RADIOLOGICAL MONITORING PROGRAM
PERIOD COVERING AUGUST 1, 1973 THRU OCTOBER 31, 1973
FOR
CER GEONUCLEAR CORPORATION
PROJECT RIO BLANCO

SUBMITTED BY
EBERLINE INSTRUMENT CORPORATION
Santa Fe Laboratories

MASTER

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SUMMARY

RESULTS FOR AUGUST 1, 1973 THROUGH OCTOBER 31, 1973

Beta radioactivity in air particulate samples for this quarter remained at very low concentrations, ranging from 0.02 to 0.05 pCi/m³. These values are consistent with values observed by Eberline at other sites during this period, at Rio Blanco during previous periods, and with values reported by the Environmental Protection Agency (EPA) Air Surveillance Network. Gamma scans of the air particulate samples (composite) indicated that the concentrations of gamma emitters were below the minimum sensitivity of the 4" diameter x 4" thick NaI(Tl) detector.

TLD data for this period indicated an average background radiation dose rate of 2.7 millirem per week. This is consistent with the dose rate measured in 1972.

Beta radioactivity in surface water ranged from 0.0 to 8.8 pCi/l. These results were in agreement with other data obtained by Eberline. Tritium concentration measured by electrolytic enrichment were in the range of 0.1 to 0.5 pCi/ml. Gamma scans indicated no detectable activity above background and system sensitivity.

Gamma scan analysis of milk indicated no significant concentration of gamma emitters except natural potassium.

The tritium concentration in water recovered by distillation from soil samples was less than 1 pCi/ml. No gamma emitters other than natural thorium, uranium and potassium were detected except for Cs-137, ranging from less than 0.04 to 1.18 pCi/g dry weight, due to worldwide fallout.

The concentration of Sr-90 in vegetation samples ranged from 0.10 to 0.64 pCi/g dry weight. The tritium concentration in water recovered by distillation was less than 1 pCi/g. No gamma emitters were detected other than natural potassium.

Several fish samples were analyzed this quarter. The concentration of Sr-90 ranged from 0.03 to 0.60 pCi/g dry weight of the edible portion of fish. One fish sample was analyzed for tritium. The tritium concentration was less than 1 pCi/g. The gamma analysis of fish indicated no significant concentrations of gamma emitters except natural potassium.

Deer meat samples were analyzed for Sr-89 and Sr-90, tritium and gamma scan. The concentration of Sr-89 and Sr-90 were $\leq$ 0.05 and 0.02 pCi/g dry weight

respectively. The tritium concentration in water recovered by distillation was less than 1 pCi/g. No gamma emitters were detected other than natural potassium.

None of the results obtained during this period differed significantly from expected levels.

INTRODUCTION

The Radiological Monitoring Program for Rio Blanco was initiated in October, 1971; however, this is the second quarterly report for Rio Blanco since the nuclear explosive was detonated on May 17, 1973. On-site measurements for the period during and following detonation indicate that no measurable amount of radioactivity was released to the biosphere. The data in this quarterly report may be compared with data from previous periods to verify that radioactivity from the detonation was not measurable in the environment.

The data obtained on-site before and after detonation (augmented program) are not included in this quarterly report, but will be included in a separate report at a later date.

This report covers the routine portion of the environmental monitoring program performed by EIC (Santa Fe Laboratory) during the period August 1, 1973 through October 31, 1973.

QUALITY CONTROL

Procedures used by Eberline Instrument Corporation (EIC) are the same as or equivalent to those recommended by the Environmental Protection Agency. Standards supplied by the National Bureau of Standards, Health and Safety Laboratory of the U.S. Atomic Energy Commission, Environmental Protection Agency, and the International Atomic Energy Agency are used for calibration of equipment and procedures. EIC also participates in interlaboratory comparison programs. The quality control program includes the use of internal tracers wherever possible, the analysis of blank samples, and the analysis of samples to which known amounts of radioactive material have been added. Samples of interlaboratory cross-checks are listed in the table below.

Interlaboratory Comparisons

<u>Sample Type</u>	<u>Isotope</u>	<u>EIC Value</u>	<u>Ref. Laboratory Standard Value</u>	<u>Ref. Lab.**</u>
Charcoal	^{131}I	4.11×10^5 dpm	4.34×10^5 dpm	LASL
Filter Paper	^{137}Cs	1.22×10^5 dpm	1.18×10^5 dpm	LASL
Filter Paper	^{60}Co	2.28×10^5 dpm	2.36×10^5 dpm	LASL
Filter Paper	^{90}Sr	2.41×10^4 dpm	2.58×10^4 dpm	LASL
Soil	^{90}Sr	2.3 pCi	2.0 pCi	HASL
Soil	^{90}Sr	4.4 pCi	4.2 pCi	HASL
Soil	^{90}Sr	54 pCi	58 pCi	HASL
Soil	^{90}Sr	68 pCi	70 pCi	HASL
Water	^3H	4.75×10^{-2} uCi	4.45×10^{-2} uCi	NERC-EPA
Water	^3H	4.75×10^{-2} uCi	4.49×10^{-2} uCi	LLL
Water	^3H	49.2 pCi/ml	51.8 pCi/ml	AQCS-EPA
Water	^3H	55.4 pCi/ml	52.9 pCi/ml	AQCS-EPA
Urine	^{239}Pu	0.50 pCi	0.63 pCi	IAEA
Urine	U	29.0 ug	33.6 ug	IAEA
Milk	^{90}Sr	1.69 nCi	1.63 nCi	IAEA
Milk	^{131}I	9.4 nCi	10.0 nCi	IAEA
Milk	^{131}I	96 nCi	100 nCi	IAEA
Milk	^{137}Cs	8.9 nCi	10.0 nCi	IAEA
Milk	^{137}Cs	91 nCi	100 nCi	IAEA
Milk	^{140}Ba	1.9 nCi	2.0 nCi	IAEA
Milk	^{140}Ba	22.4 nCi	20.0 nCi	IAEA

Quality Control (Cont'd)

*References

HASL Procedures Manual, edited by John H. Harley, Health and Safety Laboratory, U.S. Atomic Energy Commission, 1972 Edition, revised annually.

Radiochemical Procedures for the Analysis of Nuclear Reactor Aqueous Solutions, edited by H. L. Krieger and S. Gold, Environmental Protection Agency, Division of Research, August 1971.

Radionuclide Analysis of Environmental Samples, A Laboratory Manual of Methodology, edited by Herman L. Krieger, Richard J. Velten, and Frantz J. Burmann, U.S. Department of Health, Education, and Welfare, Division of Radiological Health, revised February 1966.

**Laboratory Codes

LASL - Los Alamos Scientific Laboratory, University of California

HASL - Health & Safety Laboratory, U.S. Atomic Energy Commission

LLL - Lawrence Livermore Laboratory, University of California

NERC - National Environmental Research Center, Las Vegas - EPA

AQCS - Analytical Quality Control Services - EPA

IAEA - International Atomic Energy Agency, Vienna, Austria

GAMMA SENSITIVITIES
EIC NaI (Tl) SYSTEM
4" x 4" NaI (Tl) DETECTOR

<u>Nuclide</u>	<u>Energy Used To Quantify (KeV)</u>	<u>MDA* pCi/Sample</u>	<u>MDA** pCi/Sample</u>	<u>MDA*** pCi/Sample</u>
Co-57	122	10	18	25
Ce-Pr-144	134	15	27	39
Ce-Pr-141	145	15	27	39
Hg-203	279	12	21	31
Cr-51	320	102	181	254
I-131	364	11	20	28
Ru-103 & Ru Rh-106	497-512	11	19	26
Na-22	511	6	10	16
Ba-140	537	34	62	86
Cs-134	605	14	24	30
Cs-137	662	16	28	39
Zr-Nb-95	724, 756, 765	7	13	17
Co-58	810	15	27	36
Mn-54	835	15	28	38
Zn-65	1115	40	73	88
Co-60	1173	20	37	43
K-40	1460	269	483	630

* Minimum detectable activity for a 100 mm diameter x 20 mm deep Petri dish geometry and 100-minutes counting time.

** Minimum detectable activity for a 100 mm diameter x 75 mm deep container geometry and 100-minutes counting time.

***Minimum detectable activity for a 2.5 liter Marinelli beaker geometry and 100-minutes counting time.

RIO BLANCO SITE
AIR PARTICULATE SAMPLES
(Gross Beta Analyses)

<u>Collection Date</u>	<u>Volume m³</u>	<u>Beta pCi/m³</u>
08-14-73	281.6	0.05 ± 0.01
08-31-73	349.2	0.04 ± 0.01
09-15-73	303.7	0.02 ± 0.01
10-01-73	320.7	0.02 ± 0.01
10-15-73	282.9	0.03 ± 0.01
10-31-73	327.9	0.03 ± 0.01

RIFLE
AIR PARTICULATE SAMPLES
(Gross Beta Analyses)

<u>Collection Date</u>	<u>Volume m³</u>	<u>Beta pCi/m³</u>
08-16-73	322.4	0.04 ± 0.01
08-30-73	289.7	0.04 ± 0.01
09-14-73	285.5	0.04 ± 0.01
09-28-73	280.4	0.03 ± 0.01
10-14-73	320.3	0.03 ± 0.01
11-02-73	383.2	0.03 ± 0.01

MEEKER
AIR PARTICULATE SAMPLES
(Gross Beta Analyses)

<u>Collection Date</u>	<u>Volume m³</u>	<u>Beta pCi/m³</u>
08-14-73	281.2	0.05 ± 0.01
08-31-73	349.2	0.05 ± 0.01
09-15-73	303.7	0.04 ± 0.01
09-29-73	288.4	0.05 ± 0.01
10-15-73	326.2	0.04 ± 0.01
10-31-73	329.1	0.05 ± 0.01

GRAND JUNCTION
AIR PARTICULATE SAMPLES
(Gross Beta Analyses)

<u>Collection Date</u>	<u>Volume m³</u>	<u>Beta pCi/m³</u>
08-16-73	351.3	0.04 ± 0.01
08-30-73	282.5	0.03 ± 0.01
09-14-73	281.6	0.04 ± 0.01
09-27-73	265.1	0.03 ± 0.01
10-14-73	342.0	0.03 ± 0.01
11-01-73	367.0	0.04 ± 0.01

GRAND VALLEY
AIR PARTICULATE SAMPLES
(Gross Beta Analyses)

<u>Collection Date</u>	<u>Volume m³</u>	<u>Beta pCi/m³</u>
08-16-73	344.4	0.04 ± 0.01
08-30-73	289.3	0.04 ± 0.01
09-14-73	281.6	0.04 ± 0.01
09-27-73	257.4	0.03 ± 0.01
10-14-73	342.0	0.02 ± 0.01
11-01-73	367.0	0.02 ± 0.01

RANGELY
AIR PARTICULATE SAMPLES
(Gross Beta Analyses)

<u>Collection Date</u>	<u>Volume m³</u>	<u>Beta pCi/m³</u>
08-14-73	280.8	0.05 ± 0.01
08-31-73	347.9	0.05 ± 0.01
09-15-73	303.3	0.05 ± 0.01
09-29-73	285.5	0.04 ± 0.01
10-15-73	326.2	0.04 ± 0.01
10-31-73	328.4	0.05 ± 0.01

NORREL RANCH
AIR PARTICULATE SAMPLES
(Gross Beta Analyses)

<u>Collection Date</u>	<u>Volume m³</u>	<u>Beta pCi/m³</u>
08-14-73	281.6	0.03 ± 0.01
08-31-73	349.2	0.03 ± 0.01
09-15-73	303.7	0.02 ± 0.01
09-29-73	282.1	0.02 ± 0.01
10-15-73	325.4	0.02 ± 0.01
10-31-73	328.4	0.02 ± 0.01

AIR PARTICULATE SAMPLES
(Gamma Scan)

<u>Collection Station</u>	<u>Collection Date</u>	<u>pCi/m³</u>		
		<u>Ce-141, 144</u>	<u>Ru-103, 106</u>	<u>Zr-Nb-95</u>
Grand Junction	4th Qtr. Composite	< 0.010	< 0.007	< 0.005
Grand Valley	4th Qtr. Composite	< 0.010	< 0.007	< 0.005
Meeker	4th Qtr. Composite	< 0.010	< 0.007	< 0.005
Norrel Ranch	4th Qtr. Composite	< 0.010	< 0.007	< 0.005
Rangely	4th Qtr. Composite	< 0.010	< 0.007	< 0.005
Rifle	4th Qtr. Composite	< 0.010	< 0.007	< 0.005
Rio Blanco Site	4th Qtr. Composite	< 0.010	< 0.007	< 0.005

AREA MONITORS-TLD
(Dose for Period-mrem)*

<u>Station</u>	<u>mrem $\pm$ 2 σ</u>
Wellhead	38 $\pm$ 8
One Mile Up Valley	45 $\pm$ 8
Two Miles Up Valley	**
One Mile Down Valley	42 $\pm$ 2
Two Miles Down Valley	40 $\pm$ 2
Flare Stack Up Valley	39 $\pm$ 5
Flare Stack Down Valley	36 $\pm$ 6
Norrel Ranch	44 $\pm$ 9
Equity Oil Camp	40 $\pm$ 14
Brennan Ranch	35 $\pm$ 6
Berthelson Ranch	41 $\pm$ 1
Meeker	35 $\pm$ 1
Rangely	27 $\pm$ 2
Grand Valley	35 $\pm$ 1
Rifle	59 $\pm$ 2
Grand Junction	32 $\pm$ 8

* TLD's annealed 08-21-73 and read out 12-03-73.
TLD's were in field from 08-24-73 to 11-29-73.

** TLD lost.

WATER

(Gross Alpha, Beta, Tritium, and Gamma Scan)

<u>Station</u>	<u>Collection Date</u>	<u>Alpha pCi/l</u>	<u>Beta pCi/l</u>	<u>Tritium pCi/ml*</u>	<u>Gamma Scan</u>
Fawn Creek, Downstream	10-01-73	0.0 ± 2.5	6.7 ± 6.2		ND
Fawn Creek, Upstream	10-01-73	0.0 ± 2.5	0.0 ± 2.0		ND
Berthelson Ranch	10-01-73	0.0 ± 2.5	8.3 ± 6.3	0.2 ± 0.1	ND
Equity Oil Camp	09-29-73	0.0 ± 2.5	0.0 ± 2.0	0.5 ± 0.1	ND
Brennan Ranch	10-01-73	0.0 ± 2.5	0.0 ± 2.0	0.3 ± 0.1	ND
Norrel Ranch	09-29-73	0.0 ± 2.5	0.0 ± 2.0	0.1 ± 0.1	ND
Rifle	09-28-73	0.0 ± 2.5	8.8 ± 6.3		ND
Grand Valley	09-27-73	0.0 ± 2.5	0.0 ± 2.0		ND
Grand Junction	09-27-73	0.0 ± 2.5	0.0 ± 2.0		ND
Rangely	09-29-73	0.0 ± 2.5	6.7 ± 6.2		ND
Meeker	09-29-73	0.0 ± 2.5	0.0 ± 2.0		ND
Colorado River	09-27-73		0.0 ± 2.0		ND
East Rifle Creek	09-27-73		7.7 ± 4.7		ND
Main Elk Creek	09-27-73		4.8 ± 4.6		ND
Piceance Creek	09-29-73		8.2 ± 4.7		ND
Rio Blanco Lake	09-29-73		6.4 ± 4.7		ND
White River (W. of Piceance)	09-29-73		0.0 ± 2.0		ND
White River (Meeker)	09-29-73		0.0 ± 2.0		ND

* Analyzed by electrolytic enrichment.

ND = No detectable activity above background and system sensitivity.

MILK SAMPLES
(Gamma Scan)

<u>Station</u>	<u>Collection Date</u>	<u>Gamma Scan</u>
Meeker	09-29-73	ND
Brennan Ranch	10-01-73	ND
Norrel Ranch	10-01-73	ND
Berthelson Ranch	*	*

ND = No detectable activity above background and system sensitivity other than natural potassium.

* No milk available.

SOIL SAMPLES
(Tritium and Gamma Scan)

<u>Station</u>	<u>Collection Date</u>	<u>Tritium pCi/g*</u>	<u>Gamma Scan** Cs-137 pCi/g*</u>
Wellhead	10-01-73	0.00 ± 1.00	< 0.04
Upstream #1	10-01-73	0.00 ± 1.00	1.18 ± 0.14
Upstream #2	10-01-73	0.00 ± 1.00	0.33 ± 0.15
Downstream #1	10-01 73	0.00 ± 1.00	< 0.05
Downstream #2	10-01-73	0.00 ± 1.00	< 0.05
Flare Stack, Up Valley	10-01-73	0.00 ± 1.00	0.95 ± 0.12
Flare Stack, Down Valley	10-01-73	0.00 ± 1.00	1.65 ± 0.16
Norrel Ranch	09-29-73	0.00 ± 1.00	2.89 ± 0.18
Equity Oil Camp	09-29-73	0.00 ± 1.00	0.37 ± 0.11
Brennan Ranch	09-29-73	0.00 ± 1.00	< 0.06
Berthelson Ranch	10-01-73	0.00 ± 1.00	0.94 ± 0.18
Grand Valley	09-27-73	0.00 ± 1.00	< 0.04
Grand Junction	09-27-73	0.00 ± 1.00	< 0.06
Rifle	09-28-73	0.00 ± 1.00	0.25 ± 0.14
Meeker	09-29-73	0.00 ± 1.00	< 0.06
Rangely	09-29-73	0.00 ± 1.00	< 0.05

* Analyses results based on dry weight.

** No other radionuclide was detected above background and system sensitivity other than natural thorium, uranium and potassium except Cs-137 listed above.

VEGETATION SAMPLES
(Sr-89, Sr-90, Tritium and Gamma Scan)

<u>Station</u>	<u>Vegetation Type</u>	<u>Collection Date</u>	<u>Sr-89 pCi/g*</u>	<u>Sr-90 pCi/g*</u>	<u>Tritium pCi/g*</u>	<u>Gamma Scan</u>
Upstream from Wellhead	Greasewood	10-01-73	0.00 ± 0.05	0.18 ± 0.07	0.00 ± 1.00	ND
	Goldenrod	10-01-73	0.00 ± 0.05	0.15 ± 0.08	0.00 ± 1.00	ND
	Sagebrush	10-01-73	0.00 ± 0.05	0.15 ± 0.06	0.00 ± 1.00	ND
	Serviceberry	10-01-73	0.00 ± 0.05	0.20 ± 0.04	0.00 ± 1.00	ND
	Willow	10-01-73	0.00 ± 0.05	0.64 ± 0.09	0.00 ± 1.00	ND
Downstream from Wellhead	Greasewood	10-01-73	0.00 ± 0.05	0.22 ± 0.11	0.00 ± 1.00	ND
	Goldenrod	10-01-73	0.00 ± 0.05	0.14 ± 0.06	0.00 ± 1.00	ND
	Sagebrush	10-01-73	0.00 ± 0.05	0.32 ± 0.06	0.00 ± 1.00	ND
Wellhead	Greasewood	10-01-73	0.00 ± 0.05	0.10 ± 0.07	0.00 ± 1.00	ND
	Goldenrod	10-01-73	0.00 ± 0.05	0.26 ± 0.05	0.00 ± 1.00	ND
	Sagebrush	10-01-73	0.00 ± 0.05	0.23 ± 0.09	0.00 ± 1.00	ND
Brennan Ranch	Milk Cow Feed	09-29-73	0.00 ± 0.05	0.21 ± 0.12		ND
Berthelson Ranch	Milk Cow Feed	10-01-73	0.00 ± 0.05	0.11 ± 0.05		ND
Norrel Ranch	Milk Cow Feed	09-29-73	0.00 ± 0.05	0.22 ± 0.12		ND

* Analyses results based on dry weight

ND = No detectable activity above background and system sensitivity other than natural potassium.

FISH SAMPLES

(Sr-89, Sr-90, and Gamma Scan)

<u>Station</u>	<u>Common Name and Species</u>	<u>Collection Date</u>	<u>Wet Wt. (g)</u>	<u>Dry Wt. (g)</u>	<u>Sr-89 pCi/g*</u>	<u>Sr-90 pCi/g*</u>	<u>Tritium pCi/g*</u>	<u>Gamma Scan</u>
Rio Blanco Lake	Catfish (Ictalurus punctatus)	09-05-73	140	15	0.00 ± 0.05	0.23 ± 0.12		ND
White River at Piceance Creek	Minnow (Cyprinidar)	09-17-73	18	2	0.00 ± 0.05	0.60 ± 0.50		ND
Colorado River Below De Beque	Squawfish (Ptychocheilus lucius)	09-02-73	610	79	0.00 ± 0.05	0.21 ± 0.09		ND
Elk Creek	Brook Trout (Salvelinus fontinalis)	09-09-73	440	95	0.00 ± 0.05	0.38 ± 0.30		ND
Fawn Creek	Brown Trout (Salmo trutta fario)	09-17-73	114	24	0.00 ± 0.05	0.06 ± 0.04	0.00 ± 1.00	ND
White River Near Meeker	Brown Trout (Salmo trutta fario)	09-05-73	142	19	0.00 ± 0.05	0.03 ± 0.02		ND
Rifle Creek	Brown Trout (Salmo trutta fario)	09-18-73	89	8	0.00 ± 0.05	0.07 ± 0.05		ND

* Analyses results based on dry weight of edible portion of fish.

ND = No detectable activity above background and system sensitivity
other than natural potassium.

ANIMAL SAMPLES

(Sr-89, Sr-90, Tritium and Gamma Scan)

<u>Station</u>	<u>Meat Type</u>	<u>Collection Date</u>	<u>Sr-89 pCi/g*</u>	<u>Sr-90 pCi/g*</u>	<u>Tritium pCi/g*</u>	<u>Gamma Scan</u>
Black Sulphur	Deer	10-20-73	0.00 ± 0.05	0.02 ± 0.01		ND
Fawn Creek	Deer	10-27-73			0.00 ± 1.00	ND

* Analyses results based on dry weight.

ND = No detectable activity above background and system sensitivity
other than natural potassium.