BLACK HILLS ALLIANCE

BOX 2508 RAPID CITY, SOUTH DAKOTA 57709 605-342-5127

October 30, 1980

BACKGROUND INFORMATION ON RAPID VALLEY RADIOACTIVE WATER CONTAMINATION

"The EPA has estimated that as many as 500 public water supplies exceed the 5.0 pCi/l radium concentration."

--J.E. Singley, B.A. Beaudet, W.E. Bolch and J.F. Palmer, Costs of Radium Removal from Potable Water Supplies, Environmental Protection Agency, Cincinnati, 1977.

At least two public water supplies in Rapid Valley have shown high levels of gross alpha radiation in tests this year, and the level of radium-226 in one of those wells has tested from 4-4/5 to almost 8 times the Environmental Protection Agency's (EPA) maximum contaminant level. In addition, a test at a private residence in Rapid Valley showed gross alpha contamination between 2.6 and 3.4 times the maximum level and radium-226 contamination 5.58 times the maximum level.

The EPA's maximum contaminant level for gross alpha radiation--a type of radiation that is quite harmful, but only if taken in with air, food or water--is 15 picocuries per liter of water (pCi/l). A picocurie is a way to measure radiation. Rapid Valley Water Company's well number two measured 36.8 $\pm$ 5.4 pCi/l on March 20, 1980. Their well number three measured 163.9 $\pm$ 10 pCi/l on the same day--between 10¼ and 11½ times the allowable level. The private residence of Roy Graff of the Water Company (5309 Solitaire) measured 45.1 $\pm$ 5.9 pCi/l on May 7, 1980.

The EPA's maximum contaminant level for radium-226, which gives off alpha radiation, is 5 pCi/l. The March tests of well number three resulted in a reading of 39.8 pCi/l, while a test done by the United States Geological Survey (USGS) earlier that month resulted in a reading of 24 pCi/l. The reading at Mr. Graff's residence in May was 27.9 pCi/l, and appears to have been done at state expense. (see Attachments 1, 2, 3)

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Radium taken into the body settles in the bones, where the radiation it gives off can result in cancer. (Singley, et al., p. 2, citing Norman J. Petersen, et al., 1966) The Black Hills Alliance has received three independent reports--two from health professionals in Rapid City--that indicate an increase in cases of leukemia in this area. As leukemia is a kind of bone cancer that particularly affects young children, these reports should be followed up on by scientific studies.

Radium decays into radon gas, a radioactive gas that gives off alpha radiation and mixes easily with water. When radon is present in water, household use agitates the water and radon gas is released from the water into the home. (Environmental Protection Agency, "Technologically Enhanced Natural Radiation: Draft," 1980, p. 3-42) The radon, whether or not it remains in the home, then decays into the four "radon daughters"--radon and its daughters have been shown to cause lung cancer in uranium miners.

In Rapid Valley, the two deep wells are believed to tap the Dakota or Lakota aquifer, which serve many people in South Dakota. These aquifers are on either side of the Fall River Formation, which contains much of the mineable uranium in the Black Hills. It is thus possible that the radiation contamination is natural, but that does not make it less dangerous.

Other known radiation contamination in this area includes:

The Arikaree Aquifer, and maybe the Brule and Ogllalla Aquifers, on the Pine Ridge Reservation

The Madison Aquifer at Phillip and Midland

The Cheyenne River below Edgemont as a result of uranium mill tailings. A large spill occurred there in 1962 when a tailings dam broke. The water has become less polluted since the tailings were covered with dirt, but we have no record of any tests of stream sediment since that time. (Att.

These sources contain the majority of water available to us, and further uranium development would cause more contamination of water sources. The extent of current contamination of the aquifers remains

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unknown, as does the source of most of the contamination.

Because radiation in water changes, Federal regulations do not allow water to be declared "unsafe" until four tests have been done over a year period. However, readings as high as the ones in Rapid Valley indicate a definite problem. Recent tests of the Rapid City water supply showed no problem. The EPA seems to have enforcement power to shut down Rapid Valley's contaminated wells, which are still operating. The South Dakota Department of Water and Natural Resources indicated that they have known about the contamination since the USGS's test in March, but they look to EPA for a solution. Action to close the wells could be taken by the Rapid Valley Water Company or perhaps by Pennington County officials.

In addition, there is no Federal standard for uranium in water, so uranium tests were not run. Such a standard has been in the works for over a year, but an EPA official in Denver indicated that the standard is not expected for a couple more years.

A conversation with a Rapid Valley Water Company employee did not help find out exactly who is drinking water from the radioactive wells, as they do not have maps of who is served from what source. Roy Graff indicated that EPA has tested well number three "3 or 4 times" since March, and that the polluted water is diluted to safe levels by clean water. Yet, the tests at his home showed gross alpha radiation and radium-226 levels several times the maximum EPA levels.

In view of the increasing water needs of Rapid Valley, a solution to the contamination, and its exact extent and source, should be sought immediately. There appear to be six possible solutions to problems of radium in water. Three are relatively straightforward--drilling new wells, using bottled water, or using surface water. The latter could be out of the question if Rapid Creek is reclassified to allow more pollutants in the stream.

Three other solutions are more complex, less effective, and raise further problems. Water softening can remove 59 to 99% of dissolved radium, and ion exchange plants are effective if they are working

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well. However, one ion exchange plant in New Mexico showed an increase--not a decrease--in the amount of uranium in solution after water treatment. (Environmental Protection Agency, Potential Health and Environmental Hazards of Uranium Mine Wastes: Draft Report, 1979, p. 3-106) The EPA considers both these methods cost effective. The third, more expensive process is called reverse osmosis.

The EPA warns that all three methods of radium removal from water create radioactive wastes that can, through natural processes, "be physically or biologically accumulated to undesirable levels in the environment." This is especially true because radium lasts for several thousand years, after which it decays into other long-lasting radioactive substances before it ends up as non-radioactive lead. The EPA also stated, "One can conclude that a 'best' solution to the waste problem generated by water treatment plants handling radium bearing wastes does not exist." (Singley, et al., p. 10)

Whatever solution is found for Rapid Valley's water problem, the people of that area--and probably of a larger area--have paid and will pay the costs. Mechanisms should be instituted immediately to see to it that radiation problems caused by any future uranium development are paid for by the companies causing the problem, that all questions are answered before uranium development begins again, and that people who are affected by radiation contamination know of the threat to their health immediately.

--Lilias Jones
Research and Documentation

ALL SOURCES CITED ARE AVAILABLE AT: Black Hills Alliance Research Center, Rapid City, S.D.

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SOUTH DAKOTA DEPARTMENT OF WATER AND NATURAL RESOURCES

OFFICE OF DRINKING WATER

CHEMICAL ANALYTICAL DATA

Att. 1

Supply: Rapid Valley Water Co.

n, County:

ource of Supply: Well #2

Sampling Point:

Sample: Raw [illegible] Treated ____ Composite ____

Treatment Process: [illegible]

Received By Lab:

Report Sent By Lab:

Date Collected: [illegible]

Collected By: [illegible]

Mail Report To:

Comments:

	Parameter	Maximum Limit	Results
	Arsenic	50 ug/l	
	Barium	1000 ug/l	
	Cadmium	10 ug/l	
	Chromium	50 ug/l	
	Lead	50 ug/l	
	Mercury	2 ug/l	
	Nitrate (as N)	10 mg/l	
	Selenium	10 ug/l	
	Silver	50 ug/l	
	Fluoride	2.4 mg/l	
✓	Gross alpha	15 pCi/l	36.8 ± 5.4
✓	Radium 226-~~228~~	5 pCi/l	0.5
	Turbidity	1 NTU	
	OTHER PARAMETERS		

Parameter	Suggested Limit	Results
Chloride (Cl)	250 mg/l	
Copper (Cu)	1 mg/l	
Iron (Fe)	0.3 mg/l	
Manganese (Mn)	0.05 mg/l	
Sulfate (SO_4)	250 mg/l	
Zinc (Zn)	5 mg/l	
Tot.Diss.Solids (TDS)	500 mg/l	
pH	6.5-8.5	
Alkalinity(m) ($CaCO_3$)	mg/l	
Alkalinity(p) ($CaCO_3$)	mg/l	
Bicarbonate (HCO_3)	mg/l	
Carbonate (CO_3)	mg/l	
Spec. Cond. @ °C	umhos/cm	
Calcium (Ca)	mg/l	
Magnesium (Mg)	mg/l	
Hardness ($CaCO_3$)	mg/l	
Langelier Index @ 50 °F		
Sodium (Na)	mg/l	
Potassium (K)	mg/l	
Nitrite (NO_2)(as N)	mg/l	

mg/l = milligrams/liter = parts/million (ppm)

ug/l = micrograms/liter = parts/billion (ppb)

LAB COMMENTS:

Percentage of Error:

[illegible]

Att. 2

SOUTH DAKOTA DEPARTMENT OF WATER AND NATURAL RESOURCES
OFFICE OF DRINKING WATER
CHEMICAL ANALYTICAL DATA

Supply: Rapid Valley Water Co.

County:

Source of Supply: Well # 2

Sampling Point:

Sample: Raw [illegible] Treated Composite

Treatment Process: [illegible]

Received By Lab:

Report Sent By Lab:

Date Collected: [illegible]

Collected By: [illegible]

Mail Report To:

Comments:

	Parameter	Maximum Limit	Results
	Arsenic	50 ug/l	
	Barium	1000 ug/l	
	Cadmium	10 ug/l	
	Chromium	50 ug/l	
	Lead	50 ug/l	
	Mercury	2 ug/l	
	Nitrate (as N)	10 mg/l	
	Selenium	10 ug/l	
	Silver	50 ug/l	
	Fluoride	2.4 mg/l	
✓ /	Gross alpha	15 pCi/l	163.9 ± 10
✓ /	Radium 226-~~2~~8	5 pCi/l	39.8
	Turbidity	1 NTU	
	OTHER PARAMETERS		

Parameter	Suggested Limit	Results
Chloride (Cl)	250 mg/l	
Copper (Cu)	1 mg/l	
Iron (Fe)	0.3 mg/l	
Manganese (Mn)	0.05 mg/l	
Sulfate (SO_4)	250 mg/l	
Zinc (Zn)	5 mg/l	
Tot.Diss.Solids (TDS)	500 mg/l	
pH	6.5-8.5	
Alkalinity(m) ($CaCO_3$)	mg/l	
Alkalinity(p) ($CaCO_3$)	mg/l	
Bicarbonate (HCO_3)	mg/l	
Carbonate (CO_3)	mg/l	
Spec. Cond. @ °C	umhos/cm	
Calcium (Ca)	mg/l	
Magnesium (Mg)	mg/l	
Hardness ($CaCO_3$)	mg/l	
Langelier Index @ 50 °F		
Sodium (Na)	mg/l	
Potassium (K)	mg/l	
Nitrite (NO_2)(as N)	mg/l	

LAB COMMENTS:

mg/l = milligrams/liter = parts/million (ppm)

ug/l = micrograms/liter = parts/billion (ppb)

[illegible]

[illegible]

OFFICE OF DRINKING WATER

CHEMICAL ANALYTICAL DATA

Water Supply: Rapid Valley Water

Town, County: Rapid City, Pennington

Source of Supply: deepwells, water gallery, City water

Sampling Point: 5309 Solitaire Dr.

Sample: Raw ______ Treated X ______ Composite ______

Treatment Process: Chlorinated

Date Collected: 5/7/80

Collected By: Roy R. Graff

Mail Report To: Rapid Valley Water Service Co.
3201 School Dr.
R.C., S. Dak. 57701

Comments: [illegible]

Received By Lab: 5/12/80

Report Sent By Lab: 8/25/80

Parameter	Maximum Limit	Results
Arsenic	50 ug/l	
Barium	1000 ug/l	
Cadmium	10 ug/l	
Chromium	50 ug/l	
Lead	50 ug/l	
Mercury	2 ug/l	
Nitrate (as N)	10 mg/l	
Selenium	10 ug/l	
Silver	50 ug/l	
Fluoride	2.4 mg/l	
✓ Gross alpha	15 pCi/l	45.4 ± 5.9
✓ Radium 226-~~228~~	5 pCi/l	27.9
Turbidity	1 NTU	
OTHER PARAMETERS		

Parameter	Suggested Limit	Results
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Iron (Fe)	0.3 mg/l	
Manganese (Mn)	0.05 mg/l	
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Zinc (Zn)	5 mg/l	
Tot.Diss.Solids (TDS)	500 mg/l	
pH	6.5-8.5	
Alkalinity(m) ($CaCO_3$)	mg/l	
Alkalinity(p) ($CaCO_3$)	mg/l	
Bicarbonate (HCO_3)	mg/l	
Carbonate (CO_3)	mg/l	
Spec. Cond. @ °C	umhos/cm	
Calcium (Ca)	mg/l	
Magnesium (Mg)	mg/l	
Hardness ($CaCO_3$)	mg/l	
Langelier Index @ 50 °F		
Sodium (Na)	mg/l	
Potassium (K)	mg/l	
Nitrite (NO_2)(as N)	mg/l	

mg/l = milligrams/liter = parts/million (pp

ug/l = micrograms/liter = parts/billion (pp

LAB COMMENTS: Pd by Carter

Not sufficient sample for Ra-228 and Uranium analysis

Percentage of Error:

Summary of Accidental Tailings Slurry Releases, 1959-1979[a]

Mill	Year	Cause	Solids Released, lb (kg)	Liquids Released, gal (L)	Reached Watercourse
Union Carbide-Green River	1959	Flash flood	3×10^7 (14×10^6)	3×10^6 (1.2×10^7)[b]	Yes
Kerr-McGee-Shiprock	1960	Dam failure	2×10^6 (9×10^5)[b]	2×10^5 (9.1×10^5)	Yes
Union Carbide-Maybell	1961	Dam failure	1×10^6 (5×10^5)	1×10^5 (4×10^5)b	No
Mines Development, Inc.-Edgemont	1962	Dam failure	4×10^5 (2×10^5)	5×10^4 (2×10^5)b	Yes
Atlas-Zinc Minerals-Mexican Hat	1962	Pipeline failure	7×10^5 (3×10^5)	5×10^4 (2×10^5)	Yes
Utah Construction-Riverton	1963	Flooding	2×10^8 (1×10^8)[b]	2×10^7 (8.7×10^7)	Yes
VCA-Shiprock, N. M.	1966	Pipeline failure	1×10^5 (6.4×10^4)[b]	2×10^4 (6.1×10^4)	Small amount
Atlas-Moab	1967	Pipeline failure	4×10^6 (2×10^6)[b]	4×10^5 (1.7×10^6)	Yes
Climax-Grand Junction	1967	Dam failure	$2\text{-}30 \times 10^6$ ($1\text{-}14 \times 10^6$)[b]	$0.3\text{-}3 \times 10^6$ ($1\text{-}11 \times 10^6$)	Yes
Atlas-Moab	1968	Pipeline failure	2×10^5 (1×10^5)[b]	3×10^4 (1.3×10^5)	Yes
Petrotomics-Shirley Basin	1971	Dam failure	2×10^4 (9×10^3)[b]	2×10^3 (8×10^3)	No
Western Nuclear-Jeffrey City	1971	Pipeline/dam failure[c]	No quantitative information		No
UNC-Homestake Partners, Grants	1977	Pipeline failure	1×10^8 (4.5×10^7)	2.2×10^6 (8.3×10^6)	No
Western Nuclear-Jeffrey City	1977	Dam failure[d]	1.8×10^7 (8.2×10^6)[d]	2×10^6 (7.6×10^6)	No
UNC-Church Rock, New Mexico	1977	Pipeline failure	2.5×10^3 (1.1×10^3)	4×10^3 (1.5×10^4)	Yes[e]
UNC-Church Rock, New Mexico	1979	Dam failure	2.2×10^6 (9.98×10^5)	1×10^8 (3.8×10^8)	Yes

[a] From: "Environmental Survey of the Uranium Fuel Cycle," WASH-1248, U.S. Atomic Energy Commission, Fuels and Materials, Directorate of Licensing, April 1974. Updated (last four entries) through 1979 by the staff.

[b] Assuming equal weights of solids and liquids released, and density of the liquids to be approximately 1.1 kg/L (2.4 lb/gal).

[c] Occurred at the Split Rock mill in March 1971. A tailings line broke, causing the dike to fail. The accident went undetected for two hours and tailings flowed into a natural basin adjacent to the tailings pond, on WNI property.

[d] Occurred at the Split Rock mill in April 1977: assuming equal weights of solids and liquids released, and density of the liquids to be approximately 4 kg/L (9 lb/gal).

[e] Approximately 80% of solids and 20% of liquids.

Sweeney Mining & Milling, Colorado 1980 Dam Failure 250,000 gals of water and tailings