PDR 40-8692

Cotter Corporation
General Office

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LAKEWOOD, COLORADO 80226

August 25, 1980

Mr. Jack Rothfleisch
Division of Waste Management
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Re: Radioactive Materials License No. SUA-1370

Dear Mr. Rothfleisch:

In response to our telephone conversation of Monday, July 28, 1980, license conditions 21 and 22 of RML No. 1370, and Amendment No. 1 to the above-captioned license, Cotter Corporation submits the enclosed information.

License Condition 21 - The short duration of the pilot plant operation (seventeen, 25 ton, batches over a 46 day period) during November and December, 1979, the relative lack of definitive metallurgical results, and the subsequent decision by Cotter to evaluate further the efficacy of the TL Leach process delayed the submittal of a quarterly report according to the terms of license condition 21. Additionally, a project completion report was not submitted because the company concluded, following the 1979 operations, that additional work with the process would be needed in view of the inconclusive results derived from the first 17 batches.

In accordance with the NRC's letter, dated July 31, 1980, which approved an amendment to RML SUA-1370, Cotter submits herewith the radiological safety and environmental sampling data collected in 1979. (See Tables 1 through 3.) It should be noted that ambient air particulate data are not enclosed herewith. These data will be forwarded to NRC along with the environmental and safety data collected during the 1980 pilot plant operations.

License Condition 22 - Column leach tests were conducted at Cotter's Canon City lab facilities using tailings generated during the November-December, 1979, operation of the TL Leach pilot plant.

These tailings represented a composite sample obtained by combining the tails collected from ten randomly selected sites within a leach bay at the pilot plant following completion of leaching and draining. Tailings collected from the ten random sites were obtained from different depths and different areal locations within the leach bay.

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Two tests of two columns per test were conducted using composite samples of tailings taken from PAD 5 - TEST 14 and PAD - TEST 18. The water used for stages 1 and 2 of the tests was collected from the mine dewatering well discharge (at Discharge point #001, NPDES WY-0027685). The water quality characteristics of this water is given in Table 4.

The test procedures, although modified to reflect the use of only two separate batches of tailings, were based upon the procedures outlined in Exhibit 1, attached hereto. These procedures were reviewed by DEQ and NRC prior to implementation. The procedures were derived from those proposed by ASTM in response to the leach test requirements discussed in the Resource Conservation and Recovery Act.

It is important to note that the tailings used in these tests were not washed with "clean" (non-process solution) water prior to commencement of leaching. Accordingly, Cotter's position relative to whether or not these tailings are representative of those that would be generated by a commercial scale plant is that they are not, and, in fact, the stage 1 trace metal concentrations given in Table 5 should be disregarded to the extent that we feel that they represent the chemical quality of solutions that would be expected to drain from the tails during a "clean" water wash cycle. Additionally, referring to the uranium concentrations given in Table 6, the stage 1 values represent concentrations of uranium that appear to be amenable to removal by ion exchange. This has prompted the company to evaluate the increased productive capacity that could be incorporated into a commercial scale plant by processing the stage 1 trace metal values using ion exchange.

Based upon the results of the column leaching tests using tailings from Cotter's initial TL leach pilot plant operations, Cotter intends to evaluate the effects of different "clean" water wash cycle assumptions using tailings generated during the operations conducted this year.

The data given in Table 7 represent the trace metal concentrations that more closely represent the projected characteristics of the water that would affect groundwater in the immediate vicinity of a saturated, below grade tailings disposal cell. Further analysis is needed regarding the geochemical modification of these parameters as the affected waters move down gradient from the disposal cell.

DESCRIPTION OF PILOT PLANT FACILITIES

In accordance with our July 28 telephone conversation and Mr. Scarano's July 31, 1980, request for a description of the pilot plant building and pilot plant activites conducted within and

adjacent thereto, please refer to the following discussion, and to the two maps enclosed herewith.

The general arrangement of the pilot plant facilities, as shown in Figures 1 and 2 was designed to include the following stages: (1) crushing, (2) treatment with acid, (3) curing, and (4) rinsing.

The bulk of the equipment, i.e., the grizzly, crusher, all conveyors and hoppers, weigh belt feeder, mixing drum, and acid storage tank are used in the first two stages of the process. The temporary building, containing a small lab, two (2) curing pads, and five (5) rinsing bays, is used only for the final stages of leaching (i.e., curing and rinsing only).

The pregnant solutions generated by the leaching process flow through PVC piping from the rinse bays to solution storage tanks located outside of the temporary building. The solutions are then pumped into a precipitation tank where magnesium oxide is introduced. The solutions in the precip tank are then returned to the storage tanks where they are allowed to settle until they can be transported to the Canon City Mill.

If you require additional information, or if you have any questions, please contact me at your earliest opportunity.

Sincerely,

Timothy C. Smith

Timothy C. Smith
Supervisor of Environmental Activities

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enclosures

Exhibit 1

FIELD SIMULATION - COLUMN LEACHING TEST

I - Purpose

To evaluate what would be expected to occur under saturated and aerated conditions as the result of below grade disposal of uranium ore tailings produced during the Cotter Corporation-TL Leach pilot plant operation (Application File No. TFN 1 5/99).

II - Scope

The test procedures described below are designed to provide data which will indicate the levels of solubility and leaching potential of selected parameters in the TL Leach tailings. The test will provide a method to evaluate the relative rate of leaching which would be expected to occur when the tailings material is subjected to local ground water conditions or to infiltration due to precipitation. These data will assist Cotter, NRC, and Wyoming DEQ engineers and geologists in designing an effective tailings disposal system.

III - Summary of Method

The testing method consists of placing a known weight of TL Leach tailings material in a 100 mm (4 inch) diameter column, and testing the extraction of designated constituents under both water saturated and aerated conditions. In the aerated phase, distilled water is applied at a rate determined by the climatic conditions under which the test material will be stored. The bed depth for a 100 mm diameter column will be at least 1 meter.

Cotter will conduct tests using four different batches of tailings, and each test will be comprised of two concurrently operated leach columns.

IV - Apparatus

Column size: 100 mm diameter
1 meter

Column material: Opaque plastic pipe, PVC (schedule 40); semi-tight fitting cover; volumetric flasks.

V - Reagents

Naturally occuring ground water from the "S", "A" and "B" sandstone aquifers.

ASTM Type 4 distilled water.

VI - Procedures

A. Preparation of Random Sample:

1. Collect 35-40 gallons of ground water from the Charlie Site and analyze for all water quality parameters listed in Buideline No. 4 (Revised). (Each 35-40 gallons ground water samples will be used for two concurrent leach tests only.)

2. Collect, blend and assay 320 kilograms (750 pounds) of dry tailings from the five leach pads (Figure 1.3-1 of Application File No. TFW 1 5/99). The collection of kilograms (140 pounds) of tailings from each leach pad will occur at the end of the wash/dry cycle and will require approximately 5 days to accumulate the total 320 kilogram sample. The tailings sample will be blended and split into two 160 kilogram lots and blended again. Each 160 kilogram lot will be analyzed for moisture content and assayed for Uranium and Radium-226.

3. Load each 160 kilogram lot into separate prewashed column. Use care to minimize segregation of course and fine material. Ambient temperature should be maintained at 25± - 5° C throughout the test.

B. Test for Solubility: (Stage 1)

1. Add ground water to the column, filling from the bottom until the solution is 10 mm (2.5 inch) above the surface of the sample. Note the water volume added.

2. Open bottom valve and allow solution to drain into a volumetric flask for 30 minutes beyond the point at which visible flow ceases. Adjust to folume and analyze for parameters in LQD Guideline No. 4 within 24 hours.

C. Test for Leach Potential: (Stage 2)

1. Close valve and add ground water to cover tailings bed plus 10 mm.

2. Cover column with semi-tight cover and allow column to stand undisturbed for 24 hours.

3. Withdraw 1/10 of the volume of liquid added to the column in step C.(2) from bottom of the column and return it to the top. Allow column to stand undisturbed for 24 hours.

4. Repeat step C.(3) every day for a total of 10 days.

5. At end of 10-day period, slowly drain column into volumetric flask. Cover and hold flask.

6. Allow column to drain into second volumetric Flask for an additional 24 hours.

7. Combine effluents from steps C.(5) and (6), adjust to volume and analyze for parameters listed in LQD Guideline No. . within 24 hours.

D. Aerated Leaching Test: (Stage 3, Simulation of Below Grade Non-saturated Conditions)

1. Commence additions of ASTM Type 4 water, metered to the average infiltration rate based upon annual rainfall and soil conditions at the Charlie stie. Add single portion each day and collect the effluent water in clean volumetric flask. After each five days of water addition, analyze the combined effluent for the parameters listed in LQD Guideline No. 4.

2. At end of 5-day period, add no water, but using a small vacuum pump draw water saturated air through the column from the bottom to the top at a rate of approximately 0.05 liters per hours for two days.

3. Discontinue test after a total of 19 days.

E. Calculate:

1. The readily soluable constituents for all tests from analysis of solution collected in step B.(2).

2. The constituents that leach out under non-aerated saturated conditions from analysis of solution collected in step C.(7).

3. The constituents that leach out under aerated conditions from analysis of each 5 day composite as in step D.(1).

List of parameters used for analysis will be reduced in accordance with agreement between Cotter and LQD after identifying parameters present in minimum concentrations or unaffected dry leaching.

Table 1
Breathing Zone Samples **
1979 Pilot Plant Operations

Sample No. *	Job Description	Uranium Concentration, U-Nat
1	Front-end Loader Operator	1.71×10^{-12} uCi/ml
2	Front-end Loader Operator	3.84×10^{-12}
1	Ore Prober (in test pit)	3.29×10^{-12}
1	Back hoe Operator (in test pit)	3.57×10^{-12}

* Sample 1 - Front-end Loader Operator, collected on October 26, 1979.

Sample 2 - Front-end Loader Operator, Sample 1 - Ore Prober, and Sample 1 - Back hoe Operator, collected during the period November 20 and 21, 1979.

** The standard for restricted area U-nat exposure according to 10 CFR 20, Appendix B, is 1×10^{-10} uCi/ml for insoluble natural uranium. All samples collected by Cotter are two orders of magnitude lower than the allowable restricted area U-nat concentrations, and are also below the unrestricted area limit of 5×10^{-12} uCi/ml, insoluble U-nat.

Table 2
General Air Sampling Program **

Sampling Location	Sample No. *	U-nat Concentration, uCi/ml
Run-of-Mine Ore Pad	1	9.12×10^{-14}
	2	6.0×10^{-14}
	3	5.04×10^{-14}
Crusher	1	1.02×10^{-13}
	2	5.25×10^{-13}
	3	4.77×10^{-13}
Crushed Ore Pad	1	3.47×10^{-13}
	2	1.69×10^{-13}
	3	5.13×10^{-14}
Feed Hopper	1	1.87×10^{-13}
	2	1.66×10^{-13}
	3	6.71×10^{-14}
Weigh Hopper	1	2.94×10^{-13}
	2	3.93×10^{-14}
	3	4.32×10^{-14}
Feed Conveyor	1	2.20×10^{-13}
	2	9.44×10^{-14}
	3	1.36×10^{-13}
Crushed Ore Conveyor (to mixing drum)	1	4.78×10^{-14}
	2	4.42×10^{-14}
	3	1.32×10^{-13}
Undersize Conveyor	1	5.75×10^{-14}
	2	2.31×10^{-14}
	3	6.57×10^{-14}
Cure Pad (Bldg. interior)	1	2.10×10^{-13}
	2	6.77×10^{-14}
	3	2.10×10^{-13}
Leach Pad (Bldg. interior)	1	1.38×10^{-14}
	2	1.92×10^{-13}
	3	6.81×10^{-14}

* Sample 1 - collected on October 22, 1979 (prior to commencement of pilot plant operations).

Sample 2 - collected during the period November 6 through 16, 1979.

Sample 3 - collected during the period December 7 through 14, 1979.

** These data are well below the allowable insoluble U-nat concentrations for restricted areas (1×10^{-10} uCi/ml) and are also below the allowable insoluble U-nat limits for unrestricted areas (5×10^{-12} uCi/ml).

Table 3
Atmospheric Rn-222 Monitoring Data **

Sample Period	Station No. *	Rn Concentration, uCi/ml
November 21-31, 1979	2	3.3×10^{-10}
	3	3.7×10^{-10}
December 21-31, 1979	2	6.5×10^{-10}
	3	6.4×10^{-10}

* During 1979 pilot plant operations, Station 2 was located east of the pilot plant, at the eastern boundary of the NE¼, Section 36, T45N, R77W (the permit area), and Station 3 was located south of the pilot plant, at a point immediately south of the boundary between the NE¼ and the SE¼ of Section 36.

** The allowable Rn-222 concentration for restricted and unrestricted areas are 3×10^{-8} uCi/ml and 1×10^{-8} uCi/ml, respectively.

Table 4
Charlie Groundwater Quality, Averaged values in mg/l
(Discharge point #001)

Parameter	mg/l
Fe	0.05
Pb	<0.01
Mn	<0.01
plt	8.03
TSS	<10
Zn	0.01
Se	0.004
U	0.01
SO_4	274
Ra-226	0.27 ± 0.83

Table 5
Concentrations of Trace Metals and Inorganics, mg/l
Stage 1, Solubility Test (without clean water wash)

Chemical Parameter	Column No./Batch No.			
	1/1	2/1	3/2	4/2
Al	56.0	54.0	46.0	94.0
As	NA	NA	NA	NA
Ba	NA	NA	NA	NA
Ca	480.0	474.0	465.0	465.0
Cd	<0.05	<0.05	<0.05	<0.05
Cl	NA	NA	NA	NA
Cr	0.15	0.10	<0.10	0.20
Cu	0.1	<0.1	<0.1	<0.1
Fe	187.5	187.5	158.0	280.0
Hg	NA	NA	NA	NA
K	50.0	50.0	50.0	55.0
Mg	NA	NA	NA	NA
Mn	15.0	15.0	14.0	22.0
Mo	<0.1	<0.1	<0.1	<0.1
Na	300.0	300.0	300.0	400.0
Ni	2.5	1.5	1.0	2.0
Pb	<0.1	<0.1	<0.1	0.1
Se	NA	NA	NA	NA
SO_4	3870	3850	3520	5070
U_3O_8	29.0	38.0	29.0	63.0
V	12.5	12.2	10.0	25.0
Zn	0.85	0.82	0.70	1.20
pH	2.50	2.54	2.62	2.46

Batch No. 1 = Test 14 Batch No. 2 = Test No. 18 NA = Not Available

Table 6
Uranium Concentrations in Leach Solutions
Contained in the Stage 1 Wash of the Column Leach Tests
U_3O_8, mg/l

	Stage 1 (Solubility Test)	Stage 2 (Leach Potential)	Stage 3 (Aerated Test)
$\bar{x}$	31.0	6.0	9.0
S.D.	3.0	1.0	2.0

U_3O_8, mg/l
Concentration (Independent Lab)

	Stage 1	Stage 2	Stage 3
$\bar{x}$	29.0	6.0	Not Available
S.D.	6.0	1.0	Not Available

Table 7
Concentrations of Trace Metals and Inorganics, mg/l
Stage 2, Leach Potential Test (without clean water wash)

Chemical Parameters *	Column No./Batch No.		
	1/1	2/1	3/2
Al	<1.0	<1.0	<1.0
Ca	84.0	80.0	80.0
Fe	<0.12	<0.12	<0.12
K	3.0	2.5	3.0
Mn	<0.05	<0.05	<0.05
Na	240.0	235.0	240.0
Ni	<0.15	<0.15	<0.15
U_3O_8	6.0	8.0	8.0
V	<1.7	<1.7	<1.7
Zn	<0.018	<0.018	<0.018
pH	8.21	8.29	8.23

* The list of chemical parameters in Table 7 was shortened, relative to that given in Table 5, due either to the relatively low concentrations of a particular parameter observed during stage 1 (i.e., Cd, Cr, Cu, Ph etc.) or to laboratory error.