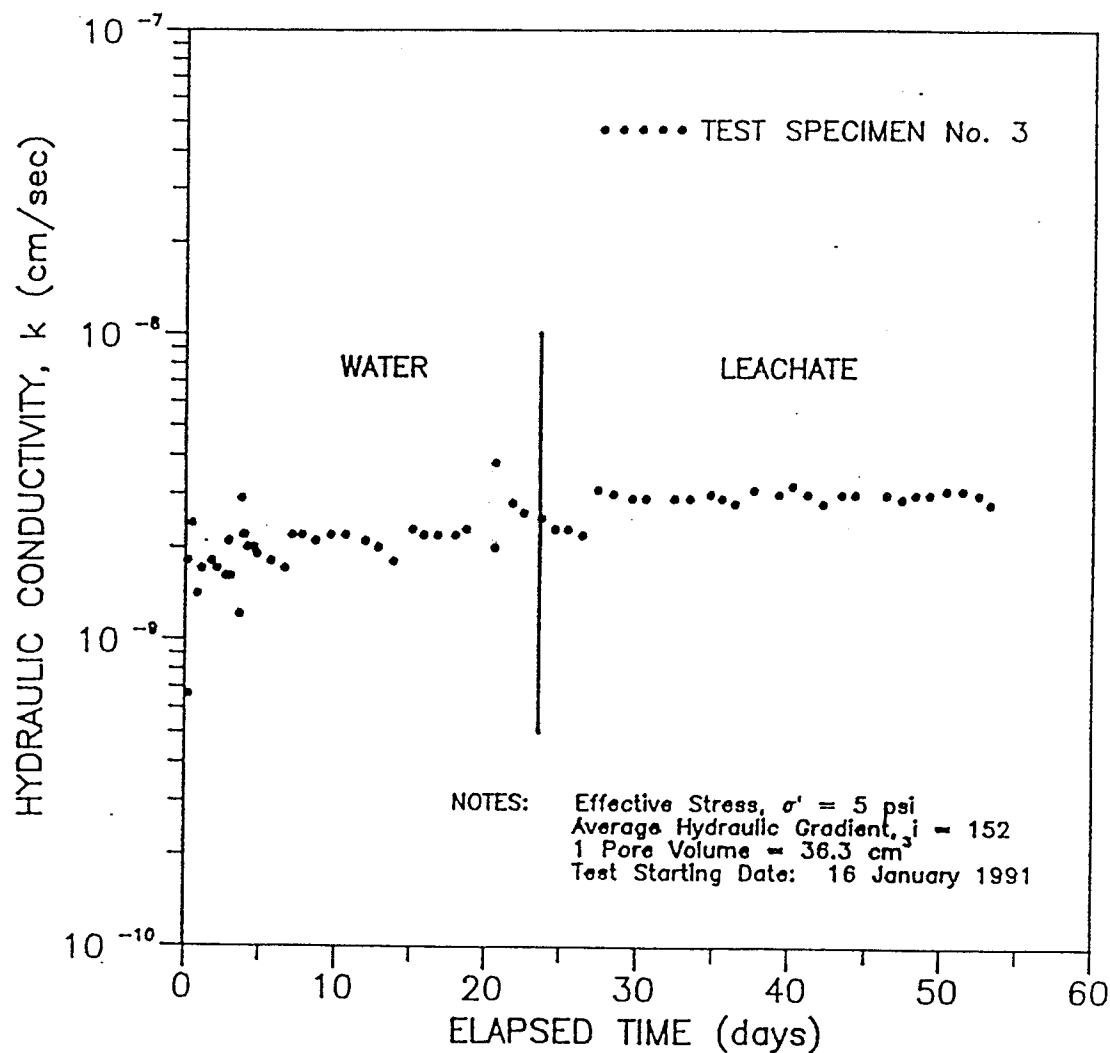


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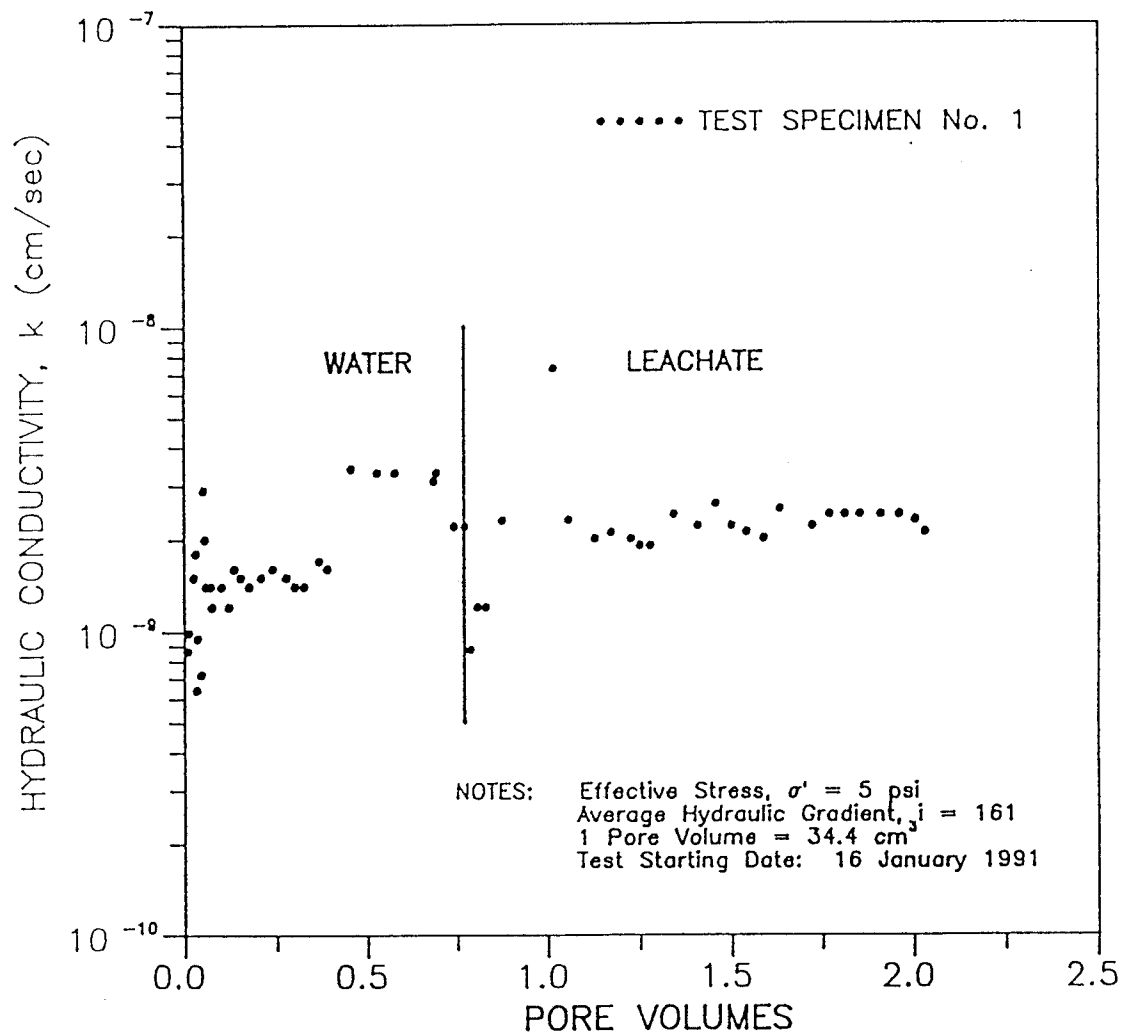
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FIGURE NO.	3.1-2
PROJECT NO.	GL1614
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EPA 9100 COMPATIBILITY TESTING BENTOMAT SAMPLE #EL005



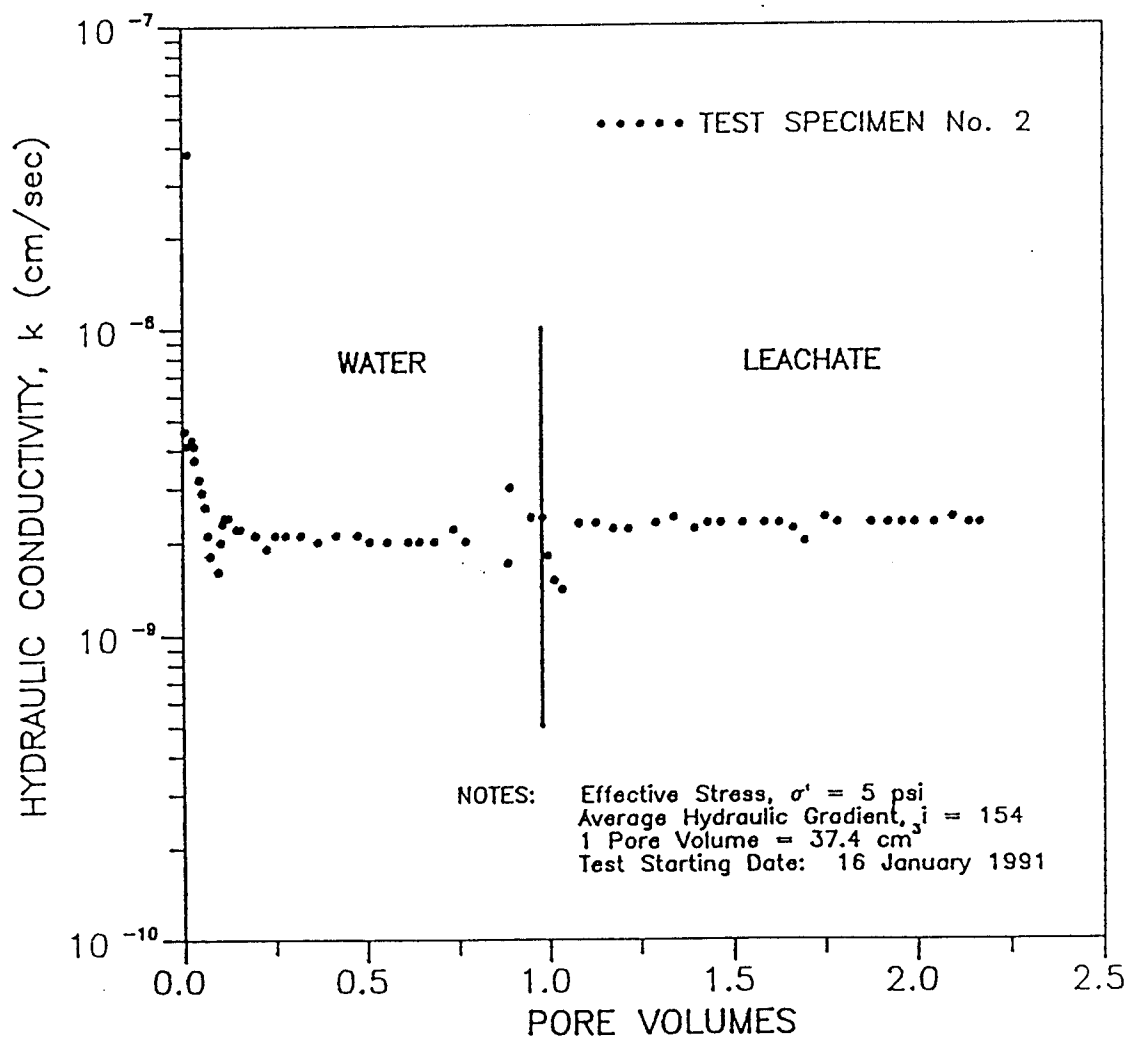
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FIGURE NO.	3.1-4
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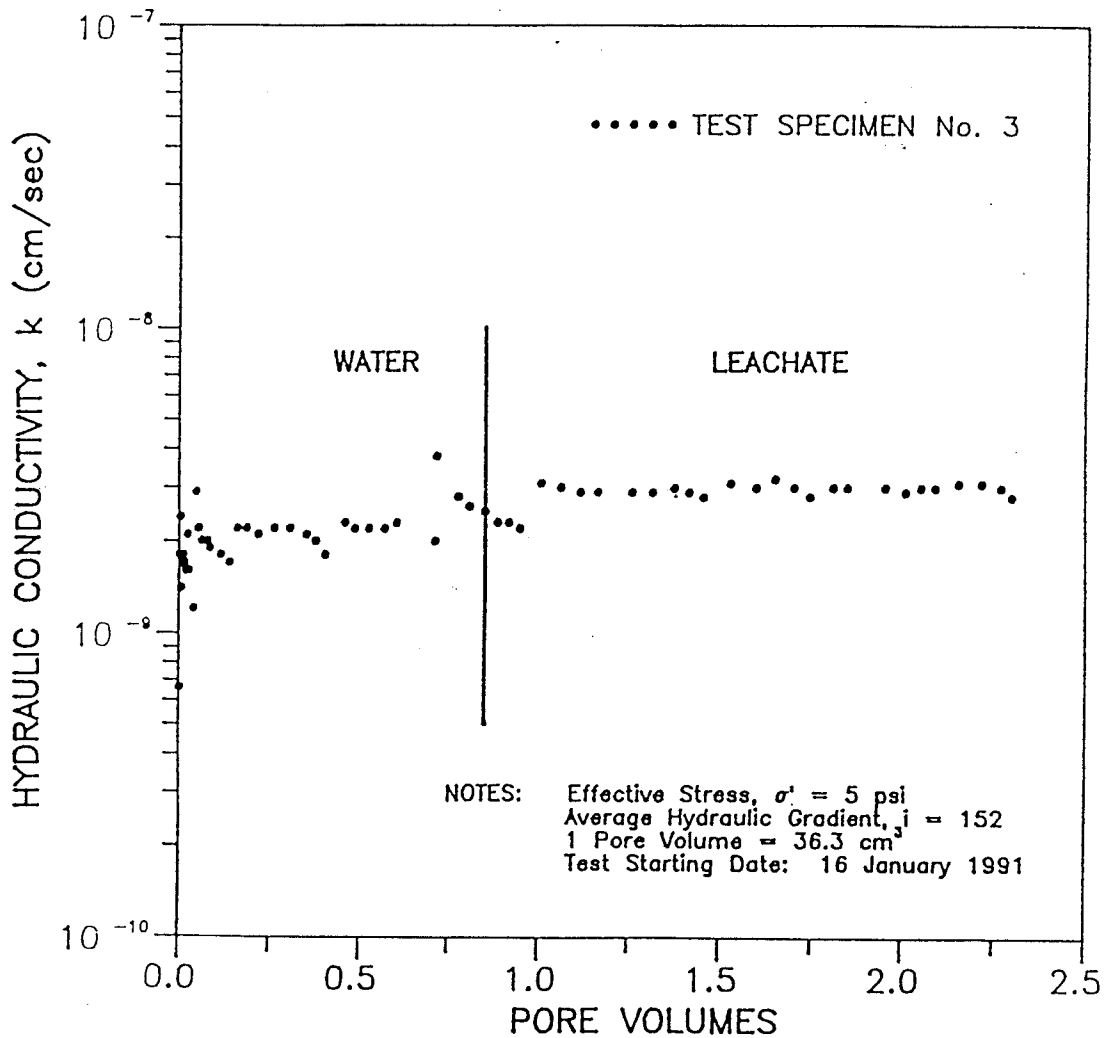
EPA 9100 COMPATIBILITY TESTING BENTOMAT SAMPLE #EL005



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FIGURE NO.	3.1-5
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EPA 9100 COMPATIBILITY TESTING BENTOMAT SAMPLE #EL005



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FIGURE NO.	3.1-6
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3.1 Task 1: EPA 9100 Compatibility Testing

3.1.1 Test Results

The physical conditions of the three Bentomat specimens, measured before and after the tests, are summarized in Table 3.1-1. Graphical presentations of the hydraulic conductivity as a function of elapsed time are presented in Figures 3.1-1, 2, and 3. Graphical presentations of the hydraulic conductivity as a function of the volume of liquid passed through the specimens (i.e., pore volumes) are presented in Figures 3.1-4, 5, and 6.

3.1.2 Observations

Because of the low hydraulic conductivity of the bentonite mat, and in order to maximize the volume of leachate through the mat, the sand layer in each test was replaced by an Amoco 4516 geotextile during that test. This generally occurred shortly before the permeant was switched from water to leachate. In many cases the data indicated erratic behavior for a short time after the switch, but the hydraulic conductivities eventually became consistent.

All specimens were initially permeated at a hydraulic gradient of 50. The resulting hydraulic conductivity measurements were somewhat variable. The hydraulic gradient was subsequently increased to 160 after approximately five days of testing. The test results tended to stabilize after the gradient increase. The average hydraulic gradients that were used for the remainder of each test after the initial increase gradient is indicated on each figure.

In all cases, the data presented in the tables show that each specimen swelled in thickness and in diameter, and that each specimen experienced an apparent loss of mass. The effluent water however, was not visibly cloudy in any of the tests.

In each figure, a transition from water to leachate is indicated. The variability in the test results near this transition is likely the result of disturbance due to leachate injection and removal of the sand layer. Within a short period of time, the test results stabilized.