PDR

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

APR 2 1 1981

WMUR:JAP
Docket No. 40-8714
SUA-1352

MEMORANDUM FOR: Ross A. Scarano, Chief
Uranium Recovery Licensing Branch

THRU: John J. Linehan, Section Leader
Operating Facilities Section I
Uranium Recovery Licensing Branch

FROM: Jeffrey A. Pohle
Operating Facilities Section I
Uranium Recovery Licensing Branch

SUBJECT: REVIEW OF CLEVELAND CLIFFS IRON COMPANY'S QUARTERLY MONITORING REPORTS FOR THE PERIODS JULY-SEPTEMBER 1980 AND OCTOBER-DECEMBER 1980

1. Program Status

The first test pattern (A-1 area on Exhibit 1) was converted from production phase to restoration phase on November 4, 1980. Cleveland Cliffs has provided written notification of this action (letter of January 23, 1981 - Exhibit 3) as required by Condition 14 of License No. SUA-1352 (Exhibit 2).

Test pattern Area B (Exhibit 1) went into production phase on December 8, 1980. Cleveland Cliffs plans to continue the test program through 1981.

Findings

1A. Included with Cleveland Cliffs letter of January 23, 1981 (Exhibit 3) is their proposed restoration plan. This plan would allow them to try alternative methods of restoration as they see fit. In a February 3, 1981 telephone conversation between John Linehan and Truman Louderback, Cleveland Cliffs was informed that they were tied to the specific plan(s) referenced in their license. If they felt a specific alternative plan did not clearly warrant a license amendment, they should request, in writing, an opinion from us. We will then decide whether or not the specific request will need a license amendment. This will be confirmed with a followed up letter to Cleveland Cliffs.

1B. Cleveland Cliffs is not including any data regarding restoration progress in test pattern area A-1 in their monitoring reports. Although their license does not require them to do so, it is important that we be kept aware of the program status during restoration operations in light of their desire to research alternative restoration techniques. We will prepare an amendment to have such data included in their quarterly reports.

1C. There appears to be a problem relating to the existing restoration criteria (Table 2, Water Quality Data and Proposed Restoration and Excursion Criteria, in the Technical Response to Questions dated January 16, 1979 - Exhibit 4). The criteria exceed both USPHS/EPA drinking water standards and the upper control limits used to define an excursion. This table is tied to the license by Condition 10 and is specifically mentioned in Condition 13. Because the NRC's restoration criteria are set to EPA drinking water standards/baseline, we will be proposing revised restoration criteria to be incorporated into this license.

1D. Included with Cleveland Cliffs' letter of January 23, 1981 (Exhibit 3) is their proposed post-restoration monitoring program. According to this plan samples will be taken from two production and two injection wells used during mining. They propose to take samples every 45 days for a six month period to verify stability of restoration. Samples are to be analyzed for the parameters listed in Table 2, Water Quality Data and Proposed Restoration and Excursion Criteria (Exhibit 4). According to Condition 14 of SUA-1352, the post-restoration monitoring program shall be subject to approval by NRC. The post-restoration monitoring program is currently being reviewed and will be incorporated, with modifications, into the existing license via an amendment.

2. Water Quality and Lixiviant Migration Control

Baseline data and biweekly well field monitor well analyses have been included in the Quarterly Reports as per Condition 29 of License SUA-1352. Quarterly full chemical analyses of all monitor wells is included as required by Condition 15. Cleveland Cliffs reported no migration problems or excursions during the two quarters July-September and October-December 1980.

Findings

2A. On several occasions concentrations of sulfate exceed the upper control limits of several monitor wells (Exhibit 5). Confirmation samples should have been obtained within 48 hours as required by Condition 17 of the license. The data do not indicate this was done in all instances. In all instances, sulfate concentrations were back below the UCL concentration after the next sampling round (two weeks later). We will notify Cleveland Cliffs, by letter, of their apparent negligence regarding Condition 17.

2B. During April and May of 1980 the sulfate concentration in monitor well 230W (upper aquifer) exceeded the UCL set for that well (April-May 1980 pre-dates the periods covered by these Quarterly Reports). Well 230W was sampled daily from May 2, 1980 to May 11, 1980 and again on May 14, 1980. (Well 230W, Exhibit 5). On all occasions the concentration of sulfate exceeded the UCL. By May 28, 1980 the sulfate concentration was back below the UCL. This event was an excursion as defined by Condition 17 of the license. Condition 17 requires Cleveland Cliffs to provide written notification describing the event and corrective actions taken. I cannot find any record of this in the Docket File. We will notify Cleveland Cliffs, by letter, of their negligence regarding Condition 17.

2C. Injection began in test area A-1 on April 2, 1980. The excursion event described above occurred shortly thereafter. Well 230W monitors the upper aquifer within test area A-2. During start up of area A-1 the water needed for lixiviant make-up (roughly 500,000 gallons) was produced from the upper aquifer.

Because of the timing of the excursion, the distance of well 230W from area A-1, the stresses placed upon the upper aquifer by withdrawing a large quantity of water, it is possible that the event was not an excursion of lixiviant but a response to variations in hydrostatic pressure in the upper aquifer. Such a response might be increased movement (velocities) of groundwater through the area of influence monitored by well 230W. Increased groundwater flow may well result in new geochemical equilibria causing a rise in the concentration of sulfates by increased dissolution of sulfide minerals. Realistically, I suspect that the rate of change, with respect to time, of sulfate concentration and the maximum concentration obtained would be less in an event such as described above than in a lixiviant excursion. Both this concept and the use of monitored aquifers as fresh water production zones will be investigated further by the staff on a generic basis.

2D. No water level elevations are being included in the Quarterly Monitoring Reports. During the meeting between NRC and Cleveland Cliffs on March 10, 1981, we presented CCIC with a copy of NRC Standard Format For Water Quality Data Submittal to the NRC (Exhibit 6). They agreed to incorporate this format into their Quarterly Reports. The inclusion of water level data in the Quarterly Reports will be incorporated into their license.

3. In-Plant Radiation Monitoring Program

Cleveland Cliffs Quarterly Reports state that sampling results for radon/ radon daughters still show levels below 25% of applicable maximum permissible concentration specified by 10 CFR, Part 20.

Radon/radon daughters - No recordable amounts
Working levels/working level months - 0.00

The measured uranium particulate concentrations are fractions of a percent of the applicable maximum permissible concentration specified by 10 CFR, Part 20 (Exhibit 7).

Findings

3A. In-plant sampling locations for radon/radon daughters and uranium particulates are not included in the reports. Measurement of uranium particulates is being done on a monthly basis as required by Condition 26 of the license. The measurement frequency of radon/radon daughters is not determinable from the data provided. Because reporting radon as non-recordable and working levels/working level months as 0.00 is not adequate under current NRC guidelines we will request that Cleveland Cliffs submit information on how radon/radon daughter samling/analysis is performed, including instrumentation, survey procedures, methodology for determining work levels and calculation of the lower limits of detection of their equipment.

4. Process Drain Field Constituent Inventory

The accumulated inventory of waste sent to the drain field is shown in Exhibit 8.

Findings

4A. Concentrations of uranium and radium in some of the waste discharged to the drain field exceeds the original estimates given in the table "Tabulation of Estimated Volume and Composition of Discharge to the Process Wastewater Drain Field" (Exhibit 9). As of 11/30/80, a total

of 2.8×10^7 Pico Curies of Ra_{226} has been discharged to the drain field. The original estimate of the total amount of Ra_{226} to be discharged was 2.36×10^7 Pico Curies. Because restoration of wellfield area B has not commenced (restoration of area A-1 is still in progress) the total amount of Ra_{226} discharged to the drain field could become much larger than the original estimate. Cleveland Cliffs requested WDEQ to raise the amount of Ra_{226} which may be discharged to the drain field to 3×10^8 Pico Curies. This is 12.7 times higher than the original estimates submitted to the NRC. WDEQ agreed to raise the limits to 8×10^7 Pico Curies only. Unless alternative restoration methods are used to decrease the volume of waste sent to the drain field the need for alternative waste disposal methods seems inevitable. Based on these findings a meeting was held with Cleveland Cliffs on March 10, 1981, to discuss the drain field operation. The following commitments were then agreed to.

1. CCIC shall submit by September 4, 1981, a report addressing all of the technical criteria in Appendix A of 10 CFR 40. The technical basis for the submittal will in part be the data collected from the drain field study. NRC will increase its oversite role in the study and may request revisions to the program to assure a mutual high degree of confidence that the accumulated data can lead to a creditable decision regarding the continuance of the disposal system.

2. CCIC will submit all data related to the design and monitoring of the drain field disposal system.

3. WMUR will revise the CCIC license to add liability conditions to assure surface cleanup and groundwater restoration in case of unacceptable impacts related to the drain field disposal system.

Summary of Follow-Up Actions

1. Notify CCIC by letter that for any alternative restoration technique which they felt did not clearly warrant a license amendment, they shall request, in writing, an opinion from NRC.

2. We will prepare a license amendment requiring CCIC to include operational restoration water quality data in their quarterly monitoring reports.

3. We will be proposing revised restoration criteria to be incorporated into this license.

4. The post-restoration monitoring program is currently being reviewed and will be incorporated, with modifications, into the existing license via an amendment.

5. CCIC will be notified by letter of their apparent failure to obtain confirmation samples within 48 hours after exceeding UCL concentrations on several occasions in violation of Condition 17 of their license.

6. CCIC will be notified by letter of their failure to provide written notification describing an excursion (May 1980) and corrective actions taken which is in violation of Condition 17 of their license.

7. The staff will investigate further, on a generic basis, the use of aquifers adjacent to production aquifers (ore zone) as a source of fresh water used in plant makeup and the possible effects caused thereby.

8. We will prepare a license amendment requiring CCIC to include water level data in their quarterly monitoring reports.

9. We will inquire about sampling methodology and the lower limits of detection of CCIC's in-plant radiation detection equipment.

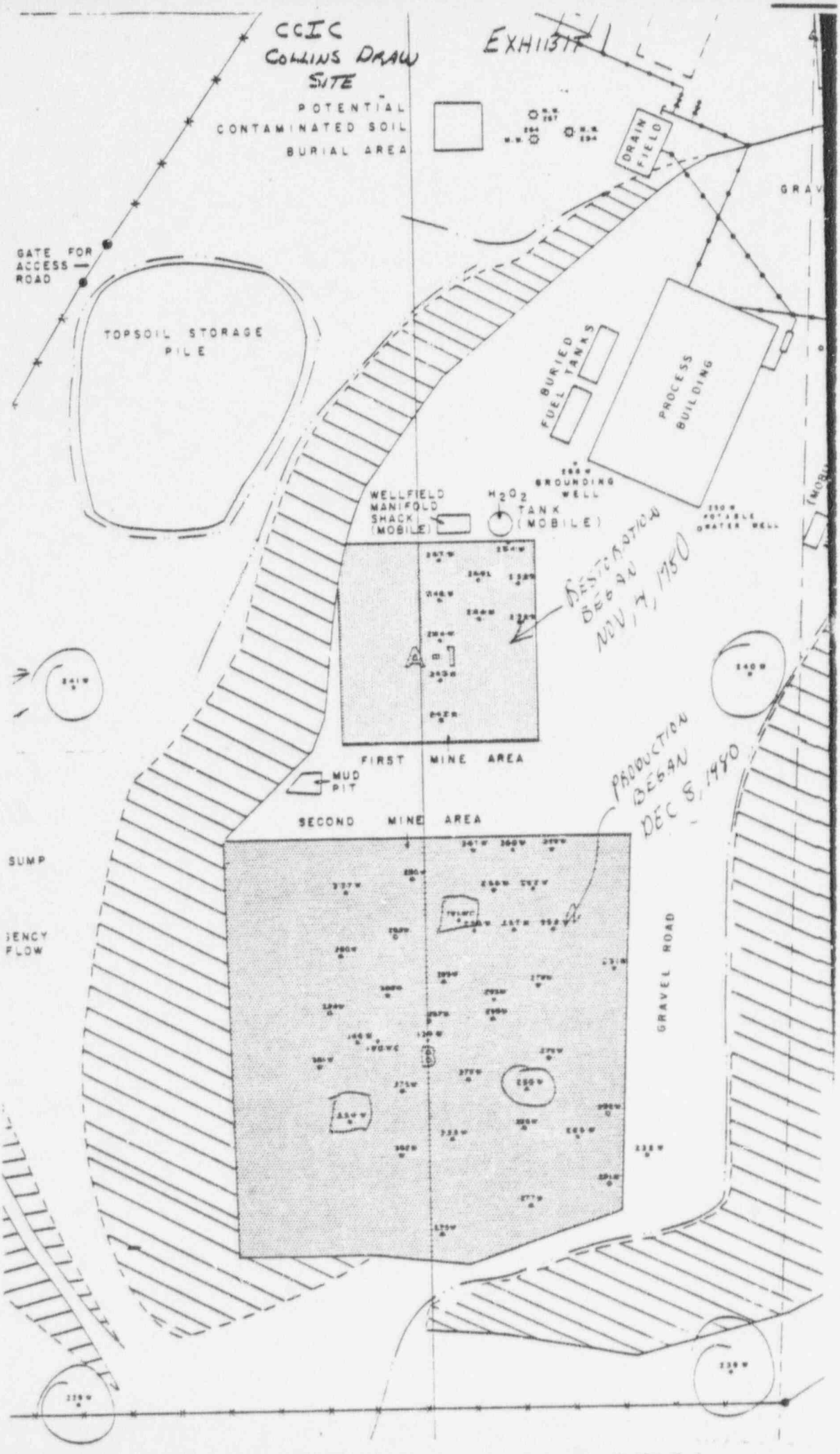
10. NRC will increase its oversite role in the drain field study and may request revisions to the program to assure a mutual high degree of confidence that the accumulated data can lead to credible decision regarding the continuance of the disposal system.

11. WMUR will revise the CCIC license to add liability conditions to assure surface cleanup and groundwater restoration in case of unacceptable impacts related to the drain field disposal system.

Jeffrey A. Pohle
Operating Facilities Section I
Uranium Recovery Licensing Branch
Division of Waste Management

Approved by:
J. J. Linehan, Section Leader
Uranium Recovery Licensing Branch

Case Closed: 04008714M01E
Case Closed: 04008714M02E


CCIC
COLLINS DRAW
SITE
EXHIBIT
POTENTIAL
CONTAMINATED SOIL
BURIAL AREA
DRAIN
FIELD
GATE FOR
ACCESS
ROAD
TOPSOIL STORAGE
PILE
BURIED
FUEL TANKS
PROCESS
BUILDING
GROUNDING
WELL
WELLFIELD
MANIFOLD
SHACK
(MOBILE)
H_2O_2
TANK
(MOBILE)
POTABLE
WATER WELL
DESIGNATION
BEGAN
NOV. 7, 1980
FIRST MINE AREA
MUD
PIT
SECOND MINE AREA
PRODUCTION
BEGAN
DEC 5, 1980
SUMP
GENCY
FLOW
GRAVEL ROAD

1/16/79

TABLE 7 - WATER QUALITY DATA and PROPOSED RESTORATION and EXCURSION CRITERIA
(1/16/79, Table 2)

Parameter ppm	PRODUCTION ZONE Number of Samples N	Smallest Observation	Largest Observation	BASELINE DEFINITION Mean $\bar{X}$	Standard Deviation + σ	Restoration Criteria	Excursion Indicators $\bar{X}$ + 2.56 σ	USPHS 1962
Total Dissolved Solids (calc)	52	308	1011	394	99			
Total Dissolved Solids (105°C)	52	320	1031	407	101	2000		500
Conductivity 77°F Lab µMohms	50	490	1410	621	141			
Conductivity 25°C Field	50	500	3100	1245	635			
Sodium (calc)	50	83	242	106	23			
Sodium (observed)	52	82	272	105	26			
Potassium	52	4	14	7	2			
Calcium	52	10	61	28	11			
Magnesium	52	1	14	2	2			
Sulfate	52	12	598	150	67	750	356	250
Chloride	52	10	64	19	12			250
Carbonate	52	0	36	9	10		35	
Bicarbonate	52	85	220	150	28		222	
pH unit - Lab	52	7.0	8.7	8.2	.3	5-9		
pH unit - Field	52	6.0	8.7	7.6	.6			
Ammonia as N	48	ND	.42	.11	.09	40		.5(NH_3)
Nitrate as N	48	ND	2.64	.14	.42	15 - 45		45
Nitrite as N	48	ND	.23	.04	.07			
Aluminum (.05)	52	ND	ND	ND				
Arsenic (.01)	52	ND	ND	ND				.05
Barium (.05)	52	ND	ND	ND				1.0
Boron (1.0)	52	ND	ND	ND				
Cadmium (.002)	52	ND	ND	ND				.01
Chromium (.01)	52	ND	ND	ND				.05
Copper (.01)	52	ND	ND	ND				1.0
Fluoride	52	.022	.27	.17	.06			.6-1.7
Iron (.01)	52	ND	2.38	.24	.43			.3
Lead (.05)	52	ND	ND	ND				.05
Manganese (.01)	52	ND	.06	.02	.02			.05
Mercury (.001)	52	ND	ND	ND				
Selenium (.01)	52	ND	ND	ND				.01
Nickel (.04)	52	ND	ND	ND				
Zinc (.01)	52	ND	ND	ND				5.0
Molybdenum (.05)	52	ND	ND	ND				
Vanadium (.05)	52	ND	ND	ND				
Uranium (.001)	43	ND	.47	.09	.16	10	.5	
Radium 226 pC/l	48	.16	99	16.2	24	16±24		
Temperature °C Field	47	11.5	16.5	14.1	1.2			

( ) - Detection limits
ND - Not Detected

S6-CDIVA

EXHIBIT 4

Table 1
Thunderbird Joint Venture
Collins Draw Project
Environmental Monitoring - 2300, Upper Aquifer

Date	Remarks	Total Dissolved Solids-TDS mg/l	Carbonate mg/l	Bicarbonate mg/l	Sulfate mg/l	(ppb) Uranium mg/l	(as N) Ammonia mg/l	pH
06/20/78	Baseline	508	0	144	255	.060	.22	8.1
07/07/78	Baseline	626	0	317	245	.020	.32	7.8
07/25/78	Baseline	498	0	159	210	.012	.46	8.0
11/15/79	Baseline	541	18	116	258	ND	ND	8.2
12/07/79	Baseline	435	0	137	205	.008	.10	7.9
	Upper Control Limits							
			Carbonate - Bicarbonate					
	N.R.C.	720	365		291	1.06	.53	10.1
	D.E.Q.	653	+20%	248	187	.04	.45	
04/02/80	Start Chemicals							
04/02/80	Wasco #1501	580	0	107	315	.002	.33	7.6
04/16/80	Wasco #1554	538	0	142	316	.007	.27	7.75
04/30/80	C.&G.L. #34033	492	0	127	255	.001	.10	8.20
04/30/80	Wasco #1580	580	trace	117	274	.010	.12	8.16
05/02/80	W. #1593 - Extra Compliance Sample	528	0	129	300	.002	ND	7.93
05/03/80	W. #1593	516	0	154	266	.0035	.22	7.89
05/04/80	W. #1593	604	0	171	315	.014	.29	7.82
05/05/80	W. #1599	616	0	156	330	.037	.14	7.77
05/06/80	W. #1599	614	0	161	322	.015	.18	7.76
05/07/80	W. #1599	606	0	159	324	.052	ND	7.74
05/04/80	W. #1609	622	0	171	316	.025	ND	7.80
05/09/80	W. #1609	626	0	168	330	.021	.13	7.79
05/10/80	Wasco #1619 Confirmation Sample	602	0	171	316	.025	ND	7.75
05/11/80	Wasco #1619	614	0	171	315	.020	ND	7.72
05/14/80	Wasco #1619	574	0	159	324	.011	ND	7.90
05/28/80	W. #1554 Monitor Round @ 1361 Hours	620	6	146	180	.044	ND	7.67
05/29/80	W. #1554 Monitor Round @ 1413 Hours	595	0	171	130	.078	ND	7.56
06/14/80	Wasco #1659	513	0	207	256	.025	ND	7.70
06/14/80	C.&G.L. #34479 Confirm Samples				270			
06/15/80	Wasco #1659	500	0	170	232	.011	ND	7.84
06/15/80	C.&G.L. #34478 Confirm Samples				250			
06/16/80	Wasco #1659	514	0	207	232	.004	ND	7.54
06/16/80	C.&G.L. #34478 Confirm Samples				255			
06/17/80	Wasco #1659	536	0	146	256	.010	ND	7.48
06/17/80	C.&G.L. #34478 Confirm Samples				265			
06/25/80	Wasco #1714	596	0	122	232	0	ND	7.27
07/09/80	Wasco #1747 Quarterly Sample	552	0	134	288	.030	ND	7.79
07/23/80	Wasco #1768	538	0	119	84	0	ND	7.85
08/07/80	Wasco #1794	472	0	115	262	0	ND	8.92
08/21/80	Wasco #1832	594	0	120	243	.001	ND	7.83
09/03/80	Wasco #1861	486	0	122	243	.001	ND	7.99
09/17/80	Wasco #1893	326	0	183	215	0	ND	7.62
10/01/80	Wasco #1934	458	0	122	295	.005	ND	7.82
10/15/80	Wasco #1962	440	0	116	244	.002	ND	7.90
10/29/80	Wasco #1988	488	0	140	215	.002	ND	7.86
11/12/80	Wasco #2022	460	0	127	235	.001	ND	--
11/26/80	Wasco #2047	484	0	122	251	.001	ND	7.26
12/10/80	Wasco #2054	492	0	122	262	.001	ND	7.72
12/23/80	Wasco #2085	480	0	113	251	.001	ND	7.73

86-CDI-Z

EXHIBIT 5

Table 2
THUNDERBIRD JOINT VENTURE
COLLINS DRAW PROJECT
ENVIRONMENTAL MONITORING - 238W

Date	Remarks	Total Dissolved Solids-TDS mg/l	Carbonate mg/l	Bicarbonate mg/l	Sulfate mg/l	(ppb) Uranium mg/l	(as N) Ammonia mg/l	pH
06/02/78	Baseline	391	24	116	138	.450	.03	8.6
06/22/78	Baseline	320	12	134	135	.466	.36	8.5
07/12/78	Baseline	350	0	146	143	.406	.07	8.9
07/31/78	Baseline	394	12	134	148	.370	.12	8.3
11/16/79	Baseline	346	0	165	125	.081	ND	8.12
	Upper Control Limits		Carbonate-Bicarbonate					
	N.R.C.	433		190	170	1.47	.41	10.6
	D.E.Q.	437	14	158	169	.50	.18	
04/02/80	Start Chemicals							
04/02/80	Wamco #1501	363	0	156	140	.088	.27	7.62
04/14/80	Wamco #1544	456	0	151	166	.369	.37	7.71
04/30/80	C.&G.L. #34039	350	0	156	147	.120	.10	7.90
04/30/80	Wamco #1580	352	0	154	168	.122	.12	7.58
05/14/80	Wamco #1619 Confirm Samples	362	0	196	115	.096	ND	7.94
06/25/80	Wamco #1714	366	0	149	88	.097	ND	7.63
07/09/80	Wamco #1747 Quarterly Sample	420	0	133	170	.081	ND	7.75
07/23/80	Wamco #1768	378	0	154	180	.085	ND	7.75
07/30/80	Wamco #1779	374	0	-	75	.063	ND	-
08/07/80	Wamco #1798	290	0	146	154	.089	ND	8.23
08/21/80	Wamco #1832	368	0	151	133	.066	ND	7.70
09/03/80	Wamco #1861	352	0	120	145	.064	ND	7.90
09/17/80	Wamco #1893	184	0	146	135	.038	ND	7.50
10/01/80	Wamco #1934	352	0	152	150	.057	ND	8.[illegible]
10/15/80	Wamco #1962	290	0	140	153	.078	ND	[illegible].87
10/29/80	Wamco #1988	324	0	134	115	.108	ND	7.77
11/12/80	Wamco #0022	330	0	146	135	.100	ND	—
11/26/80	Wamco #2017	378	0	146	133	.036	ND	7.55
12/10/80	Wamco #2054	330	0	146	128	.073	ND	7.28
12/23/80	Wamco #2085	354	0	140	151	.052	ND	7.49

36-CDI-Y

Table 3
THUNDERBIRD JOINT VENTURE
COLLINS DRAW PROJECT
ENVIRONMENTAL MONITORING - 239W

Date	Remarks	Total Dissolved Solids-TDS mg/l	Carbonate mg/l	Bicarbonate mg/l	Sulfate mg/l	(ppb) Uranium mg/l	(as N) Ammonia mg/l	pH
07/31/78	Baseline	438	9	220	136	.150	.10	7.7
06/05/78	Baseline	494	0	220	155	.061	.01	8.1
06/22/78	Baseline	440	0	195	130	.050	.14	7.9
07/12/78	Baseline	446	0	195	125	.049	.04	7.6
11/15/79	Baseline	345	0	177	113	.004	ND	7.9
	Upper Control Limits		Carbonate-Bicarbonate					
	N.R.C.	568	263		178	1.18	.16	10.1
	D.E.Q	545	2.4	250	163	.05	.08	
04/02/80	Start Chemicals							
04/12/80	Wamco #1501	343	0	159	132	.027	.23	7.62
04/16/80	Wamco #1544	388	0	163	138	.021	.27	7.65
04/30/80	C.&G.L. #34039	324	0	176	124	.030	.10	7.60
04/30/80	Wamco #1580	348	0	173	129	.038	ND	7.04
05/14/80	Wamco #1619 Confirmation Sample	360	0	207	118	.035	ND	7.54
05/28/80	Wamco #1654 Monitor Round	410	0	159	120	.130	ND	8.76
06/25/80	Wamco #1714	358	0	156	158	.042	ND	7.40
07/09/80	Wamco #1747 Quarterly Sample	412	0	159	146	.010	ND	7.45
07/23/80	Wamco #1768	402	0	154	180	.011	ND	7.62
07/30/80	Wamco #1779 Confirmation Sample	382*	--	--	67	.030	ND	--
08/07/80	Wamco #1798	318	0	151	163	.003	ND	8.28
08/21/80	Wamco #1832	350	0	144	145	.041	ND	7.57
09/03/80	Wamco #1861	360	0	159	145	.032	ND	7.80
09/17/80	Wamco #1893	196	0	159	143	.032	ND	7.47
10/01/80	Wamco #1934	356	0	146	160	.047	ND	8.02
10/15/80	Wamco #1962	318	0	153	148	.070	ND	7.79
10/29/80	Wamco #1988	306	0	153	124	.066	ND	7.80
11/12/80	Wamco #0022	338	0	146	115	.030	ND	-
11/26/80	Wamco #2017	342	0	146	133	.030	ND	7.57
12/10/80	Wamco #2054	322	0	146	123	.028	ND	7.82
12/23/80	Wamco #2085	360	0	134	160	.033	ND	7.53

*Wamco #1779 was shown as 8382 TDS (mg/l) on previous report tables. This has been changed to 382.

S6-CDI-X

Table 4
THUNDERBIRD JOINT VENTURE
COLLINS DRAW PROJECT
ENVIRONMENTAL MONITORING - 240W

Date	Remarks	Total Dissolved Solids-TDS mg/l	Carbonate mg/l	Bicarbonate mg/l	Sulfate mg/l	(ppb) Uranium mg/l	(as N) Ammonia mg/l	pH
05/23/78	Baseline	430	12	146	143	.020	.05	8.2
06/07/78	Baseline	442	12	146	139	--	.03	8.2
06/22/78	Baseline	344	10	153	125	.033	.07	8.1
07/11/78	Baseline	378	0	146	128	.029	.11	7.2
		342	0	146	145	ND	.12	8.0
	Upper Control Limits		Carbonate-Bicarbonate					
	N.R.C.	508		182	162	1.03	.14	10.2
	D.E.Q.	464	6	176	163	.012	.10	
04/02/80	Start Chemicals							
04/02/80	Wamco #1501	328	0	154	128	.105	ND	7.63
04/16/80	Wamco #1544	389	0	151	133	.015	.16	7.67
04/30/80	Chem. Lab. #34039	358	0	151	137	.010	.10	8.00
2 weeks 04/30/80	Wamco #1580	360	0	151	158	.035	ND	7.54
05/14/80	Wamco #1619 Confirmation Sample	382	0	159	175	.026	ND	7.86
05/28/80	Wamco #1654 Monitor Round	412	0	146	135	.008	ND	7.64
06/25/80	Wamco #1714	368	0	146	67	.013	ND	7.67
07/09/80	Wamco #1747 Quarterly Sample	398	0	153	148	.005	ND	7.67
07/23/80	Wamco #1768	412	0	148	158	.006	ND	7.82
2 weeks 08/07/80	Wamco #1798	320	0	144	172	.070	ND	8.33
08/21/80	Wamco #1832	374	0	146	162	.001	ND	7.75
03/12/80	Wamco #1814	--	--	--	113	--	--	--
09/03/80	Wamco #1861	368	0	146	149	.005	ND	7.92
09/17/80	Wamco #1893	180	0	159	125	.003	ND	7.52
10/01/80	Wamco #1934	366	0	146	145	.007	ND	7.92
10/15/80	Wamco #1962	326	0	146	144	.011	ND	7.85
10/29/80	Wamco #1988	334	0	146	133	.011	ND	7.70
11/12/80	Wamco #0022	350	0	139	125	.004	ND	-
11/26/80	Wamco #2017	356	0	140	128	.001	ND	7.70
12/10/80	Wamco #2054	336	0	146	133	.003	ND	7.85
12/23/80	Wamco #2055	362	0	140	151	.004	ND	7.50

S6-CDI-W

Table 5
THUNDERBIRD JOINT VENTURE
COLLINS DRAW PROJECT
ENVIRONMENTAL MONITORING - 241W

Date	Remarks	Total Dissolved Solids-TDS mg/l	Carbonate mg/l	Bicarbonate mg/l	Sulfate mg/l	(ppb) Uranium mg/l	(as N) Ammonia mg/l	pH
06/05/78	Baseline	424	12	134	140	.054	.01	8.5
06/22/78	Baseline	361	24	134	130	.042	.12	8.4
07/11/78	Baseline	371	12	134	123	.071	ND	8.3
07/28/78	Baseline	353	12	146	140	.027	.09	8.3
11/16/79	Baseline	360	0	171	130	.005	ND	8.1
	Upper Control Limits		Carbonate-Bicarbonate					
	N.R.C.	488		197	161	1.07	.14	10.5
	D.E.Q.	452	18	164	160	.06	.07	
04/02/80	Start Chemicals							
04/02/80	Wamco #1501	352	0	171	125	.001	ND	7.56
04/16/80	Wamco #1544	374	0	156	125	.048	.16	7.66
04/30/80	Chem. Lab. #34039	330	0	161	122	.070	.10	8.30
04/30/80	Wamco #1580	326	0	159	126	.059	ND	7.73
05/14/80	Wamco #1619 Confirmation Sample	350	0	174	137	.071	ND	7.89
05/28/80	Wamco #1654 Monitor Round	388	0	159	115	.101	ND	7.75
06/25/80	Wamco #1714	370	0	146	142	.095	ND	7.91
07/09/80	Wamco #1747 Quarterly Sample	410	0	165	128	.092	ND	7.83
07/23/80	Wamco #1768	414	0	148	100	0	ND	7.89
08/07/80	Wamco #1798	930	0	163	595	.016	ND	8.25
08/21/80	Wamco #1832	352	0	144	153	.042	ND	7.72
09/12/80	Wamco #1814	350	--	--	114	--	--	--
09/03/80	Wamco #1861	376	0	159	135	.053	ND	7.94
09/17/80	Wamco #1893	338	0	146	135	.042	ND	7.50
10/01/80	Wamco #1934	338	0	146	155	.209	ND	7.99
10/15/80	Wamco #1962	316	0	153	144	.058	ND	7.84
10/29/80	Wamco #1988	250	0	159	115	.078	ND	7.81
11/12/80	Wamco #0022	332	0	146	115	.062	ND	-
11/26/80	Wamco #2017	350	0	146	128	.038	ND	7.64
12/10/80	Wamco #2054	335	0	153	130	.001	ND	7.84
12/23/80	Wamco #2085	344	0	146	151	.013	ND	7.52

SHOULD HAVE TAKEN CONFIRMATION SAMPLE

2 WEEKS

S6-CDI-U

EXHIBIT 6

DATA
NRC STANDARD FORMAT FOR WATER QUALITY DATA
SUBMITTAL TO THE NRC**

1. Make certain that water quality sampling techniques and analysis are in accordance with EPA guidelines (1974).

2. All water quality data submitted to the NRC should:

   a. Be submitted in tabular form with EPA drinking water standards and MPC's listed in the same table, for ease of data comparison. Methods of sampling and preserving, and the laboratory utilized should be indicated in the table. The depths, formation(s) sampled, water level elevations and dates measured, and distances from the tailings pond or well field for each monitor well should be noted in the table.

   b. Be submitted graphically to illustrate water quality and water level elevation changes with time with the EPA drinking water standards, MPC's, or background water quality data (whatever is appropriate) for the particular constituent shown on the graph.

   c. Include a short summary of the data interpretation, noting any anomalies, with an explanation.

   d. Water quality data reports should include a map which shows all water quality sampling points.

**Note: This format differs from the sample format shown in Table 3 of NRC Regulatory Guide 4.14.

The Anaconda Copper Mining Company

URANIUM DIVISION

1980 Results

TABLE A

URANIUM PARTICULATE SAMPLING

SAMPLE NUMBER	SAMPLE COLLECTION TIME AND DATE	WEIGHT OF PAPER	WEIGHT OF PAPER AND PAPTICULATES	WEIGHT OF PARTICULATES	URANIUM CONCENTRATION	COMMENTS
P-1	4/15/80 - 4/22/80	.1224	.1337	.0113	5.4 µg	8.9×10^{-15} µCi/ml WAMCO
P-2	5/22/80 - 5/29/80	.1216	.1346	.0130	5.0 µg	8.3×10^{-15} µCi/ml "
P-3	6/12/80 - 6/19/80	.1213	.1423	.0210	48.0 µg	8.1×10^{-14} µCi/ml "
P-4	7/02/80 - 7/09/80	.1186	.1315	.0129	79.5 µg	1.33×10^{-13} µCi/ml "
P-5	8/13/80 - 8/20/80	.1246	.1546	.0300	300.0 µg	5.03×10^{-13} µCi/ml "
P-6	9/10/80 - 9/17/80	.1225	.1336	.0111	38.6 µg	6.4×10 µCi/ml "
	NOTE: Air sampler calibrated @ 40 liters/minute 9/18/80 (DJW)					
P-7	10/08/80 - 10/15/80	.1211	.1423	.0207	564.8 µg	9.5×10^{-13} µCi/ml "
P-8	11/19/80 - 11/26/80	.1223	.1450	.0227	126.7 µg	2.13×10^{-13} µCi/ml "
P-9	12/16/80 - 12/23/80	.1231	.1499	.0268	56.0 µg	9.90×10^{-14} µCi/ml "
			10 CFR PART 20	U NATURAL	40 HR AIR 1×10^{-10} µCi/ml	
					* µg = microgram	
					* µCi = microCurie	

EXHIBIT D

Table 8
PROCESS DRAIN FIELD CONSTITUENT INVENTORY
CULLEN DRAW PROJECT

DATE	REMARKS	VOLUME Meter Gallons	VOLUME Calculated Gallons	CONSTITUENT CONCENTRATIONS TDS mg/l	Na mg/l	NH3 Mg/l	As mg/l	Se mg/l	U mg/l	Ra 226 Pico-Curies/l	CONSTITUENT INVENTORY TDS Kg	Na Kg	NH3 Kg	As Kg	Se Kg	U Kg	Ra 226 PicoCuries
	Wyo. W.Q.D. Max. Permit 79-092		950,000	None	None	None	5.0	5.0	20.0	60.0	None	None	None	2.0	2.0	3.5	8.0×10^7
	NRC SUA-1352		None	None	None	None	None	None	None	None	None	None	None	None	None	None	None
06/19/83	Start Discharge 1:25 p.m.	4,010															
			27,254	2,904	296	37	0.11	.36	.36	27.4±3.1	300	30.5	3.8	.010	.040	.04	$.28 \times 10^7$
07/16/83		31,264															
			14,216	5,814	498	137	.018	.37	1.40*	29 ±2	313	26.8	7.4	.001	.009	.075*	$.25 \times 10^7$
07/30/83	Start 2-Week Composite	45,480															
07/31/83	Accumulated Inventory		41,470								613	57.3	11.2	.011	.049	.115*	$.43 \times 10^7$
	Start 2-Week Composite	45,480															
			13,967														
08/14/83		59,447		952	148	123	.018	ND	.024	83 ±6	50.5	7.8	6.5	.001	ND	.001	$.44 \times 10^7$
			16,554														
08/27/83	Start 2-Week Composite	76,001		1,696	234	65	.050	.062	.061	57 ±4	106	14.6	4.1	.003	.004	.004	$.36 \times 10^7$
08/27/83	Accumulated Inventory		71,991								769.5	79.7	21.8	.015	.053	.120	1.23×10^7
			7,174														
09/11/83		83,175		834	106	48	.12	.012	.025	10 ±1.7	22.8	2.9	1.3	.003	ND	.001	$.03 \times 10^7$
			10,528														
09/25/83		93,703		2,690	197	54	.014	.002	14.5	172 ±7	108	7.9	2.2	.006	.001	.59	$.69 \times 10^7$
09/25/83	Accumulated Inventory		89,693								900.3	90.5	25.3	.024	.054	.70	1.95×10^7
			6,047														
10/13/83		99,750		2,302	290	45	.016	.12	9.3	274 ±4	53	6.7	1.0	.00	.003	.21	$.63 \times 10^7$
10/23/83		107,417	7,667	280	72	255	.016	.04	21.1	15.8±1.5	8.2	2.1	7.4	.00	.001	.62	$.05 \times 10^7$
10/23/83	Accumulated Inventory		103,407								961.5	99.3	33.7	.024	.058	.53	2.63×10^7
			633														
11/05/83		108,050		606	122	79	.002	.002	1.5	561?	1.5	.29	.19	.000	.000	.003	$.01 \times 0^7$
			76,671														
11/19/83		144,721		10,902	304	1,400	.001	.001	.014	4.9±0.8	1,467	42.5	196.00	.00	.00	.002	$.07 \times 10^7$
			8,279														
11/21/83		153,000		4,406	262	719	.050	.59	.243	29	139	8.3	22.7	.002	.019	.008	$.09 \times 10^7$
11/23/83	Accumulated Inventory		148,990								2,569	150.39	252.59	.026	.077	1.543	2.8×10^7
			3,094														
12/04/83		156,094		8,926	328	380	.040	.27	.64	0.2±0.3	105	3.9	4.5	.00	.003	.007	0.00×10^7
			99,946														
12/13/83		256,040		4,210	274	840	.48	.24	1.3	0.7±0.5	1,603	104	320	.18	.091	.495	$.03 \times 10^7$

* The lab analyzed the wrong sample for uranium and radium. The 11.7 ppm U_3O_8 reported on last month's table is in error. The correct reading is 1.40 ppm. The error was not noticed until the radium assay was reported at an unusually high level. The radium analysis on the correct sample is still pending.

56-CD11-G

EXHIBIT 8

EXHIBIT 9

LAIEL

TABLE 18 (3/21/80)

TABULATION of ESTIMATED VOLUME & COMPOSITION of DISCHARGE to the PROCESS WASTEWATER DRAIN FIELD

Task No.	Task Description	Gal./Day to Drain Field (2 Yr. Ave)	Approx. Major Ion Component	Approx. Ion Conc. Range (mg/liter)	Max. Conc. Before Treatment (mg/liter)	Probable Conc. to Drain Field (mg/liter)	Probable lbs./day Ions to Drain Field	Total Gal. Over 2 Yrs. Drain Field	Maximum Total Lbs. Over 2 Yrs. Drain Field	Average pH Range
1	Water Softeners to Protect R.O. Unit*	15	Ca^{++}	1,000–1,750	(----)**	1,500	0.188	11,000	137	6– 8
2	Housekeeping, Washdown Plant R.O. Water	50	----	----	(----)**	----	----	36,500	----	6– 8
3	Boiler Blowdown	20	Fe^{++}	5–10	(----)**	10	1.67×10^{-3}	14,600	1.2	6– 7.5
			Ca^{++}	5–15	(----)**	15	2.5×10		1.8	6– 7.5
4	Process by IX Units***, Clean Well Water for Plant Makeup, Elutions, Well Field Pre-Conditioning	110	Ca^{++}	1,000–2,000	----	1,500	1.38	80,300	1010	6– 8
			Mg^{++}	100–300	----	200	0.18		131	
5	Decant Water from	450	U_3O_8	10–50	50	1.0	3.76×10^{-3}	329,000	2.74	7– 8.5
	Precipitation		$SO_4^=$	100–500	500	300	1.13		825	
	Yellow Cake		Cl^-	100–300	300	200	0.75		548	
	Using R.O. Unit		NH^{+4}	30–200	200	100	0.38		277	
			Mo	1–10	10	5	0.02		14.6	
6	Periodic Resin	15	U_3O_8	1–4	4	4	0.5×10^{-3}	11,000	0.4	9–11
	Cleanup (NaOH)		Na	40,000–80,000	80,000	60,000	7.5		3500	
7	Cleanup of Four	170	U_3O_8	1–10	10	1.0	1.4×10^{-3}		1.0	8– 9
	Well Fields, After		$SO_4^=$	200–500	500	300	0.43	126,000	314	
	Well Field Transfer,		Cl^-	50–150	150	100	0.14		102	
	by R.O. Cleanup		Na	1–10	10	5	0.005		3.7	
			Se	0.3–1.5	1.5	0.5	0.7×10^{-3}		0.5	
			As	0.1–0.5	0.5	0.1	0.1×10^{-3}		0.07	
			Ra_{226}	10–50 pCi/l	50 pCi/l	25 pCi/l	16×10^{-3} pCi/d		25.8×10^{-9} lbs	
8	Cleanup of Last (5th) Well Field with IX Followed by R.O. Concentration	(90-day Ave.) 1400	U_3O_8	10–20	20	1	0.01		0.9	8– 9
			Mo	50–150	150	100	1.2	126,000	108	
			Se	1–5	5	3.0	0.04		3.6	
			As	1–5	5	3.0	0.04		3.6	
		173 g/d	$SO_4^=$	2,000–6,000	6,000	4,000	47		4230	
		over 2 Yr.	Cl^-	2,000–4,000	4,000	3,000	35		3150	
		Average	Ca^{++}	1–5	5	3.0	0.04		3.6	
			$(NH_4)_2CO_3$	1×10^4–3×10^4	3×10^4	2.5×10^4	293		26,400 (13.2 tons)	
			Ra_{226}	10–50 (pCi/liter)	50 pCi/l	25 pCi/l	0.13×10^6 pCi/d		11.7×10^6 pCi	
							2.9×10^{-10} lb/d		26×10^{-9} lb	

*Reverse Osmosis Unit
**No Treatment Necessary
***Ion Exchange Unit

56–CDI–Job H

$(3.785\ \text{GAL/l})(25\ \text{pCi/l})(250{,}000) = 2.36 \times 10^7\ \text{pCi}$

Form [illegible]

S. NUCLEAR REGULATORY COMMISSION
MATERIALS LICENSE

EXHIBIT 2

Pursuant to the Atomic Energy Act of 1954, as amended, the Energy Reorganization Act of 1974 (Public Law 93-438), and Title 10, Code of Federal Regulations, Chapter 1, Parts 30, 31, 32, 33, 34, 35, 36, 40 and 70, and in reliance on statements and representations heretofore made by the licensee, a license is hereby issued authorizing the licensee to receive, acquire, possess, and transfer byproduct, source, and special nuclear material designated below; to use such material for the purpose(s) and at the place(s) designated below; to deliver or transfer such material to persons authorized to receive it in accordance with the regulations of the applicable Part(s); and to import such byproduct and source material. This license shall be deemed to contain the conditions specified in Section 183 of the Atomic Energy Act of 1954, as amended, and is subject to all applicable rules, regulations and orders of the Nuclear Regulatory Commission now or hereafter in effect and to any conditions specified below.

Licensee	
1. The Cleveland-Cliffs Iron Company	3. License number SUA-1352
2. 1460 Union Commerce Building Cleveland, Ohio 44115	4. Expiration date June 30, 1984
	5. Docket or Reference No. 040-08714

6. Byproduct, source, and/or special nuclear material	7. Chemical and/or physical form	8. Maximum amount that licensee may possess at any one time under this license
Natural Uranium	Dewatered/dried Ammonium Uranyl Carbonate	22727 kilograms (50,000 lbs) as Uranium equivalent

9. Authorized Place of Use: Collins Draw Site, Township 43 North, Range 76 West, Section Nos. 35 and 36, Campbell County, Wyoming.

10. Authorized Use: For uranium recovery from uranium solution extraction studies in accordance with statements, representations and conditions contained in (1) the licensee's application dated November 3, 1978 and supportive information attachments; and (2) additional information transmittal dated January 16, 1979.

Notwithstanding the above, the following conditions shall override any conflicting statements contained in the licensee's application and supplements.

For the U. S. Nuclear Regulatory Commission

Date 1/29/79

by _____

Division of Materials and Fuel Cycle
Facility Licensing
Washington, D. C. 20555

CONDITIONS

11. The uranium solution extraction activities shall be performed on a maximum well field area of less than one and one-quarter (1 1/4) acres within a project site area of twenty-three (23) acres according to Section 1.5, page 3 and following of the November 3, 1978 submittal.

12. Variation from the ammonium carbonate-bicarbonate leach procedure presented in the application, Section 3.1, Metallurgical Process Description, of the January 16, 1979 submittal shall require NRC approval through amendment of this license. The licensee shall discuss why he proposes the modification and how it will be expected to affect groundwater quality in the aquifer, the waste liquid characteristics, groundwater quality restoration criteria and methods and monitoring requirements.

13. At least seven (7) wells including production and upper sand monitoring wells and surrounding well field monitoring wells shall be used to monitor and establish the premining groundwater quality values of each well field test area. Where applicable, intermittent streams and regional water wells shall also be sampled semi-annually for conductivity, pH, uranium and radium. The well samples shall be analyzed for the parameters listed in Table 2, Water Quality Data and Proposed Restoration and Excursion Criteria, in the Technical Response to Questions dated January 16, 1979, to establish the baseline water quality values of the test area. At least five (5) samples shall be taken, at a minimum of two week intervals, to define premining water quality values before leachant injection is initiated.

14. Restoration of the production aquifer groundwater quality following termination of uranium solution extraction shall be initiated within forty-five (45) days after extraction operations cease for a test well field area. The licensee shall provide written notification to NRC, Division of Fuel Cycle and Material Safety, that restoration activities are being initiated. The notification shall describe the restoration steps to be taken, the projected schedule for the activity, and the proposed plan for post-restoration monitoring. The post-restoration monitoring program shall be subject to approval by NRC.

15. During uranium solution extractions, monitor wells shall be sampled every two (2) weeks and analyzed for conductivity (or total dissolved solids (TDS)), pH, total bicarbonate plus carbonate, ammonia, uranium and sulfate. Static water levels in the wells shall also be measured for preliminary potential indications of external flow patterns from the well field. On a quarterly basis, the full suite of water quality parameters as listed in Table 2 (condition No. 13) shall be determined with the samples.

For the U. S. Nuclear Regulatory Commission

Date _____

by _____

Division of Fuel Cycle and Material Safety
Washington, D.C. 20555

CONDITIONS

(continued)

16. The upper control limits (UCL's) for the bi-weekly monitor well indicator parameters listed in Condition 15 shall be fifteen (15) percent above the established baseline values for the conductivity (or total dissolved solids (TDS)), the total bicarbonate plus carbonate, and the ammonium and sulfate ions; the UCL for uranium shall be 1 mg/l above the mean baseline value and the UCL for pH shall be two units above the mean baseline value for pH.

17. When an UCL value is exceeded in an assay, the licensee shall sample and analyze the water of the affected well(s) again within forty-eight (48) hours. Analysis of the second sample shall be done within twenty-four (24) hours of sampling. If the second analysis confirms that an UCL has been exceeded, corrective action shall begin and daily monitoring of the excursion shall be initiated by the licensee. Sampling and analysis of the affected well(s) shall continue during the corrective action period on a weekly basis until at least two analyses shall show that the lead indicators do not exceed their UCL values. The licensee shall confirm this status by a letter which shall include the assay results. During the excursion status, arsenic and selenium analyses shall also be done. Written notification shall be provided to the NRC, Division of Fuel Cycle and Material Safety, within fifteen (15) days of confirming an excursion, describing the condition, the corrective actions taken and the results obtained. If corrective action is ongoing at the time the report is filed, a final report shall be submitted describing end results of the corrective actions. If after thirty (30) days, the excursion monitoring still does not show a decline of excursion parameter values, injection of lixiviant into that pattern area shall be discontinued. while producing leachant. If after one-hundred and twenty (120) days from the time an excursion was confirmed, the excursion parameters do not indicate that the corrective action is working and at least one parameter value is not below its UCL, restoration procedures for that pattern area shall be initiated.

18. A log of events describing the corrective actions taken and a chart of sample analyses shall be maintained during such period(s) to document the actions and ensuing results.

19. The volumes of any barren bleed solution discharged to a containment facility shall be measured. Monthly samples of bleed solution shall be analyzed for uranium, radium-226, selenium, arsenic and TDS.

For the U. S. Nuclear Regulatory Commission

Date _____

by _____

Division of Fuel Cycle and Material Safety
Washington, D.C. 20555

MATERIALS LICENSE

Supplementary Sheet

License Number SUA-1352

Docket or
Reference No. 040-08714

CONDITIONS

(continued)

20. Waste solution containment facilities, in service, shall be monitored for leaks every two (2) weeks.

21. Disposition of solid process residues by the licensee shall require prior approval by the NRC.

22. The project facilities shall be restricted by enclosing the pilot plant area and ancillary facilities with fencing.

23. The licensee is exempted from the requirements of Section 20.203 of 10 CFR part 20 provided all entrances to the site are conspicuously posted with the warning: "CAUTION. ANY AREA OR ROOM WITHIN THIS FACILITY MAY CONTAIN RADIOACTIVE MATERIAL."

24. The uranium recovery plant for the study shall be operated at a maximum nominal flow rate of one-hundred (100) gpm.

25. Flow rates on each injection and production well shall be measured at least once per shift and recorded on a daily operating log.

26. Air sampling for radon and/or radon daughters shall be conducted, initially, on a monthly basis inside the plant structure. Records of time-weighted exposures shall be maintained for employees whose work involves occupancy in areas where concentrations exceed twenty-five (25) percent of the concentration specified by 10 CFR Part 20, Appendix B, Table 1, Column 1, for radon-222. The radon sampling program shall be supplemented by sampling for uranium particulates on a monthly basis inside the plant structure. If sample results collected for six (6) months during recovery operations show less than twenty-five (25) percent of the applicable maximum permissible concentrations (MPC's) specified by 10 CFR Part 20 for either of the sampling programs required above, sampling may be reduced to a quarterly frequency.

27. Specified locations inside the restricted area shall be identified and posted for storage of recovered uranium slurry.

28. Exploration boreholes, post-test boreholes and all wells shall be plugged to comply with Wyoming Department of Environmental Quality (DEQ) requirements prior to decommissioning the site for unrestricted use.

For the U. S. Nuclear Regulatory Commission

Date _____

by _____

Division of Fuel Cycle and
Material Safety
Washington, D.C. 20555

MATERIALS LICENSE

Supplementary Sheet

License Number SUA-1352

Docket or
Reference No. 040-08714

CONDITIONS

(continued)

29. A quarterly report shall be submitted that summarizes the status of the test program, with supporting analytical data and evaluations regarding important environmental aspects of the operation, such as water quality baseline data, monitor well analyses, lixiviant migration control, waste generation volumes, and volumes of injected lixiviant and pregnant solution produced. The initial report should be filed following the accumulation of initial baseline data.

30. The licensee shall perform the radiological and environmental monitoring program as discussed on page 27 and following of the January 16, 1979 submittal to describe and document the possible influences of the operations, to assure compliance with appropriate standards and early indentification of possible undesirable trends.

31. The licensee shall document and maintain results of sampling, analyses, surveys and instrument calibrations, reports on inspections and audits, employee training records, as well as any related reviews, investigations and corrective actions for a period of at least three (3) years unless otherwise specified by Section 20.402 of 10 CFR Part 20.

Date 6/29/79

For the U. S. Nuclear Regulatory Commission

by

Division of Fuel Cycle and
Material Safety
Washington, D.C. 20555

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