ARCO Coal Company
Bluewater Mill
Post Office Box 638
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Telephone (505) 876-2211

40-8902

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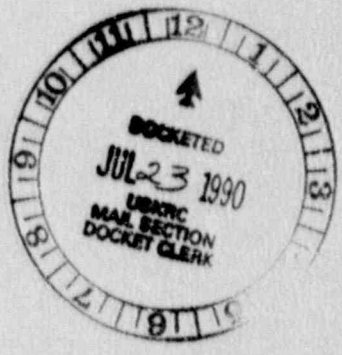
RETURN ORIGINAL TO PDR, HQ.

July 19, 1990

Ramon Hall
Director
United States Nuclear Regulatory Commission
Uranium Recovery Field Office
Region IV
730 Simms Street, Suite 100
Golden, Colorado 80401



RE: License No. SUA-1470
Docket No. 40-8902

Dear Mr. Hall:

Enclosed is the response to Question Number 5 contained in your May 30, 1990 letter regarding ARCO Coal Company's March 1990 Reclamation Plan. This response concludes ARCO's response to the fourteen (14) NRC questions related to the technical aspects of the Plan.

This response to Question Number 5 is accompanied by the appropriate revised text and tables. Please substitute these pages into the 1990 Bluewater Mill Reclamation Plan to maintain a stand-alone document.

We look forward to approval of our Plan in the near future. Should you have any questions or wish to discuss this information, please contact me.

Sincerely,

R. S. Ziegler
Project Manager

jmn

pc: RK
LM
CS

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Enclosure

F02

Add Info
90-0687

ARCO COAL COMPANY
1990 RECLAMATION PLAN
RESPONSES TO NRC QUESTIONS

Question 5 The February 1990, cover thickness analyses submitted in your March 21, 1990, plan are substantially different from the cover thickness analyses previously submitted. The most significant differences are in the physical property parameters for the slimes portion of the tailings data. Your consultants' February 1990, report does not provide sufficient justification as to why these parameters were changed. As the changes that were made are not conservative, additional information will be required before NRC can concur in designs. Please provide a more detailed assessment of why changes were made in the physical properties applied in the models.

Response 5 The change from the 5.2-foot radon cover thickness in the 1986 Reclamation Plan to the 1.7-foot thickness contained in the March 1990 Plan, is due to the layering of berm sand tailings, evaporation pond residues, and windblown tailings-contaminated soils as fill on the slime tailings area. The layered fill is described in detail in the current plan. The fill serves as an effective means for attenuating the radon flux from the slime tailings using other, less contaminated materials. The result is that the radon attenuation afforded by the fill materials reduces the amount of clean radon barrier borrow needed to complete the attenuation of the radon flux to the 20 $pCi/m^2/sec$ design requirement.

Your observation that the physical properties used for the slime tailings differ between the previous submittal and the current plan is correct. However, those changes were not influential in regard to the dramatic reduction of the radon barrier thickness. That reduction was due to the layered fill, as discussed above. To demonstrate that this is the case, we have rerun the RAECOM model using the old physical properties for the slime tailings. The area-weighted radon barrier thickness that results is 1.8 feet, assuming the same layered fill above the slime. Thus, the layered fill accounts for 3.4 feet of the cover thickness reduction, while the changes to the physical properties account for 0.1 foot of the reduction. Table 1 summarizes the two sets of physical properties assumed for the slime tailings for easy comparison.

Since both the 1.7-foot and the 1.8-foot radon barrier thicknesses fall within the 2-foot thickness planned for constructability, the actual impact of the changes to the tailings physical properties is insignificant. We will agree with your review of the slimes cover and will use the more conservative physical properties (the original values). The radon cover over the slimes will be between 1.8 and 2.0 feet. Enclosed is the revised Figure 5.4-1 and Page 23 to be included in the 1990 Reclamation Plan. Also attached is Table 5.4-2 and Table 5.4-2A which give the revised cover thickness requirements using

the original physical properties for the slime tailings. The output sheets from the RAECOM runs are included with this response and should be inserted into Appendix C of the 1990 Reclamation Plan.

The physical properties for sand and mixed tailings are the same in the current plan as were used in previous submittals. The changes in cover thickness in the sands and mixed areas are due to factors other than tailings properties. In the sands area, the change is due to both the use of the more extensive set of borrow soil radon diffusion coefficient measurements developed since the 1986 Plan, and the use of a cover compaction specification of 95% of Standard Proctor, rather than the 90% previously specified. In the mixed area, those factors also apply and, in addition, a portion of the area is to be covered with the layered fill as described above.

TABLE 1

SLIME TAILINGS PHYSICAL PROPERTIES

	1986 VALUES	1990 VALUES
Density, g/cm^3	1.56	1.41
Moisture, %	22.0	30.0
Porosity, %	42.2	48.5
Radon Diff., cm^2 sec	0.0011	0.00088
Radon Emanation	0.20	0.20

TABLE 5.4-1

PARAMETERS USED IN COVER THICKNESS CALCULATIONS

Material	Porosity	Moisture %	Source Term (pCi/g)	Emenation Coefficient	Density g/cm³	Diff. Coefficient
Cover Soil	0.341	9.5	1.0	.20	1.78	0.01390
Windblown*	0.375	9.5	34.0	.32	1.68	0.01400
Evap. Pond 90% Compaction	0.375	9.5	71.1	.17	1.68	0.01980
Evap. Pond 80% Compaction	0.445	9.5	71.1	.17	1.49	0.03200
Berm Sand	0.470	8.0	157.0	.20	1.43	0.03500
Tailings Slimes	0.422	22.0	*	.20	1.56	0.00110
Mixed Tailings	0.411	15.0	*	.24	1.59	0.00850
Tailings Sand	0.404	8.0	*	.20	1.61	0.02500

*The source term for the tailings varies with depth.
See Appendix C for values used.

TABLE 5.4-2

RADON BARRIER COVER THICKNESS REQUIREMENTS

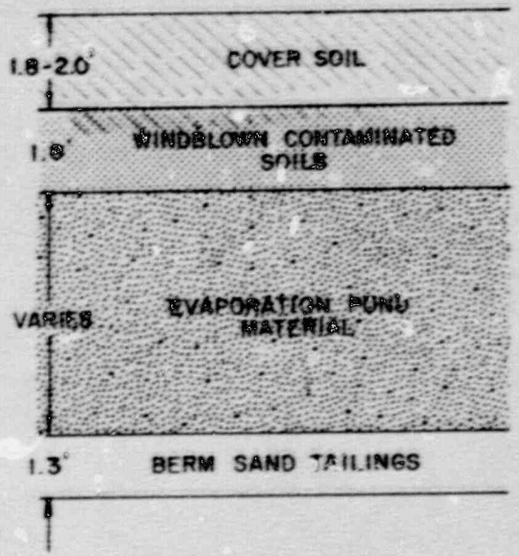
PILE/SUB-AREA	AREA (acres)	COVER THICKNESS (ft)
Main Tailings (Slimes)	75.3	1.8
Main Tailings (Mixed)	66.0	5.0
Main Tailings (Sands)	114.0	3.4
Acid Tailings (Additional)	27.0	6.6
Carbonate Tailings (Additional)	43.0	7.8
Carbonate Tailings West (Additional)	11.0	8.0
Carbonate Tailings South	2.8	12.1
Stockpile Area	70.0	1.0
Plantsite	88.0	1.1

TABLE 5.4-2A

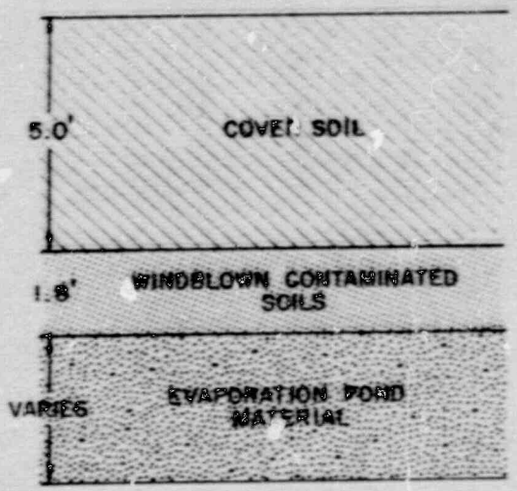
RADON BARRIER COVER THICKNESS REQUIREMENTS

	COVER THICKNESS (ft)		
PILE AREA/SUBAREA	AREA (acres)	AREA-WEIGHTED AVERAGE	INDIVIDUAL AREA
1. Slimes	75.3	1.8	
a. fill 9.3-11.3 ft.	29.7		1.6
b. fill 7.3-9.3 ft.	30.0		1.8
c. fill 5.3-7.3 ft.	11.8		2.1
d. fill 3.3-5.3 ft.	3.8		2.5

SLIMES AREA



MIXED AREA



SAND AREA

ARCO COAL COMPANY BLUEWATER MILL		
FILL & COVER DEPTHS MAIN TAILINGS		
Date:	Scale:	Figure
		5.4-1

RAECOMI.BAS

CASE TITLE: ARCO BLUEWATER MILL: SLIME + BERM SAND + (EPND+WNDBLN) 5.3-7.3 FT

BOTTOM FLUX = 0 pCi/m^2/sec
AIR CONC. = 0 pCi/l
BARE LAYER 1 FLUX = 63.34 pCi/m^2/s
LAYER 10 THICKNESS ADJUSTED TO GIVE FLUX OF 20 pCi/m^2/s AT TOP SURFACE OF LAYER 10

FILE: abw72b.FLX
DATE: 07-16-1990
TIME: 11:22:41

LAYER	THICK (cm)	POR-OSITY	MOIST (%)	Ra-226 (pCi/g)	E.F.	DENSITY (g/cm^3)	DIFF COEF (cm^2 s)	Rn FLUX (pCi/m^2/s)	Rn CONC. (pCi/cm^3)	MIC	LAYER DESCRIPTION
10	53.4	0.341	9.5	1.0	0.20	1.78	0.01390	20.00	0.0	0.633	COVER 95% STD PROCTOR
9	54.9	0.375	9.5	34.0	0.32	1.68	0.01400	25.87	31.6	0.685	WINDBLOWN 90% STD PROCTOR
8	60.9	0.375	9.5	71.1	0.17	1.68	0.01980	23.97	56.8	0.685	EP RESIDUE 90% STD PROCTOR
7	36.6	0.445	9.5	71.1	0.17	1.49	0.03200	30.17	87.3	0.765	EP RESIDUE 80% STD PROCTOR
6	39.6	0.470	8.0	157.0	0.20	1.43	0.03500	47.76	104.3	0.820	BERM SAND 80% STD PROCTOR
5	61.0	0.422	22.0	434.0	0.20	1.56	0.00110	103.59	-190.5	0.398	SLIME
4	61.0	0.422	22.0	424.0	0.20	1.56	0.00110	5.58	287.6	0.398	SLIME
3	61.0	0.422	22.0	450.0	0.20	1.56	0.00110	2.69	323.0	0.398	SLIME
2	61.0	0.422	22.0	522.0	0.20	1.56	0.00110	5.37	357.6	0.398	SLIME
1	31.0	0.422	22.0	483.0	0.20	1.56	0.00110	-2.37	370.4	0.398	SLIME

RAECONX.BAS

CASE TITLE: ARCO BLUEWATER MILL: SLIME + BERM SAND + (EPND+WNDBLN) 3.3-5.3 FT

BOTTOM FLUX = 0 pCi/m^2/sec
AIR CONC. = 0 pCi/l
BARE LAYER 1 FLUX = 63.34 pCi/m^2/s
LAYER 10 THICKNESS ADJUSTED TO GIVE FLUX OF 20 pCi/m^2/s AT TOP SURFACE OF LAYER 10

FILE: abw71b.FLX
DATE: 07-16-1990
TIME: 11:16:30

LAYER	THICK (cm)	POR-OSITY	MOIST (%)	Ra-226 (pCi/g)	E.F.	DENSITY (g/cm^3)	DIFF COEF (cm^2 s)	Rn FLUX (pCi/m^2/s)	Rn CONC. (pCi/cm^3)	MIC	LAYER DESCRIPTION
10	76.3	0.341	9.5	1.0	0.20	1.78	0.01390	20.00	0.0	0.633	COVER 95% STD PROCTOR
9	54.9	0.375	9.5	34.0	0.32	1.68	0.01400	28.93	40.0	0.685	WINDBLOWN 90% STD PROCTOR
8	38.1	0.375	9.5	71.1	0.17	1.68	0.01980	31.63	70.5	0.685	EP RESIDUE 90% STD PROCTOR
7	18.3	0.445	9.5	71.1	0.17	1.49	0.03200	39.13	98.7	0.765	EP RESIDUE 80% STD PROCTOR
6	19.8	0.470	8.0	157.0	0.20	1.43	0.03500	49.54	111.9	0.820	BERM SAND 80% STD PROCTOR
5	61.0	0.422	22.0	434.0	0.20	1.56	0.00110	103.59	-190.5	0.398	SLIME
4	61.0	0.422	22.0	424.0	0.20	1.56	0.00110	5.58	287.6	0.398	SLIME
3	61.0	0.422	22.0	450.0	0.20	1.56	0.00110	2.69	323.0	0.398	SLIME
2	61.0	0.422	22.0	522.0	0.20	1.56	0.00110	5.37	357.6	0.398	SLIME
1	31.0	0.422	22.0	483.0	0.20	1.56	0.00110	-2.37	370.4	0.398	SLIME

RAEDONX.BAS

CASE TITLE: ARCO BLUEWATER MILL: SLIME + BERM SAND + (EPND+WBLN) 9.3-11.3 FT

BOTTOM FLUX = 0 pCi/m^2/sec
AIR CONC. = 0 pCi/l
BARE LAYER 1 FLUX = 63.34 pCi/m^2/s
LAYER 10 THICKNESS ADJUSTED TO GIVE FLUX OF 20 pCi/m^2/s AT TOP SURFACE OF LAYER 10

FILE: ABW74B.FLX
DATE: 07-13-1990
TIME: 10:59:58

LAYER	THICK (cm)	POR-OSITY	MOIST (%)	Ra-226 (pCi/g)	E.F.	DENSITY (g/cm^3)	DIFF COEF (cm^2 s)	Rn FLUX (pCi/m^2/s)	Rn CONC. (pCi/cm^3)	MIC	LAYER DESCRIPTION
10	47.2	0.341	9.5	1.0	0.20	1.78	0.01390	20.00	0.0	0.633	COVER 95% STD PROCTOR
9	54.9	0.375	9.5	34.0	0.32	1.68	0.01400	21.68	24.6	0.685	WINDBLOWN 90% STD PROCTOR
8	182.8	0.375	9.5	71.1	0.17	1.68	0.01980	15.56	43.4	0.685	EP RESIDUE 90% STD PROCTOR
7	36.6	0.445	9.5	71.1	0.17	1.49	0.03200	25.95	93.1	0.765	EP RESIDUE 80% STD PROCTOR
6	39.6	0.470	8.0	157.0	0.20	1.43	0.03500	45.33	104.5	0.820	BERM SAND 95% STD PROCTOR
5	61.0	0.422	22.0	434.0	0.20	1.56	0.00110	103.59	-190.5	0.398	SLIME
4	61.0	0.422	22.0	424.0	0.20	1.56	0.00110	5.58	287.6	0.398	SLIME
3	61.0	0.422	22.0	450.0	0.20	1.56	0.00110	2.69	323.0	0.398	SLIME
2	61.0	0.422	22.0	522.0	0.20	1.56	0.00110	5.37	357.6	0.398	SLIME
1	31.0	0.422	22.0	483.0	0.20	1.56	0.00110	-2.37	370.9	0.398	SLIME

RAECOMX.BAS

CASE TITLE: ARCO BLUEWATER MILL: SLIME + BERM SAND + (EPND+WNDBLN) 7.3-9.3 FT

BOTTOM FLUX = 0 pCi/m^2/sec
AIR CONC. = 0 pCi/l
BARE LAYER 1 FLUX = 63.34 pCi/m^2/s
LAYER 10 THICKNESS ADJUSTED TO GIVE FLUX OF 20 pCi/m^2/s AT TOP SURFACE OF LAYER 10

FILE: ABW73B.FLX
DATE: 07-13-1990
TIME: 15:30:53

LAYER	THICK (cm)	POR-OSITY	MOIST (%)	Ra-226 (pCi/g)	E.F.	DENSITY (g/cm^3)	DIFF COEF (cm^2 s)	Rn FLUX (pCi/m^2/s)	Rn CONC. (pCi/cm^3)	MIC	LAYER DESCRIPTION
10	53.2	0.341	9.5	1.0	0.20	1.78	0.01390	20.00	0.0	0.633	COVER 95% STD PROCTOR
9	54.9	0.375	9.5	34.0	0.32	1.68	0.01400	23.99	25.8	0.685	WINDBLOWN 90% STD PROCTOR
8	121.9	0.375	9.5	71.1	0.17	1.68	0.01980	18.94	47.4	0.685	EP RESIDUE 90% STD PROCTOR
7	36.6	0.445	9.5	71.1	0.17	1.49	0.03200	27.64	90.8	0.765	EP RESIDUE 80% STD PROCTOR
6	39.6	0.470	8.0	157.0	0.20	1.43	0.03500	46.30	107.4	0.820	BERM SAND 80% STD PROCTOR
5	61.0	0.422	22.0	434.0	0.20	1.56	0.00110	103.59	-190.5	0.398	SLIME
4	61.0	0.422	22.0	424.0	0.20	1.56	0.00110	5.58	287.6	0.398	SLIME
3	61.0	0.422	22.0	456.6	0.20	1.56	0.00110	2.69	323.0	0.398	SLIME
2	61.0	0.422	22.0	522.0	0.20	1.56	0.00110	5.37	357.6	0.398	SLIME
1	31.0	0.422	22.0	483.0	0.20	1.56	0.00110	-2.37	370.4	0.398	SLIME