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RESULTS OF WATER QUALITY SAMPLING NEAR RICHTON, CYPRESS CREEK, AND LAMPTON SALT DOMES, MISSISSIPPI

By L. A. Gandl and C. A. Spiers

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ABSTRACT

In the Mississippi salt-dome basin in southern Mississippi, chemical quality studies of surface water and ground water have been made to determine present water-quality conditions near three salt domes being studied by the Department of Energy as potential repositories for radioactive wastes. Chloride concentrations in excess of 60 milligrams per liter in surface water and ground water in Perry County indicate that the chloride could be originating from industrial wastes, oil test wells, or dissolution of Richton or Cypress Creek domes. All water sampled near Lampton dome contained less than 50 milligrams per liter chloride.

INTRODUCTION

The U.S. Geological Survey has been asked to describe the geohydrology of the Mississippi salt-dome basin in conjunction with the U.S. Department of Energy's investigation of salt domes in Mississippi as possible sites for storage of nuclear wastes. Of the 50 domes in the salt basin, three have been selected for more intensive geohydrologic studies. The domes are Richton and Cypress Creek domes in Perry County, and Lampton dome in Marion County (fig. 1). These domes were selected jointly by the Office of Waste Isolation of Union Carbide Corporation and Law Engineering and Testing Company, contractors with the Department of Energy. In this study, the chemical quality of surface water and ground water has been examined to determine the water-quality conditions near the three salt domes.

One criteria for selection of a dome and its subsequent use as a nuclear waste repository is the hydrologic stability of the dome. In other words, is the dome being dissolved by ground water? This reconnaissance study was a first attempt at determining whether salt in the domes is in contact with the hydrologic system, and establishes a network of sampling sites for further studies. This study is part of a larger, ongoing study describing the regional geohydrology of the salt-dome basin.

The area studied was confined to Perry County and parts of Marion and Lamar Counties. The total area encompasses about 1,150 square miles (2,978 km^2)and is underlain by unconsolidated Miocene, Pliocene, Pleistocene, and Holocene sand, gravel, and clay (table 1). These formations dip gently to the south and southwest. The tops of Richton and Cypress Creek dome have penetrated to the base of the Miocene aquifers at depths between 600 and 2,000 ft (183 to 610 m). The top of Lampton dome has penetrated to Oligocene aquifers underlying Miocene strata at 1400 ft (427 m).

The Miocene aquifers are the principal aquifers used for water supplies in the area. The regional direction of ground-water flow in

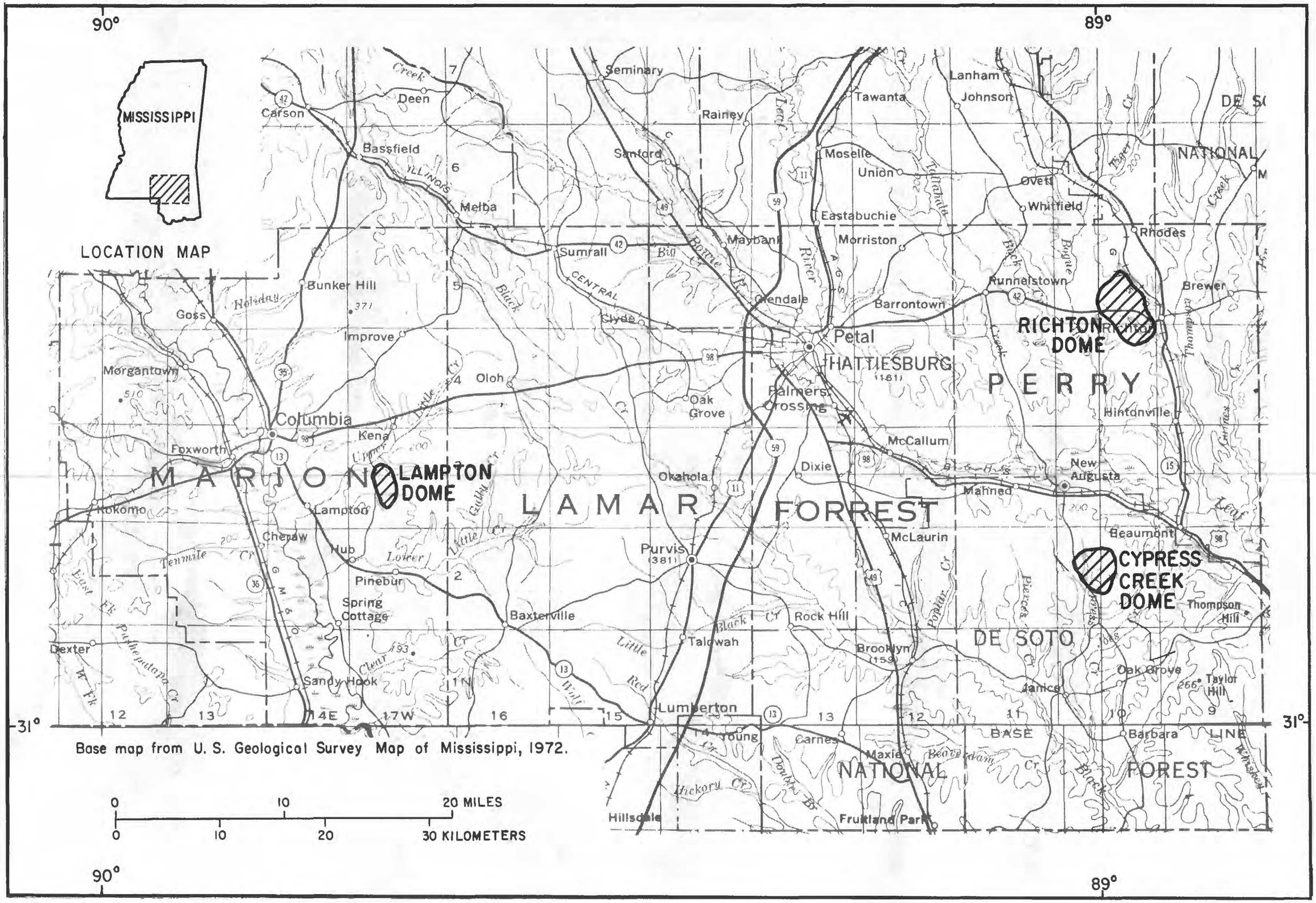

Figure 1.--Location of Richton, Cypress Creek, and Lampton domes in Mississippi.

Table 1.--Lithology and water-bearing character of formations in south-central Mississippi

System	Series	Stratigraphic unit		Uneroded thickness (feet)	Lithology and water-bearing character
Quaternary	Holocene		Alluvium	0-75	Sand and gravel supply domestic and other small-quantity requirements. Pearl River alluvium is a potentially important aquifer in Marion County.
Quaternary	Pleistocene		Terrace deposits	0-50	Sand and gravel supply domestic and other small-quantity requirements.
Tertiary	Pliocene		Citronelle Fm	0-200	Sand and gravel are important source of supply for domestic, stock, and other small- to medium-quantity requirements. Formation is scattered. Used for one small public-supply system.
Tertiary	Miocene		Pascagoula Fm Hattiesburg Fm Catahoula Sandstone	800-2,800	Lenticular beds of sand and gravelly sand are capable of supplying large quantities of water where they are well developed. Miocene beds supply Collins, Columbia, Hattiesburg, Monticello, Sumrall, and Tylertown.
Tertiary	Oligocene	Vicksburg Group	Undifferentiated	90-160	Undifferentiated sequence of sand, marl, and limestone that may yield up to 150 gal/min to wells in places. Water is probably highly mineralized but fresh in northern part of area and is definitely saline in southern part of Lamar, Marion, Forrest, and Perry Counties. This unit is not used as a source of water in this area.
Tertiary	Oligocene	Vicksburg Group	Forest Hill Sand / Red Bluff Clay	90-140	Water-bearing sand is not sufficiently developed in this area to be used as a source for other than small-quantity requirements. Underlying Red Bluff Clay replaces Forest Hill Sand toward the east.
Tertiary	Eocene	Jackson Group	Yazoo Clay	140-300	Thick clay is a confining bed. Thin sand beds are not capable of yielding significant quantities of water.
Tertiary	Eocene	Jackson Group	Moodys Branch Fm	20-30	Thin bed of marl. Not known to be used as a source of water in this area.
Tertiary	Eocene	Claiborne Group	Cockfield Fm	20-340	Sand beds may contain fresh water in northern extremity of area. Formation thins and sand content diminishes toward the southwest. The predominently clayey formation is a confining bed in southern part of area. Not used as a source of water and probably could not yield a large quantity of water. Water may be colored.
Tertiary	Eocene	Claiborne Group	Cook Mountain Fm	150-300	Sand and limestone beds probably contain saline water throughout the area. Formation thins toward the south. Basal calcareous unit is continuous throughout the area and is used for injection of brine in southwestern part of Lamar County.
Tertiary	Eocene	Claiborne Group	Sparta Sand	210-740	Potential source of fresh water in northern third of area. Not used as a source of water in area. Water may be colored. Formation thins and sand content diminishes toward the southwest. Predominantly clayey formation acts as a confining bed in southern part of area.
Tertiary	Eocene	Claiborne Group	Zilpha Clay	120-250	Clay and shale form a confining bed.
Tertiary	Eocene	Claiborne Group	Winona Sand	20-90	Clay and marl form a confining bed in this area. Sand bed is not well developed and contains saline water.
Tertiary	Eocene	Claiborne Group	Tallahatta Fm	130-220	Clay is a confining bed in this area. Meridian Sand Member is not consistently well developed, and water is saline. Because this member is usually indistinguishable from the upper Wilcox, it is often mapped with it. May have potential for injection of unwanted fluids.
Tertiary	Eocene	Wilcox Group	Undifferentiated	2,700-3,200	Sand beds are irregular in shape and distribution, and contain saline water. Beds have potential for injection of unwanted fluids.

Table modified from Taylor, R. E., and others, 1968, p. 4

the aquifers is generally southward (downdip), except where flow has been diverted by heavy pumping or salt domes. Due to pumpage, water levels in the Miocene are declining about one foot per year.

The topography is rolling to moderately hilly and drainage is by tributaries of the Pascagoula River. There is no evidence of the topography or drainage being influenced by the penetration of a salt dome into the overlying sediments, except at Cypress Creek dome where there is a topographic depression in the form of a swamp over the dome (fig. 2).

According to R. E. Taylor and others (1968, p. 60),

> "Salt domes locally alter the character and extent of the aquifers. Formations pierced by salt domes are dragged upward by the movement or growth of the salt stock, and consequently, the contiguous aquifers are changed and moved. Aquifers may change in thickness, position, and physical character over a salt dome because of local differences in the depositional environment. Faulting adds to the complexity of the aquifers near domes. The quality of ground water in the vicinity of salt domes may be poorer than that in the surrounding area. The extent to which the domes affect water quality generally varies with the depth of the domes."

INFORMATION AVAILABLE

In April 1978, a reconnaissance of streams near the three domes was made to determine the specific conductance and temperature of surface waters in the area, and to identify and locate sampling sites that could be used in further investigations. The results of these measurements are given in table 2.

Surface-water and ground-water samples were collected in the area of the three domes for laboratory analysis in August 1978. Sampling sites are shown in figures 2 and 3. The results of the analyses of the surface-water samples, as well as selected analyses from previous studies, are given in table 3. Chemical analyses of ground-water samples collected in August 1978 are given in table 4, along with ground-water analyses from previous studies.

INTERPRETATION AND CONCLUSIONS

When ground or surface water comes into contact with the sodium chloride (salt) of a salt dome, the salt is dissolved and the chloride concentration of the water increases as does its dissolved solids content and specific conductance. The relationship of the chloride concentrations and dissolved solids content to the specific conductance of water in the vicinity of the salt domes is shown on figure 4.

Although water that comes into contact with the salt of a dome would tend to have an abnormally high chloride content, a high chloride content is not conclusive proof that the water has been in contact with a salt dome.

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Table 2.--Specific conductances of surface-water samples from April 1978 reconnaissance

Site number	Descriptive name	Sampling date	Specific Conductance in micromhos at 25°C	Temperature °C	Nearest dome
02474555	Milky Creek near New Augusta	April 25	46	17.4	Cypress Creek
02474598	Mill Creek near Richton	24	47	18.5	Richton
02474600	Bogue Homo near Richton	24	165	20.0	Richton
02474604	Linda Creek near Rhodes	24	22	17.5	Richton
02474607	Linda Creek near Richton	24	34	18.0	Richton
02474610	Big Thick Branch near Richton	25	25	16.0	Richton
02474615	Mike Branch near Richton	25	24	15.5	Richton
02474620	Bogue Homo at Highway 42 near Richton	24	17	20.5	Richton
02474621	Harper Branch near Richton	24	40	17.5	Richton
02474650	Buck Creek near Runnelstown	24	205	19.5	Richton
02474658	Ready Underwood Branch near Runnelstown	25	36	19.5	Richton
02474663	Bear Branch near Runnelstown	25	44	17.0	Richton
02474665	Nicholson Branch near Richton	25	34	17.0	Richton
02474670	Bogue Homo Near New Augusta	25	140	19.0	Richton
02474676	Mill Creek near Hintonville	25	29	17.0	Richton
02474683	Coleman Creek near New Augusta	25	50	17.5	Cypress Creek
02474700	Dickeys Creek near Beaumont	25	29	17.0	Cypress Creek
02474748	Carters Creek near Beaumont	25	36	17.0	Cypress Creek
02474785	Thompson Creek near Good Hope	24	46	16.5	Richton
02474787	Pine Log Branch near Good Hope	24	40	19.5	Richton
02474795	Fox Branch near Richton	24	38	24.0	Richton
02474798	Beaver Dam Creek at Richton	24	25	20.5	Richton
02474800	Thompson Creek at Richton	25	41	16.0	Richton
02474802	Tallahala Creek Trib. No.1 at Richton	25	100	17.0	Richton
02474804	Tallahala Creek Trib. No. 2 near Richton	25	26	17.5	Richton
02474808	Pine Branch near Richton	25	37	16.5	Richton
02474812	Tallahala Creek Trib. No. 3 at Richton	25	25	16.5	Richton
02474820	Thompson Creek near Hintonville	25	71	17.5	Richton
02479150	Cypress Creek near New Augusta	25	25	20.8	Cypress Creek
02479151	Red Hill Creek near New Augusta	25	17	17.5	Cypress Creek
02479152	Shut Eye Creek near Beaumont	25	18	19.0	Cypress Creek
02479153	Cypress Creek near Beaumont	25	18	17.5	Cypress Creek
02489108	Big Creek Trib. No. 1 near Lampton	26	22	16.5	Lampton
02489113	Upper Little Creek near Lampton	26	29	15.8	Lampton
02489115	Upper Little Creek Trib. No. 1 near Columbia	26	26	14.5	Lampton
02489126	Stewarts Branch near Lampton	26	33	19.0	Lampton
02489127	Upper Little Creek near Hub	26	29	16.2	Lampton
02489130	Upper Little Creek at Lampton	26	38	16.5	Lampton
02489190	Dillon Creek at Lampton	26	38	15.0	Lampton
02489238	Jacks Creek near Pinebur	26	20	18.0	Lampton
02489246	Lower Little Creek at Pinebur	26	22	17.0	Lampton
02489249	Lower Little Creek near Pinebur	26	22	16.5	Lampton
02489257	Lower Little Creek Trib. No. 1 near Hub	26	34	14.5	Lampton

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Table 3.--Chemical analyses of surface water from selected streams in the study area

Site number	Name	Discharge (ft^3/s)	Date sampled	Silica (mg/L)	*Iron (μg/L)	Calcium (mg/L)	Magnesium (mg/L)	Sodium (mg/L)	Potassium (mg/L)	Bicarbonate (mg/L)	Sulfate (mg/L)	Chloride (mg/L)	Flouride (mg/L)	Dissolved solids (mg/L)	Hardness as $CaCO_3$ (mg/L)	pH	Specific conductance micromhos at 25°C	Color	Nearest dome
								PERRY COUNTY											
02473360	Leaf River near Mahned	625	11-29-65	11	10	4.7	0.8	99	2.0	10	6.8	160	0.1	306	15	6.0	573	15	Richton
		620	11-17-75	--	--	--	--	8.6	--	--	--	11	--	54	--	6.0	85	5	Richton
02474370	Tallahala Creek near Barrontown	570	6-18-75	--	--	--	--	--	--	--	--	--	--	--	--	5.8	95	100	Richton
02474500	Tallahala Creek near Runnelstown	2800	12-16-71	--	--	13	7.0	14	2.4	--	5.6	8	--	--	20	6.0	67	15	Richton
02474540	Tallahala Creek near Mahned	182	10-21-64	14	20	7.1	2.0	17	2.2	34	5.2	22	0.0	87	26	6.1	138	30	Richton
02474600	Bogue Homo near Richton	3700	3-10-64	7.5	170	4.1	1.4	4.1	1.3	11	4.8	7.1	1.0	37	16	5.5	63	90	Richton
		9.5	11-18-65	7.1	20	--	--	51	--	10	2.2	103	--	231	45	6.4	373	15	Richton
		--	8-22-78	6.8	480	3.2	0.9	4.0	1.6	9	4.0	6.7	0.0	54	12	6.6	59	50	Richton
02474670	Bogue Homo near New Augusta	--	3- 6-69	6.9	80	11	1.6	32	1.0	11	4.2	65	0.1	182	34	6.2	245	50	Richton
02474680	Leaf River near Wingate	780	11-18-71	--	--	--	--	12	--	--	--	14	--	78	--	7.1	110	15	Richton
02474740	Leaf River at Beaumont	--	10- 6-77	--	--	3.6	1.2	8.5	2.4	18	5.8	10	--	--	14	7.0	65	50	Richton
02474798	Beaverdam Creek at Richton	--	8-22-78	9.8	180	1.3	0.5	2.0	0.9	3	1.3	3.3	0.0	32	5	6.3	23	25	Richton
02474800	Thompson Creek at Richton	6.6	11-18-65	11	250	--	--	3.2	--	4	--	4.8	--	38	4	6.0	30	80	Richton
02474820	Thompson Creek near Hintonville	--	3-6-69	9.4	90	7.0	0.1	5.4	0.7	19	2.2	9.1	0.1	72	18	6.4	68	60	Richton
02474960	Gaines Creek near Beaumont	1.6	11-18-65	7.6	150	--	--	3.2	--	8	2.6	4.6	--	40	8	6.4	37	30	Richton
02479145	Black Creek near Janice	218	11-16-71	--	--	--	--	--	--	--	--	4.8	--	--	--	--	50	15	Cypress Creek
02479150	Cypress Creek near New Augusta	--	8-23-78	13	360	0.9	0.4	2.2	2.8	2	3.6	4.6	0.0	52	4	5.6	26	110	Cypress Creek
02479153	Cypress Creek near Beaumont	39	11-16-71	--	--	--	--	--	--	--	--	5.6	--	--	--	--	50	10	Cypress Creek
02479155	Cypress Creek near Janice	147	4-13-75	8.0	390	1.8	0.4	1.7	0.2	3	27	2.8	0.1	2.7	6	6.2	25	--	Cypress Creek
								MARION COUNTY											
02489190	Dillon Creek at Lampton	--	8-24-78	11	170	2.4	1.1	3.9	1.2	9	2.4	5.6	0.0	55	11	6.3	45	30	Lampton
02489249	Lower Little Creek near Pinebur	--	8-24-78	8.4	260	1.6	0.6	1.8	1.0	2	2.9	2.4	0.0	36	6	6.3	26	55	Lampton

*Iron in this table in micrograms per liter.

Table 4.--Chemical analyses of ground water from selected wells in the study area

WATER BEARING UNIT CODE: 110TRCS-TERRACES; 122MOCN-MIOCENE; 122CTHL-CATAHOULA; 122HBRG-HATTIESBURG; 121CRNL-CITRONELLE

Well number	Water bearing unit	Well depth (ft)	Date of collection	Silica (mg/L)	Iron (mg/L)	Calcium (mg/L)	Magnesium (mg/L)	Sodium (mg/L)	Potassium (mg/L)	Bicarbonate (mg/L)	Sulfate (mg/L)	Chloride (mg/L)	Fluoride (mg/L)	Dissolved solids (mg/L)	Hardness as $CaCO_3$	Specific conductance (micromhos at 25°C)	pH	Color
									PERRY COUNTY									
A002	122MOCN	294	9/55	--	0.03	6.7	1.6	45	2.2	134	9.8	3.5	0.2	156	23	228	8.0	3
A008	122CTHL	658	9/64	6.4	0.65	11	5.0	35	2.7	129	11	4.4	0.1	144	48	232	7.2	10
B001	110TRCS	85	9/55	--	0.00	2.2	0.5	2.6	0.6	8	2.4	3.0	0.1	43	7	38	5.8	8
B022	122MOCN	454	11/69	9.2	0.37	1.9	0.3	55	1.7	123	9.0	12	0.1	154	6	249	7.6	0
C002	122CTHL	390	6/65	24	7.90	3.9	2.0	7.8	2.9	34	5.2	2.7	0.0	66	18	81	6.0	5
C008	122CTHL	1119	9/55	--	0.00	3.0	2.0	5.2	1.0	9	2.0	8.5	0.2	60	8	64	5.7	3
C010	122CTHL	728	9/55	--	0.54	1.3	0.2	43	1.4	111	1.6	5.0	0.2	157	4	200	7.4	22
C015	122CTHL	736	8/78	12	1.10	14	2.3	150	3.0	130	29	180	0.1	447	44	826	6.7	10
C040	122MOCN	660	4/69	1.6	1.00	6.0	1.7	32	1.0	--	7.4	10	0.0	106	22	--	6.8	--
C040	122MOCN	660	8/78	11	0.44	4.9	1.7	31	2.7	88	7.2	7.0	0.0	112	19	181	6.6	2
C041	122MOCN	520	1/71	--	0.75	2.0	2.4	7.3	2.5	--	8.6	3.0	0.0	--	15	--	6.1	--
D002	122MOCN	580	6/65	11	0.06	0.7	0.1	68	0.9	160	6.4	6.0	0.4	189	2	292	7.2	5
D005	122MOCN	389	6/65	19	0.40	9.6	3.4	33	3.0	120	7.0	3.7	0.1	140	38	223	6.9	5
D046	122HBRG	--	8/78	12	0.08	0.5	0.1	60	1.4	150	8.6	5.7	0.2	157	2	265	9.0	5
G006	122MOCN	425	11/67	25	1.40	9.4	3.0	28	2.6	104	12	3.5	0.1	135	36	202	6.9	30
H001	122MOCN	525	6/65	12	0.08	0.8	0.0	86	1.2	199	0.0	21	0.5	235	2	385	7.4	5
H003	122CTHL	740	4/18	24	0.08	0.4	2.6	158	--	329	6.8	45	--	--	--	--	--	--
H007	122CTHL	--	8/78	12	0.01	0.4	0.1	120	1.1	210	1.9	66	0.4	321	1	532	8.9	5
H009	122MOCN	1090	4/69	4.4	0.00	0.0	0.0	176	0.0	--	0.0	137	0.4	442	--	--	8.4	15
H009	122MOCN	1090	6/72	13	0.16	1.3	0.2	180	1.5	249	0.2	140	--	460	4	858	7.8	0
H010	122MOCN	810	11/69	12	1.40	17	1.8	730	5.9	478	25	855	1.0	1920	50	3430	8.1	--
H014	122CTHL	786	5/64	12	0.07	0.0	0.5	104	0.2	201	0.0	42	0.4	254	2	437	8.1	10
H015	122CTHL	744	7/13	13	1.20	3.1	0.6	--	--	469	1.6	49	--	--	--	--	--	--
J006	122MOCN	483	10/64	26	0.84	4.1	2.9	14	3.4	51	6.8	4.0	0.2	93	22	118	6.2	15
J010	122MOCN	663	12/64	--	0.18	--	--	--	--	--	--	1380	--	--	467	5050	--	--
J011	122MOCN	448	12/64	--	0.06	--	--	--	--	--	--	12	--	--	9	250	--	--
J026	122HBRG	--	8/78	13	0.14	0.7	0.2	2.4	1.1	5	0.7	2.0	0.0	26	3	22	5.9	1
J037	122MOCN	--	8/78	13	0.41	0.7	0.2	95	1.1	130	6.5	59	0.1	240	3	432	9.1	10
J060	122MOCN	550	2/76	18	0.09	14	3.9	190	3.4	153	24	230	0.4	540	51	830	7.4	0
K003	122MOCN	700	6/65	28	0.78	1.1	1.3	61	0.9	144	6.8	9.3	0.4	192	8	278	7.1	5
K003	122MOCN	700	8/78	31	0.01	1.2	0.2	65	1.1	140	7.5	10	0.2	189	4	279	9.0	4
M002	122MOCN	460	5/64	18	0.03	2.6	0.1	154	0.4	148	14	148	0.1	380	7	742	7.9	5
M009	122MOCN	639	7/61	8.0	0.40	14	2.8	--	--	--	11	265	0.2	--	46	--	7.9	--
M011	122MOCN	666	9/64	20	0.10	14	3.2	202	3.8	164	23	244	0.3	595	--	1090	7.5	--
M012	122HBRG	485	10/64	17	0.17	1.6	0.5	110	1.8	149	5.4	90	0.2	309	6	531	7.8	15
Ø003	122HBRG	320	9/64	6.6	0.00	1.9	0.5	62	0.8	148	5.0	9.6	0.2	138	7	262	7.8	0
Ø007	122MOCN	240	6/65	--	--	3.4	0.9	24	0.9	71	4.0	3.7	0.1	143	12	137	6.7	5
Ø010	122CTHL	--	4/74	16	--	1.0	--	68	0.4	166	7.0	14	--	188	--	320	8.9	3
R001	122MOCN	194	6/65	13	0.04	4.9	0.9	51	0.9	144	0.0	6.0	0.2	157	16	249	7.2	5
R002	122MOCN	745	6/65	22	0.35	0.4	0.0	58	0.7	138	6.4	5.4	0.3	--	--	255	7.3	10
R007	122MOCN	347	11/69	20	0.01	0.4	0.5	64	0.7	147	7.8	6.7	0.3	172	3	261	7.8	0
									MARION COUNTY									
B024	122HBRG	--	8/78	14	0.01	1.3	0.5	2.7	0.7	10	0.3	3.7	0.0	31	5	29	5.5	1
C021	122HBRG	--	8/78	9.4	0.02	1.0	0.5	2.0	0.7	6	1.1	2.7	0.0	31	5	24	5.5	5
G006	122CTHL	1040	10/66	14	0.27	0.9	0.3	54	2.0	137	6.4	2.4	0.3	148	4	219	7.6	0
G007	122CTHL	790	5/74	19	0.17	4.2	1.7	38	4.7	122	8.8	1.7	0.1	151	17	215	5.4	0
L027	122MOCN	1000	4/74	14	0.06	3.1	0.0	55	1.3	142	8.0	1.4	0.3	142	8	235	8.1	4
L028	122MOCN	195	4/74	24	0.00	3.4	1.0	2.6	2.0	15	1.3	3.0	0.1	24	13	50	5.6	1
M004	122HBRG	327	1/62	42	0.00	11	2.6	9.4	1.8	60	0.0	8.0	0.1	113	38	133	6.4	10
M055	122HBRG	--	8/78	16	0.05	17	3.3	14	3.0	81	8.5	9.2	0.1	154	56	180	6.5	4
Ø003	122MOCN	700	8/66	44	0.66	2.1	0.4	28	1.9	68	10	3.3	0.1	109	7	133	6.9	5
Ø006	122MOCN	280	10/66	26	0.03	2.0	0.5	38	1.4	90	9.4	3.5	0.1	127	7	167	7.3	0
P002	122CTHL	1028	1/62	12	0.06	1.0	0.1	55	1.1	140	6.6	1.7	0.2	153	3	236	7.7	10
									LAMAR COUNTY									
F019	122MOCN	279	8/61	48	0.20	17	2.6	14	2.6	91	0.2	8.8	0.2	145	53	182	6.5	0
J059	122MOCN	196	8/64	58	0.73	28	7.8	19	2.4	157	0.2	8.9	0.1	223	102	275	7.2	30
J074	122MOCN	280	8/64	58	1.40	22	6.1	25	2.2	147	0.0	9.2	0.1	194	80	260	7.1	30
J117	122HBRG	454	8/34	52	1.50	17	3.8	28	2.5	132	0.0	7.2	0.1	179	58	230	7.0	10
J136	121CRNL	200	3/67	52	0.57	9.0	2.1	15	4.5	70	6.2	4.3	0.2	138	31	138	6.5	10

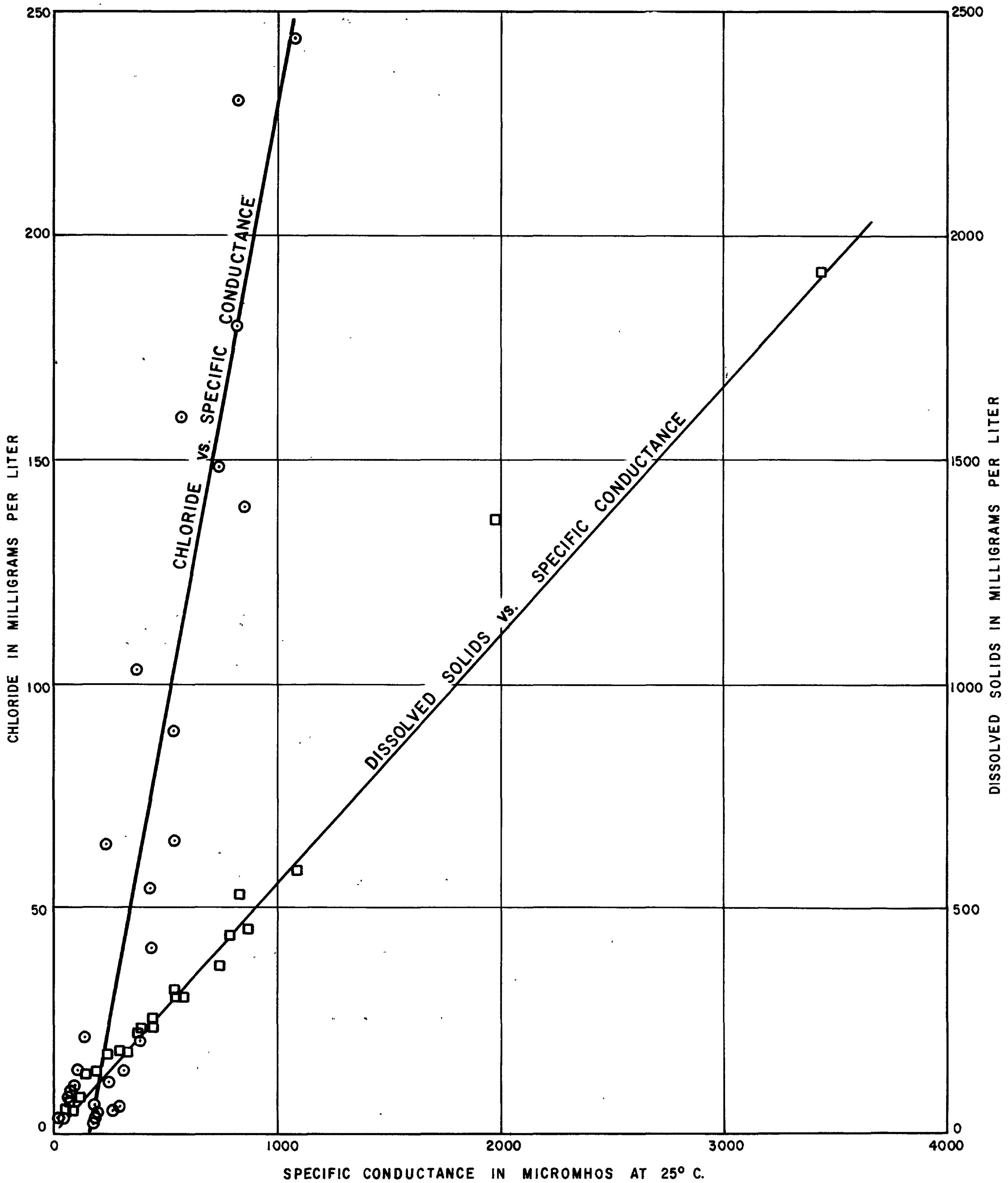

Figure 4.--Relationship of specific conductance to chloride and total dissolved solids concentrations in selected water samples from the study.

Although concentrations ranged from 2.4 to 600 mg/L (milligrams per liter) chloride, 66 percent of the samples of surface water collected in the area contained less than 10 mg/L of chloride and 81 percent contained less than 25 mg/L. Three of the four surface-water sites with chloride concentrations greater than 60 mg/L listed in table 3 are in central Perry County near or on the Leaf River (figure 5), indicating that the source of the chloride may be in this area. Three of these sites, however, recorded much lower concentrations at similar stages on other days, indicating that the source of chlorides may be intermittent.

Ground-water samples from the area contained chloride in concentrations ranging from 1.4 to 1,380 mg/L. Seventy-six percent of the samples contained less than 20 mg/L. Samples collected in Perry County along and north of the Leaf River, midway between Richton dome to the north and Cypress Creek dome to the south had the highest concentrations of chloride. None of the surface-water or ground-water samples collected in the Lampton dome area in Marion and Lamar Counties contained more than 50 mg/L chloride (tables 3 and 4).

Almost all of the ground-water samples from the study area are from wells tapping Miocene deposits. These wells range in depth from 134 to 1,119 feet (41 to 341 m). A few samples are from wells less than 200 feet (61 m) deep in the Pleistocene aquifer. Samples of water from wells less than 460 feet (150 m) deep (table 4) contained less than 20 mg/L of chloride.

The chloride concentrations in ground water in the study area generally are higher in deeper wells because salinity increases in successively deeper aquifers. Salinity is higher in deeper and downdip parts of the same aquifer because the water is farther from the source of recharge. As water moves deeper and downdip in an aquifer, it dissolves minerals and thus becomes more mineralized. The denser, more mineralized water tends to migrate more deeply into the aquifer.

The higher chloride concentrations in surface water and ground water might result from the improper disposal of brines from oil wells in the area. It also is possible that unplugged or leaky oil test wells could be leaking water from deep saline aquifers upward into the Miocene aquifers, which could then be discharging into area streams. Industrial or municipal wastes may also contribute to the high chloride concentrations, particularly those that are intermittent; however, waste discharges were not identified during this study.

Another source of the chlorides could be dissolution of Richton dome or Cypress Creek dome. Ground-water flow in the area is thought to be primarily from north to south, but some northward flow from an area south of the Leaf River could be occurring. Chlorides from the domes could thus be transported by ground water, resulting in higher levels near the river; however, information is not available at this time to support this theory.

Although this study identified several areas in which chloride concentrations were relatively high, no evidence was found to conclusively identify the source of these chlorides. Before the source can be determined, additional information about the surface water and

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ground water in the study area is necessary. Deeper wells around the periphery of the domes would provide useful information. Data from more shallow wells are needed, particularly near those locations where chloride concentrations are higher than normal for the area. Exploratory test wells near the selected domes are planned by the Department of Energy's contractor, Law Engineering and Testing Company. Chemical analysis of water samples from these wells would help identify the source of the chlorides in the water in the Miocene aquifers, although chlorides are not the only constituent that may help identify the source of the water near salt domes. Additional information obtained from these wells, such as aquifer characteristics, will help define the geohydrology of the salt-dome basin and will be among the considerations for determining whether any of the domes are suitable for storage of nuclear wastes.

SUMMARY

Surface-water and ground-water samples from some sites near Richton and Cypress Creek domes in Perry County contain higher concentrations of chlorides than normal for the area. The source of the chlorides could be: (1) the normal increase in dissolved solids downdip from the source of recharge, (2) improper disposal of brines from oil test drilling in the area, (3) leakage from a deep saline aquifer into the shallower, fresh Miocene aquifers, (4) contamination from industrial or municipal wastes, or (5) dissolution of one or both of the domes. More information from planned additional wells is needed before any conclusions can be drawn. Surface water and ground water sampled near Lampton dome did not contain excessive concentrations of chloride or any other constituents, indicating that dissolution of Lampton dome is probably not occurring.

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