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UNION CARBIDE NUCLEAR COMPANY

DIVISION OF UNION CARBIDE CORPORATION

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NEW YORK 17, N. Y.

WILLIAM M. SMART
VICE PRESIDENT

June 3, 1960

DOCKETED USAEC AUG 15 1960 Division of Licensing & Regulation Docket Officer

Mr. H. L. Price, Director (2)
Division of Licensing and Regulation
United States Atomic Energy Commission
Washington 25, D.C.

Dear Mr. Price:

This letter is in answer to your letter of May 5, 1960 pertaining to our Trace Elements Corporation mill in Maybell, Colorado, and in which you requested "a full and complete statement of the steps which will be taken in order to bring the operation of your mill into compliance with the Commission's regulations applicable to concentrations of radioactive material in liquid effluents discharged to unrestricted areas."

As we described in our letter to you of February 23, 1960 and as will be shown in the following information, we do not believe liquid effluents leaving the restricted area at the Trace Elements Corporation mill constitute a hazard to any individual. We recognize, however, that to be in compliance with the regulations we must either treat the effluents or request formal exemption. Consequently, we are hereby requesting exemption for disposal of liquid effluents at the Trace Elements Corporation mill at Maybell, Colorado, in a manner other than as specifically provided for in Title 10, Part 20 of the Federal Register and in a manner as has been practiced over the past year but which does not result in undue hazard to life or property. This request is in accord with the provisions of Section 20.103(a) and Section 20.302 of Title 10 Part 20 "Standards for Protection Against Radiation." The following data are submitted as evidence to show that it is not likely that any individual will be exposed to concentrations in excess of the limits specified in Appendix B, Table II, Part 20; namely 7×10^{-6} μc of natural uranium per milliliter and 4×10^{-9} μc of radium 226 per milliliter.

<u>Method of Disposal</u>
The Maybell mill uses an acid leach, Resin-In-Pulp uranium recovery process. Ahead of the RIP circuit the coarser sand fraction of the ore is separated and washed in classifiers. After the RIP circuit the RIP tails, including the slime fraction of the solids, are mixed with the washed sands, some dilution water is added and the tailings are pumped to a tailings pond. Lime is added to the tailings to raise the pH from about 1.5 to 2.2. Essentially, all of the solid tails are impounded in the pond. Recently an additional settling pond, approximately 2 acres in size, has been constructed by damming off the lower end of the main tails pond. This provides additional settling

area for any fine solids which may overflow the main pond during periods of high winds and when the main pond freezes over in the winter which may hinder slime settlement. At present the overflow from this second pond is a clear solution.

Two additional ponds, each approximately one acre in size, will be built this summer through which the overflow from the secondary tailings pond will flow. The main purpose of the two new ponds will be to increase the area for the effluent to evaporate and to seep into the ground. However, these ponds will also give additional area for settlement of any solid material.

At present the secondary tailings pond effluent is measured by a V-notch weir near where it leaves the restricted area and flows down what is locally called Johnson Draw. In the future if there is an overflow from the second evaporation-seepage pond it will also flow down Johnson Draw. However, the increased area for evaporation and seepage should result in a flow to the unrestricted area considerably less than at present. The accompanying sketch shows the mill location, Johnson Draw, and other pertinent drainages.

Approximately two miles below the mill Johnson Draw enters Lay Creek, an intermittent stream. During the dry months the mill effluent evaporates and seeps into the ground and does not reach Lay Creek. Lay Creek also flows only during wetter periods and during the spring run-off. It is approximately two and one-half miles between the point that Johnson Draw enters Lay Creek and the point where Lay Creek enters the Yampa River. Mill effluent reaches the Yampa River only when Lay Creek is flowing.

From periodic weir measurements over the past nine months combined with mill solution balances it has been calculated that the effluent leaving the restricted area has averaged 200 gallons per minute, varying from 180 to 220 gpm. A program has recently been initiated whereby the flow is being measured daily at the weir box. A new weir box will be installed below the evaporation-seepage ponds when they are complete.

<u>Effluent Studies and Sampling Program</u>

Starting in July, 1959 a comprehensive sampling and analytical program has been in progress to evaluate radium and uranium contained in the effluent and effects, if any, on the Yampa River. Samples have been taken at least once a week of the tailings pond effluent, Johnson Draw -- when it was flowing -- near the point where it joins Lay Creek, and the Yampa River above and below the point Lay Creek enters the river. Sampling points are shown on the accompanying sketch. Monthly composites of these samples have been assayed for uranium and radium-226.

The results of this sampling program are shown in Tables I and II. The tailings pond overflow has averaged 386×10^{-9} µc Ra-226 per ml over the past nine months. The lower level of radium during the winter and spring months is probably due to dilution from snow melt and run-off. There was no flow at the sampling point in Johnson Draw during July through September. Over the past six months the radium-226 concentration at this point has averaged 101×10^{-9} µc/ml. During this latter time the assays indicate the radium concentration at the foot of Johnson Draw is only 36 percent of that in the pond overflow. This is due to absorption on natural soils, seepage and dilution.

Uranium assays, started in October of 1959 on these samples, averaged over the past six months were 1.9×10^{-6} μc U/ml in the pond effluent and 2.3×10^{-6} μc U/ml in Johnson Draw. Both are well below the Part 20 MPC for unrestricted areas.

Effect of Effluents on Yampa River

Radium assays of the Yampa River above and below the mill have averaged 1.3 and 0.9×10^{-9} μc/ml, respectively, over the past nine months. This difference, which shows a slightly higher concentration above the mill, is not significant when considering analytical accuracy in this range.

The average of the yearly mean flows of the Yampa River at Maybell, Colorado since 1917 is 1,580 second feet (cubic feet per second). The lowest yearly mean flow, which occurred in 1934, was 517 second feet. The average of the mean flow for the low month of each year over the same period is 189 second feet and the lowest monthly flow in 43 years was 20 second feet in July of 1934. River flow data discussed herein and shown in Table III were obtained from "Compilation of Records of Surface Waters of the United States through September 1950, Part 9, Colorado River Basin", Geological Survey Water-Supply Paper 1313, and, for the period since 1950, from Mr. R. E. Whiteman, Supervising Hydrolic Engineer, Water Resources Division, U. S. G. S., Grand Junction, Colorado. If it were assumed, for purposes of calculating dilution factors that all of the pond effluent of 200 gpm reached the Yampa River, the average yearly dilution would be 3,600 to one. Based on the average radium assay of the Johnson Draw sample, 101×10^{-9} μc/ml, the radium concentration in the river would be increased 0.028×10^{-9} μc/ml or 0.007 x MPC (o.7% of MPC). It would be impossible to detect this small increase with present radium analytical techniques. Although Part 20 allows for averaging concentrations over periods up to one year (Section 20.103(a)) even during an average low water month the dilution factor could be expected to be 424 to one which would result in a radium concentration increase of 0.23×10^{-9} μc/ml or 0.059 x MPC (5.9% of MPC). It should be emphasized that during low water months the effluent does not reach Lay Creek or the YampaRiver so the latter case above would be extremely improbable. Other concentration calculations are shown in Table IV.

We conclude from the above assays and calculations that any increases in radium or uranium concentrations in the Yampa River below the mill would not only be well below Part 20 MPC levels but would be below the analytically detectable range.

Occupancy in Unrestricted areas

There are no residences nor is there anyone living in the area of Johnson Draw below the mill nor on Lay Creek between Johnson Draw and the Yampa River.

Cattle and sheep periodically are in the area. Livestock spend a major portion of the time when they are in the area near watering locations which are provided by the owner and which are mostly east and north of the mill. The Trace Elements Corporation mill provides fresh water for livestock at two small ponds east of the mill and at a watering trough north of the mill. Over the past year from regular observances of the cattle when they have been in the area, we have noted the cattle use the fresh water provided but we have never observed them drinking the pond effluent in Johnson Draw. The acidic nature of the effluent coupled with the presence of fresh water in the area appear to minimize any possible hazard which the mill effluent might present to livestock in the unrestricted area below the mill.

Uses of River Water

The small town of Maybell, Colorado obtains domestic water from wells on the opposite side of the Yampa River from the mill. To our knowledge there are no ranches on the Yampa River below Maybell that use the river water for domestic purposes. The river is only used for irrigation purposes.

Below the confluence of the Yampa and Green River the communities of Vernal and Green River, Utah use river water for domestic purposes. There is an additional dilution factor of the Yampa River of approximately 4.3 to one by the Green River. Thus, it is highly improbable that anyone using river water below the Trace Elements Corporation mill would ever drink water, even for short periods of time, that contained radium or uranium concentrations approaching MPC levels and due to effluents from the mill.

Future Procedures to Minimize Exposure of Water Users

The Trace Elements Corporation mill will continue to measure the flowrate and sample the tailings pond effluent at least weekly. The Yampa River will be sampled above and below the mill weekly. Composites of these samples will be assayed for uranium and radium-226. If the thorium-230 specification now included in the proposed revision to Part 20 is included in the regulations, this isotope will be assayed and its effect evaluated. The Union Carbide Nuclear's Grand Junction Laboratory is presently performing development work on thorium-230 analytical techniques and expects to be able to assay mill effluents and river water samples in the near future.

To reduce the quantity of effluent leaving the restricted area and to eliminate or minimize the amount of ore slimes which may be contained in the tailings pond effluent during certain periods of abnormal conditions, the two additional evaporation-seepage ponds mentioned earlier in this letter will be built. It is expected that they will be in use about September 1, 1960.

We will continue to record regularly in a log book the cattle occupancy in the vicinity of Johnson Draw and Lay Creek and any people in the area. This is presently being done daily in the vicinity of the mill and weekly on Lay Creek.

Should process changes or tailings disposal methods change in a way such that radium or uranium concentrations or quantities released to unrestricted areas might be increased fifty times or more over present figures, we will notify the Division of Licensing and Regulation and initiate steps to reduce the release of radium or uranium.

Summary

We believe the data presented herein clearly show that natural uranium and radium-226 which may periodically reach the Yampa River by means of the Trace Elements Corporation's tailings pond effluent do not present any hazard to water users and that it is very unlikely that any individual will be exposed to concentrations in excess of the limits established in Part 20 for unrestricted areas. It is estimated that during an average water year the increase in the radium concentration in the Yampa River would be a maximum of 0.007 times MPC. Uranium concentrations in the effluent are below MPC levels. Two new evaporation-seepage ponds will be built in the near future. Continued survellance of the effluent disposal system is assured.

Accordingly, we will continue to dispose of tailings and effluents at the Trace Elements Corporation mill in essentially the same manner as in the past and as described herein unless you feel an undue hazard exists and that we should do otherwise. We will be glad to discuss any phases of this request with you and hope that an exemption approval will be forthcoming within a reasonable time.

Very truly yours,

Wm. M. Smart

Wm. M. Smart,
Vice President

cc: Dr. D. S. Walker, Director
Division of Licensee Inspection
U.S. Atomic Energy Commission
P.O.Box 2108
Idaho Falls, Idaho

Enclosures

TABLE I

RADIUM ASSAYS OF MAYBELL SAMPLES

Ra-226 as $\mu c \times 10^{-9}/ml$

(Part 20 Specification = 4×10^{-9} $\mu c/ml$)

Month	Tail Pond O'Flow	Johnson Draw at Highway	Yampa River above mill	Yampa River below mill
July, 1959	595	No Flow	1.1	0.9
August	568	No Flow	1.0	1.4
September	636	No Flow	1.4	1.1
October	530	154	0.2	0.2
November	422	107	0.5	0.3
December	80	178	0.5	0.7
January, 1960	335	47	0.8	0.2
February	194	95	2.0	0.8
March	111	24	4.6	2.4
Avg.	386	101	1.3	0.9

TABLE II

URANIUM ASSAYS OF MAYBELL SAMPLES

U as $\mu c \times 10^{-6}$ $\mu c/ml$

(Part 20 Specification = 7×10^{-6} $\mu c/ml$)

Month	Tail Pond O'Flow	Johnson Draw at Highway	Yampa River above mill	Yampa River below mill
October, 1959	3.5	5.3	<0.001	<0.001
November	1.2	1.4	0.0045	0.0051
December	1.2	1.2	<0.001	<0.001
January, 1960	2.4	2.4	<0.001	<0.001
February	1.6	2.1	0.009[illegible]	0.025
March	1.3	1.2	0.028	0.012
Avg.	1.9	2.3	0.0075	0.0075

TABLE III

YAMPA RIVER FLOW DATA AND MINIMUM DILUTION FACTORS

(1917-1959)

Yampa River Flow Data at Maybell

Mean yearly flow:	Avg. of 43 years:	1580 sec. ft.
	Highest (1917)	2948 sec. ft.
	Lowest (1934)	517 sec. ft.
Low month mean flow:	Avg. of 43 years:	189 sec. ft.
	Highest (Jan. 1917)	385 sec. ft.
	Lowest (July 1934)	20 sec. ft.

Dilution Factors

Yearly Avg.	1580 sec. ft. x 60 x 7.48 =	710,000 GPM
Lowest Year	517 sec. ft. x 60 x 7.48 =	232,000 GPM
Avg. Low Month	189 sec. ft. x 60 x 7.48 =	84,800 GPM
Lowest Month	20 sec. ft. x 60 x 7.48 =	9,000 GPM

Assume pond o'flow of 200 GPM reaches river

Yearly avg.	710,000/200 =	3,600 : 1 Dilution	
Lowest Year	232,000/200 =	1,160 : 1 Dilution	
Avg. Low Month	84,800/200	424 : 1 Dilution	
Lowest Month	9,000/200	45 : 1 Dilution	(Not realistic as effluent never reaches river during dry months.)

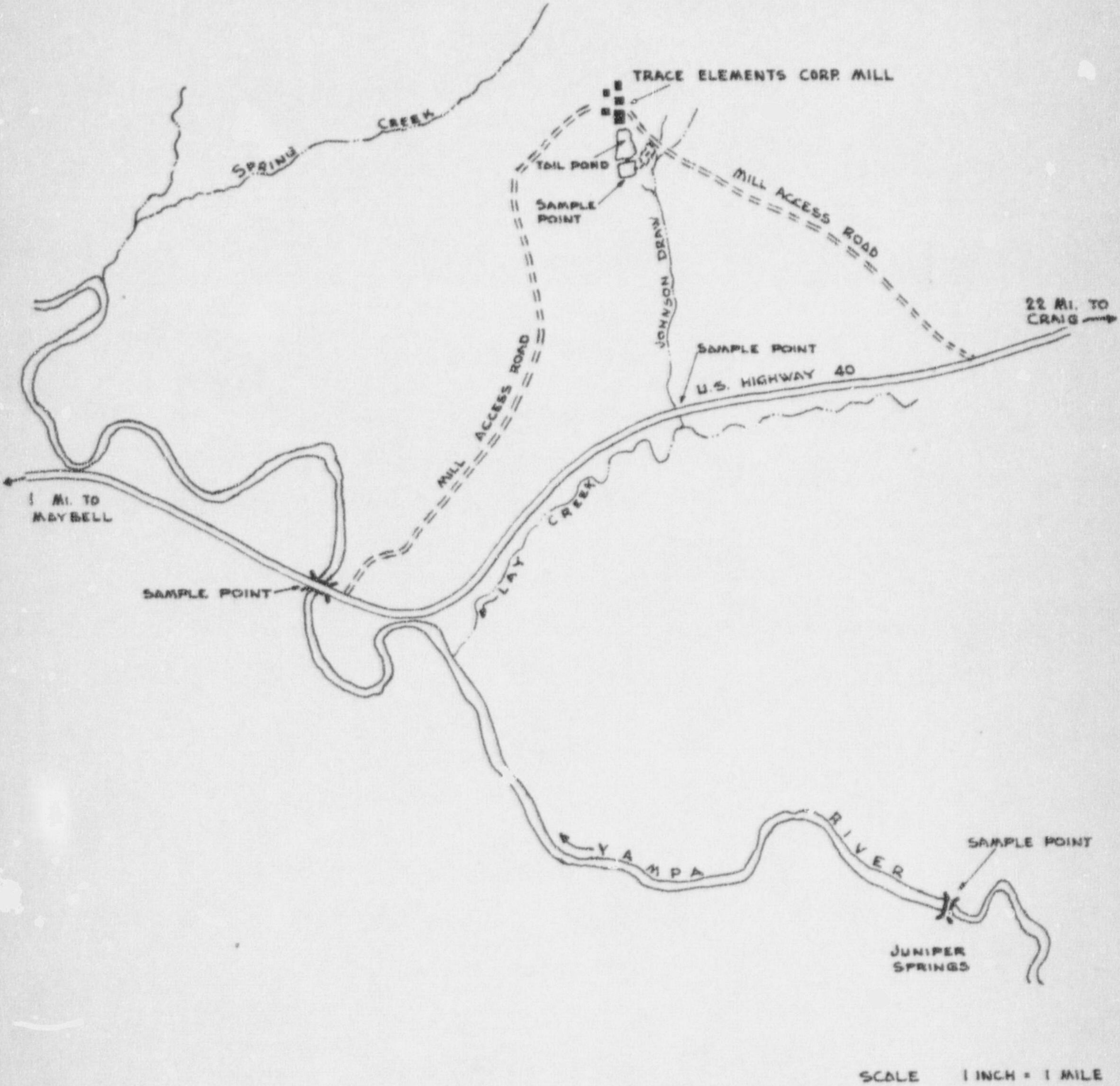
TABLE IV

POSSIBLE EFFECT OF EFFLUENTS ON RIVER

(Using assay of Johnson Draw Sample)

		Increase in Ra-226 Concentrations	
Yearly Avg.	101×10^{-9} μc/ml / 3,600	= 2.8×10^{-11} μc/ml	
		= 0.007 x MPC	
Lowest Year	101×10^{-9} μc/ml / 1,160	= 8.7×10^{-11} μc/ml	
		= 0.022 x MPC	
Avg. Low Month	101×10^{-9} μc/ml / 430	= 2.3×10^{-10} μc/ml)	See Note.
		= 0.059 x MPC)	
Lowest Month	101×10^{-9} μc/ml / 45	= 2.2×10^{-9} μc/ml)	
		= 0.56 x MPC)	

Note: Highly improbable as no effluent reaches river in dry months.



TRACE ELEMENTS CORP. MILL SITE

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Mr. H. L. Price, Director
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