PDR M-23

LAW OFFICES
EDWARD J. McGRATH
14TH FLOOR
51 MONROE STREET
ROCKVILLE, MARYLAND 20850
(301) 340-0600

October 16, 1979

RECEIVED
NOV 02 1979
U.S. Nuclear Regulatory Commission
Mail Section

Mr. Jack Rothfleisch
Uranium Licensing Division-NRC
7915 Eastern Avenue
Silver Spring, Maryland 20910

Re: Colorado Radioactive Materials License
Schwartzwalder Ore Sorter

Dear Mr. Rothfleisch:

Pursuant to our conversation, I enclose for your information copies of the following:

1. Letter dated March 6, 1979, from Dr. Traylor, Executive Director, Colorado Department of Health, to Douglas Costle, EPA, requesting EPA review of uranium concentration in the waters supplying the North Table Mountain Water and Sanitation District.

2. A copy of a letter dated April 26, 1979, from Dr. Traylor to William Miller, Manager of the Denver Water Board, requesting that the North Table Mountain District be maintained on Ralston Reservoir water, rather than switched to the Long Lake Reservoir.

3. Copies of two letters to Dr. Traylor from William L. Lappenbusch of the EPA Office of Drinking Water making recommendations concerning the North Table Mountain District water supply.

4. Copy of a letter issued by the Colorado Department of Health to various Colorado water supply systems prompted by Dr. Lappenbusch's letters.

As I advised, Cotter Corporation is currently preparing an amendment to the Radioactive Materials License Application for the Schwartzwalder Ore Sorter, which will be filed as soon as completed.

The ore sorter is not involved in the issues discussed in the enclosures due to the fact that the process modifications which were completed earlier this year have eliminated any discharge to the Schwartzwalder Mine Water Treatment System.

Sincerely yours,

Edward J. McGrath

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EJM/ss

Enclosures: 5

FEE EXEMPT

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COLORADO DEPARTMENT OF HEALTH

4210 EAST 11TH AVENUE DENVER, COLORADO 80220 PHONE 320-8333

March 6, 1979

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EDWARD J. McGRATH

Douglas Costle, Administrator
U.S. Environmental Protection Agency
401 M Street SW
Washington, D.C. 20460

Dear Mr. Costle:

Recently a question has arisen in Colorado regarding the radiological implications of contamination of the North Table Mountain Water and Sanitation District's raw water supply. This contamination has resulted because of the liquid effluent discharge of the Schwartzwalder Mine, operated by the Cotter Corporation, into the watershed of the District's raw water supply (Ralston Creek, Upper Long Lake and Lower Long Lake).

Considerable data has been generated for over twenty years on the concentrations of radioactive material in the City of Golden's and the North Table Mountain Water and Sanitation District's potable water. These supplies have had as their raw water source Ralston Creek and Upper and Lower Long Lakes. The City of Golden has long since gone to other sources while the District has contracted for this raw source, from the Denver Water Board, since the District's formation.

Early efforts on the control of radiological contamination principly centered on radium-226. With the implementation of the NPDES permit mechanism and the establishment of state stream standards, control methods also address other parameters. According to the terms of the permit, the stream standard and the State Water Quality Control Act, the mine operator (Cotter Corporation) is meeting the regulatory requirements as determined by the State and reviewed by EPA. However, uranium decay series components, at various stages of equilibrium, are found in this potable water supply distribution system at levels that are uncommon to other surface water sources going to potable distribution systems in the state.

The majority of the alpha activity has been identified as being due to the radioactive decay emissions from uranium-238 and uranium-234. Secular equilibrium has not been identified in the potable water for the decay series beyond uranium-234, in fact, gross disequilibrium is actually in evidence.

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SUMMARY OF THE RADIOLOGICAL SURVEILLANCE
OF NORTH TABLE MOUNTAIN WATER

CDH RESULTS DATE OF SAMPLE	pCi/l ALPHA ACTIVITY	pCi/l BETA ACTIVITY	mg/l U-NATURAL	pCi/l RADIUM-226	pCi/l ^{3}H
2/14/75	71.0 c 12.6	24.6 c 11.9	0.07 u 0.002	-	1047 c 467
3/25/75	133.9 c 21.2	23.0 c 12.2	0.263 u 0.004	-	814 c 446
7/14/75	49.9 c 10.4	22.5 c 10.4	N.R.	-	MDA
12/31/75	70.1 c 13.1	44.6 c 13.6	0.200 u 0.004	-	MDA
AVERAGE	81.2	28.7	0.18	-	454
3/19/76	203.6 c 21.6	58.6 c 15.1	N.R.	-	688 c 458
7/09/76	72.7 c 13.6	MDA	0.092 u 0.001	-	614 c 453
8/13/76	145 c 19	49 c 14	-	-	-
9/22/76	98.3 c 14.2	37.3 c 13.1	N.R.	-	MDA
11/10/76	233.3 c 26.2	58.2 c 15.3	N.R.	-	MDA
AVERAGE	150.6	42.2	0.092	-	575
1/19/77	125.3 c 20.9	56.9 c 15.0	N.R.	-	MDA
4/27/77	418.5 c 35.7	MDA	N.R.	-	MDA
7/29/77	132.2 c 19.2	25.4 c 11.6	N.R.	-	MDA
10/11/77	286 c 29	90 c 17	-	0.4 c 0.2	-
12/14/77	349.3 c 32.2	18.6 c 11.7	N.R.	-	MDA
AVERAGE	262.3	39.8	N.R.	0.4	MDA
3/21/78	310.3 c 29.1	31.2 c 12.7	0.033 u 0.004	-	419 c 381
5/30/78	154.9 c 20.5	37.6 c 12.8	N.R.	-	N.R.
8/21/78	327.7 c 30.8	31.7 c 12.8	0.39 u 0.04	-	984 c 321
9/12/78	MDA	MDA	-	-	-
9/14/78	MDA	MDA	-	-	-
9/14/78*	421 c 36	27 c 13	0.43 u 0.03	0.74 c 0.14	acidified
	453 c 37	21 c 12	0.47 u 0.02	0.60 c 0.12	
9/14/78*	453 c 37	26 c 13	0.46 u 0.04	0.64 c 0.13	as collected
	413 c 35	15 c 12	0.39 u 0.04	0.62 c 0.12	
9/14/78*	412 c 35	20 c 12	0.43 u 0.07	0.67 c 0.13	filtered,
	430 c 36	28 c 13	0.44 u 0.04	0.62 c 0.12	acidified
AVERAGE	240.4	23.5	0.33	0.67	702

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EPA RESULTS DATE OF SAMPLE	pCi/l ALPHA ACTIVITY	pCi/l BETA ACTIVITY	mg/l U-NATURAL	RADIUM-226	pCi/l THORIUM
8/3/78	120	160		(sus) 0.09 ± 0.01 (dis) 0.55 ± 0.04	(α dis) 0.4 ± 0.1
9/21/78		130 ± 10 150 ± 10	<9.0 <9.5		(Th^{234}) 2100 ± 300 2500 ± 700

- = not required/not requested
c = Error terms are based on the standard deviation in the case of a single sample, on the 2 sigma counting error (c).
u = Uranium error terms are based on 1 division on the fluorimeter scale (u).
MDA = ^{3}H = 500 pCi/l, alpha and beta = 8.0 pCi/l
N.R. = No Results
* = Only the acidified sample is included in the average. This was a study to determine the effect on the results of acidifying and filtering the samples. The other samples in this report were acidified when collected.

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CCEP 1

Ostle Schwartzkopf

Colorado
Department of
Health

4210 East 11th Avenue
Denver, Colorado 80220
Phone (303) 320-8333

Frank A. Traylor, Jr., M.D.
Executive Director

April 26, 1979

Mr. William H. Miller, Manager
Denver Water Board
1600 W. 12th
Denver, CO 80254

Dear Mr. Miller:

As you know, the North Table Mountain Water District ordinarily gets a good share of its water from Ralston Creek and the water has been found to contain significant quantities of uranium and other radionuclides.

I have asked the assistance of the EPA in determining a reasonable course of action in the matter. A copy of the related correspondence is enclosed for your information. The problem of radioactivity has been studied and additional information will be forthcoming.

While the study of the problem continues, and although we have not established that a health problem does exist or that a violation of the statute does exist, the people of the area have become extremely skeptical of the safety of the water.

I understand that the type of water North Table Mountain obtains is controlled by your department and that in recent weeks the water for this District has been obtained from Ralston Reservoir, which is a vastly superior source of water.

In the past, staff members from your office have indicated your willingness to provide North Table Mountain District with water from Ralston Reservoir if requested to do so by this Department.

Accordingly I am requesting that you make every effort to continue the delivery of the Ralston Reservoir water to North Table Mountain Water District until such time as we are able to dispel the reasonable fears of the people involved.

Sincerely,

Frank

Frank A. Traylor, Executive Director
COLORADO DEPARTMENT OF HEALTH

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

RECEIVED
JUL 9 1979
EXECUTIVE DIRECTOR
COLORADO DEPARTMENT OF HEALTH

Dr. Frank A. Traylor, Executive Director
Colorado Department of Health
4210 East 11th Avenue
Denver, Colorado 80220

Dear Dr. Traylor:

The Office of Drinking Water has reviewed the situation of radioactivity in the North Table Mountain Water Supply per your request. From the data provided us, it is recommended that prompt control measures be established, implemented, or maintained if action has already been taken, to reduce the concentration of radioactivity in water used for human consumption.

From the data provided us for the years 1975-1978, it is apparent that the water contains on the average 240 pCi/l U-natural; 0.67 pCi/l Ra-226; and 702 pCi/l H-3. As a result the dose rate to the critical organ (bone) should be exceeding 3000 mrem/yr. and is primarily the result of the presence of uranium.

The toxicity of uranium is that of chemical toxicity to the kidney and radiotoxicity to the bone. The National Academy of Sciences has advised us of one-day and seven-day suggested limits for uranium of 3.5 mg/l (2300 pCi/l) and 0.2 mg/l (140 pCi/l), respectively, based only on chemical toxicity. The Safe Drinking Water Committee did not recommend any chronic level for uranium.

It is our judgment at this time, however, that radiotoxicity should prevail over chemical toxicity. The estimation of the radiotoxicity of uranium is best determined by comparing U-238, U-234, and U-235 with Ra-226 since both uranium and radium are bone seekers and release energy to the same tissue. It is the consensus of EPA's program that 20 pCi U/day or 10 pCi U/l would result in a dose rate to the bone in the 70th year of about 15 mrad/year. Assuming a quality factor of 10 for high LET alpha, that concentration probably results in a 150 mrem/year bone dose rate. From information in the NAS-BEIR Report, this dose rate would be expected to cause 0.7-3 excess bone cancers/year/million people consuming two liters of water/day over their lifetimes.

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EDWARD J. McGRATH

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Since our present standard essentially limits the bone dose rate from Ra-226 and Ra-228 to 150 mrem/year; we would suggest that uranium, which also affects the same organ system, should not exceed a bone dose rate of 150 mrem/year or 10 pCi/l of uranium alone. The Office of Drinking Water, however, has established an exemption guide (interim exposure) of approximately 10 pCi/l for Ra-226 and Ra-228, depending upon the presence of other alpha emitters affecting the bone. Even though EPA does not have a standard and has not yet specified an exemption guide for uranium, it would seem prudent to assume that a 300 mrem/year bone dose rate should be considered as an upper limit for any exemption guide for interim exposure to uranium, assuming radium and other alpha emitters do not contribute significantly to the bone dose rate. The exemption guide for uranium would be 20 pCi U/l to be equivalent with the guide for radium, and this should be applied in the same manner suggested for radium.

Sincerely,

William L. Lappenbusch, Ph.D., Acting Chief
Health Effects Branch
Criteria and Standards Division
Office of Drinking Water (WH-550)

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

AUG

Mr. Frank Rozich, Director
Water Quality Control Division
Colorado Department of Health
4210 East 11th Avenue
Denver, Colorado 80220

Dear Mr. Rozich:

In regards to the letter that I sent to you recently, please be aware of a correction to be made on page 4. On line 11, please note that it should read "as dictated for levels that fall within range III (300-3000 mrem/year)" instead of "... range II (300-3000 mrem/year)".

Enclosed is a current letter.

Sincerely yours,

William L. Lappenbusch, Ph.D.
Acting Branch Chief
Health Effects Branch
Criteria and Standards Division
Office of Drinking Water (WH-550)

Enclosure

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

AUG 1 - 1979

Mr. Frank Rozich, Director
Water Quality Control Division
Colorado Department of Health
4210 East 11th Avenue
Denver, Colorado 80220

POOR ORIGINAL

Dear Mr. Rozich:

Thank you for your letter of July 11, 1979, concerned with radioactivity in drinking water, and the rationale used by the Office of Drinking Water in developing our suggested guidance to the State of Colorado on uranium in drinking water.

In response to a letter to Mr. Costle from Dr. Frank A. Traylor, Executive Director, Colorado Department of Health, the Health Effects Branch, Office of Drinking Water, EPA, reviewed the situation of radioactivity in the North Table Mountain Water Supply. Our recommendation was to establish and implement prompt control measures, or maintain such action if control measures had already been taken, and to reduce the concentration of radioactivity in water consumed by humans. Guidance levels of 10 and 20 pCi U/l were specified, depending upon the presence of other radionuclides and other variables normally considered in variance and exemption requests. Information regarding risk estimation was also provided.

It should be clear that the suggested action, risk estimation and suggested uranium concentrations apply only to drinking water and are not intended for other water quality considerations. Furthermore, the suggested uranium concentrations of 10 and 20 pCi/l are numerical levels based on our initial reviews of projected health risks. A standard for uranium in drinking water would address not only the potential health effects but also an indepth assessment of occurrence, treatment costs, and availability of monitoring technology. We hope to be able to develop such a standard within the next year.

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For our review the Health Effects Branch reviewed the 1975-1978 data that Dr. Traylor sent to us for the North Table Mountain Water Supply. This data demonstrated that the gross alpha activity, natural uranium, Ra-226, and tritium, was 240 pCi/l, 0.33 mg/l, 0.67 and 702 pCi/l, respectively. Assuming that U-238 and U-234 were in an equilibrium mixture where the specific activity was 6.77 x 10^{-7} Ci/gram, hence 10 pCi/l of this mixture would have equalled 1.5 x 10^{-2} mg/l. Hexavalent, i.e., soluble uranium, was assumed. Consequently, 0.33 mg U natural/l was assumed to be equivalent to 220 pCi/l.

The toxicity of uranium is primarily that of chemical toxicity to the kidney and radiotoxicity to the bone. It would be prudent to assume that radiotoxicity to the bone resulting in bone cancer prevails over the chemical toxicity to the kidney. In terms of suggested concentrations, however, acceptable levels to avoid kidney disease and tolerable levels to reduce the risk of bone cancer are almost equivalent. The Safe Drinking Water Committee (SDWC), NAS, has reviewed the existing uranium data for chemical toxicity and have advised us of one-day and seven-day suggested limits of 3.5 mg/l (2300 pCi/l) and 0.2 mg/l (140 pCi/l), respectively. The SDWC, NAS did not deal with the question of risk from radiotoxicity of uranium. Assuming a safety factor of only 10, however, for a lifetime exposure as opposed to ingesting uranium via drinking water for only a week, a concentration of 15 pCi/l would provide only a small margin of safety. This assumes, however, that other routes of intake do not contribute significantly to the uranium body burden.

The potential radiotoxicity expected from consuming water from the North Table Mountain Water Supply would be that of bone cancer primarily from uranium, however, other radionuclides would be expected to contribute to the expected bone dose. Consuming two liters/day over a lifetime of Ra-226 (0.67 pCi/l), $U_{nat.}$ (220 pCi/l) and other alphas (19 pCi/l) would result in a bone dose of approximately 20, 3300 and 57 mrem/year, respectively, or a total of approximately 3350 mrem/year. This assumes that 5 pCi/l Ra-226 results in a bone dose of 150 mrem/year. It also assumes that for every 10 pCi/l of alpha activity other than that from $U_{natural}$ and Ra-226, a 30 mrem/year bone dose rate is expected.

The estimation that 220 pCi/l would result in approximately 3300 mrem/year assumes that a lifetime ingestion of 20 pCi U/day or 10 pCi/l woul probably result in a dose rate to

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the bone in the 70th year of approximately 15 mrad/year or 150 mrem/year if the alpha quality factor is 10. Four analyses for the case of a lifetime ingestion at 20 pCi/day or 10 pCi/l were made using the dose models of ICRP-NRPB, Adams and Spoor, N. Nelson and UNSCEAR. The dose rate to the bone in the 70th year for each model was assumed to be 3, 11, 24 and 17 mrad/year, respectively. The metabolic parameters in the ICRP-NRPB model appear to agree with the values selected by Adams and Spoor except that these investigators estimate that 20% of ingested uranium enters the blood stream rather than only 5% as suggested by the ICRP. Dr. N. Nelson of ORP, EPA has suggested a more conservative dose estimate. The UNSCEAR (1976) estimate is not based on a metabolic model but rather on daily intake and body burden. The range of these estimated doses is a factor of eight, therefore, the estimate of 150 mrem/year via lifetime ingestion of 10 pCi/l (2 liters/day) could be off in either direction by a factor of five.

Our suggested guidance of 10 pCi U/l is based on the assumption that either 5 pCi Ra-226/l or 10 pCi U/l (2 liters/day) would result in a bone dose rate of 150 mrem/year and that the isotopes of uranium and Ra-226 are bone seekers and release energy to the same tissue. The incremental risk estimate associated with consuming water over a lifetime from the North Table Mountain Water District can be projected if an assumption is made that ingestion of 10 pCi/day or 5 pCi/l of Ra-226 or 20 pCi/day or 10 pCi/l of uranium would result in 0.7-3 excess bone cancers/year/million people exposed over their lifetimes. Higher concentrations of either constituent would result in proportionately higher projected excess bone cancers. As a result, 20 pCi/l of uranium would result in an expected excess bone cancer rate of 1.4-6/year/million people exposed over their lifetime. This assumes then that the relationship between radiation dose and excess bone cancers is linear. Almost all of the projected excess bone cancers/year/million exposed people would be fatal since the fatality rate is near 90%.

The exemption or transient rate guidance of 20 pCi U/l is based on the intent of the Federal Radiation Council (FRC) guidance. The FRC provided guidance for Ra-226 whereby the upper limit of Range II is 20 pCi/day or 10 pCi/l or 300 mrem/year bone dose rate. The intent of FRC guidance for U-238, U-234 and U-235 when compared to Ra-226 therefore would be 300 mrem/year or 40 pCi U/day or 20 pCi U/l (equivalent then to the upper limit of range II).

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Our suggested guidance to take prompt control measures is based on calculations which would indicate that for individuals drinking water from the North Table Mountain Water Supply over their lifetime, the dose rate to the critical organ (bone) would be exceeding 3000 mrem/year. Since this dose rate exceeds the intent of range III of the ESC guidance and since several samples have verified the concentration of this radioactivity in the water supply at the levels specified herein, it would not be prudent to suggest allowing up to a full year to take control measures as dictated for levels that fall within range III(300-3000 mrem/year) but rather to suggest action as quickly as possible.

Sincerely yours,

W L Lappenbusch

William L. Lappenbusch, Ph.D.
Acting Chief, Health Effects Branch
Criteria and Standards Division
Office of Drinking Water (WH-550)

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Colorado
Department of
Health

4210 East 11th Avenue
Denver, Colorado 80220
Phone (303) 320-8333

Frank A. Traylor, Jr., M.D.
Executive Director

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OCT 17 1979

EDWARD J. McGRATH

As you may know, since you operate a community water system in this State, you are subject to certain regulations pertaining to monitoring for and compliance with certain maximum contaminant levels. The purpose of this letter is to discuss the problem with respect to radionuclides.

Under the provisions of our regulations, which are consistent with the National Interim Primary Drinking Water Regulations, you are required to conform to a maximum contaminant level of 15 picocuries per liter for gross alpha and 5 picocuries per liter for radium. The gross alpha contained in our regulations is specifically defined to exclude any such count attributable to radon or to uranium.

Unfortunately, past results from this department create some doubt as to whether you are able to meet the gross alpha limit, although our belief is that the gross alpha levels in your water are due largely to uranium. If this is the case, you would be able to meet the requirements of our Primary Drinking Water Regulations. The reason that this matter is in doubt in your case is that up until recently, the results reported out of this office as gross alpha were not adjusted to exclude that attributable to uranium and to radon.

We now have that capability. Furthermore, our rules require, with certain exceptions not applicable here, that the determination of compliance with the radiation maximum contaminant levels shall be based upon a composite of 4 quarterly sample portions.

In order to collect this composite sample, you will need to collect an equal sample of water during 4 consecutive calendar quarters beginning with this quarter and to have the composited sample tested for gross alpha, as defined in the regulations, and to have radium determined, if the gross alpha is above a certain level.

I am happy to inform you that we will be able to test for you (at no cost to you) your composite sample as called for. In protecting

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this composite sample, you should make certain that the sample is not subject to evaporation during the period of storage and that the bottle is acidified with 40 ml of 1:1 Nitric acid per gallon. A suggested method is to use a gallon bottle and add exactly 1 quart per quarter.

While EPA's official position, and prior direct conversations that we have had with them, indicated that uranium was of no major concern in relation to its radioactive effect, we recently had occasion to inquire of EPA as to their recommendations concerning a specific problem in which the water in question involves drainage from a uranium mine.

Dr. Lappenbusch of EPA responded in an advisory manner concerning that problem. His advice was that the uranium level in drinking water should not exceed 10 picocuries per liter. His response is not specific as to whether this advice was given because of the probable tie-in between the uranium mine drainage and the water supply in question. However, we have later been informed that the recommendation is valid for all systems in Colorado having elevated levels of uranium. A copy of Dr. Lappenbusch's recommendation is enclosed for your information. It is conceivable that Dr. Lappenbusch's recommendation may presage a future change in the Primary Drinking Water Regulations.

The third purpose of this letter is to offer to run at no cost to your city a special purpose sample for determination of uranium content, if you so desire. This sample must be collected in a specially prepared bottle which we will provide on request. You are cautioned, however, that this special purpose sample will not change the necessity for you to have an official, prepared sample composited and run within the next year as described above. You are also informed that we are trying to find out from EPA what method of removal of the uranium may be feasible. It goes without saying that, although you are not responsible under the present regulations of this Department to remove the uranium if present, your City is encouraged, if you have it, to remove as much as you see fit.

Considering past results on tests for radionuclides in your water, you may be between a rock and a hard spot. If the gross alpha turns out to be uranium, you have a problem with respect to Dr. Lappenbusch's recommendation. If the alpha count is not uranium, you may have a problem meeting the maximum contaminant levels for gross alpha.

Sincerely,

WATER QUALITY CONTROL DIVISION

90009361

George A. Prince, P. E.
Chief
Drinking Water Section

GAP:bjd

Enclosure