



Bluewater Mill  
Post Office Box 638  
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February 21, 1997

Mr. Allyn M. Davis  
U.S. Environmental Protection Agency, Region 6  
Mail Code (6PD)  
1445 Ross Avenue  
Dallas, Texas 75202-2733

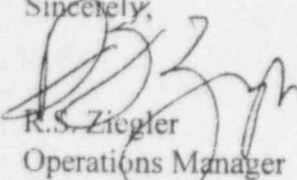
Dear Mr. Davis:

The Bluewater Uranium Mill Site (Site) in Grants, New Mexico, owned by the Atlantic Richfield Company (ARCO), is licensed, #SUA-1470, by the United States Nuclear Regulatory Commission (NRC). ARCO has just completed construction work for reclamation of the Site pursuant to the NRC's approved Reclamation Plan. Since the effective date for rescission of 40 CFR Part 61, Subpart I is December 30, 1996, ARCO is submitting the enclosed 1996 annual report for the Site in compliance with 40 CFR Part 61.104.

As indicated by the report, the Bluewater Uranium Mill is in compliance with the Standard of 40 CFR Part 61, Subpart I. Should you have any questions regarding this submittal, please contact me at (406) 563-5211 x 418 or Mr. Natver Patel of AVM Environmental Services, Inc. at (505) 287-4593.

I certify under penalty of law that I have personally examined and am familiar with the information submitted herein and based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate and complete to the best of my knowledge. I am aware that there are significant penalties for submitting false information including possibility of fine and imprisonment. See, 18 U.S.C. 1001.

Sincerely,

  
R.S. Ziegler  
Operations Manager

Enclosure 030035

CC: J. Holonich - NRC  
C. Cains - NRC Region IV  
N. Patel - AVM



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Atlantic Richfield Company

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**40 CFR Part 61, Subpart I**  
**National Emission Standards for Radionuclide Emissions**  
**from Facilities Licensed by the Nuclear Regulatory Commission**  
**and Federal Facilities Not Operated by the Department of Energy**

**REPORT ON COMPLIANCE WITH**  
**THE CLEAN AIR ACT LIMITS FOR RADIONUCLIDE EMISSIONS**

**for**

**1996**

**Prepared by:**

**Atlantic Richfield Company**  
**Bluewater Uranium Mill**  
**P.O. Box 638**  
**Grants, NM 87020**

**Prepared for:**

**U. S. Environmental Protection Agency**  
**Office of Radiation Protection Programs**  
**Washington, D. C. 20460**

**Compliance with 40 CFR Part 61, Subpart I**  
**Atlantic Richfield Company**  
**Bluewater Uranium Mill**  
**Grants, NM**

**1.0 Introduction**

The Bluewater Uranium Mill Site (Site) is located approximately ten miles west of Grants, New Mexico. Atlantic Richfield Company (ARCO) owns the Site that is licensed by the U. S. Nuclear Regulatory Commission (NRC). The mill process buildings were decommissioned in 1990. Tailings' areas reclamation began in 1991 and continued through and completed at the end of 1995.

The 40 CFR Part 61, Subpart I, limits radionuclide emissions to the ambient air from NRC-licensed facilities to that amount which would cause any member of the public to receive in any year an effective dose equivalent (EDE) of 10 mrem, of which no more than 3 mrem EDE may be from radioiodines. The exposure to radon emissions is excluded from these limits.

In assessing the EDE, ARCO followed the guidance of EPA (40 CFR Part 61, Section 61.107(3)) where environmental monitoring data collected in compliance with NRC Regulatory Guides 4.14 and 4.15 may be used to develop emission rates. ARCO used the more current ICRP 30 exposure to dose conversion factors along with NUREG-0859, Compliance Determination Procedures for Environmental Radiation Protection Standards for Uranium Recovery Facilities- 40 CFR Part 190 to calculate the annual effective dose equivalent to the maximum exposed individual.

Data from the environmental monitoring stations for the four quarters in 1996 were used in assessing the Total Effective Dose Equivalent (TEDE) to individuals of the public. Data collected by continuous measurements of air particulate concentrations for each of the four quarters for the year were used as well as annual sampling of the vegetation taken at the background location (Berryhill House), and the downwind location (Southeast Perimeter). The Southeast Perimeter sampling station is located downwind at a distance of approximately 1.5 miles from the center of the Main Tailings Pile (MTP). The highest TEDE received from the Site would be by a hypothetical individual living at the Southeast Perimeter sampling station. The radiological source term at the Site for 1996 consisted of reclaimed tailing piles and disposal areas with final radon barrier placed. ARCO has used environmental monitoring data collected as part of its license conditions to calculate the annual effective dose equivalent to the maximum exposed individual. The results are compared to the EPA 40 CFR Part 61, Subpart I standards.

ARCO continued implementation of the environmental monitoring program using NRC approved procedures as a condition of the NRC license. Air was sampled continuously through glass-fiber filter paper using low volume air samplers, at a rate of about 230 liters per minute. Filters were changed weekly. The loaded weekly filters were composited quarterly for each station and analyzed by a vendor laboratory.

Annual vegetation samples were collected at each environmental monitoring station in the Fall of the year. A composite is made from representative samples of local vegetation in the approximate proportions witnessed locally. The samples were sent to a vendor laboratory for analysis.

Attachment A consists of a map of the Site showing the environmental sampling stations and the distances and direction of the Southeast Parameter sampling station and the nearest residence. The Attachment A also contains the quarterly air sample results for the background location and the Southeast Perimeter Station, and the vegetation sample results.

## 2.0 Dose Assessment

The pathways of importance in the dose assessment are the inhalation of airborne particulate, and the ingestion of meat and milk from cattle grazing on contaminated vegetation. These pathways were assessed even though the hypothetical individual living at the Southeast Perimeter sampling station did not own cattle, eat meat from locally raised cattle, or drink milk from local cows. Because of the semiarid nature of the region, home gardening is usually not practiced in the local area.

### 2.1 Dose from the Inhalation of Particulate Long-Lived Radionuclides

The committed effective dose equivalent (H) from inhalation of particulate was calculated for the four principal long-lived radionuclides, U-238, U-234, Th-230, and Ra-226.

Committed Effective Dose Equivalent (CEDE) per Unit Intake via Inhalation factors were taken from ICRP 30 tables. The values are given below:

<u>Nuclide</u>	<u>CEDE(mrem/<math>\mu</math>Ci)</u>
U-234	13.2E4
U-238	11.8E4
Th-230	32.6E4
Ra-226	8.6E3

Continuous occupancy at a breathing rate of 20,000 liters per day (Table A-1, NUREG-0859) was assumed. The CEDE was calculated for each of the radionuclides at each station. The values given in Tables 2-1 and 2-2 were derived by multiplying the airborne concentration by the CEDE per unit intake times the annual breathing rate. No background subtraction was made for the radionuclide concentrations at the Southeast Perimeter. Note that the second station, the Berryhill House, is the background station.



## 2.2 Dose from the Ingestion of Cattle Grazed on Contaminated Vegetation

The Committed Effective Dose Equivalent (H) was calculated using guidance provided in NUREG-0859 and the more recent CEDE per Unit Uptake via Ingestion factors from ICRP-30. The long-lived radionuclides in the U-238 decay series and their corresponding CEDE per unit intake are as follows.

<u>Nuclide</u>	<u>CEDE (mrem/<math>\mu</math>Ci)</u>
U-234	283
U-238	255
Th-230	548
Ra-226	1325

The annual CEDE, H, can be expressed as follows:

$$H = (I_h)(I_c)(C)(TC)(CEDE)$$

where  $I_h$  = adult meat ingestion rate: 78.3 kg/year

$I_c$  = animal uptake of vegetation: 50 kg/day

C = radionuclide concentration in vegetation

T, environmental transfer coefficients

=  $3.4E-4$  pCi/kg per pCi/d for Uranium

=  $2.0E-4$  pCi/kg per pCi/d for Thorium

=  $5.1E-4$  pCi/kg per pCi/d for Radium

CEDE = committed effective dose equivalent per unit intake

The results shown in Tables 2-1 and 2-2 were calculated using the above model and the associated factors taken from NUREG-0859 and ICRP 30.

### 2.3 Dose from Consumption of Milk from Cattle Grazing on Contaminated Vegetation

The Committed Effective Dose Equivalent as a result of the consumption of milk was calculated using guidance provided in NUREG-0859 and the more recent CEDE per Unit Uptake via Ingestion factors from ICRP-30.

The long-lived radionuclides in the U-238 decay series and their corresponding CEDE per unit intake are as follows.

<u>Nuclide</u>	<u>CEDE (mrem/<math>\mu</math>Ci)</u>
U-234	283
U-238	255
Th-230	548
Ra-226	1325

The annual CEDE, H, can be expressed as follows:

$$H = (I_m)(I_c)(C)(TC)(CEDE)$$

where  $I_m$  = adult milk consumption rate: 130 liters/year

$I_c$  = animal uptake of vegetation: 50 kg/day

C = radionuclide concentration in vegetation

TC, environmental transfer coefficients

=  $6.1E-4$  pCi/l per pCi/d for uranium

=  $5.0E-4$  pCi/l per pCi/d for thorium

=  $5.9E-4$  pCi/l per pCi/d for radium

CEDE = committed effective dose equivalent per unit intake

The results shown in Tables 2-1 and 2-2 were calculated using the above model and the associated factors taken from NUREG-0859 and ICRP 30.

## 2.4 Dose from External Exposure Resulting from Airborne Particulate

The dose from external exposure from airborne particulate was evaluated using guidance given in NRC Regulatory Guidance 3.51, Table 4, p. 32. This exposure pathway was shown to be insignificant. Factors to calculate the annual exposure from the average airborne concentrations are:

For U-234:  $2.49E6 \text{ (mrem/y)/}(\mu\text{Ci/ml})$

For U-238:  $1.57E6 \text{ (mrem/y)/}(\mu\text{Ci/ml})$

For Th-230:  $3.59E6 \text{ (mrem/y)/}(\mu\text{Ci/ml})$

For Ra-226:  $4.90E7 \text{ (mrem/y)/}(\mu\text{Ci/ml})$

## 3.0 Calculated Annual Total Effective Dose Equivalent

Tables 2-1 and 2-2 provide the results of calculations from air particulate concentrations measured and vegetation sampling at the two environmental stations. The Berryhill House Station represents the local site background where the 1996 total annual effective dose equivalent,  $H$ , was calculated to be 1.01 mrem/y from the long-lived radionuclides. This value is essentially the same as that calculated for this location in 1995 (1.05 mrem/y), 1994 (0.85 mrem/y), 1993 (0.87 mrem/y) and in 1992 (0.88 mrem/y). The 1996 calculated TEDE at the Southeast Perimeter station was 1.93 mrem/y, well within the 10 mrem/y limit of 40 CFR Part 61, Subpart I, and essentially the same as that calculated for this location in 1995 (2.12 mrem/y), 1994 (2.04 mrem/y), and in 1993 (1.73 mrem/y). Subtracting the background effective dose equivalent from the Southeast Perimeter, the impact at the Southeast Perimeter station from airborne particulate generated at the Site is approximately 0.92 mrem/year.

In summary, these dose calculations are based on a very extensive environmental monitoring program where continuous air particulate samples were collected for the entire year. The predominant wind direction as well as the nearest residence is in the SSE direction. Air samplers placed at the Southeast Perimeter station revealed and approximately 10 percent of the 40 CFR Part 61, Subpart I limit of 10 mrem/y at the Site perimeter.

Table 2-1  
Annual Total Effective Dose Equivalent

Atlantic Richfield Company  
Bluewater Mill Site

40 CFR Part 61, Subpart I Compliance

STATION: Berryhill House (Background)		Year: 1996	
AIRBORNE CONCENTRATION			
	U-234 uCi/ml	U-238 uCi/ml	Ra-226 uCi/ml
1st qtr	1.50E-16	7.31E-17	0.00E+00
2nd qtr	1.30E-16	6.34E-17	3.00E-17
3rd qtr	1.80E-16	8.77E-17	2.00E-17
4th qtr	1.30E-16	6.34E-17	7.00E-17
Average	1.48E-16	7.19E-17	3.00E-17
VEGETATION CONCENTRATION			
	U-234 uCi/Kg	U-238 uCi/Kg	Th-230 uCi/Kg
	9.00E-06	4.39E-06	8.90E-05
ANNUAL EFFECTIVE DOSE EQUIVALENT			
	U-234 mrem	U-238 mrem	Ra-226 mrem
1st qtr	0.00E-01	0.00E-01	0.00E-01
2nd qtr	0.00E-01	0.00E-01	0.00E-01
3rd qtr	0.00E-01	0.00E-01	0.00E-01
4th qtr	0.00E-01	0.00E-01	0.00E-01
Average	0.00E-01	0.00E-01	0.00E-01
Ingestion of Meat from Cattle Grazing on Contaminated Vegetation			
	U-234 mrem	U-238 mrem	Ra-226 mrem
1st qtr	0.00E-01	0.00E-01	0.00E-01
2nd qtr	0.00E-01	0.00E-01	0.00E-01
3rd qtr	0.00E-01	0.00E-01	0.00E-01
4th qtr	0.00E-01	0.00E-01	0.00E-01
Average	0.00E-01	0.00E-01	0.00E-01
Consumption of Milk From Cattle Grazing on Contaminated Vegetation			
	U-234 mrem	U-238 mrem	Ra-226 mrem
1st qtr	0.00E-01	0.00E-01	0.00E-01
2nd qtr	0.00E-01	0.00E-01	0.00E-01
3rd qtr	0.00E-01	0.00E-01	0.00E-01
4th qtr	0.00E-01	0.00E-01	0.00E-01
Average	0.00E-01	0.00E-01	0.00E-01
Annual External Exposure From Airborne Particulates			
	U-234 mrem	U-238 mrem	Ra-226 mrem
1st qtr	0.00E-01	0.00E-01	0.00E-01
2nd qtr	0.00E-01	0.00E-01	0.00E-01
3rd qtr	0.00E-01	0.00E-01	0.00E-01
4th qtr	0.00E-01	0.00E-01	0.00E-01
Average	0.00E-01	0.00E-01	0.00E-01
Whole Body			
Skin			
Total Annual Effective Dose Equivalent = 1.01 mrem			



Table 2-2  
Annual Total Effective Dose Equivalent

Atlantic Richfield Company  
Bluewater Mill Site

40 CFR Part 61, Subpart I Compliance

STATION: South East Perimeter (Downwind @ Boundary) YEAR: 1996

	AIRBORNE CONCENTRATION				ANNUAL EFFECTIVE DOSE EQUIVALENT			
	U-234	U-238	Th-230	Ra-226	U-234	U-238	Th-230	TOTAL
	uCi/ml	uCi/ml	uCi/ml	uCi/ml	mrem	mrem	mrem	mrem
1st qtr	1.60E-16	7.80E-17	1.10E-16	1.00E-17	0.1159	0.0096	0.232	0.440
2nd qtr	2.20E-16	1.07E-16	1.20E-16	1.00E-17				
3rd qtr	4.20E-16	2.05E-16	7.00E-17	2.00E-17				
4th qtr	1.30E-16	6.34E-17	9.00E-17	4.00E-17				
Average	2.30E-16	1.13E-16	9.75E-17	1.50E-17				

Inhalation of Airborne Particulates

U-234	U-238	Th-230	Ra-226	TOTAL
mrem	mrem	mrem	mrem	mrem
0.1159	0.0096	0.232	0.001	0.440

VEGETATION CONCENTRATION

U-234	U-238	Ra-226	Th-230
uCi/Kg	uCi/Kg	uCi/Kg	uCi/Kg
1.30E-05	6.34E-06	1.90E-04	8.40E-06

Ingestion of Meat from  
Cattle Grazing on Contaminated Vegetation

U-234	U-238	Th-230	Ra-226	TOTAL
mrem	mrem	mrem	mrem	mrem
0.002	0.002	0.004	0.503	0.511

Consumption of Milk From  
Cattle Grazing on Contaminated Vegetation

U-234	U-238	Th-230	Ra-226	TOTAL
mrem	mrem	mrem	mrem	mrem
0.007	0.006	0.000	0.965	0.979

Annual External Exposure  
From Airborne Particulates

U-234	U-238	Th-230	Ra-226	TOTAL
mrem	mrem	mrem	mrem	mrem
0.000	0.000	0.000	0.000	0.000
Whole Body	0.000	0.000	0.000	0.000
Skin	0.000	0.000	0.000	0.000

Total Annual Effective Dose Equivalent = 1.93 mrem

ARCO  
BLUEWATER MILL

Radiological Analyses of Environmental Air Particulate Samples

Location: BERRYHILL HOUSE

Date sampled: 01-02-96 to 03-31-96

Radionuclide =====	Concentration uCi/ml =====	Error estimate uCi/ml =====	LLD uCi/ml =====	% of Limit* =====
U-nat	1.50E-16	1.00E-17	1.00E-16	0.17
Th-230	1.70E-16	4.00E-17	1.00E-16	0.85
Ra-226	0.00E+00	6.00E-17	1.00E-16	0.00
Pb-210	1.60E-14	6.00E-16	2.00E-15	2.67

Location: S.E. PERIMETER

Date Sampled: 01-02-96 to 03-31-96

Radionuclide =====	Concentration uCi/ml =====	Error estimate uCi/ml =====	LLD uCi/ml =====	% of Limit* =====
U-nat	1.60E-16	1.00E-17	1.00E-16	0.18
Th-230	1.10E-16	3.00E-17	1.00E-16	0.55
Ra-226	1.00E-17	6.00E-17	1.00E-16	0.00
Pb-210	1.90E-14	6.00E-16	2.00E-15	3.17

\* Effluents limit for the public specified in Appendix B  
to 10 CFR 20.1001-20.2401

ARCO  
BLUEWATER MILL

Radiological Analyses of Environmental Air Particulate Samples

Location: BERRYHILL HOUSE

Date sampled: 04-01-96 to 06-30-96

Radionuclide =====	Concentration uCi/ml =====	Error estimate uCi/ml =====	LLD uCi/ml =====	% of Limit* =====
U-nat	1.30E-16	1.00E-17	1.00E-16	0.14
Th-230	3.00E-17	2.00E-17	1.00E-16	0.15
Ra-226	3.00E-17	5.00E-17	1.00E-16	0.00
Pb-210	2.00E-14	3.10E-15	2.00E-15	3.33

Location: S.E. PERIMETER

Date Sampled: 04-01-96 to 06-30-96

Radionuclide =====	Concentration uCi/ml =====	Error estimate uCi/ml =====	LLD uCi/ml =====	% of Limit* =====
U-nat	2.20E-16	1.00E-17	1.00E-16	0.24
Th-230	1.20E-16	4.00E-17	1.00E-16	0.60
Ra-226	-1.00E-17	5.00E-17	1.00E-16	-0.00
Pb-210	2.60E-14	4.00E-15	2.00E-15	4.33

\* Effluents limit for the public specified in Appendix B  
to 10 CFR 20.1001-20.2401

ARCO  
BLUEWATER MILL

Radiological Analyses of Environmental Air Particulate Samples

Location: BERRYHILL HOUSE

Date sampled: 07-01-96 thru 09-30-96

Radionuclide =====	Concentration uCi/ml =====	Error estimate uCi/ml =====	LLD uCi/ml =====	% of Limit* =====
U-nat	1.80E-16	1.00E-17	1.00E-16	0.20
Th-230	7.00E-17	2.00E-17	1.00E-16	0.35
Ra-226	2.00E-17	2.00E-17	1.00E-16	0.00
Pb-210	1.50E-14	2.30E-15	2.00E-15	2.50

Location: S.E. PERIMETER

Date sampled: 07-01-96 thru 09-30-96

Radionuclide =====	Concentration uCi/ml =====	Error estimate uCi/ml =====	LLD uCi/ml =====	% of Limit* =====
U-nat	4.20E-16	2.00E-17	1.00E-16	0.47
Th-230	7.00E-17	1.00E-17	1.00E-16	0.35
Ra-226	2.00E-17	2.00E-17	1.00E-16	0.00
Pb-210	1.60E-14	2.50E-15	2.00E-15	2.67

\* Effluents limit for the public specified in Appendix B  
to 10 CFR 20.1001-20.2401



ARCO  
BLUEWATER MILL

Radiological Analyses of Environmental Air Particulate Samples

Location: BERRYHILL HOUSE

Date sampled: 10-01-96 thru 12-30-96

Radionuclide =====	Concentration uCi/ml =====	Error estimate uCi/ml =====	LLD uCi/ml =====	% of Limit* =====
U-nat	1.30E-16	2.00E-17	1.00E-16	0.14
Th-230	1.00E-17	2.00E-17	1.00E-16	0.05
Ra-226	7.00E-17	5.00E-17	1.00E-16	0.01
Pb-210	2.10E-14	3.40E-15	1.00E-15	3.50

Location: S.E. PERIMETER

Date sampled: 10-01-96 thru 12-30-96

Radionuclide =====	Concentration uCi/ml =====	Error estimate uCi/ml =====	LLD uCi/ml =====	% of Limit* =====
U-nat	1.30E-16	2.00E-17	1.00E-16	0.14
Th-230	9.00E-17	5.00E-17	1.00E-16	0.45
Ra-226	4.00E-17	4.00E-17	1.00E-16	0.00
Pb-210	2.30E-14	3.70E-15	2.00E-15	3.83

\* Effluents limit for the public specified in Appendix B  
to 10 CFR 20.1001-20.2401

ARCO  
Bluewater Mill

Radiological Analyses of Vegetation Samples

Location: Berryhill House #106A Date sampled: 10-14-96  
Vegetation Comp (forbs 15%, grasses 55%, and shrubs 30%)

Radionuclide =====	Concentration uCi/Kg =====	Error estimate uCi/Kg =====	LLD uCi/Kg =====
U-nat	9.00E-06	2.40E-06	3.00E-06
Ra-226	8.90E-05	3.40E-05	3.00E-07
Pb-210	-1.60E-04	2.70E-04	5.00E-06
Th-230	2.10E-05	2.10E-05	1.00E-06

Location: South East Perimeter, #107A Date sampled: 10-14-96  
Vegetation Comp (forbs 35%, shrubs 25%, and grasses 40%)

Radionuclide =====	Concentration uCi/Kg =====	Error estimate uCi/Kg =====	LLD uCi/Kg =====
U-nat	1.30E-05	2.40E-06	3.00E-06
Ra-226	1.90E-04	6.20E-05	3.00E-07
Pb-210	-1.20E-04	-2.40E-04	4.00E-06
Th-230	8.40E-06	1.80E-05	1.00E-06

## ATTACHMENT A

### Environmental Sampling Stations

