1 of 1

DOE/FE/6/594-T1

August 21, 1992

Bruce A. Gold
MR 2B-C

AFBC ROADBED PROJECT GROUNDWATER DATA

TVA permitted the use of AFBC material in a section of roadbed at Paducah, Kentucky, for the purpose of demonstrating its usability as a roadbed base. To determine if the material would leach and contaminate groundwater, four wells and seven lysimeters were installed beside and in the roadbed base material.

In August 1991, TVA Field Engineering visited the AFBC Roadbed Project to collect samples and water quality data. The goal was to collect samples and data from four wells and seven lysimeters. All attempts to collect samples from the lysimeters failed with one exemption. All attempts to collect samples from the groundwater wells were successful.

Attempts were made to sample all seven lysimeters. An apparatus consisting of a vacuum tank, a vacuum gauge, and a filtering flask was attached to each of four lysimeters. The other three had only a filtering flask attached. Vacuums were applied to all seven systems at approximately 8 p.m. on August 8. None of the lysimeters had accumulated any moisture by 3 p.m. on August 9. However, one tubular lysimeter located at box one did later accumulate enough water to sample.

A diligent effort was made to make the lysimeters function. Several attempts were made to collect the samples and/or ascertain the lysimeters' conditions. For example, each of the tubular lysimeters (two-line type) were tested for their ability to hold a vacuum. The plate lysimeters were also tested for their ability to hold a vacuum. Attachment 1 summarizes the findings about each of the lysimeters and provides the moisture readings associated with each lysimeter.

The groundwater well sampling was successful. All four wells were high producing wells and presented no problem in sampling. The attached groundwater quality data field worksheets show all the requested field data. Also, Attachment 2 displays the location of each well and its relative elevation. Please note that all water surface measurements were made from the top of the metal casing.

The analytical data from the four wells and one lysimeter are also attached.

The well data is typical of groundwater in the Paducah, Kentucky area indicating that it was not affected by the AFBC roadbed material. The analysis of the lysimeter shows concentrations for iron and manganese above normal background levels, however, the data do not reflect significant concentrations of these heavy metals. Also, the difficulty in obtaining the lysimeter samples and the fact that the samples had to be composited to obtain sufficient quantity to analyze would make a qualitative evaluation of the data questionable.

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Attachments
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Attachment 1

AFBC Roadbed Project - Paducah, Kentucky
Condition of Lysimeters

<u>Lysimeter</u>	<u>Will hold vacuum?</u>	<u>Will allow air passage?</u>	<u>Moisture Content (%)</u>
Box 1 Tubular	Yes	* Yes	97
Box 2 Plate	No	---	7
Box 2 Tubular	Yes	No	2
Box 3 Plate	No	---	11
Box 3 Tubular	No	Yes	9
Box 4 Plate	No	---	1
Box 4 Tubular	Yes	No	0

* The air passage test was used to see if air forced in one line of would return through the lysimeter's adjacent line. The air (or water sample) should return if the system is working. The absence of returning air indicates line blockage, line collapse, line perforation, or problems with the lysimeter itself. The plate lysimeters have only one line, therefore, the air passage test is not applicable.

LMK-78(3)

ATTACHMENT 2

AFBC ROADBED PROJECT

Bleich Road - Puducah, Kentucky

Ground Water Quality Data Field Worksheet (Chemical Data)

Collected By: Fitzhugh Adams Project Name: AFBC Roadbed
Collection Date: 8-9-91 Acct. No.: _____
Sample Tag No.: AFBC-W1 Well ID: AFBC-W1
Collection Method: Bladder Pump ☒ Centrifugal Pump _____ Bailer _____ Kemmerer _____
Stabilization Test: Start Time: 1255 End Time: 1315
W.S. Elevation: 24.17 W.S. Elevation: 24.0
Description of RP: _____

[illegible]

Sample Field Measurements (at time of sample collection):

Time: 13:55
 Temperature (°C) 18.2
 pH 5.5
 ORP (mV) 314
 DO (mg/l) 4.0
 Total Acidity (mg/l) _____
 Sample Turbidity: Clear _____ Slightly Turbid _____ Turbid _____ Highly Turbid ☒

Phenol Alkalinity (mg/l) _____
 Total Alkalinity (mg/l) 30
 Conductivity (µmhos/cm) 563
 Odor None
 Sample Color Muddy

Remarks: Start Pump @ 30', water color somewhat muddy @ start.

40.95 Well Bottom
24.17 WS
16.8
116
2.68
x 2
75/5.36 7 min @ 3 LPM

Volume of water in well casing: _____
Volume of purged well water: _____

Reviewed by _____ Date _____

Ground Water Quality Data Field Worksheet (Chemical Data)

Collected By: Fitzhugh, Adams Project Name: AFBC Roadbed
Collection Date: 8-9-91 Acct. No.: _____
Sample Tag No.: AFBC W2 Well ID: AFBC W2
Collection Method: Bladder Pump ☒ Centrifugal Pump _____ Bailer _____ Kemmerer _____
Stabilization Test: Start Time: 1215 End Time: 1235
W.S. Elevation: 22.1 W.S. Elevation: 22.3

Description of RP:

[illegible]

Sample Field Measurements (at time of sample collection):

Time: 1235
 Temperature (°C) 17.2
 pH 5.6
 ORP (mV) 295
 DO (mg/l) 6.4
 Total Acidity (mg/l) _____
 Sample Turbidity: Clear _____ Slightly Turbid ☒ Turbid _____ Highly Turbid _____

Phenol Alkalinity (mg/l) _____
 Total Alkalinity (mg/l) 15 (low test)
 Conductivity (µmhos/cm) 250
 Odor Nisue
 Sample Color Slightly Turbid

Remarks: Start Pump @ 28' Water @ Start was
very muddy looking.

37.8 Well Bottom
~~22.1~~ WS
 15.7
~~16~~
 2.5
 x2
 75/5.0 7 min @ 36 Pm

Volume of water in well casing: _____
Volume of purged well water: _____

Reviewed by _____ Date _____

Ground Water Quality Data Field Worksheet
(Chemical Data)

Collected By: Adams, Fitzhugh Project Name: AFBC Road Bed
 Collection Date: 8-9-91 Acct. No.: _____
 Sample Tag No.: No. 3 AFBC-W3 Well ID: No. 3 AFBC-W3
 Collection Method: Bladder Pump ☒ Centrifugal Pump _____ Bailer _____ Kemmerer _____
 Stabilization Test: Start Time: 0915 End Time: 0940
 W.S. Elevation: 72.35 25.9 W.S. Elevation: 26.6
 Description of RP: _____

Time (min)	Pump Rate	Water Surface (ft)	Temperature (°C)	pH	DO (mg/L)	Conductivity (µmhos/cm)	ORP (mV)
0915	3 LPM	25.9	16.9	5.6	6.1	98	+306
0920			16.3	5.5	5.5	98	+320
0925			16.1	5.5	5.4	98	+329
0930			16.1	5.5	5.4	97	+325
0935		27.2	16.0	5.5	5.4	97	+326
0940		26.6	16.0	5.5	5.4	97	+326

Sample Field Measurements (at time of sample collection):

Time: 0940
 Temperature (°C) 16.0 Phenol Alkalinity (mg/l) _____
 pH 5.5 Total Alkalinity (mg/l) 5 (low test)
 ORP (mV) 326 Conductivity (µmhos/cm) 97
 DO (mg/l) 5.4 Odor none
 Total Acidity (mg/l) _____ Sample Color Muddy
 Sample Turbidity: Clear _____ Slightly Turbid _____ Turbid _____ Highly Turbid ☒

Remarks: Start pump @ 31' water color was very
muddy looking @ start.

38.25 well bottom
 25.90
 12.35
 8.16
 1.97
 .75 / 3.95 5 min @ 3 LPM

Volume of water in well casing: _____
 Volume of purged well water: _____

Reviewed by _____ Date _____

Ground Water Quality Data Field Worksheet (Chemical Data)

Collected By: Adams, Fitzhugh Project Name: AFBC Roadbed
Collection Date: 8-9-91 Acct. No.: 1-2-11

Collection Date: 8-9-91 Acct. No.: 1522-11

Sample Tag No.: AFBC W-4 Well ID: AFBC-W4

Collection Method: Bladder Pump ☒ Centrifugal Pump ☐ Bailer ☐ Kemmerer ☐

Stabilization Test: Start Time: 1000 End Time: 1025

W.S. Elevation: 20.3 W.S. Elevation: _____

Description of RP: _____

[illegible]

Sample Field Measurements (at time of sample collection):

Time: 1025

Temperature (°C) 14.6

pH 5.6

ORP (mV) 332

DO (mg/l) 2.5

Total Acidity (mg/l) _____

Sample Turbidity: Clear 1.1 Slightly Turbid

Phenol Alkalinity (mg/l) 37

Total Alkalinity (mg/l) 26

Conductivity ($\mu\text{mhos/cm}$) 96

Odor None

Sample Color Clear

_____ Turbid _____ Highly Turbid _____

Remarks: Start Pump @ 26' water color muddy @
start.

37. 9 well Bottom

20.3 W.S

17.6

Xello

2.81

$$\frac{x^2}{2}$$

15.62 8 min @ 31 P.

Volume of water in well casing: _____

Volume of purged well water: _____

Reviewed by _____ Date _____

Lab Sample Number :91/15450 Project Leader :Gilberto Quintero

Sample ID Information :AFBC-W1
 Sample comments :AFBC ROADBED PROJECT
 Sample type/matrix :WATER
 Sample collected by :F ENG
 Sample collection date :910812
 Sample login date :910813 Sample received by lab :910813
 Sample account number :2312-769000-21M,GQ

Alt. IDC	Analysis Performed	result	units
01105	Aluminum, Total in Water	8500.	ug/L
01002	Arsenic, Total in Water	< 1.0	ug/L
01007	Barium, Total in Water	80.	ug/L
01022	Boron, Total in Water	160.	ug/L
01027	Cadmium, Total in Water	< 0.1	ug/L
00940	Chloride in Water	3.	mg/L
01034	Chromium, Total in Water	2.5	ug/L
01042	Copper, Total in Water	< 10.	ug/L
00951	Fluoride in Water	< 0.1	mg/L
01045	Iron, Total in Water	46000.	ug/L
01051	Lead, Total in Water	1.	ug/L
01132	Lithium, Total in Water	10.	ug/L
00927	Magnesium, Tot in Water	11.	mg/L
01055	Manganese, Tot in Water	76.	ug/L
00937	Potassium, Tot in Water	1.9	mg/L
01147	Selenium, Total in Water	13.	ug/L
01142	Silicon, Total in Water	18000.	ug/L
00929	Sodium, Total in Water	69.	mg/L
01082	Strontium Total in Water	280.	ug/L
00945	Sulfate in Water	160.	mg/L
01087	Vanadium, Total in Water	30.	ug/L
01092	Zinc, Total in Water	60.	ug/L
00630	Nitrate-Nitrite Nitrogen	1.8	mg/L
00916	Calcium, Total in Water	25.	mg/L
46570	Ca and Mg Hardness Calc.	108.	mg/L CaCO3

Lab Sample Number :91/15451 Project Leader :Gilberto Quintero

Sample ID Information :AFBC-W2
 Sample comments :AFBC ROADBED PROJECT
 Sample type/matrix :WATER
 Sample collected by :F ENG
 Sample collection date :910812
 Sample login date :910813 Sample received by lab :910813
 Sample account number :2312-769000-21M,GQ

Alt. IDC	Analysis Performed	result	units
01105	Aluminum, Total in Water	6700.	ug/L
01002	Arsenic, Total in Water	< 1.0	ug/L
01007	Barium, Total in Water	60.	ug/L
01022	Boron, Total in Water	< 50.	ug/L
01027	Cadmium, Total in Water	0.1	ug/L
00940	Chloride in Water	2.	mg/L
01034	Chromium, Total in Water	2.3	ug/L
01042	Copper, Total in Water	< 10.	ug/L
00951	Fluoride in Water	< 0.1	mg/L
01045	Iron, Total in Water	13000.	ug/L
01051	Lead, Total in Water	2.	ug/L
01132	Lithium, Total in Water	< 10.	ug/L
00927	Magnesium, Tot in Water	4.3	mg/L
01055	Manganese, Tot in Water	260.	ug/L
00937	Potassium, Tot in Water	1.3	mg/L
01147	Selenium, Total in Water	3.0	ug/L
01142	Silicon, Total in Water	17000.	ug/L
00929	Sodium, Total in Water	30.	mg/L
01082	Strontium Total in Water	80.	ug/L
00945	Sulfate in Water	< 1.0	mg/L
01087	Vanadium, Total in Water	< 10.	ug/L
01092	Zinc, Total in Water	30.	ug/L
00630	Nitrate-Nitrite Nitrogen	2.4	mg/L
00916	Calcium, Total in Water	9.0	mg/L
46570	Ca and Mg Hardness Calc.	40.	mg/L CaCO3

Lab Sample Number :91/15452 Project Leader :Gilberto Quintero

Sample ID Information :AFBC-W3
 Sample comments :AFBC ROADBED PROJECT
 Sample type/matrix :WATER
 Sample collected by :F ENG
 Sample collection date :910812
 Sample login date :910813 Sample received by lab :910813
 Sample account number :2312-769000-21M,GQ

Alt. IDC	Analysis Performed	result	units
01105	Aluminum, Total in Water	24000.	ug/L
01002	Arsenic, Total in Water	< 1.0	ug/L
01007	Barium, Total in Water	100.	ug/L
01022	Boron, Total in Water	90.	ug/L
01027	Cadmium, Total in Water	0.3	ug/L
00940	Chloride in Water	5.	mg/L
01034	Chromium, Total in Water	7.4	ug/L
01042	Copper, Total in Water	< 10.	ug/L
00951	Fluoride in Water	< 0.1	mg/L
01045	Iron, Total in Water	32000.	ug/L
01051	Lead, Total in Water	6.	ug/L
01132	Lithium, Total in Water	10.	ug/L
00927	Magnesium, Tot in Water	3.7	mg/L
01055	Manganese, Tot in Water	360.	ug/L
00937	Potassium, Tot in Water	2.8	mg/L
01147	Selenium, Total in Water	< 1.0	ug/L
01142	Silicon, Total in Water	38000.	ug/L
00929	Sodium, Total in Water	6.8	mg/L
01082	Strontium Total in Water	100.	ug/L
00945	Sulfate in Water	1.0	mg/L
01087	Vanadium, Total in Water	50.	ug/L
01092	Zinc, Total in Water	170.	ug/L
00630	Nitrate-Nitrite Nitrogen	2.6	mg/L
00916	Calcium, Total in Water	6.8	mg/L
46570	Ca and Mg Hardness Calc.	32.	mg/L CaCO3

Lab Sample Number :91/15453 Project Leader :Gilberto Quintero

Sample ID Information :AFBC-W4
 Sample comments :AFBC ROADBED PROJECT
 Sample type/matrix :WATER
 Sample collected by :F ENG
 Sample collection date :910812
 Sample login date :910813 Sample received by lab :910813
 Sample account number :2312-769000-21M,GQ

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| Alt. IDC | Analysis Performed | result | units |
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01105      Aluminum, Total in Water  4000.   ug/L
01002      Arsenic, Total in Water   < 1.0   ug/L
01007      Barium, Total in Water    120.    ug/L
01022      Boron, Total in Water     < 50.    ug/L
01027      Cadmium, Total in Water    0.9     ug/L
00940      Chloride in Water          28.     mg/L
01034      Chromium, Total in Water    13.     ug/L
01042      Copper, Total in Water        < 10.    ug/L
00951      Fluoride in Water              < 0.1    mg/L
01045      Iron, Total in Water           2300.    ug/L
01051      Lead, Total in Water            10.     ug/L
01132      Lithium, Total in Water         < 10.    ug/L
00927      Magnesium, Tot in Water         1.5     mg/L
01055      Manganese, Tot in Water         19.     ug/L
00937      Potassium, Tot in Water         0.6     mg/L
01147      Selenium, Total in Water        < 1.0    ug/L
01142      Silicon, Total in Water        11000.   ug/L
00929      Sodium, Total in Water          14.     mg/L
01082      Strontium Total in Water        < 50.    ug/L
00945      Sulfate in Water                1.0     mg/L
01087      Vanadium, Total in Water        < 10.    ug/L
01092      Zinc, Total in Water            60.     ug/L
00630      Nitrate-Nitrite Nitrogen       4.2     mg/L
00916      Calcium, Total in Water        4.7     mg/L
46570      Ca and Mg Hardness Calc.      18.     mg/L CaCO3

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Lab Sample Number :91/16327 Project Leader :Gilberto Quintero

Sample ID Information :AFBC *lysimum*
 Sample comments :AFBC ROADBED PROJECT
 Sample type/matrix :WATER
 Sample collected by :F ENG
 Sample collection date :910826
 Sample login date :910827 Sample received by lab :910827
 Sample account number :2312-769000-21M,GQ

Alt. IDC	Analysis Performed	result	units
01105	Aluminum, Total in Water	< 50.	ug/L
01002	Arsenic, Total in Water	< 1.	ug/L
01007	Barium, Total in Water	40.	ug/L
01022	Boron, Total in Water	< 50.	ug/L
01027	Cadmium, Total in Water	< 0.1	ug/L
00940	Chloride in Water	66.	mg/L
01034	Chromium, Total in Water	< 1.	ug/L
01042	Copper, Total in Water	< 10.	ug/L
00951	Fluoride in Water	0.4	mg/L
01045	Iron, Total in Water	12000.	ug/L
01051	Lead, Total in Water	1.	ug/L
01132	Lithium, Total in Water	< 10.	ug/L
00927	Magnesium, Tot in Water	39.	mg/L
01055	Manganese, Tot in Water	31000.	ug/L
00937	Potassium, Tot in Water	2.5	mg/L
01147	Selenium, Total in Water	00000.	ug/L
01142	Silicon, Total in Water	13000.	ug/L
00929	Sodium, Total in Water	79.	mg/L
01082	Strontium Total in Water	700.	ug/L
00945	Sulfate in Water	360.	mg/L
01087	Vanadium, Total in Water	20.	ug/L
01092	Zinc, Total in Water	50.	ug/L
00630	Nitrate-Nitrite Nitrogen	< 0.01	mg/L
00916	Calcium, Total in Water	68.	mg/L
46570	Ca and Mg Hardness Calc.	330.	mg/L CaCO3

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