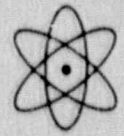


**FERRET EXPLORATION COMPANY OF NEBRASKA, INC.**

**216 Sixteenth Street Mall, Suite 810  
Denver, Colorado 80202**

**(303) 825-2266  
(303) 825-1544 - FAX**

40-8829



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RETURN ORIGINAL TO PDR, HQ.

August 21, 1990

Mr. Ramon Hall  
U.S. Nuclear Regulatory Commission  
Uranium Recovery Field Office  
Box 25325  
Denver, Colorado 80225

RE: Docket No. 40-8829  
SUA-1441

Dear Mr. Hall:



Enclosed please find two (2) copies of Ferret Exploration Company of Nebraska's Semiannual ALARA Report covering the two quarters ending June 30, 1990. This is the final ALARA report for license SUA-1441. All subsequent ALARA reports will be for commercial license SUA-1534.

If you have any questions regarding this report, please contact me at the above number.

Sincerely,

*Ralph Knode*

Ralph Knode  
Vice President

DESIGNATED ORIGINAL

Received By *Mary C. Hood*

*Lior  
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FERRET EXPLORATION COMPANY OF NEBRASKA, INC.

CROW BUTTE PROJECT

SEMIANNUAL ALARA REPORT

for the Two Quarters Ending

June 30, 1990

Docket Number: 40-8829

License Number: SUA-1441

Date Submitted: AUGUST, 21, 1990

Submitted By:

Shonda Granton  
Radiation Safety Officer

Ralph Knodel  
Vice President

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### APPENDIX

## 1.0 INTRODUCTION

The following ALARA Report for the Crow Butte R&D Project covers the time period from January 1, 1990 through June 30, 1990. Since Source Materials License SUA 1534 for commercial operations has been issued and now supercedes SUA 1441, this will be the final ALARA Report for the R & D operation.

The Crow Butte Pilot Plant discontinued process operations on August 13, 1989. At this time Wellfield No. 1 was shut-in in anticipation of commercial construction. Wellfield No. 2 is restored. An NRC site inspection was conducted on May 17, 1990. No violations or deviations were identified during this inspection.

A review of the existing Radiation Safety Program in place at the Crow Butte mine site was performed for the first half of 1990. All records and files appear to be in good order. Exposure levels to employees are consistently well below the allowable NRC exposure limits. No increasing trends in radionuclide concentration or employee exposure were noted for the first half of 1990.

On June 25-26, 1990, Bart Conroy of Resource Technologies performed the Annual Quality Assurance Program Audit and the Radiation Monitoring Program Audit. No discrepancies or deficiencies were identified in either program.

## 2.0 EXPOSURE RECORDS

The regulatory limits used for the Crow Butte project are as follows:

### Internal Occupational Exposure

Radon Daughters: 4 WLM (annually)  
Uranium Particulates:  $1 \times 10^{-10}$  uCi/ml  
0.063 uCi (quarterly)  
0.0065 uCi (weekly)

Combination of Constituents: Not to exceed unity when calculated by dividing the measurement made by the MPC for that constituent and adding the quotients.

### External Occupational Exposure

Gamma: 5 rems whole body (annually)  
1.25 rems whole body (quarterly)

Action levels are set at 25% of the above maximum permissible concentrations at the Crow Butte project.

Internal and external occupational exposures for all site employees are calculated by the Health Physics Technician (HPT) from data collected during this period. Monthly, quarterly, and semiannual radiation exposure summary forms are in the appendix and include occupational exposure summaries for radon daughters, uranium particulate, and gamma.

Maximum individual internal exposure due to radon daughters was as follows: first quarter, 0.033 WLM; second quarter, 0.047 WLM; and first half 1990, 0.080 WLM.

Maximum individual internal exposure due to uranium particulate was as follows: first quarter,  $1.57 \times 10^{-4}$  uCi; second quarter,  $4.28 \times 10^{-5}$  uCi; and first half 1990,  $2.00 \times 10^{-4}$  uCi.

Internal exposure due to the combination of radon daughters and uranium particulate, using the maximum individual exposures above, does not exceed unity as specified in 10 CFR 20, Appendix B.

External occupational gamma exposures were measured using personnel TLD badges. Maximum individual external exposure was as follows: first quarter, 0.006 rem; second quarter, 0.001 rem; and first half, 1990, 0.006 rem.

At no time during the first half of 1990 did any employee receive 25% of the allowable exposure limits for any radionuclide. Documentation and data are in good order and on file in the HPT files.

The calculations that are utilized by the HPT in determining occupational exposure are from the USNRC Regulatory Guide 8.30: "Health Physics Surveys in Uranium Mills" and from 10 CFR 20.

The HPT or appropriate designee issues Radiation Work Permits (RWP's) for all non-routine procedures which are undertaken. There were no RWP's issued during the first half of 1990.

### 3.0 BIOASSAY

Bioassays are performed on all personnel and contractors who are on site on a regular basis. Included in the Appendix are the bioassay results for the reporting period. All employees showed less than 5 ug/l. Spiked samples are included by Ferret-Nebraska with the employee samples. The spikes are not identified to the laboratory and are reported along with the employee results. Spike samples are made from specimens obtained from employees not assigned to the plant site.

Samples are sent to Energy Laboratories Inc. of Casper, Wyoming, where analyses are performed in compliance with Regulatory Guides 4.15 and 8.22: "Quality Assurance for Radiological Monitoring Programs (Normal Operation) - Effluent Streams and the Environment" and "Bioassay at Uranium Mills" respectively. Quality assurance and Standard Operating Procedures (SOP's) for the outside laboratory and project quality assurance spikes are in the HPT files at the mine site.

All bioassay results including spiked samples were reported to the HPT within the twenty-day limit specified in USNRC Reg. Guide 8.22.

#### 4.0 INSPECTION LOG ENTRIES AND SUMMARY REPORTS OF DAILY, WEEKLY, AND MONTHLY INSPECTIONS

The HPT and/or qualified designated operator conduct a daily walk-through, visual inspection of all work and storage areas within the plant to insure proper implementation of good safety and health practices that will minimize unnecessary contamination and insure adherence to the SOP's. Areas of concern or problems are observed and noted on the Daily Walk-Through Inspection Form. No major problems were noted during these inspections; minor problems were corrected immediately.

Operators, on a daily shift basis, are required to note in a log book any areas of concern or operational adjustments made during their shift. The left page of the operators' log book is used to document all activities and occurrences during each shift. The right page is used to post instructions from supervisors or general plant information. Operators initial each message after reading them. This is to insure smooth operations during shift changes and facilitate transfer and communication

of information required for their shift. The HPT also reviews the operators' log book as part of the daily walk-through inspection.

Operators perform the daily inspection of the pond enclosure, embankments, measurement of pond freeboard and leak detection systems. All information is recorded on the Waste Pond Data Sheet. Quarterly pond inspections are conducted by the project supervisor and copies are included in the semiannual reports and are on file at the mine site.

The HPT provides written weekly and monthly summaries of inspection findings to the plant superintendent and RSO. The monthly summaries detail all the radiation monitoring for the period and include copies of exposure calculations. Also included in the monthly reports are results of area and personnel TLD's, minutes from safety meetings, number of RWP's issued with any resulting additional personnel exposures, and documentation of any unusual or non-routine events occurring during the month. A copy is also forwarded to the vice president of Ferret-Nebraska. All reports are on file at the mine site. The inspection and reporting system in place appears to provide smooth transfer of data to appropriate personnel, and early detection of any non-routine events.

Visitors/contractors, upon entering the restricted area, are required to sign in, read and sign a Hazard Identification Sheet which is then retained on file by the HPT. All visitors are escorted while on site by an employee of Ferret-Nebraska. If necessary, contractors are escorted to their appropriate location of the restricted area. Before leaving the restricted area all visitors/contractors must perform a proper alpha survey and sign out. A review of the visitor log book indicates that all



visitors are properly signing in and out and noting they have performed a proper alpha survey. A review of the employee sign out sheet indicates all employees are listing actual survey results when signing out.

#### 5.0 DOCUMENTED TRAINING PROGRAM ACTIVITIES

MSHA Annual Refresher Training classes were held on June 13, 1990. Twenty-five FEN employees and contractors attended the eight hours of training.

Rhonda Grantham, Environmental Specialist, attended a training course entitled "Occupational Respiratory Protection for the Nuclear Industry" presented by Darell Bevis Associates, Inc. on April 9-13, 1990.

Documentation for the MSHA training, radiation safety training, and SOP's for task training are on file at the mine site in the HPT files.

#### 6.0 RADIATION SAFETY MEETING SUMMARY

As specified in License No. SUA 1441, radiation/safety training meetings are conducted every two months for all site personnel. During the first half of 1990 radiation/safety meetings were held February 21, April 18, and June 13 (MSHA Refresher). Areas addressed included SOP revisions, discussion of specific SOP's in light of radiation safety, and ongoing review of general radiation safety. Also discussed were general plant safety, the semiannual fire-fighting review, equipment safety, and an update of the Hazard Communication Program. At least thirty minutes of each meeting is devoted to radiation safety as required.

Minutes of the radiation/safety meetings are in good order and on file in the HPT files.

## 7.0 RADIOLOGICAL SURVEY AND SAMPLING

All radiation monitoring equipment used at the Crow Butte site appears to be properly calibrated. Recalibration is performed at required intervals and documentation was reviewed and is on file at the mine site.

### 7.1 Site Monitoring-Operating Status

#### 7.1.1 Radon Daughters

Surveys for radon daughters are required on a monthly basis. Levels within the process plant and office complex were less than the 0.08 WL action level for the first half of 1990.

Listed below are the monthly plant averages for radon daughter concentrations for the reporting period. All values are in Working Levels.

January	0.012	April	0.011
February	0.013	May	0.014
March	0.009	June	0.020

All radon daughter monitoring data is in good order and on file at the mine site. Monthly summary forms of radon daughter surveys and individual survey results are included in the Appendix.

### 7.1.2 Uranium Particulate

Surveys for uranium particulate are required to be performed monthly within the plant structure. The gross alpha method is used for determining long lived radionuclides. The average monthly uranium particulate concentrations for the reporting period are listed below. All values are in uCi/ml.

January	$3.11 \times 10^{-13}$	April	$1.43 \times 10^{-13}$
February	$3.64 \times 10^{-13}$	May	$3.24 \times 10^{-14}$
March	$1.21 \times 10^{-13}$	June	$4.13 \times 10^{-14}$

Due to the slurry nature of the yellowcake, airborne uranium does not appear to be a problem at this site. This is documented by the consistently low concentrations observed. In addition, since the plant is shut down there is no yellowcake product on site at this time. Monthly summary forms for airborne uranium are included in the Appendix.

All data is in good order and on file in the HPT files at the mine site.

### 7.1.3 Gamma

Gamma surveys are performed on a monthly basis throughout the plant facility and office structure utilizing an ESP-1 with an HP-270 probe. In conjunction with the monthly surveys, area dosimeters (TLD's) have been placed in specified plant and office areas. Both area and personnel TLD's are changed quarterly. Employee occupational external exposure is

determined from the personnel TLD badges. Summaries of area TLD and personnel TLD badges are included in the Appendix.

During December, 1987, a "Radiation Area" was established around a small radium removal column which had been used in treating R.O. permeate for land application. The column is not currently in use and is located in a low access part of the plant. The "Radiation Area" remains in effect and is monitored regularly.

Increased gamma levels around certain filter canisters and IX columns have been observed at the Crow Butte site. Extra monitoring is warranted near these locations during production operations. Data collected using the area TLD's and the ESP-1 with HP-270 probe provides screening information to identify potential problems.

As expected, all gamma radiation levels (with the exception of the above mentioned radium removal column) decreased noticeably concurrent with plant shut-down.

All data and documentation is on file at the mine site in the HPT files.

## 8.0 SOLID/LIQUID WASTES - EFFLUENT

### 8.1 Contaminated Waste

#### 8.1.1 Solid Waste

Effluent generated from the mine site in the form of solids (spent resin, resin fines, miscellaneous pipe and fittings, etc.) is separated into two categories as follows:

- a) Wastes which can be decontaminated and reclassified as non-contaminated waste.
- b) Wastes which cannot be easily decontaminated.

Wastes included in category "a" are those which can be decontaminated using the best available method. A survey is performed on the decontaminated waste to assure all contamination has been removed and is within the guidelines to be released to an unrestricted area, documented, and disposed of at the nearest sanitary landfill. Radiation levels will be below those stated in Attachment No.1 to USNRC Source Material License No. SUA-1441.

Wastes included in category "b" are stored on a curbed concrete pad until they can be shipped to an NRC licensed site. Currently there is a small amount of this type of waste being properly stored on site.

### 8.1.2 Liquid Waste

Effluent generated at the mine site in the form of liquid is stored in the evaporation ponds. Evaporation pond levels, leak detection systems, etc., are measured on a daily basis (see Section 3.2).

Since the plant was shut down there was no process bleed generated during the first half of 1990. A small amount of waste water was generated from plant and equipment cleanup. All water generated from plant cleanup was sent to the west cell. R.O. permeate is stored in the east cell where it can be treated to meet specifications for land application. Sample frequency for both pond contents is now once annually (USNRC Amendment No. 18 of SUA 1441). The pond contents were not sampled during the first half of 1990.

### 8.2 Non-Contaminated

Solid wastes (boxes, office wastes, etc.) are collected on site on a regular frequency and disposed of at a licensed sanitary landfill.

Domestic liquid wastes (restroom and lunchroom water) are disposed of in a septic system at the facility.

All waste or equipment, regardless of potential for contamination, is surveyed for both alpha and beta-gamma prior to release from the site, as required by Attachment No. 1 to Ferret-Nebraska's NRC license.

Documentation on the contaminated/non-contaminated solid wastes and the release of non-contaminated waste are in good order and on file in the HPT files at the site.

#### 9.0 REPORTS ON OVEREXPOSURE OF WORKERS

No employee overexposures occurred during the first half of 1990.

#### 10.0 STANDARD OPERATING PROCEDURES

Standard Operating Procedures (SOP's) appear to be complete and are being used at the mine site. They are available to all staff and management involved with the process and operations of the facility.

During the first half of 1990, ten minor revisions were made to the existing SOP's. No new SOP's were implemented during the first half of 1990.

APPENDIX



FERRET EXPLORATION COMPANY OF NEBRASKA

CROW BUTTE PROJECT

RADIATION EXPOSURE SUMMARY

MONTH ENDING January, 1990

MONTH ENDING	% SOL U308 DETERMINED	EMPLOYEE NAME	OCCUPANCY hrs	GAMMA EXPOSURE RATE mR/hr	EXPOSURE mR	WORKING LEVELS WL	EXPOSURE WLM	URANIUM CONCENTRATION uCi/ml	URANIUM INTAKE uCi
1-90	yes	Bass	150	-	*	0.012	0.010	$3.11 \times 10^{-13}$	$5.60 \times 10^{-5}$
1-90	yes	Collings	0	-	*	0.012	0	$3.11 \times 10^{-13}$	0
1-90	yes	Daugherty	120	-	*	0.012	0.008	$3.11 \times 10^{-13}$	$4.48 \times 10^{-5}$
1-90	yes	Grantham	179	-	*	0.012	0.012	$3.11 \times 10^{-13}$	$6.68 \times 10^{-5}$
1-90	yes	Hamaker	192	-	*	0.012	0.013	$3.11 \times 10^{-13}$	$7.17 \times 10^{-5}$
1-90	yes	Huffman	40	-	*	0.012	0.003	$3.11 \times 10^{-13}$	$1.49 \times 10^{-5}$
1-90	yes	Knobe	1	-	*	0.012	$6.94 \times 10^{-5}$	$3.11 \times 10^{-13}$	$3.73 \times 10^{-7}$
1-90	yes	Lenmon	186.5	-	*	0.012	0.013	$3.11 \times 10^{-13}$	$6.96 \times 10^{-5}$
1-90	yes	Miller	160	-	*	0.012	0.011	$3.11 \times 10^{-13}$	$5.97 \times 10^{-5}$
1-90	yes	Prosser	112	-	*	0.012	0.008	$3.11 \times 10^{-13}$	$4.18 \times 10^{-5}$
1-90	yes	Raben	184	-	*	0.012	0.013	$3.11 \times 10^{-13}$	$6.87 \times 10^{-5}$
1-90	yes	Thayer	72	-	*	0.012	0.005	$3.11 \times 10^{-13}$	$2.69 \times 10^{-5}$

\*Gamma Exposure Frequency Quarterly

$$WLM = \left( \frac{WLM}{173} \right) (Hrs) < 0.08 WLM$$

$$U; uCi = (Uc uCi/ml) (1.2 m^3/hr) (\cdot hr/mo)(1000 ml/L)(1000 L/m^3) < 0.005 uCi (\text{@ } 25\%)$$

Radionuclide Mixture Concentration

$$\frac{WLM}{4 WLM} + \frac{U; uCi/ml}{1 \times 10^{10} uCi/ml} < 1$$

$$0.006 < 1$$

**FERRET EXPLORATION COMPANY OF NEBRASKA, INC.  
CROW BUTTE PROJECT**

**RADIATION EXPOSURE SUMMARY**

MONTH ENDING: February, 1990

MONTH ENDING	% SOL U <sub>3</sub> O <sub>8</sub> DETERMINED	EMPLOYEE NAME	OCCUPANCY hrs	GAMMA EXPOSURE RATE mR/hr	EXPOSURE mR	WORKING LEVELS WL	EXPOSURE WLM	URANIUM CONCENTRATION uCi/ml	URANIUM INTAKE uCi
2-90	yes	Bass	175.5	-	*	0.013	0.013	3.64 x 10 <sup>-13</sup>	7.67 x 10 <sup>-5</sup>
2-90	yes	Collings	1	-	*	0.013	7.51 x 10 <sup>-5</sup>	3.64 x 10 <sup>-13</sup>	4.37 x 10 <sup>-7</sup>
2-90	yes	Daugherty	153	-	*	0.013	0.011	3.64 x 10 <sup>-13</sup>	6.68 x 10 <sup>-5</sup>
2-90	yes	Grantham	140	-	*	0.013	0.011	3.64 x 10 <sup>-13</sup>	6.12 x 10 <sup>-5</sup>
2-90	yes	Hamaker	108	-	*	0.013	0.008	3.64 x 10 <sup>-13</sup>	4.72 x 10 <sup>-5</sup>
2-90	yes	Huffman	65	-	*	0.013	0.005	3.64 x 10 <sup>-13</sup>	2.84 x 10 <sup>-5</sup>
2-90	yes	Knode	2	-	*	0.013	1.50 x 10 <sup>-4</sup>	3.64 x 10 <sup>-13</sup>	8.74 x 10 <sup>-7</sup>
2-90	yes	Lenmon	105.5	-	*	0.013	0.008	3.64 x 10 <sup>-13</sup>	4.61 x 10 <sup>-5</sup>
2-90	yes	Miller	136	-	*	0.013	0.010	3.64 x 10 <sup>-13</sup>	5.94 x 10 <sup>-5</sup>
2-90	yes	Prosser	54	-	*	0.013	0.004	3.64 x 10 <sup>-13</sup>	2.36 x 10 <sup>-5</sup>
2-90	yes	Raben	136	-	*	0.013	0.010	3.64 x 10 <sup>-13</sup>	5.94 x 10 <sup>-5</sup>
2-90	yes	Thayer	86	-	*	0.013	0.006	3.64 x 10 <sup>-13</sup>	3.76 x 10 <sup>-5</sup>

$$WLM = \sum \frac{(WL)(Hrs)}{173} < 0.08 \text{ WL}$$

$$uCi = (Uc \text{ uCi/ml})(1.2 \text{ m}^3/\text{hr})(x \text{ hr/wo})(1000 \text{ ml/L})(1000 \text{ L/m}^3)(0.005 \text{ uCi}(0.25\%))$$

\* Gamma Exposure Frequency Quarterly

Radionuclide Mixture Concentration

$$\frac{WL}{WLM} + \frac{U: \text{uCi/ml}}{1 \times 10^{-10} \text{ uCi/ml}} < 1$$

$$\frac{0.007}{1} < 1$$

**FERRET EXPLORATION COMPANY OF NEBRASKA, INC.  
CROW BUTTE PROJECT**

**RADIATION EXPOSURE SUMMARY**

MONTH ENDING: March, 1990

MONTH ENDING	% SOL U <sub>3</sub> O <sub>8</sub> DETERMINED	EMPLOYEE NAME	OCCUPANCY hrs	GAMMA* EXPOSURE RATE mR/hr	EXPOSURE mR	WORKING LEVELS WL	EXPOSURE WLM	URANIUM CONCENTRATION uCi/ml	URANIUM INTAKE uCi
3-90	yes	Bass	40	-	2	0.009	0.002	$1.21 \times 10^{-13}$	$5.81 \times 10^{-6}$
3-90	yes	Collings	0	-	1	0.009	0	$1.21 \times 10^{-13}$	0
3-90	yes	Daugherty	123	-	1	0.009	0.006	$1.21 \times 10^{-13}$	$1.79 \times 10^{-5}$
3-90	yes	Grantham	200	-	2	0.009	0.010	$1.21 \times 10^{-13}$	$2.90 \times 10^{-5}$
3-90	yes	Hamaker	176.5	-	0	0.009	0.009	$1.21 \times 10^{-13}$	$2.56 \times 10^{-5}$
3-90	yes	Huffman	129.5	-	5	0.009	0.007	$1.21 \times 10^{-13}$	$1.88 \times 10^{-5}$
3-90	yes	Knode	6	-	0	0.009	$3.12 \times 10^{-4}$	$1.21 \times 10^{-13}$	$8.71 \times 10^{-7}$
3-90	yes	Lemmon	87.5	-	3	0.009	0.005	$1.21 \times 10^{-13}$	$1.27 \times 10^{-5}$
3-90	yes	Miller	176	-	6	0.009	0.009	$1.21 \times 10^{-13}$	$2.56 \times 10^{-5}$
3-90	yes	Prosser	128	-	0	0.009	0.007	$1.21 \times 10^{-13}$	$1.86 \times 10^{-5}$
3-90	yes	Raben	178	-	5	0.009	0.009	$1.21 \times 10^{-13}$	$2.58 \times 10^{-5}$
3-90	yes	Thayer	165	-	0	0.009	0.009	$1.21 \times 10^{-13}$	$2.40 \times 10^{-5}$

$$WLM = \sum \frac{(WL)(Hrs)}{173} \approx 0.00 \text{ WLM}$$

$$U; \text{ uCi} = (U; \text{ uCi/ml}) (1.2 \text{ m}^3/\text{hr}) (x \text{ hr/yr}) (1000 \text{ ml/l}) (1000 \text{ l/m}^3) (0.005 \text{ uCi/25g})$$

\* Gamma Exposure Frequency Quarterly

Radionuclide Mixture Concentration

$$\frac{WL}{4 \text{ WLM}} = \frac{U; \text{ uCi/ml}}{1 \times 10^{-13} \text{ uCi/ml}} < 1$$

$$\frac{0.003}{1} < 1$$

FERRET EXPLORATION COMPANY OF NEBRASKA, INC.

CROW BUTTE PROJECT

RADIATION EXPOSURE SUMMARY

MONTH ENDING: April, 1990

MONTH ENDING	% SOL U <sub>3</sub> O <sub>8</sub> DETERMINED	EMPLOYEE NAME	OCCUPANCY hrs	GAMMA* EXPOSURE RATE mR/hr	EXPOSURE mR	WORKING LEVELS WL	EXPOSURE WLM	URANIUM CONCENTRATION uCi/ml	URANIUM INTAKE uCi
4-90	yes	Bass	135	-	*	0.011	0.009	1.43 x 10 <sup>-13</sup>	2.32 x 10 <sup>-5</sup>
4-90	yes	Collings	1	-	*	0.011	6.35 x 10 <sup>-5</sup>	1.43 x 10 <sup>-13</sup>	1.72 x 10 <sup>-7</sup>
4-90	yes	Daugherty	148	-	*	0.011	0.009	1.43 x 10 <sup>-13</sup>	2.54 x 10 <sup>-5</sup>
4-90	yes	Grantham	149	-	*	0.011	0.009	1.43 x 10 <sup>-13</sup>	2.56 x 10 <sup>-5</sup>
4-90	yes	Hamaker	116	-	*	0.011	0.007	1.43 x 10 <sup>-13</sup>	1.99 x 10 <sup>-5</sup>
4-90	yes	Huffman	35	-	*	0.011	0.002	1.43 x 10 <sup>-13</sup>	6.09 x 10 <sup>-6</sup>
4-90	yes	Knobe	6	-	*	0.011	3.82 x 10 <sup>-4</sup>	1.43 x 10 <sup>-13</sup>	1.03 x 10 <sup>-6</sup>
4-90	yes	Lenmon	48	-	*	0.011	0.003	1.43 x 10 <sup>-13</sup>	8.24 x 10 <sup>-6</sup>
4-90	yes	Miller	152	-	*	0.011	0.010	1.43 x 10 <sup>-13</sup>	2.61 x 10 <sup>-5</sup>
4-90	yes	Prosser	51.5	-	*	0.011	0.003	1.43 x 10 <sup>-13</sup>	8.84 x 10 <sup>-6</sup>
4-90	yes	Raben	136	-	*	0.011	0.009	1.43 x 10 <sup>-13</sup>	2.33 x 10 <sup>-5</sup>
4-90	yes	Thayer	112	-	*	0.011	0.007	1.43 x 10 <sup>-13</sup>	1.92 x 10 <sup>-5</sup>

$$WLM = \sum \frac{(WL)(Hrs)}{173} < 0.08 \text{ WL}$$

$$U; \text{ uCi} = (U; \text{ uCi/ml})(1.2 \text{ m}^3/\text{hr})(\text{hr}/\text{mo})(1000 \text{ ml/L})(1000 \text{ L/m}^3) < 0.005 \text{ uCi} (\text{25\%})$$

\* Gamma Exposure Frequency Quarterly

Radionuclide Mixture Concentration

$$\frac{WL}{173} + \frac{U; \text{ uCi/ml}}{1 \times 10^{-10} \text{ uCi/ml}} < 1$$

$$0.004 < 1$$

FERRET EXPLORATION COMPANY OF NEBRASKA, INC.

CROW BUTTE PROJECT

RADIATION EXPOSURE SUMMARY

MONTH ENDING: May, 1990

MONTH ENDING	% SOL U <sub>3</sub> O <sub>8</sub> DETERMINED	EMPLOYEE NAME	OCCUPANCY hrs	GAMMA* EXPOSURE RATE mR/hr	EXPOSURE mR	WORKING LEVELS WL	EXPOSURE WLM	URANIUM CONCENTRATION uCi/ml	URANIUM INTAKE uCi
5-90	yes	Bass	44	-	*	0.014	0.004	3.24 x 10 <sup>-14</sup>	1.71 x 10 <sup>-6</sup>
5-90	yes	Collings	1	-	*	0.014	8.09 x 10 <sup>-5</sup>	3.24 x 10 <sup>-14</sup>	3.89 x 10 <sup>-6</sup>
5-90	yes	Daugherty	66	-	*	0.014	0.005	3.24 x 10 <sup>-14</sup>	2.57 x 10 <sup>-6</sup>
5-90	yes	Grantham	196	-	*	0.014	0.016	3.24 x 10 <sup>-14</sup>	7.62 x 10 <sup>-6</sup>
5-90	yes	Hamaker	64	-	*	0.014	0.005	3.24 x 10 <sup>-14</sup>	2.49 x 10 <sup>-6</sup>
5-90	yes	Huffman	38.5	-	*	0.014	0.003	3.24 x 10 <sup>-14</sup>	1.50 x 10 <sup>-6</sup>
5-90	yes	Knobe	10	-	*	0.014	0.001	3.24 x 10 <sup>-14</sup>	3.89 x 10 <sup>-7</sup>
5-90	yes	Lemmon	50	-	*	0.014	0.004	3.24 x 10 <sup>-14</sup>	1.94 x 10 <sup>-6</sup>
5-90	yes	Miller	152	-	*	0.014	0.012	3.24 x 10 <sup>-14</sup>	5.91 x 10 <sup>-6</sup>
5-90	yes	Prosser	71.5	-	*	0.014	0.006	3.24 x 10 <sup>-14</sup>	2.78 x 10 <sup>-6</sup>
5-90	yes	Raben	64.5	-	*	0.014	0.005	3.24 x 10 <sup>-14</sup>	2.51 x 10 <sup>-6</sup>
5-90	yes	Thayer	71	-	*	0.014	0.006	3.24 x 10 <sup>-14</sup>	2.76 x 10 <sup>-6</sup>

WLM =  $\frac{[WL](Hrs)}{175} < 0.08 \text{ WL}$

U; uCi =  $(Uc \text{ uCi/ml})(1.2 \text{ e}^3/\text{hr})(x \text{ hr/eo})(1000 \text{ ml/L})(1000 \text{ L/e}^3)(0.005 \text{ uCi}(25\%))$

\* Gamma Exposure Frequency Quarterly

Radionuclide Mixture Concentration

$\frac{WL}{WLM} + \frac{U; \text{ uCi/ml}}{1 \times 10^{-10} \text{ uCi/ml}} < 1$

$\frac{0.004}{1} < 1$

FERRET EXPLORATION COMPANY OF NEBRASKA, INC.

CROW BUTTE PROJECT

RADIATION EXPOSURE SUMMARY

MONTH ENDING: June, 1990

MONTH ENDING	% SOL U <sub>3</sub> O <sub>8</sub> DETERMINED	EMPLOYEE NAME	OCCUPANCY hrs	GAMMA* EXPOSURE RATE mR/hr	EXPOSURE mR	WORKING LEVELS WL	EXPOSURE WLM	URANIUM CONCENTRATION uCi/ml	URANIUM INTAKE uCi
6-90	yes	Bass	0	-	0	0.020	0	4.13 x 10 <sup>-14</sup>	0
6-90	yes	Collings	0	-	0	0.020	0	4.13 x 10 <sup>-14</sup>	0
6-90	yes	Daugherty	35	-	0	0.020	0.004	4.13 x 10 <sup>-14</sup>	1.73 x 10 <sup>-6</sup>
6-90	yes	Grantham	193	-	0	0.020	0.022	4.13 x 10 <sup>-14</sup>	9.57 x 10 <sup>-6</sup>
6-90	yes	Hamaker	82	-	0	0.020	0.009	4.13 x 10 <sup>-14</sup>	4.06 x 10 <sup>-6</sup>
6-90	yes	Huffman	4	-	0	0.020	4.62 x 10 <sup>-4</sup>	4.13 x 10 <sup>-14</sup>	1.98 x 10 <sup>-7</sup>
6-90	yes	Knode	5	-	0	0.020	0.001	4.13 x 10 <sup>-14</sup>	2.48 x 10 <sup>-7</sup>
6-90	yes	Lemmon	0	-	0	0.020	0	4.13 x 10 <sup>-14</sup>	0
6-90	yes	Miller	168	-	0	0.020	0.019	4.13 x 10 <sup>-14</sup>	8.33 x 10 <sup>-6</sup>
6-90	yes	Prosser	49.5	-	0	0.020	0.006	4.13 x 10 <sup>-14</sup>	2.45 x 10 <sup>-6</sup>
6-90	yes	Raben	1	-	0	0.020	1.16 x 10 <sup>-4</sup>	4.13 x 10 <sup>-14</sup>	4.96 x 10 <sup>-6</sup>
6-90	yes	Thayer	40	-	1	0.020	0.005	4.13 x 10 <sup>-14</sup>	1.98 x 10 <sup>-6</sup>

$$WLM = \sum \frac{(WL)(Hrs)}{173} < 0.08 \text{ WL}$$

$$U; \text{ uCi} = (U; \text{ uCi/ml})(1.2 \text{ m}^3/\text{hr})(x \text{ hr/wo})(1000 \text{ ml/L})(1000 \text{ L/m}^3) < 0.005 \text{ uCi} (0.25\%)$$

\* Oesaa Exposure Frequency Quarterly

Radionuclide Mixture Concentration

$$\frac{WL}{4 \text{ WLM}} + \frac{U; \text{ uCi/ml}}{1 \times 10^{-10} \text{ uCi/ml}} < 1$$

$$0.005 < 1$$

FERRET EXPLORATION CO. OF NEBRASKA, INC.  
CROW BUTTE 200 02T

SEMIANNUAL RADIATION EXPOSURE SUMMARY

PERIOD ENDING: June, 1990

NAME	FIRST QUARTER			SECOND QUARTER			SEMIANNUAL TOTAL		
	mR	WLM	uCi	mR	WLM	uCi	mR	WLM	uCi
Bass	2	0.025	$1.39 \times 10^{-4}$	0	0.013	$2.49 \times 10^{-5}$	2	0.038	$1.64 \times 10^{-4}$
Collings	1	$7.51 \times 10^{-5}$	$4.37 \times 10^{-7}$	0	$1.44 \times 10^{-4}$	$2.11 \times 10^{-7}$	1	$2.19 \times 10^{-4}$	$6.48 \times 10^{-7}$
Daugherty	1	0.025	$1.30 \times 10^{-4}$	0	0.018	$2.97 \times 10^{-5}$	1	0.043	$1.60 \times 10^{-4}$
Grantham	2	0.033	$1.57 \times 10^{-4}$	0	0.047	$4.28 \times 10^{-5}$	2	0.080	$2.00 \times 10^{-4}$
Hamaker	0	0.030	$1.44 \times 10^{-4}$	0	0.021	$2.64 \times 10^{-5}$	0	0.051	$1.70 \times 10^{-4}$
Huffman	5	0.015	$6.21 \times 10^{-5}$	0	0.005	$7.79 \times 10^{-6}$	5	0.020	$6.99 \times 10^{-5}$
Knode	0	0.001	$2.12 \times 10^{-6}$	0	0.002	$1.67 \times 10^{-6}$	0	0.003	$3.79 \times 10^{-6}$
Lemmon	3	0.026	$1.28 \times 10^{-4}$	0	0.007	$1.02 \times 10^{-5}$	3	0.033	$1.38 \times 10^{-4}$
Miller	6	0.030	$1.45 \times 10^{-4}$	0	0.041	$4.03 \times 10^{-5}$	6	0.071	$1.55 \times 10^{-4}$
Prosser	0	0.019	$8.40 \times 10^{-5}$	0	0.015	$1.41 \times 10^{-5}$	0	0.034	$9.81 \times 10^{-5}$
Raben	5	0.032	$1.54 \times 10^{-4}$	0	0.014	$2.59 \times 10^{-5}$	5	0.046	$1.80 \times 10^{-4}$
Thayer	0	0.020	$8.85 \times 10^{-5}$	1	0.018	$2.39 \times 10^{-5}$	1	0.038	$1.12 \times 10^{-4}$

mR = Gamma Exposure

WLM = Radon Daughters, Working Level Months

uCi = Uranium Intake

FERRET EXPLORATION COMPANY OF NEBRASKA, INC.

CROW BUTTE PROJECT

RECORD OF BIOASSAY SAMPLE COLLECTION AND HANDLING

NAME	EMPLOYEE ID NUMBER	WORK CATEGORY	DATE BOTTLE DISTRIBUTED	DATE BOTTLE RETURNED	DATE SENT TO LABORATORY	NAME OF LABORATORY	DATE RESULTS RETURNED	RESULTS (ugU/l)
Don Bass	506-50-4145	Op	3-5-90	3-5-90	3-7-90	Energy Laboratories, Inc	3-22-90	<5
Mike Brost	508-70-6906	O	3-2-90	3-5-90	3-7-90	Energy Laboratories, Inc	3-22-90	<5
Emil Daugherty	505-60-3142	Op	3-5-90	3-5-90	3-7-90	Energy Laboratories, Inc	3-22-90	<5
Rhonda Grantham	505-80-5721	O	3-5-90	3-5-90	3-7-90	Energy Laboratories, Inc	3-22-90	<5
Paul Hamaker	508-70-6467	Op	3-5-90	3-5-90	3-7-90	Energy Laboratories, Inc	3-22-90	<5
Leland Huffman	252-94-9306	Op	3-4-90	3-4-90	3-7-90	Energy Laboratories, Inc	3-22-90	<5
Ralph Knode	520-52-1238	O	3-2-90	3-6-90	3-7-90	Energy Laboratories, Inc	3-22-90	<5
Tom Lemmon	508-52-5201	Op	3-5-90	3-5-90	3-7-90	Energy Laboratories, Inc	3-22-90	<5
Chuck Miller	524-72-9638	O	3-5-90	3-5-90	3-7-90	Energy Laboratories, Inc	3-22-90	<5
Jim Prosser	506-62-4388	Op	3-2-90	3-5-90	3-7-90	Energy Laboratories, Inc	3-22-90	<5
Pete Raben	507-52-3945	Op	3-5-90	3-5-90	3-7-90	Energy Laboratories, Inc	3-22-90	<5
Gary Thayer	508-52-8699	Op	3-5-90	3-5-90	3-7-90	Energy Laboratories, Inc	3-22-90	<5
B. Jones	369-05-2721	Op	3-2-90	3-5-90	3-7-90	Energy Laboratories, Inc	3-22-90	16.0
M. Monte	212-77-0034	Op	3-2-90	3-5-90	3-7-90	Energy Laboratories, Inc	3-22-90	30.0

WORK CATEGORIES:

D - Dryer operation or maintenance

Op - Operator

M - Maintenance

L - Laboratory

W - Wellfield

E - Exploration

O - Other (Explain)



FERRET EXPLORATION COMPANY OF NEBRASKA, INC.

CROW BUTTE PROJECT

RECORD OF BIOASSAY SAMPLE COLLECTION AND HANDLING

NAME	EMPLOYEE ID NUMBER	WORK CATEGORY	DATE BOTTLE DISTRIBUTED	DATE BOTTLE RETURNED	DATE SENT TO LABORATORY	NAME OF LABORATORY	DATE RESULTS RETURNED	RESULTS (ugU/l)
Don Bass	506-50-4145	Op	6-8-90	6-10-90	6-14-90	Energy Laboratories, Inc	6-25-90	<5
Mike Brost	508-70-6906	O	6-8-90	6-11-90	6-14-90	Energy Laboratories, Inc	6-25-90	<5
Emil Daugherty	505-60-3142	Op	6-11-90	6-11-90	6-14-90	Energy Laboratories, Inc	6-25-90	<5
Rhonda Grantham	505-80-5721	O	6-11-90	6-11-90	6-14-90	Energy Laboratories, Inc	6-25-90	<5
Paul Hamaker	508-70-6467	Op	6-11-90	6-11-90	6-14-90	Energy Laboratories, Inc	6-25-90	<5
Leland Huffman	252-94-9306	Op	6-11-90	6-11-90	6-14-90	Energy Laboratories, Inc	6-25-90	<5
Ralph Knode	520-52-1238	O	6-11-90	6-12-90	6-14-90	Energy Laboratories, Inc	6-25-90	<5
Tom Lemmon	508-52-5201	Op	6-11-90	6-11-90	6-14-90	Energy Laboratories, Inc	6-25-90	<5
Chuck Miller	524-72-9638	O	6-11-90	6-11-90	6-14-90	Energy Laboratories, Inc	6-25-90	<5
Jim Prosser	506-62-4388	Op	6-11-90	6-11-90	6-14-90	Energy Laboratories, Inc	6-25-90	<5
Pete Raben	507-52-3945	Op	6-11-90	6-11-90	6-14-90	Energy Laboratories, Inc	6-25-90	<5
Gary Thayer	508-52-8699	Op	6-11-90	6-11-90	6-14-90	Energy Laboratories, Inc	6-25-90	<5
B. Jones	369-05-2721	Op	6-8-90	6-12-90	6-14-90	Energy Laboratories, Inc	6-25-90	29.2
M. Monte	212-77-0034	Op	6-8-90	6-11-90	6-14-90	Energy Laboratories, Inc	6-25-90	14.7
Steve Collings	304-46-5744	O	6-12-90	6-12-90	6-14-90	Energy Laboratories, Inc	6-25-90	<5
Sue Dirks	506-88-4292	O	6-8-90	6-12-90	6-14-90	Energy Laboratories, Inc	6-25-90	<5
Dave Landrum	462-70-3741	W	6-11-90	6-11-90	6-14-90	Energy Laboratories, Inc	6-25-90	<5
Steve Magnuson	384-70-6089	O	6-11-90	6-11-90	6-14-90	Energy Laboratories, Inc	6-25-90	<5

WORK CATEGORIES:

O - Dryer operation or maintenance

L - Laboratory

Other (Explain)

Op - Operator

W - Wellfield

M - Maintenance

E - Exploration

FERRET EXPLORATION COMPANY OF NEBRASKA, INC  
CROW BUTTE PROJECT

SUMMARY OF RADON DAUGHTER SURVEYS

SURVEY PERIOD 1-15-90

LOCATION I.D.	LOCATION DESCRIPTION	DATE	PRESENT WORKING LEVEL	PREVIOUS WORKING LEVEL	RECOMMENDED ACTION
1-D	Wellfield Controls	1-15-90	0.013	0.019	
2-D	Between 1x columns	}	0.014	0.018	
3-D	RO Feed-Prod Surges		0.012	0.010	
4-D	MAINTENANCE AREA		0.014	0.009	
5-D	Lunchroom		0.006	0.004	
6-D	Reception Area		0.008	0.005	
7-D	LAB		0.004	0.005	
8-D	Operator Office		0.010	0.005	
	Plant Average	1-15-90	0.013	0.012	JAN Exposure
	Office Average	}	0.006	0.005	
	Overall Average		0.010	0.009	

REMARKS: Survey by RD. Doors called prior to & during survey.  
Unseasonably WARM & PARTLY cloudy. Cold front on the way.  
MS-3 # 932 & SAC 25 counting system.

FERRET EXPLORATION COMPANY OF NEBRASKA, INC  
CROW BUTTE PROJECT

SUMMARY OF RADON DAUGHTER SURVEYS

SURVEY PERIOD 2-7-96

LOCATION I.D.	LOCATION DESCRIPTION	DATE	PRESENT WORKING LEVEL	PREVIOUS WORKING LEVEL	RECOMMENDED ACTION
1-D	Wellfield Controacs	2-7-96	0.018	0.012	
2-D	Between IX columns	7	0.018	0.014	
3-D	RO Feed-Prood Surge		0.014	0.012	
4-D	Maintenance Area		0.011	0.014	
5-D	Lunchroom		0.003	0.006	
6-D	Reception Area		0.003	0.008	
7-D	LAB		0.004	0.004	
8-D	Operator Office		0.005	0.010	
	Plant Average		2-7-96	0.013	0.012
	Office Average		0.003	0.006	
	Overall Average		0.010	0.010	

REMARKS: Survey by PC. Doors closed prior to & during survey. CLEAR & unseasonably warm.  
MS-SACRS counting system.

ERRERET EXPLORATION CO. OF NEBRASKA, INC.

CROW BUTTE PROJECT

SUMMARY OF RADON DAUGHTER SURVEYS

SURVEY PERIOD 3-20-90

LOCATION I.D.	LOCATION DESCRIPTION	DATE	PRESENT WORKING LEVEL	PREVIOUS WORKING LEVEL	RECOMMENDED ACTION
1-D	Wellfield Controls	3-20-90	0.011	0.012	
2-D	Between IX columns	}	0.007	0.018	
3-D	RO Feed-Prod Surge		0.012	0.014	
4-D	Maintenance		0.010	0.011	
5-D	Lunchroom		0.004	0.003	
6-D	Reception Area		0.004	0.003	
7-D	LAB		0.004	0.004	
8-D	Operator. Office		0.007	0.005	
	Plant Average		3-20-90	0.009	0.013
	Office Average	}	0.004	0.003	
	Overall Average		0.007	0.010	

REMARKS: Plant doors closed prior to & during survey. CLEAR & COOL

**FERRET EXPLORATION CO. OF NEBRASKA, INC.**  
**CROW BUTTE PROJECT**

**SUMMARY OF RADON DAUGHTER SURVEYS**

SURVEY PERIOD April 27, 1990

LOCATION I.D.	LOCATION DESCRIPTION	DATE	PRESENT WORKING LEVEL	PREVIOUS WORKING LEVEL	RECOMMENDED ACTION
1-D	Wellfield Controls	4-27-90	0.015	0.011	
2-D	Between 1x columns	}	0.013	0.007	
3-D	RO Feed-Prod Surge		0.015	0.012	
4-D	Maintenance Area		0.008	0.010	
5-D	Lunchroom		0.001	0.004	
6-D	Reception Area		0.002	0.004	
7-D	LAB		0.002	0.004	
8-D	Operator Office		0.002	0.007	
	Plant Average	4-27-90	0.011	0.009	April exposure
	Office Average	}	0.002	0.004	
	Overall Average		0.008	0.007	

REMARKS: Survey by RSO. Doors closed prior to & during survey. Cold & RAINY/snowy.

**FERRET EXPLORATION CO. OF NEBRASKA, INC.**  
**CROW BUTTE PROJECT**

**SUMMARY OF RADON DAUGHTER SURVEYS**

SURVEY PERIOD 5-14-90

LOCATION I.D.	LOCATION DESCRIPTION	DATE	PRESENT WORKING LEVEL	PREVIOUS WORKING LEVEL	RECOMMENDED ACTION
1-D	Wellfield Control	5-14-90	0.020	0.015	
2-D	Between IX columns	}	0.014	0.013	
3-D	Rn Feed-Prod Surge		0.014	0.015	
4-D	Maintenance		0.010	0.008	
5-D	Lunchroom		0.005	0.001	
6-D	Reception Area		0.002	0.002	
7-D	LAB		0.003	0.002	
8-D	Operator Office		0.010	0.006	
	Plant Average	5-14-90	0.014	0.011	MAX Exposure
	Office Average	}	0.003	0.002	
	Overall Average		0.010	0.008	

REMARKS: Survey by Rb. Cool + Overcast. Doors closed prior to + during survey

**FERRET EXPLORATION CO. OF NEBRASKA, INC.**  
**CROW BUTTE PROJECT**

**SUMMARY OF RADON DAUGHTER SURVEYS**

SURVEY PERIOD June 21, 1990

LOCATION I.D.	LOCATION DESCRIPTION	DATE	PRESENT WORKING LEVEL	PREVIOUS WORKING LEVEL	RECOMMENDED ACTION
1-D	Wellfield Controls	6-21-90	0.018	0.020	
2-D	Between IX columns	}	0.013	0.014	
3-D	RO Feed-Prod Surge		0.022	0.014	
4-D	MAINTENANCE		0.027	0.010	
5-D	Lunch Room		0.003	0.005	
6-D	Reception Area		0.004	0.002	
7-D	LAD		0.003	0.003	
8-D	Operator Office		0.020	0.010	
	Flank Average	6-21-90	0.020	0.014	June Exposure
	Diurnal Average	}	0.003	0.003	
	Meridian Average		0.014	0.010	

REMARKS: Survey by Ed. Plant doors closed All night prior to & during survey. Cool & overcast.

FERRET EXPLORATION COMPANY OF NEBRASKA, INC  
CROW BUTTE PROJECT

SUMMARY OF AIRBORNE URANIUM SURVEYS

SURVEY PERIOD JANUARY 1990

LOCATION ID	LOCATION DESCRIPTION	DATE	PRESENT URANIUM CONCENTRATION <small>μCi/ml</small>	PREVIOUS URANIUM CONCENTRATION <small>μCi/ml</small>	Weekly Intake Evaluation $< 3.4 \times 10^{-11}$ (25% M)
	Between U <sub>3</sub> O <sub>8</sub> Tanks	1-15-90	$3.11 \times 10^{-3}$		OK
			..		
	JANUARY PLANT AVERAGE		$3.11 \times 10^{-3}$	$1.38 \times 10^{-3}$	

REMARKS:

I = (x) (b) (T)

- I = Uranium Intake
- x = Average U concentration in the breathing zone (uCi/m<sup>3</sup>)
- b = Breathing rate, 1.2 m<sup>3</sup>/hr
- T = Exposure Time (40 hr/wk)

$$0.00163 \text{ uCi} = (3.4 \times 10^{-11} \text{ uCi/ml} \times 1 \times 10^6 \text{ ml/m}^3) (1.2 \text{ m}^3/\text{hr})(40 \text{ hr})$$

@ 25% MPC



FERRET EXPLORATION COMPANY OF NEBRASKA, INC  
 CROW BUTTE PROJECT

SUMMARY OF AIRBORNE URANIUM SURVEYS

SURVEY PERIOD February, 1990

LOCATION I.D.	LOCATION DESCRIPTION	DATE	PRESENT URANIUM CONCENTRATION $\mu\text{Ci}/\text{ml}$	PREVIOUS URANIUM CONCENTRATION $\mu\text{Ci}/\text{ml}$	Weekly Intake Evaluation $< 3.4 \times 10^{-11}$ (25% MPC)
	Between U <sub>3</sub> O <sub>8</sub> Tank	2-5-90	$3.64 \times 10^{-9}$		
	Feb PLANE Average		$3.64 \times 10^{-9}$	$3.11 \times 10^{-10}$	

REMARKS:  
 I = (x) (b) (T)       $0.00163 \mu\text{Ci} = (3.4 \times 10^{-11} \mu\text{Ci}/\text{ml} \times 1 \times 10^6 \text{ ml}/\text{m}^3) (1.2 \text{ m}^3/\text{hr})(40 \text{ h})$   
 I = Uranium Intake      @ 25% MPC  
 x = Average U concentration in the breathing zone ( $\mu\text{Ci}/\text{m}^3$ )  
 b = Breathing rate,  $\text{m}^3/\text{hr}$   
 T = Exposure Time (h)





FERRET EXPLORATION CO. OF NEBRASKA, INC.

CROW BUTTE PROJECT

SUMMARY OF AIRBORNE URANIUM SURVEYS

SURVEY PERIOD May, 1990

LOCATION I.D.	LOCATION DESCRIPTION	DATE	PRESENT URANIUM CONCENTRATION uCi/l	PREVIOUS URANIUM CONCENTRATION uCi/l	WEEKLY INTAKE EVALUATION $< 3.4 \times 10^{-11}$ (25% MPC)
	Between U <sub>3</sub> O <sub>8</sub> Tanks	5-8-90	$3.24 \times 10^{-14}$		OK
	MAY PLANT Average		$3.24 \times 10^{-14}$	$1.43 \times 10^{-13}$	

REMARKS:

I = (x) (b) (t)  $0.00163 \text{ uCi} = (3.4 \times 10^{-11} \text{ uCi/ml} \times 1 \times 10^6 \text{ ml/m}^3)(1.2 \text{ m}^3/\text{hr})(40 \text{ hr})$   
@ 25% MPC

I = Uranium Intake  
 x = Average U concentration in the breathing zone (uCi/m<sup>3</sup>)  
 b = Breathing Rate (1.2 m<sup>3</sup>/hr)  
 t = Exposure Time (40 hr/wk)

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FERRET EXPLORATION CO. OF NEBRASKA, INC.

CROW BUTTE PROJECT

SUMMARY OF AIRBORNE URANIUM SURVEYS

SURVEY PERIOD June, 1990

LOCATION I.D.	LOCATION DESCRIPTION	DATE	PRESENT URANIUM CONCENTRATION uCi/l	PREVIOUS URANIUM CONCENTRATION uCi/l	WEEKLY INTAKE EVALUATION ( $3.4 \times 10^{-11}$ (25% MPC))
	Between U/O Tanks	6-13-90	$4.13 \times 10^{-14}$		OK
	June Plant Average		$4.13 \times 10^{-14}$	$3.24 \times 10^{-14}$	

REMARKS:

$I = (x) (b) (T)$ 

$$0.00163 \text{ uCi} = (3.4 \times 10^{-11} \text{ uCi/ml} \times 1 \times 10^6 \text{ ml/m}^3)(1.2 \text{ m}^3/\text{hr})(40 \text{ hr})$$

$$\text{@ 25\% MPC}$$

- I = Uranium Intake
- x = Average U concentration in the breathing zone (uCi/m<sup>3</sup>)
- b = Breathing Rate (1.2 m<sup>3</sup>/hr)
- T = Exposure Time (40 hr/wk)

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**TMA**  
Thermo Analytical Inc.

TMA/Eberline  
3675 Jefferson Street NE  
Albuquerque, NM 87109  
(505) 345-9837

# TLD ENVIRONMENTAL MONITOR REPORT

DATE ISSUED 04/01/90 DATE ANNEALED 03/15/90 CUSTOMER NO. 6184 DOSIMETRY SERVICES  
DATE RETURNED 07/05/90 DATE READ 07/10/90 PAGE 1 OF 1 DATE 07/13/90

BADGE NUMBER	IDENTIFICATION	DOSIMETER READINGS (mrem)					<i>Exposure Period 4/2/90 - 7/2/90</i>			
		FIRST	SECOND	THIRD	FOURTH	FIFTH	AVERAGE *	2σ	MREM/WEEK **	FREQUENCY
0000	CONTROL	20	21	21	21	21	20.6	0.9	1.23	Q
0001	CONTROL	26	31	31	31	26	29.8	3.3	1.77	Q
0002	CONTROL	24	24	23	26	24	24.2	2.2	1.44	Q
0003	PLANT	566	596	627	606	516	567.0	69.3	34.52	Q
0004	PLANT	204	209	221	198	178	202.0	31.7	11.96	Q
0005	PLANT	146	149	143	155	145	147.6	9.3	8.76	Q
0006	PLANT	76	81	76	66	84	75.4	14.9	4.47	Q
0007	PLANT	119	113	116	112	116	115.2	5.5	6.83	Q

\* - DOSIMETER DAMAGED  
\*\* - BASED ON ELAPSED TIME FROM DATE ANNEALED TO DATE READ

FREQUENCY CODES  
M - MONTHLY  
Q - QUARTERLY  
S - SEMI-ANNUAL  
A - ANNUAL  
I - IRREGULAR

CUSTOMER ATTENTION ADDRESS CITY  
FERRET OF NEBRASKA  
RHONDA GRANTHAM  
P.O. BOX 169  
CRAWFORD NE 69339

**TMA**

Thermo Analytical Inc.

TMA/Electroline

3825 Jefferson Street NE

Albuquerque, NM 87109

(505) 345-0831

**TLD ENVIRONMENTAL MONITOR REPORT**DATE ISSUED 01/01/90 DATE ANNEALED 12/14/89 CUSTOMER NO. 6134  
DATE RETURNED 1/05/90 DATE READ 04/11/90 PAGE 1 OF 1DOSIMETRY SERVICES  
DATE 04/13/90

BADGE NUMBER	IDENTIFICATION	DOSIMETER READINGS (mrem)					Exposure Period 1/2/90 - 4/2/90			
		FIRST	SECOND	THIRD	FOURTH	FIFTH	AVERAGE *	2 *	MREM/WEEK **	FREQUENCY
0000	CONTROL	20	21	22	23	23	21.8	2.6	1.29	Q
0001	CONTROL	31	30	31	31	23	29.2	7.0	1.72	Q
0002	CONTROL	27	25	26	23	29	27.0	3.2	1.59	Q
0003	PLANT	652	724	595	706	547	655.5	65.3	40.33	Q
0004	PLANT	274	239	258	256	232	251.8	33.2	14.81	Q
0005	PLANT	139	155	155	144	169	157.0	17.9	9.24	Q
0006	PLANT	39	86	74	73	70	79.4	15.0	4.67	Q
0007	PLANT	109	122	109	79	116	107.0	33.1	6.29	Q



\* - DOSIMETER DAMAGED

FREQUENCY CODES

\*\* - BASED ON ELAPSED TIME  
FROM DATE ANNEALED TO  
DATE READM - MONTHLY  
Q - QUARTERLY  
S - SEMI ANNUAL  
A - ANNUAL  
I - IRREGULARCUSTOMER  
ATTENTION  
ADDRESS  
CITYFERRET OF NEBRASKA  
RHONDA GRANTHAM  
P.O. BOX 169  
CRAWFORD

NE 69339



The dosimetry procedure is accredited by NVLAP of the U.S. Department of Commerce as meeting the requirements for performance and accuracy of dosimetry.

**CURRENT TLD OCCUPATIONAL RADIATION EXPOSURE REPORT**  
APPROVED FOR USE IN LIEU OF NRC FORM 5  
CUSTOMER NO. 6184 PAGE 1 OF 2

DATE 04/17/90 DOSIMETRY SERVICES

Exposure Period 1/1/90 - 4/1/90

BAGNO NO	FACILITY	NAME	SOCIAL SECURITY NO		TYPE SERVICE	DATE OF BIRTH	LOCATION	TOTAL DOSE FOR PERIOD (mrem)		TOTAL DOSE FOR PERIOD (mrem)		TOTAL DOSE FOR PERIOD (mrem)		TOTAL DOSE FOR PERIOD (mrem)		REMARKS AND TLD TYPE
			DATE OF BIRTH	AGE (YRS)				WHOLE BODY	EXTREMITY	WHOLE BODY	EXTREMITY	WHOLE BODY	EXTREMITY	WHOLE BODY	EXTREMITY	
1000	CONTROL				T	01/01/90		25								
1001	BASS	D	506-50-4145	36	T	01/01/90		25								1-25 5-0
1002	DAUGHERTY	E	04/22/36 53	53	Q	04/05/90										0-244 175
1003			505-60-3142	40	Q	01/01/90										1-25 5-0
1004	GRANTHAM	R	04/17/49 40	40	Q	04/05/90										0-197 110
1005	HAMAKER	P	505-80-5721	36	Q	01/01/90										1-25 5-0
1006	HUFFMAN	L	02/10/54 36	36	Q	04/05/90										0-310 90
1007	KNODE	R	505-70-6467	40	Q	01/01/90										1-25 5-0
1008	LEMMON	T	10/20/49 40	40	Q	04/05/90										0-135 110
1009	MILLER	C	252-96-9306	33	Q	01/01/90										1-25 5-0
1010	PROSSER	J	12/28/56 33	33	Q	04/05/90										0-201 75
1011	RABEN	P	520-52-1238	34	Q	01/01/90										1-25 5-0
1012	THAYER	G	03/29/56 34	34	Q	04/05/90										0-009 80
1013	SMORAVA	S	508-52-5201	47	Q	01/01/90										1-25 5-0
1014	COLLINGS	S	06/08/42 47	47	Q	04/05/90										0-106 145
1015			524-72-9638	42	Q	01/01/90										1-25 5-0
			02/23/48 42	42	Q	04/05/90										0-060 120
			506-62-4388	40	Q	01/01/90										1-25 5-0
			11/22/49 40	40	Q	04/05/90										0-104 110
			507-52-3945	49	Q	01/01/90										1-25 5-0
			11/03/40 49	49	Q	04/05/90										0-857 155
			508-5-8699	45	Q	01/01/90										1-25 5-0
			09/15/44 45	45	Q	04/05/90										0-083 135
			508-58-9896	39	Q	01/01/90										1-25 5-0
			05/20/50 39	39	Q	04/05/90										0-013 105
			304-46-5744	44	Q	01/01/90										1-25 5-0
			04/12/45 44	44	Q	04/05/90										0-012 130

FERRET OF NEBRASKA  
RHONDA GRANTHAM  
P.O. BOX 169  
CRANFORD NE 69339

CUSTOMER  
ATTENTION  
ADDRESS  
CITY

NOTE: CODES  
C - RADIO DAMAGED  
S - REWORKED BY TELEPHONE CHOP WIRE  
F - RADIO NOT LOANED  
G - RADIO NOT RECALIBRATED  
D - CONTAMINATED  
Z - CALCULATED CONTROL  
WITH INCLUDES NUMBER THIS PAGE & VALUE

TYPE SERVICE CODES  
T - WHOLE BODY DOSE AND  
Q - WHOLE BODY DOSE AND  
R - WHOLE BODY DOSE AND  
S - WHOLE BODY DOSE AND  
G - WHOLE BODY DOSE AND  
P - WHOLE BODY DOSE AND  
C - WHOLE BODY DOSE AND





The dosimetry procedures are accredited by NVLAP of the U.S. Department of Commerce as having the competence to perform specified tests in accordance with prescribed test methods and accreditation criteria.

**CURRENT TLD OCCUPATIONAL RADIATION EXPOSURE REPORT**  
 APPROVED FOR USE IN LIEU OF NRC FORM 5

DATE: 04/17/90  
 PAGE: 2 OF 2  
 NRC#: 6184

DATE: 04/17/90  
 DOSIMETRY SERVICES

FACILITY	FACILITY NO	NAME	SOCIAL SECURITY NO	TYPE SERVICE	DATE OF BIRTH	LOCATION	TOTAL TLD NET COUNTS	DOSE FOR PERIOD		ACCUMULATED DOSE		REMARKS	
								CHARGE	NET	MEASUREMENT	ESTIMATED	DOSE FOR PERIOD	ESTIMATED
1016				T O	01/01/90 06/05/90			0 0	0 0	0 0	0 0	1-25 5-0	0.000
1													
1													
1													
1													
1													
1													
1													
1													
1													
1													
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1													
1													



TYPE SERVICE CODES  
 1 - BASIC TLD  
 2 - BASIC TLD  
 3 - BASIC TLD  
 4 - BASIC TLD  
 5 - BASIC TLD  
 6 - BASIC TLD  
 7 - BASIC TLD  
 8 - BASIC TLD  
 9 - BASIC TLD  
 0 - BASIC TLD

INCIDENT CODES  
 1 - UNUSUAL  
 2 - UNUSUAL  
 3 - UNUSUAL  
 4 - UNUSUAL  
 5 - UNUSUAL  
 6 - UNUSUAL  
 7 - UNUSUAL  
 8 - UNUSUAL  
 9 - UNUSUAL  
 0 - UNUSUAL

NOTE CODES  
 C - BASIC CODE  
 D - BASIC CODE  
 E - BASIC CODE  
 F - BASIC CODE  
 G - BASIC CODE  
 H - BASIC CODE  
 I - BASIC CODE  
 J - BASIC CODE  
 K - BASIC CODE  
 L - BASIC CODE  
 M - BASIC CODE  
 N - BASIC CODE  
 O - BASIC CODE  
 P - BASIC CODE  
 Q - BASIC CODE  
 R - BASIC CODE  
 S - BASIC CODE  
 T - BASIC CODE  
 U - BASIC CODE  
 V - BASIC CODE  
 W - BASIC CODE  
 X - BASIC CODE  
 Y - BASIC CODE  
 Z - BASIC CODE  
 WITH INCLUDES NUMBERING SYSTEM

CUSTOMER  
 ATTENTION  
 ADDRESS  
 CITY

**FERRET OF NEBRASKA  
 RHONDA GRANTHAM  
 P.O. BOX 169  
 CRAWFORD  
 NE 69339**



The accuracy of this report is dependent on the accuracy of the information provided by the customer. Thermo Analytical Inc. is not responsible for errors or omissions in this report or for any consequences arising from the use of the information contained herein.

**CURRENT TLD OCCUPATIONAL RADIATION EXPOSURE REPORT**

APPROVED FOR USE IN LIEU OF NRC FORM 5

CUSTOMER NO. 6184

PAGE 1 OF 2

PAGES

DATE 07/18/90

DOSSIMETRY SERVICES

Exposure Period 4/19/88-7/18/90

TLD NO	FACILITY	NAME	SOCIAL SECURITY NO	TYPE OF RADIATION	DATE OF RADIATION	LOCATION	TOTAL TLD FOR PERIOD (mrem)		TOTAL DOSE FOR PERIOD (mrem)		EXPOSURE PERIOD (mrem)		EXPOSURE PERIOD (mrem)
							SHIELD BODY	UNSHIELDED BODY	SHIELD BODY	UNSHIELDED BODY	SHIELD BODY	UNSHIELDED BODY	
1000		CONTROL		T	04/01/90		28	0	0	0	0	0	1-25 5-0
1001		BASS	506-50-4145	T	07/05/90		28	0	0	0	0	0	0-244 180
1002		DAUGHERTY	04/22/36 54	Q	07/05/90		0	0	0	0	0	0	1-25 5-0
1003			505-60-3142	T	04/01/90		0	0	0	0	0	0	0-197 115
1004			04/17/49 43	Q	07/05/90		0	0	0	0	0	0	1-25 5-0
1005		GRANTHAM	505-80-5721	Q	07/05/90		0	0	0	0	0	0	0-029 5-0
1006		HAMAKER	02/10/54 36	T	04/01/90		0	0	0	0	0	0	1-25 5-0
1007		HUFFMAN	508-70-6467	Q	07/05/90		0	0	0	0	0	0	0-010 90
1008		RNODE	10/20/49 40	T	04/01/90		0	0	0	0	0	0	1-25 5-0
1009		LEMON	252-94-9306	Q	07/05/90		0	0	0	0	0	0	0-135 110
1010		MILLER	12/28/56 33	T	04/01/90		0	0	0	0	0	0	1-25 5-0
1011		PROSSER	520-52-1236	Q	07/05/90		0	0	0	0	0	0	0-201 75
1012		THAYER	03/29/56 34	T	04/01/90		0	0	0	0	0	0	1-25 5-0
1013		SMORAVA	508-52-5201	Q	07/05/90		0	0	0	0	0	0	0-009 80
1014		COLLINGS	06/08/42 48	T	04/01/90		0	0	0	0	0	0	1-25 5-0
1015			524-72-9638	Q	07/05/90		0	0	0	0	0	0	0-106 150
			02/28/48 42	T	04/01/90		0	0	0	0	0	0	1-25 5-0
			506-62-4388	Q	07/05/90		0	0	0	0	0	0	0-079 5-0
			11/22/49 40	T	04/01/90		0	0	0	0	0	0	1-25 5-0
			507-52-3945	Q	07/05/90		0	0	0	0	0	0	0-104 110
			11/03/40 49	T	04/01/90		0	0	0	0	0	0	1-25 5-0
			09/13/44 45	Q	07/05/90		0	0	0	0	0	0	0-157 155
			508-58-9896	T	04/01/90		1	0	0	0	0	0	1-25 5-0
			05/20/50 40	Q	07/05/90		1	0	0	0	0	0	0-083 135
			304-46-5744	T	04/01/90		0	0	0	0	0	0	1-25 5-0
			04/12/45 45	Q	07/05/90		0	0	0	0	0	0	0-013 110
							0	0	0	0	0	0	1-25 5-0

**FERRET OF NEBRASKA**  
**RHONDA GRANTHAM**  
 P.O. BOX 169  
 CRAWFORD

CUSTOMER NO. NE 69339

STATUS: (CODES)  
 C - BASED SHARDED  
 E - REPORTED BY TELEPHONE OR MAIL  
 F - BASED NOT TESTED  
 G - ABNORMAL IN READING  
 H - CONTAMINATED  
 I - CALCULATED CONTROL  
 J - WITH ACCESSORIES MONITORING IN PLACE

STATUS: (CODES)  
 M - MONTHLY  
 Q - QUARTERLY  
 S - SEMI-ANNUALLY  
 Y - YEARLY  
 Z - UNUSUAL RADIATION

The accuracy, completeness and reliability of the information reported on this form is the responsibility of the person(s) reporting. The licensee must ensure the information is accurate, complete and reliable.

**NVLAP**

**CURRENT TLD OCCUPATIONAL RADIATION EXPOSURE REPORT**

APPROVED FOR USE IN LIEU OF NRC FORM 5

CONTRACT NO. **6184**

PAGE **2** OF **2**

DOSSIMETRY SERVICES

DATE **07/18/90**

NAME	SOCIAL SECURITY NO.	TYPE SERVICE	DATE OF RADIATION EXPOSURE	LOCATION	TOTAL TLD NET COUNTS	TOTAL DOSE FROM THIS REPORT		ACCUMULATED TOTAL DOSE FROM ALL REPORTS		REMARKS	
						SKIN	INTERNAL	SKIN	INTERNAL	REMARKS	REMARKS
			T Q		0	0	0	0	0	0	1.25 S.0 0.000



**FERRIS OF NEBRASKA  
RHONDA GRANTHAM  
P.O. BOX 169  
CRAWFORD**

NE 69339

CUSTOMER ATTENTION ADDRESS CITY

NOTE: CODES  
C - BADGE MANAGED  
R - REPORTED BY TELEPHONE OR MAIL  
D - BADGE NOT USED  
A - ABNORMAL READINGS  
M - CONFIRMATION  
T - CALCULATED COUNTS  
\* - OTHER (INCLUDES IN TYPE SERVICE)

FREQUENCY CODES  
W - WEEKLY  
B - BI-MONTHLY  
M - MONTHLY  
Q - QUARTERLY  
Y - YEARLY  
R - REGULAR

TYPE SERVICE CODES  
H - HANDS  
S - SKIN  
I - INTERNAL  
M - MIXED  
W - WHOLE BODY

10