

File
S. Sabata

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EVALUATION OF THE IMPACT
OF THE
MINES DEVELOPMENT, INC. MILL
ON
WATER QUALITY CONDITIONS IN THE CHEYENNE RIVER

ENVIRONMENTAL PROTECTION AGENCY
Region VIII
Denver, Colorado

September 1971

ADDENDUM I

TO

"EVALUATION OF THE IMPACT OF THE
MINES DEVELOPMENT, INC. MILL
ON
WATER QUALITY CONDITIONS IN THE CHEYENNE RIVER"

DISSOLVED MERCURY IN CHEYENNE RIVER,
COTTONWOOD CREEK, AND SEEPAGE SAMPLES-
1971

<u>Station</u>	<u>Dissolved Hg (ug/l)</u>
1. Cheyenne River just upstream from the State Highway 18 bridge outside of Edgemont.	2.1
2. Cottonwood Creek upstream from mill property at the county road bridge; off State Highway 52.	3.5
3. Cottonwood Creek at the road culvert; downstream from sand tailings Pile No. 2.	4.2
4. Cottonwood Creek at confluence with the Cheyenne River.	1.8
5. Cheyenne River about 1.5 miles downstream from the mill.	0.6
6. Cheyenne River about 6 miles downstream from the mill; at Gull Hill Park.	3.0
7. Cheyenne River at ford on County Road II.	3.2
8. Cheyenne River at State Highway 71 bridge.	0.8
9. Cheyenne River in the headwaters of Angostura Reservoir.	1.8
Seepage into Cottonwood Creek just upstream from the pipeline suspension bridge.	1.0
Seepage into Cottonwood Creek several hundred yards upstream from the pipeline suspension bridge.	2.3

Station

Dissolved Hg
(ug/l)

Seepage into the Cheyenne River just upstream from Pond No. 1. 2.2

NOTE: Analyses performed on field-filtered samples by the Division of Field Investigations - Cincinnati, Environmental Protection Agency. With the exception of the seepage samples, the dissolved mercury values refer to 5-day composite samples.

ADDENDUM II

TO

"EVALUATION OF THE IMPACT OF THE
MINES DEVELOPMENT, INC. MILL
ON
WATER QUALITY CONDITIONS IN THE CHEYENNE RIVER"

1. Page 1: In the fourth line, change the superscript 1/ to a/. Similarly, change the footnote designation from 1/ to a/.
2. Page 6: Insert the superscript 1 after the last word on this page.
3. Page 7, Item 2: "Increases" should be changed to "Increased".
4. Page 10, Table I: Insert superscripts 2,3,4, & 5 after U. S. Public Health Service, Federal Radiation Council, International Commission on Radiological Protection (ICRP), and the National Committee on Radiation Protection (NCRP), respectively.
5. Page 11: The following paragraph is to be added after the second paragraph:

Despite the fact that the increased radioactivity concentrations in Cottonwood Creek and the Cheyenne River do not pose a public health hazard, steps should be taken to eliminate or substantially reduce the radioactivity of the seepage entering Cottonwood Creek and the Cheyenne River. This is consistent with a policy of minimizing the release of radioactive materials to man's environment insofar as is practicable. That is, the waste management program should be the best available provided the specific practices are technologically feasible and economically reasonable. Moreover, elimination of the aesthetically displeasing discoloration of bank and channel areas requires curtailment of the seepage from the retention ponds (or substantial reduction thereof).

In the fourth line of the third paragraph, insert the superscript a/ after "... high-radioactivity solids..". This change is accompanied by the following footnote at the bottom of the page:

a/ A Sample of drained sands from Pile No. 2 collected during the 1966 study contained 230 pCi of radium-226 per gram dry weight.

6. Page 26: In the second sentence, insert the superscript 6 after "report".
7. A section listing references, Section VII, should be added as the last page of the report and noted in the Table of Contents.

VII. REFERENCES

1. Tsivoglou, E. C., Kalda, D. C., and Dearwater, J. R., "The Resin-In-Pulp Uranium Extraction Process. Mines Development Company, Edgemont, South Dakota", Technical Report W62-17, U. S. Public Health Service, R. A. Taft Sanitary Engineering Center, Cincinnati, Ohio (1962)
2. U. S. Public Health Service, "Drinking Water Standards-1962", Publication No. 956.
3. Federal Radiation Council, "Background Material for the Development of Radiation Protection Standards", Staff Report No. 2 (September, 1961).
4. International Commission on Radiological Protection, "Recommendations of the International Commission on Radiological Protection, as Amended 1959 and Revised 1962", ICRP Publication No. 6, Pergamon Press, New York, New York (1964).
5. National Committee on Radiation Protection, "Maximum Permissible Body Burdens and Maximum Permissible Concentrations of Radionuclides in Air and Water for Occupational Exposure", Handbook 69 (including Addendum I), U. S. Department of Commerce, National Bureau of Standards (August 1963).
6. Federal Water Pollution Control Administration, "Evaluation of the Radioactivity Levels in the Vicinity of the Mines Development, Inc. Uranium Mill at Edgemont, South Dakota, 1966", Technical Advisory and Investigations Branch, Physical and Engineering Sciences Section, Cincinnati, Ohio (May 1967).

TABLE XIII

EDGEMONT MONITORING PROGRAM

CHEYENNE RIVER AT STATE HIGHWAY 18 BRIDGE
UPSTREAM OF MINES DEVELOPMENT, INC., URANIUM MILL

Collection Date	Flow (cfs)	Suspended Portion		Dissolved Portion									
		Radium-226 (pCi/g)	Uranium (ug/g)	Gross Alpha (pCi/l)	Gross Beta (pCi/l)	Radium-226 (pCi/l)	Uranium (ug/l)	Arsenic (ug/l)	Iron (ug/l)	Lead (ug/l)	Manganese (ug/l)	Vanadium (ug/l)	Zinc (ug/l)
5/11/72	22	---	---	---	---	---	---	<10	---	---	---	---	---
5/16/72	36	---	---	---	---	---	---	<10	100	100	30	1	58
5/24/72	125	2.3	1.0	<1	8	0.3	20	<10	60	98	60	8	22
5/31/72	8.7	3.4	---	<1	8	<0.1	16	---	40	105	60	5	21
6/6/72	27	2.2	---	<1	6	<0.1	17	<10	40	112	80	2	20
6/13/72	18	1.6	0.4	<1	<1	0.1	14	---	3300	85	120	---	82
6/20/72	171	1.5	0.7	<1	17	0.2	10	---	3700	60	70	20	54
6/29/72	267	---	2.0	<1	<1.5	0.1	4	<10	470	60	320	23	50
7/7/72	33	3.5	---	25	<20	0.2	12	---	1900	87	260	100	105
7/15/72	4.7	---	---	<3	<20	0.3	16	---	310	67	170	2	49
7/24/72	3.6	---	---	<2	54	1.8	15	---	90	70	100	7	54
7/31/72	5.9	---	---	<2	<20	0.3	20	---	60	80	40	5	21

TABLE XIII

EDGEMONT MONITORING PROGRAM

CHEYENNE RIVER AT STATE HIGHWAY 18 BRIDGE
UPSTREAM OF MINES DEVELOPMENT, INC., URANIUM MILL

Collection Date	Flow (cfs)	Suspended Portion		Dissolved Portion									
		Radium-226 (pCi/g)	Uranium (ug/g)	Gross Alpha (pCi/l)	Gross Beta (pCi/l)	Radium-226 (pCi/l)	Uranium (ug/l)	Arsenic (ug/l)	Iron (ug/l)	Lead (ug/l)	Manganese (ug/l)	Vanadium (ug/l)	Zinc (ug/l)
8/7/72	64	2.2	1.8	<2	<20	0.2	5	---	---	---	---	---	---
8/14/72	2.9	22	---	<2	<20	0.4	16	----	420	60	60	7	56
9/2/72	8.1	---	---	8	<20	0.2	12	---	150	60	60	7	40
9/9/72	16	1.4	1.2	3	<20	<0.1	9	---	---	---	---	---	---
9/14/72	4.0	1.5	---	<2	25	0.7	19	---	150	60	80	4	54
9/23/72	4.0	2.3	---	<2	<20	0.3	19	---	70	70	60	4	30
5-Month Average	---	---	---	---	---	0.3	14	---	740	78	105	14	48

TABLE XIV

EDGEMONT MONITORING PROGRAM

COTTONWOOD CREEK UPSTREAM OF MINES DEVELOPMENT, INC., URANIUM MILL
AT COUNTY ROAD BRIDGE; JUST EAST OF STATE HIGHWAY 52

Collection Date	Suspended Portion		Dissolved Portion									
	Radium-226 (pCi/g)	Uranium (ug/g)	Gross Alpha (pCi/l)	Gross Beta (pCi/l)	Radium-226 (pCi/l)	Uranium (ug/l)	Arsenic (ug/l)	Iron (ug/l)	Lead (ug/l)	Manganese (ug/l)	Vanadium (ug/l)	Zinc (ug/l)
5/11/72	---	---	---	---	---	---	<10	---	---	---	---	---
5/16/72	---	---	---	---	---	---	<10	60	54	110	2	30
5/24/72	11	---	<1	15	0.2	16	<10	270	112	30	2	30
5/31/72	---	---	<1	7	0.2	23	---	60	152	60	2	30
6/6/72	---	---	<1	<3	0.1	34	<10	60	124	80	1	22
6/13/72	---	---	<1	7	0.4	21	---	60	130	40	---	64
6/20/72	---	---	<1	11	0.1	16	---	80	40	60	2	50
6/29/72	---	---	<1	10	0.1	27	<10	180	105	80	8	50
7/7/72	1.4	---	<1	<20	0.1	19	---	110	107	120	3	60
7/15/72	---	---	<2	<20	<0.1	25	---	340	87	420	3	65
7/24/72	---	---	<2	<20	0.7	32	---	160	80	80	5	112
7/31/72	---	---	<2	<20	0.1	57	---	260	100	160	8	59

TABLE XIV

EDGEMOHT MONITORING PROGRAM

COTTONWOOD CREEK UPSTREAM OF MINES DEVELOPMENT, INC., URANIUM MILL
AT COUNTY ROAD BRIDGE, JUST EAST OF STATE HIGHWAY 52

Collection Date	Suspended Portion		Dissolved Portion									
	Radium-226 (pCi/g)	Po-210 (pCi/g)	Gross Alpha (pCi/l)	Gross Beta (pCi/l)	Radium-226 (pCi/l)	Uranium (ug/l)	Arsenic (ug/l)	Iron (ug/l)	Lead (ug/l)	Manganese (ug/l)	Vanadium (ug/l)	Zinc (ug/l)
8/7/72	0.1	---	<2	<20	<0.1	49	---	860	90	60	9	104
8/14/72	---	---	3	22	0.2	54	---	---	---	---	---	---
9/2/72	1.8	---	8	21	0.1	41	---	160	70	60	86	68
9/9/72	9.7	---	<2	<20	0.3	28	---	380	110	80	7	93
9/14/72	10	---	<2	<20	0.4	33	---	190	90	60	16	86
9/23/72	9.3	---	<2	<20	0.4	32	---	110	100	40	8	48
5-Month Average	---	---	---	---	0.2	32	---	213	99	96	11	61

TABLE XV

EDGEMONT MONITORING PROGRAM

COTTONWOOD CREEK DOWNSTREAM OF SEEPAGE
FROM MINES DEVELOPMENT, INC., URANIUM MILL

Collection Date	Suspended Portion		Dissolved Portion									
	Radium-226 (pCi/g)	Uranium (ug/g)	Gross Alpha (pCi/l)	Gross Beta (pCi/l)	Radium-226 (pCi/l)	Uranium (ug/l)	Arsenic (ug/l)	Iron (ug/l)	Lead (ug/l)	Manganese (ug/l)	Vanadium (ug/l)	Zinc (ug/l)
5/11/72	---	---	---	---	---	---	<10	---	---	---	---	---
5/16/72	---	---	---	---	---	---	<10	470	100	240	54	27
5/24/72	35	---	4	20	0.8	157	<10	110	80	340	56	10
5/31/72	---	---	2	11	0.4	82	---	30	120	130	470	31
6/6/72	---	---	2	26	0.3	203	<10	30	124	670	59	27
6/13/72	---	---	6	18	1.6	230	---	3600	110	430	---	35
6/20/72	---	---	8	27	1.8	270	---	1200	20	1110	2200	58
6/29/72	---	---	19	10	1.1	233	<10	2480	132	90	120	36
7/7/72	144	---	16	45	5.5	194	---	3600	117	1250	590	354
7/15/72	32	---	15	38	8.7	134	---	32000	27	15600	---	295
7/24/72	160	---	30	68	5.7	456	---	980	80	4880	47	126
7/31/72	54	---	12	37	10	331	---	6960	100	4180	102	108

TABLE XV

EDGEMONT MONITORING PROGRAM

COTTONWOOD CREEK DOWNSTREAM OF SEEPAGE
FROM MINES DEVELOPMENT, INC., URANIUM MILL

Collection Date	Suspended Portion		Dissolved Portion									
	Radium-226 (pCi/g)	Uranium (ug/g)	Gross Alpha (pCi/l)	Gross Beta (pCi/l)	Radium-226 (pCi/l)	Uranium (ug/l)	Arsenic (ug/l)	Iron (ug/l)	Lead (ug/l)	Manganese (ug/l)	Vanadium (ug/l)	Zinc (ug/l)
8/7/72	8.1	66	<4	<20	5.1	444	---	1860	120	2360	200	89
8/14/72	8.9	25	13	<20	9.8	500	---	1620	100	1820	180	96
9/2/72	54	---	33	41	1.9	400	---	1330	70	1840	7	148
9/9/72	55	---	8	21	5.5	300	---	1160	80	1160	122	73
9/14/72	76	46	8	21	4.3	245	---	300	90	1080	78	75
9/23/72	61	20	5	<20	8.8	300	---	860	110	900	122	77
5-Month Average	---	---	---	---	4.5	280	---	3480	93	2240	290	98

TABLE XVI

EDGEMONT MONITORING PROGRAM

CHEYENNE RIVER AT RED CANYON

APPROXIMATELY TWO MILES DOWNSTREAM THE CONFLUENCE WITH COTTONWOOD CREEK

Collection Date	Suspended Portion		Dissolved Portion									
	Radium-226 (pCi/g)	Uranium (ug/g)	Gross Alpha (pCi/l)	Gross Beta (pCi/l)	Radium-226 (pCi/l)	Uranium (ug/l)	Arsenic (ug/l)	Iron (ug/l)	Lead (ug/l)	Manganese (ug/l)	Vanadium (ug/l)	Zinc (ug/l)
5/11/72	---	---	---	---	---	---	<10	---	---	---	---	---
5/16/72	1.7	---	<1	10	0.2	14	<10	380	98	40	3	22
5/24/72	2.5	1.0	<1	17	0.4	23	<10	50	98	20	4	30
6/3/72	1.5	---	<1	7	0.1	21	---	30	94	60	2	12
6/17/72	1.2	---	1	5	0.2	12	<10	30	100	90	1	15
6/22/72	1.9	1.1	<1	10	0.3	10	---	9000	90	220	---	62
6/26/72	1.0	0.5	1	9	0.1	8	---	5100	50	90	8	70
6/29/72	---	0.6	<1	11	0.1	4	<10	545	53	190	8	54
7/7/72	14	---	---	---	0.6	---	---	2450	98	100	23	170
7/15/72	1.5	----	4	<20	0.3	15	---	140	80	50	1	40
7/24/72	15	---	<2	<20	0.3	20	---	60	80	60	6	54
7/31/72	---	---	<2	<20	0.3	19	---	20	80	40	5	16

TABLE XVI
 EDGEMONT MONITORING PROGRAM
 CHEYENNE RIVER AT RED CANYON
 APPROXIMATELY TWO MILES DOWNSTREAM THE CONFLUENCE WITH COTTONWOOD CREEK

Collection Date	Suspended Portion		Dissolved Portion									
	Radium-226 (pCi/g)	Uranium (ug/g)	Gross Alpha (pCi/l)	Gross Beta (pCi/l)	Radium-226 (pCi/l)	Uranium (ug/l)	Arsenic (ug/l)	Iron (ug/l)	Lead (ug/l)	Manganese (ug/l)	Vanadium (ug/l)	Zinc (ug/l)
6/7/72	1.9	1.3	<2	<20	0.2	5	---	---	---	---	---	---
8/14/72	6.9	2.7	<2	<20	0.3	16	---	640	70	60	9	57
9/2/72	---	---	<2	<20	0.3	15	---	20	50	20	2	12
9/15/72	1.0	1.3	<2	<20	0.3	10	---	---	---	---	---	---
9/14/72	2.1	---	<2	<20	0.3	16	---	70	70	80	6	61
9/23/72	---	---	<2	<20	0.4	14	---	110	50	60	4	11
5-Month Average	---	---	---	---	0.3	14	---	1240	79	79	6	47

2. Dissolved radium-226 concentrations were low and within the range of 0.1 - 0.7 pCi/l; excluding the one anomolous result of 1.8 pCi/l at the State Highway 18 bridge (7/24). Similarly, low levels of dissolved uranium were observed with concentrations in the range of 5 to 20 μ g/l. For both radionuclides, concentrations were independent of river flow and remained relatively constant throughout the five-month data period.
3. Concentration ranges for heavy metals were:

Arsenic	<10 μ g/l
Lead	50 - 120 μ g/l
Manganese	20 - 320 μ g/l
Vanadium	1 - 100 μ g/l
Zinc	12 - 170 μ g/l

Cottonwood Creek

1. With the exception of dissolved uranium, water quality at the county road bridge was similar to upstream Cheyenne River water quality. Dissolved radium-226 results (Table XIV) showed a maximum of 0.7 pCi/l, and a 5-month average of 0.2 pCi/l. This average is the same as those calculated for the Cheyenne River stations. In contrast, dissolved uranium - on an average value basis - occurred at a concentration slightly greater than twice that found in the Cheyenne River - 32 μ g/l versus 14 μ g/l. Furthermore, the dissolved uranium data did not exhibit relative constancy over the 5-month period. Instead, the data showed a rise to a maximum in late-July and August, and subsequently declining values.
2. Attributable to seepage from mill ponds, average concentrations of dissolved uranium and radium-226 at the station downstream of the road culvert (Table XV) were substantially greater than background levels (10 and 20 times greater, respectively). For the 5-month data period, dissolved radium-226 showed a range of 0.4 to 10 pCi/l; dissolved uranium a range of 82 to 500 μ g/l. The rise in concentrations during the monitoring period were undoubtedly caused by decreasing creek flow; hence, decreasing dilution of seepage flowing into the creek. The data do not support any claim to the effect that radioactivity levels upstream of the mill do, on occasion, exceed the corresponding levels downstream of the zones of active seepage.
3. Seepage also produced significant increases in the concentrations of dissolved iron, manganese, and vanadium (Table XV). Based on 5-month average values, the increases were on the order of 15, 20, and 30 times greater than naturally-occurring levels for iron, manganese, and vanadium, respectively. It is interesting to note

that despite the large increase in the dissolved iron concentration and the extensive precipitation that occurs in Cottonwood Creek, the maximum concentrations of dissolved iron were found in the Cheyenne River.

4. Seepage did not impact the concentration of arsenic, lead, and zinc. Consequently, analysis of these metals has been terminated.

Based on comparisons with the results of previous studies, no significant improvement in the water quality of Cottonwood Creek occurred through September, 1972. Although sufficient data have not been accumulated to reach a final decision, it is an obvious possibility that the actions taken to date may not be adequate for achieving demonstrable improvement in water quality. The other possibility is that the data are representative of a transitional phase and some improvement will be observed during 1973. Therefore, the actions taken by Mines Development, Inc., to abate seepage - although suspect in terms of overall adequacy - remain an open question at this time.

REFERENCES

- (1) U. S. Environmental Protection Agency, "Evaluation of the Impact of the Mines Development, Inc., Mill on Water Quality Conditions in the Cheyenne River," Region VIII, Denver, Colorado (September 1971).
- (2) Hickey, J. L. S., and S. D. Campbell, "High Radium-226 Concentrations in Public Water Supplies," in Public Health Reports, 83, 7, pp. 551-557 (July 1968).
- (3) Federal Radiation Council, "Background Material for the Development of Radiation Protection Standards," Staff Report Number 2 (September 1961).
- (4) U. S. Environmental Protection Agency, "Transcript of Proceedings in the Matter of Pollution of the Navigable Waters of Western South Dakota," Held at Rapid City, South Dakota (October 19-21, 1971).

APPENDIX A

F₁₀₀
100%

EDGEMONT, SOUTH DAKOTA

C
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P
Y

November 28, 1972

Dr. Robert H. Hays
State Health Officer
South Dakota Department of Health
Pierre, South Dakota 57501

Dear Sir:

A progress report on the stabilization tests for the sand tailings at Mines Development, Inc., follows:

A test plot of approximately one and one-half acres was established north of the mill complex. Based upon a soil analysis made by the Brookings Lab., pretreatment consisted of blading the area smooth (the plot has a general slope of about 6% to the southeast), addition of one-half ton of lime per acre in the form of $\frac{1}{4}$ " down, crushed rock; spreading of eight to ten tons of manure per acre and disking. A blend of brome grass and red clover was seeded, followed by the application of fifteen pounds of ammonium nitrate. The seed bed was watered by an overhead sprinkler system on an average of once every three days throughout the growing season. No reliable estimate of the water used is available.

The results were the establishment of a grass stand on approximately fifteen percent of the seed bed. No clover appeared to have germinated in this environment. The grass that matured was generally located down slope from the sprinkler locations.

The alternate test plot located south of the mill complex was prepared in the same manner. The slope, again to the southeast, varied from 20 to 5 percent. Here the growth of native annuals and bushes was promoted by the nutrients added. The results indicate that two species known locally as Fireweed and Sunflowers will grow in this environment. Seeds for the Fireweed seed have not been found and further seeding will have to come from a mulch prepared from cuttings. The weed has a tough stock that should resist sand erosion but the root system is not too extensive for holding purposes.

Dr. Robert Hays
SD State Health Officer

-2-

November 28, 1972

Additional areas will be leveled and substantially more fertilizer added during the next growing season. The addition of some soil builders by flooding test plots with silted water from the creek at high water will be done in the coming spring.

Very truly yours,

MINES DEVELOPMENT, INC.

G. A. Fluke
District Engineer

gaf:lh
cc: Mr. Irvin L. Dickstein, Director
EPA, Enforcement Division
Denver, Colorado

JAMES ASOUREZK
SOUTH DAKOTA

United States Senate

WASHINGTON, D.C. 20510

September 16, 1976

0m129004

Honorable John Pastore
Chairman
Joint Committee on Atomic Energy
H-403 Capitol Building
Washington, D. C. 20510

Dear John:

Enclosed is a copy of a letter from Dick Kneip, the Governor of South Dakota, requesting that the site of the Mines Development, Inc. uranium mill in Edgemont, South Dakota, be included in ERDA's study list of inactive uranium mill sites.

Needless to say, residents and officials of the state and the Edgemont area are concerned about health and environmental problems from radiation. The state is seeking the counsel of ERDA and of your committee to recommend control or disposition of the uranium mill tailings. We respectfully request that the Joint Committee on Atomic Energy look into the situation, and take appropriate action to include Edgemont in any study list of the Joint Committee or of ERDA.

Thank you for your attention to this matter.

With best personal regards.

Sincerely,

James Abourezk
United States Senate

cc: William A. Anders, Chairman
Nuclear Regulatory Commission
Washington, D. C. 20555



STATE OF SOUTH DAKOTA

RICHARD F. KNEIP
GOVERNOR

EXECUTIVE OFFICE

PIERRE
57501

July 30, 1976

The Honorable James Abourezk
United States Senate
Washington, D.C.

Dear Jim:

Personnel from the South Dakota Department of Environmental Protection, the South Dakota Department of Health and individuals in Edgemont, South Dakota, have for some time now been concerned with the radioactive effects of tailings from past uranium milling operations in Edgemont, South Dakota.

In 1956, Mines Development, Inc., began operating the Edgemont uranium mill, which operated continuously until 1972. Tailings from the mill were deposited in a number of tailings ponds and piles; and during the mill operation, radioactive leachate from the ponds seeped into the Cheyenne River and Cottonwood Creek. This pollution was detected through a monitoring program of the U.S. Environmental Protection Agency, but the monitoring program discontinued when the mill ceased operations in 1972.

E.P.A. reports indicate that the largest problem and potential health hazard is caused by migration of radon gas to adjacent populated areas, subjecting nearby homes to entrapping radon gas which subsequently decays into radioactive daughter products which is then inhaled by residents. This type of radiation exposure is chronic since the Radium 226 parent in the uranium mill tailings has a radioactive half-life of 1620 years. The effects of chronic exposure to low levels of radiation are well documented. Radon daughter elements have been implicated in contributing to the high incidence of lung cancer among individuals who are occupationally exposed to these radioactive elements. Windblown radioactive tailings are also deposited on private property near the site.

Based on the above concerns, I believe that we should begin immediately to investigate the proper use, disposition and stabilization of the Edgemont mill tailings piles.

The Honorable James A. Jourezk

July 30, 1976

Page Two

A recent quote from remarks by Edward A. Mason, Commissioner of the U.S. Nuclear Regulatory Commission may indicate to you the present situation on disposal responsibility of abandoned mill tailings. Mr. Mason said:

"We (the N.R.C.) and the E.P.A. have recognized the potential environmental danger from mill tailings, and upon investigation the N.R.C. discovered a regulatory gap which precludes an immediate direct attack on the problem. While the N.R.C. licenses uranium mills, our jurisdiction expires with the license when the mill closes down. The National Environmental Policy Act does provide N.R.C. with some jurisdiction over abandoned piles of mill tailings, but the jurisdictional problem is complicated by the fact that there are 20 so-called Agreement States to which the N.R.C. has turned over certain regulatory responsibilities, historically including mill tailings. These 25 States include some of those in which the mill tailings are located. Who, then, has responsibility for determining the nature and extent of the environmental hazard and the cause of action to combat it? N.R.C. is in the midst of making a decision on such important questions as the drafting of a Generic Environmental Impact Statement on mill tailings, the assignment of regulatory jurisdiction, and possible legislation to resolve the present regulatory ambiguity."

It, therefore, apparently seems that in this specific case the ultimate responsibility for controlling the environmental impact of radioactive mill tailings at Edgemont lies with the State of South Dakota, which is not an Agreement State.

The U.S. Energy Research and Development Administration and the Joint Committee on Atomic Energy recently instituted a program to undertake engineering assessments at inactive uranium mill sites and to recommend remedial control actions. Phase I of this program involved a survey indicating the number of such sites. Eighteen sites were identified in October 1974, and became eligible for a Phase II study which entails the preparation of a report on each site "concerning the proper treatment, use and stabilization of uranium tailings which have resulted from past production activities throughout the western United States." E.R.D.A. recently completed a \$400,000 Phase II study on the uranium mill tailings, at the former Vitro site in Salt Lake City, Utah. The final report on the Utah site is designed to provide an assessment of the problem, examine the alternative solutions, and prepare cost estimates and plans and specifications for alternative remedial action measures.

Since the Edgemont mill site ceased the production of uranium in 1972, I believe that it should qualify as an inactive mill site, particularly since the N.R.C. Source Material license of this site expired in early 1976. The

The Honorable James A. Albrecht

July 30, 1976

Page Three

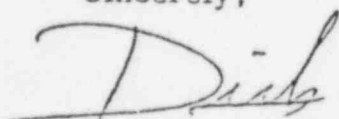
environmental problems and public health concerns at Edgemont are the same as those associated with the Vitro site in Salt Lake City, with the exception that the population is not nearly as large.

In view of the foregoing, I am requesting that you seek a mechanism with the Joint Committee on Atomic Energy which will result in the inclusion of the Edgemont site on E.R.D.A.'s study list of inactive uranium mill sites. I also believe that a Phase II study is necessary so that we can decide upon the most efficient and effective means of controlling the long-term public health problems which will exist in Edgemont.

I would certainly appreciate your bringing this matter to the attention of the appropriate J.C.A.E. members and I ask that you use whatever influence is necessary to initiate the Phase II study of the Edgemont mill site and tailings piles. I should also point out that I have also written to the other members of the South Dakota Congressional Delegation on this matter.

I will be happy to provide you with any further information to aid you in this endeavor. You are also more than welcome to contact either Secretary Judy Call or Secretary Allyn Lockner on this matter. Your cooperation is greatly appreciated and I wish you the very best. As always, I remain

Sincerely,



RICHARD F. KNEIP
GOVERNOR

RFK/mdg

cc: Miss Judith K. Call, Secretary
Department of Health

Dr. Allyn Lockner, Secretary
Department of Environmental Protection

~~April~~ 1973

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ENVIRONMENTAL EVALUATION
OF
MINES DEVELOPMENT, INC. URANIUM & VANADIUM
MILLING OPERATIONS
AT
EDGEMONT, SOUTH DAKOTA

TECHNICAL SUPPORT BRANCH
SURVEILLANCE AND ANALYSIS DIVISION
U. S. ENVIRONMENTAL PROTECTION AGENCY
REGION VIII

84402080160

40 pp.

APRIL, 1973

SUMMARY

Since the Mines Development, Inc., uranium mill located at Edgemont, South Dakota, began commercial operation in 1956, the resultant impact of waste management practices on environmental radiation levels has been the subject of several State and Federal studies. The first set of post-operational samples were collected during June, 1957. During the latter part of July, 1957, an intensive in-plant study was conducted to characterize the mill process and liquid effluents. Water quality studies conducted during September, 1966, and July, 1971, showed that process and waste liquors were being lost by seepage from mill ponds and entering surface waters - Cottonwood Creek and the Cheyenne River. Soil and bottom sediment samples collected during the 1971 study confirmed the loss of unstabilized sand tailings to the water environment by wind and water erosion.

Water quality degradation attributable to mill operations was considered at the Environmental Protection Agency - State of South Dakota Conference in the Matter of Pollution of the Navigable Waters of Western South Dakota (held in Rapid City, South Dakota on October 19 - 21, 1971). Based principally on the findings of the 1971 field study, the Conferees put forth recommendations calling for (1) curtailment of pond seepage, (2) development of a plan providing for the stabilization and ultimate disposal of sand tailings, and (3) the establishment of a water quality monitoring program (State in cooperation with EPA) to monitor and document the progress of abatement actions.

The mill was revisited October 3, 1972, to discuss the efforts undertaken by Mines Development, Inc., to abate radiological pollution and to assess the progress achieved in the year following the 1971 Conference. To eliminate seepage from mill ponds, the Company had instituted a program of operating the ponds at lower fluid levels and systematically abandoning old ponds. Although visual observations indicated that some reduction in the seepage flow to Cottonwood Creek had been achieved, water quality monitoring data for the period of May through September, 1972, showed no significant improvement.

As the result of the mill visit, it was concluded that little progress had been made on the crucial issue of sand tailings stabilization and ultimate disposal. Aside from two limited experiments to test potential stabilization procedures, no positive actions had been taken to prevent the loss of sand tailings to the environment by wind and water erosion. At the Pond No. 2 disposal area, sand tailings have drifted through the site Perimeter fence and are migrating down the Cheyenne River bank, toward the State Highway, and into the yard of a single family dwelling adjacent to the disposal site. A soil sample collected from a residential area to the east of inactive sand tailings pile No. 1 contained a high concentration of radium-226 indicative of wind transport from this pile. To eliminate these situations and prevent additional off-site contamination, a corrective action program should be implemented without delay.

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INTRODUCTION

Field studies to quantify the impact of waste disposal practices at the Mines Development, Inc., uranium mill on the quality of Cottonwood Creek and the Cheyenne River have been conducted on several occasions by Federal and State personnel - the most recent field study occurring in July of 1971. The findings of these efforts were the basis for the Environmental Protection Agency report⁽¹⁾ presented at the Conference in the Matter of Pollution of the Navigable Waters of Western South Dakota (held in Rapid City, South Dakota, on October 19-21, 1971). Consistent with the Environmental Protection Agency recommendations calling for improvement in waste management practices, the Conferees set forth the following requirements:

1. "By January 1, 1973, sealed storage for liquid uranium and vanadium mill wastes at Mines Development, Inc., at Edgemont, South Dakota, shall be provided to eliminate the seepage into Cottonwood Creek and the Cheyenne River. A progress report shall be made by Mines Development, Inc., and the State to the Conferees by July 1, 1972."
2. "A plan providing for the stabilization and ultimate disposal of sand tailings from Mines Development, Inc., shall be developed by February 15, 1972. One alternative for ultimate disposal that should be investigated is storage in the excavated portions of the open-pit uranium mine operated by Mines Development, Inc."
3. "By July 1, 1972, monitoring stations shall be established on Cottonwood Creek (at the mouth) and the Cheyenne River (downstream from the Mines Development, Inc., mill) by the State of South Dakota in cooperation with the Environmental Protection Agency to determine the extremes in chemical and radioactivity concentrations as well as the annual average radioactivity."

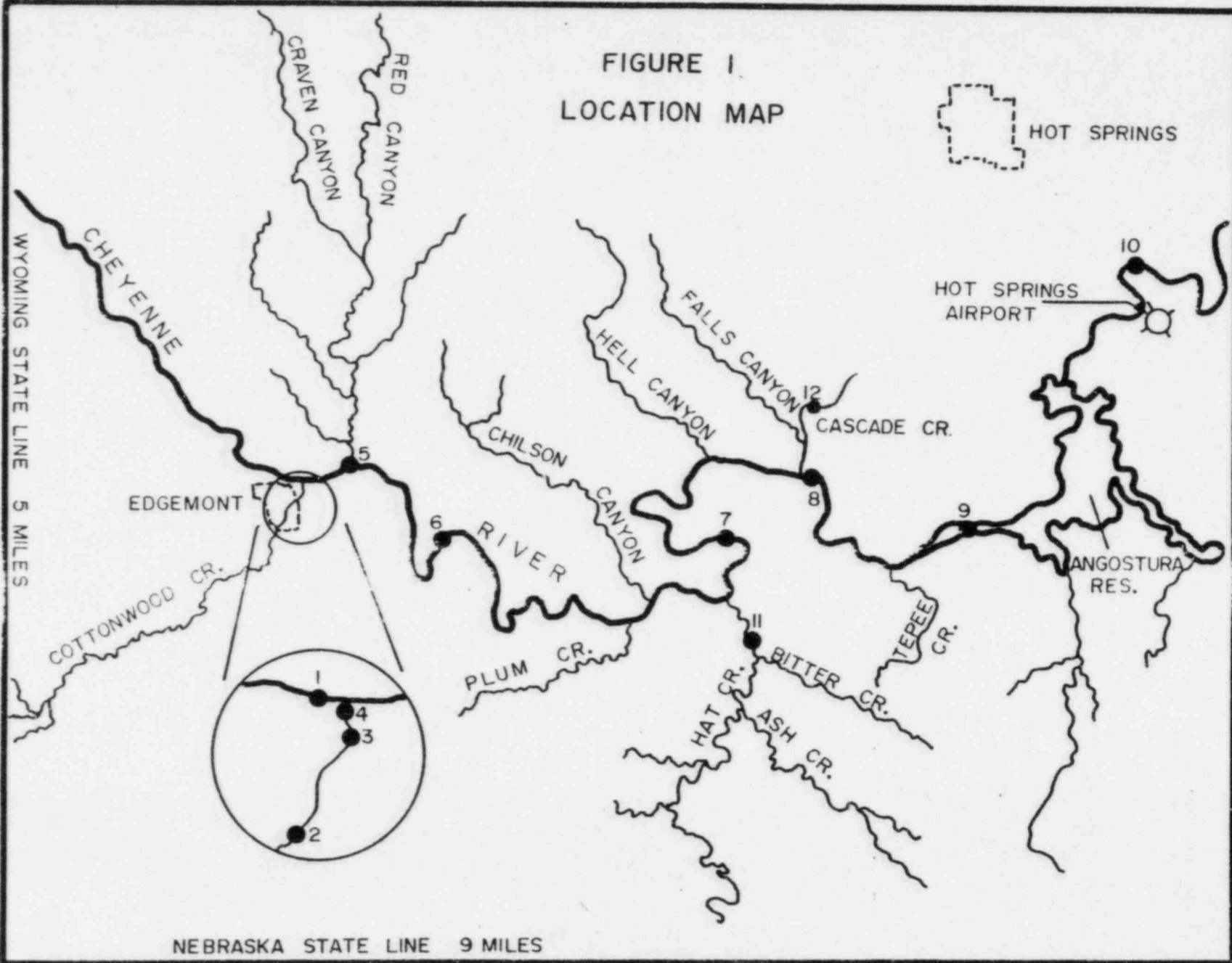
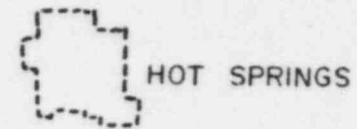
A map of the area covered by the water quality studies is shown in Figure 1.

The objectives of this report are three-fold:

1. To present all the analytical results from the July 1971 water quality study and discuss the significance thereof. As noted in the Conference report, only a limited number of the 1971 results were available at the time of the Conference.

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FIGURE I
LOCATION MAP



2. Discuss the efforts expended and the progress achieved by Mines Development, Inc., in the abatement of seepage from mill ponds and the stabilization of on-site tailings piles.
3. Present the initial results of the "Edgemont" water quality monitoring program (five month period of May through September, 1972).

1971 FIELD STUDY

Detailed descriptions of the July 1971 field study and associated sample processing procedures were presented in the Enforcement Conference report. The study involved the collection of surface water, well water, seepage, soil, and bottom sediment samples. Summarized briefly, surface water sampling stations were established on the following:

Cheyenne River	-	7 Stations
Cottonwood Creek	-	3 Stations
Hat Creek	-	1 Station
Cascade Creek	-	1 Station
Angostura Reservoir	-	13 Stations

Water sampling stations for the Cheyenne River and three tributaries are listed in Table I and are shown in Figure I. Angostura Reservoir stations are shown in Figure II.

The collection frequency for water samples from Cottonwood Creek and the Cheyenne River was daily over the 5-day study period at all stations except Stations 9 and 10. At these latter two stations as well as at the stations on at Cascade Creek and Hat Creek, grab samples were collected only once during the study. In the case of Angostura Reservoir, grab water samples were collected at the surface and near the bottom of the water column at each station.

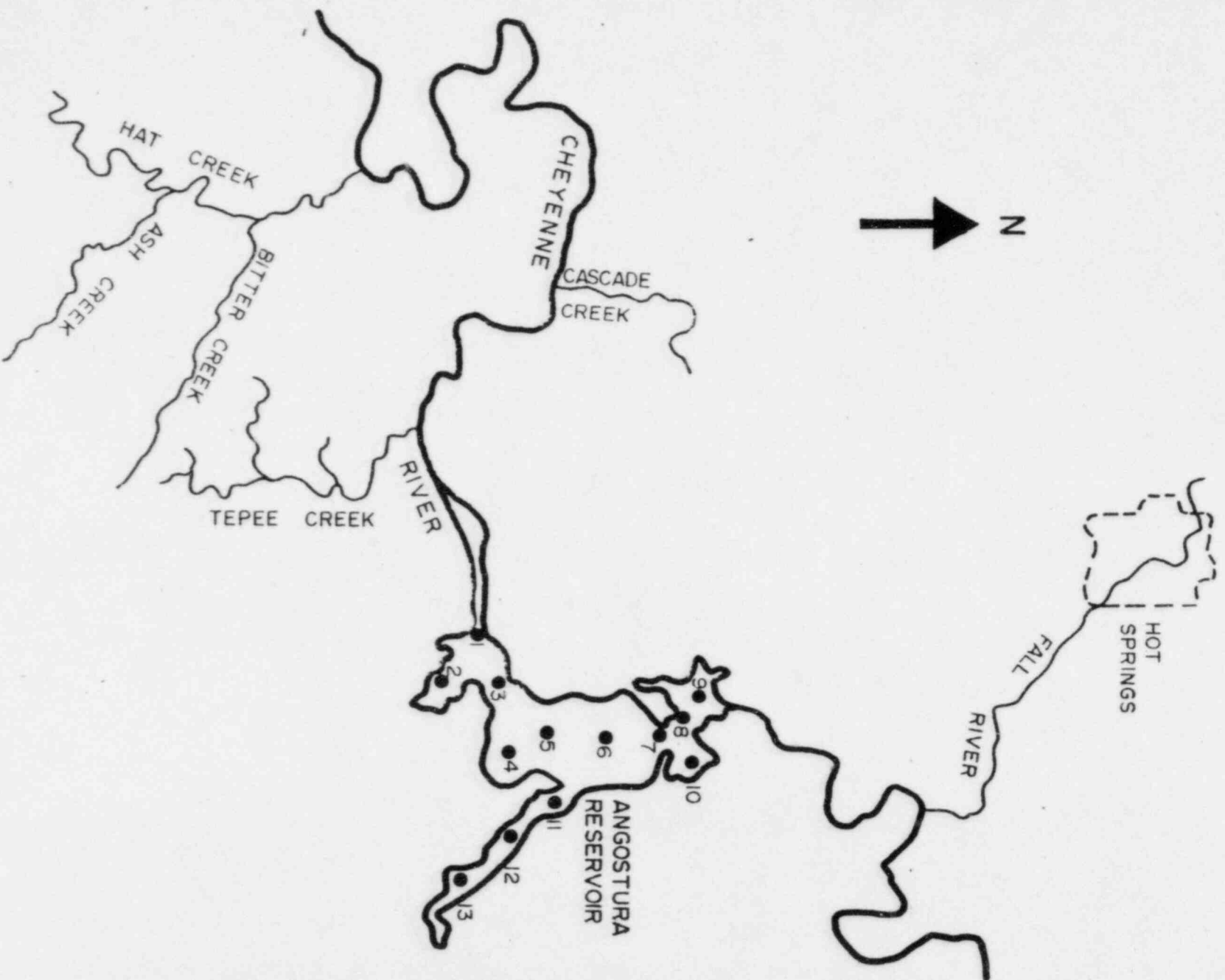
Flow data for the study period are summarized in Table II. Flow in Cottonwood Creek increased from an average 0.1 cfs upstream of the mill (Station 2) to 0.4 cfs at the road culvert and 0.5 cfs at the mouth. The approximate 0.3 cfs increase between Station 2 and the road culvert was largely due to overflow from the mill water tower and seepage from mill ponds. The small flow increase between the culvert and the creek mouth might represent the drainage into the creek from an abandoned railroad well. However, this small difference was within the limits of the metering procedure employed for flow measurements. Flow in the Cheyenne River was about 5 cfs at the upstream railroad bridge (Station 1) and approximately 132 cfs at the State Highway 71 Bridge. The increase was largely attributable to Hat Creek (100 cfs) and Cascade Creek. All other potential tributaries were dry.

TABLE I
SURFACE WATER SAMPLING STATIONS
CHEYENNE RIVER AND TRIBUTARIES - 1971

<u>Station</u>	<u>Description</u>
1	Cheyenne River just upstream of the State Highway 18 Bridge outside of Edgemont; at the railroad bridge.
2	Cottonwood Creek upstream of mill property at the county road bridge; off State Highway 52.
3	Cottonwood Creek at the mill road culvert; downstream of sand tailings pile No. 2.
4	Cottonwood Creek at the confluence with the Cheyenne River.
5	Cheyenne River about 1.5 miles downstream of the mill.
6	Cheyenne River about six (6) miles downstream of the mill; at Gull Hill Park.
7	Cheyenne River at ford on County Road 11.
8	Cheyenne River at State Highway 71 Bridge.
9	Cheyenne River in the headwaters of Angostura Reservoir.
10	Cheyenne River below Angostura Dam.
11	Hat Creek at State Highway 71 Bridge.
12	Cascade Creek near Brainerd Indian School.

FIGURE 11

ANGOSTURA RESERVOIR SAMPLING STATIONS



Surface Waters

Water quality results for the Cheyenne River, Cottonwood Creek, Cascade Creek, and Hat Creek are summarized in Tables III and IV. In the case of stations for which composite samples were prepared, complete radiochemical analysis was performed only on the composite sample (Table III) with analysis of the daily samples limited to dissolved radium-226 and uranium (Table IV). With the exception of the radium-226 results for Station 2, there was excellent agreement between the average results calculated for the daily samples and the corresponding results for the composite samples. Based on the separate results for the five (5) samples collected at Station 2, the background concentration of dissolved radium-226 in Cottonwood Creek was approximately 0.10 pCi/l instead of the 0.26 pCi/l indicated by composite sample analysis.

The radioactivity results for the Cottonwood Creek stations showed a significant degradation in quality as the creek traverses mill property. The level of dissolved radium-226 increased 30-fold from 0.10 pCi/l upstream of the mill to 3.1 pCi/l at the road culvert. Similarly, dissolved uranium increased from 26 ug/l to 147 ug/l. Field pH measurements also showed a small reduction in pH in the reach receiving seepage from mill ponds - 7.0 to 7.1 upstream at Station 2 as compared to 6.4 to 6.8 at the road culvert.

In contrast to the degradation of water quality in Cottonwood Creek, there was no detectable change in the radiological water quality of the Cheyenne River as the result of pond seepage. Concentrations of radium-226 and uranium at Station 5, approximately 1.5 miles below the confluence with Cottonwood Creek, were comparable to those at the upstream or baseline station (Station 1). This is consistent with results of mass balance calculations. Even by assuming complete conservation of the pollutants in the dissolved form (i.e., no loss by chemical precipitation, adsorption, etc.), the calculated concentrations for Station 5 for a complete mixing condition are not dramatically different than background levels - calculated values of 0.5 pCi/l and 31 ug/l of radium-226 and uranium, respectively. The fact that the mass balance approach is not totally accurate is undoubtedly attributable to several factors, including the possible transition of radium-226 and uranium from the dissolved to solid state. Dissolved radium-226 results for Stations 7 and 8 on the Cheyenne River indicated a contributing source in this reach as the average concentration increased from 0.25 pCi/l to 0.34 pCi/l (Table IV). Apparently, the source of this small increase was the small tributary, Cascade Creek. A single grab sample from this stream contained 1.7 pCi/l of dissolved radium-226.

Water quality data for Angostura Reservoir (Table V) showed no detectable impact of radioactivity-bearing seepage from the mill on dissolved radioactivity in the reservoir. Based on the collective analysis of the separate results, the average dissolved concentrations of radium-226 and uranium were 0.17 pCi/l and 8 ug/l, respectively. These values are comparable

TABLE II
STREAM FLOWS

<u>Station</u>	<u>Date</u>	<u>Flow(cfs)</u>	<u>Method of Measurement</u>
1 - Cheyenne River upstream of mill	7/26	6.6	Permanent USGS Gage
	7/27	3.8	
	7/28	4.4	
	7/29	5.6	
	7/30	4.4	
	Avg. - 5.0		
2 - Cottonwood Creek upstream of mill	7/26	0.14	Staff Gage
	7/27	0.12	
	7/28	0.12	
	7/29	0.05	
	7/30	0.07	
	Avg. - 0.10		
3 - Cottonwood Creek at mill road culvert	7/26	0.64	Staff Gage
	7/27	0.12	
	7/28	0.29	
	7/29	0.29	
	7/30	0.29	
	Avg. - 0.40		
4 - Cottonwood Creek near mouth	7/26	0.62	Staff Gage
	7/27	0.62	
	7/28	0.39	
	7/29	0.62	
	7/30	0.50	
	Avg. - 0.53		
8 - Cheyenne River at State Highway 71 Bridge	7/26	148	Permanent USGS Gage
	7/27	137	
	7/28	129	
	7/29	127	
	7/30	122	
	Avg. - 132		
11 - Hat Creek	7/26	100	Permanent USGS Gage

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TABLE III

RADIOACTIVITY IN CHEYENNE RIVER, COTTONWOOD CREEK,
CASCADE CREEK, AND HAT CREEK WATER SAMPLES

Station	Solids		Dissolved Radioactivity					pH
	Suspended (mg/l)	Dissolved (mg/l)	Total Alpha Radium (pCi/l)	Radium-226 (pCi/l)	Uranium (ug/l)	Total Alpha Thorium (pCi/l)	Thorium-natural (ug/l)	
1 - Composite	---	---	0.11	0.24	16	0.10	4	8.0 - 8.2
2 - Composite	---	---	0.67	0.26	26	0.80	3	7.0 - 7.1
3 - Composite	---	---	0.75	3.1	147	0.02	2	6.4 - 6.8
4 - Composite	---	---	0.09	2.6	177	0.38	1	6.7 - 7.1
5 - Composite	---	---	0.17	0.32	28	0.85	7	7.8 - 8.0
6 - Composite	---	---	0.32	0.28	14	0.06	5	8.1 - 8.4
7 - Composite	---	---	0.11	0.21	19	0.10	3	7.9 - 8.2
8 - Composite	---	---	0.10	0.31	14	0.10	3	7.9 - 8.2
9 - Grab (7/27)	32	1360	0.14	0.49	10	0.20	3	---
10 - Grab (7/26)	3	---	0.11	0.47	12	0.11	3	---
11 - Grab (7/26)	25	1560	0.08	0.37	23	----	3	7.7
12 - Grab (7/26)	2	1530	0.08	1.7	5	< 0.01	< 1	6.8

TABLE IV

RADIUM-226 AND URANIUM IN CHEYENNE RIVER AND
COTTONWOOD CREEK WATER SAMPLES

<u>Station</u>	<u>Collection Date</u>	<u>Suspended Solids (mg/l)</u>	<u>Dissolved Solids (mg/l)</u>	<u>Dissolved Radium-226 (pCi/l)</u>	<u>Dissolved Uranium (ug/l)</u>
1	7/26	9	2540	0.34	17
	7/27	7	----	0.27	18
	7/28	6	----	0.22	24
	7/29	7	----	0.45	19
	7/30	4	----	0.26	15
				Avg. - 0.31	Avg. - 19
2	7/26	9	4050	0.02	26
	7/27	15	----	0.11	38
	7/28	6	----	0.10	22
	7/29	6	----	0.10	20
	7/30	5	----	0.07	18
				Avg. - 0.08	Avg. - 25
3	7/26	1422 ^(a)	2950	3.6	67
	7/27	31	----	4.0	212
	7/28	85	----	3.2	194
	7/29	24	----	2.8	156
	7/30	37	----	2.5	233
				Avg. - 3.2	Avg. - 160
4	7/26	75	2810	2.0	158
	7/27	27	----	2.5	150
	7/28	86	----	3.7	228
	7/29	16	----	2.2	89
	7/30	11	----	2.1	135
				Avg. - 2.5	Avg. - 152
5	7/26	11	3850	0.34	33
	7/27	4	----	0.25	27
	7/28	4	----	0.40	14
	7/29	9	----	0.24	21
	7/30	21	----	0.29	20
				Avg. - 0.30	Avg. - 23

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TABLE IV
(Continued)

<u>Station</u>	<u>Collection Date</u>	<u>Suspended Solids (mg/l)</u>	<u>Dissolved Solids (mg/l)</u>	<u>Dissolved Radium-226 (pCi/l)</u>	<u>Dissolved Uranium (ug/l)</u>
6	7/26	8	1800	0.22	---
	7/27	6	----	0.23	---
	7/28	8	----	0.28	---
	7/29	7	----	0.29	---
	7/30	5	----	0.30	---
				Avg. - 0.26	
7	7/26	4	2720	0.27	---
	7/27	5	----	0.27	---
	7/28	3	----	0.22	---
	7/29	3	----	0.21	---
	7/30	3	----	0.28	---
				Avg. - 0.25	
8	7/26	7	1720	0.31	---
	7/27	8	----	0.34	---
	7/28	5	----	0.37	---
	7/29	11	----	0.33	---
	7/30	6	----	0.33	---
				Avg. - 0.34	

(a) High result considered to be due to the channel disturbance caused by the 7/25 reconnaissance of the creek.

TABLE V

DISSOLVED RADIOACTIVITY IN ANGOSTURA RESERVOIR

Station (a)(b)	Date	Solids		Dissolved Radioactivity			
		Suspended (mg/l)	Dissolved (mg/l)	Radium-226 (pCi/l)	Uranium (ua/l)	Total Alpha Thorium (pCi/l)	Thorium-natural (ug/l)
A-1:	7/26						
Surface		14	930	0.23	9	< 0.01	0.0
Bottom (12')		37	---	0.24	8	0.04	0.7
A-2:	7/26						
Surface		79	980	0.24	10	< 0.01	1.5
Bottom (22')		130	---	0.02	13	0.07	4.9
A-3:	7/26						
Surface		12	1260	< 0.01	6	< 0.01	0.7
Bottom (20')		28	---	< 0.01	-	0.02	0.7
A-4:	7/26						
Surface (30')		5	1230	0.21	8	< 0.01	0.5
Bottom (-)		10	---	0.19	10	0.06	0.5
A-5:	7/26						
Surface		7	1110	0.46	10	< 0.01	0.3
Bottom (-)		22	---	0.16	9	0.22	0.3

- 12 -

116
96/

TABLE V
(Continued)

Station	Date	Solids		Dissolved Radioactivity			
		Suspended (mg/l)	Dissolved (mg/l)	Radium-226 (pCi/l)	Uranium (ug/l)	Total Alpha Thorium (pCi/l)	Thorium-natural (ug/l)
A-6:	7/26						
Surface		5	1090	< 0.01	11	< 0.04	0.0
Bottom (56')		7	---	0.05	9	0.08	3.4
A-7:	7/27						
Surface		8	---	0.23	9	0.05	0.0
Bottom (-)		9	---	0.14	6	0.08	1.5
A-8:	7/27						
Surface		4	---	0.13	7	< 0.04	0.3
Bottom (-)		6	---	0.18	9	0.08	1.2
A-9:	7/27						
Surface		----- Sample Lost -----					
Bottom (-)		8	---	0.12	8	< 0.04	0.7
A-10:	7/27						
Surface		4	---	0.15	8	< 0.04	1.7
Bottom (48')		9	---	0.23	8	0.06	1.1

11/1/76

TABLE V
(Continued)

Station	Date	Solids		Dissolved Radioactivity			
		Suspended (mg/l)	Dissolved (mg/l)	Radium-226 (pCi/l)	Uranium (μ Ci/l)	Total Alpha Thorium (pCi/l)	Thorium-natural (μ g/l)
A-11:	7/26						
Surface		6	1120	0.13	9	< 0.01	0.3
Bottom (45')		18	---	0.34	9	0.07	0.7
A-12:	7/27						
Surface		11	---	0.28	6	0.12	0.9
Bottom (34')		16	---	0.18	7	< 0.04	1.4
A-13:	7/27						
Surface		17	---	0.14	8	< 0.04	---
Bottom (14')		19	---	0.26	4	< 0.04	---

- (a) Refer to Figure II
(b) Collection depth in parentheses

Fig 14

with the corresponding baseline concentrations for the Cheyenne River. No significant difference was observed between the "surface" and "bottom" concentrations of either radionuclide.

Well Waters

Seven wells in the Edgemont area were sampled (grab samples) to determine the concentrations of radium-226 and uranium in groundwater:

- Mines Development, Inc., well - mill process water
- City Airport well
- City Park well
- City Reservoir well
- Railroad wells - "old" and "new"
- Cheyenne River Campground well

All wells, excluding the campground well, were completed in a deep, confined aquifer. The campground well, located on the opposite side of the river from the other wells, was completed in a shallow aquifer under water table conditions. Radiochemical analysis was performed on the samples "as collected" without filtration.

The radium-226 concentration in groundwater used for municipal water supply and mill process water was substantially higher than the naturally-occurring concentration in area surface waters. Grab samples from the municipal, mill, and railroad wells contained 3.3 to 5.0 pCi/l; averaging 3.9 pCi/l (Table VI). For uranium, the opposite was the case with the groundwater level somewhat lower than the surface water level - 4 to 7 ug/l versus an average 19 ug/l at Station 1 on the Cheyenne River. Unlike the deep wells, the shallow campground well contained a low concentration of radium - 0.12 pCi/l. This difference indicates a lack of inter-connection between deep and shallow aquifers.

Although the radium-226 concentration in groundwater is sufficiently high to consider the water tower overflow and the "old" railroad well drainage as sources of increased radium-226 (dissolved) in Cottonwood Creek, the associated low flows of these discharges indicate that the actual impact is not great because of dilution by natural creek flow and seepage. The average daily flow of the water tower overflow is estimated by mill management to be on the order of 2 to 3 gpm. Such a flow was only about 1% of the creek flow at the road culvert during the field study. Similarly, flow measurements at the road culvert and the confluence showed the railroad well drainage to be less than 0.1 cfs.

TABLE VI

RADIOACTIVITY IN WELL WATER SAMPLES

<u>Well Description</u>	<u>Radioactivity</u>			
	<u>Radium-226 (pCi/l)</u>	<u>Uranium (ug/l)</u>	<u>Total Alpha Thorium (pCi/l)</u>	<u>Thorium-natural (ug/l)</u>
Mines Development, Inc., mill well	3.5	5.0	0.09	---
City of Edgemont				
Airport well	3.7	7.0	0.13	---
Park well	4.4	5.0	< 0.05	---
Reservoir well	5.0	5.0	0.07	---
Cheyenne River campground well - north of the mill; across the river	0.12	0.2	< 0.04	0.8
Railroad wells				
"Old" well	3.7	4.0	0.12	0.5
"New" well	3.3	5.0	----	0.0
(Both wells located within several hundred feet of the mill well)				

120%

The Edgemont water supply was sampled in 1966 by Messrs. Hickey and Campbell(2) in their effort to identify population groups consuming water with a relatively high radium content (more than 3.0 pCi/l). Their reported finding for a single grab sample was 5.33 pCi/l which is consistent with the 1971 results. Assuming an intake of 1.0 liter per day of drinking water, radium-226 intake by Edgemont residents served by the municipal supply is on the order of 5 pCi per day from this source. This falls within Range II (2-20 pCi per day) of the Federal Radiation Council guidance(3) for radium-226 intake by the general public. For any level of intake within Range II, it is appropriate to undertake quantitative surveillance and routine control to ensure that the intake from all sources, not drinking water alone, does not exceed the upper limit - 20 pCi per day of radium-226. Although studies have not been conducted in Edgemont to determine the average daily intakes from other sources (air, foodstuffs, beverages, etc.), it is unlikely that these sources together with the drinking water supply produce a total daily intake in excess of 20 pCi. Despite the fact that the average dose received by Edgemont residents is apparently below the recommended limit, dose reduction through treatment of the water supply to remove radium-226 is desirable. Reduction in the radium concentration to near surface water concentrations should be achievable by centralized municipal water softening or "home" water softeners.

Seepage

Dissolved radioactivity results for seepage samples are summarized in Table VII. Based on the uranium content of groundwater samples (less than 10 ug/l), the high uranium concentrations in seepage samples collected in the vicinity of the pipeline suspension bridge indicated the mill ponds are the major source of seepage entering Cottonwood Creek. Similarly, the uranium concentration in direct seepage to the Cheyenne River just below the confluence with Cottonwood Creek indicated the source of this seepage is also the mill ponds. Although the sample collected from the seepage zone just upstream of Pond No. 1 was not analyzed for uranium, the source of this seepage was identified to be Pond No. 1 during the 1966 field study (1966 - 89 ug/l of uranium).

The concentrations of radium-226 and uranium in seepage collected at the base of the river bank adjacent to the Pond No. 2 sand tailings storage area are consistent with the premise that the source is the movement of drainage from the abandoned railroad well through the sand tailings. At the time of the field study, this drainage had formed a small pool at the south end of the storage area.

A comparison of the dissolved radioactivity in the ponded liquors and seepage samples shows substantial reductions in radionuclide concentrations as the solutions move through the soil to the surface waters (Tables VII and VIII). This is well illustrated by the results for Pond No. 3 and the seepage samples collected at the base of the east wall of the pond (wall thickness less than 50 feet). There was about a 100-fold difference in the dissolved radium-226 concentrations and only

TABLE VII

DISSOLVED RADIOACTIVITY IN SEEPAGE SAMPLES

<u>Description</u>	<u>Dissolved Radioactivity</u>			
	<u>Radium-226</u> <u>(pCi/l)</u>	<u>Uranium</u> <u>(ug/l)</u>	<u>Total Alpha</u> <u>Thorium (pCi/l)</u>	<u>Thorium-natural</u> <u>(ug/l)</u>
Cottonwood Creek (along east bank);				
(a) Several hundred yards upstream of the pipeline suspension bridge (approximately 6 feet above the water surface) - two samples	0.18 1.1	332 816	0.31 ----	0.8 0.0
(b) 50-100 feet upstream of the pipeline suspension bridge (at the bank - stream bed interface)	0.54	---	----	---
Cheyenne River (south bank):				
(a) At base of bank adjacent to Pond No. 2; just downstream of State Highway 18 Bridge	2.3	5	0.26	3.0
(b) Approximately 100 yards downstream of the confluence with Cottonwood Creek	0.35	176	17	50

TABLE VII

(Continued)

<u>Description</u>	<u>Dissolved Radioactivity</u>			
	<u>Radium-226</u> <u>(pCi/l)</u>	<u>Uranium</u> <u>(ug/l)</u>	<u>Total Alpha</u> <u>Thorium (pCi/l)</u>	<u>Thorium-natural</u> <u>(ug/l)</u>
Cheyenne River (south bank):				
Continued				
(c) Just upstream of Pond Number 1 (approximately 2 feet above the water surface)	1.1	---	----	---
(d) Approximately 1 1/2 miles down- stream of the mill (just above water surface)	2.1	26	0.19	0.0
On Site:				
Seepage from Pond No. 3 across road toward Edgemont sewage lagoon	0.68	2320	0.94	3.0

122/100

TABLE VIII
RADIOACTIVITY IN MILL PONDS

Dissolved (ppm)	Dissolved Radioactivity				Bottom Sediment (dry weight basis)			
	Radium-226 (pCi/l)	Uranium (ug/l)	Total Alpha Thorium (pCi/l)	Thorium-Natural (ug/l)	Radium-226 (pCi/g)	Uranium (ug/g)	Total Alpha Thorium (pCi/g)	Thorium-natural (ug/g)
---	98	1860	1240	110	---	---	---	---
---	61	1860	1400	180	1007	19	11	---
,360	93	8090	---	180	46	140	63	180
,300	726	56,000	---	650	75	33	67	---

about a 4-fold difference in the dissolved uranium concentrations. The higher affinity for radium-226 to be retained in the soil is an expected finding.

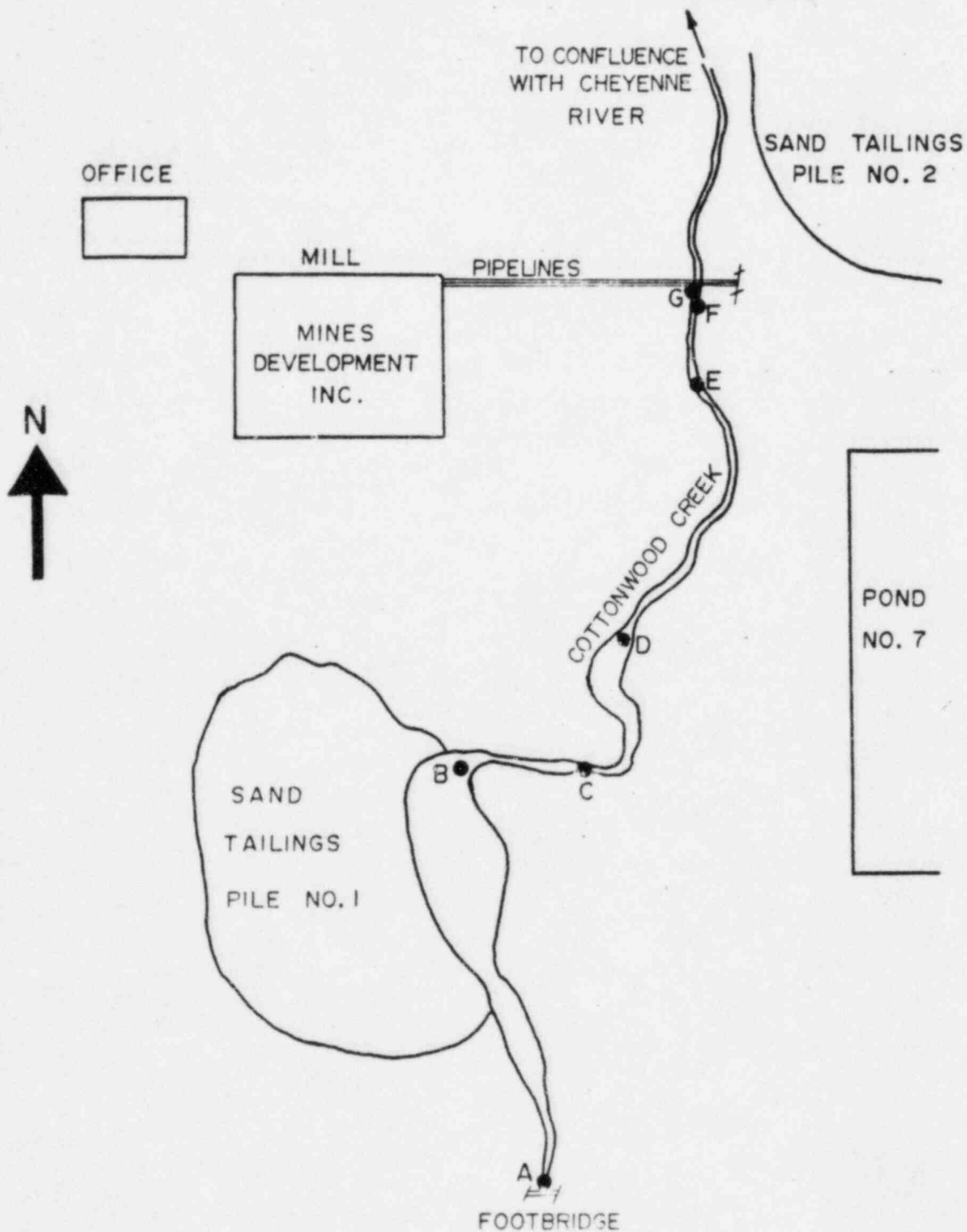
Bottom Sediment and Soil

Radioactivity results for bottom sediments collected from Cottonwood Creek, the Cheyenne River, and Angostura Reservoir are presented in Table IX. These data showed the same contamination pattern as exhibited by the radioactivity results for water samples. Bottom sediment contamination in Cottonwood Creek occurred throughout the reach extending from the channel adjacent to sand tailings pile No. 1 downstream to the confluence with the Cheyenne River. Radium-226 and uranium concentrations in the contaminated reach of the creek ranged from 3 to 41 pCi/gram and 3.1 to 53 ug/gram, respectively. Comparatively, background levels range from 1.0 to 2.5 pCi/gram for radium-226 and 1.0 to 6.0 ug/gram for uranium. All sediment samples from the Cheyenne River and Angostura Reservoir showed background levels.

Contamination zones in Cottonwood Creek were not identical for radium-226 and uranium. Uranium contamination was largely confined to the lower portion of the creek; the seepage impacted stretch extending from a point just upstream of the pipeline crossing downstream to the mouth. Radium contamination included this stretch and the stretch extending upstream to the pool adjacent to sand tailings pile No. 1 (Figure III). This finding illustrated the difference between contamination attributable solely to the erosion of sand tailings piles versus the combined effect of radioactivity-bearing seepage and tailings pile erosion. Sand tailings material contains a high concentration of radium-226 (on the order of 200 pCi/gram), but is essentially depleted in uranium (>20 ug/gram). Thus, as shown by the results for Stations C, D, and E (Table IX; Figure III), the deposition of sand tailings from pile No. 1 in the creek has produced elevated radium-226 concentrations without a corresponding increase in the uranium content. The confinement of uranium contamination to the seepage-impacted stretch indicates that uranium entering the creek via the seepage flow undergoes mass transport from the dissolved to solid state by physical (adsorption/absorption) and/or chemical reactions (precipitation).

As was the case in previous studies, the sediment sample collected at the pedestrian bridge across Cottonwood Creek (Station A) contained radium-226 at a concentration slightly greater than the background level. The possible explanations are a natural source (spring flow) or periodic contamination of the site by windblown sand tailings from pile No. 1 (located several hundred feet downstream). Since the sediment was stained at this

FIGURE III
COTTONWOOD CREEK
BOTTOM SEDIMENT SAMPLING STATIONS



NOTE: DRAWING NOT TO SCALE

TABLE IX

RADIOACTIVITY CONTENT OF BOTTOM SEDIMENTS FROM COTTONWOOD CREEK
CHEYENNE RIVER AND ANGOSTURA RESERVOIR

Station	Radioactivity Content (dry weight basis)			
	Radium-226 (pCi/g)	Uranium (ug/g)	Total Alpha Thorium (pCi/g)	Thorium-natural (ug/g)
Cottonwood Creek: (a)				
2 - Upstream of all waste sources	2.4	6.7	0.08	15
A - Pedestrian footbridge; Figure III	3.9	6.4	1.6	22
B - Poned area; Figure III	24	8.2	8.4	15
C - Riffle area; Figure III	41	2.8	0.20	15
D - Poned area; Figure III	11	3.1	3.3	6
E - Approximately 50 yards above the pipeline suspension bridge; Figure III	12	7.5	4.0	-
F - 50-100' upstream of the pipeline suspension bridge; Figure III	15	17	1.9	-
G - Pipeline suspension bridge; Figure III	40	53	---	-
3 -	19	13	0.38	15
4 -	4	28	0.29	16

TABLE IX
(Continued)

Station	Radioactivity Content (dry weight basis)			
	Radium-226 (pCi/g)	Uranium (ug/g)	Total Alpha Thorium (pCi/g)	Thorium-natural (ug/g)
Cheyenne River:				
1 - Upstream of all waste sources H through M - Sampling locations spaced along the edge of the river channel; downstream edge of Pond No. 1 to approximately one mile downstream	1.0	2.4	0.08	9
5 -	1.0-2.6	1.5-4.4	0.8-1.5	-
6 -	1.0	3.1	0.08	16
7 -	2.5	3.1	0.11	18
8 -	1.0	---	0.09	10
9 -	0.90	---	0.11	12
	1.6	---	0.43	17

TABLE IX

(Continued)

Station	Radioactivity Content (dry weight basis)			
	Radium-226 (pCi/g)	Uranium (ug/g)	Total Alpha Thorium (pCi/g)	Thorium-natural (ug/g)
Angostura Reservoir: (b)				
1 -	1.7	4.1	0.41	30
2 -	1.7	3.9	0.66	26
3 -	1.7	4.6	0.73	25
4 -	1.0	3.2	0.39	18
5 -	1.4	4.4	0.75	32
6 -	1.7	4.6	----	42
7 -	1.8	3.3	0.64	44
8 -	1.4	3.2	0.32	39
9 -	1.2	3.2	0.57	35
10 -	1.3	3.3	0.43	31
11 -	1.6	5.4	0.66	25
12 -	2.6	4.1	0.69	19
13 -	1.5	3.6	0.84	--

(a) Refer to Figure III

(b) Refer to Figure II

129
1006

location (reddish-brown to reddish-orange discoloration), the former cannot be discounted as a contributing factor. However, as discussed in the following section of this report, a soil sample collected across the creek from pile No. 1 (to the east) showed a high level of contamination. This finding indicated that wind transport of sand tailings may well be the major source of the elevated radium-226 concentrations at Station A.

Sediment samples from the Cheyenne River contained radium-226 and uranium within the background ranges of 1.0 to 2.6 pCi/gram and 1.5 to 4.4 ug/gram, respectively. This included the special set of six samples collected along the channel edge from the downstream corner of Pond No. 1 to a point approximately one mile downstream (Stations H through M - Table IX). Since this stretch of river was characterized by sediment staining attributable to seepage from Pond No. 1, it had been anticipated that the radium and uranium concentrations of these samples would be slightly higher than the observed background levels. Angostura sediment samples contained radium-226 and uranium in concentrations comparable to those in the Cheyenne River.

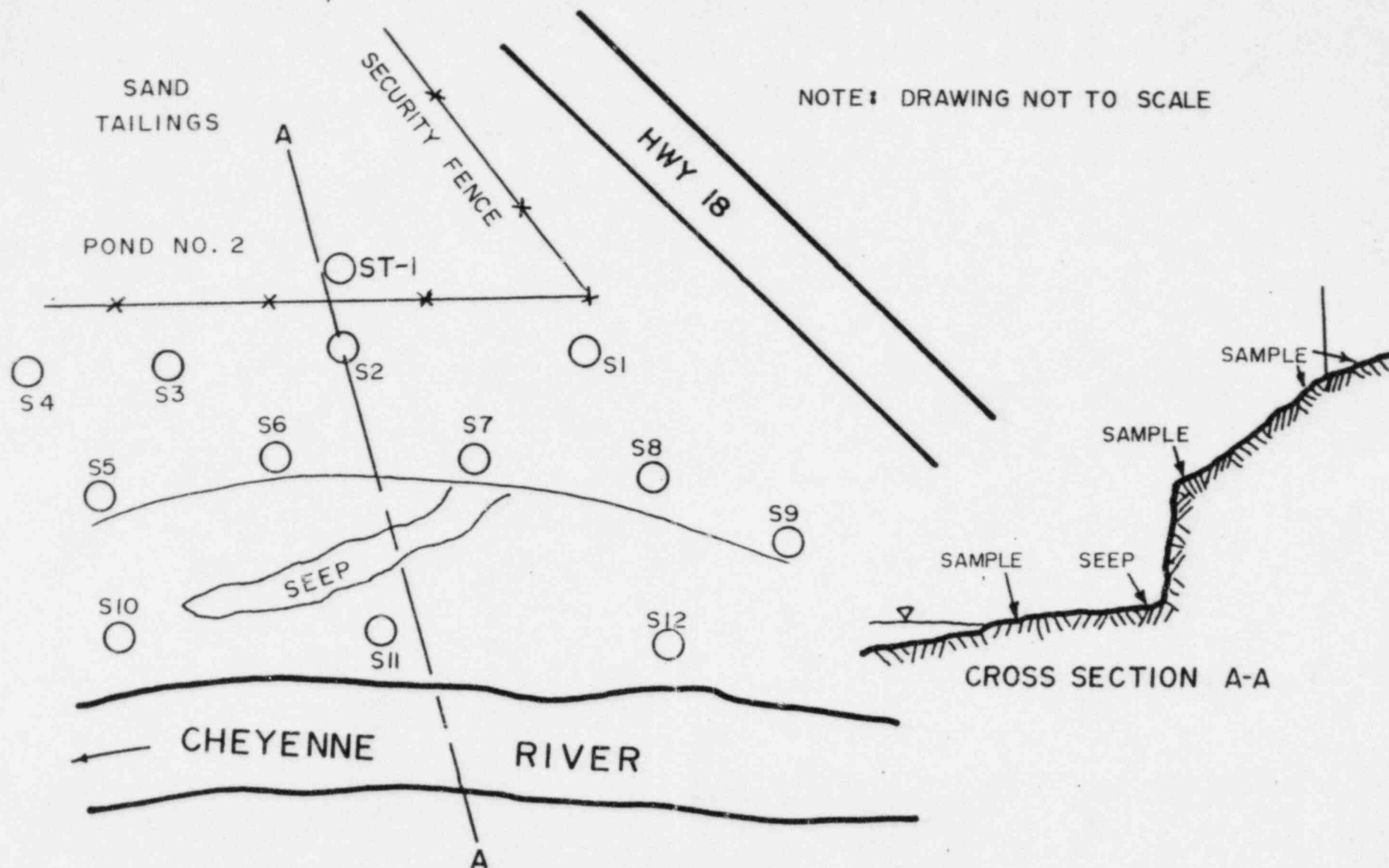
The field study eliminated any question regarding the transport of sand tailings from pile No. 1 into Cottonwood Creek by erosive action during periods of high runoff and/or wind action. Such transport was documented by the analysis of bottom sediment samples as well as visual observation of the common boundary between the creek and the tailings pile for a distance of several hundred feet. One small section of this common boundary is shown in Figure IV (photograph taken on October 3, 1972 - low flow condition). Similar documentation was obtained for the loss of sand tailings from the Pond No. 2 storage area. Soil samples collected at thirteen locations on the Cheyenne River bank and the dry stream bed adjacent to Pond No. 2 (Figure V) showed that sand tailings had breached the security fence and were beginning to migrate down the slope. Radium-226 concentrations in samples collected just outside the fence - Stations S1, S2, S3, and S4 - were indicative of sample compositions approaching 25 to 50% sand tailings (Table X). Along the line marking the sharp increase in bank slope - Stations S5, S6, S7, S8, and S9 - background concentrations of radium-226 were found. These data suggested that a loss of solids to the river had and continues to take place, but the magnitude of the loss has not been large. Slightly elevated radium-226 concentrations in the dry stream bed - Stations S11 and S12 - were probably caused by seepage as opposed to sand tailings.

Sand tailings have sloughed from pile No. 2 onto the flood plain of Cottonwood Creek. This was evidenced by the mounds of "white" sand on the bench between the tailings pile and the creek channel. A grab sample from one of the mounds showed the presence of "pure" sand tailings - 162 pCi of radium-226 per gram. During periods of high flow, this is undoubtedly a source of contamination to the Cheyenne River system.

FIGURE IV

SAND TAILINGS PILE NO. 1 ALONG
STRETCH OF COTTONWOOD CREEK
OCTOBER 1972

131
100%



NOTE: DRAWING NOT TO SCALE

FIGURE V
SOIL SAMPLES COLLECTED FROM THE BANK

TABLE X
RADIOACTIVITY CONTENT OF SOIL SAMPLES COLLECTED
FROM THE CHEYENNE RIVER BANK ADJACENT TO THE
POND NO. 2 STORAGE AREA

<u>Station(a)</u>	<u>Radioactivity Content (dry weight basis)</u>		
	<u>Radium-226</u> <u>(pCi/g)</u>	<u>Uranium</u> <u>(ug/g)</u>	<u>Total Alpha</u> <u>Thorium (pCi/g)</u>
ST-1	43	14	4.7
S1	96	16	6.4
S2	46	5.4	5.5
S3	56	23	12
S4	54	19	8.2
S5	1.8	3.3	1.0
S6	2.0	3.3	0.4
S7	1.9	3.2	2.6
S8	2.1	4.3	0.9
S9	1.3	4.5	0.5
S10	---	---	---
S11	5.4	0.6	2.5
S12	5.3	4.1	0.7

(a) Refer to Figure V

Fish - Angostura Reservoir

Consistent with the background radioactivity levels in the water and bottom sediments of Angostura Reservoir, the analysis of fish samples showed extremely low concentrations of radium-226 and uranium in bone and edible tissue (flesh). Summarized in Table IX, all radium-226 results were less than 0.1 pCi per gram (dry weight) and all but one uranium result were less than 0.1 ug per gram. These data are identical with the results for fish collected from the reservoir during the September 1966 study. (1)

TABLE XI

RADIUM-226 AND URANIUM IN ANGOSTURA RESERVOIR FISH
AUGUST 1971

<u>Species</u>	<u>Number of Fish</u>	<u>Length (Inches)</u>	<u>Radium-226 (pCi/g)</u>	<u>Uranium (ug/g)</u>	<u>Radium-226 (pCi/g)</u>	<u>Uranium (ug/g)</u>
Carp	1	--	<0.1	<0.1	<0.1	<0.1
Channel Catfish	1	--	<0.1	<0.1	<0.1	<0.1
	3	--	<0.1	<0.1	<0.1	<0.1
Crappie	7	<10	<0.1	<0.1	<0.1	<0.1
Perch	4	--	<0.1	<0.1	<0.1	<0.1
Walleye	1	15	<0.1	0.6	<0.1	<0.1
	1	16	<0.1	<0.1	<0.1	<0.1
	1	20	<0.1	<0.1	<0.1	<0.1
	1	21	<0.1	<0.1	<0.1	<0.1

(a) Results refer to live weight

1.55
100/6

PROGRESS TOWARD POLLUTION ABATEMENT

Environmental Protection Agency personnel visited the mill on October 3, 1972, to discuss the efforts undertaken by Mines Development, Inc., to abate radiological pollution from the milling operation. The Company's overall program generally follows the points expressed by Mr. K. L. Hudson, District Manager, in his statement prepared for the Enforcement Conference record.⁽⁴⁾ Specific actions taken in the period of about one year following the Conference are described below together with an assessment of the probability of success in resolving the existing problems.

Liquid Waste Management

The operational changes instituted to eliminate seepage from mill ponds involve the operation of ponds at reduced static heads, i.e., smaller holding volumes than was the practice prior to 1972 and a long-term program of new pond construction. Mines Development, Inc., personnel view the seepage problem as one caused by the deterioration of the ponds with age complicated by excessive fluid pressure on embankments. Therefore, by operating the ponds with lower embankment pressures and systematically abandoning "old" ponds, it is believed that the seepage problem can be eliminated.

Several changes in the pond system have been made since October, 1971, consistent with the above analysis of the problem. Pond No. 10 (75 million gallon capacity) was constructed and became operational in February, 1972, replacing Pond No. 1 for vanadium raffinate storage. The reason for the abandonment of Pond No. 1 was to eliminate one source of direct seepage to the Cheyenne River. Although the stored raffinate was being pumped out of the pond at the time of the mill visit, the liquid level indicated that Pond No. 1 had been in a static state for the bulk of the year; consequently, a continued source of seepage. Pond No. 3 has been drained and the deposited slimes are being mined for vanadium recovery. Based on Mr. Hudson's statement to the Enforcement Conference,⁽⁴⁾ this pond will also be abandoned at the completion of this mining activity. The two other significant changes involve Ponds No.'s 8 and 9 (formerly No. 10). These ponds were converted from a contingency status to active process ponds. Table XII summarizes the operational functions of the various ponds as of October, 1972, and the changes in the pond system since the 1971 field study.

Through October, 1972, significant improvement in the seepage problem was not evident. There was limited visual evidence to indicate that some reduction in the seepage flow to Cottonwood Creek had occurred since the high bank to the west and north of Pond No. 7 was dry in appearance. In 1971, this same area was observed as moist (and "dripping") to a height over six feet above the water surface. However, damp sections on the creek bank just upstream of sand tailings pile No. 2 indicated that the seepage

TABLE XII
MILL PROCESS AND RETENTION PONDS

<u>Pond</u>	<u>Pond Use</u>	
	<u>October 1972</u>	<u>1971</u>
No. 1	Scheduled for abandonment; liquor is being pumped to No. 10.	Disposal of raffinate from the vanadium extraction circuit.
No. 2	Sand tailings storage.	Sand tailings storage.
No. 3	No liquid storage; deposited slime tailings are being mined for vanadium recovery.	Storage basin for vanadium-bearing liquor (blue liquor).
No. 4	"Polishing" sedimentation basin for vanadium-bearing liquor.	Not in use.
No. 7	Retention and storage of uranium sand tailings; water recycled for use as process water and repulping sand tailings for pumping to this pond.	Retention and storage of slime tailings and sand tailings; sedimentation basin to produce clarified blue liquor.
No. 8	Retention and storage of uranium slime tailings and flyash and slag residues from the vanadium circuit; sedimentation basin to produce clarified blue liquor.	Contingency.

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10/1

III. Long-term Radon Progeny Sampling

Long-term radon progeny sampling using either the Radon Progeny Integration Sampling Unit (RPISU) or the Measurement of Daughters (MOD) sampling unit may be required in any structure having a grab WL in the range 0.01 to 0.033WL and a radiation survey indicating the presence of residual radioactive material or an exposure rate less than 20 μ R/hr above background. Such long-term radon progeny samples shall be collected for at least 100 hours, every other month, for at least six samples during a yearly cycle.

IV. Soil Sampling

Soil sampling, both surface and at depth, shall be completed at specified locations to determine the concentrations of uranium decay chain series radionuclides (e.g., uranium, radium-226, thorium-230 and lead-210). The lower limit of detection shall be at least 0.50 pCi/gram of soil for radium-226 analysis, which may be used to determine compliance to the regulatory standards. Bore-hole logging to determine the presence of radium-226 at depths of up to 8 feet may also be required.

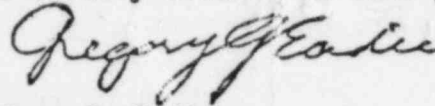
V. Engineering Assessment

An engineering assessment shall be completed at each structure which exceeds the EPA's standards for uranium mill tailings cleanup (i.e., as proposed in 40 CFR 192 of an annual average WL greater than 0.015, or having radium in soil greater than 5 pCi/g, or a gamma radiation exposure rate in excess of background of 0.02 mR/hr). The assessment shall provide a detailed map of all residual radioactive material deposits and volume estimates. Such information may be obtained by gamma radiation survey techniques, bore-hole logging techniques, or soil sampling and analysis.

VI. Remedial Action/Verification Program

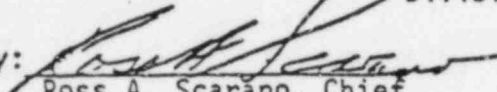
Remedial action shall be completed at any location where residual radioactivity has been identified and such material shall be removed and transported to the disposal site. A verification program shall be conducted which will utilize the same screening and measurement

program that was initially used for identifying involved structures and the verification program shall confirm that the EPA standards are met before any structure is finally cleared in this program.



Greg G. Eadie
Uranium Recovery Licensing Branch
Division of Waste Managment

Approved by:


Ross A. Scarano, Chief

Enclosures:

1. Figure 1
2. Interim HUD/South Dakota Radiation Survey Protocol

Docket 40-1341

JUN 9 1975

Mr. John A. Green
Regional Administrator
United States Environmental
Protection Agency
Region VIII
1860 Lincoln Street
Denver, Colorado 80203

Distribution:

LVGossick
WJDircks
KRChapman
HJLarson
RECunningham
RLFonner
LCrouse
WJ Kerr
RBChitwood
JERothfleisch
JFKendig
ELEins (EDO #8635)
GERTter (EDO #8635)
SECY (3)
MF:FCEP R/F

NMSS R/F
EDO R/F
Docket File (w/incoming)
NRC PDR (w/incoming)

Dear Mr. Green:

I am pleased to respond to your letter of April 25, 1975, to Chairman Anders concerning the suggestion that the Tennessee Valley Authority (TVA) develop an environmental impact statement for their proposed uranium milling operation at Edgemont, South Dakota.

Members of the Nuclear Regulatory Commission's Division of Materials and Fuel Cycle Facility Licensing and Office of the Executive Legal Director met with representatives of TVA on November 19, 1974, to discuss the need for an environmental report in connection with the license renewal for TVA's Edgemont, South Dakota uranium mill. At this meeting TVA reported that they expected to write an environmental impact statement on the mining operation. They were informed that, according to the procedures required by Title 10 of the Code of Federal Regulations, Part 51, the Nuclear Regulatory Commission will perform an environmental impact evaluation of the milling activities and operations based on environmental information submitted by TVA. At present, TVA plans to submit their environmental information by August 1, 1975.

Sincerely,

William J. Dircks
Assistant Executive Director
for Operations

cc: Sheldon Meyers
Office of Federal Activities
Environmental Protection Agency

SEE PREVIOUS YELLOW FOR CONCURRENCES

X7631/icm 6/3/75 OFFICE SURNAME DATE	MF:FCEP RBChitwood JFKendig 06/3/75	EDO WJDircks 06/03/75				
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*File
So. Dakota*

4
SEP 12 1975

Belting
So. Dakota
File

Mr. Melvin O. Nelson
Radiological Safety Specialist
Sanitation and Safety Program
Joe Foss Building
Pierre, South Dakota 57501

Dear Mr. Nelson:

This is in answer to the question in your letter dated August 5, 1975 concerning the TVA mill at Edgemont, South Dakota. Since the Tennessee Valley Authority is a government corporation, it would continue to operate under an NRC license even though South Dakota became an Agreement State. As required by the National Environmental Policy Act, the issuance of a license for a uranium mill must be accompanied by an environmental impact statement prepared by the staff of NRC. South Dakota will have the opportunity to comment on this action.

In connection with the termination of a uranium mill license, an environmental impact assessment will be performed. This may or may not result in the preparation of an environmental impact statement. Please refer to Sections 51.5(b)(8) and (c) of the enclosed 10 CFR 51 for NRC's requirements.

If you have any further questions concerning the Agreement State program, please let me know.

Sincerely,

Distribution:

✓ JFoulke
RBChitwood
JMFelton
NMSS: R/F
MF: AY R/F
MF: FCEP R/F

G. Wayne Kerr, Chief
Agreements and Exports Branch
Division of Materials and
Fuel Cycle Facility Licensing

Enclosure:
As stated

MF:AE	MF:AE	MFCEP
JFoulke/hkr	GWKerr	RBChitwood
9/ 175	9/ 175	9/ 175

84-20301-20
Lp

6
SEP 8 1976

Mr. George F. Murphy, Jr.
Executive Director
Joint Committee on Atomic Energy
Congress of the United States
Washington, D.C. 20510

Dear Mr. Murphy:

Your letter of August 11, 1976 transmitted a copy of a letter from Governor Kneip of South Dakota to Senator McGovern which expressed concern about the environmental impact of tailings from past uranium milling operations at Edgemont, South Dakota. You requested information for the Joint Committee regarding the issues raised by the Governor and the actions that the Nuclear Regulatory Commission (NRC) plans to take with respect to the public health aspects of mill tailings, such as exist at Edgemont. We believe the following information will clarify the status of the Edgemont mill and indicate the approach being taken by NRC with respect to development of waste management practices for uranium mill tailings.

In his letter, Governor Kneip provided a brief history of the Edgemont mill up through 1972, when the mill operator, Mines Development, Inc., ceased operations. Although mill operations have not resumed, the license for the mill issued by the Regulatory staff of the Atomic Energy Commission (AEC), now NRC, has remained in effect. In mid-1974 the Edgemont mill property was purchased by the Tennessee Valley Authority (TVA), and the mill license was officially transferred to TVA, with the approval of the AEC, on August 15, 1974. As indicated by the Governor's letter this license was due to expire in early 1976 (February); however, because TVA filed a timely application for renewal of the license in January 1976, this license remains in effect in accordance with the Administrative Procedure Act (5 U.S.C. Section 558) and NRC regulations until a final determination on the application is made by the Commission. Accordingly, although the uranium milling facility has been and will presently remain in an inactive status, TVA, as the owner, is responsible for proper management of the tailings on the site and is subject to NRC jurisdiction. In view of this, the Edgemont site does not appear to be a candidate for Phase II studies which have been directed toward abandoned mill tailings sites.

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SPF

The apparent confusion regarding site jurisdiction and responsibilities stated above was resolved at meetings between NRC staff members, representatives of the Environmental Protection Agency Region VIII and officials of the South Dakota Department of Health and Department of Environmental Protection on August 24 and 27, 1976, respectively. In conjunction with these meetings, the NRC staff members made a site visit and met with TVA officials on August 26, 1976.

While TVA has applied for renewal of the license and submitted an environmental report concerning the facility, as required by NRC, it has also indicated that there can be no operation of the mill until major refurbishment of the mill is accomplished. The extent of the refurbishment and modifications is currently under study by TVA. The full environmental impact of the planned future operations cannot be evaluated until these plans are completed and submitted to NRC. However, the NRC staff has initiated a review of the environmental impact of the existing tailings. TVA is presently conducting an environmental monitoring program, including radon determinations, to provide additional data for this review. The NRC staff and its consultants for this environmental review (Argonne National Laboratory) will evaluate the licensee's data and conduct independent environmental sampling as necessary to complete the review. The results of this review will include an evaluation of environmental impacts of the existing tailings piles and the identification and assessment of alternatives for mitigating these impacts. This assessment will be included in the Environmental Impact Statement which will be published for the Edgemont mill.

Over the near term, the site visit confirmed that not all of the existing tailings areas were sufficiently stabilized to prevent blowing of tailings off the property. Accordingly, the NRC staff is pursuing with TVA measures to correct this situation while the overall environmental assessment continues.

As you are aware, the Commission published in the Federal Register (41 FR 22430, copy enclosed) a notice of intent to prepare a generic environmental impact statement (GEIS) on uranium milling. As stated in the notice, the purpose of the GEIS will be to assess the environmental impacts of uranium milling operations, including the management of uranium mill tailings, and to provide an opportunity for public participation in decisions

Mr. George F. Murphy, Jr.

-3-

concerning any proposed changes in NRC regulations or regulatory authority based on this assessment. The GEIS will identify and evaluate alternatives for mitigating the environmental impacts of uranium milling and provide a cost-benefit analysis of the alternatives. The environmental assessment will incorporate, as appropriate, data and information that is being developed by the ERDA-EPA Phase II studies now being conducted on certain abandoned tailings piles. It is expected that completion of the draft GEIS will require approximately two years. During the conduct of the associated studies and preparation of the GEIS, the NRC staff and its consultants plan to solicit the views, comments and recommendations of appropriate officials in affected States, such as South Dakota.

It should be noted that in the announcement of its intent to prepare the GEIS, the Commission stated that it will continue to review applications for renewal of existing licenses for uranium milling and new uranium milling licenses on a case-by-case basis. These licensing actions during the interim period will be accompanied by individual environmental impact statements. The Commission further stated that any such licensing actions taken in this interim period will be subject to the express condition that any approved waste generating processes and mill tailings management practices may be subject to revision in accordance with the conclusions of the final GEIS and any related rule making.

If you should have any further questions regarding this matter, please let me know.

Sincerely,

(Signed) Lee V. Gossick

Lee V. Gossick
Executive Director for Operations

Enclosure:
Federal Register Notice

[PRM 40-21]

URANIUM MILLING

Intent to Prepare a Generic Environmental
Impact Statement

On May 14, 1975, the Nuclear Regulatory Commission (NRC) published in the *FEDERAL REGISTER* (40 FR 20983) a notice that a petition for rule making had been filed with the Commission by the *Natural Resources Defense Council, Inc.*

The petitioners requested the Commission to issue regulations that would (a) require uranium mill operators licensed by the Commission to post a performance bond that would cover the cost of

uranium mill tailings, and the Agreement State to require uranium mill operators licensed by the Agreement State to post a similar performance bond.

The petitioners also requested the Commission to proceed immediately with the preparation of a draft programmatic environmental impact statement on the the Commission's uranium milling regulatory program, including that part of the mill licensing program administered by Agreement States. Further, the petitioners requested the Commission to issue or renew no licenses during the time the environmental impact statement is being prepared that would permit a licensee to escape any new regulations promulgated as a result of the requested environmental impact statement.

Interested persons were invited to submit comments on the petition by July 14, 1975. In view of the interest which was shown in the subject matter of the petition, the comment period was extended to August 28, 1975. Thirty-one responses from varying sources were received within the comment period. (Copies are on file at the Commission's Public Document Room, 1717 H Street, N.W., Washington, D.C.)

After giving due consideration to the petition, the comments received, and the history of uranium mill tailings management practices, the Commission believes that, from the standpoint of longer range policy, this matter can be profitably examined in a programmatic context. It views the preparation of a generic environmental statement as a suitable vehicle for such an examination.

Accordingly, notice is hereby given that the Nuclear Regulatory Commission (NRC) will prepare a generic environmental impact statement (GEIS) on uranium milling operations. The purpose of the GEIS will be to assess the environmental impact of uranium milling operations, including the management of uranium mill tailings, and to provide an opportunity for public participation in decisions concerning any proposed changes in NRC regulations or regulatory authority based on this assessment. Information pertinent to the environmental impact from uranium mill operations in both Agreement and non-Agreement States will be included. It is anticipated that the draft GEIS will be published in approximately two years.

The Commission also has given careful consideration to petitioners' request that licensing actions involving renewal of licenses for existing uranium mills and the issuance of licenses for any new mills should be deferred pending completion of the generic environmental impact statement. In considering this matter, the Commission noted that most of the presently operating uranium mills licensed by the NRC are subject to renewal licensing action during the contemplated interim period. The production capacity of the existing uranium mills in both Agreement States and non-Agreement States slightly exceeds the fuel require-

ments. However, the full capacity of existing mills will be required to support presently operating nuclear power reactors and those expected to begin operation in 1977. Additional uranium milling capacity will be required to support nuclear power reactors now under construction with operational dates of 1978 and beyond. Since approximately two years is required to complete the construction of a mill, new mills expected to begin production in 1978 will require NRC licensing action in 1976 and 1977 if a uranium mill short-fall is to be avoided. However, the number of new mills expected during this interim period is small.

In light of the above, a deferral of licensing actions on new mills or suspension of present milling activities during the interim prior to completion of the GEIS would result in substantial shortages of necessary domestic uranium fuel for operating nuclear power reactors. The Commission has concluded that there should be no such general deferral during the period required for preparation of the generic statement, and that licensing actions may continue during the interim period subject to certain conditions. In reaching this conclusion, the Commission considered the following specific factors:

(1) It is likely that each individual licensing action of this type would have a utility that is independent of the utility of other licensing actions of this type;

(2) It is not likely that the taking of any particular licensing action of this type during the time frame under consideration would constitute a commitment of resources that would tend to significantly foreclose the alternatives available with respect to any other individual licensing action of this type;

(3) It is likely that any environmental impacts associated with any individual licensing action of this type would be such that they could adequately be addressed within the context of the individual license application without overlooking any cumulative environmental impacts;

(4) It is likely that any technical issues that may arise in the course of a review of an individual license application can be resolved within that context; and

(5) A deferral on licensing actions of this type would result in substantial harm to the public interest as indicated above because of uranium fuel requirements of operating reactors and reactors now under construction.

During preparation of the GEIS, the Commission will continue to review applications for renewal of existing licenses for uranium milling and for new uranium milling licenses on a case-by-case basis. These licensing actions during the interim period will be accompanied by individual environmental impact statements tailored to the facts of the case. Since the Commission's general conclusions with respect to the five factors, as set forth above, may not fit the factual circumstances of particular licensing actions, the five factors will be applied,

text of these statements in reaching licensing determinations. The NRC will continue its program of assuring that adequate financial security arrangements, through bonding or other feasible methods, are made for the reclamation and stabilization of mill tailings. Any licensing actions that are taken will be subject to express conditions that approved waste generating processes and mill tailings management practices may be subject to revision in accordance with the conclusions of the final GEIS and any related rule making.

The determinations to prepare a generic environmental impact statement and to continue processing related applications in the interim subject to specified criteria are a partial response to the petition of the Natural Resources Defense Council, Inc. Other aspects of the petition, such as regulations covering financial responsibility for uranium mill waste management over the long-term, have not been decided at this time. It is the intention of the Commission that proposed rules be published for public comment no later than the time of publication of the final GEIS. The content of these rules will be developed out of the information derived from the preparation of the GEIS and the conclusions resulting from the assessment of alternatives.

Dated at Washington, D.C., this 1st day of June 1976.

For the U.S. Nuclear Regulatory Commission.

SAMUEL J. CHALK,
Secretary of the Commission

[FR Doc. 76-10287 Filed 6-2-76; 9:24 am]

2. Dakota
710

Tennessee Valley Authority
ATTN: Mr. Godwin Williams, Jr.
Manager, Power
830 Power Building
Chattanooga, Tennessee 37401

On August 26, 1976 NRC staff members, accompanied by our consultant from Argonne National Laboratory, made a site visit to your Edgemont, South Dakota uranium milling plant. It was observed that some of the tailings piles generated by past operations were in various stages of reclamation. It was also observed, however, that tailings ponds numbers 3, 7, 8, 9 and 10 were not covered and that loose tailing sands from pond #7 were blowing onto unrestricted areas.

Since the mining and reprocessing of uncovered tailings for vanadium values will not be accomplished for years, if at all, it is not reasonable to wait to take care of the erosion problem. Measures to eliminate the blowing of tailings onto unrestricted areas must be taken promptly.

Accordingly, provide us with detailed plans to stabilize, on an interim basis at least, the loose sand tailings area in the south-east corner of pond #7 no later than November 15, 1976. The submission should include an initiation and completion schedule for the stabilization plans that would lead to an early resolution of this problem.

[illegible]

Form ABC 119 (Rev. 9-2013) ABCM 0202

☆ U.S. GOVERNMENT PRINTING OFFICE: 1974. 895,100

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-2-

Enclosed you will find a report from our consultant regarding the site visit. The report includes recommendations for interim stabilization and monitoring techniques.

Sincerely,

L. C. Rouse, Chief
Fuel Processing & Fabrication Branch
Division of Fuel Cycle and
Material Safety

Enclosure:
As stated

cc: Miss Judith K. Call, Secretary
Department of Health
State of South Dakota

Dr. Allyn Lockner, Secretary
Department of Environmental Protection
State of South Dakota

John A. Green, Regional Administrator
United States Environmental Protection Agency



ARGONNE NATIONAL LABORATORY

September 2, 1976

Mr. Ross Scarano
Fuel Process and Fabrication Branch
U.S. Nuclear Regulatory Commission
Washington, D. C. 20555

Dear Mr. Scarano:

In view of our conversation of September 1, 1976, I have been pursuing the question of interim stabilization of the sand tailings at the Edgemont, S.D. Uranium Mill.

Although I have obtained information from a number of sources, both verbal and published, I believe the best method to be considered is that stated in the enclosed article by Karl C. Dean and Richard Havens of the Salt Lake City Metallurgy Research Center, U.S. Bureau of Mines, Salt Lake City, Utah. This is the same branch of the U.S. Bureau of Mines mentioned in the TVA Environmental Information Report, Edgemont, S.D., Uranium Mill (pp. 126 and 128), and which Gary Krantz mentioned was assisting them in the mill tailings stabilization effort.

The enclosed article is quite informative, and takes the three-pronged approach which others have used in mill tailings stabilization: (1) physical coverings, including incorporation or use of restraining materials, (2) chemical stabilizers, especially elastomeric polymers to form surficial crusts, and (3) biological control in terms of a "permanent" vegetative covering. (I would include algal-lichen-moss establishment as well as tree-shrub-grass-forbe as a climax vegetative community.) They do not mention the use of earth barricades such as is being attempted to restrain the sand movement at Edgemont pond #7.

I would concur with the U.S. Bureau of Mines article -- see Table No. 5, and p. 472 -- that the combination chemical-vegetative method of stabilization appears to be the best in terms of (1) maximum effectiveness, (2) minimal maintenance, and (3) least cost. I believe that this method should be given primary consideration for stabilization of the Edgemont sand tailings, and especially for the interim stabilization of the very mobile sand tailing in the east and southeast end of tailings pond #7.

The only method which is not mentioned in the report is asphalt emulsion, which could be rolled on or applied with a hydroseeder. This material could be considered for an interim period and the material would most likely disintegrate after several years of weathering. As with the aforementioned method, it could be applied only to the sand tailings and not the entire pond area. In that a ready supply of manure is available to TVA at Edgemont, this organic material also could be considered for spreading on the tailings, concurrent or subsequent to application of the chemical-vegetative method -- the addition of organic matter is highly desirable as a mulch, fertilizer, and a substrate for establishment of vegetative growth.

A monitoring effort also could be established for the southeast end of tailings pond #7. To be considered for the monitoring are (1) the placement of depth markers (wooden stakes or even marked cribbing) leeward and windward of the tailings to quantify sand movement, (2) periodic photographic documentation (IR also could be included for vegetation distribution), (3) elevated particulate collectors, e.g., gummed slides on posts which could later be examined microscopically for numbers and kinds of particles and chemically for radioactivity, (4) placement of a wind recorder for wind direction - frequency-velocity measurements, and (5) other micrometeorological instrumentation to include an in situ net thermal exchange radiometer, recording evaporimeter and portable hygrothermograph. The instrumentation would be particularly useful for data gathering and interpretation for establishment of a "permanent" vegetative cover for reclamation purposes.

Although the Bureau of Mines is studying the ability of xeric (drought tolerant or resistant) shrubs to become established on the steep slopes of East Tailings #3, and they recommend Indian ricegrass (not only a xeric plant, but also recommended as a nitrogen-fixer), additional plants also could be recommended such as Sudan grass, which also does well in xeric situations. It appeared that two species of dune grasses already were becoming established in the marginal sand at pond #7, and these should be further observed and considered as candidate species for stabilization and/or reclamation purposes.

As for reclamation per se, it should be the long-term goal for uranium mill tailings, even though the areas will be essentially isolated by fencing. Establishment of an "enduring" or regenerating vegetation (perennial and annuals, both higher plants and cryptogams) should be a major goal, not only for stabilization against wind and water erosion, but also for aesthetic reasons. (Favorable microbial-plant-soil relationships also need to be established.) However, it might be considered that the plants may act as "radon pumps" in arid and semi-arid areas where high evapo-transpiration rates prevail. (This could possibly be ameliorated by irrigation procedures.)

Finally, although the TVA Environmental Information Report for the Edgemont Uranium Mill appears to be cognizant of the need for sand tailings stabilization and indicates they have received "considerable attention," (p. VII), observations at the site indicate that "considerable attention" is rather qualitative at this point in time and subject to interpretation,

and much work is still needed. The pond sand tailings especially should not be left "open," regardless of the future intent to mine the pond tailings for vanadium, and the earth barrier erected at the southeast end of pond #7 should not by any means be considered as the ultimate solution to stabilization. Also, observations of the "East" sand tailings did not, in my estimation, indicate the site "to be covered by a growth of vegetation on all of the benches and top surface area." (p. 128) -- again, a qualitative statement open to interpretation!

These are my thoughts and recommendations on the Edgemont situation. Do let me know if you have questions or comments or desire further information. I will send you copies of all correspondence which pertain to or may assist us in regard to the Edgemont Uranium Mill tailings stabilization and reclamation.

As mentioned, I will be visiting the Lucky Mac and Western Nuclear plants in Wyoming next week along with other ANL team members. Also, subsequent efforts will be made to visit and determine the research efforts of ERDA-funded projects for reclamation of abandoned or inactive uranium mill tailings. So far as I am aware, these projects are being undertaken by (1) Ford, Bacon and Davis Utah, Inc., especially for the Vitro site at Salt Lake City, (2) Batelle Northwest Lab, for a study of effectiveness of asphalt emulsion on tailing stabilization, and (3) several studies by the Los Alamos Lab at a site near their Lab and at Grants, New Mexico. I am also contacting Benny Benally, one of the "students" of our Land Reclamation Training Program at Navajo Community College, who is employed by the Navajo Environmental Protection Commission and is responsible for monitoring uranium mine and mill "cleanup" on tribal lands.

Sincerely,

Roy E. Cameron

Roy E. Cameron, Deputy Director
Land Reclamation Program

enclosure

cc: P. Gustafson
W. Hallett
L. Link
M. Novik
W. Sinclair



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

NOV 18 1976

Ref: SAP/GWK

MEMORANDUM FOR: Robert G. Ryan, Director
Office of State Programs

SUBJECT: NOVEMBER 8, 1976 LETTER FROM GOVERNOR KNEIP, SOUTH DAKOTA,
TO LEE GOSSICK

I have discussed the attached letter with NMSS staff and obtained clarifying information from Colorado.

As I understand it, the Phase II studies were concerned with only those tailings sites where there was no longer an active license and the tailings had been "abandoned" or were in an inactive state. The Edgemont mill in South Dakota was shut down but there was always a license in effect since TVA planned to begin operations again. As of 11/17/76 I understand NRC will discuss with ERDA the possibility of placing the Edgemont mill in the Phase II study program.

With regard to the Rifle, Colorado mill, I have been informed by Colorado that they have a license in effect for storage of gauges and a small R&D heap leach operation. However, they are not processing ore for production purposes. Therefore, it was included in the Phase II studies.

With regard to the Riverton, Wyoming mill, it was not originally on the list for Phase II studies. This was because, although the mill per se no longer existed, the license continued in effect under timely renewal provisions of the regulations. The licensee later filed a request for termination of the license and ERDA was then requested to include Riverton in the Phase II studies.

It appears that if ERDA includes the Edgemont mill in the Phase II studies, most of Governor Kneip's concerns will have been resolved. NMSS staff is in the process of responding to all aspects of the Governor's letter.

With regard to the latter part of Governor Kneip's letter, NRC expects TVA to furnish the same kind of information regarding long-term maintainance and monitoring guarantees as we would of a non-government applicant.

G. Wayne Kerr

G. Wayne Kerr, Assistant Director
for State Agreements Program
Office of State Programs

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IP.



STATE OF SOUTH DAKOTA

RICHARD F. KNEIP
GOVERNOR

EXECUTIVE OFFICE

PIERRE
57501

November 8, 1976

Lee D. Gossick, Executive Director for Operations
Nuclear Regulatory Commission
Washington, D.C. 20555

James L. Liverman, Assistant Administrator for Environment and Safety
Energy Research and Development Administration
Washington, D.C. 20545

Dear Mr. Gossick and Mr. Liverman:

I am advised that personnel of the South Dakota Department of Environmental Protection have reviewed your respective comments to Mr. George Murphy concerning the designation of the Tennessee Valley Authority Uranium Mill at Edgemont, South Dakota, for Phase II studies.

I now think several points need to be clarified before the State of South Dakota can be assured that the licensing of the mill by N.R.C. provides adequate control for existing tailings.

While it has been explained to us that Phase II is not intended to include active mills, it is our understanding that there are two licensed mills presently included under Phase II, one at Rifle, Colorado, and the other at Riverton, Wyoming. The Riverton Mill is believed to be in the same situation as the Edgemont Mill, licensed but inactive. In your views, how does the Edgemont site differ from those in Colorado and Wyoming?

A letter to Mr. Murphy dated September 8, 1976, and signed by Mr. Gossick states: "Apparent confusion regarding site jurisdiction responsibilities stated above were resolved at meetings between N.R.C. staff members . . ." This statement is only partially true. Mr. Ross Scarano did explain that N.R.C. licensing of the T.V.A.'s mill subjects the stabilization of the tailings to conditions which may be written into the license, but he has also disclaimed

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APP

Mr. Gossick and Mr. Liverman

November 8, 1976

Page Two

any responsibility of N.R.C. to study the adverse health impacts of these tailings on the people of Edgemont, as suggested in Apendix I, prepared by the South Dakota Department of Health. At the present time this matter has not been resolved, and since the health impacts of the tailings seem to be within the scope of Phase II, but not within the jurisdiction of any governmental agency, we believe that the possible health impacts alone warrant Phase II designation.

One final point of concern to the South Dakota Department of Health personnel, is the possibility that, upon completion of an environmental statement for the reconstruction of the Edgemont Mill, that T.V.A. may be forced to relocate their mill to a site away from the town and a major river drainage. If at that time, T.V.A. abandons the existing mill site or conducts only minimal maintenance activities, what is N.R.C.'s recourse? Is T.V.A. legally responsible for perpetual care of the tailings generated by the previous mill operators? Will Phase II designation be available three or more years hence?

This concern is intensified by T.V.A.'s response to an N.R.C. comment to T.V.A.'s environmental information report. I quote the comment and its response verbatim:

N.R.C. comment: "When dealing with the private sector of the industry the N.R.C. required the applicant to post a bond or provide other financial commitments to guarantee that tailing areas will be stabilized and long-term maintenance and monitoring will be performed. Though the commitments for stabilization and long-term maintenance in this licensing action may be atypical, please indicate what guarantees T.V.A. will offer to provide assurance that stabilization and long-term maintenance and monitoring will be accomplished. Also, define those restrictions or covenants which will be placed on the tailing areas and indicate how this will be accomplished."

T.V.A. response: "T.V.A. is an agency and instrumentality of the United States and is required by law to assure an ample supply of electricity to the area it serves at rates as low as are feasible. T.V.A.'s acquisition and planned operation of the Edgemont facility is in furtherance of this statutory responsibility and is purely a governmental function . . . As a federal agency, T.V.A. is subject to the provisions of the National Environmental Policy Act and Executive Order 11752. As you know, these require federal agencies to provide leadership in the protection and enhancement of environmental quality, to factor environmental values into the federal decision-making process, and to comply with all substantive federal, state, and local requirements respecting the control and abatement of environmental pollution. Accordingly, T.V.A. will investigate all reasonable alternatives and assure the long-term stabilization of tailings areas. In the event of future disposal of the Edgemont property after the decommissioning, long-term stabilization could be assured by appropriate deed restrictions or other measures . . . Beyond the above commitments, T.V.A. does not presently propose to offer any specific performance guarantees. In our opinion

Mr. Gossick and Mr. Liverman

November 8, 1976

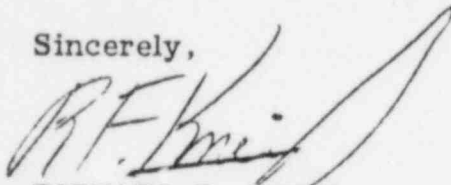
Page Three

special performance guarantees from one federal agency to another are entirely unnecessary and inappropriate. T.V.A. engages in many activities which can potentially result in effects on the environment such as the construction and operation of nuclear-powered steam plants. These activities are in part regulated by other federal agencies and in no case is T.V.A. required to guarantee the performance of environmental compliance to another federal agency."

The above comments do not instill within us a feeling of security, but rather a curious feeling that the matter is not so well in hand as we have been lead to believe. In light of these lingering doubts, we have no alternative but to again formally request Phase II designation for the Edgemont Uranium Mill.

I respectfully request your immediate attention to this matter and I will be awaiting your early reply. With every best wish, I remain

Sincerely,



RICHARD F. KNEIP
GOVERNOR

RFK/mrd

Enclosures

P.S. The attached enclosures provide additional information on this matter.

cc: Senator James Abourezk
Senator George McGovern
Representative James Abdnor
Miss Judith K. Call, Secretary
South Dakota Department of Health
Dr. Allyn O. Lockner, Secretary
South Dakota Department of Environmental Protection
Mr. Paul Smith
Region VIII, U.S. Environmental Protection Agency

APPENDIX I: Prepared by the South Dakota Department of Health

Of serious concern to the people of South Dakota is the relationship between radiation exposure and cancer, specifically respiratory cancer. This relationship is well documented by reports from the Environmental Protection Agency and in a joint publication of the National Institute for Occupational Safety and Health and National Institute of Environmental Health Sciences.² However, these documents do not contain specific documentation of studies performed on populations around active or inactive uranium mill tailing piles. The EPA document does portend to establish projected increases but is based on theoretical and extrapolated data from uranium mine workers and others.

As a result of the potential reactivation of the Edgemont, South Dakota milling facility, a statistical investigation of cancer death rates was conducted to see if proximity to a potential hazard resulted in a significant difference between that area and the remainder of South Dakota. Due to data limitations the whole of Fall River County in which Edgemont is located was compared with the remainder of South Dakota. The comparison included sixteen years of data, from 1960 thru 1975. Mortality figures were obtained from the South Dakota Public Health Statistics Program.³ Midyear population estimates were also obtained from the South Dakota Public Health Statistics Program.⁴

From the data, death rates due to cancer were calculated and plotted for the state and for the county (FIGURE 1). The plot indicated that a real difference in death rates may exist. Testing this hypothesis via a one-way Analysis of Variance yielded the following summary table:

SOURCE OF VARIATION	DEGREES FREEDOM	MEAN SUM SQUARES	F
EXPLAINED	1	2.9296	12.4314
UNEXPLAINED	30	.23566	
TOTAL			

South Dakota Mean = 1.5067

Fall River Mean = 2.1118

Grand Mean = 1.8092

The ratio of explained variation to unexplained (error) variation yielded an F-statistic of 12.43 which is significant at the $\alpha = .01$ level ($F \geq 7.56$). This means that there is one chance in every one hundred trials of such a difference occurring randomly.

Further inquiry using only respiratory cancer death data and similar methodology suggested that Fall River County rates differed from respiratory cancer mortality for the state as shown in FIGURE 2. A one-way Analysis of Variance again showed that a statistically significant difference existed between Fall River County and South Dakota as shown in the following table:

SOURCE OF VARIATION	DEGREES FREEDOM	MEAN SUM SQUARES	F
EXPLAINED	1	.4219	14.338
UNEXPLAINED	30	.0294	
TOTAL			

South Dakota Mean = .2251

Fall River Mean = .4547

Grand Mean = .3399

The results were significant at the alpha = .001 level ($F = 13.29$), i.e. such a difference occurring randomly one time in a thousand.

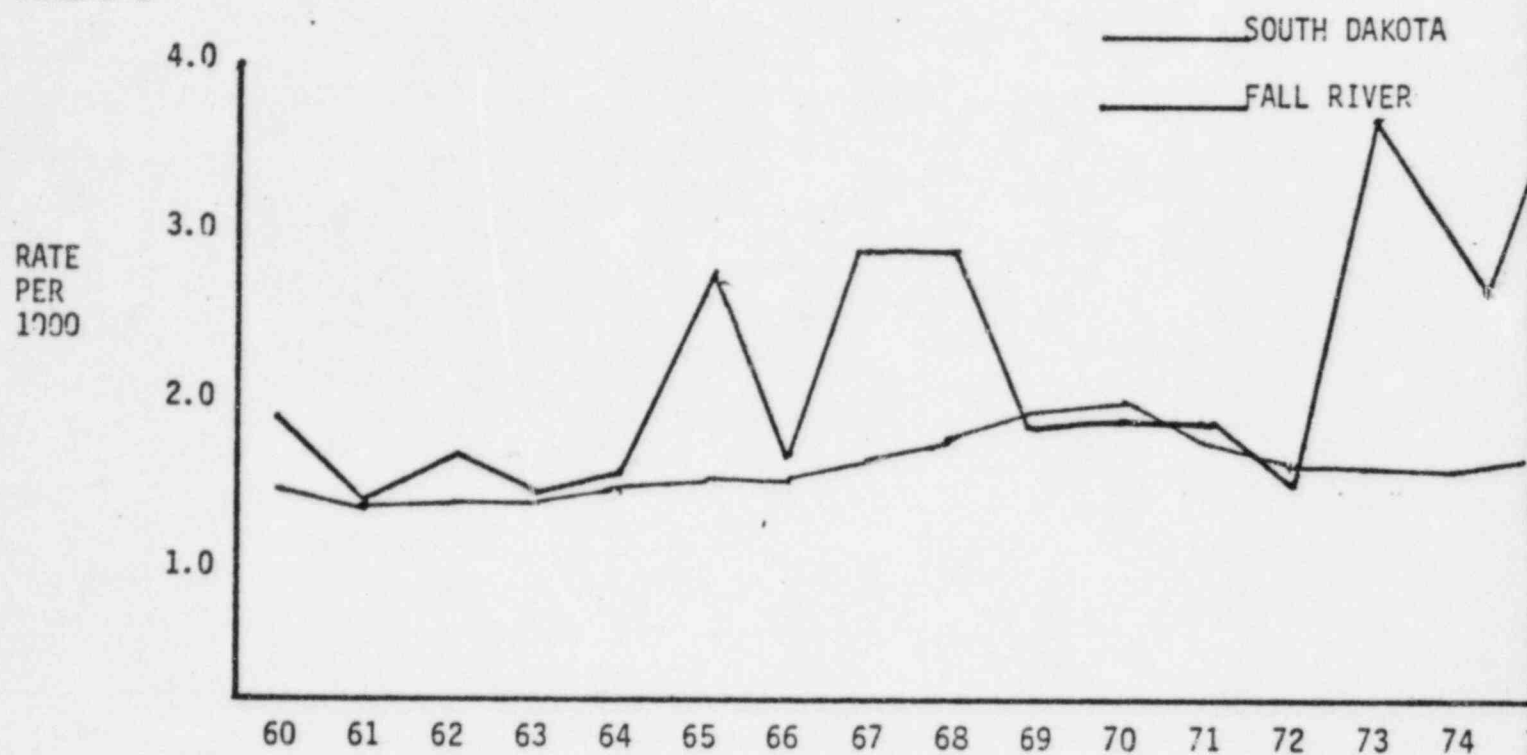
Tests were also conducted of the respiratory cancer rates for three cells within the 1960 - 1975 interval. Only the six year cell from 1970 - 1975 proved significant at the .05 level ($F = 4.96$). The fact that only the latest group proved significant may be a reflection of the time lag between the onset of radiation exposure and the development of a malignant neoplasm, as shown in uranium mine experiences.³

While available data limitations, especially those of age distribution, length of residence, employment history and small number epidemiology, restrict the total value of this investigation, it does illustrate that much additional study is warranted. It is inconceivable that consideration of reopening the Edgemont facility without a detailed examination of the population of Fall River County to explain these highly significant variations.

CANCER DEATH RATE, ALL AGES, ALL CAUSES

○ SOUTH DAKOTA VRS FALL RIVER CO
1960-1975

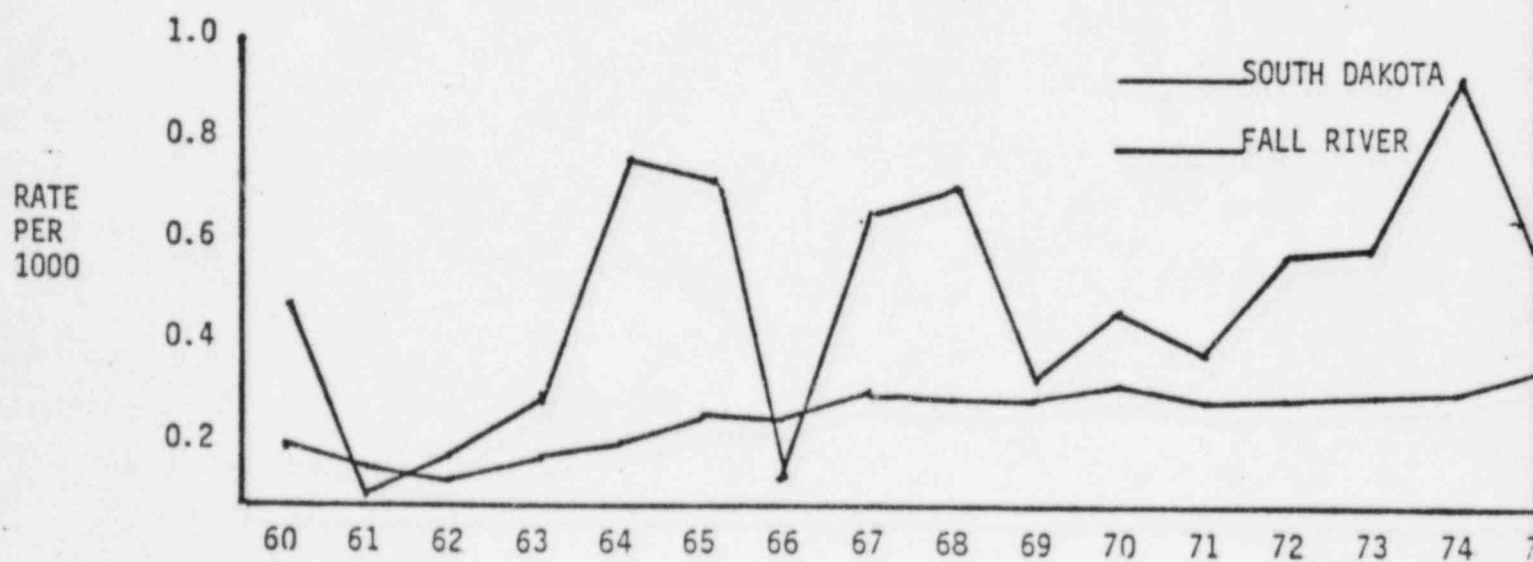
FIGURE 1



RESPIRATORY CANCER DEATH RATE, ALL AGES, ALL CAUSES

SOUTH DAKOTA VRS FALL RIVER CO.
1960-1975

FIGURE 2



SOUTH DAKOTA

YEAR	CANCER DEATHS	RESPIRATORY CANCER DEATHS	POPULATION*
1960	1,006	129	683,000
1961	984	106	693,000
1962	997	106	705,000
1963	1,002	122	708,000
1964	1,019	144	701,000
1965	1,030	147	692,000
1966	1,004	140	683,000
1967	1,095	155	671,000
1968	1,112	158	669,000
1969	1,133	162	668,000
1970	1,094	188	666,257
1971	1,159	173	674,000
1972	1,132	185	680,000
1973	1,147	192	681,899
1974	1,144	201	681,386
1975	1,128	212	683,291

* Only 1960 and 1970 figures are Census counts, all other years are Census Bureau estimates.

FALL RIVER

YEAR	CANCER DEATHS	RESPIRATORY CANCER DEATHS	POPULATION*
1960	21	5	10,688
1961	16	1	11,000
1962	20	2	11,100
1963	16	3	10,900
1964	17	8	10,900
1965	26	7	9,900
1966	13	1	8,200
1967	21	5	7,600
1968	20	5	7,200
1969	12	2	7,100
1970	13	3	7,505
1971	14	2	8,100
1972	12	4	8,300
1973	28	4	8,200
1974	20	7	8,224
1975	28	5	8,372

* Only 1960 and 1970 figures are Census counts, all other years are Census Bureau estimates.

1. POTENTIAL RADIOLOGICAL IMPACT OF AIRBORNE RELEASES AND DIRECT GAMMA RADIATION TO INDIVIDUALS LIVING NEAR INACTIVE URANIUM MILL TAILINGS PILES, U.S. Environmental Protection Agency, Office of Radiation Programs, January 1976.
2. RADON DAUGHTER EXPOSURE AND RESPIRATORY CANCER QUANTITATIVE AND TEMPORAL ASPECTS, U.S. Department of Health, Education and Welfare, Public Health Service (Joint Monograph No. 1, 1971), P. 111.
3. SOUTH DAKOTA VITAL STATISTICS DEPARTMENT of Health, Public Health Statistics, annual reports 1960 - 1975, and unpublished mortality data of the Public Health Statistics Program.
4. SOUTH DAKOTA VITAL STATISTICS DEPARTMENT of Health, Public Health Statistics, annual reports 1960 - 1975. Estimates since 1970 have been in cooperation with the United States Bureau of the Census.

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TENNESSEE VALLEY AUTHORITY
KNOXVILLE, TENNESSEE

②

OFFICE OF THE BOARD OF DIRECTORS

NOV 29 1978

S. Sahota
File

Dr. Joseph M. Hendrie, Chairman
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Dr. ^{JM}Hendrie:

With your October 6, 1978, letter to me you sent a memorandum from C. V. Smith and expressed a need to discuss TVA's Edgemont Uranium Mill.

On October 24, 1978, our staffs met to discuss the ultimate disposal of tailings at TVA's Edgemont facility and your staff's rationale for stating that permanent onsite disposal of tailings at Edgemont was unacceptable. In the meeting, NRC representatives indicated that such items as long-term concerns for erosion, seepage into ground water, and possible conflict with yet-to-be-issued EPA regulations were their primary reasons for concern with onsite disposal.

As a result of this meeting, we understand better the NRC staff position regarding this problem. Onsite disposal will not be proposed. TVA is continuing its evaluation of alternative decommissioning plans for the Edgemont facility taking into account your staff's views and will provide to the NRC staff by March 1, 1979, a decommissioning plan and environmental report pursuant to the amendment issued by your staff.

For these reasons, I believe a discussion between TVA and NRC, as suggested in your October 6, 1978, letter, is probably unnecessary at this time. However, if you believe that a meeting or discussion would be beneficial, please get in touch with me.

Sincerely,

One

S. David Freeman
Chairman

7901050193
to



STATE OF SOUTH DAKOTA

RICHARD F. KNEIP
GOVERNOR

EXECUTIVE OFFICE

PIERRE
57501

*Chapman
C. LUG
Ducks
[Signature]*

*Shelley Schwartz
Warren Kerr
#41*

*Will R
S. Dakota*

December 30, 1976

Lee V. Gossick, Executive Director
for Operations
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Gossick:

Thank you for your letter of December 27th which was sent in reply to my earlier letter of November 8th concerning the matter of uranium mill tailings at Edgemont, South Dakota.

I am pleased to note that after consultation with appropriate governmental agencies, the Nuclear Regulatory Commission has decided to proceed with our request that Phase II study of the Edgemont site be conducted as soon as possible.

As I indicated in my earlier communication, I and the members of my administration certainly do consider this a very serious matter and we are most pleased that you concur that before any further action is taken that the Phase II study must be conducted. I do ask that you continue to keep me posted on this matter.

Best wishes for the 1977 New Year and I remain

Sincerely,

[Signature of Richard F. Kneip]
RICHARD F. KNEIP
GOVERNOR

RFK/mdg

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cc: Dr. Allyn Lockner, Secretary

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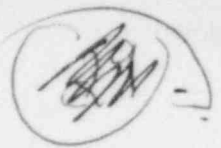
Department of Environmental Protection

Re EDO-1125

MEMO TO: ROSS SCARANO, NRC
FROM: ROBIN CARPENTER, SENATOR MCGOVERN
RE: EDGEMONT URANIUM DEVELOPMENT
June 14, 1979

If possible, McGovern would like you to cover the following points in your meeting with him. The same points should be covered in more detail for staff, whom you will meet with prior to McGovern.

1. History of mining and milling in Edgemont and NRC/AEC role in regulation, focusing on mill tailing disposal and milling operations.
2. NRC involvement with TVA after TVA purchased the milling facility and mineral rights in 1972. Overview of mill decommissioning study, environmental assessments, TVA mining plans.
3. What future analyses can be expect from NRC or TVA prior to actual mining and milling in the Edgemont area.
4. What is the status of Union Carbide plans in South Dakota?
5. The impact of uranium mining and milling and tailings disposal on area water supplies and water quality are the most important issues that must be resolved before South Dakota is going to allow any major uranium development. The state is already withholding a water permit from TVA until a contractual agreement is reached regarding water replacement. What are TVA's water requirements for mining, and milling? What role can the NRC play in assuring that water supplies and water quality will not be affected. In addition, we have serious concerns about in-solution mining due to the fractured land formation in this area. Does the NRC have any role in alleviating water related impacts that may develop as a result of this kind of mining.
6. It is our understanding that TVA has not made any final decision regarding their milling plans for uranium produced in South Dakota, although it looks as though they will not use the existing mill. Has TVA made any plans for locating a new mill in South Dakota and what would the water requirements of this mill be?
7. Please bring copies of any recent studies or plans submitted by TVA or Union Carbide or reports that you have developed pertinent to this issue.



Office of the Governor

STATE OF SOUTH DAKOTA

William J. Janklow
GOVERNOR

September 24, 1979

Mr. Jack Martin
Division of Waste Management
United States Nuclear Regulatory Commission
Washington, D. C. 20555

Dear Mr. Martin:

Members of my staff have reviewed the final draft of the Above Ground Gamma Ray Logging of Edgemont, South Dakota, and vicinity. The gamma ray logging survey was conducted in November of 1978, by the United States Environmental Protection Agency - Las Vegas, through a contract with the United States Nuclear Regulatory Commission. A list of participants on this 1978 survey is enclosed. Agencies represented include the United States Environmental Protection Agency, the United States Nuclear Regulatory Commission, Tennessee Valley Authority and the State of South Dakota. It is apparent after review of this document that additional analyses need to be conducted. Of immediate concern are the residents living in the Cottonwood Community. Actual radiation dosages to individuals living in the Cottonwood area must be determined in order to determine the health risks associated with living in this community. In addition to Cottonwood, soil samples from the Edgemont area where above-background radiation levels were found must be collected and analyzed to determine the source and extent of the radiation contamination.

The State of South Dakota's radiological laboratory equipment, finances and personnel are very limited, therefore, I am requesting, through you, that your agency join with the State of South Dakota, the United States Environmental Protection Agency and the United States Nuclear Regulatory Commission in a cooperative effort to: (1) determine the health risk for persons living in Cottonwood, and (2) determine the source and extent of radiation contamination in the Edgemont area. If your agency is able to take part in this cooperative effort, please contact Warren R. Neufeld, Secretary of the Department of Water and Natural Resources (605-773-3152) so a meeting can be arranged.

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State Capitol Building

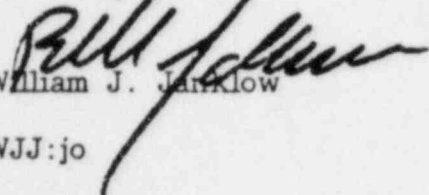
Pierre, South Dakota 57501

(605) 779-3212

Mr. Jack Martin
Page 2
September 24, 1979

Thank you for your time and consideration in this very important matter.

Sincerely yours,


William J. Janklow

WJJ:jo

Enclosure

cc: Mr. Gene Trager
United States Nuclear Regulatory Commission
Washington, D. C. 20555

PING C. CHEE

(312) ^{FTS} 972-3112

EIS Division

Argonne National Lab

Argonne, IL

Michael R. Casada

Nuclear Raw Materials Branch

TVA. Chattanooga, Tenn

923 CAB-C FTS 554-5746

John Geidt

1860 Lincoln St.

U.S. EPA Region VIII

Denver CO

FTS 327-2221

Vonni Kallenmeijn

S.D. Dept of Environmental Protection

Foss Building

Pierre, S.D. 57501

773-3351

Jeffrey L. Kotsch

Mill Licensing - NMSS

(Mail Stop SS-396)

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



12
JAN 16 1980

Ruth C. Clusen
Assistant Secretary for
Environment
U. S. Department of Energy
Washington, D. C. 20545

Dear Ms. Clusen:

This letter is to request your assistance in a remedial action program in Edgemont, South Dakota. Although the assistance requested should not be substantial, it concerns removal of a radiation health hazard and is needed at the earliest possible time.

The Commission has received preliminary notification from the Environmental Protection Agency (EPA), Region VIII, concerning high radiation exposures to the occupants of a residence in Edgemont. The radiation exposures are due to the radon emitted from materials used as fill around the basement walls and under the basement slab in the residence and which are believed to be uranium mill tailings. It is most likely that these tailings were removed from the uranium mill at Edgemont while it was in active operation prior to 1974.

Three measurements of radon daughter concentrations were taken using a Radon Progeny Integrating Sampling Unit (RPISU). The consecutive measurements of greater than 160 hours duration were taken with radon progeny levels being measured at 0.66 WL (working level), 0.65 WL, and 0.78 WL, respectively. Current NRC regulations (10 CFR Part 20) limit radon concentrations in effluents in unrestricted areas to 0.033 WL (10 CFR 20.106). One-year continuous exposure to 0.78 WL would be equivalent to 19.5 working level months (WLM), or about five times the occupational exposure limit for uranium miners. Assuming a dose conversion factor of 5 rem/WLM, such continuous exposure would result in a lung dose of 97.5 rem per year. Current occupants have been present at this address for the last two years.

RPISU measurements were made at this residence after preliminary gamma radiation surveys of the structure indicated that uranium mill tailings had possibly been used in the foundation. As yet, we do not know if tailings were used in the foundation material itself. The gamma survey measurements were made of this and other locations in Edgemont to determine

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ENCLOSURE

if tailings may have been hauled or windblown from the Edgemont mill posing public health hazards. The results of the preliminary surveys, conducted by the EPA with NRC, TVA, and State assistance and completed in November 1978, indicated that there were as many as 60 possible tailings use locations in Edgemont of which 18 were considered ones where resultant radiation inside structures might be significant. In nearby Cottonwood Community, there are an additional 26 structures which may have levels which are significantly above-background. The final phase of the measurement program being conducted to determine which structures will require remedial action began with the residence of concern and is being pursued as actively as currently available resources and equipment will allow.

Although the Edgemont uranium mill was inactive since 1974, it was not included for remedial action under Title I of the Uranium Mill Tailings Radiation Control Act (UMTRCA) of 1978 because the millsite and tailings piles are under an active NRC license. The Source Material License SUA-816, and responsibilities associated with it, were assumed by the Tennessee Valley Authority (TVA) after it purchased the site in August 1974. In March 1979, the TVA submitted a plan for decommissioning the millsite and tailings. The plan includes relocation of the tailings pile from the current mill site adjacent to the town to a more remote site. The TVA has implemented a program of interim stabilization of the tailings piles until the decommissioning can be completed to prevent any further blowing of tailings. The NRC is currently preparing an Environmental Impact Statement in support of a licensing action to authorize the decommissioning of the mill site.

Although TVA has assumed responsibility for cleanup of the mill site and tailings pile, and has participated in a cooperative effort with the State of South Dakota, the EPA and the NRC to evaluate the health risk posed by tailings which may have been removed or blown off-site, TVA responsibility for cleaning up off-site contamination remains an unresolved question.

Because of this situation, we are requesting that you take action to include off-site locations in Edgemont (and the nearby Cottonwood Community) in the Formerly Utilized Sites Remedial Action Program (FUSRAP). It is anticipated that the types of remedial actions required at tailings locations in Edgemont will be similar to those performed at locations in Grand Junction, Colorado. However, as indicated above, there will be a significantly smaller number of required actions. I am also requesting that, in the interim, you assist in completion of the ongoing measurement program and that you take action, such as conducting a research and development program, which will have the effect of reducing the immediate health hazard to the public which has been identified.

Ruth C. Clusen

-3-

Please feel free to contact me concerning any additional details. Mr. Ross A. Scarano of my staff (301) 427-4103 is available to work with your staff on this matter.

Sincerely,



William J. Dircks, Director
Office of Nuclear Material
Safety and Safeguards

cc: George W. Cunningham
Assistant Secretary for Nuclear Energy
U. S. Department of Energy

OCT 25 1979

Distribution: EDO-7470

WMUR r/f

WM r/f

NMSSr/f

Mail File

EATrager

HJMiller

RAScarano

REBrowning

JBMartin

NGill

ELeins

GErtter

RShell, TVA

JGeidt, EPA

VKallemeyn, St of SD

WJDircks

OCA

LVGossick

RRyan

SECY

Docket File 40-1341

RFonner, ELD

The Honorable William J. Janklow
Governor of South Dakota
Pierre, South Dakota 57501

Dear Governor Janklow:

In your letter of September 24, 1979, you expressed concerns about above-background radiation levels at off-site locations in Edgemont, South Dakota, and the health risk posed by tailings to individuals living in the Cottonwood Community area. You specifically requested that the U.S. Nuclear Regulatory Commission (NRC) join in a cooperative effort with the State of South Dakota, the Environmental Protection Agency (EPA) and the Tennessee Valley Authority (TVA) to: (1) determine the health risk for persons living in Cottonwood, and (2) determine the source and extent of radiation contamination in the Edgemont area. As indicated in my letter of September 14, 1979, such a cooperative effort is already underway. The following is an update on our activities in this area.

We are in full agreement that the health risk for Cottonwood Community residents should be determined as quickly as possible. The NRC is obtaining contractor assistance to take radon daughter concentration (RDC) and external gamma radiation measurements on open lands and inside structures in the Cottonwood area. The EPA has agreed to support the NRC in evaluation of the resulting measurement data and in development of the radiological assessment. As it would be most appropriate for the State to take the lead in gaining access to properties to permit these required measurements we request your assistance in this matter.

We also fully agree that the full extent of tailings contamination in Edgemont must now be determined in order to determine which properties require remedial action. This effort will begin as soon as the State can pave the way for the required radiation measurements and soil sampling with the owners/occupants of the properties involved. Steps will then be taken to obtain and analyze soil samples and to take other measurements as necessary to determine which properties require remedial action.

OFFICE ►

SURNAME ►

ALAN R. SIMPSON, NYO.
LARRY FRESSLER, & OAK.

United States Senate

COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS
WASHINGTON, D.C. 20510

January 16, 1980

Chairman's Sign
Susp- 1/28

Mr. John F. Ahcarne
Chairman
Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Chairman Ahcarne:

It has come to our attention that occupants of a residence in Edgemont, South Dakota have been exposed to potentially high radiation levels due to radon which is being emitted from materials located around the basement walls of their house. At this time it is believed that uranium mill tailings from the Edgemont uranium mill are the source of this radiation.

We have been informed that those agencies having responsibilities for the safe management and disposal of the uranium mill tailings at the Edgemont mill - EPA, NRC, and TVA - are now in the process of working together with the State of South Dakota to assure that remediation steps are taken to ensure public health and safety surrounding the mill site.

The Committee on Environment and Public Works, which has oversight jurisdiction over all three agencies having responsibilities at Edgemont, would appreciate being apprised of your agency's activities in helping to ensure the health and safety of the residents near the Edgemont uranium mill. Please notify us immediately of any problems you encounter in carrying out your responsibilities and of any progress made towards finding a solution to this problem.

We appreciate your immediate attention to this letter.

Sincerely,

GARY HART

Gary Hart
Chairman, Subcommittee on
Nuclear Regulation

Alan K. Simpson
Ranking Minority Member,
Subcommittee on Nuclear Regulation

George McEovern
U.S. Senator

Harry Prosser
W. Schaffer

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1) ~~1/16/80~~
2) S. Bohart's File

FROM: Gary Hart, Chmn, Subcomm on Nuclear Regulation Senators Alan K. Simpson, George McGovern, TO & Larry Pressler Chairman Ahearne		ACTION CONTROL		DATES		CONTROL NO.	
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		ACKNOWLEDGMENT				DATE OF DOCUMENT	
		INTERIM REPLY				1/16/80	
		FINAL REPLY				PREPARE FOR SIGNATURE OF:	
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Req info re NRC's activities in helping to ensure health & safety of residents near Edgemont, S.D. uranium mill against high radiation levels due to radon		<p style="text-align: center;">PRIORITY MAIL</p> <p style="text-align: center;"><i>✓ for Kern</i></p>					
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