UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

DATA ON GROUND-WATER QUALITY WITH EMPHASIS ON RADIONUCLIDES, SARASOTA COUNTY, FLORIDA

By H. Sutcliffe, Jr., and R. L. Miller

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Prepared in cooperation with

SARASOTA COUNTY, FLORIDA

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UNITED STATES DEPARTMENT OF THE INTERIOR

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ABSTRACT

A compilation of analytical results are presented for selected radiochemical and chemical characteristics for 200 water samples collected from 92 wells in Sarasota County, Florida. Radium-226 analysis was made on 161 of the water samples and 86 samples equaled or exceeded the 5 picocuries per liter maximum contaminant level established by the National Interim Primary Drinking Water Regulations.

INTRODUCTION

Sarasota County, located on the west coast of Florida about 50 miles south of Tampa, is predominantly a retirement and tourist oriented area. The pleasant climate has created a 35-mile urban development along the coast. Industrial development is limited to the service industry and environmentally clean industry such as optics, electronics, and printing. Population growth has created increasing demands on water supplies in the area, both public and domestic.

Previous sampling of water from wells in Sarasota County has indicated that some ground water contains radionuclides, in particular radium-226, in concentrations that exceed recommended limits for public water supplies (U.S. Environmental Protection Agency, 1976). Past sampling has been sparse, unsystematic, and from wells open to multiple water-bearing zones. Thus, little is known of the vertical distribution of radionuclides in ground water or hydrogeologic controls that determine their distribution. This study, being done in cooperation with Sarasota County, is designed to establish baseline data on the natural occurrence of radionuclides in ground water in the county.

The radiochemical data presented in this report were acquired by selective sampling and logging of existing wells and new wells as they were drilled between January 1976 and April 1979. Wells selected for radiochemical sampling were those open to specific water-bearing zones or those which were sampled at specific depths as they were drilled. These samples were analyzed for radium-226 and occasionally for radium-228 by the U.S. Geological Survey National Water Quality Laboratory in Arvada, Colo. The U.S. Geological Survey National Water Quality Laboratory in Atlanta, Ga., analyzed for major ions except for one sample that was analyzed by the Southwest Florida Water Management District.

Borehole geophysical logging techniques that were used to determine the water-bearing zones were gamma ray, caliper, electrical resistivity, temperature, and conductivity.

PREVIOUS INVESTIGATIONS

The water resources of Sarasota County have been described in many publications. Stringfield (1933) investigated several areas of the county, Bishop (1960) reported on the freshwater resources, and Joyner and Sutcliffe (1976) described the hydrogeology of the county and presented large amounts of data on the chemical quality of ground water. Radionuclides in ground water, however, were neglected until Kaufmann and Bliss (1977) reported data for 49 wells sampled in Sarasota County during 1975 and 1976. Many of these wells were not identified as, or selected for, being open to discrete water-bearing zones; therefore, only selected data from their report are included.

SIGNIFICANCE OF URANIUM AND RADIUM-226

Uranium is seldom found in natural waters in toxic concentrations (Gough and others, 1979, p. 53). It is associated with phosphatic deposits in Florida (Cathcart, 1966, p. 36), and, as radium-226 is a daughter product in the uranium-238 series (Friedlander and others, 1964, p. 9), the uranium data presented in table 1 may prove useful in later geochemical interpretations.

Radium-226 is the most important naturally occurring radionuclide likely to occur in public water supplies (U.S. Environmental Protection Agency, 1976). Radium is sometimes found in surface water as a result of man's activities, but in ground water it usually occurs as the result of natural geochemical processes (U.S. Environmental Protection Agency, 1976). Because of the health risk, the maximum contaminant level for combined radium-226 and radium-228 was set at 5 picocuries per liter (pCi/L) by the National Interim Primary Drinking Water Regulations (U.S. Environmental Protection Agency, 1976).

LOCATION AND RESULTS OF SAMPLING

The location of well sites where water samples were collected is shown in figure 1, and results of chemical analyses are listed in table 1. Each site listed in table 1 has been assigned a map number and an identification number as used in the Geological Survey's nationwide data storage and retrieval system. The map number identifies the site location in figure 1. The identification number reflects the site latitude, longitude, and sequential number. For example, the well having station number 265653082190301 is located at latitude 26°56'53", longitude 82°19'03", and its sequential number is 01. Table 1

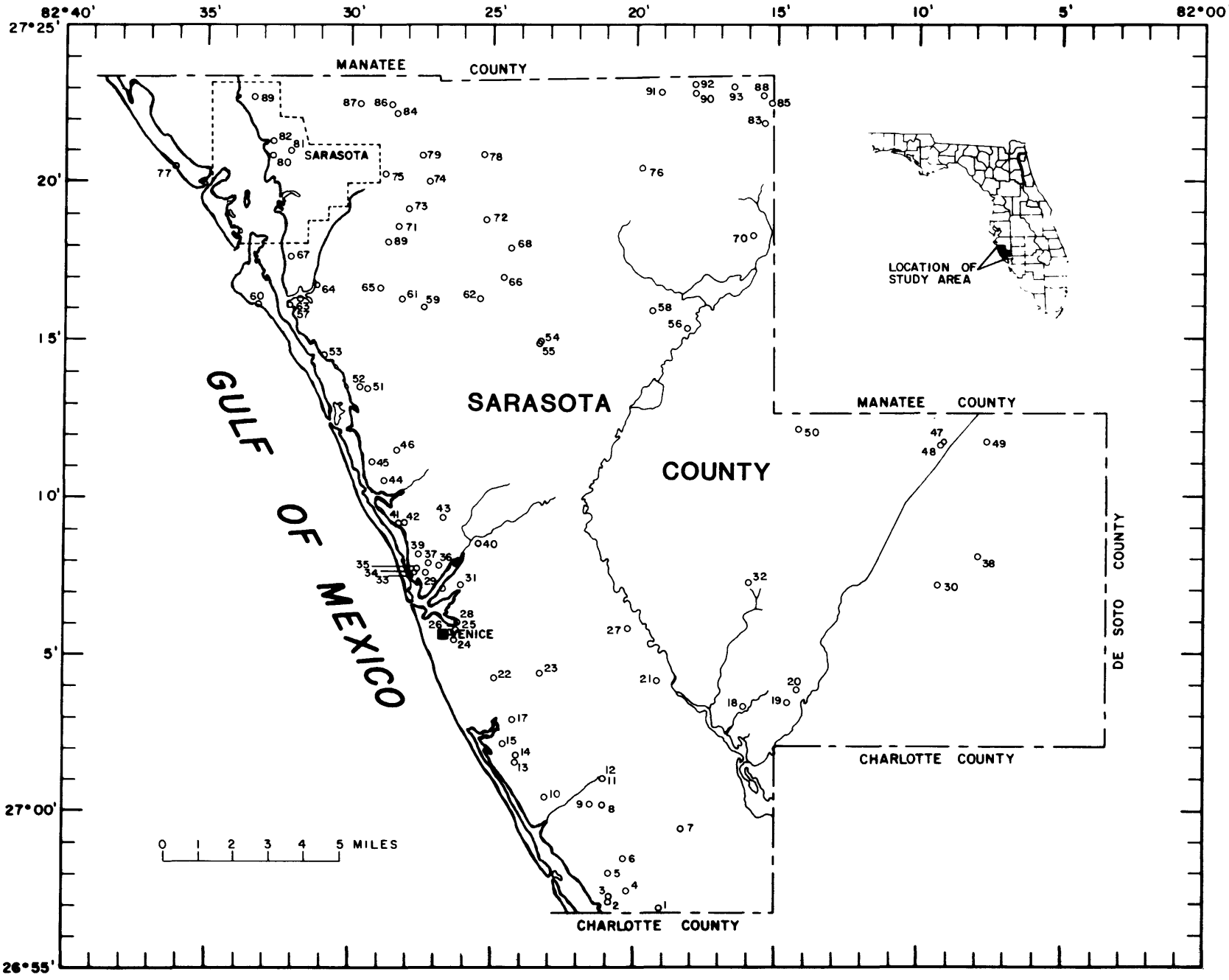

Figure 1.--Locations of study area and sampling sites.

Table 1.--Chemical analyses of ground water in Sarasota County

Dissolved constituents are in picocuries per liter (pCi/L); micrograms per liter (ug/L); or milligrams per liter (mg/L).
Hydrologic zones are selected according to Joyner and Sutcliffe (1976), table 2, p. 19 and noted as follows: S, surficial zone; 1, Tamiami Formation; 2, upper unit, Hawthorn Formation; 3, lower unit, Hawthorn Formation and Tampa Limestone; 4, basal Tampa Limestone, Suwannee Limestone, and Ocala Limestone; 5, Avon Park Limestone.
Samples from several sources are identified as follows: MR, mixed raw wster; MP, mixed product water after trestment; M, mixed (several wells); R, raw (single well); P, product (to service).

MAP NUMBER	STATION NUMBER	DATE OF SAMPLE	TIME	HYDROLOGIC ZONE	SAMPLING DEPTH (FT)	RADIUM 226, DISSOLVED, RADON METHOD (PCI/L)	RA-226, DISSOLVED, PLANCHET COUNT (PCI/L)	SPECIFIC CONDUCTANCE (MICROMHOS)	URANIUM DISSOLVED, EXTRACTION (UG/L)	URANIUM DISSOLVED, DIRECT FLUOROMETRIC (PCI/L)
1	265653082190301	75-12-02	1530	1	46	--	--	2150	--	--
		75-12-08	1200	2	107	--	--	3400	--	--
		75-12-09	1430	2	140	--	--	3000	--	--
		75-12-10	1110	2	170	--	--	2000	--	--
		75-12-11	1000	2	200	--	--	1650	--	--
		75-12-12	1600	3	300	--	--	--	--	--
		75-12-17	1555	3	320	--	--	3600	--	--
		78-05-10	0930	3	--	25	--	--	--	--
2	265710082205101	75-12-23	1400	2	93	--	--	610	--	--
		75-12-30	0800	2	120	--	--	3800	--	--
		75-12-30	1401	2	168	--	--	3800	--	--
		76-01-06	1600	3	310	--	--	4700	--	--
		78-05-10	1000	3	--	20	--	--	--	--
3	265713082205601	75-06-17	1245	S,1,MR	--	--	--	902	--	--
		76-08-25	1240	S,1,MR	--	--	--	939	--	--
		78-07-27	1145	S,1,MR	--	1.7	--	--	--	--
4	265731082201101	78-06-27	1000	1	86	1.9	--	--	--	--
		78-06-27	1600	2	150	12	--	--	--	--
5	265801082205601	76-05-03	1500	1	81	.91	--	640	--	--
6	265834082202402	79-02-08	1430	S	--	--	.3	--	--	--
7	265930082181601	78-05-10	1040	S	24	3.3	--	--	--	--
8	270018082210902	78-08-24	1210	1	--	13	--	1690	--	--
9	270021082221301	78-05-04	1100	S	42	9.6	--	2940	--	--
10	270041082230401	78-06-27	1300	2	127	7.3	--	--	--	--
11	270102082211401	78-09-05	1210	2	120	7.4	--	--	--	--
12	270102082211402	78-08-31	1030	1	70	.94	--	420	--	--
13	270138082240801	78-07-27	1345	1,2,MR	--	3.1	--	--	--	--
14	270139082240801	79-03-00	1600	2	195	--	3.7	590	--	--
		79-03-12	0830	2	110	--	1.7	830	--	--
		79-03-14	1455	3	305	--	<1.4	460	--	--
15	270209082243201	78-04-13	1400	1	--	2.3	--	1000	--	--
17	270252082241601	78-07-27	1410	2,MR	--	1.4	--	--	--	--
18	270319082160601	78-10-13	1600	2	82	--	16	1160	--	--
19	270332082143801	78-10-13	1300	1	60	--	8.5	3920	--	--
		78-10-18	1500	2	115	--	25	1690	--	--
20	270343082141901	78-10-13	0915	2	104	--	5.7	1300	--	--
21	270408082191101	78-07-27	1520	1,2,MR	--	9.6	--	--	--	--
22	270422082245101	78-07-27	1420	1,2,MR	--	3.2	--	--	--	--
23	270424082231401	78-07-27	1430	2,MP	--	8.2	--	--	--	--
24	270542082261801	79-02-02	1400	2	163	--	5.4	--	--	--
25	270543082261706	79-02-08	1140	S	--	--	4.4	--	--	--
26	270543082261902	79-02-02	1300	1	68	--	4.2	--	--	--
27	270553082200801	78-07-27	1550	1,2	--	14	--	--	--	--
28	270601082261401	75-06-17	1045	MR	--	--	--	1320	--	--
		76-08-24	1015	MR	--	--	--	2120	--	--
		78-07-27	1040	1,2,MR	--	9.0	--	--	--	--
29	270702082264609	79-01-24	1100	2,R	--	--	12	--	--	--
		79-01-24	1115	2,R	--	--	10	--	--	--
		79-02-01	1115	2,R	--	--	--	--	--	--
30	270710082092101	79-01-25	1200	2,3,4,5	--	--	3.7	--	--	--
31	270711082260201	76-07-20	--	1,2,MP	--	.22	--	530	<.01	--
		76-07-20	1110	1,2,MR	--	2.7	--	2450	.02	--
		76-07-20	1125	1,2,MP	--	--	--	--	--	--
32	270714082155201	78-05-10	1300	3	--	3.4	--	--	--	--
33	270732082275101	76-07-20	1015	1,R	--	12	--	2550	--	.4

SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L)	SOLIDS, SUM OF CONSTI-TUENTS, DIS-SOLVED (MG/L)	CALCIUM DIS-SOLVED (MG/L AS CA)	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG)	POTAS-SIUM, DIS-SOLVED (MG/L AS K)	SODIUM, DIS-SOLVED (MG/L AS NA)	STRON-TIUM, DIS-SOLVED (UG/L AS SR)	BICAR-BONATE (MG/L AS HCO3)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	SULFATE DIS-SOLVED (MG/L AS SO4)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)	HARD-NESS (MG/L AS CACO3)
--	--	130	25	--	--	2400	218	580	44	.8	430
--	--	280	190	--	--	29000	177	2600	470	.6	1500
--	--	130	75	--	--	800	152	920	28	.6	760
--	--	120	57	--	--	8700	149	600	1.5	.7	540
--	--	96	47	--	--	8400	154	480	12	.9	440
--	--	140	140	--	--	20000	163	1300	180	1.9	950
2820	2220	130	120	17	490	18000	159	1200	150	1.7	840
--	--	--	--	--	--	--	--	--	--	--	--
--	--	93	6.6	--	--	850	300	46	.3	.2	260
--	--	110	--	--	--	1300	300	120	1.6	.2	260
--	--	200	94	--	--	16000	169	1200	170	.5	920
2866	2570	210	110	19	540	30000	164	1400	160	1.1	1000
--	--	--	--	--	--	--	--	--	--	--	--
546	494	110	14	1.0	60	900	296	134	14	.4	330
582	520	110	12	1.4	68	940	288	160	12	.3	330
--	--	--	--	--	--	--	--	--	--	--	--
--	--	120	23	--	--	1400	390	150	25	.4	400
1150	900	110	46	6.4	150	4300	196	450	21	.5	470
375	350	97	13	1.3	17	270	340	31	4.5	.1	300
--	--	24	2.5	--	--	180	64	5.6	28	.4	70
595	551	120	11	.2	75	820	430	120	2.4	.1	350
1200	978	100	43	9.5	190	6700	180	490	25	.6	430
2040	1700	190	63	6.0	330	12000	240	740	220	.4	750
824	622	87	30	6.4	85	3700	180	260	24	.9	350
--	--	.75	34	--	--	3400	190	120	110	.7	330
414	385	120	7.3	.5	21	640	370	34	2.8	.2	330
--	--	--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--	--	--
290	291	32	14	6.1	34	3100	170	48	22	3.3	160
--	--	130	10	--	--	750	450	90	4.8	.2	370
--	--	--	--	--	--	--	--	--	--	--	--
1150	1100	150	55	4.0	180	4800	260	410	150	.4	610
--	--	200	100	--	--	8600	220	970	280	.6	920
1850	1740	160	85	9.4	370	17000	190	700	290	.8	770
1420	1340	170	74	8.4	210	14000	430	420	210	.6	750
--	--	--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--	--	--
1010	--	220	26	--	--	1100	340	93	370	.1	660
--	--	190	17	--	--	1200	290	150	290	.2	550
--	--	--	--	--	--	--	--	--	--	--	--
990	887	170	44	2.9	64	3000	278	96	348	.7	610
1700	1600	270	100	5.4	90	9500	211	180	820	1.0	1100
--	--	--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--	--	--
--	--	230	88	--	--	6000	190	150	720	.6	940
--	--	83	85	--	--	22000	63	510	400	1.5	580
--	--	--	--	1.9	--	--	--	--	--	--	--
--	--	400	160	5.9	--	15000	153	92	1400	1.8	1700
--	--	48	22	--	--	2000	30	21	200	.5	210
--	--	--	--	--	--	--	--	--	--	--	--
--	--	430	150	5.4	--	14000	152	90	1400	2.7	1700

TABLE 1.--CHEMICAL ANALYSES OF GROUND WATER IN SARASOTA COUNTY-CONTINUED

MAP NUMBER	STATION NUMBER	DATE OF SAMPLE	TIME	HYDRO-LOGIC ZONE	SAMPLING DEPTH (FT)	RADIUM 226, DISSOLVED, RADON METHOD (PCI/L)	RA-226, DISSOLVED, PLANCHET COUNT (PCI/L)	SPECIFIC CONDUCTANCE (MICROMHOS)	URANIUM DISSOLVED, EXTRACTION (UG/L)	URANIUM DISSOLVED, DIRECT FLUOROMETRIC (PCI/L)
		76-07-20	1035	I,P	--	8.4	--	910	<.01	--
		79-01-24	1130	I,P	--	--	12	--	--	--
		79-01-24	1145	I,P	--	--	1.2	--	--	--
34	270737082271501	76-07-19	1300	C,R	--	8.9	--	1400	.01	--
		76-07-19	1330	C,P	--	.69	--	240	<.01	--
35	270739082273601	76-07-19	1400	S,I,MR	--	16	--	2450	.02	--
		76-07-19	1445	S,I,MP	--	.96	--	380	<.01	--
36	270748082265001	76-07-20	0930	I,MR	--	10	--	1440	.02	--
37	270757082270101	78-04-13	1300	S	29	13	--	2150	--	--
		78-04-13	1500	S	40	2.2	--	1310	--	--
		78-04-14	0940	I	87	9.6	--	2690	--	--
		78-04-14	1030	I	87	9.8	--	2690	--	--
38	270802082075501	79-01-25	1300	--	--	--	4.9	--	--	--
39	270831082272601	76-07-19	1520	C,MR	--	8.2	--	1540	.01	--
40	270842082252701	76-07-20	0830	I,C,MR	--	14	--	1700	.07	--
41	270904082281701	78-04-26	1515	I	42	9.0	--	1165	--	--
		78-04-27	0850	C	82	6.2	--	1350	--	--
		78-04-27	0950	C	93	11	--	1690	--	--
		78-04-27	1445	C	127	16	--	2360	--	--
42	270905082280201	76-01-26	1500	I,C,S,MR	--	--	--	1490	--	--
		76-07-19	1100	I,C,S,MP	--	1.8	--	555	<.01	--
		76-07-19	1130	I,C,S,MR	--	--	--	--	--	--
		76-07-19	1200	I,C,S,MR	--	--	--	--	--	--
43	270920082264401	76-07-20	1420	C,S,MP	--	8.9	--	1440	.04	--
44	271034082285901	76-07-20	1500	MP	--	--	--	--	--	--
		79-01-24	1045	MP	--	--	1.0	--	--	--
		79-01-24	1315	MR	--	--	22	--	--	--
		79-02-01	1045	MP	--	--	--	--	--	--
		79-02-01	1315	MR	--	--	--	--	--	--
45	271111082290409	79-01-24	1300	C	--	--	12	--	--	--
46	271131082282301	78-09-14	1415	C	--	6.4	--	2260	--	--
		79-01-11	1000	C	--	--	--	2400	--	--
47	271134082092201	78-05-11	1110	C	--	.96	--	--	--	--
48	271134082092202	79-02-02	1130	S	--	--	3.1	--	--	--
49	271137082074801	79-05-08	0835	C	220	--	5.6	770	--	--
		79-07-17	0930	C,S,4,5,M	1108	--	--	750	--	--
50	271202082141701	76-03-15	0900	S	40	1.3	--	820	--	.5
		76-03-17	0930	C	100	4.1	--	690	--	2.7
		76-03-19	0930	C	155	4.5	--	660	--	3.3
51	271324082292209	79-01-24	1330	I,P	--	--	7.1	--	--	--
		79-02-01	1330	I,P	--	--	--	--	--	--
52	271332082293801	78-10-10	0840	C	--	--	9.0	--	--	--
53	271428082305301	78-04-19	1210	I	43	7.3	--	1118	--	--
		78-04-19	1420	C	63	7.0	--	2400	--	--
		78-04-19	1600	C	80	11	--	1790	--	--
		78-04-19	1640	C	80	13	--	1750	--	--
54	271456082230901	78-05-10	1430	I	--	3.6	--	--	--	--
55	271456082230902	78-05-10	1450	S	--	.12	--	--	--	--
56	271507082180801	76-03-01	0800	C	142	13	--	860	1.4	--
		76-03-02	0800	C	186	14	--	1150	1.3	--
		76-03-03	0800	C	210	8.7	--	1060	--	4.0
		76-03-05	0800	3	300	14	--	1100	1.0	--
57	271550082320501	74-12-11	1300	C	101	--	23	2280	--	--
58	271552082192701	78-09-22	1050	C	145	3.9	--	820	--	--
59	271557082271001	77-09-08	1010	C,MR	--	--	--	--	--	--

SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L)	SOLIDS, SUM OF CONSTI-TUENTS, DIS-SOLVED (MG/L)	CALCIUM DIS-SOLVED (MG/L AS CA)	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG)	POTAS-SIUM, DIS-SOLVED (MG/L AS K)	SODIUM, DIS-SOLVED (MG/L AS NA)	STRON-TIUM, DIS-SOLVED (UG/L AS SR)	BICAR-BONATE (MG/L AS HCO3)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	SULFATE DIS-SOLVED (MG/L AS SO4)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)	HARD-NESS (MG/L AS CACO3)
--	--	124	42	4.0	--	4100	1	30	430	1.0	490
--	--	--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--	--	--
--	--	180	72	2.9	--	6700	86	39	690	.4	750
--	--	22	6.1	1.0	--	810	24	11	98	.1	89
--	--	370	130	6.0	--	1000	170	140	1100	.6	1500
--	--	30	11	1.5	--	850	32	22	65	.1	120
--	--	190	64	4.7	--	3100	210	68	580	.5	760
--	--	400	91	--	--	850	230	54	1100	.3	1400
--	--	190	38	--	--	560	280	70	370	.2	600
--	--	360	140	--	--	1200	210	130	1200	1.2	1500
2270	2090	350	150	5.8	60	1300	160	120	1300	1.6	1500
--	--	87	28	--	--	12000	200	190	340	1.6	550
--	--	240	70	4.8	--	4400	216	58	710	.4	890
--	--	220	77	5.0	--	6700	156	68	740	.6	870
--	--	150	26	--	--	1000	360	130	180	.5	480
--	--	240	42	--	--	130	290	120	200	.5	770
--	--	170	100	--	--	400	320	110	650	.4	840
2270	2110	370	150	6.0	55	13000	180	93	1300	.6	1600
--	--	280	83	--	--	11000	288	110	740	1.1	1100
--	--	73	30	2.2	--	5000	102	49	270	.6	310
--	--	470	170	--	--	16000	150	200	1500	2.0	1900
--	--	530	170	--	--	16000	154	420	1600	1.9	2000
--	--	4.0	.8	5.0	--	80	280	110	230	.6	13
--	--	32	11	--	--	920	32	28	120	.2	130
--	--	--	--	--	--	--	--	--	--	--	--
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--	--	28	9.0	--	--	730	25	24	93	.4	110
--	--	400	140	--	--	10000	180	180	1300	.7	1600
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--	--	330	140	--	--	9300	190	90	1200	1.1	1400
--	--	--	--	--	--	--	--	--	--	--	--
560	--	73	22	--	--	780	340	69	81	2.2	270
--	--	62	39	--	--	3900	292	58	82	1.9	320
509	476	66	35	3.1	29	16000	--	51	150	1.9	330
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--	--	120	48	--	--	1800	270	100	250	.8	500
572	547	88	29	4.0	60	670	270	97	95	.9	340
--	--	96	64	--	--	1500	200	83	380	.7	530
--	--	120	110	--	--	3100	290	360	550	1.4	760
--	--	120	95	--	--	3400	280	200	510	1.7	690
1380	1270	140	100	10	110	4700	230	180	560	1.8	770
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1830	1770	200	120	12	200	7000	200	400	690	.5	1000
510	483	75	28	3.4	50	1500	240	88	90	1.2	300
846	775	130	52	3.3	40	2400	200	81	330	.8	540

TABLE 1.--CHEMICAL ANALYSES OF GROUND WATER IN SARASOTA COUNTY-CONTINUED

MAP NUMBER	STATION NUMBER	DATE OF SAMPLE	TIME	HYDROLOGIC ZONE	SAMPLING DEPTH (FT)	RADIUM 226, DISSOLVED, RADON METHOD (PCI/L)	RA-226, DISSOLVED, PLANCHET COUNT (PCI/L)	SPECIFIC CONDUCTANCE (MICROMHOS)	URANIUM DISSOLVED, EXTRACTION (UG/L)	URANIUM DISSOLVED, DIRECT FLUOROMETRIC (PCI/L)
		78-02-01	1500	2,MP	--	--	9.8	--	--	--
60	271601082330501	78-08-23	0800	S	34	3.6	--	9500	--	--
		78-08-24	1330	1	69	110	--	19000	--	--
		78-08-24	1600	1	79	28	--	6500	--	--
		78-08-28	0900	1	89	26	--	5750	--	--
		78-08-29	1100	2	130	27	--	6000	--	--
		78-08-29	1500	2	155	15	--	4000	--	--
		78-08-30	0900	2	170	13	--	2630	--	--
		78-08-30	1630	2	190	29	--	3010	--	--
		78-08-31	1400	2	215	22	--	2100	--	--
		78-09-05	1300	3	235	3.8	--	1450	--	--
		78-09-07	1100	3	315	3.4	--	1520	--	--
		78-09-07	1400	3	325	2.8	--	2050	--	--
		78-09-11	1500	3	335	9.6	--	3200	--	--
		78-09-11	1800	3	345	7.6	--	3750	--	--
		78-10-03	1630	3	500	7.8	--	3200	--	--
		78-10-05	1430	4	530	2.7	--	3590	--	--
		78-10-05	1530	4	535	4.1	--	4030	--	--
		78-10-09	1630	4	565	4.4	--	4180	--	--
		79-06-06	1600	4	--	--	--	--	--	--
		79-06-28	1650	4	--	--	--	2380	--	--
61	271606082280201	79-02-02	0900	2	--	--	7.2	--	--	--
62	271609082252401	78-09-14	1500	2	--	.38	--	495	--	--
63	271612082313901	78-11-29	1800	3	420	3.8	--	2650	--	--
		78-12-01	1600	4	545	5.9	--	3725	--	--
64	271633082311901	78-09-19	1030	2	--	16	--	--	--	--
65	271634082285801	78-11-02	1000	1	69	--	3.2	1055	--	--
		78-11-13	1000	2	140	--	9.8	750	--	--
		78-11-13	1530	2	170	--	7.1	830	--	--
		78-11-14	1630	2	190	--	5.3	700	--	--
		78-11-20	1500	2	240	--	3.2	650	--	--
		78-11-20	1630	3	250	--	6.8	765	--	--
		78-11-28	1300	3	315	--	2.2	520	--	--
		78-11-29	1030	3	345	--	3.7	745	--	--
		78-12-04	1700	3	360	--	3.0	980	--	--
		78-12-05	1000	3	375	--	2.6	1200	--	--
		78-12-06	1330	3	405	--	2.4	1350	--	--
		78-12-07	1400	3	450	--	2.0	1660	--	--
		78-12-12	1630	4	495	--	1.6	1890	--	--
		78-12-13	1100	4	510	--	1.3	2030	--	--
		78-12-18	1200	4	585	--	3.4	2310	--	--
66	271659082243901	78-09-20	1130	2	124	10	--	1320	--	--
67	271747082320401	78-11-07	0930	S	44	--	1.0	--	--	--
		78-11-08	0930	1	62	--	1.7	955	--	--
		78-11-08	1130	1	78	--	8.4	1020	--	--
		78-11-09	0830	2	133	--	5.0	--	--	--
		78-11-09	1130	2	160	--	12	--	--	--
68	271757082241301	79-02-01	1515	2	--	--	2.8	--	--	--
69	271803082284101	78-07-28	1030	2	110	3.1	--	--	--	--
70	271821082155101	78-05-11	0950	S	22	.07	--	--	--	--

SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L)	SOLIDS, SUM OF CONSTI-TUENTS, DIS-SOLVED (MG/L)	CALCIUM DIS-SOLVED (MG/L AS CA)	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG)	POTAS-SIUM, DIS-SOLVED (MG/L AS K)	SODIUM, DIS-SOLVED (MG/L AS NA)	STRON-TIUM, DIS-SOLVED (UG/L AS SR)	BICAR-BONATE (MG/L AS HCO3)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	SULFATE DIS-SOLVED (MG/L AS SO4)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)	HARD-NESS (MG/L AS CACO3)
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--	--	200	130	--	--	22000	148	460	800	2.0	1100
--	--	--	--	--	--	--	--	270	--	--	--
859	--	130	53	--	--	1900	260	49	340	.6	550
285	285	46	21	.8	28	260	240	28	24	.3	200
--	--	--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--	--	--
2330	2120	290	140	10	160	19000	180	360	1000	1.3	1300
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986	939	150	59	3.6	60	5300	190	100	430	1.1	620
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598	547	95	41	2.9	43	580	230	96	120	.7	410
738	--	120	37	--	--	1500	270	72	210	.8	450
499	443	70	20	3.8	50	3100	240	83	57	1.0	260
--	--	--	--	--	--	--	--	--	--	--	--

TABLE 1.--CHEMICAL ANALYSES OF GROUND WATER IN SARASOTA COUNTY-CONTINUED

MAP NUMBER	STATION NUMBER	DATE OF SAMPLE	TIME	HYDROLOGIC ZONE	SAMPLING DEPTH (FT)	RADIUM 226, DISSOLVED, RADON METHOD (PCI/L)	RA-226, DISSOLVED, PLANCHET COUNT (PCI/L)	SPECIFIC CONDUCTANCE (MICROMHOS)	URANIUM DISSOLVED, EXTRACTION (UG/L)	URANIUM DISSOLVED, DIRECT FLOUROMETRIC (PCI/L)
71	271824082283501	78-07-31	1200	2	120	4.0	--	--	--	--
72	271846082250901	78-07-05	1400	2	162	15	--	--	--	--
73	271901082275601	78-09-14	1600	2	--	30	--	1115	--	--
74	271959082270901	79-01-11	1500	2	--	--	13	795	--	--
75	272013082285401	78-06-28	1500	2	89	1.8	--	--	--	--
76	272020082194801	78-01-11	1430	3	300	.16	--	--	--	--
		78-01-12	1145	3	400	1.2	--	--	--	--
		78-01-13	1245	4	500	3.2	--	--	--	--
		78-02-06	1650	4	500	--	--	--	--	--
77	272026082360301	78-08-21	1200	3	320	5.5	--	2040	--	--
78	272043082251701	78-10-04	1430	2	183	--	1.2	--	--	--
79	272047082273701	78-07-07	1100	2	150	15	--	--	--	--
80	272049082324401	79-04-06	1200	3	479	--	5.6	--	--	--
81	272053082320202	78-08-29	1400	5	1147	3.2	--	5500	--	--
82	272102082324001	79-01-22	1145	4	--	--	8.5	--	--	--
83	272151082151801	76-07-15	0800	3	400	3.3	--	450	--	<.7
		76-08-10	0900	4	655	2.4	--	720	--	1.4
		76-08-24	1158	4	655	5.1	--	868	<.01	--
84	272202082282401	78-11-07	1100	3	475	--	5.9	--	--	--
		78-11-08	1200	4	715	--	3.2	--	--	--
85	272220082151201	75-05-01	0900	4	570	--	--	720	--	--
		76-07-14	1420	4	570	5.3	--	740	<.01	--
86	272222082283201	78-12-06	1700	2	132	--	.8	397	--	--
87	272222082294001	78-09-22	1600	2	92	7.8	--	820	--	--
88	272233082152701	75-04-30	1430	4	600	--	--	1140	--	--
		76-07-14	1330	4	600	5.3	--	1120	.08	--
89	272237082331601	78-11-09	1030	1	38	--	2.8	690	--	--
		78-11-16	1530	3	380	--	2.5	1105	--	--
		78-11-17	0830	3	--	--	3.7	1195	--	--
90	272248082175301	75-04-28	1430	4	578	--	--	980	--	--
		76-07-13	1340	4	520	6.3	--	960	.01	--
91	272248082190301	75-04-28	0900	4	607	--	--	1080	--	--
		76-07-13	0830	4	607	1.4	--	1100	--	.0
		78-01-27	0855	4	--	--	--	1095	--	--
92	272252082175401	75-06-17	0900	MR	--	--	--	995	--	--
		76-08-25	1100	MR	--	--	--	1010	--	--
		78-08-01	1210	MR	--	4.0	--	--	--	--
93	272256082163501	75-04-30	1300	4,5	1000	--	--	1300	--	--
		76-07-14	1245	4,5	1191	4.3	--	1370	.02	--
		78-07-27	1335	4,5	--	--	--	1185	--	--

SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L)	SOLIDS, SUM OF CONSTI-TUENTS, DIS-SOLVED (MG/L)	CALCIUM DIS-SOLVED (MG/L AS CA)	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG)	POTAS-SIUM, DIS-SOLVED (MG/L AS K)	SODIUM, DIS-SOLVED (MG/L AS NA)	STRON-TIUM, DIS-SOLVED (UG/L AS SR)	BICAR-BONATE (MG/L AS HCO3)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	SULFATE DIS-SOLVED (MG/L AS SO4)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)	HARD-NESS (MG/L AS CACO3)
485	437	59	24	4.4	45	1100	250	95	31	1.3	270
1130	920	140	62	3.6	55	5900	210	98	410	1.1	610
707	593	78	41	10	75	1200	230	230	4.1	1.4	370
538	521	72	43	4.8	37	4400	210	66	140	2.3	360
991	854	90	47	8.5	140	900	260	230	180	.8	420
297	305	33	23	5.9	32	6800	220	37	16	3.1	180
301	310	40	23	4.2	28	11000	230	23	39	2.1	210
925	924	140	88	3.6	16	28000	170	19	520	1.4	740
583	556	78	41	3.8	24	18000	200	22	240	1.9	380
--	--	--	--	--	--	--	--	--	--	--	--
375	353	77	6.1	1.9	42	540	200	83	18	.7	220
513	505	79	32	5.1	38	2800	210	67	130	2.3	330
--	--	240	130	--	--	22000	160	280	870	2.1	1200
4020	3510	430	200	15	480	21000	89	1100	1200	1.0	1900
6110	5610	460	220	29	1200	2700	160	2400	1200	1.1	2100
--	--	--	--	4.3	--	--	--	--	--	--	--
--	--	--	--	3.1	--	--	--	--	--	--	--
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--	--	73	36	--	--	19000	222	29	160	1.2	350
--	--	110	48	2.4	--	19000	168	19	330	1.0	490
256	265	39	22	4.8	25	510	210	33	11	1.5	190
522	490	67	34	4.9	47	570	210	93	98	1.0	310
--	--	140	64	--	--	20000	192	16	400	1.2	640
--	--	150	64	2.8	--	20000	152	18	440	1.2	660
--	--	--	--	--	--	--	--	--	--	--	--
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--	--	--	--	--	--	--	--	--	--	--	--
--	--	100	55	--	--	24000	205	18	330	1.8	500
--	--	100	52	3.2	--	24000	204	20	360	1.9	490
--	--	130	64	--	--	30000	197	17	400	1.5	620
--	--	130	60	3.3	--	25000	187	21	400	1.4	600
--	--	--	--	--	--	--	--	26	430	--	--
730	687	110	52	3.0	21	16000	212	25	320	1.8	510
766	718	120	56	2.8	15	20000	192	21	360	1.4	550
--	--	--	--	--	--	--	--	--	--	--	--
--	--	180	75	--	--	18000	194	15	560	1.1	780
--	--	200	78	2.9	--	16000	192	19	600	1.3	830
--	--	--	--	--	--	--	--	16	540	--	--

also lists the hydrologic zone (as described by Joyner and Sutcliffe, 1976, p. 19) and depth sampled, where known, and results of radionuclide and chemical-quality analyses. Data for wells where the hydrologic zone is not identified are given because they are representative of the quality of the raw water or product water at a water plant. Generally, the water furnished is all from the same zone.

Some areas of the county were not sampled because wells in the areas were not open to a single water-bearing zone, or because there was no drilling in the areas during the data collection period. Data listed in table 1 are from files of the U.S. Geological Survey, the U.S. Environmental Protection Agency, or from sampling done as part of this study.

Radiochemical and chemical characteristics were determined for 200 groundwater samples collected from 92 wells in the county. Radium-226 activities ranged from near zero to 110 pCi/L. Radium-226 analysis was made on 161 of the water samples and 86 samples equaled or exceeded the 5 pCi/L maximum contaminant level established by the National Interim Primary Drinking Water Regulations (U.S. Environmental Protection Agency, 1976). Sixty percent of the wells had radium-226 activities, at one or more depths, that exceeded the recommended maximum contaminant level.

Data for chemical constituents are included because they are useful for water-management planning and data interpretation. Data from this initial phase of the study will be used in the interpretive phase to determine if the occurrence of radionuclides in ground water is associated with specific water-bearing zones, perhaps zones containing abundant phosphatic minerals in the rocks. A definition of hydrogeologic units, geologic controls, and the occurrence of radionuclides may provide a basis for developing well-construction methods that would prevent water with high radionuclide concentration from entering producing wells.

ACKNOWLEDGMENTS

Without support of the Sarasota County Commission and their Administrator, Ed Maroney, this project would not have been possible. We wish to acknowledge the assistance of the Environmental Health Section of the Sarasota County Health Department for furnishing notification when wells would be drilled and could be sampled. The assistance of well drillers who collected cuttings and water samples during drilling of wells is greatly appreciated. The Southwest Florida Water Management District allowed the U.S. Geological Survey to participate in the drilling of several core holes and assisted in collecting core samples.

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