MISSISSIPPI DEPARTMENT OF NATURAL RESOURCES
Bureau of Pollution Control
P.O. Box 10385
Jackson, Mississippi 39289-0385
(601) 961-5171

December 15, 1989

Approved S1-2
BAT
12/21/89

Mr. Narindar Kumar
Site Investigation & Support Branch
Waste Management Division
U.S. EPA - Region IV
345 Courtland Street, N. E.
Atlanta, Georgia 30365

Re: Hercules, Incorporated
Hattiesburg, Mississippi
MSD008182081

Dear Mr. Kumar:

Enclosed is a preliminary assessment report for the above referenced site. If you have any questions about the report, please contact Mr. Michael Slack at (601) 961-5217.

Sincerely,

Jim Hardage

Jim Hardage
Hazardous Waste Division

JH:MS=21
Enclosure

U.S. EPA REGION IV

SDMS

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V. 2-040506

A
PRELIMINARY ASSESSMENT REASSESSMENT (PAR)
REPORT FOR
HERCULES, INCORPORATED
HATTIESBURG, MISSISSIPPI
MSD008182081

Date 12/21/89
Approved SI-2 high priority
BAT

PREPARED FOR:

Narindar Kumar
Site Investigation and Support Branch
Waste Management Division - Region IV
Environmental Protection Agency
345 Courtland Street, N. E.
Atlanta, GA 30365

PREPARED BY:

Michael Slack
Hazardous Waste Division
Mississippi Bureau of Pollution Control (BPC)
P. O. Box 10385
Jackson, Mississippi 39289

REVIEWED AND EDITED BY:

Jim Hardage (BPC)

December 15, 1989

This Preliminary Assessment Reassessment (PAR) Report Includes:

1. Introduction
2. Background
3. Station Description
4. Sampling History
5. Waste Sources/Quantity/Hazardous Substances
6. Geology/Hydrology
7. The Aquifer of Concern
8. Precipitation
9. Surface Water
10. Environmental Concern
11. Conclusions and Recommendations
12. Appendix
    (a) HRS II Checklist
    (b) References

Introduction

The following report is a preliminary assessment reassessment (PAR) of Hercules, Incorporated in Hattiesburg, Forrest County, Mississippi. The original preliminary assessment was performed by the State in November, 1979.

County Code:	035
Congressional District:	05
Coordinates:	Latitude 31° 20' 20"
	Longitude 89° 18' 25"
Location:	NE1/4 SW1/4 S04 T4N R13W
Directions to Site:	Hercules, Incorporated may be reached by traveling north on Main Street through the City of Hattiesburg. Turn left at the intersection of Main Street and Seventh Street. Travel approximately one-half (0.5) of a mile on Seventh Street. Hercules, Incorporated is adjacent to Seventh Street on the right side.
Contact Official:	Preston W. Kirkendall Plant Manager Hercules, Incorporated P. O. Box 1937 W. Seventh Street Hattiesburg, MS 39401 Telephone: 601/545-3450 FAX
Cooperate Headquarters:	Hercules, Incorporated (601) 584-3226 Hercules Plaza 1313 N. Market Street Wilmington, DE 19894

Background

The Hercules facility produces a diverse line of industrial chemicals using rosins from pine tree stumps and paper mill by-products (tall oil). Some of the products manufactured at the facility are modified resins, polyamides, ketene dimer, crude tall oil wax emulsions, synthetic rubber, and Delnav, an agricultural pesticide. Over 250 products are produced at the facility. The facility began operation in 1923 and is presently an active facility (Reference 11 and 13).

In 1980, pursuant to RCRA, Hercules filed notification for on-site generation, treatment, and storage of spent sulfuric acid from a rosin polymerization operation. In 1983, the Mississippi Bureau of Pollution Control (BPC) determined that the spent sulfuric acid was exempt from

the RCRA hazardous waste regulations because it was being reused in the wastewater treatment system for elementary neutralization. As a result of this determination, interim status for storage and treatment of spent sulfuric acid in tanks and in a surface impoundment was withdrawn and Hercules reverted to the status of an occasional generator. In 1986, Hercules submitted a subsequent RCRA notification as a marketer and burner of hazardous waste boiler fuel (References 13 and 18).

The above mentioned wastewater treatment system treats contaminated water from all sources throughout the plant. Hercules currently has an NPDES permit for discharge of the treated wastewater into the Bowie River. Hercules also has an Air Pollution Control Permit for the operation of air emissions equipment at the facility (Reference 20).

Prior to 1980, in response to a Congressional subcommittee request for information from major chemical companies concerning waste disposal, Hercules voluntarily completed a survey form in which they identified disposal of various wastes from their process operations in a landfill on site. The landfill was referred to as the "Back Forty" landfill. This voluntary survey form later served as notification under the CERCLA program for on-site disposal of potentially hazardous substances. This landfill is not regulated under the RCRA program (Reference 17).

Station Description

The Hercules facility is approximately 200 acres in size. The facility consists of a complex chemical operation that involves wood grinding, shredding, extraction, fractionation, refining, distillation and processing of rosins from pine tree stumps. Common facilities at the site include the office, laboratory, shops, powerhouse, central loading and packaging facilities, and the railroad (Reference 11).

The facility is located on the north side of the City of Hattiesburg. The entire facility is fenced in and is not accessible to non-employees. This facility is surrounded by residential areas (References 8 and 11).

An area approximately forty acres in size on the north side of the facility, referred to as the Back Forty, has been used in the past for disposal of various wastes, including process wastes, boiler ash, and wastewater treatment sludge from the previously mentioned surface impoundment. The type of disposal of the process wastes has been primarily by landfill. The sludge has been disposed of in open shallow pits. The boiler ash has been disposed of by landfill and waste piles.

Based on site visits in 1979 and 1981 by the BPC, containment of the waste is thought to be unsound. Specifically, the landfill was not adequately covered in 1979, and ponding and unsound diking was observed at a sludge disposal pit in 1981. Further, it is unlikely that either the landfill or the sludge pits have a liner or a leachate collection system.

Sampling History

In July, 1981, samples were collected at Hercules by EPA Region IV and the BPC. Specifically, a sample of the influent to the wastewater surface impoundment and a sample of wastewater treatment sludge from the Back Forty sludge disposal pit were collected and analyzed for oil and grease, total metals, and Delnav, a pesticide.

Barium, cadmium, and silver were detected in the influent sample at low (below one ppm) levels. Arsenic, barium, and lead were detected in the sludge sample at low (below one ppm) levels. Delnav was not detected in either sample at a detection level of 0.1 ppm (Reference 23).

In March of 1983, samples from groundwater monitoring wells at the Hercules site were collected by the BPC. Groundwater samples were collected from the South well near the surface impoundment and the North well near the Back Forty sludge pits. Waste samples were collected from a sludge pit and a boiler ash pile. The groundwater samples were analyzed for phenol and total metals. The test results indicated that the shallow groundwater quality was acceptable. The waste samples were analyzed for the EP Toxicity (metals) characteristic. The test results indicated that the sludge and ash were not classified as hazardous under the Mississippi RCRA regulations. However, the groundwater and waste analyses were very limited in scope and did not include a full scan of priority pollutants (See References 21 and 22).

Waste Sources/Quantity/Hazardous Substances

According to the previously mentioned survey forms that Hercules submitted to a Congressional subcommittee, 347,100 tons of process wastes have been disposed of at the site. The process wastes consists of heavy metals (iron, manganese, magnesium, zinc, cadmium, copper, chromium (trivalent)), pesticides, halogenated aliphatics, resins, elastomers, solvents, oil sludges, esters and ethers, alcohols, ketones and aldehydes, salts, and mercaptans (Reference 17).

The hazardous substances of concern are manganese, cadmium, and chromium. These substances have a severe toxicity and are highly persistent. The physical states of the hazardous substances at the time of disposal were solids, liquids, and sludges (Reference 14).

Geology/Hydrology

The geological formations below the site area in descending order are as follows: Hattiesburg Formation, Catahoula Sandstone, Vicksburg Group (Undifferentiated) and Yazoo Clay.

Fresh-water aquifers in the study area are mostly beds of sand or zones of sandy beds. The beds dip gently to the southwest and contain fresh water as much as 40 miles from the outcrops and as much as 3,000 feet below land surface (Reference 2).

Prediction of aquifer thickness and lithology is difficult because of the lenticular bedding of most units. Lithologic changes occur in short distances and individual sands, which are irregular and thicken or thin in short distances, are difficult to trace, especially along the dip of the beds (Study area - Reference 2).

At Hattiesburg, the Hattiesburg Formation consists of thick beds of massive clays - 150 or 200 feet thick - which contain some lime but very little sand. Geophysical logs from area water wells indicate that the clay layer extends to a depth of approximately 215 feet below the land surface. A sand layer approximately 30 feet in thickness, however, occurs in the clay layer at a depth of approximately 65 feet below the land surface. Wells in the vicinity of Hattiesburg show that the clay bed is underlain by interbedded sands and clays with the sands increasing in prominence and becoming gravelly toward the base (Reference 1 and 4). Four Forrest County aquifer tests of the Hattiesburg Formation show hydraulic conductivities ranging from 96 to 180 ft/d (Reference 6).

Separating the Hattiesburg from the underlying Catahoula is extremely difficult. To avoid confusion both of these units are referred as the Miocene Aquifer System. The aquifer system is composed of numerous interbedded layers of sand and clay (sand beds in the miocene are characteristically lens-shaped or wedge-shaped). Because of the interbedded nature, the formations cannot be reliably separated and correlated either on the surface or in the subsurface (References 2, 5, and 7).

Recharge to the Miocene Aquifer is from rainfall directly on the outcrop and leakage between aquifer units of the Miocene Aquifer System. Ten Forrest County aquifer tests of the Catahoula Sandstone, which is the lower unit the of Miocene Aquifer System, show hydraulic conductivities ranging from 18 to 170 ft/d. Hydraulic conductivities average 95 ft/d for the Miocene Aquifer System. Lithologic data and other published information indicates that the Miocene Aquifer System extends to a depth of approximately 1150 feet below the land surface (Reference 6 and 7).

Underlying the Miocene Aquifer is the Vicksburg Group (Undifferentiated) which is generally composed of limestone beds alternating with thin beds of limy sand and clay. Lithologic data indicates that the Vicksburg Group (Undifferentiated) extends to a depth of approximately 1300 feet below the land surface (Reference 2).

The Aquifer of Concern

The Hattiesburg Formation and the Catahoula Sandstone are considered as a single hydraulic unit, referred to as the Miocene Aquifer System. These aquifers constitute the aquifer of concern (AOC).

The first water bearing unit of the AOC occurs in the surficial aquifer (Hattiesburg Formation) at a depth of approximately 65 feet below the land surface. The unsaturated zone consists primarily of clay and has an average hydraulic conductivity of approximately 1×10^{-6} cm/s (Reference 1 and 4).

U.S.G.S. identifies ten (10) public water supply wells for the City of Hattiesburg in the AOC within the three-mile radius of the site. All of these wells occur in the lower unit (Catahoula Sandstone) of the AOC. These wells are located and identified as #D004, #D005, #D006, #B002, #B003, #B023, #B017, #B001, #B005, #B007 on the U.S.G.S. water wells printout. There is no indication of the depth at which these wells are screened; however, the depth of these wells range approximately 419 feet below the land surface (#B001) to approximately 678 feet below the land surface (#D005) (Reference 3).

The Mississippi State Department of Health, Division of Water Supply, identified two additional public water supply wells for the City of Hattiesburg in the AOC. One of these wells (not identified on the U.S.G.S. printout) is located within the three-mile radius of the site.

The other well is located and identified as U.S.G.S. #D007 (City of Hattiesburg). This well is located between the three- and four-mile radius of the site. The City of Hattiesburg wells (12) supply an estimated population of 55,100 (Reference 3 and 12).

There are also numerous private wells occurring in both units of the AOC within the three-mile radius. No other drinking water source is presently available (Reference 3 and 12).

The nearest well in the AOC is a private well located approximately 3400 feet south of the site. This well is located and identified as U.S.G.S. #D049 on the topographic map (Reference 8) and the water well printout (Reference 3). There is no indication of the depth at which this well is screened; however, the well extends to a depth of approximately 576 feet below the land surface (Reference 3).

Precipitation

The climate of southeastern Mississippi is humid and semitropical. Average annual rainfall is approximately 60 inches. Average annual runoff from the numerous streams in the area is approximately 20 inches. The remainder of the precipitation seeps into the ground or is dissipated by evapotransporation.

The mean annual lake evaporation for the area is approximately 46 inches. The net annual precipitation of the area is about 14 inches. The one-year, twenty-four-hour rainfall is approximately 4 inches (References 2 and 14).

Surface Water

The site and surrounding area is flat with a slight gradient to the east northeast. The facility slope and intervening terrain is less than 1% (Reference 8).

The nearest perennial surface water is identified on the topographic map as Greens Creek. Greens Creek runs adjacent to the "Back Forty" and flows in an easterly northeasterly direction before its entrance into the Bowie River. Greens Creek intersects the Bowie River approximately 2800 stream feet from the site. From this intersection the Bowie River flows in a southeasterly direction for approximately 9,600 stream feet before its entrance into the Leaf River (Reference 8).

The three-mile migration pathway ends in the Leaf River approximately 3,450 stream feet south of the intersection of the Bowie River with the Leaf River (Reference 8).

The Mississippi Bureau of Land and Water Resources indicates one surface water intake along the three-mile migration pathway at the intersection of Greens Creek with the Bowie River. The water is used by Hercules, Incorporated for industrial purposes (References 8 and 9).

Environmental Concerns

There are no critical habitats of federal endangered species or national wildlife refuges within one mile of the site along the surface water migration pathway (Reference 15).

Topographic maps of the Hercules, Incorporated site and the surrounding area indicate no wetlands along the migration pathway (Reference 8).

Conclusions and Recommendations

A site screening investigation is recommended on a high priority basis.

REFERENCES

1. Mississippi State Geological Survey, Bulletin 44, Forrest County Mineral Resources, Mississippi University, 1941, pp. 24, 35-58.

2. Water for Industrial Development in Forrest, Greene, Jones, Perry, and Wayne Counties, Mississippi, Water Resources Division, U.S. Geological Survey, 1966, pp. 2, 3, 6, 38, 40, 41, 42, 43, 4, 5, 7, 9, 39, 44, 45, 54, 55, 58, 59, 62, 63.

3. Printout from U.S. Geological Survey Data Base of all Wells within a Three-mile Radius and Four-mile Radius of Hercules, Incorporated.

4. Geophysical Logs of Water Wells Near Hercules, Incorporated, Hattiesburg, Mississippi from the Mississippi Bureau of Geology.

5. Shows, Thad N., Water Resources of Mississippi, Bulletin 113, Mississippi Geological, Economic, and Topographic Survey, Jackson, Mississippi, 1970, pp. 114, 115.

6. Results of Aquifer Tests in Mississippi, U.S. Geological Survey Water Resources Division, Bulletin 71-2, pp. 10, 22, 1971.

7. Gandl, L. A., Characterization of Aquifers Designated as Potential Drinking - Water Sources in Mississippi, U.S. Geological Survey, Water Resources Investigations, Open-File Report 81-550, Jackson, Mississippi, 1982, pp. 15-20.

8. Topographic Maps of Hercules, Incorporated:
   Mississippi Quadrangle 7.5 Minute Series;
   Caterville, Mississippi Quadrangle 7.5 Minute Series;
   Hattiesburg SW, Mississippi Quadrangle 7.5 Minute Series;
   Eastabuchie Quadrangle 7.5 Minute Series.

9. Information on Groundwater and Surface Water Use from the Mississippi Bureau of Land and Water Resources, Jackson, Mississippi.

10. EPA HWDMS List of RCRA Hazardous Waste Generators

11. Locations, Sketch Maps, and Information on Hercules, Incorporated, from the Mississippi Bureau of Pollution Control, Hazardous Waste Division (BPC, HWD) Files.

12. Information on Public Water Supply Wells in Hattiesburg, Mississippi, From Water Supply Division, Mississippi State Department of Health.

13. Hercules, Incorporated, RCRA Notification Forms 8700-12, 3510-1, and 3510-3, from BPC, HWD Files.

14. EPA HRS Guidance Manual

15. U.S. Fish and Wildlife Service, Vicksburg Office, Species List; and U.S. Fish and Wildlife Service, Jackson Office, Topographic Maps Indicating Sensitive Environments.

16. Drillers Logs of Water Wells Near Hercules, Incorporated from the Mississippi Bureau of Land and Water Resources.

17. Waste Management Survey, Forms A and B, Completed by Hercules, Inc., from the BPC, HWD Files.

18. Letters from BPC, HWD Files, Concerning Removal of Hercules, Inc. from RCRA Interim Status.

19. State of Mississippi Water Pollution Control NPDES Permit, Issued to Hercules, Incorporated on September 24, 1986; Expires September 28, 1991.

20. State of Mississippi Air Pollution Control Permit, Issued to Hercules, Incorporated on March 24, 1987; Expires April 1, 1990.

21. Sampling Results from Groundwater Monitoring Wells at Hercules, Incorporated, March 1983, from BPC, HWD Files.

22. Letter to Hercules, Incorporated from BPC, HWD, June 22, 1983, Concerning Results of Analyses of Groundwater Samples and Waste Samples from Hercules, Incorporated.

23. Letter and Sampling Results to Hercules, Incorporated from BPC, HWD, August 25, 1981, Concerning Waste Samples Collected at Hercules, Inc., on July 9, 1981.

24. Integrated Risk Information System (IRIS).

APPENDIX

APPENDIX A

APPENDIX B

1

MISSISSIPPI
STATE GEOLOGICAL SURVEY

WILLIAM CLIFFORD MORSE, Ph.D.
Director

BULLETIN

FORREST COUNTY MINERAL RESOURCES

(GEOLOGY)

TEXT

CATAHOULA FORMATION

The Catahoula formation is not exposed at the surface in Forrest County but is reached by numerous wells at depths of 300 to 400 feet in the valleys of the Leaf and Bouie Rivers.

HATTIESBURG FORMATION

At Hattiesburg, the Hattiesburg formation, as exposed in the river bluffs, consists of thick beds of massive clays—150 or 200 feet thick—which contain some lime but very little sand. Wells in the vicinity of Hattiesburg and outcrops in the extreme northeastern corner of the county—as well as outcrops in the adjacent parts of Jones County—show that this thick clay bed is underlain by interbedded sands and clays, the sands increasing in prominence and becoming gravelly toward the base. Outcrops along the higher parts of the river bluffs at Hattiesburg and wells at Camp Shelby show that the thick clay bed is overlain by and grades upward into alternating fine-grained silty sands and clays similar to outcrops of the Pascagoula farther south. In some places this upper sand-clay zone—40 or 50 feet thick—is partly consolidated to a soft sandstone. This interval has usually been considered the uppermost member of the Hattiesburg formation and has been so mapped in the past. That is also the present conception of the oil geologists who have worked in the territory. The burning tests in the laboratory, however, show that the pyro-physical properties of this upper interval more closely resemble the burning properties of the known Pascagoula than of the underlying thick clay. Accordingly, one would be inclined to draw the Hattiesburg-Pascagoula contact at the top of the massive clay bed. However, in the absence of definite proof, it can only be stated that the contact between the two Miocene formations—the Hattiesburg and the Pascagoula—is either covered or gradational and so obscure that it cannot be definitely located.

PASCAGOULA FORMATION

Along the Pascagoula River, the type locality of the Pascagoula formation, an unconformity between the Hattiesburg formation and the overlying Pascagoula formation is supposed to be present. A search along the Pascagoula River from Pascagoula to Merrill and along the Leaf River from Hattiesburg to Beaumont failed to locate an unconformity. Although the out-

CORRELATION CHART

TEST HOLE RECORDS

A total of 191 test holes were drilled within the limits of Forrest County. A part of these were drilled to assist in a study of the stratigraphic relations and areal distribution of the several geologic formations, a part were drilled in order to discover deposits of possible economic value, and a part were drilled to determine the extent of known deposits. It was not thought to be worthwhile to reproduce the records (logs) of all test holes drilled, as many encountered nothing of economic value and others served only to confirm the presence and lateral extent of beds encountered and sampled in other holes. In the several pages which follow there are reproduced the records (logs) of all test holes from which samples were tested in the laboratory. In addition there are included records of other representative test holes from virtually every part of the county. These records serve to illustrate the stratigraphic and economic geology of the county and reference is made to them by number in both the Geology and Tests sections of the report. The records (logs) of all test holes drilled within the county may be consulted in the files of the Mississippi Geological Survey at University, Mississippi.

The ceramic tests do not show significant differences in the pyrophysical characteristics of the several formations, and no attempt is made, therefore, to group the test hole records (logs) according to formations, or according to the ceramic qualities of the samples collected. Rather, the records are numbered consecutively in the order in which the test holes were drilled. The test hole numbers and sample numbers constitute a cross index between the several parts of the report.

HATTIESBURG BRICK WORKS PROPERTY

TEST HOLE 1

Location: T.5 N., R.13 W., Sec. 32, SW.1/4, SW.1/4; 250 feet east of the east side of Hattiesburg Water Works Pumping Station

Drilled: October 9, 1939

Elevation: 239 feet

Water level: 30.5 feet

No.	Depth	Thick.	Description of strata
			High Terrace (?)
1	1.0	1.0	Sand, coarse grained
			Hattiesburg formation
2	3.1	2.1	Sand, reddish brown semi-plastic medium grained clayey; C-1
3	7.3	4.2	Clay, variegated red, gray, and yellow, plastic sandy, slightly carbonaceous; P-1
4	19.5	12.2	Clay, brownish gray semi-plastic sandy, slightly carbonaceous; P-2
5	33.0	13.5	Clay, dark gray semi-plastic sandy, carbonaceous, slightly limey, very silty; C-2
6	40.5	7.5	Clay, light gray and yellow semi-plastic silty, carbonaceous; C-3

HATTIESBURG BRICK WORKS PROPERTY

TEST HOLE 1A

Location: T.5 N., R.13 W., Sec. 32, SW.1/4, SW.1/4; 250 feet east of the east side of Hattiesburg Water Works Pumping Station

Drilled: October 9, 1939

Elevation: 239 feet

Water level: 30.5 feet

No.	Depth	Thick.	Description of strata
			High Terrace (?)
1	1.0	1.0	Sand, brownish gray
			Hattiesburg formation
2	3.7	2.7	Sand, reddish brown semi-plastic clayey
3	50.6	46.9	Clay, light gray sandy, slightly micaceous, slightly limey; mottled with red and yellow limonite stains; P-1

Mississippi Southern College Property

Test Hole 7

Location: T.4 N., R.13 W., Sec. 7, NW.1/4, NW.1/4; 500 feet northwest of bridge crossing the Mississippi Central Railroad and 70 feet south of the railroad — Drilled: March 22, 1939

Elevation: 247 feet — Water level: 24.4 feet

No.	Depth	Thick.	Description of strata
			Hattiesburg formation (?)
1	0.5	0.5	Topsoil
2	7.0	6.5	Clay, reddish brown and gray sandy; contains scattered small chert gravels embedded in clay; C-1
3	55.5	48.5	Clay, light gray slightly sandy, carbonaceous slightly limey; contains a few scattered quartz and chert pebbles as large as 0.5 inches in diameter; P-1

A. R. Sumrall Property

Test Hole 8

Location: T.5 N., R.13 W., Sec. 31, NE.1/4, SW.1/4; 175 feet southeast of Mixon Creek bridge and 30 feet west of Highway U. S. 49 center line — Drilled: October 11, 1939

Elevation: 211 feet — Water level: 50.5 feet

No	Depth	Thick.	Description of strata
			Hattiesburg formation (?)
1	0.2	0.2	Topsoil
2	2.7	2.5	Clay, gray-brown plastic slightly sandy, slightly carbonaceous; C-1
3	50.8	48.1	Silt, light gray plastic clayey; limey carbonaceous; P-1
4	51.8	1.0	Sand, light bluish gray coarse grained

Markie E. Stevens Property

Test Hole 12A

Location: T.4 N., R.13 W., Sec. 6, NW.1/4, NE.1/4; 0.4 mile south of Highway U. S. 49 and 80 feet east of center line of north-south road — Drilled: October 16, 1939

Elevation: 215 feet — Water level: 28.2 feet

No.	Depth	Thick.	Description of strata
			Hattiesburg formation
1	0.8	0.8	Topsoil
2	43.6	42.8	Clay, light gray carbonaceous, limey, silty, micaceous; stained with limonite; P-1

J. J. Newman Lumber Co. Property

Test Hole 14A

Location: T.5 N., R.14 W., Sec. 27, NW.1/4, NE.1/4; 0.4 mile west of road junction at section corner and 30 feet south of section line — Drilled: October 12, 1939

Elevation: 238 feet — Water level: Dry

No.	Depth	Thick.	Description of strata
			Hattiesburg formation (?)
1	0.7	0.7	Topsoil
2	4.8	4.1	Sand, light brown and gray very fine grained; contains pea-gravel
3	44.8	40.0	Clay, light gray to light brown plastic sandy, carbonaceous; contains scattered pea-gravel; P-1

McCaughey and Calhoun Property

Test Hole 20

Location: T.5 N., R.14 W., Sec. 11, SE.1/4, SE.1/4; 0.95 mile north of Bouie River bridge and 50 feet west of road — Drilled: April 17, 1939

Elevation: 240 feet — Water level: 19.3 feet

No.	Depth	Thick	Description of strata
			Low Terrace (?)
1	0.7	0.7	Topsoil
2	5.0	4.3	Clay, dark reddish brown sandy; contains scattered pea-gravel; C-1
3	13.0	8.0	Sand, reddish brown semi-plastic clayey, gravelly; C-2
4	19.3	6.3	Sand, red, brown, and gray, clayey; C-3
			Hattiesburg formation
5	42.0	22.7	Clay, light gray plastic carbonaceous, very sandy; contains scattered pea-gravel; P-1

TAYLOR LUMBER CO. PROPERTY

TEST HOLE 43

Location: T.4 N., R.13 W., Sec. 29, SW.1/4, SW.1/4; 0.9 mile south of Southern Railway overpass on Highway U. S. 11 and 60 feet west of pavement Drilled: May 3, 1939

Elevation: 251 feet Water level: 20.0 feet

No.	Depth	Thick.	Description of strata
			Hattiesburg formation
1	0.7	0.7	Topsoil
2	5.8	5.1	Sand, light brown and red slightly clayey
3	13.4	7.6	Clay, light brown and gray sandy; stained with limonite; P-1
4	26.1	12.7	Clay, gray plastic carbonaceous, limey; C-2

J. S. TURNER PROPERTY

TEST HOLE 46A

Location: T.3 N., R.13 W., Sec. 6, SW.1/4, SW.1/4; 0.7 mile south of Highway U. S. 11 at road intersection and 50 feet west of road Drilled: October 18, 1939

Elevation: 353 feet Water level: 15.4 feet

No.	Depth	Thick.	Description of strata
			Citronelle formation (?)
1	1.2	1.2	Topsoil
2	13.0	11.8	Sand, dark brown fine grained, contains scattered pea-gravel; C-1
			Hattiesburg formation (?)
3	47.3	34.3	Clay, variegated red and gray plastic sandy; contains scattered gravel; P-1

W. J. MORRIS PROPERTY

TEST HOLE 47

Location: T.4 N., R.13 W., Sec. 20, NW.1/4, NE.1/4; 800 feet north of road junction on Highway U. S. 11 and 100 feet east of the highway Drilled: May 11, 1939

Elevation: 217 feet Water level: 16.6 feet

No.	Depth	Thick.	Description of strata
			High Terrace (?)
1	0.8	0.8	Topsoil
2	5.9	5.1	Sand, light brown and gray coarse grained slightly clayey; contains scattered gravel; C-1
3	11.1	5.2	Sand, light gray fine grained very clayey; limonite stained; C-2
			Hattiesburg formation
4	18.7	7.6	Clay, light gray to light brown semi-plastic sandy, micaceous; P-1
5	35.2	16.5	Clay, light brown carbonaceous, limey; P-2
6	45.1	9.9	Clay, same as interval 5; P-3

P. B. JOHNSON PROPERTY

TEST HOLE 51

Location: T.4 N., R.13 W., Sec. 34, SW.1/4, SE.1/4; 0.8 mile south of road junction with Highway U. S. 49 and 300 feet west of the highway Drilled: May 17, 1939

Elevation: 188 feet Water level: 21.4 feet

No.	Depth	Thick.	Description of strata
			Hattiesburg formation
1	0.2	0.2	Topsoil
2	14.5	14.3	Clay, light gray sandy limonitic; P-1
3	30.4	15.9	Clay, light gray lignitic, limey; C-1

MRS. M. L. RODES PROPERTY

TEST HOLE 57

Location: T.3 N., R.13 W., Sec. 11, SE.1/4, SW.1/4; 0.4 mile south of road junction with Highway U. S. 11 and 70 feet west of the highway

Drilled: May 24, 1939

Elevation: 207 feet Water level: 11.6 feet

No.	Depth	Thick.	Description of strata
			High Terrace
1	0.4	0.4	Topsoil
2	3.2	2.8	Sand, red clayey, gravelly; C-1
			Hattiesburg formation
3	11.6	8.4	Clay, light brown sandy, micaceous; mottled with red, yellow, and gray; C-2
4	12.5	0.9	Sand, light gray fine grained clayey, micaceous
5	13.7	1.2	Clay, red silty; interlaminated with gray clay; C-3
6	27.6	13.9	Clay, light gray plastic sandy; P-1

CITY OF HATTIESBURG PROPERTY

TEST HOLE 86

Location: T.4 N., R.13 W., Sec. 14, SW.1/4, SW.1/4; 80 feet north of gravel pit road at Mississippi Central Railroad spur and 40 feet west of the track

Drilled: June 19, 1939

Elevation: Water level: 8.2 feet

No.	Depth	Thick.	Description of strata
			Low Terrace
1	1.4	1.4	Topsoil
2	2.6	1.2	Sand, light brown fine grained, grit-bearing
3	8.2	5.6	Sand and gravel, light yellow and white coarse grained; the pebbles range in size upward to about 0.7 inch; C-2. Sample P-1 is a sample of the washed sand from the pit

Remarks: Hole drilled on banks of gravel pit said to be 40 or 50 feet in depth. Drilling below the water level was not feasible with hand tools. It is estimated that between 1,500,000 and 2,000,000 cubic yards of the washed sand are available.

THE DIXIE TUNG EMPIRE CORP. PROPERTY

TEST HOLE 90

Location: T.1 S., R.12 W., Sec. 4, NW.1/4, SW.1/4; 0.25 mile north of overpass at abandoned railroad grade and 100 feet west of Highway U. S. 49

Drilled: June 20, 1939

Elevation: 215 feet Water level: 4.8 feet

No.	Depth	Thick.	Description of strata
			Alluvium
1	0.6	0.6	Topsoil
2	7.4	6.8	Sand, light brown to white very fine grained; C-1
3	32.7	25.3	Clay, light gray to blue-gray plastic very sandy; contains isolated quartz and chert pebbles and fragments of white chalky material; P-1

LUTHER LOVETT PROPERTY

TEST HOLE 91

Location: T.5 N., R.14 W., Sec. 3, NE.1/4, NW.1/4; west side of gravel pit road, 0.3 mile north of Gulf and Ship Island Railroad crossing

Drilled: June 20, 1939

Elevation:— Water level: 7.1 feet

No.	Depth	Thick.	Description of strata
			Low Terrace of Bouie River
1	0.7	0.7	Topsoil
2	2.3	1.6	Sand, light yellow to gray very fine grained silty, limonitic; C-1
3	6.5	4.2	Sand, light gray very fine grained silty; limonitic in part; C-2
4	7.7	1.2	Sand, gray to white coarse grained, gravel bearing; C-3. Sample P-1 is from the washed sand.

Remarks: Hole drilled near edge of gravel pit. It is estimated that a minimum of 1,000,000 to 1,500,000 cubic yards of the washed sand are available in the old pit.

MISSISSIPPI SOUTHERN COLLEGE PROPERTY

TEST HOLE 121A

Location: T.4 N., R.13 W., Sec. 7, SE.1/4, NW.1/4; 5.0 feet east of Test Hole 121 — Drilled: October 26, 1939

Elevation: 232 feet — Water level: 26.5 feet

No.	Depth	Thick.	Description of strata
			Hattiesburg formation
1	0.6	0.6	Topsoil
2	10.4	9.8	Sand, gray and brown slightly clayey: C-1
3	30.1	19.7	Clay, light gray to light brown very sandy, micaceous: P-1
4	36.4	6.3	Sand, light gray coarse grained clayey, micaceous: C-2
5	61.4	25.0	Clay, light gray very sandy, carbonaceous: P-2

W. J. MORRIS PROPERTY

TEST HOLE 155

Location: T.4 N., R.13 W., Sec. 20, NW.1/4, NE.1/4; 800 feet north of road junction on Highway U. S. 11 and 400 feet east of the highway

Drilled: Sept. 20, 1939

Elevation: 217 feet — Water level: 6.0 feet

No.	Depth	Thick.	Description of strata
			High Terrace
1	0.8	0.8	Topsoil
2	11.4	10.6	Sand and gravel, light brown and gray clayey
3	27.7	16.3	Clay, light gray plastic very sandy; bears scattered small pebbles and limonite stains throughout: P-1
4	35.8	8.1	Clay, same as interval 3: P-2

W. J. MORRIS PROPERTY

TEST HOLE 156

Location: T.4 N., R.13 W., Sec. 20, NW.1/4, NE.1/4; 950 feet north of road junction on Highway U. S. 11 and 100 feet east of highway

Drilled: Sept. 21, 1939

Elevation: 231 feet — Water level: 18.5 feet

No.	Depth	Thick.	Description of strata
			High Terrace (?)
1	0.6	0.6	Topsoil
2	9.4	8.8	Sand, light brown slightly clayey
3	17.4	8.0	Clay, light gray semi-plastic silty, very limonitic: P-1
4	20.5	3.1	Sand, light gray coarse grained: stained with limonite
5	29.0	8.5	Clay, light gray plastic sandy, gravel-bearing: P-2
6	48.7	19.7	Clay, light brown; same as interval 5: P-3
7	58.8	10.1	Clay, brown; same as interval 6: P-4

TATUM LEATHER CO. PROPERTY

TEST HOLE 157

Location: T.4 N., R.13 W., Sec. 20, NE.1/4, SW.1/4; 0.2 mile north of Southern Railway overpass and 60 feet west of Highway U. S. 11

Drilled: Sept. 20, 1939

Elevation: 216 feet — Water level: Dry

No.	Depth	Thick.	Description of strata
			Hattiesburg formation
1	0.5	0.5	Topsoil
2	3.7	3.2	Silt, light gray and brown semi-plastic
3	37.3	33.6	Clay, bluish gray and brown massive plastic very silty, sandy, limey: P-1

W. J. MORRIS PROPERTY

TEST HOLE 158

Location: T.4 N., R.13 W., Sec. 20, NE.1/4, NW.1/4; 800 feet north of road junction on Highway U. S. 11 and 200 feet west of the highway

Drilled: Sept. 22, 1939

Elevation: 219 feet — Water level: 22.8 feet

No.	Depth	Thick.	Description of strata
			High Terrace
1	2.0	2.0	Topsoil
2	3.2	1.2	Sand, light brown clayey
3	41.0	37.8	Clay, interlaminated red, yellow, and gray, plastic sandy; contains a few scattered gravel in upper part: P-1

TATUM LUMBER CO. PROPERTY

TEST HOLE 159

Location: T.4 N., R.13 W., Sec. 20, NE.1/4, SW.1/4; 0.1 mile north of Southern Railway overpass on Highway U. S. 11 and 185 feet west of the highway
Drilled: Sept. 21, 1939

Elevation: 220 feet
Water level: 18.0 feet

No.	Depth	Thick.	Description of strata
			Hattiesburg formation
1	1.3	1.3	Topsoil
2	18.5	17.2	Clay, light gray semi-plastic carbonaceous, slightly limey, sandy; limonite stained throughout; grades downward to sand; P-1

TATUM LUMBER CO. PROPERTY

TEST HOLE 160

Location: T.4 N., R.13 W., Sec. 20, SE.1/4, SW.1/4; 250 feet north of Highway U. S. 11 underpass
Drilled: Sept. 25, 1939

Elevation: 214 feet
Water level: 19.5 feet

No.	Depth	Thick.	Description of strata
			Hattiesburg formation
1	0.5	0.5	Topsoil
2	3.5	3.0	Silt, light gray very sandy, limonite stained
3	15.2	11.7	Clay, reddish brown and gray semi-plastic sandy; P-1
4	29.2	14.0	Clay, gray; same as interval 3; P-2
5	32.7	3.5	Clay, same as interval 4
6	37.5	4.8	Sand, light gray fine grained clayey, limonitic

W. A. MORRIS PROPERTY

TEST HOLE 161

Location: T.4 N., R.13 W., Sec. 20, NW.1/4, NE.1/4; 0.1 mile north of road junction on Highway U. S. 11 and 100 feet east of the highway
Drilled: Sept. 25, 1939

Elevation: 224 feet
Water level: 14.3 feet

No.	Depth	Thick.	Description of strata
			Hattiesburg formation (?)
1	0.8	0.8	Topsoil
2	14.7	13.9	Sand, light brown and gray fine grained clayey
3	28.2	13.5	Clay, light gray plastic silty, stained with limonite; contains scattered small gravel; P-1

TATUM LUMBER CO. PROPERTY

TEST HOLE 162

Location: T.4 N., R.13 W., Sec. 21, NW.1/4, SW.1/4; 100 feet south of Bonhomie, Hattiesburg and Southern Railroad and 150 feet west of gravel road
Drilled: Sept. 26, 1939

Elevation:—
Water level: Dry

No.	Depth	Thick.	Description of strata
			Hattiesburg formation
1	0.9	0.9	Topsoil
2	6.9	6.0	Clay, reddish brown semi-plastic sandy; P-1
3	30.5	23.6	Clay, light gray semi-plastic slightly limey; P-2
4	43.7	13.2	Clay, same as interval 3; P-3

TATUM LUMBER CO. PROPERTY

TEST HOLE 163

Location: T.4 N., R.13 W., Sec. 29, NW.1/4, NE.1/4; 0.3 mile south of Southern Railway overpass on Highway U. S. 11 and 225 feet east of the highway
Drilled: Oct. 2, 1939

Elevation: 236 feet
Water level: 15.8 feet

No.	Depth	Thick.	Description of strata
			High Terrace
1	0.9	0.9	Topsoil
2	10.3	9.4	Sand, light brown and white clayey, limonitic; gravel-bearing in lower part
			Hattiesburg formation (?)
3	45.7	35.4	Clay, light gray plastic micaceous, slightly sandy; limonite stained in part; contains scattered gravel; P-1

G. SARTIN PROPERTY

TEST HOLE 164

Location: T.4 N., R.13 W., Sec. 17, SW.1/4, NW.1/4; 0.7 mile south of Hardy Street at road intersection and 90 feet east of section line road between Sections 17 and 18
Drilled: Sept. 27, 1939

Elevation:—
Water level: Dry

No.	Depth	Thick.	Description of strata
			Hattiesburg formation
1	1.4	1.4	Topsoil
2	4.5	3.1	Sand, reddish brown very fine grained
3	37.5	33.0	Clay, variegated brown and gray, massive semi-plastic sandy; P-1
4	53.0	15.5	Clay, same as interval 3; P-3

STATE OF MISSISSIPPI PROPERTY

TEST HOLE 187

Location: T.1 N., R.12 W., Sec. 16, SE.1/4, NE.1/4; 0.45 mile south of road intersection and 80 feet east of gravel road Drilled: Nov. 7, 1939
Elevation:— Water level: 3.4 feet

No.	Depth	Thick.	Description of strata
			Pascagoula formation
1	0.7	0.7	Topsoil
2	31.0	30.3	Clay, gray brown and red very plastic limonitic slightly sandy; P-1
3	32.4	1.4	Sand, light gray fine grained silty, limonitic

LAURA KNOX PROPERTY

TEST HOLE 189

Location: T.3 N., R.13 W., Sec. 3, NE.1/4, SE.1/4; 200 feet northeast of Test Hole 188 Drilled: Nov. 8, 1939
Elevation:— Water level: 10.1 feet

No.	Depth	Thick.	Description of strata
			Hattiesburg formation
1	0.2	0.2	Topsoil
2	1.9	1.7	Sand, light brown fine grained semi-plastic slightly clayey; C-1
3	9.5	7.6	Clay, light brown and gray plastic slightly sandy; P-1
4	10.2	0.7	Sand, light gray very fine grained; C-2
5	34.1	23.9	Clay, light gray plastic sandy, limonitic; P-2
6	35.0	0.9	Sand, light brown fine grained silty, very micaceous

P. B. JOHNSON PROPERTY

TEST HOLE 190

Location: T.4 N., R.13 W., Sec. 34, SE.1/4, SE.1/4; 0.7 mile south of road crossing on Highway U. S. 49 and 500 feet east of highway
Drilled: Nov. 8, 1939
Elevation: — Water level: 25.0 feet

No.	Depth	Thick.	Description of strata
			Hattiesburg formation
1	1.2	1.2	Topsoil
2	37.9	36.7	Clay, light gray and brown semi-plastic slightly sandy, carbonaceous; P-1

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2

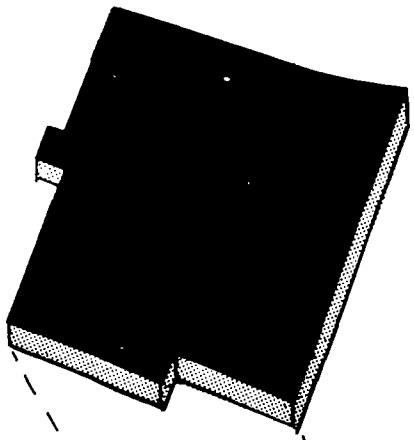
WATER FOR

INDUSTRIAL DEVELOPMENT

IN

Forrest, Greene, Jones, Perry, and Wayne Counties
Mississippi

A COOPERATIVE STUDY SPONSORED JOINTLY BY
WATER RESOURCES DIVISION, U. S. GEOLOGICAL SURVEY
and
Mississippi Research and Development Center
JACKSON, MISSISSIPPI



WATER FOR INDUSTRIAL DEVELOPMENT

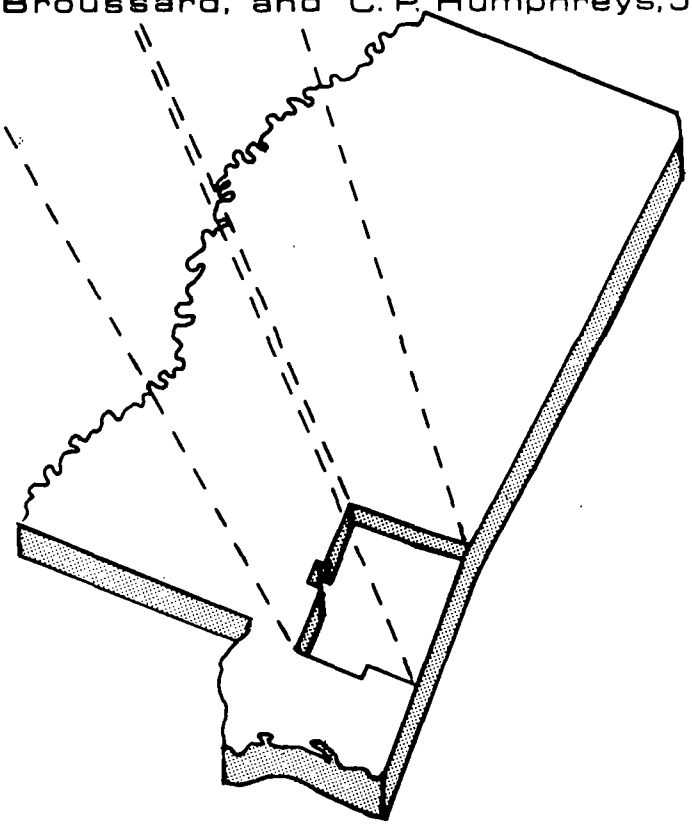
In

Forrest, Greene, Jones, Perry, and Wayne Counties,

Mississippi

By

T. N. Shows, W. L. Broussard, and C. P. Humphreys, Jr.



Prepared by

WATER RESOURCES DIVISION

U. S. GEOLOGICAL SURVEY

1966

many municipal and industrial water managers, well owners, water-well contractors, and oil company personnel. The Mississippi Power Company supplied daily temperature readings on the Leaf River at Hattiesburg.

HYDROLOGIC SETTING

Climate

The climate of southeastern Mississippi is humid and semitropical. Average annual rainfall ranges from 56 inches in the northwest corner of the five-county area to 64 inches in southern Forrest and Perry Counties. Average annual runoff from the numerous streams in the area ranges from 18 inches in the north to 26 inches in the south (fig. 1). The remainder of the precipitation seeps into the ground or is dissipated by evapotranspiration. The mean annual temperature in the five-county area is about 66° F; the mean monthly temperature ranges from 82° F in July to 51° F in January at Hattiesburg. On the average, Hattiesburg has 106 days annually with temperatures equal to or greater than 90° F, and only 41 days annually with temperatures equal to or less than 32° F.

Geology and Topography

The study area is within the Pascagoula River basin in the East Gulf Coastal Plain. Exposed rocks are of sedimentary deposition and most are unconsolidated. The exposed sediments range in age from late Eocene to Recent with Miocene and younger sediments forming the majority of the exposed sediments (fig. 3). The geologic units containing fresh-water aquifers range in age from early Eocene to Recent alluvial deposits. Most geologic units are traceable from the surface deep into the subsurface (figs. 2 and 20).

The geologic units have a regional southwestward dip of 20-45 feet per mile (fig. 23 and 24). The dip of the beds is steep (40-45 feet per mile) in Wayne and Jones Counties, but it flattens (20-25 feet per mile) in Greene, Perry, and Forrest Counties owing to the major structural uplift of the Wiggins anticline south of the study area.

Several shallow piercement salt domes in the area locally affect the dip, strike, and thickness of formations. The formations display gentle arching or uplifting across these structures. Caution should be exercised in drilling wells in the vicinity of the shallow domes, especially near the shallow Richton dome (depth of caprock 497 feet, fig. 32) because the base of fresh water is shallow over some of these domes.

One recognizable subsurface fault (figs. 2, 23, and 24) is in southern Forrest County. It is an east-west trending fault associated with the Wiggins anticline, which is south of Forrest County in Stone County. The fault causes an offset in the deep beds but no movement is apparent in the shallower Miocene deposits.

Lithology varies between geologic units, but typically consist of interbedded clay, sand, and gravel. Sand and clay in various proportions constitute most of the sediments; however a few consolidated limestone layers occur in some units, particularly in the Vicksburg Group. The formations thicken downdip to the west and south toward the Mississippi River and the Gulf of Mexico.

The deposits, particularly Miocene and younger, are lenticular (figs. 21 and 22), and lithology changes in short distances. The sands, which are irregular and thicken or thin in short distances, are difficult to trace down the dip. Most of the water-bearing units were deposited in a deltaic environment.

Topography reflects the geology and drainage of the region and results from erosion of the gently dipping unconsolidated sedimentary beds. The landform is characterized by low, dissected, rounded hills and a few large streams in wide, flat valleys. Swamps are common in the lowland areas adjacent to the larger streams. There are many small man-made stock ponds in the area.

Elevation in the area ranges from less than 100 feet above sea level in the southern part along the Leaf River to 430 feet in western Jones County. Local relief is gentle; elevations vary only a small amount in short distances.

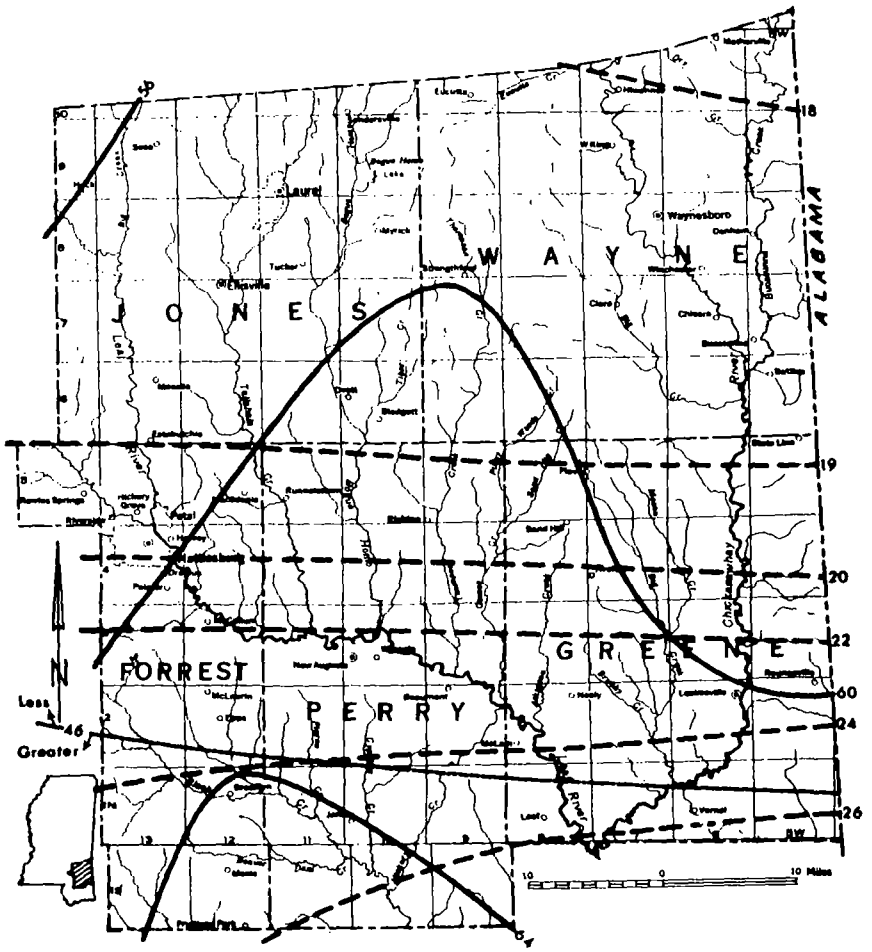
Drainage

The five-county area lies within the central part of the Pascagoula River basin. The major sub-basins in the area are the Leaf River, Chickasawhay River, and Black Creek (fig. 3). The Leaf River enters northwestern Jones County and flows generally southward to the vicinity of Hattiesburg in northern Forrest County, thence southeastward to meet the Chickasawhay River south of the Greene County line to form the main stem of the Pascagoula River. The Chickasawhay River drains the eastern parts of Wayne and Greene Counties. Black Creek flows through southern Forrest and Perry Counties and enters the Pascagoula River south of the study area. The streams are typical of those found in the southern United States, having winding meanders, broad, wooded flood plains, and many oxbow lakes along the larger rivers.

Occurrence of Ground Water

Ground water is any water in the ground that is in the zone of saturation. An aquifer is any water-bearing unit capable of yielding water to wells; in the study area most aquifers are composed of sand and gravel. The unconsolidated sediments have openings, or voids, between grains which are saturated with water below the water table. The shape, size, assortment, and degree of compaction of the grains determines the ease with which water moves through the material.

Water enters the permeable geologic units in their areas of outcrop (fig. 3) and moves generally southwestward in the direction of the dip toward areas of discharge which may be wells, springs, seeps, or adjacent permeable



EXPLANATION

——— 60
Average annual precipitation, in inches.
Extracted from U.S. Weather Bureau, 1959, "Climates of the States." Based on period 1931-55.

– – – – 19
Average annual runoff from streams, in inches.
Based on streamflow records for period 1939-1960.

····· 46
Average annual lake evaporation, in inches.
Extracted from U.S. Weather Bureau Tech. Paper No. 37. Based on period 1946-55.

Fig. 1. Map showing annual precipitation, evaporation, and run-off

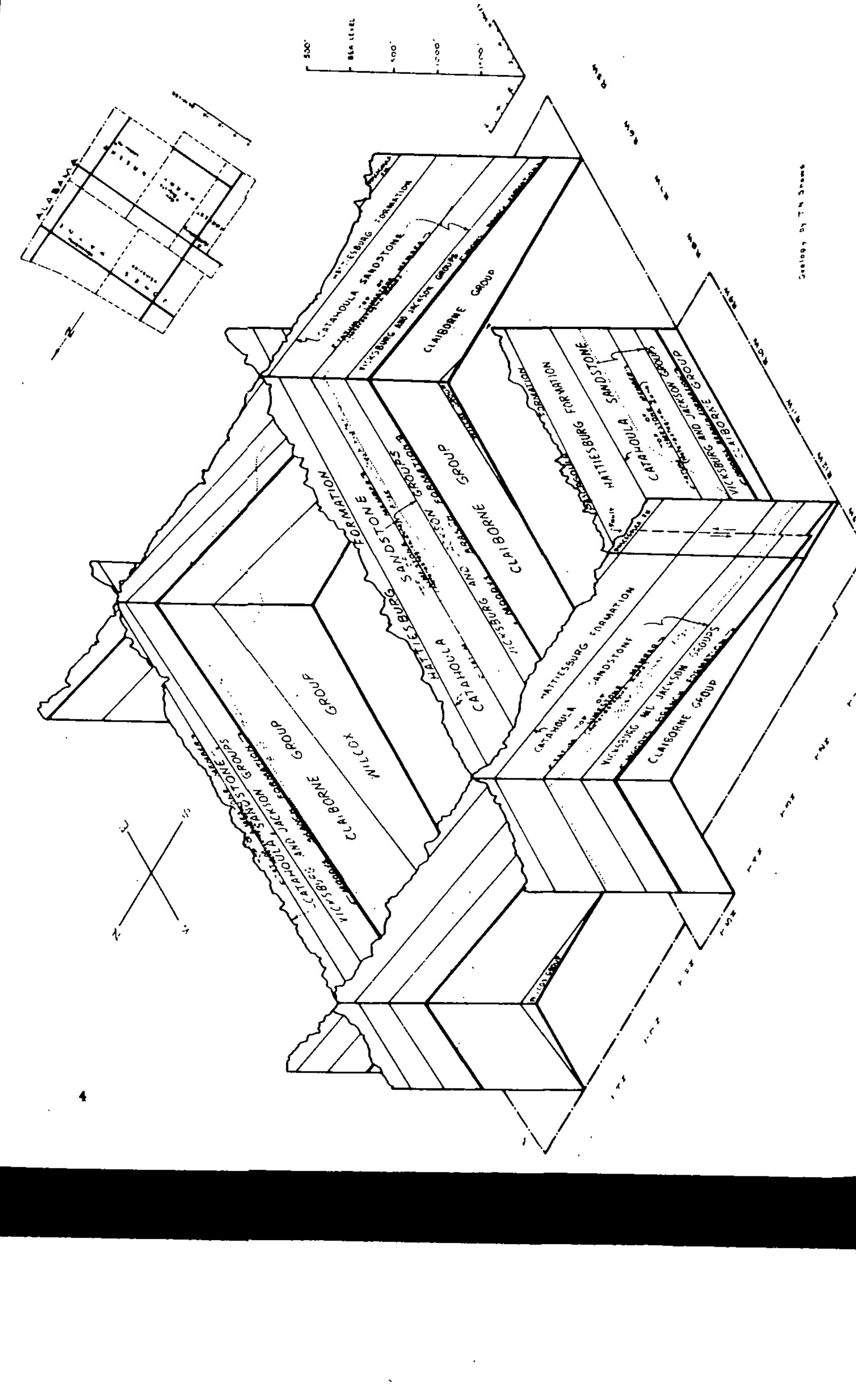
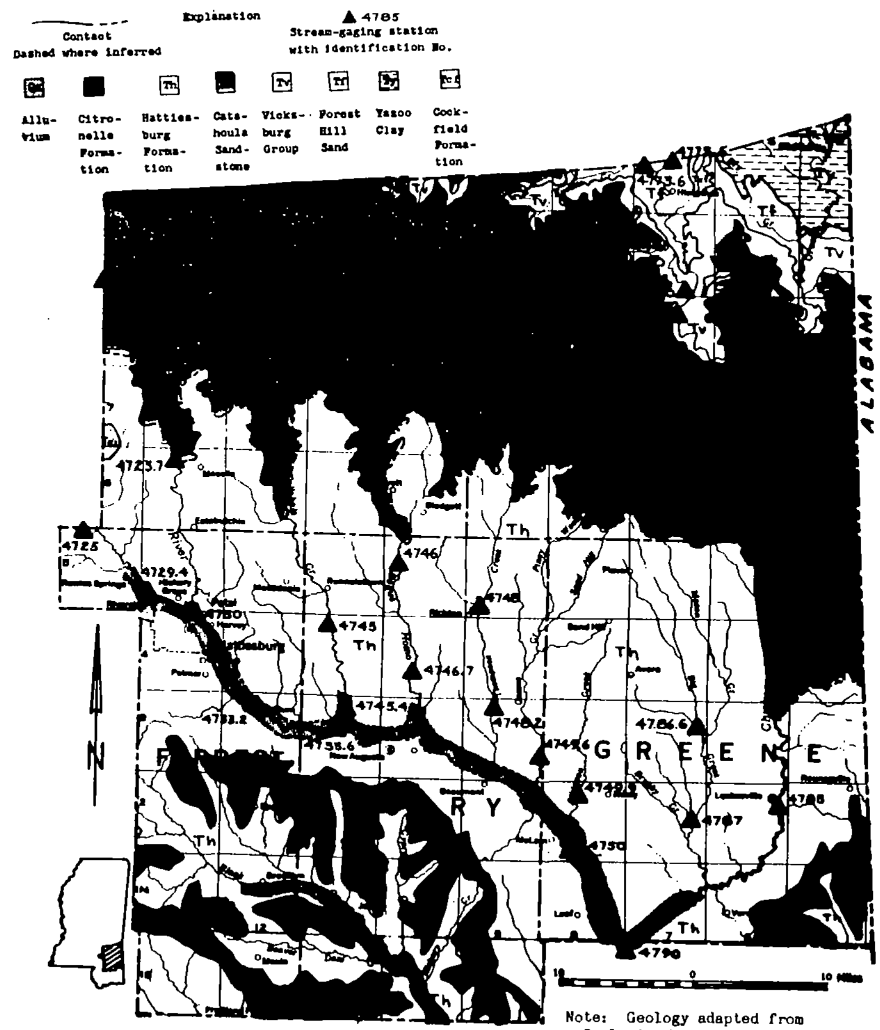


Fig. 2. Fence diagram showing geology of area



Note: Geology adapted from Geologic Map of Mississippi (1945).

Fig. 3. Geologic map showing principal streams and gaging stations

Table 1.--Stratigraphic column and water resources in Forrest, Greene, Jones, Perry, and Wayne Counties, Miss.

System	Series	Group	Formation	Unconsolidated thickness (ft)	Lithology	Water resources
Quaternary	Recent		Alluvium	0-125	Clay, sand, and gravel in the larger stream valleys, particularly in Forrest, Greene, and Perry Counties.	Important aquifer at certain locations in the larger stream valleys, as at Hattiesburg on the Leaf River. Supplies domestic wells along the streams.
	Pleistocene		Terrace deposits	0-50	Red and gray sand and gravel with clay lens. Occurs on the hills and form terraces along the streams.	Not an important aquifer, except for shallow dug wells.
Tertiary	Pliocene		Citronelle	0-190	Clay, sand, gravel, and ferruginous layers. These deposits usually are not impositive on the higher hills in the area, particularly in the southern counties.	Not an important aquifer. Supplies shallow domestic wells, particularly in southern part of area.
	Miocene		Pascagoula	90-1200	Clay, sandy clay, sand, and gravel, with some thin ferruginous layers. Sand beds occur at various horizons and vary in thickness from thin layers to 200 feet. A thin zone of limestone (Tatum Limestone Member) occurs in the lower half of the unit.	An important source of water in the extreme southern part of Forrest, Greene, and Perry Counties. Sands capable of supplying large quantities of water.
			Hattiesburg	100-600		An important source of water in Forrest, Greene, and Perry Counties. Sands and gravels capable of yielding large amounts of water.
	Miocene(?)		Catahoula Sandstone	400-700		An important source of water in all but northern third of area. Majority of wells throughout the area are completed in the Catahoula. Large yielding wells are possible in most locations from the thick sands
	Oligocene	Vicksburg	Undifferentiated	70-120	Limestone beds alternating with clay sand and clay beds. Thick sand layers, 80-90 feet, occur locally at Waynesboro and Sandersville.	Generally not an aquifer. A fair aquifer in certain locations such as Waynesboro and Sandersville, where there are beds of sand up to 40 feet thick. The clay interval yields water to domestic wells in central Wayne and northeastern Jones Counties.
			Forest Hill Sand	80-100	Thin sand and clay layers with silt.	Not used as an aquifer, except for shallow domestic wells near outcrop.
	Eocene	Jackson	Yazoo Clay	200-275	Clay and calcareous sand with thin limestone layers. The Cocoa Sand Member, near the bottom, is generally 10 to 15 feet thick and composed of clay sand. In eastern Wayne County, the unit is about 70 feet thick and composed of sand with thin layers of limestone.	Not an aquifer, except in eastern Wayne County, where the Cocoa Sand Member is an important local source of water supply. The Cocoa Sand Member supplies domestic wells and one community water system in the vicinity of Buckatunna.
			Moodys Branch	15-30	Glauconitic, fossiliferous marl and sand. Indurated beds occur near the outcrop.	Not an aquifer.
		Claiborne	Cockfield	300-540	Sand and clay with lignite. Thin to thick beds of sand alternating with clay. Lignite is common but not as prevalent as in the Sparta. Sand beds are 30 feet thick in northeastern Wayne County and 70 feet thick at Laurel.	A potential important source of water in northern Wayne and Jones Counties. Several large industrial wells tap this aquifer at Laurel. Water is colored except near outcrop in northern Wayne County.
			Cook Mountain		Shale, clay, limestone, and sandstone. Top of formation is usually a limestone and bottom is a clay or shale.	Not an aquifer.
			Sparta Sand		Sand, sandy clay and clay, with lignitic layers. Sand thickness ranges from 45 feet in eastern Wayne County to 80 feet in central Jones County. Lithology in southern counties is primarily clay and differentiation from the underlying Zilpha Clay is difficult.	An important source of water in parts of northern Jones and Wayne Counties. Colored water is common in this aquifer.
			Zilpha Clay		Shale and brown clay, with glauconite.	Not an aquifer.
			Winona Sand		Calcareous sandstone and clay with thin beds of sand.	Not an aquifer.
			Tallahatta		Brittle clay and sandstone (buhrstone). Thick sand occurs near bottom of section	Not an aquifer, except for lower sand (Meridian Sand Member) which is usually not differentiated from the underlying Wilcox. The Meridian Sand Member is assumed but is potentially an important source of water in the northern third of Wayne and Jones Counties.
		Wilcox	Undifferentiated	1400-1640	Sand, sandy shale, clay and shale. Beds of lignite occur in the sand and clay. Sand beds compose 10 percent of the unit. Sands are micaceous, medium to coarse-grained. Sand thickness ranges from 150 to 290 feet in northern Wayne County.	Potentially an important source of water in northern third of Wayne County but is untapped in study area. Best aquifers are probably in lower third of the unit.

beds. Water levels are lowered in the aquifers in the vicinity of discharge, and the lower water levels change the direction of ground-water movement. Some of the geologic units are relatively impermeable (aquicludes) and allow little movement of water. Permeability (Glossary) within an aquifer is usually greater horizontally than vertically because of horizontal stratification.

Aquifers are classified as water-table or artesian depending on whether the water level is within the aquifer and unconfined or whether it is confined. Water in a water-table well stands at about the same level as in the aquifer outside the well. Water-table aquifers receive recharge from local precipitation. Discharge from water-table aquifers supplies most of the base flow of the streams, especially during droughts. Water in the terrace and alluvial aquifers in most places occurs under water-table conditions.

In artesian aquifers the water-bearing material is confined by impermeable beds and water is confined under hydrostatic pressure or head; thus, water in wells will rise above the top of the water-bearing material. Water in the majority of aquifers in the study area occurs under artesian conditions, except for small areas in the outcrops.

Changes in quality of water occur as the water moves down the dip from the outcrop to areas of discharge. Dissolved-solids content usually increases down the dip (fig. 20) and the type of the water changes from calcium to sodium bicarbonate. The deeper water is usually softer because the calcium and magnesium content has been decreased by ionic exchange for sodium. The pH of the water increases down the dip, and iron problems are reduced.

The temperature of shallow ground water is about 66° F, which is the mean annual temperature of the air. The temperature of the water increases 1° F for each additional 65 to 100 feet of depth in the five-county area. Ground water temperature, except in shallow water-table wells, does not vary with seasonal changes in air temperature.

PRESENT WATER USE

Total water use in the five-county area is estimated to be 152 mgd (million gallons per day); ground-water use is 28 mgd and surface water use is 124 mgd. Most water is used for cooling purposes, and only a small percentage is actually consumed. All municipal and most industrial supplies are obtained from wells (fig. 4). The Mississippi Power Company and the Hercules Powder Company at Hattiesburg use both ground and surface water. These two plants use an estimated 124 mgd of surface water for industrial cooling.

The heaviest withdrawal of ground water occurs in the Hattiesburg (9.3 mgd) and Laurel (12.5 mgd) areas. Most other areas are rural with no appreciable concentration of water withdrawal, except for public supply in the smaller towns. The many rural water systems that have been installed or proposed will cause an increase in the use of ground water in the rural areas.

Ground water is used for irrigation at two tree seedling nurseries, one near Waynesboro and the other near Brooklyn. Surface water is used for crop irrigation along a few of the streams, but the total surface-water withdrawal for irrigation is small and restricted to infrequent dry periods.

Geiger Lake at Paul B. Johnson State Park, 12 miles south of Hattiesburg, is a 300-acre lake operated by the Mississippi Park Commission for recreational purposes. The Mississippi Game and Fish Commission operates Lake Bogue Homo, a 1,500-acre lake 5½ miles east of Laurel. The Leaf, Bowie, and Chickasawhay Rivers and many oxbow lakes along the Leaf and Chickasawhay are also used extensively for boating and fishing. Numerous private lakes and farm ponds throughout the area afford private fishing areas. The U. S. Department of Agriculture has developed scenic float routes on reaches of Black Creek and its tributaries in De Soto National Forest. The Pat Harrison Waterway District, in cooperation with other agencies, is planning several projects in southeastern Mississippi which include facilities for swimming, fishing, and boating.

At present there is no commercial water traffic, but it has long been the aim of local interests to link the cities of Meridian, Hattiesburg, and Laurel with the Gulf of Mexico through a system of barge canals. The Pat Harrison Waterway District is empowered by legislative act to develop plans for such navigation facilities in conjunction with Federal or State agencies.

SURFACE WATER

An abundant supply of surface water of good quality suitable for most industries is available. During an average year, more than two trillion gallons of water flows from the Leaf and Chickasawhay River basins. This large volume of water flows at an average rate of about 9,600 cfs (cubic feet per second), or 6,200 mgd, past a gaging station (No. 4790) on the Pascagoula River just downstream from the confluence of the Leaf and Chickasawhay Rivers. The quantity and quality of streamflow, however, vary with time and place and this variability requires the collection and interpretation of a mass of data to appraise adequately the surface-water resources of the five-county area.

Water shortages that will increase the pollution problem and adversely affect recreational interests can occur at some locations on various streams. Often the period of deficient flow coincides with a time of maximum water demand. On the other hand, too much water during floods may cause loss of life and property damage and create many problems in transportation, commerce, and agriculture. Streamflow and water-quality data have been collected and analyzed from a network of continuous-record gaging stations supplemented by partial-record sites (fig. 3 and table 2).

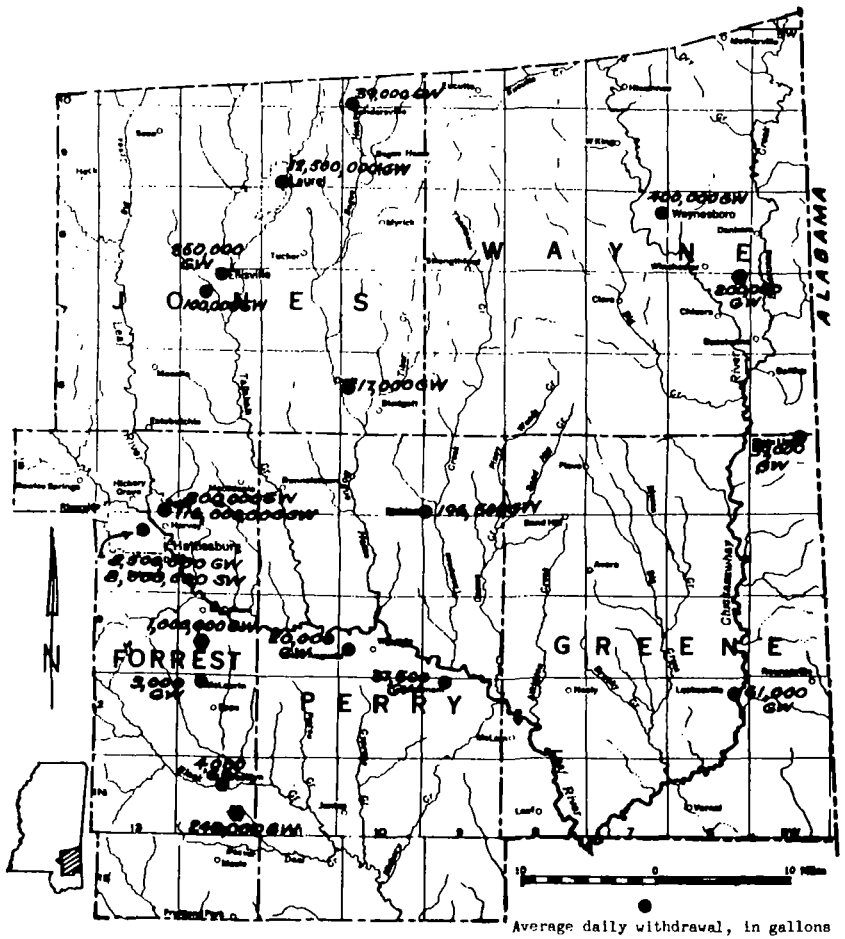
Flow Duration

Flow duration data for continuous-record gaging stations were computed from the daily discharges by the total-period method. A flow-duration curve based on these data shows, without regard to chronological order, the flow variability of a stream. Estimates of the duration of flows at short-time continuous-record stations were obtained by using methods described by Searcy (1959).

A tabulation of flow-duration data, adjusted to base period October 1928-September 1957, for stations in the area is shown in table 3. These data can be plotted on logarithmic-probability paper if graphical presentation is desired. The data in table 3 are reliable long-term predictions of the future flow patterns of the streams in the area if no unusual climatological or man-made changes occur; however, values for individual years will deviate, sometimes considerably, from the long-term period.

Flow-duration data may be used for comparing flow characteristics of different streams. If the effect of drainage-area size is removed (by dividing discharge by drainage area) a direct comparison may be made. Flow-duration curves for Bowie Creek at U. S. Highway 49 near Hattiesburg, Leaf River near McLain, Pascagoula River at Merrill, Chickasawhay River at Leakesville, and Tallahala Creek at Laurel are shown on figure 5. These stations were selected to illustrate the variation in base flow of streams in the area. Bowie Creek has a much higher low-flow yield per square mile than the other streams on figure 5. The slope of the lower end of the flow-duration curve for Bowie Creek is flatter than those of the low-yielding streams. Slope of the duration curve is a measure of the variability of that stream.

Although the information in figure 5 is expressed as discharge per square mile, it does not imply that each drainage basin internally has uniform yield. The streamflow yields of



Average daily withdrawal, in gallons

GW - ground water
SW - surface water

Seasonal daily withdrawal, in gallons

GW - ground water
SW - surface water

Fig. 4. Map showing major water withdrawals

Table 2.--Stream-gaging stations and water-sampling sites

(Type of record: 1, continuous-record gaging station; 2, low-flow partial-record station; 3, daily sampling site; 4, periodic sampling site; 5, continuous conductivity site; 6, DO and BOD sampling site; 7, sediment sampling site.

Identification No.	Station	Drainage area (sq mi)	Period of streamflow record	Type of record: Streamflow	Type of record: Chemical quality	Location
02467201	Leaf River near Collins	242	Sept. 1938-	1	4	NW¼ sec. 33, T. 9 N., R. 14 W., at bridge on U.S. Highway 84, 9½ miles northeast of Collins.
02467211	Big Creek near Laurel	[a] 100	1942-43 1951 1953-56 1958 1960 1961-	2	--	SW¼ sec. 4, T. 8 N., R. 17 W., at bridge on U.S. Highway 84, 10¼ miles west of Laurel.
02467215.5	Leaf River near Ellisville	[a] 910	1951-54 1956 1960 1961-	2	--	Sec. 32, T. 8 N., R. 13 W., at bridge on State Highway 588, 8 miles west of Ellisville.
02467217.7	Leaf River near Moselle	1,090	1961-	2	4	NW¼ sec. 9, T. 6 N., R. 13 W., at bridge on Interstate Route 59, 1 mile west of Moselle.
02467225	Bowie Creek near Hattiesburg	104	Sept. 1938-	1	4,6,7	Sec. 4, T. 5 N., R. 14 W., at bridge on U.S. Highway 49, 10 miles northwest of Hattiesburg.
02467229.4	Bowie River at Hattiesburg	456	1961-	2	--	Sec. 30, T. 4 N., R. 13 W., at bridge on Interstate Route 59, 1½ miles north of intersection of U.S. Highway 49 and 11 in Hattiesburg.
02467230	Leaf River at Hattiesburg	[b] 1,960	Sept. 1938-	1	[b] 1,4,6,7	NW¼ sec. 2, T. 4 N., R. 13 W., at bridge on U.S. Highway 11, at eastern city limits of Hattiesburg.
02467233.2	Leaf River at McCallum	[b] 1,890	1961-	2	4,6	NW¼ sec. 10, T. 3 N., R. 12 W., at county highway bridge, 1 mile east of McCallum.
02467233.6	Leaf River near Mahned	[b] 1,880	1961-	2	4,5,6,7	NW¼ sec. 15, T. 3 N., R. 11 W., at county highway bridge, 1½ miles north of Mahned.
02467235	Tallahala Creek at Laurel	213	1938-40 1944-	1	4	NW¼ sec. 8, T. 8 N., R. 11 W., at bridge on State Highway 15 and 4 mile southeast of Laurel.
02467243	Tallahoma Creek near Laurel	[a] 170	1954-56 1958 1960 1963-	2	--	SW¼ sec. 24, T. 9 N., R. 12 W., at bridge on county highway, 2 miles northeast of Laurel.
02467245	Tallahala Creek near Runnelstown	612	Oct. 1939-	1	4,6	NW¼ sec. 6, T. 4 N., R. 11 W., at county highway bridge between Sunrise and Runnelstown, 3 miles south of Runnelstown.
02467245.4	Tallahala Creek near Mahned	640	1961-	2	4,6	SE¼ sec. 10, T. 3 N., R. 11 W., at bridge on county highway, 2 miles north of Mahned.
02467249	Bogue Homa near Richton	190	1947 1954 1956 1961-	2	--	W½ sec. 17, T. 5 N., R. 10 W., at bridge on county highway, 7 miles northwest of Richton.
02467268	Thompson Creek near Richton	[a] 186	1942-43 1951-54 1956 1960 1961 1963-	2	--	NW¼ sec. 32, T. 5 N., R. 9 W., at bridge on State Highway 42, ½ mile east of Richton.
02467268.2	Thompson Creek near Hintonville	[a] 212	1961-	2	--	SW¼ sec. 33, T. 4 N., R. 9 W., at county highway bridge, 1½ miles east of Hintonville.
02467269.6	Gaines Creek near Beaumont	[a] 132	1961-	2	--	SE¼ sec. 25, T. 3 N., R. 9 W., at county highway bridge, 5 miles east of Beaumont.
02467269.9	Atkinson Creek near McLain	[a] 55	1961-	2	--	NW¼ sec. 14, T. 2 N., R. 8 W., at county highway bridge, 1 mile north of McLain.
02467270	Leaf River near McLain	[b] 3,510	Oct. 1939-	1	4,6,7	SE¼ sec. 29, T. 2 N., R. 8 W., at bridge on U.S. Highway 98, 1½ miles east of McLain.
02467271.1	Shubuta Creek near Shubuta	95	1939 1961-	2	--	NW¼ sec. 15, T. 1 N., R. 13 E., at county highway bridge, 1½ miles northwest of Shubuta.
02467271.5	Chickasawhay River at Shubuta	[b] 3,660	1943 1953 1961-	2	--	On line between secs. 9 and 10, T. 10 N., R. 7 W., at bridge on U.S. Highway 45, 1 mile southeast of Shubuta.
02467271.6	Porcupine Creek near Shubuta	[a] 70	1961-	2	--	NE¼ sec. 18, T. 10 N., R. 7 W., at bridge on county highway, 2 miles southwest of Shubuta.
02467274.9	Yellow Creek at Waynesboro	[a] 90	1963-	2	--	SE¼ sec. 35, T. 9 N., R. 7 W., at bridge on county highway, ½ mile northwest of Waynesboro.
02467275	Chickasawhay River near Waynesboro	[b] 3,660	[c] 1938-40 1947-48 1961-	1,2	3,4,6,7	NW¼ sec. 10, T. 8 N., R. 7 W., at bridge on U.S. Highway 84, 2 miles west of Waynesboro.
02467279	Patton Creek near Waynesboro	[a] 10	1956 1958 1960 1963-	2	--	SE¼ sec. 18, T. 8 N., R. 6 W., at bridge on U.S. Highway 45, 1¾ miles southeast of Waynesboro.
02467280	Bucatunna Creek at Denham	468	[c] 1938-49 1952-56 1958 1960 1963-	1,2	--	SE¼ sec. 18, T. 8 N., R. 5 W., at bridge on county highway, 0.3 mile east of Denham.
02467280.2	Big Red Creek near Bucatunna	[a] 40	1961-	2	--	NE¼ sec. 21, T. 7 N., R. 5 W., at bridge on county highway, 3 miles northeast of Bucatunna.

able time, as specified by the Board in its authorization, to the stream at a point downstream from the place of withdrawal. This appropriation can be made only if the Board shall find that such action will not result in any substantial detriment to property owners affected thereby or to the public interest.

Average minimum flows calculated for streams in the area are presented in table 11. Data for the period 1941-60 were used for the determinations of the average minimum flows.

The law states that the Board has authority to enter into compacts and agreements concerning the State's share of water flowing in streams, where parts of such water courses are contained within the territorial limits of a neighboring state.

GROUND WATER

Location, Extent, and Lithology of Aquifers

Fresh-water aquifers in the five-county area are mostly beds of sand or zones of sandy beds. The beds dip gently to the southwest and contain fresh water as much as 40 miles from the outcrops and as much as 3,000 feet below land surface. Aquifers of Miocene age are available in practically the entire area, except in the northern third of Jones and Wayne Counties (fig. 19), but no single geologic unit contains fresh water throughout the five counties. Aquifers in Claiborne and Wilcox groups are available in the northern third of the area, but the great depth (1,200-3,000 feet) of the Wilcox has limited its use owing to the higher cost of deep wells. Shallow alluvial deposits in the larger stream valleys are potentially important aquifers in the three southern counties.

Lithology and thickness of aquifers is shown in table 1 and in a northeast-southwest cross-section (fig. 20) parallel to the general dip of the beds. Detailed sections through Laurel and Hattiesburg show the lenticular bedding of the Miocene beds (figs. 21 and 22). Depth and thickness of aquifers can be estimated from the sections for places in the vicinity of the sections, but structure contour maps drawn on mappable geologic horizons are useful for estimating aquifer depths at any place in the area. Because the Moodys Branch Formation is thin (15-20 feet), a contour map showing the configuration of the top of the mappable Moodys Branch Formation (fig. 23) is essentially the top of the Cockfield Formation. Another contour map, showing the configuration of the base of the Catahoula Sandstone (fig. 24), can be used to determine the depth of a well necessary to penetrate the Catahoula.

Thickness of geologic units increase from the outcrop toward the southwest in the direction of the center of deposition. The thickness of the Sparta Sand ranges from 110 feet in northeastern Wayne County to 190 feet in north-central Jones County. Thickness of the Cockfield Formation ranges from 80 feet in northern Wayne County to 150 feet in north-central Jones County. Miocene beds range in thickness from about 100 feet in northern Jones County to about 2,000 feet in southern Forrest County. The alluvium underlying the major flood plains in the area is as much as 125 feet thick, as in the Leaf River flood plain at Hattiesburg.

Most of the aquifers are composed of sand or gravel mixed with varying proportions of silt and clay. Lignite is common in the Claiborne and Wilcox Groups. The alluvium is composed mostly of unstratified coarse sand and gravel. The beds of sand in the Miocene sediments, the principal source of ground water in the area, may be thinner than 2 feet or thicker than 200 feet. Commonly there are several beds of sand in each water-bearing geologic unit.

The marine Vicksburg Groups and Cocoa Sand are more uniform in lithology than most of the other water bearing units. The Cocoa Sand in eastern Wayne County is about 60 feet thick and is composed of thin layers (2-10 feet) of fine- to medium-grained sand alternating with thin layers (4-8 feet) of calcareous sandstone and limestone. The Vicksburg is generally composed of limestone beds alternating with thin beds (2-4 feet) of limy sand and clay. The Vicksburg at particular locations, as at Waynesboro and Sandersville, is composed of relatively thick sand beds (30-50 feet) interspersed with thin layers (1-2 feet) of limestone. The limestone or limy sand section of the Vicksburg (known locally as "Honeycomb rock") yields water to domestic wells across central Wayne and northeastern Jones Counties.

Prediction of aquifer thickness and lithology is difficult because of the lenticular bedding of most units. Lithologic changes occur in short distances and individual sands are difficult to trace, especially along the dip of the beds (figs. 21 and 22); sand beds in the Miocene are characteristically lens shaped or wedge shaped. Construction of a well where water is needed may be a problem because of the lenticular bedding of most sands, and test drilling is recommended to determine the depth, thickness, and character of aquifers underlying a particular site.

The depth of drilled water wells ranges from 20 to 1,316 feet (table 12). A well at Laurel is 1,316 feet deep, but most wells are less than 800 feet deep. At most places more than one aquifer is available.

Aquifer and Well Hydraulics

Transmissibility, Permeability, and Storage

Aquifers vary considerably in their ability to transmit and store water. Transmission and storage of water by an aquifer depends on the porosity (Glossary), size of open spaces between grains of the aquifer material, and interconnection of the open spaces; all of which are related to the depositional history of the aquifer. Coefficients of permeability and transmissibility (Glossary) are measures of the ability of an aquifer to transmit water. The coefficient of

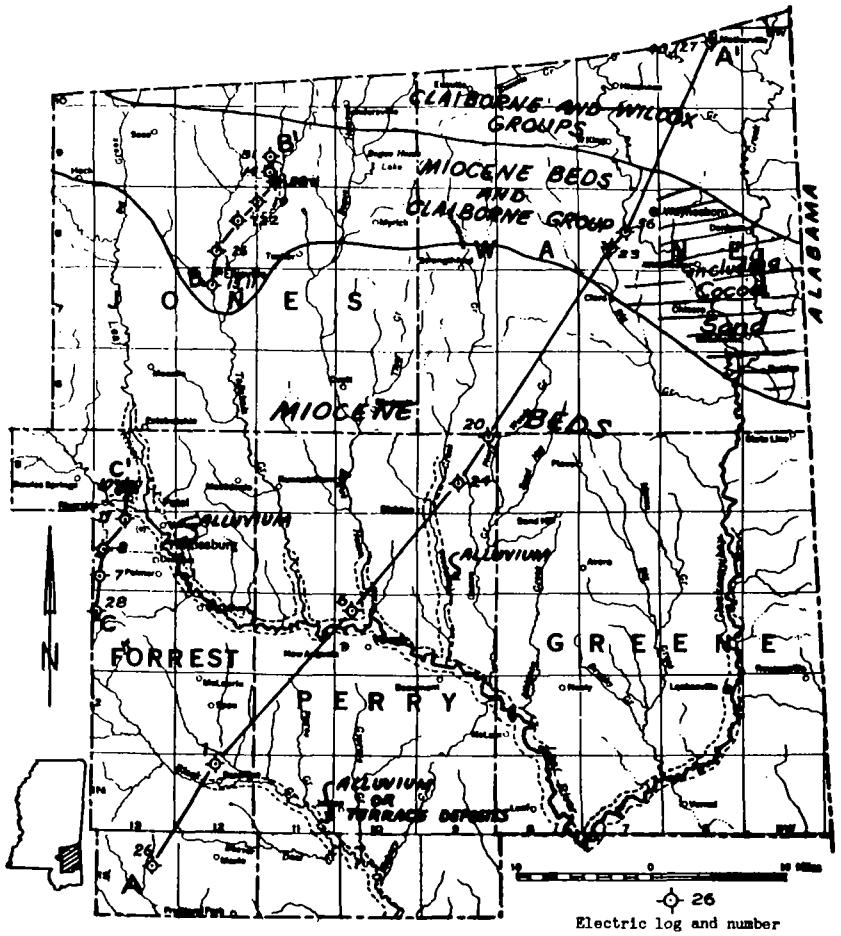


Fig. 19. Map showing distribution of fresh-water aquifers and location of geohydrologic sections

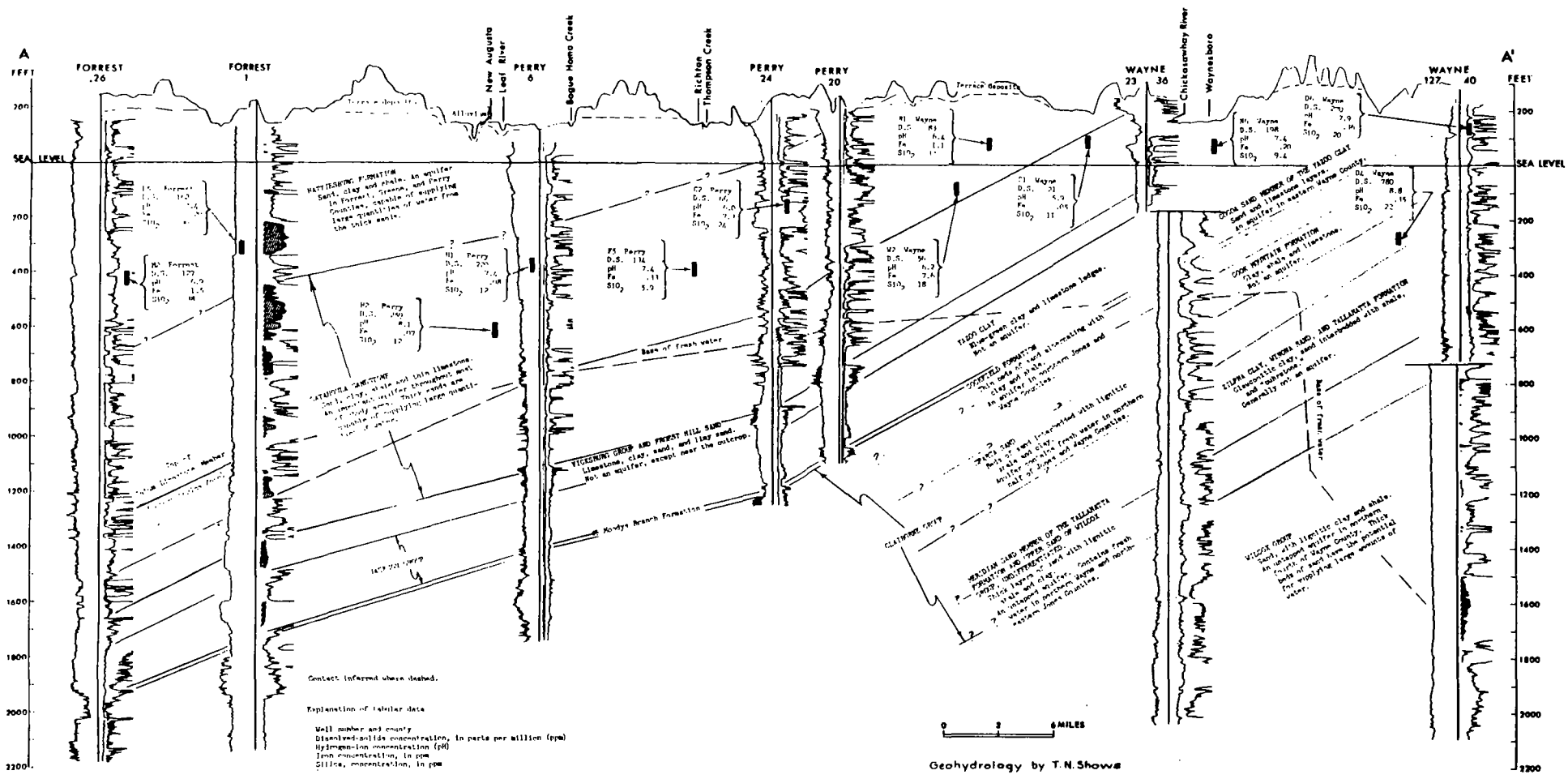


Fig. 20. Geohydrologic section (A-A') from southwestern Forrest County to northeastern Wayne County

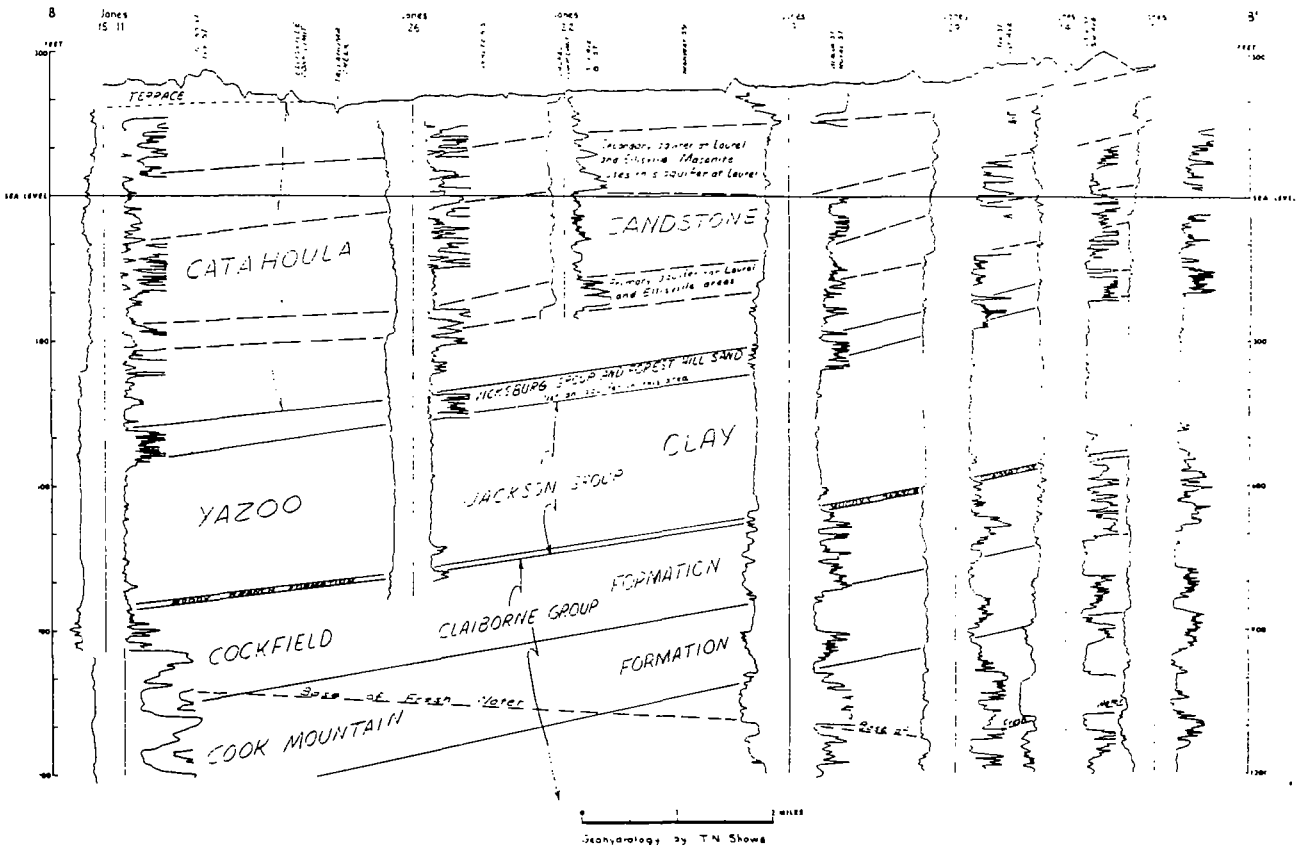


Fig. 21. Geohydrologic section (B-B') from Ellisville to Laurel

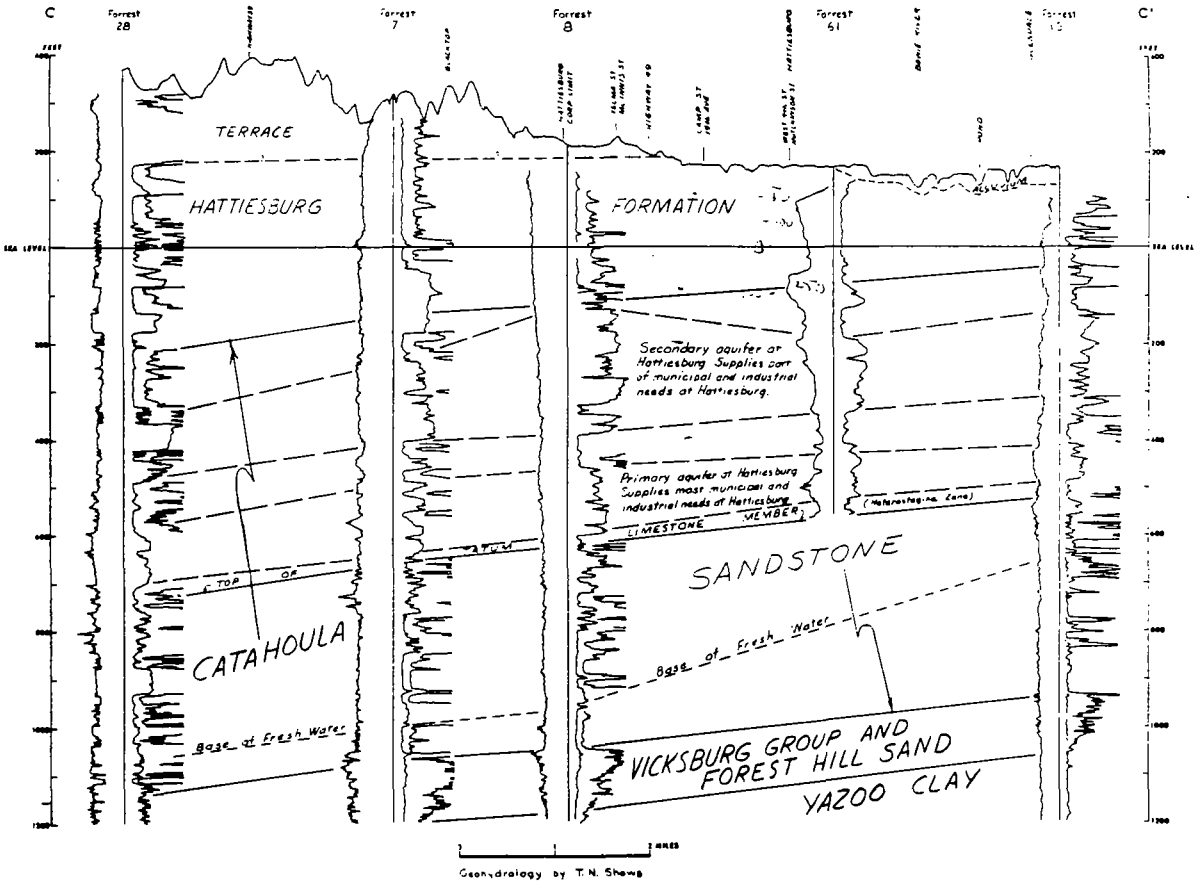


Fig. 22. Geohydrologic section (C-C') through the Hattiesburg area

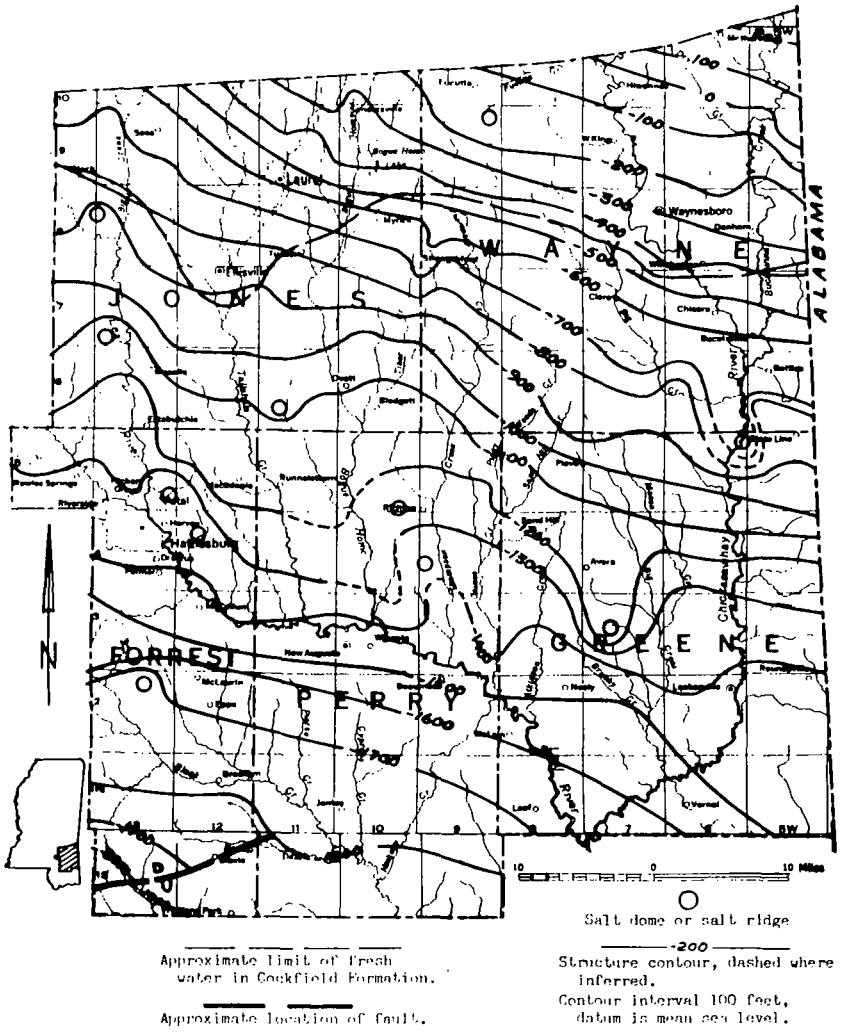


Fig. 23. Contour map showing configuration of the top of the Moodys Branch Formation

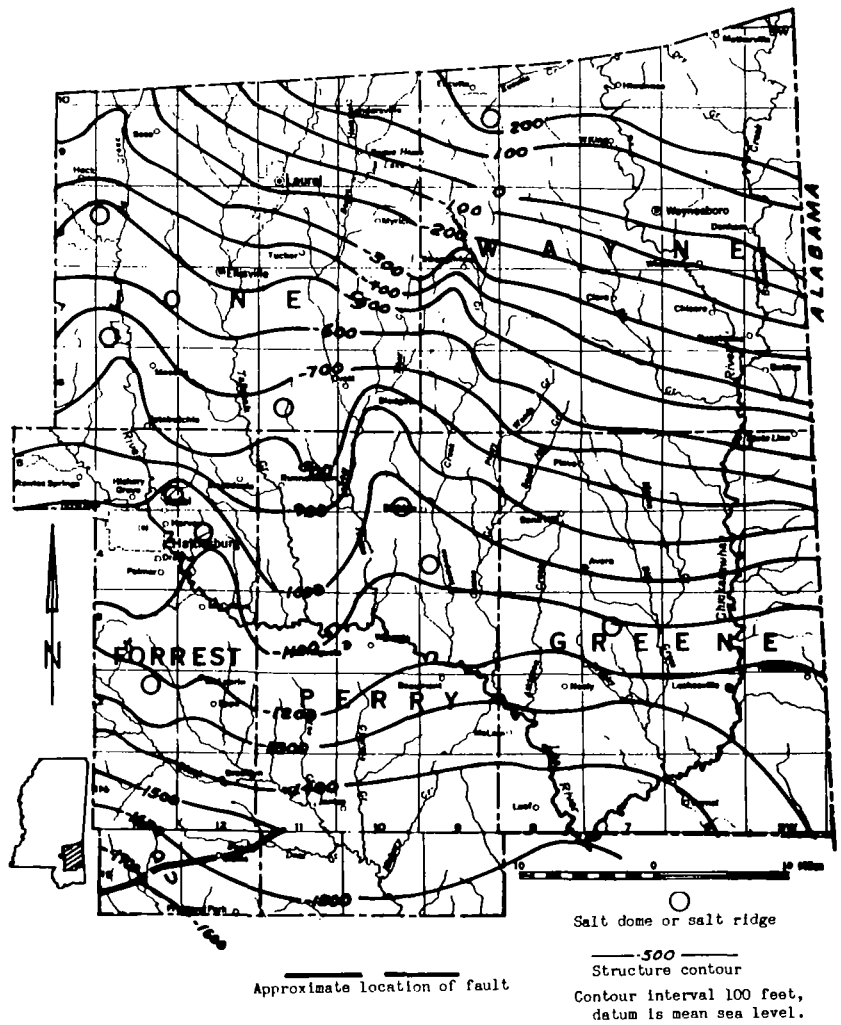
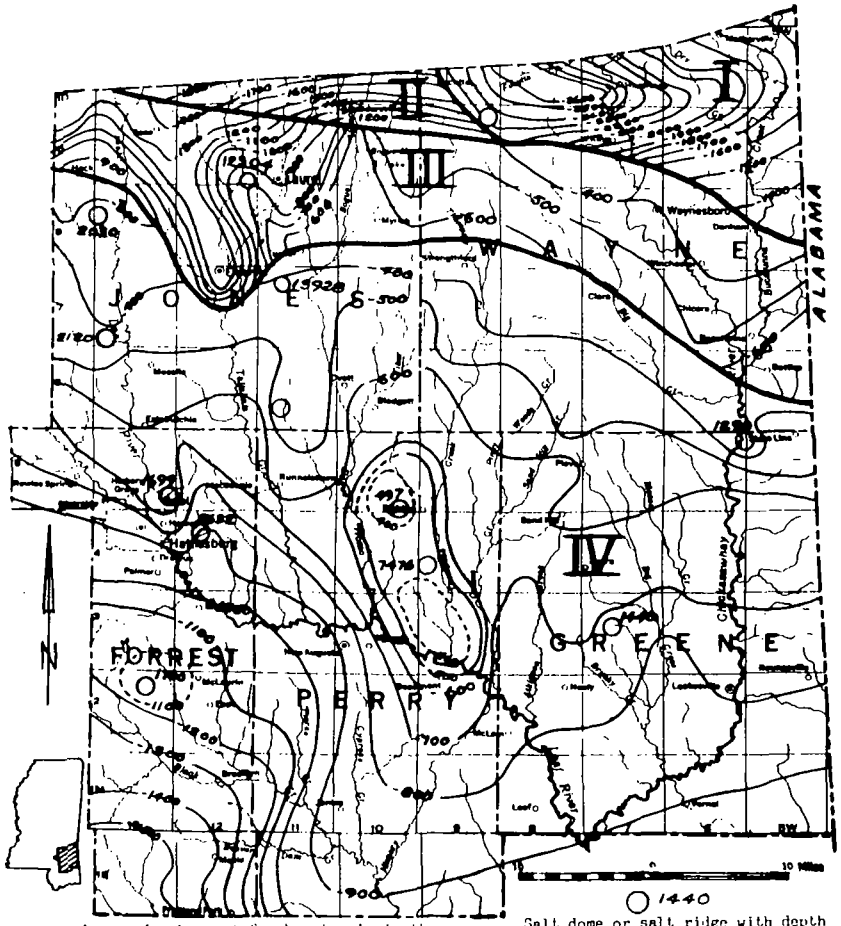


Fig. 24. Contour map showing configuration of the base of the Catahoula Sandstone



Area I.--Deepest fresh water is in the lower part of Wilcox Group.

Area II.--Deepest fresh water is in the upper part of Wilcox Group.

Area III.--Deepest fresh water is in Claiborne and Jackson Groups.

Area IV.--Deepest fresh water is in Miocene deposits.

Salt dome or salt ridge with depth to top of caprock below land surface.

-700 Contour on base of fresh water, dashed where inferred. Contour interval 100 feet, datum is mean sea level.

Line of abrupt change in base of fresh water.

Fig. 32. Contour map showing configuration of the base of the fresh-water section

are several fresh-water-bearing sands (fig. 20, 21, and 22) above the base of fresh water.

Ground-water quality varies with locality and is affected by contact with the sediments through which it slowly moves. Chemical composition of the sediments are different between zones of an individual aquifer and from one aquifer to another. Consequently the chemical quality of water pumped from a well is the result of many environmental factors. Water moves down dip in a southwesterly direction through aquifers containing clay, sand, gravel and other sedimentary material of varying size, compaction, and mineral content from which it dissolves various concentrations of the different mineral constituents. Time of contact of the water with the aquifer materials affects the amounts of the different minerals that are dissolved. In general, water from wells screened in highly permeable sands contain less dissolved solids than water from wells screened in sands with low permeabilities, if the wells are the same depth.

As water moves down the dip it exchanges calcium to the aquifer material for sodium, and changes from a moderately hard water having low dissolved solids near the outcrop areas to soft water having higher sodium and dissolved-solids concentrations at greater distance down dip. The change in water type and the increase in sodium concentration at greater distance down the dip of the Catahoula Sandstone is shown in figure 33.

Water percolating through the soil zone gathers carbon dioxide from organic matter in exchange for oxygen dissolved from the air. Most shallow wells (less than 125 feet deep) and some deeper wells in the Miocene contain water having sizable carbon dioxide concentrations (0-80 ppm) which acidify the water and render it corrosive to most metals. This corrosive water dissolves iron when in contact with iron-bearing minerals or with iron in the well system. Wells screened in the Sparta Sand, Cockfield Formation, Vicksburg Group, and Cocoa Sand member of the Yazoo Clay, in northern Wayne and Jones Counties, produce water having lower iron concentrations (0.00-0.42 ppm) than found in other formations of the study area. Iron concentrations in water from Miocene wells range from 0.00 ppm (03 Perry, 320-foot well near Janice) to 32 ppm (D5 Jones, 126-foot well near Sandersville). Treatment of iron-bearing ground water usually consists of aeration to remove carbon dioxide and to raise the pH; followed by settling and filtration to remove the iron precipitates.

Ground water usually contains higher silica concentrations than surface water because it remains in contact with silicate minerals under conditions favorable to solution for a longer period of time. Measured silica concentrations in the Miocene sediments range from 3 to 71 ppm. Silica concentrations measured in other aquifers of the study area ranged from 8 to 84 ppm with approximately 90 percent of the samples having concentrations less than 40 ppm.

Ground water which contains anaerobic bacteria or decaying vegetation has a reducing effect upon minerals if there is no oxygen supply. The unpleasant taste and smell of hydrogen sulfide gas noted in water from the 564-foot sand at Richton and the Cockfield at Waynesboro indicate that sulfate minerals have been reduced to sulfides at these places. Hydrogen sulfide can be removed successfully by aeration of waters with a low pH or by chlorination of waters having a pH greater than 7.

Passage of water through decaying vegetation (including lignite beds) imparts color to the water. Color of water from the Cockfield Formation ranges from 5 to 240 units and color of water from one well screened in the Sparta Sand was 450 units. About 95 percent of the wells in the Miocene sediments show color of 20 units and less. Color may be removed by pH adjustment and coagulation by alum. Chemical analyses and well depths (table 14 and 15) and a map showing well locations (fig. 27) can be used to locate ground water of desirable quality.

None of the water samples collected from wells during the study indicated pollution by man's activity. Analysis of spring water in the vicinity of a brine disposal pit in the Chaprell Oil Field, Wayne County, indicated seepage of brine into the shallow ground water in that area. Potential hazard of pollution by chemicals and bacteria exists in wells screened in shallow aquifers. This hazard could be controlled by proper well location and design.

Water-Supply Potential

The water-supply potential is generally good; the largest potential supplies are in several formations of Miocene age and in the Wilcox Group. Aquifers of Miocene age underlie the southern two-thirds of the area and the Wilcox contains important aquifers in the northern one-third (fig. 19). Beds of Miocene age and the Claiborne Group contain important aquifers in the northern parts of Jones and Wayne Counties, but nearly all water supplies are obtained from the shallow beds of Miocene age. This band of shallow Miocene and deep Claiborne beds has less water-supply potential than other areas, partly because the water in the deeper aquifers is moderately mineralized (500 to 1,000 ppm dissolved solids). The water-supply potential for most municipal localities is summarized in appendix II.

Multiple aquifers underlie most places in the five-county area, and usually one or more of these aquifers will yield more than 2,000 gpm (2.9 mgd) to properly constructed wells. The mean transmissibility of the aquifers in the area as determined by 40 pumping tests is about 50,000 gpd per foot. The following well field layout in an average aquifer is used to illustrate the im-

Table 12.--Records of selected wells in Forrest, Greene, Jones, Perry, and Wayne Counties--Continued

Well No.	Owner	Year completed	Depth (ft)	Casing diameter (in)	Water-bearing unit	Elevation of land-surface datum (ft)	Water level: above (+) or below land surface (ft)	Water level: Date of measurement	Method of lift	Use	Yield: Gallons per minute	Yield: Date	Temperature (°F)	Remarks
						FORREST COUNTY--Continued								
J1	Johnnie State Park	1960	131	6	Hattiesburg	215	30	1960	T	D	--	--	--	C
J2	Town of McLaurin, No. 2	1959	181	6	do	151	109.1	10- 6-62	T	P	--	--	68	C
J3	do No. 3	1954	175	6	do	160	110	1954	T	P	--	--	68	C
J4	Johnson State Park	1952	154	6	do	220	50	--	T	D	--	--	--	C
J5	Smithy State Park	1961	115	2	do	215	55	1961	J	D,S	--	--	62	C
J7	Tompson State Park	1960	112	6	do	240	50	1960	R	R	--	--	--	C
L2	U.S. Forest Service (Lake Nursery)	1936	171	8	Catahoula	290	151	1936	T	Ir	100	1936	--	C
L3	do	1957	117	10.8	do	300	155	1962	T	Ir	--	--	--	C
L4	Smith Freeman Attendance Center	1962	525	6	Hattiesburg	195	30	1962	T	D,S	95	1966	71	C
L17	Brooklyn Water Assoc.	1966	685	8,6	do	210	88	6- 6-66	S	P	252	1966	74	C
L49	U.S. Forest Service (Lake Nursery)	1936	178	6	do	290	142	1936	T	I	--	--	--	C
M9	Malone School, Census	1953	488	6	do	124	80	1953	T	D,S	--	--	71	C
N1	Camp Tish, Ary Scout Camp	1955	240	6	do	380	183	3- -55	T	D	--	--	72	C
N2	Marathon Oil Co.	1954	529	6,4	do	270	94	1- 7-54	T	D,S	61	1954	73	C
N4	U.S. Forest Service, Black Creek Work Center	1961	117	6	do	190	44	4-21-61	S	D,S	--	--	--	--
						GREENE COUNTY								
A4	Sand Hill School	1949	535	6	Catahoula	310	180	1949	T	P	30	--	--	C
A5	Lester Brewer	1961	618	2	do	265	97	1961	J	D,S	--	--	--	C
A9	Mrs. Margie Brewer	1964	610	2	do	272	112	1964	J	D,S	--	--	--	C
A11	James C. Mills	1955	80	2	Terrace	290	60	1955	J	D,S	--	--	71	C
A15	James E. McInis	1964	650	2	Catahoula	327	160	12- -64	J	D,S	--	--	69	C
A16	Mrs. Margie Brewer	1960	38	6	Terrace	273	11.8	1-10-61	R	D,S	--	--	--	C
A17	Sandhill Teachers Home	1964	95	2	do	314	65	1964	J	D,S	--	--	--	C
A18	Mrs. Margie Brewer	1965	610	2	Catahoula	275	110	6- -65	J	--	--	--	70	C
B1	Mrs. S. S. Henderson	1963	100	2	do	190	--	--	C	D,S	--	--	--	--
C1	L. D. Clark	1957	170	3	do	98	20	1965	F	D,S	9	1965	64	C
D1	Town of State Line	1963	305	8,6	do	260	97	8- -63	T	P	60	1965	70	C,P
B3	Clifton Watson	1960	298	2	do	184	71	10- -60	J	D,S	--	--	66	C
B4	Cities Service Co., No. 62	1965	685	4	do	260	11.1	3-12-65	A	I	--	--	86	C
F3	Guy Avera	1964	305	2	do	275	80	1964	C	D,S	--	--	--	C
F4	E. O. Dubee	1963	302	2	do	299	90	3-12-64	J	D,S	7	1965	--	C
G1	Samuel P. Elmore	1938	685	2	do	238	100	1938	C	D,S	--	--	66	C
G2	Mark Hall, Jr.	1922	75	2	Terrace	265	60	1965	C	D,S	--	--	65	C
G3	J. H. Clark	1951	190	6	Catahoula	110	+ 10	6- 1-65	F	D,S	25	1965	66	C
G4	do	1957	155	2	do	112	+ 20	1957	F	D,S	60	1965	68	C
J1	C. O. Cook	1955	360	2	Hattiesburg	185	15	1955	C	D,S	--	--	--	C
J3	Grover Anderson	1964	153	2	Catahoula	228	90	8- 1-64	J	D,S	--	--	--	C
J6	Sam Turner	1965	537	2	do	229	84	2- -65	J	D,S	--	--	70	C
J7	Elgin Turner	1958	90	3	Terrace	165	55	1958	J	D,S	--	--	--	C
K2	Baptist Parsonage	1961	110	2	Hattiesburg	74	+ 11	4-24-64	J	D,S	--	--	--	--
L4	Shell Oil Co., Bonnes No. 1	1965	640	1	Catahoula	140	20.6	3-12-65	A	R	30	1965	--	C
M1	R. W. Buffin, Jr.	1958	385	2	do	155	25	1958	J	D,S	--	--	70	C
M2	J. I. Freeman	1929	162	2	Hattiesburg	78	+ 4	1964	J	D,S	--	--	68	C
M10	R. W. Buffin, Sr.	1965	620	2	do	174	65	3-20-65	J	D,S	--	--	71	C
P1	Town of Leakesville, No. 1	1960	160	6	do	100	21.2	11-12-64	S	P	100	1965	--	C,P
P2	do No. 3	1950	125	6	do	100	60	2- -65	T	D,S	150	1965	--	C
P3	do No. 2	1957	160	6	do	100	60	1957	T	P	65	1965	70	C
P11	do	1955	607	6	Catahoula	105	+ 5	11-12-64	T	P	2	1965	71	C
Q1	Leakesville Colored School	1960	160	6	Hattiesburg	90	+ 10	1960	J	P	--	--	--	--
Q2	do	1965	160	6	do	70	+ 10	1960	J	P	--	--	--	--
Q5	E. S. Carmichael	1965	700	2	do	200	65	1965	C	D,S	--	--	70	C
R1	J. J. Edwards	1948	48	2	Terrace	105	10	1948	J	D,S	--	--	68	C
						JONES COUNTY								
A3	A. J. Green, Jr.	1955	60	2	Terrace	300	20	4-25-55	J	D	--	--	70	C
A3	Soso Water Assoc.	1965	640	6,4	Catahoula	310	72	7-20-65	S	P	130	1965	70	C,P
B11	Dr. J. H Allegar	--	130	4	do	270	60	7- -55	C	D	--	--	68	C
B24	Shady Grove Water Assoc.	1965	482	6,4	do	310	171	8-26-65	S	P	165	1965	69	C,P
B35	do	1965	198	6,4	do	290	151	3-11-65	S	P	140	1965	69	C
C8	Transcontinental Gas Pipe Line Corp.	1950	215	6	do	345	94	1950	T	D	14	--	--	C
C27	Henry B. Tate	1955	158	2	do	295	85	4-27-55	C	D,S	--	--	--	C
C29	R. M. Peters	1960	70	2	Terrace	300	60	1955	J	D,S	--	--	--	C
C31	City of Laurel, No. 16	1954	318	24,16	Catahoula	262	103	9- -54	T	P	300	1960	72	C
C13	do No. 24	1960	360	24,10	do	290	132	9- 6-60	R	R	--	--	--	C
C14	do No. 5	1945	381	10,12	do	278	127	10- -45	T	P	800	1965	72	C
C15	do No. 6	1949	681	10,10	do	241	136	9- -49	T	P	800	1965	72	C
C17	do No. 8	1954	341	10,12	do	275	130	9- -54	T	P	900	1965	68	C
C38	Southern United Ice Co.	1966	346	10,8	do	271	126	1966	T	R	--	--	--	C
C44	Powers Water Assoc.	1965	385	6,4	do	292	164	3-26-65	S	P	--	--	68	C
C45	C. M. McKenzie	1965	410	2	do	295	112	5- -65	C	D,S	5	--	68	C
C46	Powers Water Assoc.	1966	385	6	do	295	142.9	6- 6-66	S	P	304	1966	69	C
C53	City of Laurel	1900	310	10	do	248	50	1949	R	R	--	--	--	C
C55	City of Laurel, No. 2	1950	180	24,10	do	277	108.9	1950	R	R	800	1960	--	C
C57	do No. 7	1965	321	10,10	do	274	114.4	1965	T	P	810	1966	--	C,P
D3	Southland Refinery	1966	660	10,6	Cookfield	293	60	6-27-66	T	Ir	175	1966	74	C
B4	C. W. McKenzie	1965	70	2	Catahoula	285	--	--	J	D	--	--	--	C
B5	Miss Dollye C. Perkins	1955	138	2	do	295	--	--	C	D	10	1955	68	C
B7	C. W. McKenzie	1966	210	4	do	295	30	5- -55	C	D,S	3	1966	68	C
B26	Magnolia Boys Town	1955	400	4	Catahoula	252	64	1954	T	D,S	--	--	68	C
B28	B. R. Mayo	1940	76	2	Terrace	235	30	3- -55	C	D,S	--	--	--	C
B29	Bogue Homa School	1956	34	6	do	343	19	4- 8-56	C	D	--	--	--	C
B31	E. B. Sherrod	1950	150	2	do	345	--	--	C	D,S	--	--	--	C
B34	Bill McDonald	1963	630	2	Cookfield	315	80	11-26-63	J	D,S	--	--	--	C
B35	Town of Sandersville	1963	130	10	Vicksburg	230	31	1-24-64	T	P	--	--	68	C
B37	Sinclair Oil Co., Plant No. 30	1962	636	4	Eocene	322	--	--	R	I	40	1962	--	C
B38	Dumas Oil Co.	1960	80	2	Vicksburg	345	--	--	R	I	70	1962	--	C
B45	Town of Sandersville	1962	710	8	Cookfield	283	14	4- -62	R	R	174	1962	76	C

Table 13.--Aquifer and well characteristics determined from pumping tests in Forrest, Greene, Jones, Perry, and Wayne Counties

Well No.	Location of test	Water-bearing unit	Depth of well (ft)	Length of test (hours)	Coefficient of transmissibility (gpd/ft)	Coefficient of permeability (gpd/ft²)	Coefficient of storage	Specific capacity (gpm/ft at the end of 1 day)
		FORREST COUNTY						
[illegible]	Hattiesburg	Catahoula	[illegible]	[illegible]	[illegible]	540	--	[illegible]
[illegible]	do	do	[illegible]	[illegible]	[illegible](?)	--	--	11
[illegible]	do	do	[illegible]	90	24,000	400	0.0003	9.7
[illegible]	do	Hattiesburg	[illegible]	100	44,000	440	.0002	--
[illegible]	do	Catahoula	[illegible]	130	140,000	1,080	--	40
[illegible]	do	do	[illegible]	80	[illegible]	175	.0001	1?
[illegible]	Petal	Alluvium	136	100	24?,000	2,460	.0005	--
[illegible]	Hattiesburg	Catahoula	[illegible]	74	14,000	190	--	7.5
[illegible]	do	do	352	150	[illegible]	470	--	[illegible]
[illegible]	Palmers Crossing	do	642	21?	110,000	510	.0002	20
[illegible]	Hattiesburg	do	[illegible]	90	[illegible]	430	--	--
[illegible]	do	do	[illegible]	72	[illegible]	540	.0002	11
[illegible]	Camp Shelby	Hattiesburg	400	82-102	54,000-?4,000	580-680	.0002-.0005	--
[illegible]	Brooklyn	do	580	170	230,000	1,350	--	22
		GREENE COUNTY						
[illegible]	State Line	Catahoula	[illegible]	58	27,000	460	--	15
[illegible]	Leakesville	Hattiesburg	140	[illegible]	2,800	74	--	.9
		JONES COUNTY						
[illegible]	Soso	Catahoula	470	120	75,000	635	--	6.8
[illegible]	Shady Grove	do	184	46	72,000	1,560	0.0002	5.5
[illegible]	do	do	[illegible]	46	72,000	1,590	.0002	12
[illegible]	Powers	do	185	55	60,000	1,090	--	12
[illegible]	do	do	185	55	55,000	1,000	--	4.1
[illegible]	Laurel	do	322	[illegible]	[illegible]	1,140	--	20
[illegible]	do	do	24?	40	44,000	1,100	.001	[illegible]
[illegible]	do	do	43?	[illegible]	12,000	900	.0003	15
[illegible]	Calhoun	do	438	54	55,000	1,020	.0002	11
[illegible]	[illegible]	do	[illegible]	[illegible]	4,800	150	--	.8
[illegible]	do	do	540	40	4,500	110	--	1
[illegible]	Laurel	do	405	[illegible]	34,000	485	--	14
[illegible]	do	do	600	57	17,000	290	--	6.5
[illegible]	do	do	[illegible]	100	44,000	440	.0003	8.6
[illegible]	Ellisville	do	450	80	40,000	500	.0002	12
		PERRY COUNTY						
[illegible]	Richton	Catahoula	464	--	6,100	--	--	1.4
[illegible]	New Augusta	do	223	[illegible]	2,600	130	0.0002	1.8
[illegible]	Beaumont	do	[illegible]	148	100,000(?)	675(?)	--	24
[illegible]	do	do	285	47	2,700	[illegible]	--	.6
		WAYNE COUNTY						
[illegible]	Waynesboro	Vicksburg	118	5?	25,000	450	--	17
[illegible]	Waynesboro Work Center	Catahoula	140	30	56,000	800	--	6.1
[illegible]	Waynesboro Tree Nursery	do	192	52	58,000	1,035	.0001	23

Table 14.--Chemical analyses of water from wells in Forrest, Greene, Jones, Perry, and Wayne Counties, Miss.

Chemical Constituents, in parts per million

Water-bearing unit: Qa, alluvium; Qt, terrace deposits; Th, Hattiesburg Formation; Tc, Catahoula Sandstone; Tv, Vicksburg Formation; Tcc, Cocoa Sand; Tcf, Cockfield Formation; Ts, Sparta Sand

Well No.	Water-bearing unit	Depth (feet)	Date of collection	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids (residue on evaporation at 180°C)	Hardness as $CaCO_3$: Calcium, Magnesium	Hardness as $CaCO_3$: Noncarbonate	Sodium adsorption ratio	pH	Color	Temperature (°F)
										Forrest County												
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
										Greene County												
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
										Jones County												
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Table 14.--Chemical analyses of water from wells in Forrest, Greene, Jones, Perry, and Wayne Counties, Miss.--Continued

Chemical constituents, in parts per million

Water-bearing unit: Qa, alluvium; Qt, terrace deposits; Th, Hattiesburg Formation; Tc, Catahoula Sandstone; Tv, Vicksburg Formation; Tcc, Cocoa Sand; Tcf, Cockfield Formation; Ts, Sparta Sand

Well No.	Water-bearing unit	Depth (feet)	Date of collection	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids (residue on evaporation at 180°C)	Hardness as $CaCO_3$: Calcium, Magnesium	Hardness as $CaCO_3$: Noncarbonate	Sodium adsorption ratio	pH	Color	Temperature (°F)
										Jones County--Continued												
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
										Perry County												
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
										Wayne County												
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

3

U.S. EPA REGION IV

SDMS

Unscannable Material Target Sheet

DocID: 10704416 Site ID: MSD008182081

Site Name: Hercules, Inc.

Nature of Material:

Map:	☐	Computer Disks:	☐
Photos:	☐	CD-ROM:	☐
Blueprints:	☐	Oversized Report:	☐
Slides:	☐	Log Book:	☐

Other (describe): Well Plot

Amount of material: _____

* Please contact the appropriate Records Center to view the material *

Public Water Supply Wells in AOC within the three-mile radius of Hercules Inc.

Nearest Drinking Water Well in AOC from Hercules Site (Private)

LOCAL WELL NUMBER	LOCAL WELL NUMBER	LATITUDE (DEGREES)	LONGITUDE (DEGREES)	PRIMARY USE OF WATER	DEPTH OF WELL (FEET)	BOTTOM OF OPEN INTERVAL (FEET)	TYPE OF OPENINGS	DISCHARGE (GPM)
A001 UNIV SO MS	A001 UNIV SO MS	312056	892138	I	195	--	-	--
A002 USM GOLF COURSE	A002 USM GOLF COURSE	312112	892153	I	195	--	-	--
A003 UNIV SOU MISS	A003 UNIV SOU MISS	312109	892132	I	195	--	-	--
A004 WEST HILLS C CL	A004 WEST HILLS C CL	312052	892136	U	248	--	S	--
A005 HATTIESBURG C CL	A005 HATTIESBURG C CL	312108	892254	R	174	--	S	--
A006 VERNON L HALL	A006 VERNON L HALL	312244	892220	H	500	--	-	--
A007 CHARLES JOHNS	A007 CHARLES JOHNS	312231	892257	H	72.0	--	T	--
A008 STANDARD OIL CO	A008 STANDARD OIL CO	312132	892203	H	165	--	S	--
A009 JL COUGHLAN	A009 JL COUGHLAN	312237	892155	H	277	--	-	--
A010 J H CAMERON	A010 J H CAMERON	312237	892155	H	85.0	--	-	--
A011 H H CAMERON	A011 H H CAMERON	312237	892155	H	18.0	--	-	--
A012 F S PRESTRESS	A012 F S PRESTRESS	312325	892239	H	80.0	--	-	--
A013 MISS FED CORP.	A013 MISS FED CORP.	312341	892204	H	65.0	--	-	--
A014 MACKS FISH CAMP	A014 MACKS FISH CAMP	312328	892134	H	147	--	-	--
A015 GEO JAMES	A015 GEO JAMES	312327	892119	H	318	--	S	--
A021 C M RAINES	A021 C M RAINES	312125	892234	H	126	--	S	--
A023 HATTIESBURG C CL	A023 HATTIESBURG C CL	312109	892233	U	752	752.00	S	100.00
A024 RAWLS SPGS W A	A024 RAWLS SPGS W A	312203	892154	P	705	--	S	220.00
A025 TILLMAN	A025 TILLMAN	312326	892238	H	590	--	-	--
A031 E P FILLINGAME	A031 E P FILLINGAME	312210	892130	H	105	--	S	--
A032 M RAYBURN	A032 M RAYBURN	312139	892236	H	150	--	S	12.00
A034 WILLIAM RAYBURN	A034 WILLIAM RAYBURN	312300	892235	H	165	--	S	6.00
A035 BROWN CONSTR CO	A035 BROWN CONSTR CO	312228	892137	H	60.0	--	S	35.00
A036 BILL MACK	A036 BILL MACK	312113	892230	H	140	--	S	12.00
A037 BILL MACK	A037 BILL MACK	312113	892230	H	140	--	S	12.00
A039 RAWLS SPGS W A	A039 RAWLS SPGS W A	312217	892152	P	680	--	S	200.00
A042 BILL MOE	A042 BILL MOE	312112	892231	H	150	--	S	14.00
A044 BROOME CONST CO	A044 BROOME CONST CO	312210	892120	H	60.0	--	S	30.00
A046 BILL MOE	A046 BILL MOE	312104	892238	H	140	--	S	10.00
A063 L E RHIAN	A063 L E RHIAN	312114	892214	H	185	185.00	S	45.00
A067 CHURCH OF GOD	A067 CHURCH OF GOD	312141	892114	H	285	285.00	S	74.00
A072 BOWIE PRODS	A072 BOWIE PRODS	312338	892205	N	340.	340.	S	200.
B001 HATTIESBURG	B001 HATTIESBURG	312109	892009	P	419	--	S	1065.00
B002 HATTIESBURG	B002 HATTIESBURG	312109	891942	P	622	--	S	970.00
						--	-	760.
B003 HATTIESBURG	B003 HATTIESBURG	312105	891949	P	610	--	S	953.00
B004 HATTIESBURG	B004 HATTIESBURG	312105	891949	U	450	--	-	953.00
B005 HATTIESBURG	B005 HATTIESBURG	312115	891923	P	621	--	S	990.00
B006 HATTIESBURG	B006 HATTIESBURG	312115	891936	U	444	--	S	964.00
B007 HATTIESBURG	B007 HATTIESBURG	312115	891923	P	635	--	S	908.00

AQUIFER CODE	WATER LEVEL (FEET)	DATE WATER LEVEL MEASURED
122HBRG	100.00	01-01-58
122HBRG	--	--
122HBRG	--	--
122HBRG	86.00	10-30-81
122HBRG	97.00	08-01-64
122CTHL	--	--
122HBRG	54.00	10-01-64
122HBRG	22.00	10-01-64
122HBRG	1.00	09-01-49
122HBRG	7.00	01-01-64
--	15.00	09-01-65
122HBRG	40.00	08-01-64
122HBRG	--	--
122HBRG	7.00	09-01-63
122CTHL	--	--
122HBRG	78.00	02-01-65
122CTHL	100.00	03-13-65
122CTHL	86.00	06-01-66
122CTHL	--	--
122HBRG	82.00	07-01-69
122HBRG	92.00	10-01-70
122HBRG	103.00	05-01-71
122MOCN	11.00	02-01-72
122HBRG	92.00	07-01-71
122HBRG	92.00	07-01-71
122HBRG	115.00	10-29-81
122MOCN	92.00	08-01-72
122MOCN	19.00	02-01-72
122MOCN	92.00	03-01-72
122MOCN	105.00	11-20-79
122MOCN	61.00	09-26-80
122MOCN	40.	03-06-87
122CTHL	10.00	04-01-66
122CTHL	77.00	08-31-81
--		
122CTHL	31.00	12-01-64
122CTHL	8.00	09-01-55
122CTHL	34.00	09-01-55
122CTHL	28.00	05-14-81
122CTHL	20.00	08-01-55

LOCAL WELL NUMBER	LOCAL WELL NUMBER	LATITUDE (DEGREES)	LONGITUDE (DEGREES)	PRIMARY USE OF WATER	DEPTH OF WELL (FEET)	BOTTOM OF OPEN INTERVAL (FEET)	TYPE OF OPENINGS	DISCHARGE (GPM)
B008 UNION OIL CO.	B008 UNION OIL CO.	312253	891614	U	260	--	-	90.00
B009 UNION TEX CO	B009 UNION TEX CO	312224	891616	N	260	--	S	400.00
B010 WARREN PETR CO.	B010 WARREN PETR CO.	312154	891543	U	289	--	S	90.00
B011 WARREN PETRO CO	B011 WARREN PETRO CO	312154	891543	N	292	--	S	325.00
B012 PETAL	B012 PETAL	312143	891612	-	289	--	S	90.00
B014 MOBIL OIL CO.	B014 MOBIL OIL CO.	312227	891614	U	252	--	S	300.00
B015 DIXIE PIPELINE	B015 DIXIE PIPELINE	312235	891636	H	248	--	S	--
B017 HATTIESBURG	B017 HATTIESBURG	312107	892006	P	607	--	S	1000.00
B018 JACK GANDY	B018 JACK GANDY	312135	891754	H	50.0	--	-	--
B019 A R FEED MILLCO	B019 A R FEED MILLCO	312309	891911	H	113	--	-	--
B020 TEXACO OIL CO	B020 TEXACO OIL CO	312136	892052	H	58.0	--	S	--
B021 C G CARGILL	B021 C G CARGILL	312214	891942	H	96.0	--	-	--
B023 HATTIESBURG	B023 HATTIESBURG	312106	891951	P	607	--	S	1000.00
B024 CHAS TYLER	B024 CHAS TYLER	312249	891514	H	185	--	S	--
B025 E L LEE	B025 E L LEE	312351	891526	H	122	--	S	--
B026 CHARLES LYLES	B026 CHARLES LYLES	312155	891515	H	145	--	S	--
B027 LEWIS R SIMS	B027 LEWIS R SIMS	312142	891519	H	82.0	--	S	--
B028 H F SUMRALL	B028 H F SUMRALL	312111	892049	H	70.0	--	S	--
B029 WATSON	B029 WATSON	312205	891828	H	65.0	--	S	--
B030 CHAS WADE	B030 CHAS WADE	312127	891820	H	55.0	--	S	--
B031 CHAS. WADE	B031 CHAS. WADE	312127	891820	H	55.0	--	S	--
B032 HATTIESBURG EQP	B032 HATTIESBURG EQP	312115	891611	H	25.0	--	S	--
B033 CARGILE	B033 CARGILE	312227	891900	H	87.0	--	S	8.00
B034 C WILLIAMSON	B034 C WILLIAMSON	312202	891909	H	65.0	--	S	--
B035 C J MORGAN	B035 C J MORGAN	312152	891839	H	75.0	--	S	--
B048 C S BENNETT	B048 C S BENNETT	312300	891800	H	175	--	S	--
B049 ADEN BALL	B049 ADEN BALL	312400	891600	H	45.0	--	S	--
B050 ADEN BALL	B050 ADEN BALL	312400	891600	H	47.0	--	S	--
B051 GAIL BROWN	B051 GAIL BROWN	312353	891548	H	75.0	--	S	--
B052 C F WILLIAMS	B052 C F WILLIAMS	312202	891906	H	65.0	--	S	--
B054 LOVELL COOLEY	B054 LOVELL COOLEY	312140	891750	H	82.0	--	S	30.00
B055 BARRON HENDRY	B055 BARRON HENDRY	312148	891529	H	65.0	--	S	12.00
B056 S BROMFIELD	B056 S BROMFIELD	312117	891531	H	82.0	--	S	20.00
B057 AMERICAN S&G CO	B057 AMERICAN S&G CO	312121	891814	H	106	--	S	17.00
B058 MCMAHAN	B058 MCMAHAN	312109	892025	H	105	--	S	10.00
B059 B UNDERWOOD	B059 B UNDERWOOD	312112	891624	H	75.0	--	S	26.00
B060 W H RATCLIFF	B060 W H RATCLIFF	312108	891542	H	55.0	--	S	20.00
B061 HERSHEL MOHLER	B061 HERSHEL MOHLER	312141	891526	H	60.0	--	S	20.00
B062 J C PITTMAN	B062 J C PITTMAN	312152	891756	H	68.0	--	S	15.00
B063 LAUREL HALMIX C	B063 LAUREL HALMIX C	312126	891736	I	106	--	S	18.00

AQUIFER CODE	WATER LEVEL (FEET)	DATE WATER LEVEL MEASURED
122CTHL	--	--
122CTHL	3.00	11-01-56
122CTHL	50.00	09-01-53
122CTHL	50.00	01-01-54
122CTHL	2.00	09-01-55
122CTHL	6.00	09-01-58
122CTHL	--	--
122CTHL	37.00	01-01-65
122HBRG	--	--
122CTHL	--	--
122HBRG	--	--
122HBRG	--	--
122CTHL	42.00	09-01-66
122CTHL	--	--
122MOCN	--	--
122HBRG	--	--
122HBRG	--	--
122HBRG	--	--
122HBRG	--	--
122HBRG	32.00	01-01-66
122HBRG	32.00	01-01-66
122HBRG	12.00	01-01-60
122HBRG	38.00	09-01-67
122HBRG	23.00	01-01-68
122HBRG	--	--
122HBRG	38.00	02-01-62
122HBRG	31.00	05-01-61
122HBRG	31.00	05-01-61
122HBRG	--	--
122HBRG	--	--
124HCGB	25.00	06-01-68
122MOCN	22.00	01-01-69
122MOCN	23.00	01-01-69
122MOCN	27.00	01-01-69
122MOCN	82.00	02-01-69
122MOCN	8.00	03-01-69
122MOCN	32.00	04-01-69
122MOCN	21.00	06-01-69
122MOCN	20.00	06-01-69
122MOCN	34.00	06-01-69

LOCAL WELL NUMBER	LOCAL WELL NUMBER	LATITUDE (DEGREES)	LONGITUDE (DEGREES)	PRIMARY USE OF WATER	DEPTH OF WELL (FEET)	BOTTOM OF OPEN INTERVAL (FEET)	TYPE OF OPENINGS	DISCHARGE (GPM)
B064 B H FORTE	B064 B H FORTE	312236	891636	H	73.0	--	S	--
B065 REX BRASWELL	B065 REX BRASWELL	312233	891845	H	55.0	--	S	30.00
B066 NEWTON WILSON	B066 NEWTON WILSON	312248	891815	H	63.0	--	S	10.00
B068 LAGRACE MOTEL	B068 LAGRACE MOTEL	312115	892030	H	86.0	--	S	26.00
B069 GLENDALE UTIL DST	B069 GLENDALE UTIL DST	312152	891848	U	654	--	S	300.00
B070 LAGRACE MOTEL	B070 LAGRACE MOTEL	312115	892030	H	87.0	--	S	30.00
B071 EASTABUCHIE W A	B071 EASTABUCHIE W A	312354	891530	P	810	--	S	200.00
B072 ROADWAY EXPRESS	B072 ROADWAY EXPRESS	312300	891833	H	88.0	--	S	18.00
B073 DOPHIN SIMS	B073 DOPHIN SIMS	312227	891836	H	75.0	--	S	10.00
B074 N J CARPENTER	B074 N J CARPENTER	312215	891803	H	65.0	--	S	10.00
B075 S J WILLIAMSON	B075 S J WILLIAMSON	312145	892008	H	90.0	--	S	20.00
B076 HAPPY ACRES	B076 HAPPY ACRES	312104	891645	U	100	--	S	250.00
B077 G E WEITAN	B077 G E WEITAN	312207	891945	H	108	--	S	30.00
B078 LAUREL HOT MIX	B078 LAUREL HOT MIX	312124	891845	H	97.0	--	S	15.00
B079 ETHEL GORDY	B079 ETHEL GORDY	312230	891810	H	85.0	--	S	22.00
B080 ENTERPRISE PROD	B080 ENTERPRISE PROD	312225	891545	N	320	--	S	500.00
B081 ENTERPRISE PROD	B081 ENTERPRISE PROD	312225	891545	N	352	--	S	500.00
B082 PMA PROC. DIV	B082 PMA PROC. DIV	312115	891615	U	100	--	S	305.00
B083 EWARD	B083 EWARD	312338	891543	H	35.0	--	S	7.00
B084 AMERICAN SAND	B084 AMERICAN SAND	312057	891838	H	94.0	--	S	12.00
B085 RANDY POWELL	B085 RANDY POWELL	312049	891601	H	25.0	--	S	--
B086 RUSSELL	B086 RUSSELL	312048	891602	H	25.0	--	S	--
B088 ENTERPRISE PROD	B088 ENTERPRISE PROD	312300	891605	H	100	--	S	20.00
B089 DAVID MICK	B089 DAVID MICK	312211	891500	H	98.0	--	S	15.00
B093 ENTERPRISE GAS	B093 ENTERPRISE GAS	312202	891541	-	--	--	-	--
B096 MILTON EVANS	B096 MILTON EVANS	312327	891928	H	89.0	--	S	15.00
B098 REO HINTON	B098 REO HINTON	312150	891715	H	82.0	--	S	30.00
B100 PMA PORK PROC DIC	B100 PMA PORK PROC DIC	312114	891615	U	96.0	--	S	315.00
B101 AMERICAN SAND	B101 AMERICAN SAND	312130	891910	H	96.0	--	S	15.00
B103 MOBILE OIL CORP	B103 MOBILE OIL CORP	312112	891619	N	254	254.00	S	550.00
B104 DELTA UNDERGROUND C	B104 DELTA UNDERGROUND C	312304	891603	N	340	340.00	S	1000.00
B105 HATTIESBG STORAGE	B105 HATTIESBG STORAGE	312208	891544	N	315.	315.00	S	1000.00
						--	-	1005
B106 HATTISBURG STORAGE	B106 HATTISBURG STORAGE	312208	891544	N	330	330.00	S	1000.00
B108 HATTISBURG STORAGE	B108 HATTISBURG STORAGE	312243	891515	N	312	312.00	S	1200.00
						--	-	1288
B111 ENTERPRISE PROD	B111 ENTERPRISE PROD	312226	891527	N	390	--	S	892.00
B112 WARREN PETROLEUM	B112 WARREN PETROLEUM	312154	891542	N	324.	262.	S	350.
						324.	S	--
B120 WARREN PETRO CO	B120 WARREN PETRO CO	312206	891534	N	372	372.00	S	1100.00

AQUIFER CODE	WATER LEVEL (FEET)	DATE WATER LEVEL MEASURED
122MOCN	19.00	07-01-69
122MOCN	20.00	07-01-69
122MOCN	28.00	03-01-69
122MOCN	86.00	02-01-70
122MOCN	50.00	02-01-69
122MOCN	31.00	03-01-70
122CTHL	95.00	10-30-81
122HBRG	26.00	09-01-70
122HBRG	41.00	07-01-70
112LTRC	21.00	11-01-70
122HBRG	12.00	12-01-70
110ALVM	17.00	12-01-70
122HBRG	38.00	01-01-71
122HBRG	17.00	03-01-71
122HBRG	31.00	07-01-71
122HBRG	119.00	08-01-71
122HBRG	119.00	08-01-71
122HBRG	15.00	10-29-81
112LTRC	7.00	10-01-71
122MOCN	30.00	12-01-71
122MOCN	11.00	11-01-71
122MOCN	13.00	11-01-71
122MOCN	16.00	07-01-72
122MOCN	21.00	04-01-72
--	--	--
122MOCN	58.00	08-01-73
122MOCN	22.00	05-01-74
110ALVM	15.00	10-29-81
--	25.00	09-01-75
122MOCN	24.00	11-30-77
122MOCN	95.00	07-31-77
122MOCN	66.00	12-30-77
--		
122MOCN	88.00	01-15-78
122MOCN	55.00	04-15-78
--		
122HBRG	129.00	03-01-75
122HBRG	82.	11-19-82
--		
122HBRG	130.00	09-01-79

LOCAL WELL NUMBER	LOCAL WELL NUMBER	LATITUDE (DEGREES)	LONGITUDE (DEGREES)	PRIMARY USE OF WATER	DEPTH OF WELL (FEET)	BOTTOM OF OPEN INTERVAL (FEET)	TYPE OF OPENINGS	DISCHARGE (GPM)
B123 UNION TEX CO	B123 UNION TEX CO	312228	891615	N	256	256.00	S	1000.00
B126 AM SAND & GRAVEL	B126 AM SAND & GRAVEL	312120	891827	H	110	110.00	P	6.00
B184 HATTIESBURG	B184 HATTIESBURG	312110	891945	U	--	--	-	--
C012 CHARLES LYLES	C012 CHARLES LYLES	312300	891443	H	185	--	S	--
C030 MATHIS GARY	C030 MATHIS GARY	312233	891442	H	110	--	S	10.00
C036 M CARPENTER	C036 M CARPENTER	312124	891412	H	115	--	S	10.00
C067 PETAL	C067 PETAL	312152	891407	-	1014	1014.00	S	45.00
C068 PETAL	C068 PETAL	312152	891407	-	708	708.00	S	43.00
						--	-	43
C069 PETAL	C069 PETAL	312157	891407	P	722	722.00	S	500.00
C070 PETAL	C070 PETAL	312154	891407	P	735	735.00	S	500.00
D004 HATTIESBURG	D004 HATTIESBURG	311836	891701	P	485	--	S	1200.00
D005 HATTIESBURG	D005 HATTIESBURG	311847	891702	P	678	--	S	1200.00
D006 HATTIESBURG	D006 HATTIESBURG	311847	891702	P	673	--	S	1200.00
D007 HATTIESBURG	D007 HATTIESBURG	311803	891644	P	688	--	S	1200.00
D008 HATTIESBURG	D008 HATTIESBURG	311834	891701	U	710	--	S	--
D009 MARSHALL DURBIN	D009 MARSHALL DURBIN	311804	891645	N	678	--	S	350.00
D010 MARSHALL DURBIN	D010 MARSHALL DURBIN	311804	891647	N	678	--	S	550.00
D011 DIXIE PINE PROD	D011 DIXIE PINE PROD	311723	891607	N	740	--	S	250.00
D012 DIXIE PINE PROD	D012 DIXIE PINE PROD	311723	891610	U	727	--	S	1000.00
D013 COASTAL CHEM CO	D013 COASTAL CHEM CO	312019	891745	U	325	--	S	--
D014 DIXIE PINE PROD	D014 DIXIE PINE PROD	312015	891851	U	501	--	S	600.00
D016 HERCULES PWD CO	D016 HERCULES PWD CO	312016	891707	U	451	--	S	1387.00
D018 SOUTHERN RR	D018 SOUTHERN RR	311953	891653	U	410	--	S	--
D019 CENTRAL PKNG CO	D019 CENTRAL PKNG CO	311936	891642	U	420	--	S	60.00
D020 MISS POWER	D020 MISS POWER	311935	891613	E	110	--	S	400.00
D021 MISS POWER CO	D021 MISS POWER CO	312002	891545	E	112	--	S	400.00
D022 MISS POWER CO.	D022 MISS POWER CO.	312002	891546	U	108	--	S	--
D023 CRYSTAL ICE CO.	D023 CRYSTAL ICE CO.	311954	891553	U	360	--	-	--
D026 BEV DRIVE IN	D026 BEV DRIVE IN	311639	891702	H	40.0	--	-	--
D027 CEN FORRESTATCR	D027 CEN FORRESTATCR	311633	891650	H	360	--	S	--
D028 PETAL	D028 PETAL	312047	891543	-	120	--	-	--
D028 PETAL	D028 PETAL	312037	891548	P	124	--	S	600.00
D029 E FORREST UTIL	D029 E FORREST UTIL	312002	891544	-	134	--	-	--
D029 PETAL	D029 PETAL	312002	891544	P	134	--	S	750.00
D030 EAST FOREST UTL	D030 EAST FOREST UTL	312039	891545	U	390	--	S	500.00
D031 CLINTON LBR CO.	D031 CLINTON LBR CO.	312035	891627	U	390	--	-	--
D032 BEVERLY DRIVE-IN	D032 BEVERLY DRIVE-IN	311642	891701	U	50.0	--	-	--
D033 JOS DELIA	D033 JOS DELIA	311653	891748	H	55.0	--	-	--
D034 JOS DELIA	D034 JOS DELIA	311653	891748	H	55.0	--	-	--

AQUIFER CODE	WATER LEVEL (FEET)	DATE WATER LEVEL MEASURED
122MOCN	23.00	06-01-80
121CRNL	62.00	07-14-84
--	--	--
122CTHL	85.00	04-01-66
122MOCN	84.00	07-01-69
122MOCN	98.00	09-01-70
122MOCN	102.00	02-16-81
122CTHL	131.00	10-29-81
--		
122CTHL	131.00	10-29-81
122CTHL	144.00	02-01-82
122CTHL	30.00	11-06-87
122CTHL	20.00	12-01-64
122CTHL	20.00	04-01-64
122CTHL	20.00	06-01-64
122CTHL	80.00	02-15-76
122CTHL	65.00	09-01-61
122CTHL	11.00	01-01-63
122CTHL	6.00	10-01-50
122CTHL	26.00	06-01-55
122CTHL	9.00	11-01-63
122CTHL	--	--
122CTHL	14.00	01-01-53
122CTHL	14.00	11-01-63
122CTHL	--	--
112TRCS	11.	02-01-48
112TRCS	16.00	10-01-63
--	17.00	11-01-63
122CTHL	8.00	04-01-63
122HBRG	--	--
122CTHL	--	--
112TRCS	--	--
112TRCS	10.00	03-01-64
110ALVM	--	--
112TRCS	20.00	11-01-62
122MOCN	3.00	01-01-43
122CTHL	25.00	05-01-64
122HBRG	--	--
--	--	--
122HBRG	10.00	01-01-59

LOCAL WELL NUMBER	LOCAL WELL NUMBER	LATITUDE (DEGREES)	LONGITUDE (DEGREES)	PRIMARY USE OF WATER	DEPTH OF WELL (FEET)	BOTTOM OF OPEN INTERVAL (FEET)	TYPE OF OPENINGS	DISCHARGE (GPM)
D035 PEPSI COLA BOT.	D035 PEPSI COLA BOT.	312043	891950	U	346	--	-	--
D036 REV BERRY BELL	D036 REV BERRY BELL	311802	891813	H	320	--	S	--
D038 HERCULES POWDER	D038 HERCULES POWDER	312015	891842	N	687	--	S	1000.00
D039 COASTAL CHEMICAL	D039 COASTAL CHEMICAL	312020	891737	U	350	350.00	S	483.00
D040 WOMACK ICE CO	D040 WOMACK ICE CO	312021	891710	U	18.0	--	S	16.00
D040 WOMACK ICE CO.	D040 WOMACK ICE CO.	312021	891711	U	105	--	S	12.00
D042 PALMERS XING W A	D042 PALMERS XING W A	311656	891702	P	642	--	S	300.00
D043 PALMERS CROSSUT	D043 PALMERS CROSSUT	311654	891701	U	326	--	T	--
D044 PALMERS XING W A	D044 PALMERS XING W A	311640	891659	P	642	--	S	300.00
D045 CENTRAL W A	D045 CENTRAL W A	311735	891650	P	694	--	S	250.00
D046 CENTRAL W A	D046 CENTRAL W A	311736	891658	P	672	--	S	252.00
D047 H S LITTLE	D047 H S LITTLE	312031	892035	H	60.0	--	-	--
D048 R O BLACKWELL	D048 R O BLACKWELL	312031	892035	H	185	--	S	6.00
D049 LEON PRINGLE	D049 LEON PRINGLE	311948	891842	H	576	--	S	--
D050 N D CARPENTER	D050 N D CARPENTER	311936	891452	H	35.0	--	S	--
D051 GEORGE DRAUGHIN	D051 GEORGE DRAUGHIN	311936	891512	H	23.0	--	S	--
D052 GEO DRAUGHIN	D052 GEO DRAUGHIN	311933	891513	H	33.0	--	-	--
D053 VAN HOOK	D053 VAN HOOK	311942	892011	H	362	--	-	--
D054 D M WARD	D054 D M WARD	311721	891717	H	120	--	-	--
D055 KENNISON	D055 KENNISON	312029	891928	H	138	--	S	--
D056 MISS SOU. UNIV.	D056 MISS SOU. UNIV.	311957	892004	I	--	--	-	--
D057 W D CARPENTER	D057 W D CARPENTER	311933	891510	H	35.0	--	S	--
D058 C M LINGEL	D058 C M LINGEL	312008	891622	H	78.0	--	S	--
D059 ERNIE ELKINS	D059 ERNIE ELKINS	311656	892053	H	60.0	--	S	--
D060 HERCULES PWD CO	D060 HERCULES PWD CO	312029	891810	N	671	--	S	1000.00
D061 MURRAY ENVELOPE	D061 MURRAY ENVELOPE	312029	891811	U	105	--	S	72.00
D062 EDD WALTERS	D062 EDD WALTERS	311837	891614	H	48.0	--	S	--
D063 GEO VARNADO	D063 GEO VARNADO	311800	891900	H	120	--	S	--
D064 JAMES WEBB	D064 JAMES WEBB	311656	891658	H	78.0	--	S	--
D065 M RAYBORN	D065 M RAYBORN	311900	891600	H	935	--	S	--
D065 M RAYBORN	D065 M RAYBORN	311900	891600	H	100	--	S	--
D066 PAUL RAYBORN	D066 PAUL RAYBORN	311900	891600	H	94.0	--	S	--
D068 RAY BRELAND	D068 RAY BRELAND	311900	891600	H	106	--	S	--
D069 J D LEWIS	D069 J D LEWIS	311901	891910	S	360	--	-	--
D070 MURRAY ENVELOPE	D070 MURRAY ENVELOPE	312035	891820	N	422	--	S	158.00
D072 PINE BURR PK CO	D072 PINE BURR PK CO	311845	891650	N	662	--	S	450.00
D073 L A PRINCE	D073 L A PRINCE	311957	891612	H	105	--	S	30.00
D076 BOB CHAIN	D076 BOB CHAIN	311713	892029	H	50.0	--	S	15.00
D077 WHSY RADIO STAT	D077 WHSY RADIO STAT	312041	891629	H	60.0	--	S	7.00
D078 ROSS RAYBOURN	D078 ROSS RAYBOURN	311739	891624	H	110	--	S	8.00

AQUIFER CODE	WATER LEVEL (FEET)	DATE WATER LEVEL MEASURED
122CTHL	49.00	07-01-58
122CTHL	32.00	09-01-51
122CTHL	36.00	09-01-65
122HBRG	5.00	05-26-65
--	8.00	04-01-65
122HBRG	--	--
122CTHL	48.00	11-01-65
122CTHL	--	--
122HBRG	64.00	11-19-81
122CTHL	27.00	04-01-66
122CTHL	47.00	11-19-81
122HBRG	--	--
122HBRG	80.00	01-01-58
122CTHL	16.00	01-01-54
122HBRG	18.00	09-01-60
122HBRG	5.00	11-01-57
122HBRG	--	--
122CTHL	--	--
122HBRG	--	--
122HBRG	49.00	12-01-57
122MOCN	6.00	12-01-40
122HBRG	18.00	09-01-60
122MOCN	6.00	12-01-40
122HBRG	18.00	09-01-60
122HBRG	12.00	08-01-60
122HBRG	50.00	08-01-66
122CTHL	26.00	03-01-67
--	31.00	02-01-67
122HBRG	33.00	10-01-62
122HBRG	16.00	02-01-62
122HBRG	18.00	02-01-61
122HBRG	76.00	11-01-60
122HBRG	76.00	11-01-60
122HBRG	--	--
122HBRG	16.00	10-01-60
122CTHL	--	--
122HBRG	21.00	07-01-68
122CTHL	50.00	07-01-68
122MOCN	17.00	03-01-70
121CRNL	17.00	03-01-69
122MOCN	18.00	10-01-69
122MOCN	26.00	08-01-69

LOCAL WELL NUMBER	LOCAL WELL NUMBER	LATITUDE (DEGREES)	LONGITUDE (DEGREES)	PRIMARY USE OF WATER	DEPTH OF WELL (FEET)	BOTTOM OF OPEN INTERVAL (FEET)	TYPE OF OPENINGS	DISCHARGE (GPM)
D079 E P FILLENGAME	D079 E P FILLENGAME	311645	892024	H	485	--	S	20.00
D080 CUMMINGS	D080 CUMMINGS	311657	892038	H	417	--	S	7.00
D081 STEWART	D081 STEWART	311733	892018	H	65.0	--	S	7.00
D083 DAVID COX	D083 DAVID COX	311648	892050	H	60.0	--	S	5.00
D084 MARSHALL DURBIN	D084 MARSHALL DURBIN	311942	891524	N	684	--	S	400.00
D085 M BREWER	D085 M BREWER	311930	891812	H	358	--	S	14.00
D086 BEESON ACADEMY	D086 BEESON ACADEMY	311651	891727	H	523	--	S	26.00
D087 ROY LIVIRETT	D087 ROY LIVIRETT	312015	891524	H	20.0	--	S	10.00
D089 MASONITE CORP	D089 MASONITE CORP	311633	891600	H	162	--	S	30.00
D090 LEE TAYLOR	D090 LEE TAYLOR	311645	891515	H	126	--	S	--
D092 RICHARD PARKER	D092 RICHARD PARKER	312038	891720	H	80.0	--	S	--
D093 ROGER BLACKWELL	D093 ROGER BLACKWELL	311640	892050	H	65.0	--	S	6.00
D094 TJ MILLER	D094 TJ MILLER	311655	892037	H	72.0	--	S	14.00
D095 HUGH MCCARDLE	D095 HUGH MCCARDLE	312027	891514	H	35.0	--	S	5.00
D096 JOE TATUM	D096 JOE TATUM	311758	891707	H	125	--	S	65.00
D097 RAY LIVERETT	D097 RAY LIVERETT	312043	891713	H	65.0	--	S	10.00
D098 LEE RUSTIN	D098 LEE RUSTIN	312030	891730	H	58.0	--	S	18.00
D100 MS POWER CO	D100 MS POWER CO	311928	891737	N	650	650.00	S	70.00
D101 BILLY MOORE	D101 BILLY MOORE	311701	892041	H	400	400.00	S	10.00
D102 MARSHALL DURBIN	D102 MARSHALL DURBIN	311822	891638	N	672	672.00	S	500.00
D103 MS POWER CO	D103 MS POWER CO	311928	891737	N	650	650.00	S	70.00
D104 MS TANK	D104 MS TANK	312004	891957	N	700	700.00	S	300.00
D105 MP&L	D105 MP&L	311927	891730	A	122	122.00	S	100.00
D106 CIVIL DEFENSE	D106 CIVIL DEFENSE	311823	891758	H	672	672.00	S	10.00
D107 HATTIESBURG	D107 HATTIESBURG	311958	891950	U	690.	690.	S	198.
D108 HATTIESBURG	D108 HATTIESBURG	311958	891958	U	640.	640.	S	--
D109 HERCULES	D109 HERCULES	312024	891846	N	641.	641.	S	150.
D110 PETAL	D110 PETAL	312044	891542	P	128.	128.	S	500.
D130 HATTIESBURG	D130 HATTIESBURG	311930	891730	U	390	390.00	S	--
E001 MACK TIMS	E001 MACK TIMS	312024	891406	H	105	--	S	--
E002 H CRANFORD	E002 H CRANFORD	312007	892202	H	150	--	-	--
E005 O E HART	E005 O E HART	311933	892240	H	300	--	-	--
E006 JOHN E SHUMAKER	E006 JOHN E SHUMAKER	311907	892237	H	200	--	-	--
E007 EARL NIX	E007 EARL NIX	311938	892139	H	342	--	-	--
E008 W L SAUCIER	E008 W L SAUCIER	311933	892158	H	284	--	S	--
E009 DAISY SAUCIER	E009 DAISY SAUCIER	311923	892137	H	310	--	T	4.00
E010 J Q HUGH	E010 J Q HUGH	311916	892149	H	110	--	-	--
E010 M M TIMS JR.	E010 M M TIMS JR.	312023	891407	H	70.0	--	S	--
E011 ARNOLD LINE	E011 ARNOLD LINE	312002	892254	Z	880	--	S	75.00
E013 HAL FOX	E013 HAL FOX	311854	892139	H	513	--	S	--

AQUIFER CODE	WATER LEVEL (FEET)	DATE WATER LEVEL MEASURED
122MOCN	183.00	09-01-69
122MOCN	178.00	02-01-70
122MOCN	25.00	02-01-70
122MOCN	34.00	04-01-70
122CTHL	53.00	08-01-70
122CTHL	70.00	06-01-70
122CTHL	52.00	09-01-70
122HBRG	10.00	07-01-70
122HBRG	18.00	08-01-70
122HBRG	--	--
112LTRC	17.00	10-01-71
122MOCN	32.00	03-01-72
121CRNL	47.00	07-01-72
--	12.00	11-01-72
122MOCN	60.00	12-01-72
122MOCN	12.00	07-01-74
122MOCN	12.00	07-01-74
122MOCN	80.00	11-10-79
122HBRG	215.00	07-31-80
122MOCN	69.00	11-01-80
122MOCN	80.00	11-10-79
122CTHL	80.00	12-10-80
122HBRG	23.00	08-15-81
122MOCN	71.00	04-12-83
122CTHL	85.	09-04-85
122CTHL	85.	09-04-85
122CTHL	59.	01-15-88
110ALVM	19.	08-15-88
122CTHL	-7.00	06-12-50
122HBRG	--	--
121PLCN	70.00	11-01-61
122MOCN	100.00	11-01-61
122MOCN	75.00	11-01-61
122MOCN	110.00	11-01-61
122MOCN	80.00	11-01-61
122HBRG	--	--
121PLCN	--	--
122HBRG	50.00	05-01-51
122HBRG	95.00	12-01-66
122MOCN	75.00	11-01-61

LOCAL WELL NUMBER	LOCAL WELL NUMBER	LATITUDE (DEGREES)	LONGITUDE (DEGREES)	PRIMARY USE OF WATER	DEPTH OF WELL (FEET)	BOTTOM OF OPEN INTERVAL (FEET)	TYPE OF OPENINGS	DISCHARGE (GPM)
E014 HARVEY TAYLOR	E014 HARVEY TAYLOR	311723	892205	H	187	--	-	--
E018 A D SAUCIER	E018 A D SAUCIER	311909	892202	H	97.0	--	T	--
E019 J Z WARD	E019 J Z WARD	312020	892133	H	40.0	--	-	--
E029 JAMES C BARREN	E029 JAMES C BARREN	311954	892255	H	26.0	--	-	--
E030 MARGRET LAIRD	E030 MARGRET LAIRD	311900	892211	H	40.0	--	-	--
E031 R E WEATHERS	E031 R E WEATHERS	311815	892248	H	32.0	--	-	--
E035 JOE F WHITE	E035 JOE F WHITE	311940	891730	H	26.0	--	S	--
E038 T DAVENPORT	E038 T DAVENPORT	311818	891410	H	30.0	--	S	--
E043 G T EDWARDS	E043 G T EDWARDS	311747	892237	H	28.0	--	-	--
E044 HERBERT DRAIN	E044 HERBERT DRAIN	311653	892141	H	100	--	-	--
E045 D S STEWART	E045 D S STEWART	311709	892106	H	30.0	--	-	--
E046 CHESTER MOULDER	E046 CHESTER MOULDER	311700	892101	D	69.0	--	-	--
E047 O W COLLINS	E047 O W COLLINS	311631	892219	H	49.0	--	-	--
E048 E W MATHEWS	E048 E W MATHEWS	311631	892256	H	80.0	--	-	--
E072 L O ENGLISH	E072 L O ENGLISH	311740	892230	H	168	--	-	--
E082 ARNOLD LINE W A	E082 ARNOLD LINE W A	312002	892254	P	786	--	S	150.00
E083 JACK CHANDLER	E083 JACK CHANDLER	311758	892239	H	38.0	--	S	--
E084 NORFIELD	E084 NORFIELD	311759	892240	H	30.0	--	S	--
E091 PHILIP PHUGH	E091 PHILIP PHUGH	311723	892148	H	55.0	--	S	15.00
E092 W G MCDONALD	E092 W G MCDONALD	311730	892205	H	50.0	--	S	5.00
E101 GEO FRIEND	E101 GEO FRIEND	311731	892252	H	35.0	--	S	12.00
E107 B F COURTNEY	E107 B F COURTNEY	311700	892130	H	122	--	S	4.00
E108 S WALKER	E108 S WALKER	311936	892224	H	155	--	S	6.00
E109 LEON BRYANT	E109 LEON BRYANT	311700	892136	H	67.0	--	S	12.00
E110 PHILIP PUGH	E110 PHILIP PUGH	311733	892154	H	57.0	--	S	--
E111 RICHBURG GROCRY	E111 RICHBURG GROCRY	311642	892100	H	80.0	--	S	10.00
E112 BENTON LOTT	E112 BENTON LOTT	311715	892148	H	57.0	--	S	7.00
E124 LAMAR PARK SUBDIV	E124 LAMAR PARK SUBDIV	311913	892127	U	721	--	S	150.00
E131 LAMAR PARK W A	E131 LAMAR PARK W A	311831	892257	Z	75.0	--	-	--
E134 ARNOLD LINE W A	E134 ARNOLD LINE W A	312003	892241	P	770	--	S	250.00
						--	-	245
E135 LAMAR PARK W A	E135 LAMAR PARK W A	311834	892218	Z	42.0	--	-	--
E138 BILLY HAMBRY	E138 BILLY HAMBRY	311745	892131	H	39.0	--	S	15.00
E141 LAMAR PARK W A	E141 LAMAR PARK W A	311912	892128	P	714	--	S	315.00
						--	-	315
E145 BILLIE HARBERRY	E145 BILLIE HARBERRY	311800	892101	H	38.0	--	S	15.00
E189 LAMAR PARK W A	E189 LAMAR PARK W A	311901	892122	P	714	--	S	300.00
E198 BEN COURTNEY	E198 BEN COURTNEY	311638	892130	H	108	--	S	4.00
E205 ARNOLD LINE W A	E205 ARNOLD LINE W A	312009	892233	P	802	--	S	412.00
E210 LAMAR PARK W A	E210 LAMAR PARK W A	312046	892119	P	740	670.00	S	300.00

AQUIFER CODE	WATER LEVEL (FEET)	DATE WATER LEVEL MEASURED
122MOCN	--	--
112TRCS	--	--
121CRNL	15.00	11-01-61
121CRNL	16.00	11-01-61
121CRNL	20.00	11-01-61
121CRNL	32.00	11-01-61
112LTRC	16.00	08-01-62
122MOCN	19.00	10-01-71
121CRNL	20.00	11-01-61
121CRNL	40.00	11-01-61
121CRNL	15.00	11-01-61
122HBRG	--	--
121CRNL	30.00	11-01-61
121CRNL	30.00	11-01-61
122MOCN	159.00	12-01-64
122CTHL	96.00	02-01-68
121CRNL	16.00	02-01-68
121CRNL	14.00	02-01-68
121CRNL	34.00	10-01-68
121CRNL	28.00	10-01-68
121CRNL	14.00	06-01-69
121CRNL	98.00	09-01-69
121CRNL	92.00	09-01-69
121CRNL	39.00	02-01-70
121CRNL	39.00	02-01-70
121CRNL	45.00	02-01-70
121CRNL	31.00	03-01-70
122MOCN	140.00	08-01-71
--	--	--
122CTHL	87.00	07-01-71
--		
--	--	--
121CRNL	22.00	04-01-71
122CTHL	143.00	08-01-71
--		
121CRNL	22.00	06-01-71
122CTHL	159.00	11-19-81
122MOCN	59.00	06-01-74
122CTHL	106.00	06-01-75
122CTHL	135.00	10-01-79

LOCAL WELL NUMBER	LOCAL WELL NUMBER	LATITUDE (DEGREES)	LONGITUDE (DEGREES)	PRIMARY USE OF WATER	DEPTH OF WELL (FEET)	BOTTOM OF OPEN INTERVAL (FEET)	TYPE OF OPENINGS	DISCHARGE (GPM)
E210 LAMAR PARK W A	E210 LAMAR PARK W A	312046	892119	P	740	740.00	S	--
E211 AMOCO PROD	E211 AMOCO PROD	312024	892217	Z	510	510.00	P	75.00
E214 HATTIESBURG	E214 HATTIESBURG	311938	892111	-	680.	680.	S	177.
E215 HATTIESBURG	E215 HATTIESBURG	311938	892111	U	660.	660.	S	--
E220 HATTIESBURG	E220 HATTIESBURG	311725	892102	U	1000.	920.	S	--
						960.	S	--
						1000.	S	--
E221 HATTIESBURG	E221 HATTIESBURG	311725	892102	U	960.	960.	S	--
E222 HATTIESBURG	E222 HATTIESBURG	311725	892101	U	720.	660.	S	100.
						720.	S	--

AQUIFER CODE	WATER LEVEL (FEET)	DATE WATER LEVEL MEASURED
--	135.00	10-01-79
122MCCN	100.00	11-07-79
122CTHL	83.	09-17-85
122CTHL	--	--
122CTHL	245.	05-31-89
--		
--		
122CTHL	246.	05-31-89
122CTHL	247.	06-30-89
--		

Public Water Supply Wells in AOC within the Three-Mile Radius of Hercules Inc.

Nearest Drinking Water Well in AOC from Hercules Site (Private)

P999
.NULL.
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1DATE: 11/29/89 WATER WELLS ON RECORD WITHIN 3 MILE RADIUS OF HERCULES PAGE 1

LOCAL WELL NUMBER	LAND-NET LOCATION	LATITUDE (DEGREES)	LONGITUDE (DEGREES)	DATE WELL CONSTRUCTED	PRIMARY USE OF WATER	DEPTH OF WELL (FEET)	AQUIFER CODE
D022 MISS POWER CO.	NENES11T04NR13W	312002	891546	01-01-44	U	108	--
D040 WOMACK ICE CO	SENWS03T04NR13W	312021	891710	01-01-65	U	18.0	--
D061 MURRAY ENVELOPE	NESWS04T04NR13W	312029	891811	01-01-67	U	105	--
B184 HATTIESBURG	SESES31T05NR13W	312110	891945	07-19-85	U	--	--
B101 AMERICAN SAND	--NES32T05NR13W	312130	891910	01-01-75	H	96.0	--
D029 E FORREST UTIL	---	312002	891544	--	-	134	110ALVM
D110 PETAL	NWNWS01T04NR13W	312044	891542	08-15-88	P	128	110ALVM
B076 HAPPY ACRES	SWNES35T05NR13W	312104	891645	01-01-70	U	100	110ALVM
B100 PMA PORK PROC DIC	NWSES35T05NR13W	312114	891615	01-01-73	U	96.0	110ALVM
E035 JOE F WHITE	-----S10T04NR12W	311940	891730	01-01-62	H	26.0	112LTRC
D092 RICHARD PARKER	NENWS03T04NR13W	312038	891720	01-01-71	H	80.0	112LTRC
B074 N J CARPENTER	NENWS28T05NR13W	312215	891803	01-01-70	H	65.0	112LTRC
D020 MISS POWER	NWNES11T04NR13W	311935	891613	01-01-48	E	110	112TRCS
D029 PETAL	SWSWS01T04NR13W	312002	891544	01-01-62	P	134	112TRCS
D021 MISS POWER CO	NENES11T04NR13W	312002	891545	01-01-63	E	112	112TRCS
D028 PETAL	NWNWS01T04NR13W	312047	891543	--	-	120	112TRCS
D028 PETAL	NWNWS01T04NR13W	312037	891548	01-01-55	P	124	112TRCS
B126 AM SAND & GRAVEL	SENWS33T05NR13W	312120	891827	07-14-84	H	110	121CRNL
D036 REV BERRY BELL	NENWS21T04NR13W	311802	891813	01-01-51	H	320	122CTHL
D008 HATTIESBURG	NESES15T04NR13W	311834	891701	01-01-57	U	710	122CTHL
D004 HATTIESBURG	SENES15T04NR13W	311836	891701	--	P	485	122CTHL
D072 PINE BURR PK CO	NESES15T04NR13W	311845	891650	01-01-68	N	662	122CTHL
D005 HATTIESBURG	NENES15T04NR13W	311847	891702	01-01-60	P	678	122CTHL
D006 HATTIESBURG	NENES15T04NR13W	311847	891702	01-01-60	P	673	122CTHL
D069 J D LEWIS	SESES08T04NR13W	311901	891910	--	S	360	122CTHL
D130 HATTIESBURG	NWSES10T04NR13W	311930	891730	01-01-50	U	390	122CTHL
D085 M BREWER	-----S10T04NR13W	311930	891812	01-01-70	H	358	122CTHL
D019 CENTRAL PKNG CO	NWSWS11T04NR13W	311936	891642	01-01-57	U	420	122CTHL
D053 VAN HOOK	SENES07T04NR13W	311942	892011	01-01-57	H	362	122CTHL
D049 LEON PRINGLE	NWNWS09T04NR13W	311948	891842	01-01-54	H	576	122CTHL
D018 SOUTHERN RR	NENES10T04NR13W	311953	891653	01-01-39	U	410	122CTHL
D023 CRYSTAL ICE CO.	NENES11T04NR13W	311954	891553	--	U	360	122CTHL
D107 HATTIESBURG	SWSWS05T04NR13W	311958	891950	08-30-85	U	690	122CTHL
D108 HATTIESBURG	SWSWS05T04NR13W	311958	891958	08-30-85	U	640	122CTHL
D104 MS TANK	SESES06T04NR13W	312004	891957	12-03-80	N	700	122CTHL
D038 HERCULES POWDER	NWSWS04T04NR13W	312015	891842	01-01-65	N	687	122CTHL
D014 DIXIE PINE PROD	SENWS23T04NR13W	312015	891851	01-01-43	U	501	122CTHL
D016 HERCULES PWD CO	SWNWS04T04NR13W	312016	891707	01-01-52	U	451	122CTHL
D013 COASTAL CHEM CO	SWNWS03T04NR13W	312019	891745	01-01-47	U	325	122CTHL
D109 HERCULES	SWNWS04T04NR13W	312024	891846	01-15-88	N	641	122CTHL

1DATE: 11/29/89 WATER WELLS ON RECORD WITHIN 3 MILE RADIUS OF HERCULES PAGE 2

LOCAL WELL NUMBER	LAND-NET LOCATION	LATITUDE (DEGREES)	LONGITUDE (DEGREES)	DATE WELL CONSTRUCTED	PRIMARY USE OF WATER	DEPTH OF WELL (FEET)	AQUIFER CODE

D060 HERCULES PWD CO	SWNWS04T04NR13W	312029	891810	01-01-67	N	671	122CTHL
D031 CLINTON LBR CO.	NWNES02T04NR13W	312035	891627	01-01-39	U	390	122CTHL
D035 PEPSI COLA BOT.	NWNWS05T04NR13W	312043	891950	01-01-58	U	346	122CTHL
B002 HATTIESBURG	SWNWS32T05NR13W	312109	891942	01-01-30	P	622	122CTHL
B003 HATTIESBURG	NWSWS32T05NR13W	312105	891949	01-01-30	P	610	122CTHL
B004 HATTIESBURG	SWNWS32T05NR13W	312105	891949	01-01-30	U	450	122CTHL
B023 HATTIESBURG	NWSWS32T05NR13W	312106	891951	01-01-66	P	607	122CTHL
B017 HATTIESBURG	NESES31T05NR13W	312107	892006	01-01-64	P	607	122CTHL
B001 HATTIESBURG	NESES31T05NR13W	312109	892009	01-01-41	P	419	122CTHL
B005 HATTIESBURG	NESWS32T05NR13W	312115	891923	01-01-31	P	621	122CTHL
B007 HATTIESBURG	NESWS32T05NR13W	312115	891923	01-01-52	P	635	122CTHL
B006 HATTIESBURG	SWNES32T05NR13W	312115	891936	01-01-34	U	444	122CTHL
B012 PETAL	SESWS26T05NR13W	312143	891612	01-01-55	-	289	122CTHL
D063 GEO VARNADO	-----S23T04NR13W	311800	891900	01-01-62	H	120	122HBRG
D062 EDD WALTERS	-----S14T04NR13W	311837	891614	01-01-62	H	48.0	122HBRG
D065 M RAYBORN	-----S14T04NR13W	311900	891600	01-01-60	H	935	122HBRG
D066 PAUL RAYBORN	-----S14T04NR13W	311900	891600	01-01-60	H	94.0	122HBRG
D065 M RAYBORN	-----S14T04NR13W	311900	891600	01-01-60	H	100	122HBRG
D068 RAY BRELAND	-----S14T04NR13W	311900	891600	01-01-60	H	106	122HBRG
D105 MP&L	NESWS10T04NR13W	311927	891730	07-07-81	A	122	122HBRG
D058 C M LINGEL	SESWS02T04NR13W	312008	891622	01-01-60	H	78.0	122HBRG
D087 ROY LIVIRETT	SENWS01T04NR13W	312015	891524	01-01-70	H	20.0	122HBRG
D039 COASTAL CHEMICAL	NWSWS03T04NR13W	312020	891737	04-01-65	U	350	122HBRG
D040 WOMACK ICE CO.	SENWS03T04NR13W	312021	891711	01-01-65	U	105	122HBRG
D055 KENNISON	--NWS05T04NR13W	312029	891928	01-01-57	H	138	122HBRG
D047 H S LITTLE	-----S06T04NR13W	312031	892035	01-01-65	H	60.0	122HBRG
D048 R O BLACKWELL	-----S06T04NR13W	312031	892035	01-01-58	H	185	122HBRG
D070 MURRAY ENVELOPE	NENES04T04NR13W	312035	891820	01-01-68	N	422	122HBRG
B082 PMA PROC. DIV	NWSES35T05NR13W	312115	891615	01-01-71	U	100	122HBRG
B028 H F SUMRALL	NWNES31T05NR13W	312111	892049	01-01-66	H	70.0	122HBRG
B032 HATTIESBURG EQP	-----S35T05NR13W	312115	891611	01-01-60	H	25.0	122HBRG
B078 LAUREL HOT MIX	NENES33T05NR13W	312124	891845	01-01-71	H	97.0	122HBRG
B031 CHAS. WADE	-----S33T05NR13W	312127	891820	01-01-66	H	55.0	122HBRG
B030 CHAS WADE	-----S33T05NR13W	312127	891820	01-01-66	H	55.0	122HBRG
B018 JACK GANDY	NENES33T05NR13W	312135	891754	01-01-49	H	50.0	122HBRG
B020 TEXACO OIL CO	NWNWS31T05NR13W	312136	892052	01-01-64	H	58.0	122HBRG
B075 S J WILLIAMSON	SESES30T05NR13W	312145	892008	01-01-70	H	90.0	122HBRG
B035 C J MORGAN	SWNES28T05NR13W	312152	891839	01-01-66	H	75.0	122HBRG
B052 C F WILLIAMS	SENWS29T05NR13W	312202	891906	01-01-68	H	65.0	122HBRG
B034 C WILLIAMSON	SENWS29T05NR13W	312202	891909	01-01-68	H	65.0	122HBRG

LOCAL WELL NUMBER	LAND-NET LOCATION	LATITUDE (DEGREES)	LONGITUDE (DEGREES)	DATE WELL CONSTRUCTED	PRIMARY USE OF WATER	DEPTH OF WELL (FEET)	AQUIFER CODE
B029 WATSON	-----S28T05NR13W	312205	891828	01-01-66	H	65.0	122HBRG
B077 G E WEITAN	SWNWS29T05NR13W	312207	891945	01-01-71	H	108	122HBRG
B021 C G CARGILL	-----S29T05NR13W	312214	891942	01-01-61	H	96.0	122HBRG
B073 DOPHIN SIMS	NWSES28T05NR13W	312227	891836	01-01-70	H	75.0	122HBRG
B033 CARGILE	NENES29T05NR13W	312227	891900	01-01-67	H	87.0	122HBRG
B079 ETHEL GORDY	NENWS28T05NR13W	312230	891810	01-01-71	H	85.0	122HBRG
D102 MARSHALL DURBIN	SWSWS14T04NR13W	311822	891638	09-02-80	N	672	122MOCN
D106 CIVIL DEFENSE	NENWS15T04NR13W	311823	891758	04-11-83	H	672	122MOCN
D100 MS POWER CO	NWSWS10T04NR13W	311928	891737	09-07-79	N	650	122MOCN
D103 MS POWER CO	NWSWS10T04NR13W	311928	891737	09-07-79	N	650	122MOCN

D073 L A PRINCE	NENWS11T04NR13W	311957	891612	01-01-70	H	105	122MOCN
D056 MISS SOU. UNIV.	NENES07T04NR13W	311957	892004	---	I	--	122MOCN
D098 LEE RUSTIN	NESWS03T04NR13W	312030	891730	01-01-74	H	58.0	122MOCN
D030 EAST FOREST UTL	NWNWS01T04NR13W	312039	891545	01-01-43	U	390	122MOCN
D077 WHSY RADIO STAT	NWNES02T04NR13W	312041	891629	01-01-69	H	60.0	122MOCN
D097 RAY LIVERETT	NENWS03T04NR13W	312043	891713	01-01-74	H	65.0	122MOCN
B086 RUSSELL	SESES35T05NR13W	312048	891602	01-01-71	H	25.0	122MOCN
B085 RANDY POWELL	SESES35T05NR13W	312049	891601	01-01-71	H	25.0	122MOCN
B084 AMERICAN SAND	SWSWS33T05NR13W	312057	891838	01-01-71	H	94.0	122MOCN
B060 W H RATCLIFF	NWSWS36T05NR13W	312108	891542	01-01-69	H	55.0	122MOCN
B058 MCMAHAN	SENWS31T05NR13W	312109	892025	01-01-69	H	105	122MOCN
B103 MOBILE OIL CORP	NESWS35T05NR13W	312112	891619	06-08-77	N	254	122MOCN
B059 2 UNDERWOOD	NWSES35T05NR13W	312112	891624	01-01-69	H	75.0	122MOCN
B068 LAGRACE MOTEL	SWNES31T05NR13W	312115	892030	01-01-70	H	86.0	122MOCN
B070 LAGRACE MOTEL	SWNES31T05NR13W	312115	892030	01-01-70	H	87.0	122MOCN
B057 AMERICAN S&G CO	NESWS33T05NR13W	312121	891814	01-01-69	H	106	122MOCN
B063 LAUREL HALMIX C	NWNWS34T05NR13W	312126	891736	01-01-69	I	106	122MOCN
B098 REO HINTON	-----S27T05NR13W	312150	891715	01-01-74	H	82.0	122MOCN
B062 J C PITTMAN	SESES29T05NR13W	312152	891756	01-01-69	H	68.0	122MOCN
B069 GLENDALE UTIL DST	---SWS28T05NR13W	312152	891848	01-01-69	U	654	122MOCN
B065 REX BRASWELL	SWSWS21T05NR13W	312233	891845	01-01-69	H	55.0	122MOCN
B066 NEWTON WILSON	-----S21T05NR13W	312248	891815	01-01-69	H	63.0	122MOCN
B054 LOVELL COOLEY	SESES28T05NR13W	312140	891750	01-01-68	H	82.0	124HCGB

LOCATION ARE NOT FIELD VERIFIED
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1DATE: 11/29/89 WATER WELLS ON RECORD WITHIN 4 MILE RADIUS OF HERCULES PAGE 1

LOCAL WELL NUMBER	LAND-NET LOCATION	LATITUDE (DEGREES)	LONGITUDE (DEGREES)	DATE WELL CONSTRUCTED	PRIMARY USE OF WATER	DEPTH OF WELL (FEET)	AQUIFER CODE
D022 MISS POWER CO.	NENES11T04NR13W	312002	891546	01-01-44	U	108	--
D040 WOMACK ICE CO	SENWS03T04NR13W	312021	891710	01-01-65	U	18.0	--
D095 HUGH MCCARDLE	NESWS01T04NR13W	312027	891514	01-01-72	H	35.0	--
D061 MURRAY ENVELOPE	NESWS04T04NR13W	312029	891811	01-01-67	U	105	--
B184 HATTIESBURG	SESES31T05NR13W	312110	891945	07-19-85	U	--	--
B101 AMERICAN SAND	--NES32T05NR13W	312130	891910	01-01-75	H	96.0	--
B093 ENTERPRISE GAS	SWNWS25T05NR13W	312202	891541	01-01-73	-	--	--
D029 E FORREST UTIL	--	312002	891544	--	-	134	110ALVM
D110 PETAL	NWNWS01T04NR13W	312044	891542	08-15-88	P	128	110ALVM
B076 HAPPY ACRES	SWNES35T05NR13W	312104	891645	01-01-70	U	100	110ALVM
B100 PMA PORK PROC DIC	NWSES35T05NR13W	312114	891615	01-01-73	U	96.0	110ALVM
E035 JOE F WHITE	-----S10T04NR12W	311940	891730	01-01-62	H	26.0	112LTRC
D092 RICHARD PARKER	NENWS03T04NR13W	312038	891720	01-01-71	H	80.0	112LTRC
B074 N J CARPENTER	NENWS28T05NR13W	312215	891803	01-01-70	H	65.0	112LTRC
D020 MISS POWER	NWNES11T04NR13W	311935	891613	01-01-48	E	110	112TRCS
D029 PETAL	SWSWS01T04NR13W	312002	891544	01-01-62	P	134	112TRCS
D021 MISS POWER CO	NENES11T04NR13W	312002	891545	01-01-63	E	112	112TRCS
D028 PETAL	NWNWS01T04NR13W	312047	891543	--	-	120	112TRCS
D028 PETAL	NWNWS01T04NR13W	312037	891548	01-01-55	P	124	112TRCS
B126 AM SAND & GRAVEL	SENWS33T05NR13W	312120	891827	07-14-84	H	110	121CRNL
D045 CENTRAL W A	NESES22T04NR13W	311735	891650	01-01-65	P	694	122CTHL
D046 CENTRAL W A	SENES22T04NR13W	311736	891658	01-01-65	P	672	122CTHL
D036 REV BERRY BELL	NENWS21T04NR13W	311802	891813	01-01-51	H	320	122CTHL
D007 HATTIESBURG	SENES15T04NR13W	311803	891644	01-01-60	P	688	122CTHL
D009 MARSHALL DURBIN	--NWS23T04NR13W	311804	891645	01-01-59	N	678	122CTHL
D010 MARSHALL DURBIN	--NWS23T04NR13W	311804	891647	01-01-63	N	678	122CTHL
D008 HATTIESBURG	NESES15T04NR13W	311834	891701	01-01-57	U	710	122CTHL
D004 HATTIESBURG	SENES15T04NR13W	311836	891701	--	P	485	122CTHL
D072 PINE BURR PK CO	NESES15T04NR13W	311845	891650	01-01-68	N	662	122CTHL
D005 HATTIESBURG	NENES15T04NR13W	311847	891702	01-01-60	P	678	122CTHL
D006 HATTIESBURG	NENES15T04NR13W	311847	891702	01-01-60	P	673	122CTHL
D069 J D LEWIS	SESES08T04NR13W	311901	891910	--	S	360	122CTHL
D130 HATTIESBURG	NWSES10T04NR13W	311930	891730	01-01-50	U	390	122CTHL
D085 M BREWER	-----S10T04NR13W	311930	891812	01-01-70	H	358	122CTHL
D019 CENTRAL PKNG CO	NWSWS11T04NR13W	311936	891642	01-01-57	U	420	122CTHL
D084 MARSHALL DURBIN	-----S13T04NR13W	311942	891524	01-01-70	N	684	122CTHL
D053 VAN HOOK	SENES07T04NR13W	311942	892011	01-01-57	H	362	122CTHL
D049 LEON PRINGLE	NWNWS09T04NR13W	311948	891842	01-01-54	H	576	122CTHL
D018 SOUTHERN RR	NENES10T04NR13W	311953	891653	01-01-39	U	410	122CTHL
D023 CRYSTAL ICE CO.	NENES11T04NR13W	311954	891553	--	U	360	122CTHL

1DATE: 11/29/89 WATER WELLS ON RECORD WITHIN 4 MILE RADIUS OF HERCULES

LOCAL WELL NUMBER	LAND-NET LOCATION	LATITUDE (DEGREES)	LONGITUDE (DEGREES)	DATE WELL CONSTRUCTED	PRIMARY USE OF WATER	DEPTH OF WELL (FEET)	AQUIFER CODE

D107 HATTIESBURG	SWSWS05T04NR13W	311958	891950	08-30-85	U	690	122CTHL
D108 HATTIESBURG	SWSWS05T04NR13W	311958	891958	08-30-85	U	640	122CTHL
D104 MS TANK	SESES06T04NR13W	312004	891957	12-03-80	N	700	122CTHL
D038 HERCULES POWDER	NWSWS04T04NR13W	312015	891842	01-01-65	N	687	122CTHL
D014 DIXIE PINE PROD	SENWS23T04NR13W	312015	891851	01-01-43	U	501	122CTHL
D016 HERCULES PWD CO	SWNWS04T04NR13W	312016	891707	01-01-52	U	451	122CTHL
D013 COASTAL CHEM CO	SWNWS03T04NR13W	312019	891745	01-01-47	U	325	122CTHL
D109 HERCULES	SWNWS04T04NR13W	312024	891846	01-15-88	N	641	122CTHL
D060 HERCULES PWD CO	SWNWS04T04NR13W	312029	891810	01-01-67	N	671	122CTHL
D031 CLINTON LBR CO.	NWNES02T04NR13W	312035	891627	01-01-39	U	390	122CTHL
D035 PEPSI COLA BOT.	NWNWS05T04NR13W	312043	891950	01-01-58	U	346	122CTHL
B002 HATTIESBURG	SWNWS32T05NR13W	312109	891942	01-01-30	P	622	122CTHL
B003 HATTIESBURG	NWSWS32T05NR13W	312105	891949	01-01-30	P	610	122CTHL
B004 HATTIESBURG	SWNWS32T05NR13W	312105	891949	01-01-30	U	450	122CTHL
B023 HATTIESBURG	NWSWS32T05NR13W	312106	891951	01-01-66	P	607	122CTHL
B017 HATTIESBURG	NESES31T05NR13W	312107	892006	01-01-64	P	607	122CTHL
B001 HATTIESBURG	NESES31T05NR13W	312109	892009	01-01-41	P	419	122CTHL
B005 HATTIESBURG	NESWS32T05NR13W	312115	891923	01-01-31	P	621	122CTHL
B007 HATTIESBURG	NESWS32T05NR13W	312115	891923	01-01-52	P	635	122CTHL
B006 HATTIESBURG	SWNES32T05NR13W	312115	891936	01-01-34	U	444	122CTHL
B012 PETAL	SESWS26T05NR13W	312143	891612	01-01-55	-	289	122CTHL
B010 WARREN PETR CO.	SWNWS25T05NR13W	312154	891543	01-01-53	U	289	122CTHL
B011 WARREN PETRO CO	NWSWS25T05NR13W	312154	891543	01-01-54	N	292	122CTHL
B009 UNION TEX CO	NWNES26T05NR13W	312224	891616	01-01-56	N	260	122CTHL
B014 MOBIL OIL CO.	NENWS26T05NR13W	312227	891614	01-01-58	U	252	122CTHL
B015 DIXIE PIPELINE	SESWS23T05NR13W	312235	891636	01-01-61	H	248	122CTHL
B008 UNION OIL CO.	SENWS23T05NR13W	312253	891614	01-01-52	U	260	122CTHL
B019 A R FEED MILLCO	NESWS20T05NR13W	312309	891911	01-01-65	H	113	122CTHL
D054 D M WARD	SESWS22T04NR13W	311721	891717	01-01-57	H	120	122HBRG
D063 GEO VARNADO	-----S23T04NR13W	311800	891900	01-01-62	H	120	122HBRG
D062 EDD WALTERS	-----S14T04NR13W	311837	891614	01-01-62	H	48.0	122HBRG
D065 M RAYBORN	-----S14T04NR13W	311900	891600	01-01-60	H	935	122HBRG
D066 PAUL RAYBORN	-----S14T04NR13W	311900	891600	01-01-60	H	94.0	122HBRG
D065 M RAYBORN	-----S14T04NR13W	311900	891600	01-01-60	H	100	122HBRG
D068 RAY BRELAND	-----S14T04NR13W	311900	891600	01-01-60	H	106	122HBRG
D105 MP&L	NESWS10T04NR13W	311927	891730	07-07-81	A	122	122HBRG
D057 W D CARPENTER	NESES12T04NR13W	311933	891510	01-01-60	H	35.0	122HBRG
D052 GEO DRAUGHIN	NESWS12T04NR13W	311933	891513	01-01-57	H	33.0	122HBRG
D050 N D CARPENTER	NESES12T04NR13W	311936	891452	01-01-60	H	35.0	122HBRG
D051 GEORGE DRAUGHIN	NESWS12T04NR13W	311936	891512	01-01-57	H	23.0	122HBRG

LOCAL WELL NUMBER	LAND-NET LOCATION	LATITUDE (DEGREES)	LONGITUDE (DEGREES)	DATE WELL CONSTRUCTED	PRIMARY USE OF WATER	DEPTH OF WELL (FEET)	AQUIFER CODE
D058 C M LINGEL	SESWS02T04NR13W	312008	891622	01-01-60	H	78.0	122HBRG
D087 ROY LIVIRETT	SENWS01T04NR13W	312015	891524	01-01-70	H	20.0	122HBRG
D039 COASTAL CHEMICAL	NWSWS03T04NR13W	312020	891737	04-01-65	U	350	122HBRG
D040 WOMACK ICE CO.	SENWS03T04NR13W	312021	891711	01-01-65	U	105	122HBRG
D055 KENNISON	--NWS05T04NR13W	312029	891928	01-01-57	H	138	122HBRG
D047 H S LITTLE	-----S06T04NR13W	312031	892035	01-01-65	H	60.0	122HBRG
D048 R O BLACKWELL	-----S06T04NR13W	312031	892035	01-01-58	H	195	122HBRG
D070 MURRAY ENVELOPE	NENES04T04NR13W	312035	891820	01-01-68	N	422	122HBRG
A004 WEST HILLS C CL	SWSES36T05NR14W	312052	892136	01-01-63	U	248	122HBRG
A001 UNIV SO MS	SESWS14T05NR14W	312056	892138	01-01-58	I	195	122HBRG

LOCAL WELL NUMBER	LAND-NET LOCATION	LATITUDE (DEGREES)	LONGITUDE (DEGREES)	DATE WELL CONSTRUCTED	PRIMARY USE OF WATER	DEPTH OF WELL (FEET)	AQUIFER CODE
B082 PMA PROC. DIV	NWSES35T05NR13W	312115	891615	01-01-71	U	100	122HBRG
A003 UNIV SOU MISS	SWNES36T05NR14W	312109	892132	---	I	195	122HBRG
B028 H F SUMRALL	NWNES31T05NR13W	312111	892049	01-01-66	H	70.0	122HBRG
A002 USM GOLF COURSE	SWNES36T05NR14W	312112	892153	---	I	195	122HBRG
B032 HATTIESBURG EQP	----S35T05NR13W	312115	891611	01-01-60	H	25.0	122HBRG
B078 LAUREL HOT MIX	NENES33T05NR13W	312124	891845	01-01-71	H	97.0	122HBRG
B031 CHAS. WADE	----S33T05NR13W	312127	891820	01-01-66	H	55.0	122HBRG
B030 CHAS WADE	----S33T05NR13W	312127	891820	01-01-66	H	55.0	122HBRG
A008 STANDARD OIL CO	NENES36T05NR14W	312132	892203	01-01-64	H	165	122HBRG
B018 JACK GANDY	NENES33T05NR13W	312135	891754	01-01-49	H	50.0	122HBRG
B020 TEXACO OIL CO	NWNWS31T05NR13W	312136	892052	01-01-64	H	58.0	122HBRG
B027 LEWIS R SIMS	----S25T05NR13W	312142	891519	01-01-66	H	82.0	122HBRG
B075 S J WILLIAMSON	SESES30T05NR13W	312145	892008	01-01-70	H	90.0	122HBRG
B035 C J MORGAN	SWNES28T05NR13W	312152	891839	01-01-66	H	75.0	122HBRG
B112 WARREN PETROLEUM	NWSWS25T05NR13W	312154	891542	10-07-82	N	324	122HBRG
B026 CHARLES LYLES	SENWS25T05NR13W	312155	891515	01-01-67	H	145	122HBRG
B052 C F WILLIAMS	SENWS29T05NR13W	312202	891906	01-01-68	H	65.0	122HBRG
B034 C WILLIAMSON	SENWS29T05NR13W	312202	891909	01-01-68	H	65.0	122HBRG
B029 WATSON	----S28T05NR13W	312205	891828	01-01-66	H	65.0	122HBRG
B120 WARREN PETRO CO	SWNWS25T05NR13W	312206	891534	12-14-78	N	372	122HBRG
B077 G E WEITAN	SWNWS29T05NR13W	312207	891945	01-01-71	H	108	122HBRG
A031 E P FILLINGAME	----S25T05NR14W	312210	892130	01-01-69	H	105	122HBRG
B021 C G CARGILL	----S29T05NR13W	312214	891942	01-01-61	H	96.0	122HBRG
B080 ENTERPRISE PROD	NWNWS25T05NR13W	312225	891545	01-01-71	N	320	122HBRG
B081 ENTERPRISE PROD	NWNWS25T05NR13W	312225	891545	01-01-71	N	352	122HBRG
B111 ENTERPRISE PROD	NENWS25T05NR13W	312226	891527	01-01-74	N	390	122HBRG
B073 DOPHIN SIMS	NWSES28T05NR13W	312227	891836	01-01-70	H	75.0	122HBRG
B033 CARGILE	NENES29T05NR13W	312227	891900	01-01-67	H	87.0	122HBRG
B079 ETHEL GORDY	NENWS28T05NR13W	312230	891810	01-01-71	H	85.0	122HBRG
B048 C S BENNETT	-----S25T05NR13W	312300	891800	01-01-62	H	175	122HBRG

LOCAL WELL NUMBER	LAND-NET LOCATION	LATITUDE (DEGREES)	LONGITUDE (DEGREES)	DATE WELL CONSTRUCTED	PRIMARY USE OF WATER	DEPTH OF WELL (FEET)	AQUIFER CODE
B072 ROADWAY EXPRESS	SWNES20T05NR13W	312300	891833	01-01-70	H	88.0	122HBRG
D081 STEWART	SENWS19T04NR13W	311733	892018	01-01-70	H	65.0	122MOCN
D078 ROSS RAYBOURN	-----S23T04NR13W	311739	891624	01-01-69	H	110	122MOCN
D096 JOE TATUM	NENWS22T04NR13W	311758	891707	01-01-72	H	125	122MOCN
D102 MARSHALL DURBIN	SWSWS14T04NR13W	311822	891638	09-02-80	N	672	122MOCN
D106 CIVIL DEFENSE	NENWS15T04NR13W	311823	891758	04-11-83	H	672	122MOCN
D100 MS POWER CO	NWSWS10T04NR13W	311928	891737	09-07-79	N	650	122MOCN
D103 MS POWER CO	NWSWS10T04NR13W	311928	891737	09-07-79	N	650	122MOCN
D073 L A PRINCE	NENWS11T04NR13W	311957	891612	01-01-70	H	105	122MOCN
D056 MISS SOU. UNIV.	NENES07T04NR13W	311957	892004	--	I	--	122MOCN
D098 LEE RUSTIN	NESWS03T04NR13W	312030	891730	01-01-74	H	58.0	122MOCN
D030 EAST FOREST UTL	NWNWS01T04NR13W	312039	891545	01-01-43	U	390	122MOCN
D077 WHSY RADIO STAT	NWNES02T04NR13W	312041	891629	01-01-69	H	60.0	122MOCN
D097 RAY LIVERETT	NENWS03T04NR13W	312043	891713	01-01-74	H	65.0	122MOCN
B086 RUSSELL	SESES35T05NR13W	312048	891602	01-01-71	H	25.0	122MOCN
B085 RANDY POWELL	SESES35T05NR13W	312049	891601	01-01-71	H	25.0	122MOCN
B084 AMERICAN SAND	SWSWS33T05NR13W	312057	891838	01-01-71	H	94.0	122MOCN
B060 W H RATCLIFF	NWSWS36T05NR13W	312108	891542	01-01-69	H	55.0	122MOCN
B058 MCMAHAN	SENWS31T05NR13W	312109	892025	01-01-69	H	105	122MOCN
B103 MOBILE OIL CORP	NESWS35T05NR13W	312112	891619	06-08-77	N	254	122MOCN

B059 B UNDERWOOD	NWSES35T05NR13W	312112	891624	01-01-69	H	75.0	122MOCN
A063 L E RHIAN	NESWS35T05NR14W	312114	892214	11-20-79	H	185	122MOCN
B068 LAGRACE MOTEL	SWNES31T05NR13W	312115	892030	01-01-70	H	86.0	122MOCN
B070 LAGRACE MOTEL	SWNES31T05NR13W	312115	892030	01-01-70	H	87.0	122MOCN
B056 S BROMFIELD	NWSES36T05NR13W	312117	891531	01-01-69	H	82.0	122MOCN
B057 AMERICAN S&G CO	NESWS33T05NR13W	312121	891814	01-01-69	H	106	122MOCN
B063 LAUREL HALMIX C	NWNWS34T05NR13W	312126	891736	01-01-69	I	106	122MOCN
B061 HERSHEL MOHLER	NWNES36T05NR13W	312141	891526	01-01-69	H	60.0	122MOCN
A067 CHURCH OF GOD	SWSES25T05NR14W	312141	892114	09-26-80	H	285	122MOCN
B055 BARRON HENDRY	SESWS25T05NR13W	312148	891529	01-01-69	H	65.0	122MOCN
B098 REO HINTON	-----S27T05NR13W	312150	891715	01-01-74	H	82.0	122MOCN
B062 J C FITTMAN	SESES29T05NR13W	312152	891756	01-01-69	H	68.0	122MOCN
B069 GLENDALE UTIL DST	--SWS28T05NR13W	312152	891848	01-01-69	U	654	122MOCN
B105 HATTIESBG STORAGE	SWNWS25T05NR13W	312208	891544	09-22-77	N	315	122MOCN
B106 HATTISBURG STORAGE	SWNWS25T05NR13W	312208	891544	01-15-78	N	330	122MOCN
A044 BROOME CONST CO	NESWS25T05NR14W	312210	892120	01-01-72	H	60.0	122MOCN
B123 UNION TEX CO	NWNES26T05NR13W	312228	891615	06-01-80	N	256	122MOCN
B065 REX BRASWELL	SWSWS21T05NR13W	312233	891845	01-01-69	H	55.0	122MOCN
B064 B H FORTE	SWSES23T05NR13W	312236	891636	01-01-69	H	73.0	122MOCN
B066 NEWTON WILSON	-----S21T05NR13W	312248	891815	01-01-69	H	63.0	122MOCN

LOCAL WELL NUMBER	LAND-NET LOCATION	LATITUDE (DEGREES)	LONGITUDE (DEGREES)	DATE WELL CONSTRUCTED	PRIMARY USE OF WATER	DEPTH OF WELL (FEET)	AQUIFER CODE
B088 ENTERPRISE PROD	NESES23T05NR13W	312300	891605	01-01-72	H	100	122MOCN
B104 DELTA UNDERGROUND C	SENES23T05NR13W	312304	891603	07-25-77	N	340	122MOCN
B096 MILTON EVANS	-----S17T05NR13W	312327	891928	01-01-73	H	89.0	122MOCN
B054 LOVELL COOLEY	SESES28T05NR13W	312140	891750	01-01-68	H	82.0	124HCGB

LOCATIONS HAVE NOT BEEN FIELD VERIFIED
BOTTOM

4

U.S. EPA REGION IV

SDMS

Unscannable Material Target Sheet

DocID: 1070616 Site ID: MSD008182081

Site Name: Hercules, Inc.

Nature of Material:

Map:	☐	Computer Disks:	☐
Photos:	☐	CD-ROM:	☐
Blueprints:	☐	Oversized Report:	☐
Slides:	☐	Log Book:	☐

Other (describe): Electrical Log

Amount of material: _____

* Please contact the appropriate Records Center to view the material *

5

Water Resources of Mississippi

THAD N. SHOWS

BULLETIN 113

MISSISSIPPI GEOLOGICAL, ECONOMIC AND TOPOGRAPHICAL SURVEY

WILLIAM HALSELL MOORE
DIRECTOR AND STATE GEOLOGIST

JACKSON, MISSISSIPPI
1970

PRICE $2.00

to be associated with the organic material (lignite, leaves, roots, etc.) deposited in the aquifer material. The Kosciusko and Cockfield aquifers are known to contain colored water of varying degrees in the Jackson area, Bay Springs, Waynesboro and other locations.

Treatment for color removal (coagulation with alum) is expensive and uneconomical for most purposes. Aquifers that contain colored water are not recommended for well development provided shallower aquifers are avai'able for use. Most people prefer clear water for domestic use.

An investigation in 1969 determined that the high chlorides in a city well at Prentiss was caused by industrial pollution from a local plant. The situation is serious at that particular area and should not be allowed to continue.

GROUND WATER

AREA VI

South Mississippi is underlain by several thick aquifer systems and at most locations multiple aquifers are present. The aquifers present in Area VI include the Catahoula, Hattiesburg, Pascagoula, Graham Ferry and Citronelle (fig. 10 and Table 18). Recent publications on the ground water resources in Harrison and Hancock Counties referred to "Miocene aquifers" for the fresh water section in those areas. The Graham Ferry aquifer is recognized in Jackson County and is the principal aquifer for industrial and municipal supplies in the vicinity of Pascagoula.

The aquifers in the coastal counties consist of thick beds of sand or gravel separated by clay layers. The sands are generally lenticular, thereby are not continuous over a large area. Most of these aquifers are capable of supplying large volumes of water to wells in the coastal counties.

The base of fresh water is about 500 feet below sea level across the northeastern part of Area VI in Covington, Jones, Wayne and part of Greene and Perry Counties (fig. 2). The deepest fresh water is present in northwestern Hancock and southwestern Pearl River Counties to a depth of 3,000 feet below sea level. Very few water wells have penetrated the entire freshwater section in the southern half of Area VI (Table 19). A number of shallow piercement-type salt domes are located in

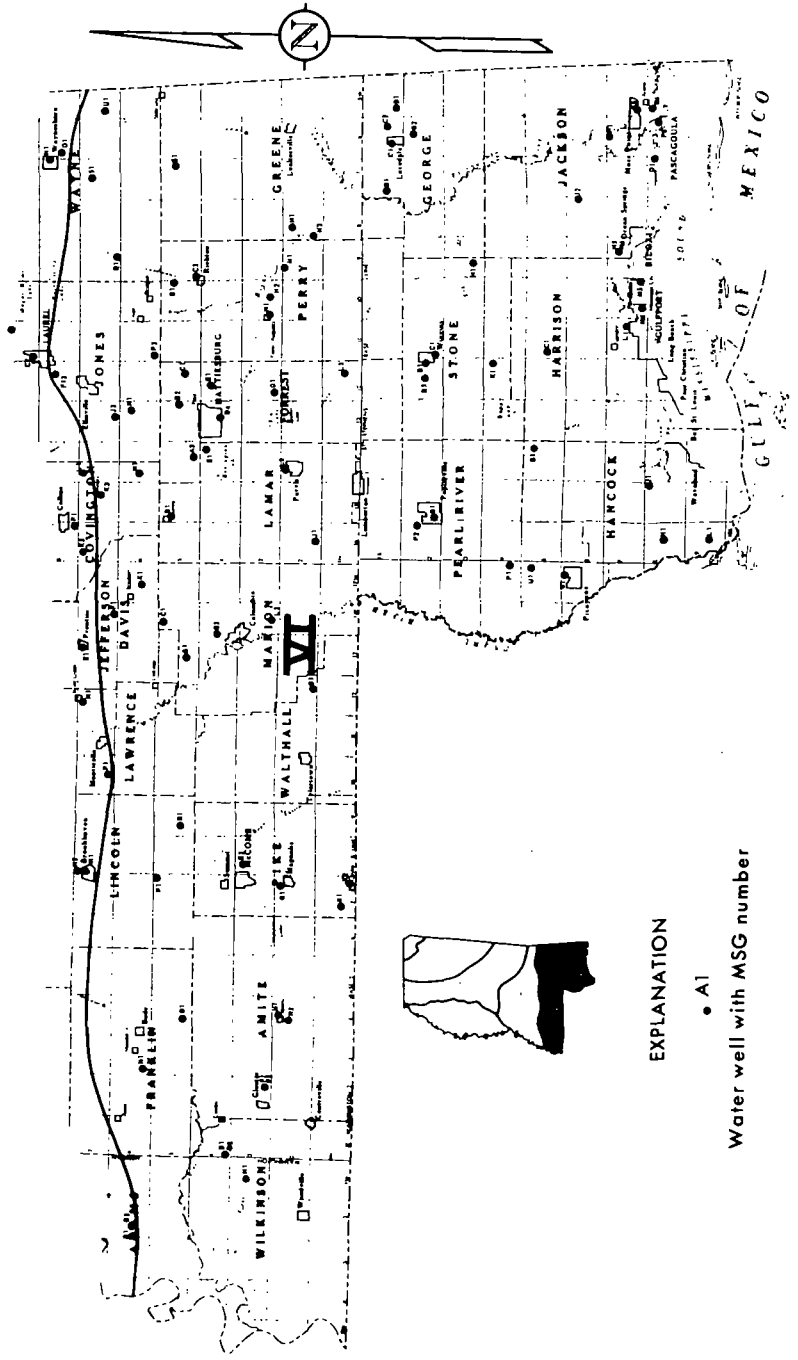


Figure 10.—Location of selected wells in Area VI.

Table 18.—Stratigraphic column and water resources in Area VI.

ERA	SYSTEM	SERIES	GROUP	STRATIGRAPHIC UNIT	THICKNESS (feet)	WATER RESOURCES
Cenozoic	Quaternary	Holocene		Alluvium	0-80	Not an important aquifer. A few large wells may be possible along some of the major streams in local areas. Salt water has intruded this aquifer adjacent to the Mississippi Sound.
		Pleistocene		Terrace Deposits	0-100	Some local wells tap this aquifer, but is not used over a very extensive area. Large quantities of water may be available in the southern part where a number of these deposits are developed in a staircase fashion. Salty water is present along the coast in some of these deposits.
				Citronelle	0-100	Supplies shallow domestic wells throughout most of the area. A few municipal wells are completed in this aquifer. Quality of water is fair. The water usually contains low dissolved solids and has a low pH.
	Tertiary	Pliocene		Graham Ferry	0-200	Main source of water supply for municipal and industrial wells in the vicinity of Pascagoula. A number of wells in western Jackson and eastern Harrison Counties utilize this aquifer. Quality of water is generally good. Water is slightly alkaline and iron is seldom a problem in the wells at Pascagoula.
		Miocene		Pascagoula	0-1000	An important source of water supply for the municipal, industrial and domestic wells in Hancock, Harrison and Jackson Counties. The Pascagoula, Hattiesburg and the Catahoula are difficult to differentiate in the subsurface. Recent publications have placed all of the aquifers into "Miocene aquifers." Quality of water is good from this aquifer. Color is high in a number of wells adjacent to the Mississippi Sound. Hydrogen sulfide content may be a local problem.
				Hattiesburg	0-400	An important source of water supply for the municipal wells at Lucedale. This aquifer has the potential of supplying large volumes of water to wells in Pearl River, Stone and George Counties. Numerous domestic wells tap this aquifer in the central part of the area (southern Forrest, Greene, Perry, Pearl River, Stone and George Counties). The quality of water is generally good.
				Catahoula	500-900	An important source of water in the northern half of the area. The aquifer supplies numerous municipal, industrial, and domestic water supplies as far south as northern Pearl River, Stone and George Counties. The aquifer is fresh farther south but because of the depth and availability of shallower aquifers is not generally used. The quality of water is generally good.

Area VI and to the north in Area V. The base of fresh water is shallow over some of the domes. Therefore caution should be exercised in drilling deep water wells on these structures. Deep aquifers are present in Harrison and Hancock Counties which have the ability of supplying large volumes of fresh water to properly constructed wells. A test well 2,460 feet deep (USGS) located in Gulfport's industrial park had a water level of about 100 feet above land surface.

CATAHOULA AQUIFER

Most of the water supplies in the northern part of Area VI are from the Catahoula aquifer. The wells are generally shallow (100 to 1,000 feet deep) and yield large volumes of water. The aquifer consists of beds of sand or gravel separated by clay layers. The sand and gravel beds thicken toward the Gulf and are several hundred feet thick in south Mississippi.

Numerous municipal, industrial, and domestic water supplies are completed in the Catahoula aquifer across this area. The aquifer is used as far south as northern Pearl River, Stone and George Counties. The use of this aquifer has been limited south of the above mentioned area because of the availability of shallower aquifers. Wells yielding up to 2,000 gpm are possible from this aquifer at some locations such as Carson in Jefferson Davis County and Wiggins in Stone County. The sands are generally lenticular in the northern part of Area VI. Test drilling is recommended for most locations because of the lenticular deposits.

Large volumes of water are pumped from the Catahoula aquifer at Hattiesburg, Richton, Purvis, and McComb. A large number of wells for rural water systems and domestic supplies utilize this aquifer in the northern part of Area VI.

Water levels are above the land surface along some of the streams. Flowing wells are primarily located in the Bogue Chitto, Okatoma Creek, Pearl River, Pascagoula River, Chickasawhay River, and some of the smaller creeks across the area. Some of the deeper water levels reported are from 250 to 380 feet. A well which is 796 feet deep in the Catahoula aquifer at Baxterville, Lamar County, had a water level of 264 feet in 1964. A well 425 feet deep at Bassfield, Jefferson Davis County, had a water level of 380 feet in 1964. Slightly deeper water levels may be expected on tops of high hills. Water levels are depressed in areas of heavy pumpage in a small area such as the Hattiesburg well field located at the new water plant.

HATTIESBURG AQUIFER

The Hattiesburg aquifer is not as widely used as the Catahoula aquifer. The Hattiesburg aquifer has the potential of supplying large wells in the central and southern part of Area VI. A number of shallow domestic and small municipal wells utilize this aquifer in southern Lamar, southern Forrest, Perry and Greene Counties. The municipal wells at Lucedale and two community supply wells north of Lucedale are completed in the Hattiesburg aquifer at a depth of about 1,000 feet. Most of the ground-water development from this aquifer is in Pearl River, Stone and George Counties and slightly north of these counties. The extreme depth is the limiting factor south of these counties. The aquifer is presently being used for ground-water supplies in Wilkinson, Amite, Pike, Walthall, and Marion Counties, which are along the Louisiana boundary.

Separating the Hattiesburg from the underlying Catahoula or the overlying Pascagoula is extremely difficult in the subsurface in Area VI. One solution to this problem is to refer to these units as "Miocene aquifers" and not designate particular aquifers.

Water levels will be similar to those in the Catahoula aquifer. The higher water levels will be located along the streams. A well 1,008 feet deep for the Town of Lucedale had a water level of 100 feet in 1960.

PASCAGOULA AQUIFER

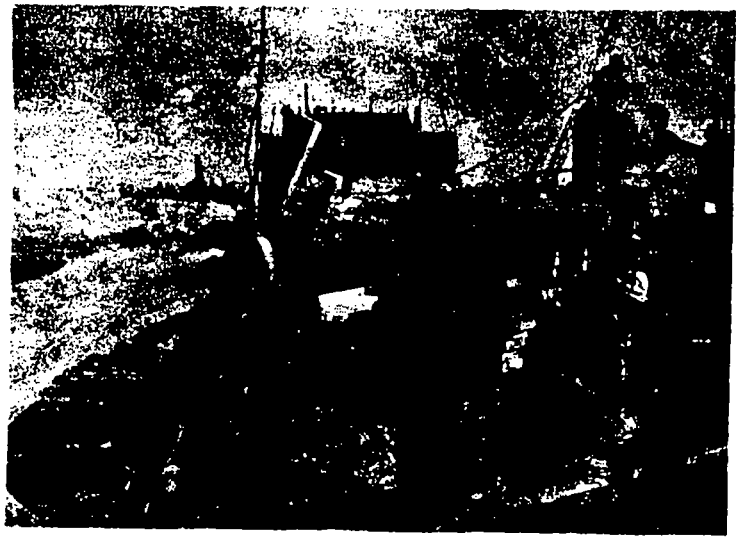
The Pascagoula aquifer is an important source of water supply in the three coastal counties, Hancock, Harrison, and Jackson. Numerous municipal, industrial and domestic wells utilize this aquifer in these counties. Most of the municipalities along the coast have wells completed in this aquifer. Yields from this aquifer are as much as 3,000 gpm at the NASA Test Site. The aquifer consists of thick sands and gravels at a number of locations along the coast. Multiple aquifers or zones of sands are present at most locations.

Water levels are generally above or near the land surface except in areas of concentrated withdrawals. A number of the

6

Results of Aquifer Tests in Mississippi

Compiled by
Roy Newcome, Jr.



Prepared by the
U. S. Geological Survey
Water Resources Division

in cooperation with the
Mississippi Board of Water Commissioners

Bulletin 71-2
1971

ABBREV.	ABBREV.	STANDARD FULL NAME	REMARKS
TRCS	110TRCS	Terrace dposits, undifferentiated	(111,112)
MRVA	112MRVA	Mississippi River alluvial aquifer	
CRNL	121CRNL	Citronelle aquifers	
GRMF	121GRMF	Graham Ferry aquifer	
MOCN	122MOCN	Miocene aquifer system	
PCGL	122PCGL	Pascagoula aquifer	
HBRG	122HBRG	Hattiesburg aquifer	
CTHL	122CTHL	Catahoula aquifer	
OLGC	123OLGC	Oligocene aquifer system	
MSPG	123MSPG	Mint Spring aquifer	
FRHL	123FRHL	Forest Hill aquifer	
MDBC	124MDBC	Moodys Branch aquifer	
CCKF	124CCKF	Cockfield aquifer	
CKMN	124CKMN	Cook Mountain aquifer	
SPRT	124SPRT	Sparta aquifer system	
WNON	124WNON	Winona aquifer	
TLLT	124TLLT	Tallahatta aquifer	
MUWX	124MUWX	Meridian-upper Wilcox aquifer	
WLCXU	124WLCXU	Upper Wilcox aquifer	
WLCXM	124WLCXM	Middle Wilcox aquifer	
WLCXL	124WLCXL	Lower Wilcox aquifer	
WLCX	124WLCX	Wilcox aquifer	(undifferentiated
RPLY	211RPLY	Ripley aquifer	
COFF	211COFF	Coffee Sand aquifer	
EUTW	211EUTW	Eutaw aquifer	
MCSN	211MCSN	McShan aquifer	
?ETMS	?	Eutaw-McShan aquifer	
GORD	211GORD	Gordo aquifer	
COKR	211COKR	Coker aquifer	
PLZC	300PLZC	Paleozoic aquifer system	

GEOLOGIC UNIT CODE FOR MISSISSIPPI

Alphabetical List

Aquifers

Alluvial aquifer, Mississippi River	QGMA
Alluvium, Pleistocene	QGOA
Alluvium, Quaternary, undifferentiated	Q-OA
Alluvium, Recent	QROA
Byram Formation, Glendon Limestone Member	TØGM
Camden Chert	D3CA
Catahoula Sandstone	TMCA
Catahoula Sandstone, upper part	TMUM
middle part	TMMM
lower part	TMBM
Citronelle Formation	TPCI
Claiborne Group	TECG
Clayton Formation	TLCL
Coastal Deposits	QBCD
Cockfield Formation	TECØ
Cook Mountain Formation	TECK
Potterchitto Sand Member	TEDM
Coffee Sand	K3CS
Coker Formation	K3CØ
upper unnamed member	K37M
Eoline member	K3EM
"massive sand"	K3MM
Eocene Series, undifferentiated	TESE
Eutaw Formation, (unrestricted)	K3EE
Tombigbee Sand Member	K3TM
Unnamed member	K36M
Eutaw Formation, (restricted)	K3EU
lower part	K38M
Forest Hill Sand	TØFH
Fort Payne Chert	M1FP
Gordo Formation	K3GØ
Graham Ferry Formation	TPGF
Hatchetigbee Formation	TEHA
Hattiesburg Formation	TMHA
High terrace deposits	QGHT
Intermediate terrace deposits	QGIT
Low terrace deposits	QGLT
Lower Cretaceous	K1
Lower Tuscaloosa	K3TL
Lower Wilcox aquifer	TELW
Marianna Limestone	TØMA
Mint Spring Marl Member	TØMS
McShan Formation	K3MS
Meridian-upper Wilcox aquifer	TEMW
Middle Tuscaloosa	K3TC
Middle Wilcox aquifer	TETW
Midway Group	TLMG
Miocene Series, undifferentiated	TMMZ
Mississippi River alluvial aquifer	QGMA
Moodys Branch Formation	TEMB
Naheola Formation	TLNA
Nanafalia Formation	TENA
Fearn Springs Member	TEFM
Paleozoic rocks	Y
Pascagoula Formation	TMPA
Fort Adams Member	TMFM
Homochitto Sand	TMHM
lower part	TMLM
Paynes Hammock Sand	TMPH
Pleistocene	QG
Pleistocene-Pliocene	AQ
Pleistocene-Recent	QB
Pliocene	TP
Porters Creek Clay, Tippah Sand Lentil	TLTL
Matthews Landing Marl Member	TLMM
Pottsville Formation	N6PO
Quaternary alluvium	Q-OA
Quaternary deposits	Q-OD
Quaternary sand, undifferentiated	Q-1S
Quaternary sand and gravel, undifferentiated	Q-1G
Quaternary terraces, undifferentiated	Q-OT
Recent alluvium	QROA
Recent terrace deposits	QROT
Ripley Formation	K3RI
Chiwapa Member	K3CM
McNairy Sand Member	K3SM
Coon Creek Tongue	K3KM
Selma Group	K3SG
Sparta Sand	TESS
upper part	TEST
middle part	TESX
lower part	TESB
Tallahatta Formation	TETA
Neshoba Sand Member	TEJM
Basic City Shale Member	TETM
Meridian Sand Member	TEMM
Tertiary	T
Tertiary-Quaternary	A
Tuscahoma Formation	TETU
Tuscaloosa Group	K3TG
Unnamed Group (Eutaw and McShan Formations)	K32G
Upper Wilcox aquifer	TEUW
Upper Cretaceous	K3
Upper Tuscaloosa	K3TU
Vicksburg Group	TØVG
Wilcox Group	TEWG
Winona-Neshoba aquifer	TEWN
Winona Sand	TEWS
Yazoo Clay, Cocoa Sand Member	TECM
Zilpha Clay	TEZC

SUMMARY OF PUMPING TESTS IN COVINGTON COUNTY

WELL NO.	OWNER	DATE	DEPTH FT	AQUI-FER	AQUI-FER THICK-NESS FT	SCREEN LENGTH FT	PUMP. PERIOD HRS	TEST YIELD GPM	SPEC. CAPA-CITY GPM/FT 1-DAY	TRANS-MISSI-BILITY GPD/FT	PERMEA-BILITY GPD/FT2	STOR. COEF.	TRANS-MISS-IVITY FT2/D	HYDR. CON-DUCT-IVITY FT/D
F002	COLLINS	5-67	217	TMUM	100	60	5	435	22	37000	370	.0004	4900	49
F003	COLLINSWOOD PRO	5-67	741	TMCA			1	740	37	80000			10000	
F005	COLLINSWOOD PRO	2-67	164	TMCA	100		4	711		17000	170	.0003	2200	22
K001	SEMINARY	N-66	249	TMCA	95	67	2	351	29	80000	840		10000	110
N001	SANFORD	4-66	802	TMMZ	43	30	1	111		25000	580		3300	77

SUMMARY OF PUMPING TESTS IN DE SOTO COUNTY

NO TESTS

SUMMARY OF PUMPING TESTS IN FORREST COUNTY

WELL NO.	OWNER	DATE	DEPTH FT	AQUI-FER	AQUI-FER THICK-NESS FT	SCREEN LENGTH FT	PUMP. PERIOD HRS	TEST YIELD GPM	SPEC. CAPA-CITY GPM/FT 1-DAY	TRANS-MISSI-BILITY GPD/FT	PERMEA-BILITY GPD/FT2	STOR. COEF.	TRANS-MISS-IVITY FT2/D	HYDR. CON-DUCT-IVITY FT/D
A023	HATTIESBURG C C	3-65	752	TMCA	50		4	84	7.3	27000	540		3600	72
B017	HATTIESBURG	1-65	607	TMCA	80		9	995	9.7	48000	600	.0003	6400	80
D001	HATTIESBURG AP	6-42	194	TMHA	100	30	3	297	24	120000	1200	.0001	16000	160
D004	HATTIESBURG	4-64	485	TMCA	130	50	12	1030	40	170000	1300		22000	170
D005	HATTIESBURG	4-64	678	TMCA	80	50	11	1050	13	30000	370	.0001	4000	50
D029	E FORREST UTIL	N-62	134	O-OA	100	31	12	750		200000	2000	.0006	26000	260
D038	HERCULES POWDER	9-65	687	TMCA	105	96	8	1016	7.5	15000	140		2000	18
D039	COASTAL CHEM CO	5-65	353	TMCA	150	40	2	483	5.7	70000	460		9300	62
D042	PALMERS CROSSNG	3-66	642	TMCA	216	42	2	285	20	110000	500	.0002	14000	68
D045	CENTRAL UTILITY	4-66	694	TMCA	90	40	1	206	12	39000	430		5200	57
D046	CENTRAL UTILITY	4-66	672	TMCA	90	40	1	252	11	39000	430	.0002	5200	57
G014	CAMP SHELBY	5-43	402	TMHA	86	80	73	550	29	70000	810	.0004	9300	100
G016	CAMP SHELBY	5-43	409	TMHA		80	26	532	19	70000			9300	
G022	CAMP SHELBY	5-43	404	TMHA	83	80	31	522	26	69000	830		9200	110
H006	PAUL B JOHNSON	1-68	330	TMHA	47	20	1	80	4.7	34000	720		4500	96
L017	BROOKLYN W A	5-66	580	TMHA	170	40	1	240	22	230000	1300		30000	180
M035	CARNES UTILITY	0-70	820	TMCA	70	40	2	145		36000	510		4800	68

7

CHARACTERIZATION OF AQUIFERS DESIGNATED AS POTENTIAL DRINKING-WATER SOURCES IN MISSISSIPPI

U. S. GEOLOGICAL SURVEY
WATER RESOURCES INVESTIGATIONS
OPEN-FILE REPORT 81-550

Prepared in cooperation with the
MISSISSIPPI DEPARTMENT OF NATURAL RESOURCES
BUREAU OF POLLUTION CONTROL

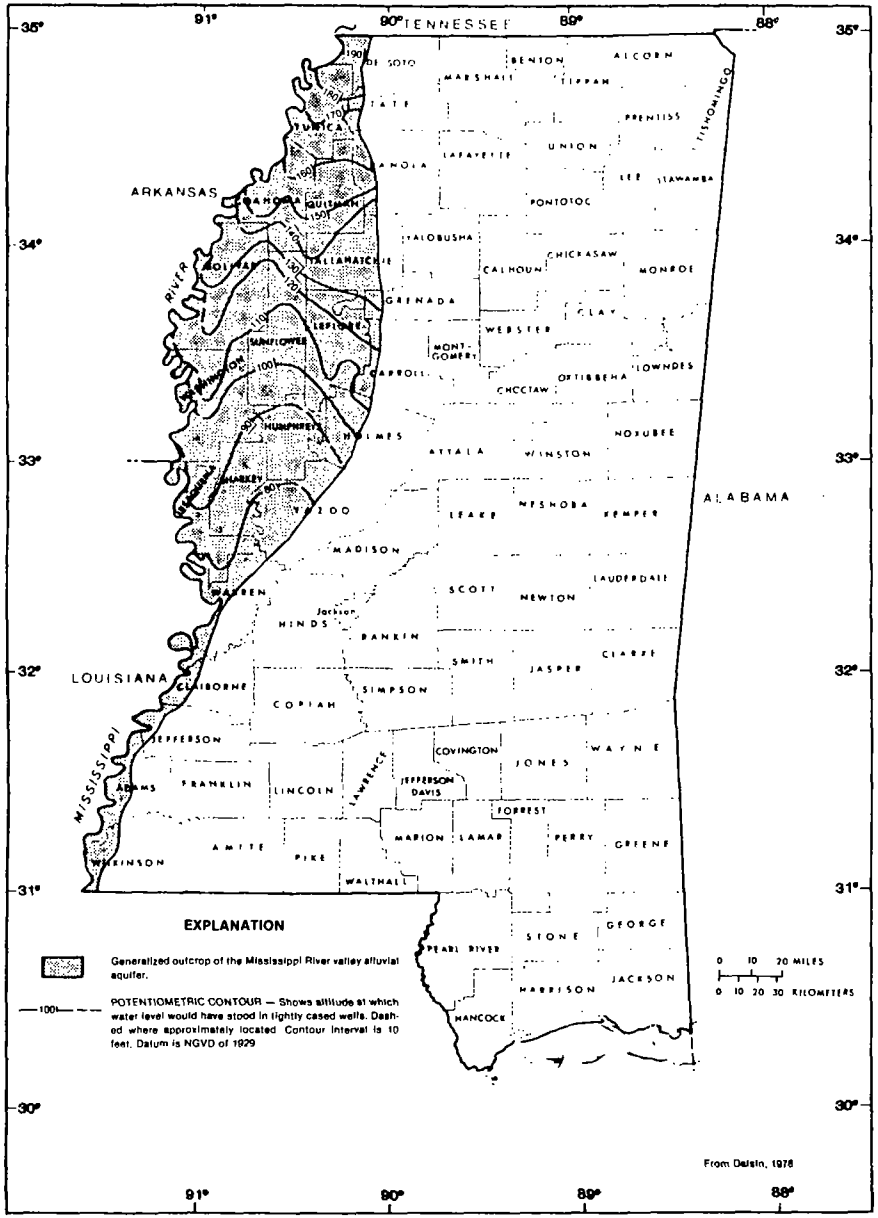


Figure 7. — Potentiometric surface of the Mississippi River valley alluvial aquifer.

Agricultural chemicals used in the heavily farmed area may be a source of contamination of the aquifer in some places.

Gravel is mined from the Mississippi River valley alluvial aquifer and from other alluvium in the state. Mining of gravel and possible future mining of lignite locally may cause changes in recharge to the aquifer and quality of water in the aquifer.

Citronelle Aquifers

The Citronelle aquifers are made up of many discontinuous, hydrologically independent aquifers. They are present in the state from around 32° latitude southward (fig. 8). The beds are exposed at the surface over most of their area of occurrence and are present primarily on hilltops. Along stream valleys they have been eroded to expose the underlying Miocene beds. The aquifers dip southward at about 6 ft/mi and the dip becomes steeper near the coast where they are overlain by coastal terraces. The aquifer is thickest and less dissected near the coast but rarely exceeds 100 feet thick. The Citronelle is made up of quartz sand, chert gravel, and lenses and layers of clay. It is a major source of gravel in the state.

The Citronelle Formation commonly is only partially saturated. It is a water table aquifer with water levels which vary from place to place due to the discontinuous nature of the aquifer. The low water levels vary seasonally, but are little affected regionally by pumpage because very little water is withdrawn. Locally however, water levels are lowered rapidly by pumpage. Recharge is from rainfall directly on the outcrop, and water moves quickly both vertically and downdip, recharging the underlying Miocene aquifers and sustaining local streams.

Six aquifer tests indicate transmissivities ranging from 4,000 to 13,000 ft^2/d, hydraulic conductivities of 82 to 200 ft/d, and specific capacities of 6.2 to 46 (gal/min)/ft of drawdown (Boswell, 1979a). The limited saturated thickness and limited storage capacity of the Citronelle limits its use. Large wells can be developed in the Citronelle, but a larger and more reliable source is available from the underlying Miocene aquifers.

Dissolved-solids concentrations of water in the Citronelle are less than 500 mg/L except at places along the coast where seawater is in contact with the aquifer. At most localities the water is high in iron content. In addition to local contamination by seawater along the Gulf Coast, the Citronelle may be contaminated by landfills in old gravel pits, by sewage, and by industrial and oil field wastes in surface pits. Most of the wastes in the area are dispersed through area streams, but some move into the underlying Miocene aquifer system.

Miocene Aquifer System

The Miocene aquifer system crops out in most of the southern one-third of the state (fig. 9) except where it is covered by younger coastal deposits and the Citronelle Formation. The aquifer system is composed of numerous interbedded layers of sand and clay that include

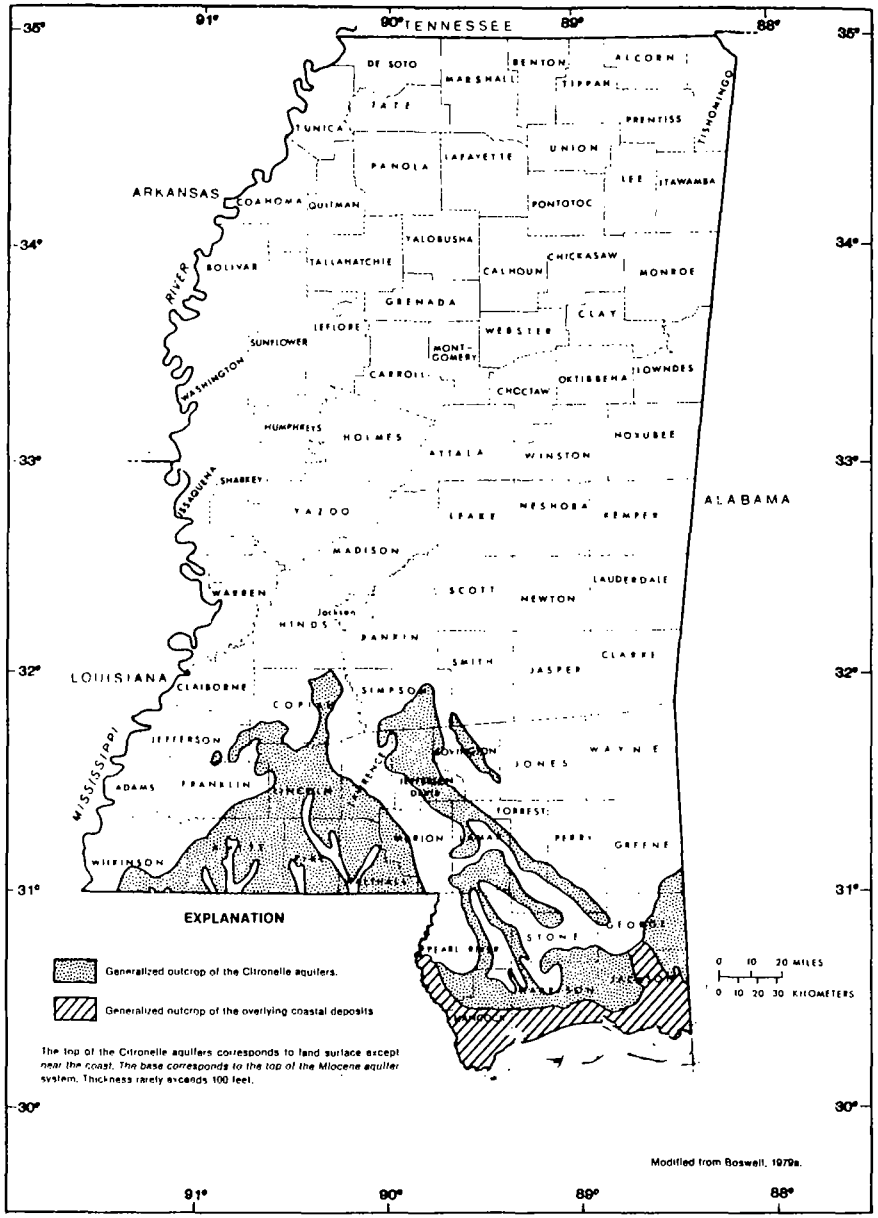


Figure 8. — Outcrop of the Citronelle aquifers and overlying coastal deposits.

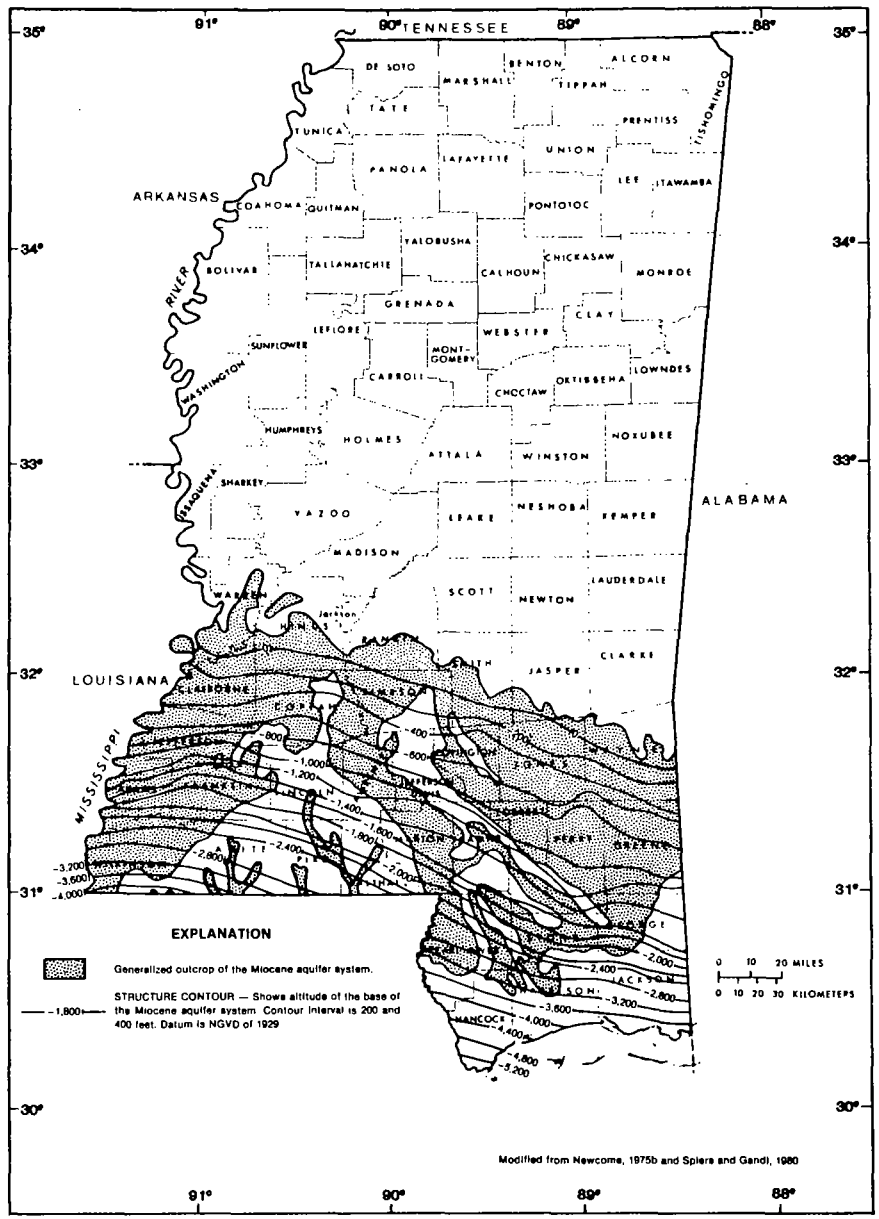


Figure 9. — Configuration of the base of the Miocene aquifer system.

the Pascagoula and Hattiesburg Formations, and the Catahoula Sandstone. Because of their interbedded nature, the formations cannot be reliably separated and correlated either on the surface or in the subsurface. The formations dip southwestward at 30 to 100 ft/mi and the dip steepens towards the coast. The aquifer system thickens as the dip steepens (fig. 10), and the thickness exceeds 3,000 feet near the coast. Within that 3,000 feet, the sand beds alone are over 1,000 feet thick, although the deepest beds do not contain freshwater (fig. 11).

The shallowest sands of the Miocene aquifer system are water-table aquifers, but the deeper sands are confined and are fully saturated. Water levels in the Miocene aquifers vary, but usually range from a few feet above land surface to 100 feet below land surface. Water levels have been regionally declining by 1 to 2 ft/yr, although the decline is greater near some centers of pumpage.

Recharge to the Miocene aquifers is from rainfall directly on the outcrop, seepage from the overlying Citronelle Formation, and leakage between aquifer units of the Miocene aquifer system.

Water movement is downdip, towards center of pumpage, and between aquifers of the system. The underlying Oligocene formations and in particular the clay of the Bucatunna Formation prevents movement between the Miocene and Oligocene aquifer systems.

The Miocene aquifers are a very prolific source of ground water. Aquifer test results have indicated transmissivity values averaging 13,000 ft^2/d. Hydraulic conductivities determined from the tests average 95 ft/d, and specific capacities are as high as 30 (gal/min)/ft of drawdown (Newcome, 1975b).

Wells in the Miocene usually tap only the upper aquifers because abundant water is available at shallow depths. Much freshwater in the deeper aquifers is available but undeveloped. The aquifers are utilized for small domestic wells and large municipal and industrial wells.

Water in the Miocene aquifers commonly is a soft sodium-bicarbonate type. Excessive iron is found in samples from some locations, but this is at places due to corrosion of pipes. Downdip near the coast, water in the deeper sand beds is saline (fig. 11). However, freshwater may be available on the offshore islands at estimated depths as great as 2,200 feet below sea level in some places.

The shallow Miocene aquifers have been contaminated in places by improperly sealed surface disposal sites and by leakage from disposal sites in the overlying Citronelle Formation (Boswell, 1979a). The deepest Miocene aquifer, the Catahoula Sandstone, is used for brine disposal in Adams, Wilkinson, and Hancock Counties (Bicker, 1972).

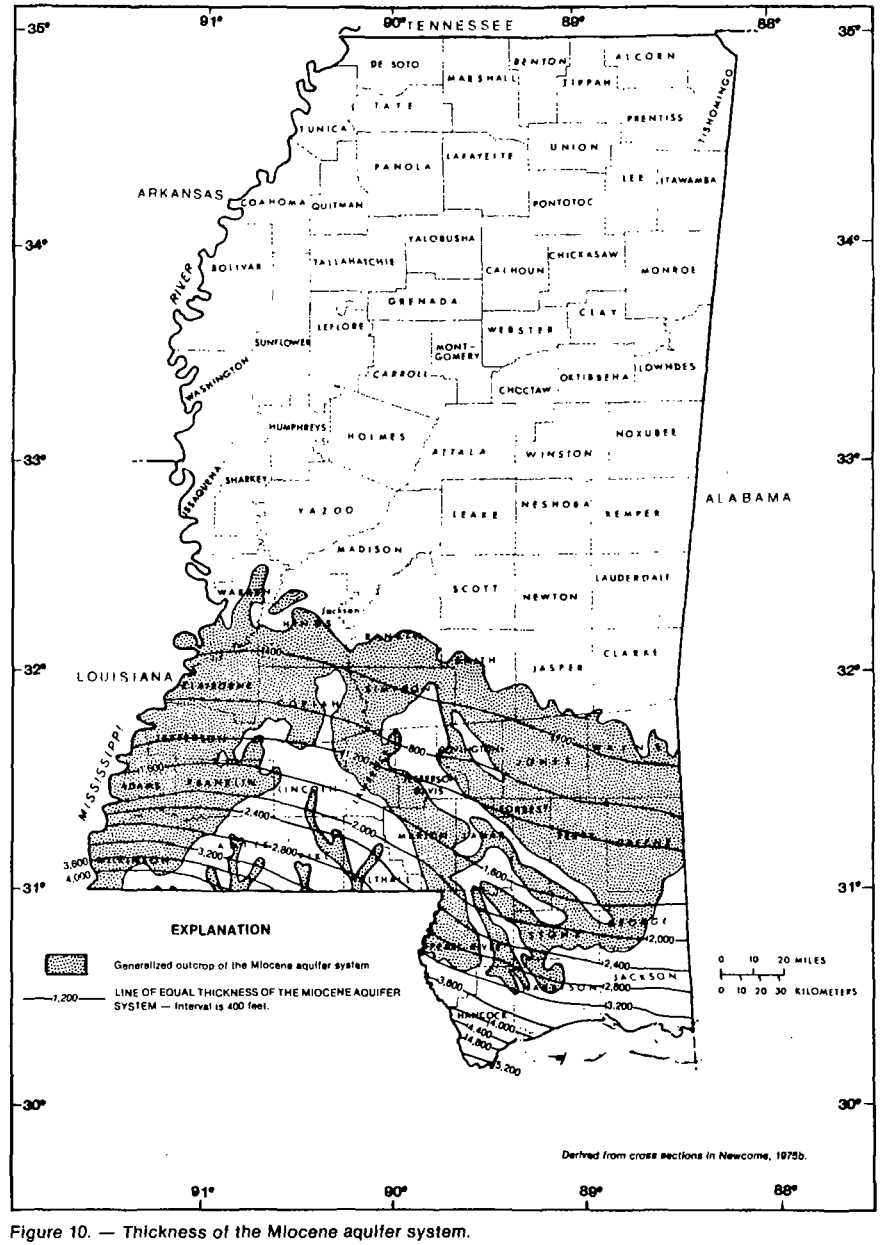


Figure 10. — Thickness of the Miocene aquifer system.

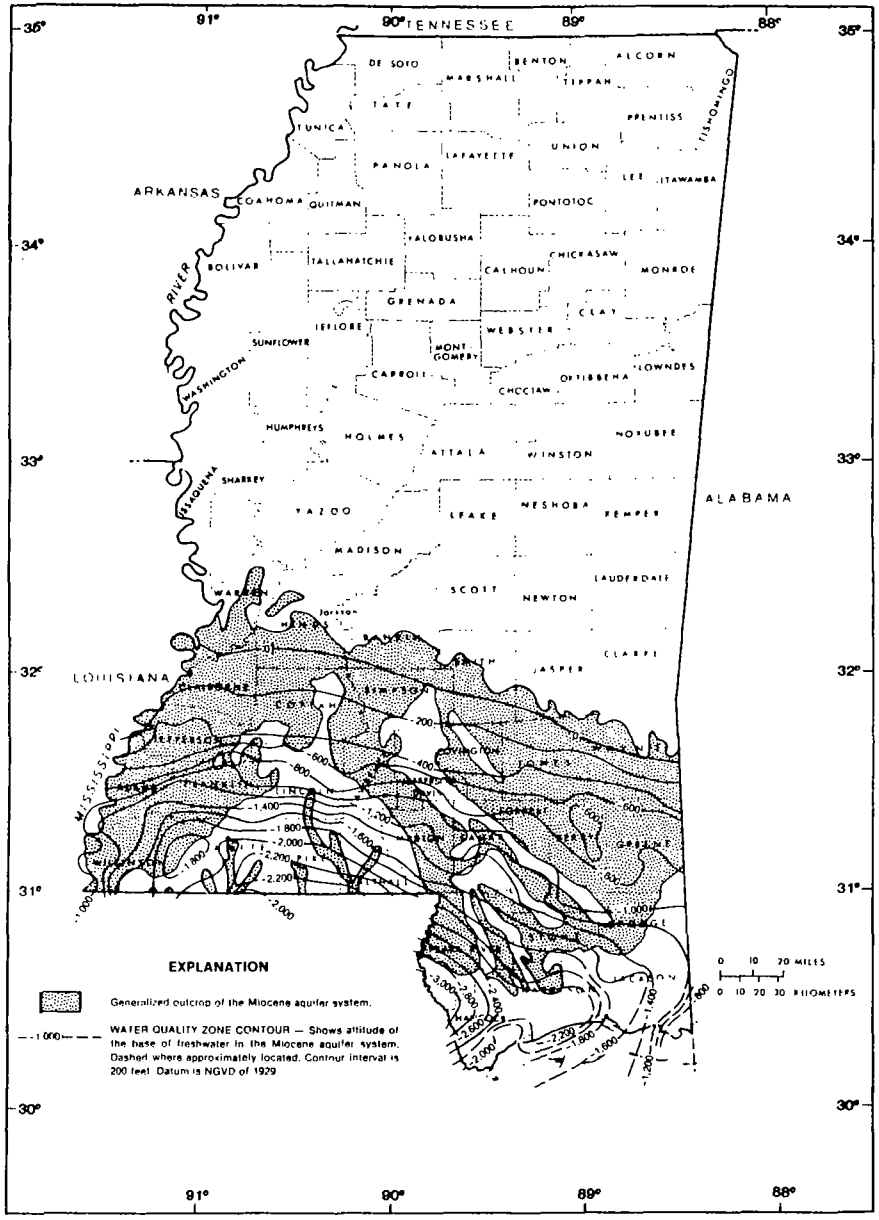


Figure 11. — Configuration of the base of freshwater in the Miocene aquifer system.

Oligocene Aquifer System

The Oligocene aquifer system crops out in a band across the state from northern Warren County in the west to northern Wayne County in the east. Figures 12 and 13 show the structure contours on the base and top of the aquifer system, respectively. The formations dip to the south at approximately 30 ft/mi and range in thickness from less than 100 to more than 200 feet (fig. 14). The Oligocene aquifer system consists of the Byram, Glendon, Marianna, and Mint Spring Formations of the Vicksburg Group, and the underlying Forest Hill Formation. The formations of Vicksburg Group are composed of discontinuous interbedded marls, limestones, and sands. The Forest Hill Formation contains clay, silt, and irregular sand beds. To the east, the aquifers thin and the Forest Hill changes lithologically to a clay known as the Red Bluff Formation. Sand beds in the Oligocene aquifers range from 20 to 80 feet thick, but water is produced from solution channels in limestone beds as well as the sands.

Water levels in the Oligocene aquifers are at or near the surface in the outcrop area and slope downdip (fig. 15). In much of the downdip area, water levels are declining at 0.5 to 2.0 ft/yr. Recharge to the Oligocene aquifers is from rainfall on the outcrop. The overlying Bucatunna Formation and underlying Yazoo Clay effectively isolate the Oligocene aquifers from recharge by other aquifers.

Hydraulic data from aquifer tests are sparse and characteristics vary widely. Four tests indicate transmissivities ranging from 120 to 3,300 ft^2/d, hydraulic conductivities ranging from 3 to 60 ft/d, and specific capacities ranging from 1.5 to 12 (gal/min)/ft of drawdown (Gandl, 1979).

Most wells in the Oligocene aquifers are domestic and irrigation wells, because more abundant water supplies are available from deeper or shallower aquifers. The highest yielding well produces 300 gal/min.

Water from the Oligocene aquifers is a soft sodium-bicarbonate type, but it may be high in iron, color, and fluoride. The downdip limits of fresh, slightly saline, and moderately saline water are shown in figure 12; however, in the southeast the formations become so thin and clayey that they are not considered to be aquifers.

Bentonite, glauconite, and scattered lignite are found in the Oligocene aquifers and, if mined, would be mined in the outcrop area.

Cockfield Aquifer

The Cockfield aquifer crops out in a diagonal band from Bolivar County in the northwest to Clarke County in the southeast (fig. 16). In the northwest it is overlain by the Mississippi River Valley alluvial aquifer. It also crops out along the Pearl River near Jackson in Hinds County. The top of the Cockfield (fig. 17) is deeply eroded where it is overlain by the alluvial aquifer. The Cockfield dips to the southwest at 20 to 30 ft/mi. It is thickest in the northwest and downdip to the west (fig. 18). To the southeast the formation thins; it becomes more

8

U.S. EPA REGION IV

SDMS

Unscannable Material Target Sheet

DocID: 1706616 Site ID: MSD008182081

Site Name: Hercules, Inc.

Nature of Material:

Map:	☒	Computer Disks:	☐
Photos:	☐	CD-ROM:	☐
Blueprints:	☐	Oversized Report:	☐
Slides:	☐	Log Book:	☐

Other (describe): Racine Map

Amount of material: _____

* Please contact the appropriate Records Center to view the material *

9

BLW-NC-1

RETURN COMPLETED FORM TO:

Bureau of Land and Water Resources
P.O. Box 10631
Jackson, Mississippi 39209
Telephone (601) 961-5200

For Office Use Only:	
County:	Forrest
Date Received:	1-15-86
Permit No:	MS-SW00238
Quad Map:	
Water Management Dist:	
Hydrologic River Basin:	

NOTICE OF CLAIM FOR CONTINUED USE OF SURFACE/GROUND WATERS FOR BENEFICIAL USE

Pursuant to the laws of the State of Mississippi, namely §51-3-5 (2) or (3), as amended, I, the landowner,

HERCULES INC. (Name) 51-0023450 (S/S or Tax ID No.)

WEST 7TH STREET (Address), HATTIESBURG (City or Town), MS 39401 (State and Zip)

(601) 545 3450 (Telephone Number), do hereby file claim for the continued use of: (circle one)

(surface water) ground water for the following beneficial use: (circle one or more)

municipal; irrigation; recreation; livestock water; fish culture; (industrial;)

Other _____ (Specify)

1. Name & Address of agent or applicant if different from landowner.

_____ (Name), _____ (S/S or Tax ID No.), _____ (Address)

_____ (City or Town), _____ (State and Zip), ( ) _____ (Telephone Number)

2. Location of point of diversion/withdrawal (include location map with claim)

SE ¼ of SW ¼ of Section 33, Township 5N, Range 13W, County Forrest

3. Volume of water diverted/withdrawn:

(1) _____ acre feet per year, diverted/withdrawn at a maximum rate of _____ gallons per minute; or

(2) 2628 million gallons per ~~day~~ Year diverted/withdrawn at a maximum rate of 8500 gallons per minute.

4. Description of lands on which water will be used:
(a) Copy legal description of property upon which water is to be used (may be copied word for word from your deed).

Attach separate sheet if necessary SECTION 4 AND 5, Township 4N, Range 13W

(b) Has the above described land any water right or source of water supply other than that herein applied for?

(Water Rights Number(s) _____) Describe the nature and amount of any additional supply

THREE (3) LAYNE WELLS - 1000 gpm each

SECTION A (to be completed if source of water is from surface supply)

1. Prior water rights permit/license number 0003, dated August 23, 1957

2. Source of supply is Bowie River which drains into Leaf River

_____ which drains into Pascagoula River

3. Description of diversion works:

(a) Water obtained directly from stream: Bowie River (Name)

Pump FOUR (4) CENTRIFUGAL (Size and type) Power Unit 2-150HP AND 2-75HP (Size and type)

Lift 2-180FT AND 2-140FT ft. Maximum capacity 2-2500gpm AND 2-1750gpm gpm

(b) Storage reservoir _____ (Name)

Height of dam _____ feet. Surface area at normal pool _____ acres

Storage capacity at normal pool _____ acre feet

10

FACILITY ID / CNTY#	FACILITY NAME / COUNTY NAME	NOTIF DATE	MAIL STREET / LOC STREET	MAIL CITY / LOC CITY	ST / ZIP	GEN	TRN	TSD	UIC	CONF	FACIL. STATUS	PERMIT STATUS	DCID SE
MSD985966589	ACE BODY SHOP		1153 BOJIE ST. 1153 BOJIE ST.	HATTIESBURG HATTIESBURG	MS 39401 MS 39401	2							
035	FORREST												
MSD982106700	B.F. GOODRICH CO.		1301 WEST SEVENTH STREET 1301 WEST SEVENTH STREET	HATTIESBURG HATTIESBURG	MS 39401 MS 39401	1							
035	FORREST												
MSD981749401	CAMP SHELBY TRAINING SITE					2							
035	FORREST		CAMP SHELBY	CAMP SHELBY	MS 39407								
MSD991290560	CHEVRON USA INC 3040		PO BOX 1706	ATLANTA	GA 30301					00			
035	FORREST	810116	1400 JERSEY STREET	HATTIESBURG	MS 39401						C303-9		
MSD982770455	CMC FALK STEEL		P. O. BOX 247	VICKSBURG	MS 39180	2							
035	FORREST	890921	HIGHWAY 61 NORTH BUSINESS	VICKSBURG	MS 39180								
MSD981919731	COURTESY MOTORS, INC		P. O. BOX 352	HATTIESBURG	MS 39401	2							
035	FORREST		1410 WEST PINE STREET	HATTIESBURG	MS 39401								
MSD982770125	DOSSETT PONTIAC		1058 W. PINE	HATTIESBURG	MS 39401	2							
035	FORREST	890707	1058 W. PINE	HATTIESBURG	MS 39401								
MSD050912799	DOWEL SCHLUMBERGER INC		ROUTE 2 BOX 514	HATTIESBURG	MS 39401		X			Y 00	C119-1 C1105-6		
035	FORREST	800818	1232 JAMES STREET	HATTIESBURG	MS 39401						C303-1		
MSD981931157	ENTERPRISE PRODUCTS CO.		P. O. BOX 506	PETAL	MS 39465	1							
035	FORREST		HIGHWAY 11 NORTH	PETAL	MS 39465								
MSD981480742	FAULKNER CONCRETE PIPE CO.		P.O. BOX 16987	HATTIESBURG	MS 39404	2							
035	FORREST		HIGHWAY 49 NORTH	HATTIESBURG	MS 39404								
MSD100653476	FORREST COUNTY AGRI HIGH SCHOOL		P. O. BOX 9	BROOKLYN	MS 39425	2							
035	FORREST		OLD 49 SOUTH	BROOKLYN	MS 39425								
MSD094180270	GEORGIA-PACIFIC CORP		ROUTE 10 BOX 565-A	HATTIESBURG	MS 39401	2				00			
035	FORREST	800812	4911 OLD RAWLS SPRINGS RD	HATTIESBURG	MS 39401								
MSD006182081	HERCULES INC		PO BOX 1937	HATTIESBURG	MS 39401	1				W 00	C119-1 C1105-6		
035	FORREST	800818	W 7TH ST	HATTIESBURG	MS 39401								
MSD000833434	JANNIK SERVICES INCORPORATED		103 REGENCY DRIVE	HATTIESBURG	MS 39401		X			00			
035	FORREST	800817	103 REGENCY DRIVE	HATTIESBURG	MS 39401								
MSD982770026	JERRY'S WRECKER SERVICE PAINT		604 63RD STREET	HATTIESBURG	MS 39401	2							
035	FORREST	890626	604 63RD STREET	HATTIESBURG	MS 39401								

**** CONTINUED ON PAGE 25 ****

11

INFORMATION

TOUR NOTES

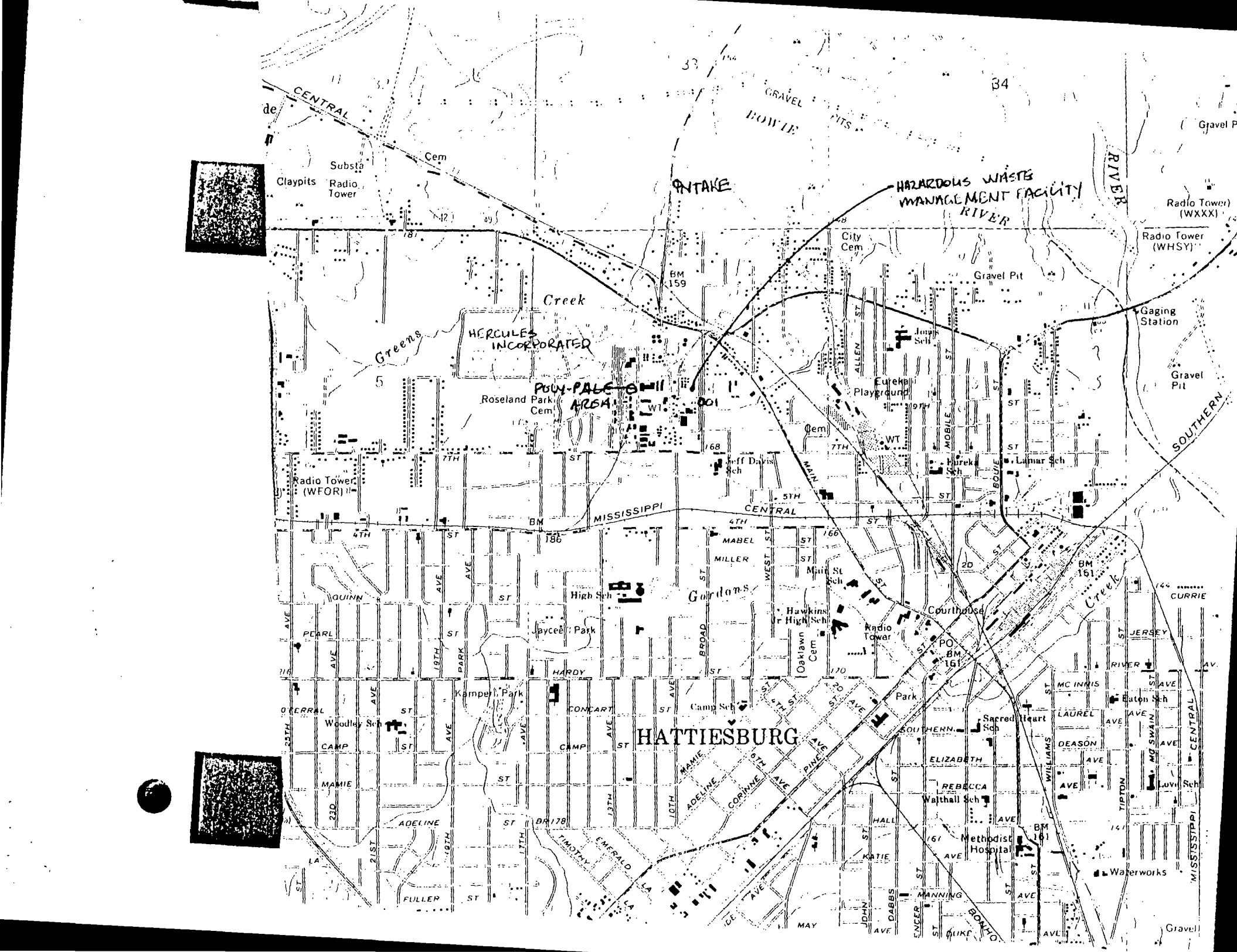
HERCULES INC.

The HATTIESBURG PLANT

Welcomes You!

R. H. HELLER
Plant Manager

REV. 3-79
STANDARD—HATTIESBURG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Creek
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HERCULES INCORPORATED
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Roseland Park Cem
Gaging Station
Gravel Pit
SOUTHERN
Eureka Playground
Jones Sch
Eureka Sch
Lamar Sch
Jeff Davis Sch
Radio Tower (WFOR)
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ALLEN
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Gordons
Hawkins Jr High Sch
Courthouse
Radio Tower
PO
BM 161
Oaklawn Cem
Jaycee Park
Kamper Park
Woodley Sch
Camp Sch
HATTIESBURG
Park
Sacred Heart Sch
Eaton Sch
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CONCART
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TIPTON
MC SWAIN
JERSEY
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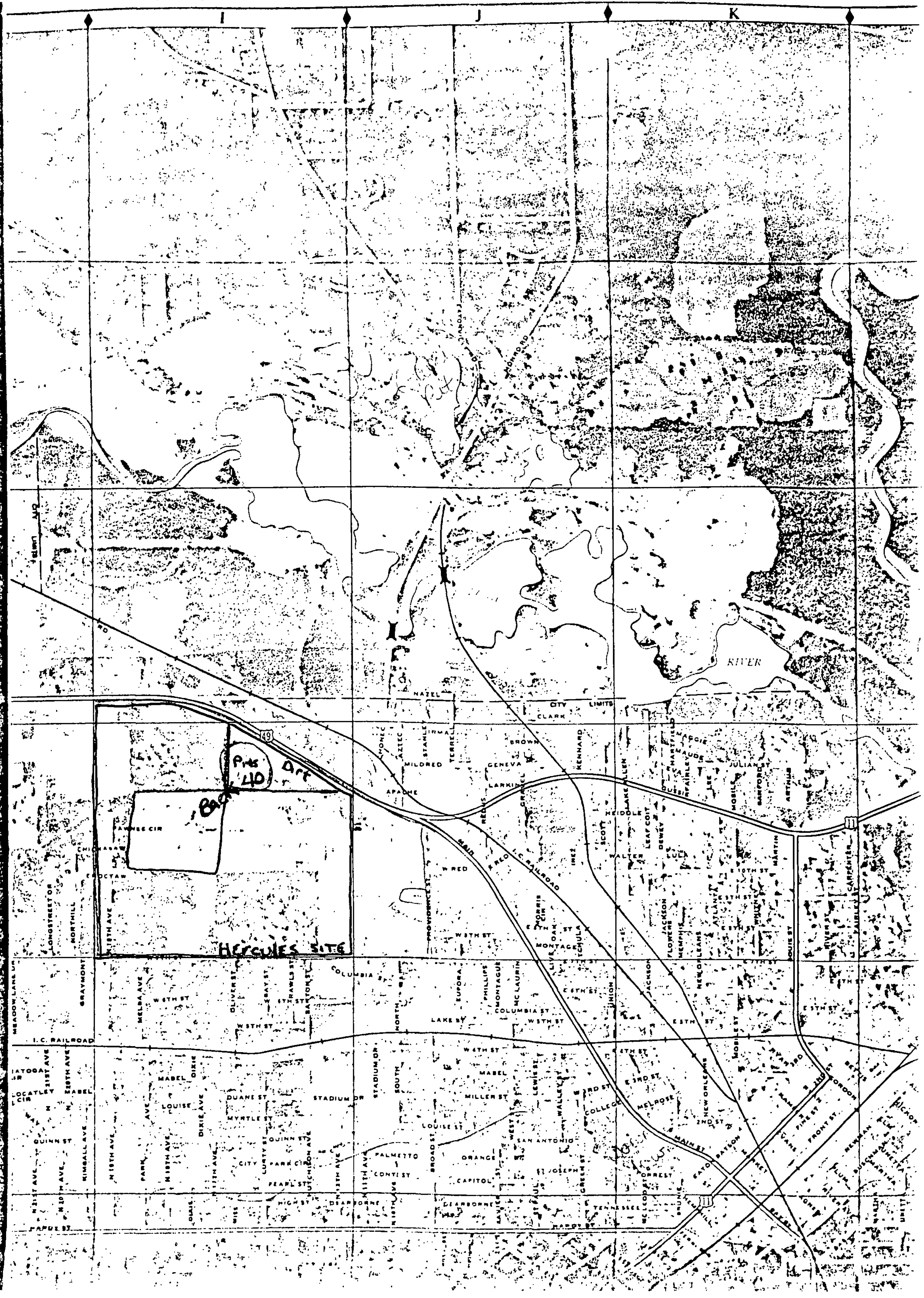
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LARKIN
KENNARD
HEIDDLE
WALTER
JULIAN ST
MAUDE
PAWNEE CIR
CHICKASAW
CHOCTAW
Pits '40
Back Dirt
HERCULES SITE
MAIN
I.C. RAILROAD
COLUMBIA ST
LAKE ST
MABEL
LOUISE
DUANE ST
STADIUM DR
MYRTLE ST
QUINN ST
MILLER ST
SAN ANTONIO
PALMETTO
ORANGE
CAPITOL
FORREST
MELROSE
MAIN ST
DEARBORNE
HIGH ST
PEARL ST
TENNESSEE
HARDY ST
FRONT ST
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11

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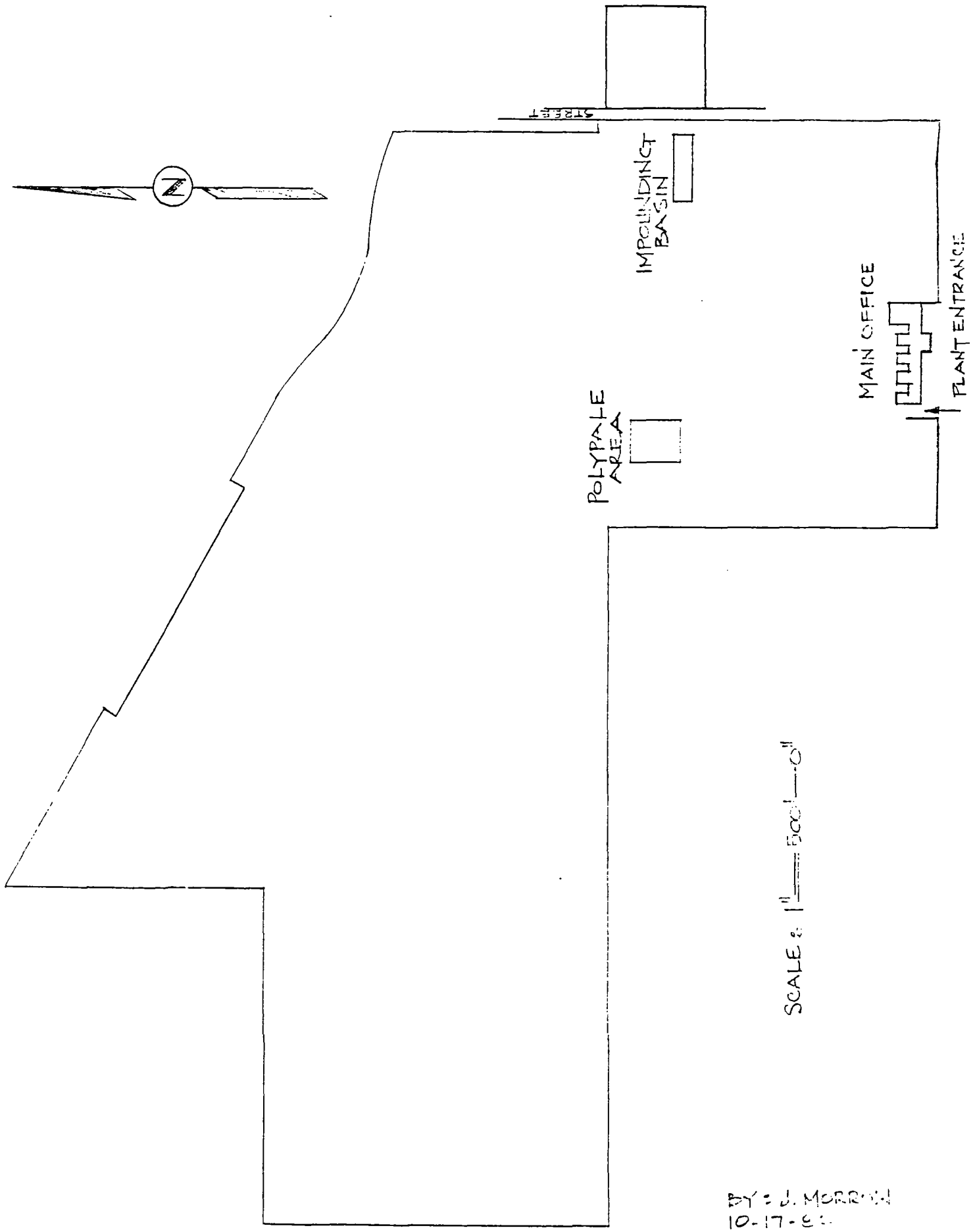
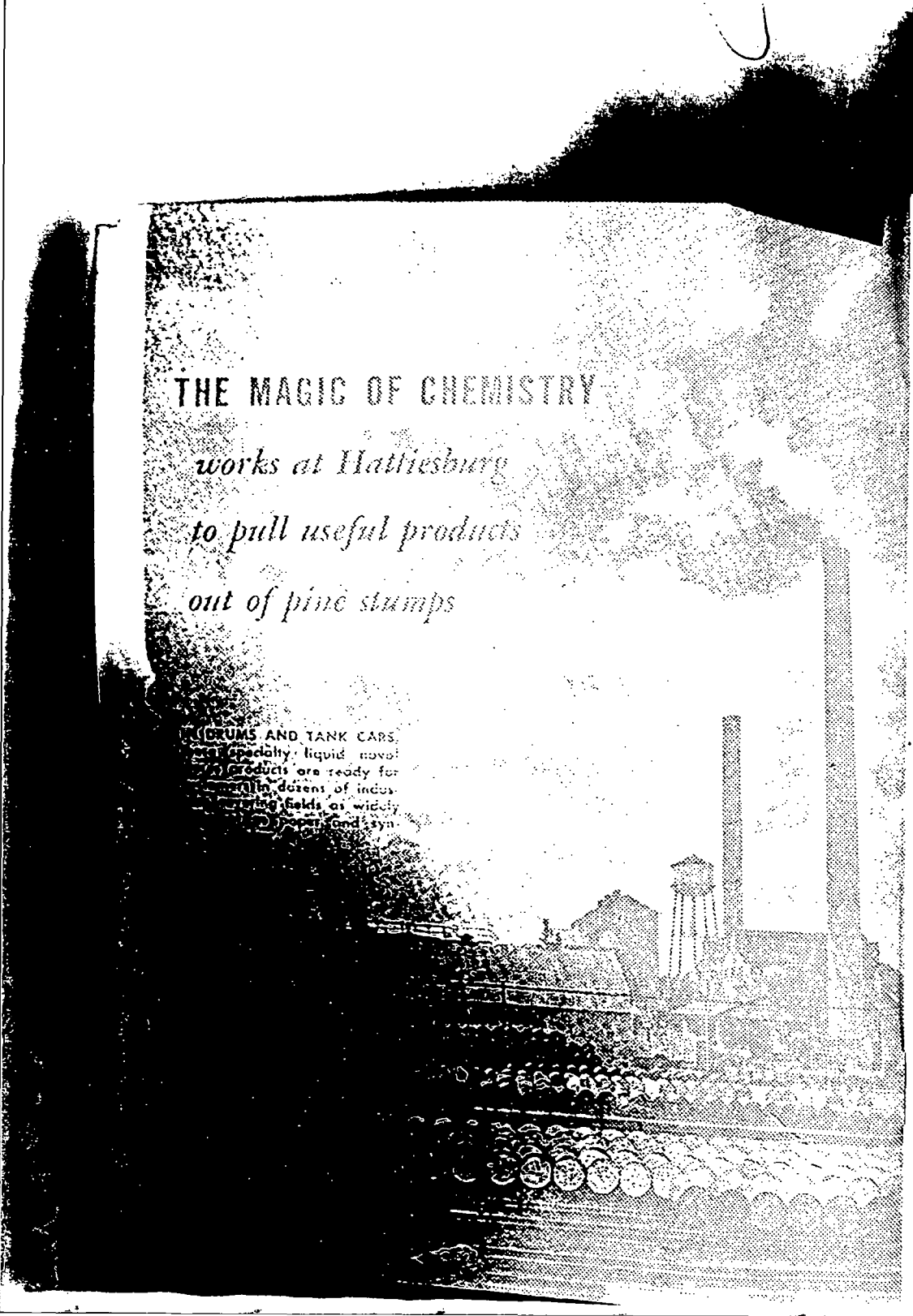
Form Approved OMB No. 158-S80004

V. FACILITY DRAWING *(see page 4)*



HERCULES POWDER COMPANY
HATTIESBURG
PLANT



The stumps of the long-leaf pine, left in the ground after the trees have been cut down for lumber, contain valuable resins. At its Hattiesburg, Mississippi plant, Hercules extracts turpentine, pine oil, and rosin from these stumps.

The process is complicated, and the manufacturing equipment necessary costs millions of dollars. The chemical knowhow needed to do the job was acquired through Hercules' nearly forty years of experience in the naval stores business.

The operation begins when tractors with big, forklike fingers snake through the fields and forests of the South to find these stumps and tear them from the soil. The stumps and their roots, hauled to the plant in trucks and railroad cars, are stacked in huge piles or taken directly to the mill. From a storage pit an overhead crane lifts them on to a conveyor where they are washed and carried to the "hog."

The hog is a big grinder with knives sharp as razors, which slash and cut the stumps and roots – with a noise like thunder – into pieces of wood five to ten inches long. From there the wood goes to the shredder.

Sharp-edged hammers on the rims of wheels, rotating a mile a minute, sliver and chip the wood until it is almost as fine as shredded wheat.

The purpose of this cutting and slashing is to make it easier to remove the resin from the wood. In giant extractor tanks, solvents extract the resin from the chips in much the same way that coffee is brewed. The resultant oily mixture and the chemicals made from it are the lifeblood of the naval stores industry.

The naval stores industry produces chemicals for many of the things we use in our daily lives . . . insecticides, rosin for varnishes and paints, turpentine in the familiar Hercules orange-and-black cans, pine oils and chemicals that go into textiles, rubber, paper, adhesives, plastics, and a hundred other uses.

Thousands of Hercules men and women work in this industry, obtaining the chemicals from these resinous stumps. At Hattiesburg and its sister plant at Brunswick, Georgia, 1,800 people are employed, and 500 more work in woods camps around the two plants to supply the hungry hogs and shredders with stumps. A steady stream of stumps comes into Hattiesburg from millions of pine-covered acres in the states of Mississippi, Louisiana, and Alabama.

Hattiesburg operations consist of wood gathering and plant operations. The plant operations can be grouped into three classifications:

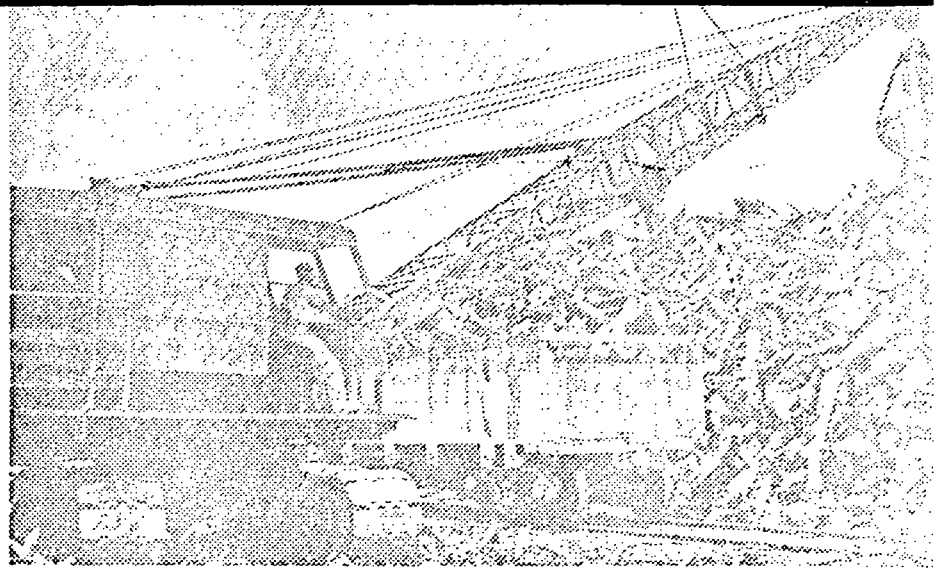
HATTIESBURG naval stores plant where nearly a thousand Herculites work with millions of dollars worth of equipment. Using the magic of chemistry and the know-how acquired by thirty-five years in the business, they turn Southern pine stumps into valuable products for industry.

Primary – all operating units required to produce rosin, pine oil, and turpentine. This covers wood grinding, shredding, extraction, refining, and distillation of the crude resin.

Secondary – those units that produce specialty products, in most cases using as the main raw material one of the materials produced by the primary operations.

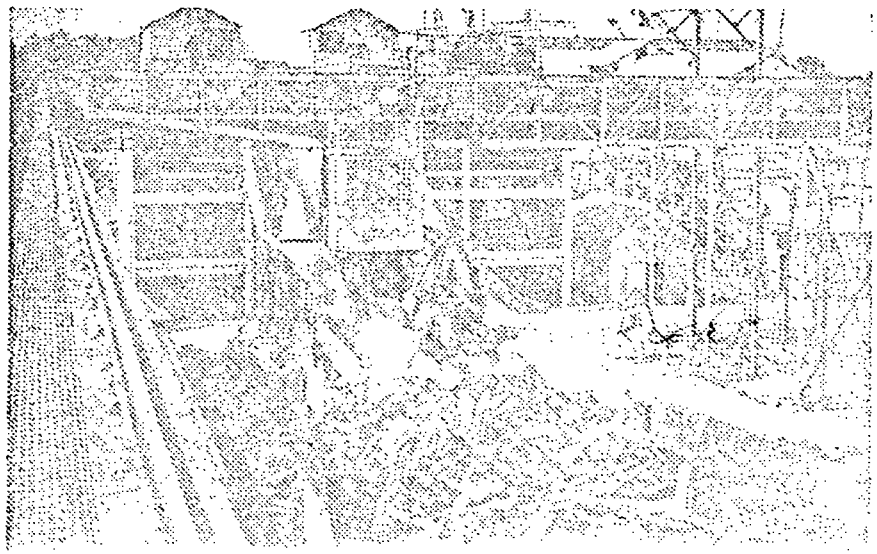
Common facilities – include the office, laboratory, shops, powerhouse, central loading and packaging facilities, and the railroad.

In secondary operations, rosin is processed into special grades; or it is limed, polymerized, hydrogenated, ammoniated, or esterified into chemicals having special properties for industrial uses. Pine oil is the source of anethole and other chemical materials which must meet rigid quality specifications. Turpentine is processed to yield pinene and synthetic pine oil. Dipentene

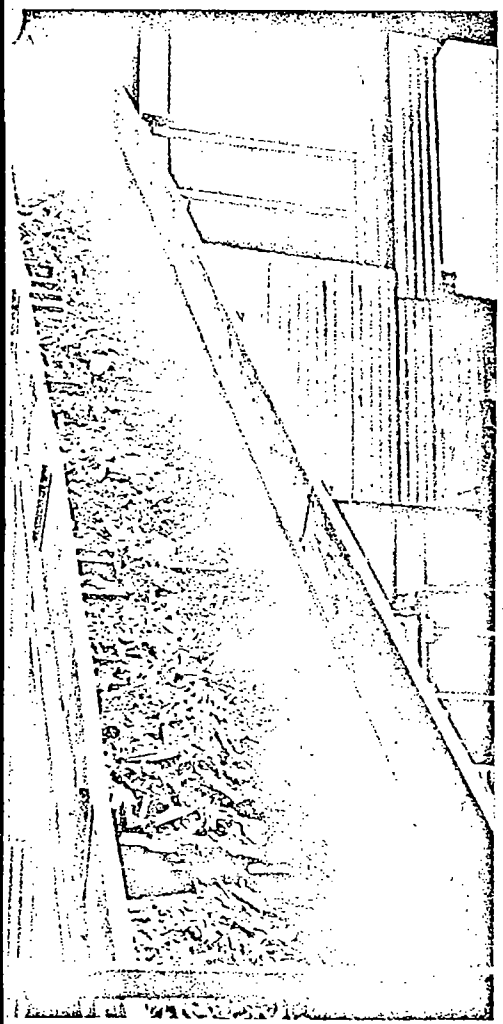


UNLOADING STUMPS from a gondola car to the wood storage pile is the job of this huge crane operated by Barney Sullivan. In addition to the stumps brought in by rail, some 300 tons are trucked in daily, five days a week, for the plant which operates 24 hours a day and to stock this over-size wood pile, covering about 80 acres and holding three to four months' supply.

THE STUMP PIT contains food for the hogs which are huge revolving V-shaped spools covered with rows of heavy knives which tear the stumps apart. The pit, about a quarter full in this picture, holds 600 tons of wood. Here an operator, in the little house slung under the bridge of the crane, picks up a load to be dropped into the conveyor hopper on its way to the hogs above.



THE HOG has ground up the stumps into pieces about five to ten inches long. Here they are carried on the conveyor to the shredder house to be ground still finer. The shredders, a series of wheels with square-cornered hammers, pound and chip the wood.



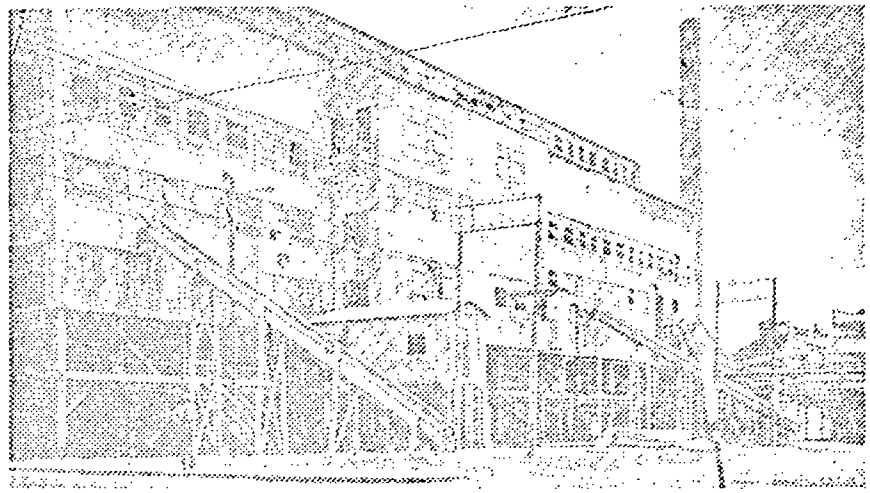
and Solvenol® are processed into para-cymene, para-menthane-hydroperoxide, para-cresol, acetone, and other high-quality products.

The plant operates twenty-four hours a day, with the exception of the railroad, millroom, and Truline® plant, which work sixteen hours a day; the mechanical department and shipping crews work eight hours a day, five days a week.

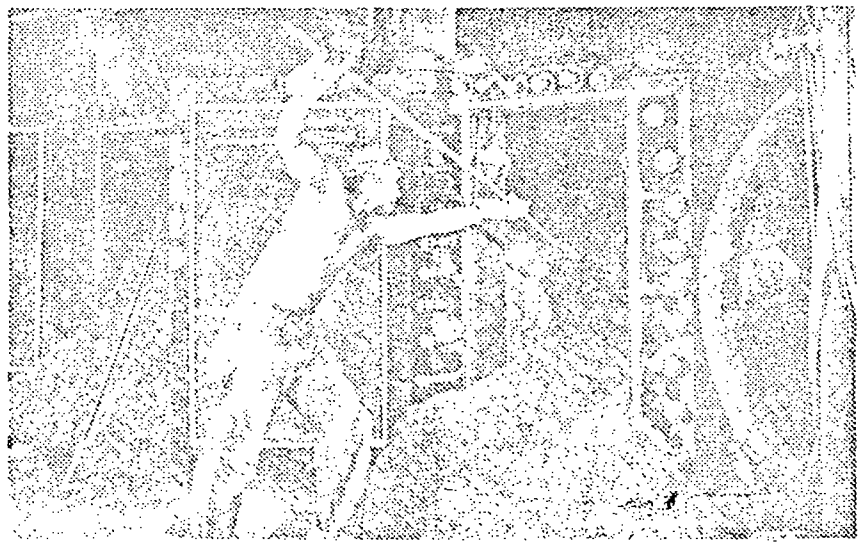
The cutting and slashing of the giant knives of the hogs and the shredders bring forth a stream of chips for the extractors and stills which remove the resins, separate the resins into many different products, and process them for the industries of the world.

The fine chips go from the chip bin to the extractor house by conveyor. Inside this huge building sixteen steel tanks, each about the size of a farm silo, stand in a row. Into the extractors the conveyor belt dumps about half a carload of chips.

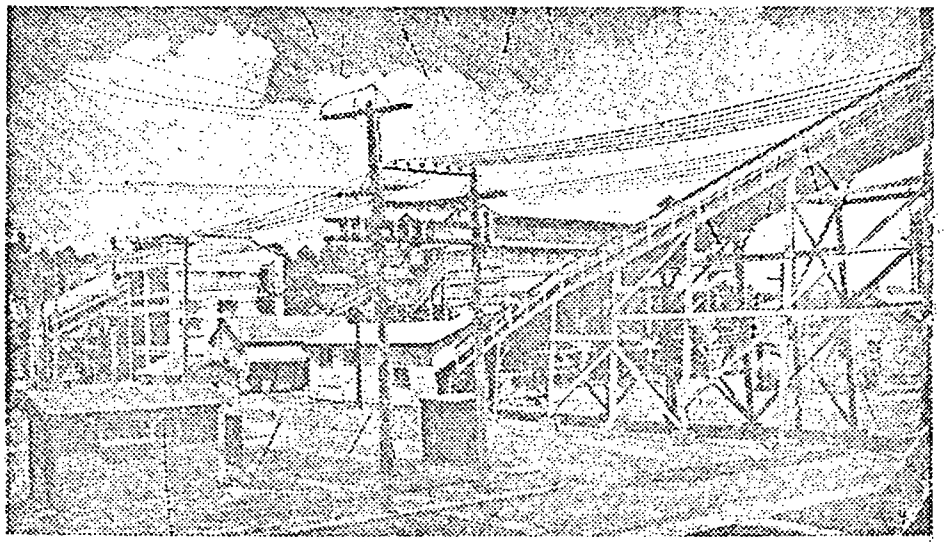
To dissolve the resins, the solvent enters the bottom of the tank and is pumped through the chips – to come off at the top and go on to the bottom of the next tank to repeat the process through ten extractors. The rest of the extractors are needed for solvent recovery, emptying, and refilling. Heat and pressure are used to extract the resin from the chips more thoroughly. The oily mixture of solvent and dissolved resin is drained off to be processed in the refinery. The solvent which remains in the chips is recovered for reuse in the process. Then the spent chips are removed from the extractor

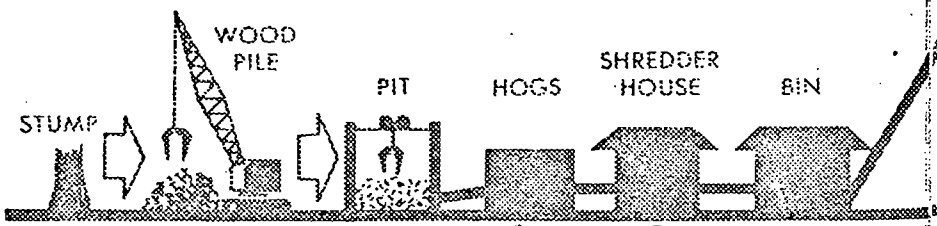


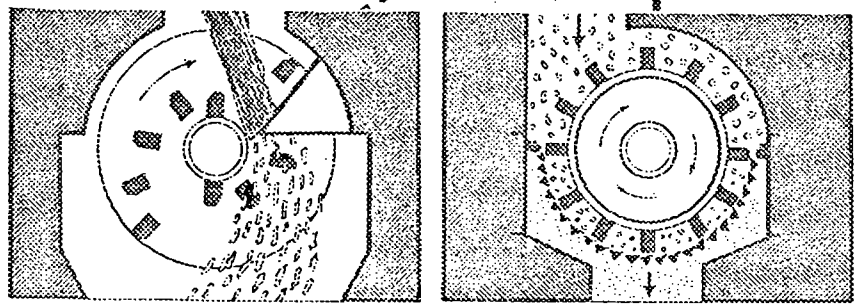
THE EXTRACTOR HOUSE contains a row of sixteen huge steel tanks, called extractors, each about as big as a good size farm silo.

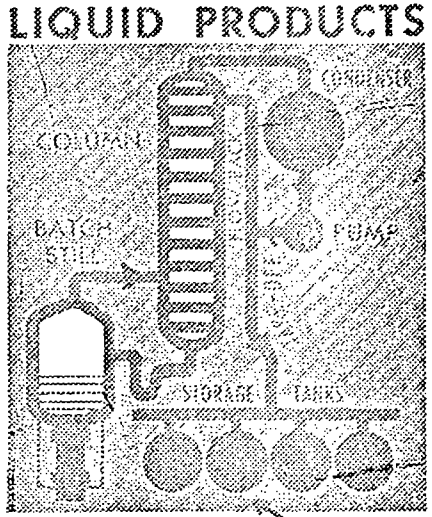


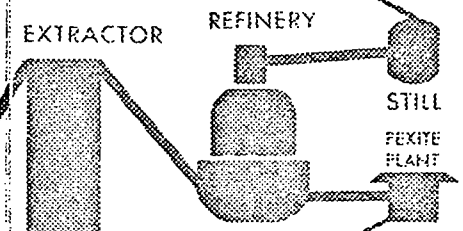
SPENT CHIPS, which have given up their resins in the extracting process, are raked out of the bottom of the extractor to go on their way by conveyor belt to a useful end as fuel for the plant's boilers. Hugh Moore, on the job here, and his fellow extractor pullers work at top speed like this for about an hour in order to empty the extractor. Then the puller has a well-earned rest period before unbolting the huge door of the next extractor.

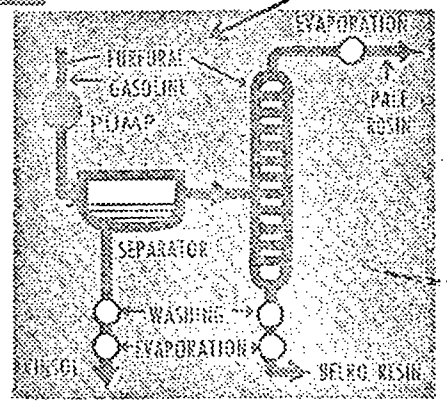












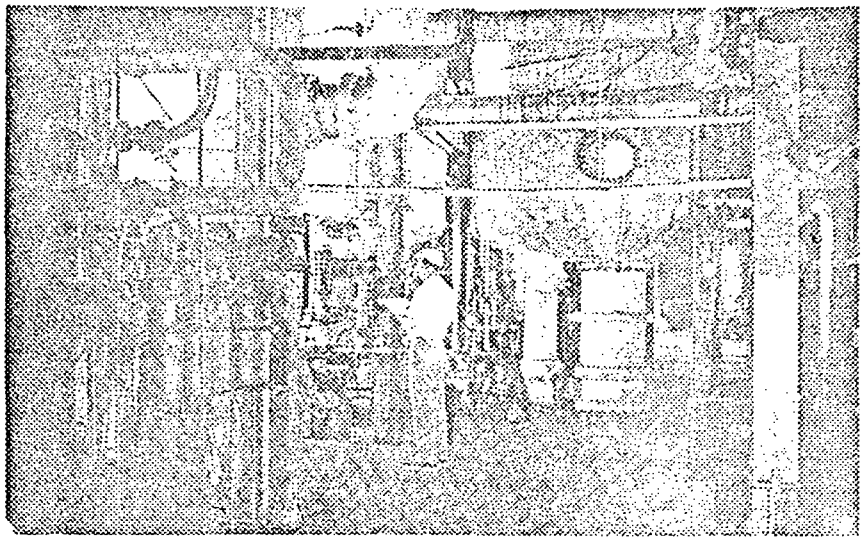
in order to make it ready to repeat the cycle.

In the refinery the solvent content and the turpentine and pine oil are removed by distillation in several evaporators, thus separating them from the crude rosin. This rosin goes to the Pexite plant, where it is refined. The turpentine and pine oil are sent into the stills for further separating ("fractionating" is the term chemists use).

A still is a piece of equipment widely used in chemical operations in which material is placed in a closed tank and heated to boiling. Then the hot vapors that rise are fractionated in a column to obtain a pure vapor, which is condensed into a liquid.

At the Hattiesburg plant and its sister plant at Brunswick, Georgia, are elaborate stills, which are tall towers with an inverted bottlelike tank at the base. The stills fractionate the liquid naval stores products into many different chemical materials, each having properties that fit them to do specific jobs as basic raw materials for industry. The refined liquid naval stores produced in these stills include: turpentine, alpha- and beta-pinene, monocyclic terpenes, pine oil, anethole, and other liquids.

The rosin from the evaporators is refined in the Pexite plant with furfural, a heavy liquid that smells like almonds and is obtained from oat hulls. The rosin, dissolved in gasoline, is washed with the furfural to remove the dark-colored portions, leaving a pale amber-colored rosin in the gasoline. After recovery of the gasoline,



IN THE REFINERY, W. S. Chambliss takes a reading at a distillation unit. Here the solvent and liquid naval stores products, which have been separated from the rosin, are fractionated to remove the solvent from the oils. Millions of dollars worth of equipment, know-how acquired by thirty-five years in the business, highly skilled workers, and constant laboratory check on quality and yield have gained Hercules a leading position in the naval stores industry.

the pale rosin is sold in drums and tank cars. Some of it is used in the plant to make other products like Poly-pale,® Staybelite,® and Resin 731.* The dark rosin is used to make Vinsol® and Truline® binder.

Today Hercules' naval stores products are many and varied, tailored to do specific jobs in hundreds of industries. These myriad products have been developed through the years by the ingenuity of chemists from three primary naval stores products — rosin, turpentine, and pine oil, which back in the early twenties were the only products of the industry.

Many skills and many tasks are needed to operate the Hercules naval stores plant at Hattiesburg. Yet this process could not stand by itself, and the operators alone could not make the plant run for long without the help of a large company of men and women who perform the plant services.

The service facilities, such as transportation by railroad and truck, the laboratory, and the office staff are all vital to the efficient operation of the Hattiesburg naval stores plant.

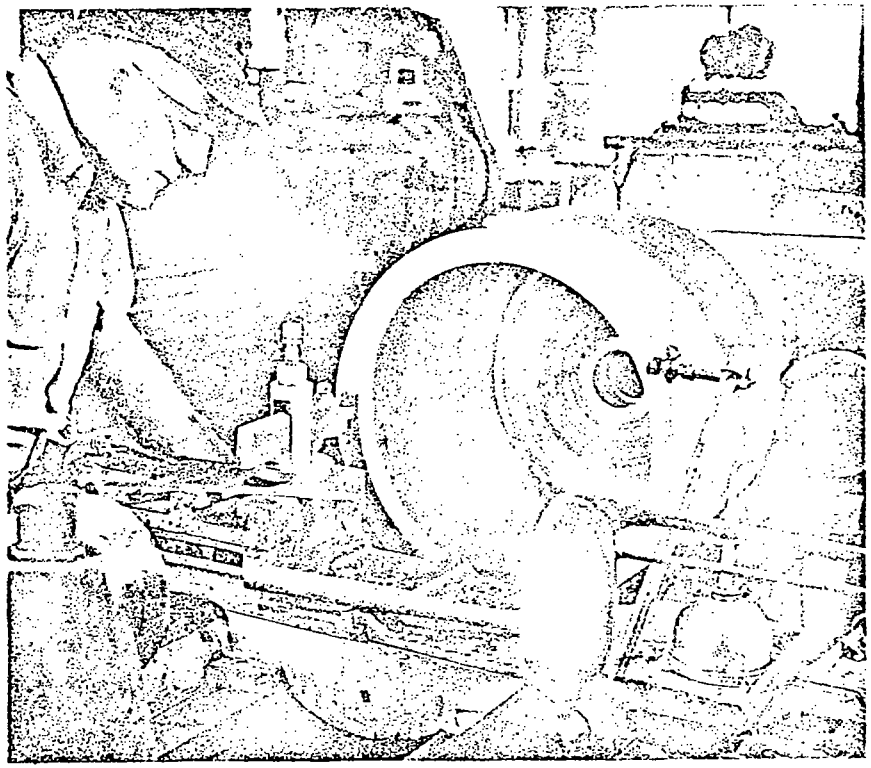
The office performs a variety of services for the plant. All payroll, accounting, purchasing, engineering, stenographic, and personnel work is carried on by eighty-four men and women in this group. They get the orders from our salesmen and pass them on to the plant so that the right products will be produced in the right quantities to fill our customers' demands.

Safety is an important part of this staff's work. A safety committee which meets once a month, a roving safety committee which spots hazardous conditions in the plant and corrects them, and plant foremen who insist on safe methods for their crews all work with the Personnel and Safety Departments located in the plant office.

The machine shop and maintenance crew are the builders and trouble-shooters of the plant. These 237 men — carpenters, pipefitters, pipe insulators, electricians, painters, welders, foundrymen, and other skilled workers — build and equip new buildings. They either make the equipment that goes inside or install tanks and reactors that we buy to equip the plant.

When something springs a leak or a pump won't work, it is a maintenance man who puts it back in shape again.

Another specialized group that helps



IN THE MACHINE SHOP, Dan Blocker faces off the end of a casting for the overhead crane, which lifts the stump wood onto the conveyor to the hog.

*Hercules Trademark

RECEPTIONIST AND TELEPHONE OPERATOR
Mattie J. Odom welcomes plant visitors W. R. Shannon and A. H. Gallagher of the General Electric Company.

to run the plant is the laboratory. These eighty-nine men and women are the checkers for the operators; they tell the plant men how they are doing. They analyze chemical materials we buy to make sure that they are what we want, and they analyze all finished products to make certain that the quality is up to the standards we guarantee our customers.

Chemical research is carried on to see if better ways of making our products can be found, or if new products can be made from the resins or oils.

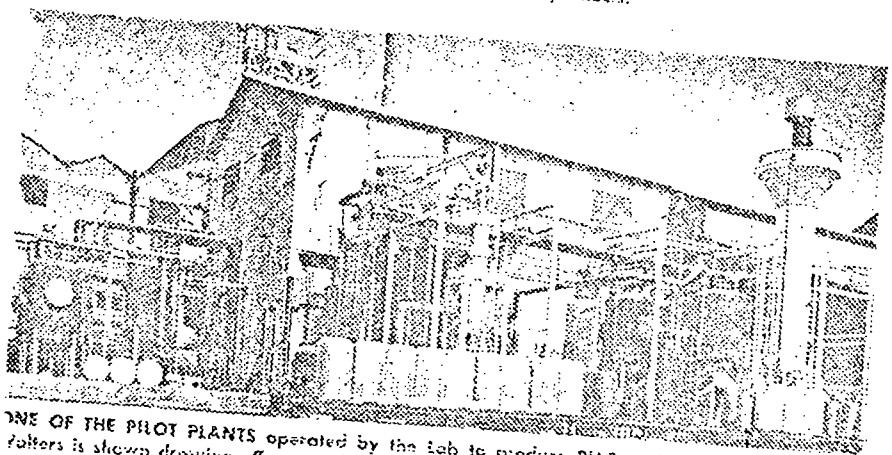
The three pilot plants at Hattiesburg are run by the laboratory. One is a hydrogenation high pressure plant; another is a pilot plant for Dresinate,® operated for the Paper Makers Chemical Department; and a third is kept busy on various sorts of research work.

A small railroad with a diesel locomotive and two smaller engines is used to shift nearly a thousand cars from place to place within the plant every month. Almost as many highway trucks enter and leave the plant. Cars and trucks haul stump wood into the plant; and finished drums of rosin, turpentine, and other products start out on their way to the customers.

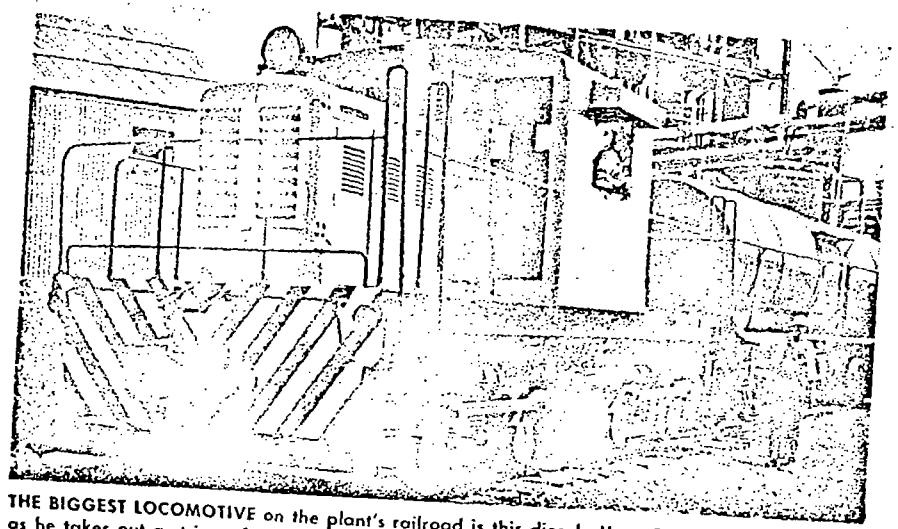
Four of the yard trucks are equipped with two-way radio, so that they can be dispatched to any point and directed about the plant.

The Hercules Hattiesburg plant is

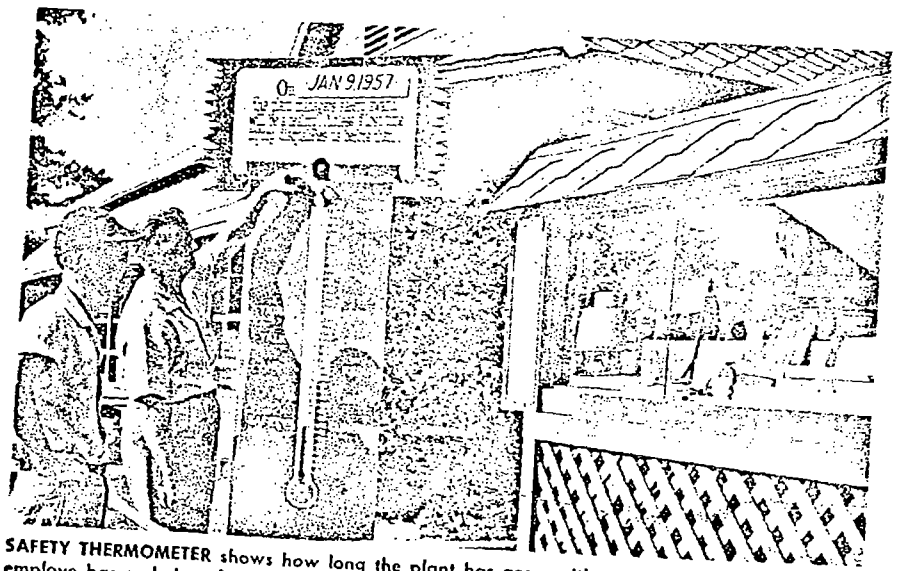
FINISHED PRODUCTS are analyzed in the laboratory. Here Katheryn N. McNeese, analyst, uses the thermometer drop method to determine the softening point of rosin. The temperature at which rosin begins to soften is important to users of our products.



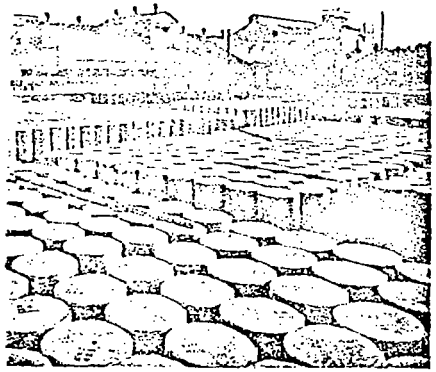
ONE OF THE PILOT PLANTS operated by the lab to produce PMC rubber chemicals. Charles Walters is shown drawing off a sample of Dresinate 5.



THE BIGGEST LOCOMOTIVE on the plant's railroad is this diesel. Here, D. H. Widdon, engineer, as he takes out a string of tank cars pauses to talk with Earlie Hudnall, signalman. Two other locomotives are "fireless cookers" — they get a charge of steam from the powerhouse which keeps them running for about a half day.



SAFETY THERMOMETER shows how long the plant has gone without a lost-time accident. Each employe has a choice of plant manager's prizes, shown in the window, after 270 accident-free days. E. L. Summers, safety supervisor, puts some red ink in the thermometer to mark another week without an accident. Lawrence O'Flynn, concrete finisher, looks at the prizes.



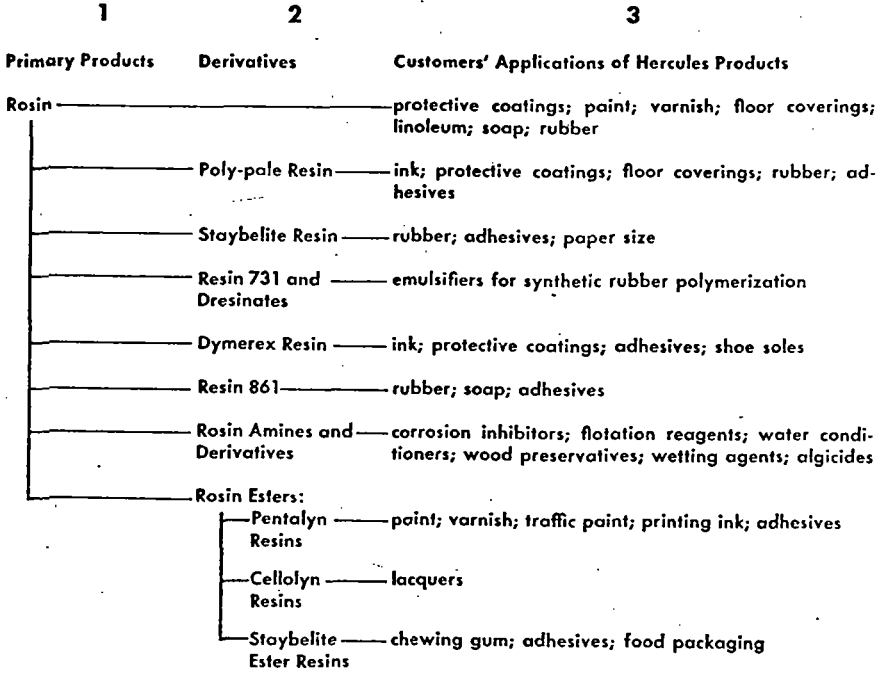
DRUMS OF ROSIN, made by the magic of chemistry from the resins in stump wood, are ready for shipment to naval stores customers in many industries all over the world.

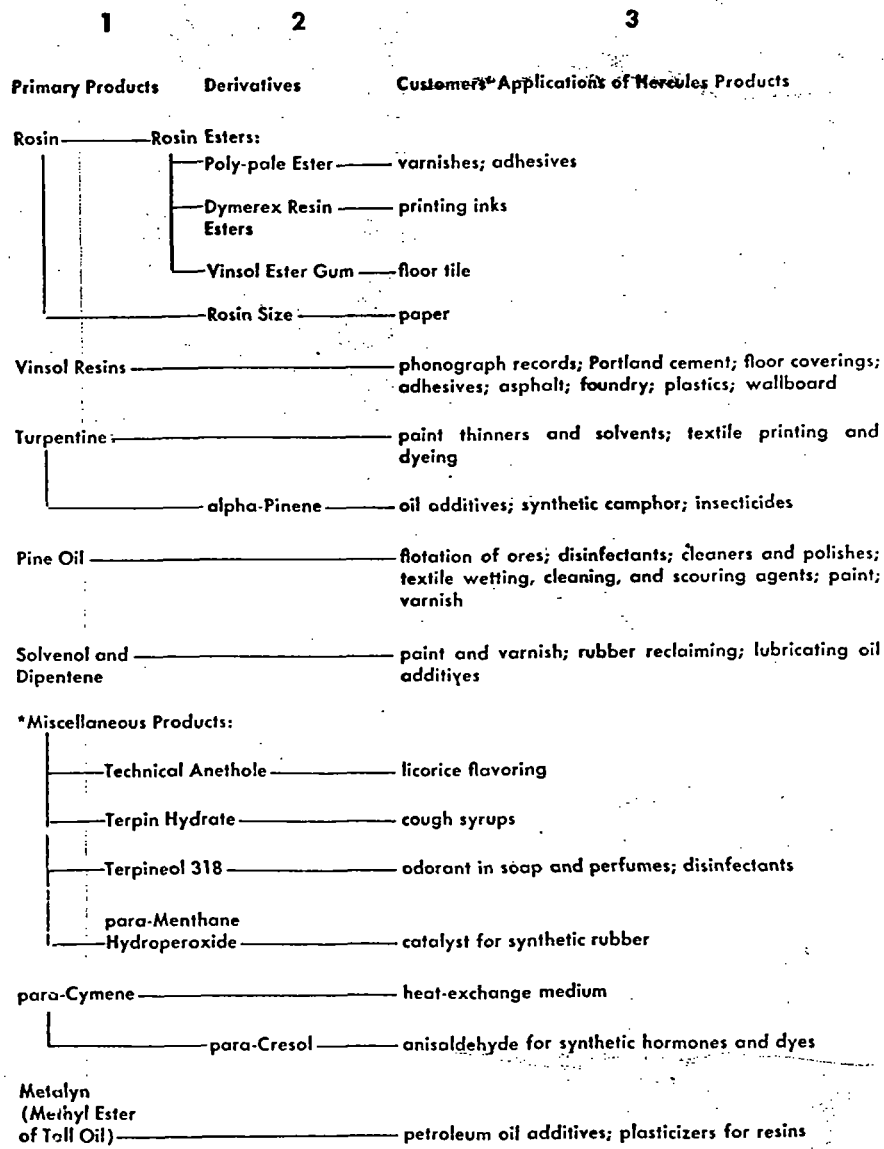
one of the company's two naval stores plants in southeastern United States; a sister plant is located at Brunswick, Georgia. A Paper Makers Chemical Department plant at Savannah, Georgia, produces paper size and other paper chemicals, tall oil rosin, and tall oil fatty acids. At Bessemer, Alabama, Hercules makes dynamite and acid. Sales offices are located in the South at Atlanta, Georgia; Beaumont, Texas; Birmingham, Alabama; Brownsville, Dallas, and Houston, Texas; Greenville, Mississippi; New Orleans, Louisiana; and Raleigh, North Carolina. A map on the back cover shows the location of all Hercules plants and offices in the United States.

STUMPING OPERATIONS carried on throughout the South yield land values as well as naval stores chemicals. This typical field of stumps is of little value for forestry or agriculture. Stump-gathering operations will clear the land, churn the soil, and leave it suitable for crops, cattle grazing, or much more productive second-growth timber.

The products derived from the crude extract obtained from the pine stump flow out into a diverse tree of chemicals almost as wondrous as the pine which once grew where the stump was found. The oily crude extract is separated into the three primary products: rosin, turpentine, and pine oil, plus several miscellaneous chemicals. From these, an array of esters, resins, and other specialized chemicals are produced by the plant to meet more precisely the needs of Hercules customers, most of whom are manufacturers of a wealth of consumer products.

The chart below shows: (1) the primary products coming from the crude extract, (2) the products derived from them by Hercules, and (3) the end uses for which the customer buys our products.





*Most of these products are in the technical form, and some are further purified or compounded before being used in food and drugs.

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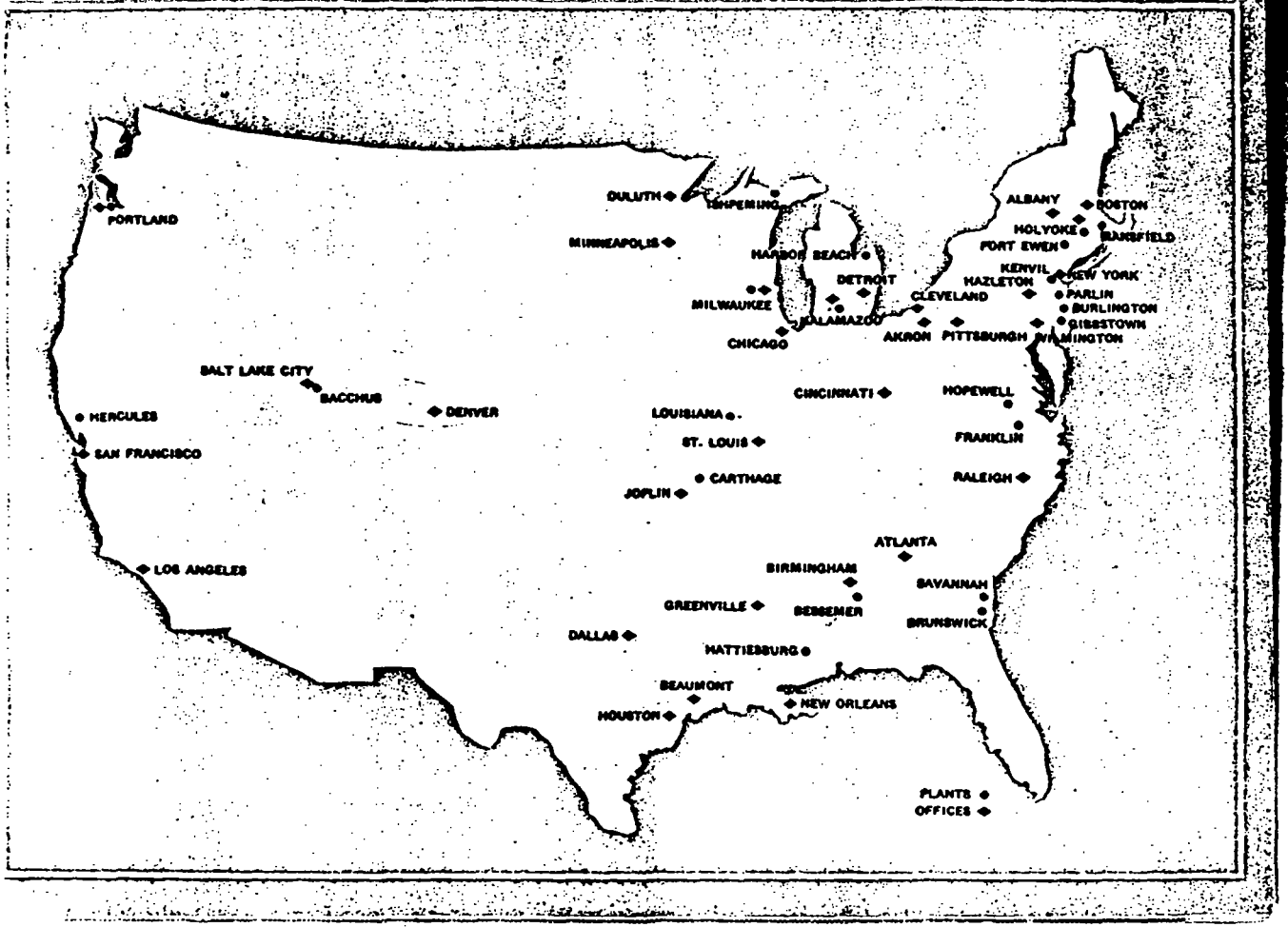
DULUTH
ISHPEMING
PORTLAND
MINNEAPOLIS
HARBOR BEACH
DETROIT
MILWAUKEE
KALAMAZOO
CHICAGO
CLEVELAND
AKRON
PITTSBURGH
ALBANY
BOSTON
HOLYOKE
BARRSFIELD
FORT EWEN
KENVIL
HAZLETON
NEW YORK
PARLIN
BURLINGTON
GIBBSTOWN
WILMINGTON
SALT LAKE CITY
BACCHUS
DENVER
HERCULES
SAN FRANCISCO
LOUISIANA
ST. LOUIS
CARTHAGE
JOPLIN
CINCINNATI
HOPEWELL
FRANKLIN
RALEIGH
ATLANTA
LOS ANGELES
BIRMINGHAM
BESSEMER
GREENVILLE
SAVANNAH
BRUNSWICK
DALLAS
HATTIESBURG
BEAUMONT
HOUSTON
NEW ORLEANS
PLANTS
OFFICES

12

Data Sheet Report Summary
Mississippi State Department of Health
Division of Water Supply

PWS ID	Name of System	Wells	Connections	Consecutive
0160008	SOUTHSIDE WATER ASSOCIATION	0	40	Y
0160009	SOUTHWEST COVINGTON W/A	2	785	N
0160010	WILLOW GROVE WATER ASSN	2	550	N
0160011	NORTH COVINGTON W/A-SOUTH	1	629	N
** County Code: 17				
0170001	BELMONT WATER ASSOCIATION	2	381	N
0170002	BRIGHT'S WATER ASSOCIATION	2	483	N
0170005	DAYS WATER ASSOCIATION	2	478	N
0170006	EUDORA WATER ASSOCIATION	2	238	N
0170007	CITY OF OLIVE BRANCH-FAIRHAVEN	2	30	N
0170009	TOWN OF HERNANDO	3	1035	N
0170010	HORN LAKE WATER ASSOCIATION	3	769	N
0170011	LEWISBURG WATER ASSOCIATION	2	625	N
0170012	NORTH MS UTILITIES-MAYWOOD	1	200	N
0170013	MINERAL WELLS	3	45	N
0170014	NESBIT WATER ASSOCIATION	2	423	N
0170015	CITY OF OLIVE BRANCH	6	724	N
0170016	PLEASANT HILL WATER ASSN	3	768	N
0170017	PLUM POINT WATER ASSOCIATION	2	468	N
0170018	SOUTHAVEN W/A	5	5723	N
0170019	WALLS WATER ASSOCIATION	1	216	N
0170020	NORTH MS UTILITIES-BUENA VISTA	2	170	N
0170021	COUNTRY MANOR MOBILE HOME PARK	1	55	N
0170022	CITY OF HORN LAKE UTILITY	3	2026	N
0170023	METRO DESOTO UTILITY COMPANY	2	32	N
0170024	DESOTO UTILITY-N HOLLY HILLS	2	213	N
0170025	DESOTO UTILITY-S TWIN LAKES	2	714	N
0170026	SKYLANE MOBILE HOME PARK	2	90	N
0170027	COUNTRY HAVEN MOBILE HOME PARK	1	103	N
0170028	NORTH MS UTILITIES-CHICK BLUFF	2	175	N
0170029	N. MS UTILITIES-LAKE O'HILLS	2	206	N
0170031	MAGNOLIA HILLS MHP	2	80	N
0170032	N MS UTILITIES-BRIDGETOWN	1	161	N
0170033	KOKO REEF WATER CO	2	50	N
0170034	HILLTOP MOBILE HOME PARK	2	38	N
0170035	SMOKEY HOLLOW WATER ASSN	2	40	N
0170043	WALLS WATER ASSN- LAKE FOREST	2	982	N
0170048	CITY OF OLIVE BRANCH-FAIRHAVEN	1	240	N
** County Code: 18				
0180001	BARRONTOWN W/A	3	1016	N
0180003	CARNES WATER ASSOCIATION	2	170	N
0180004	CENTRAL WATER ASSOCIATION	2	325	N
0180005	DIXIE COMMUNITY UTILITY ASSN.	3	882	N
0180006	EASTABUCHIE WATER ASSOCIATION	2	315	N
0180007	GLENDALE UTILITY DISTRICT	2	1090	N
0180008	CITY OF HATTIESBURG	10	14500	N
0180009	MCLAURIN WATER ASSOCIATION	2	165	N

13

Please print or type in the unshaded areas only
(fill—in areas are spaced for elite type, i.e., 12 characters/inch).

Form Approved OMB No. 158-R0175

FORM 1 GENERAL

U.S. ENVIRONMENTAL PROTECTION AGENCY

GENERAL INFORMATION

Consolidated Permits Program

(Read the "General Instructions" before starting.)

I. EPA I.D. NUMBER

F	M	S	D	0	0	8	1	8	2	0	8	1		

GENERAL INSTRUCTIONS

If a preprinted label has been provided, affix it in the designated space. Review the information carefully; if any of it is incorrect, cross through it and enter the correct data in the appropriate fill—in area below. Also, if any of the preprinted data is absent *(the area to the left of the label space lists the information that should appear)*, please provide it in the proper fill—in area(s) below. If the label is complete and correct, you need not complete Items I, III, V, and VI *(except VI-B which must be completed regardless)*. Complete all items if no label has been provided. Refer to the instructions for detailed item descriptions and for the legal authorizations under which this data is collected.

LABEL ITEMS

I. EPA I.D. NUMBER: MSD008182081

III. FACILITY NAME: HERCULES INCORPORATED

V. FACILITY MAILING ADDRESS: PO BOX ~~1552~~ 1937, HATTIESBURG, MS 39401

VI. FACILITY LOCATION: W SEVENTH ST, HATTIESBURG, MS 39401

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II. POLLUTANT CHARACTERISTICS

INSTRUCTIONS: Complete A through J to determine whether you need to submit any permit application forms to the EPA. If you answer "yes" to any questions, you must submit this form and the supplemental form listed in the parenthesis following the question. Mark "X" in the box in the third column if the supplemental form is attached. If you answer "no" to each question, you need not submit any of these forms. You may answer "no" if your activity is excluded from permit requirements; see Section C of the instructions. See also, Section D of the instructions for definitions of bold—faced terms.

SPECIFIC QUESTIONS	MARK 'X' YES	NO	FORM ATTACHED	SPECIFIC QUESTIONS	MARK 'X' YES	NO	FORM ATTACHED
A. Is this facility a **publicly owned treatment works** which results in a **discharge** to **waters of the U.S.**? (FORM 2A)		X		B. Does or will this facility *(either existing or proposed)* include a **concentrated animal feeding operation** or **aquatic animal production facility** which results in a **discharge** to **waters of the U.S.**? (FORM 2B)		X	
C. Is this a facility which currently results in **discharges** to **waters of the U.S.** other than those described in A or B above? (FORM 2C)	X			D. Is this a proposed facility *(other than those described in A or B above)* which will result in a **discharge** to **waters of the U.S.**? (FORM 2D)		X	
E. Does or will this facility treat, store, or dispose of **hazardous wastes**? (FORM 3)	X		X	F. Do you or will you inject at this facility industrial or municipal effluent below the lowermost stratum containing, within one quarter mile of the well bore, underground sources of drinking water? (FORM 4)		X	
G. Do you or will you inject at this facility any produced water or other fluids which are brought to the surface in connection with conventional oil or natural gas production, inject fluids used for enhanced recovery of oil or natural gas, or inject fluids for storage of liquid hydrocarbons? (FORM 4)		X		H. Do you or will you inject at this facility fluids for special processes such as mining of sulfur by the Frasch process, solution mining of minerals, in situ combustion of fossil fuel, or recovery of geothermal energy? (FORM 4)		X	
I. Is this facility a proposed **stationary source** which is one of the 28 industrial categories listed in the instructions and which will potentially emit 100 tons per year of any air pollutant regulated under the Clean Air Act and may affect or be located in an attainment area? (FORM 5)		X		J. Is this facility a proposed **stationary source** which is NOT one of the 28 industrial categories listed in the instructions and which will potentially emit 250 tons per year of any air pollutant regulated under the Clean Air Act and may affect or be located in an attainment area? (FORM 5)		X	

III. NAME OF FACILITY

1 SKIP: HERCULES INCORPORATED

IV. FACILITY CONTACT

A. NAME & TITLE *(last, first, & title)*	B. PHONE *(area code & no.)*
2 THOMS T.E. DEVELOPMENT SUPV.	601 545 3450

V. FACILITY MAILING ADDRESS

A. STREET OR P.O. BOX			
3 PO BOX 1937			
B. CITY OR TOWN	**C. STATE**	**D. ZIP CODE**	
4 HATTIESBURG	MS	39401	

VI. FACILITY LOCATION

A. STREET, ROUTE NO. OR OTHER SPECIFIC IDENTIFIER			
5 WEST 7TH STREET			
B. COUNTY NAME			
FORREST			
C. CITY OR TOWN	**D. STATE**	**E. ZIP CODE**	**F. COUNTY CODE** *(if known)*
6 HATTIESBURG	MS	39401	

CONTINUED FROM THE FRONT

VII. SIC CODES (4-digit, in order of priority)

A. FIRST	B. SECOND
(specify) 2861 Gum and wood chemicals	(specify) 2821 Synthetic resins
C. THIRD	**D. FOURTH**
(specify) 2822 Synthetic rubber	(specify) 2879 Pesticides & Agricultural Chemica

VIII. OPERATOR INFORMATION

A. NAME

HERCULES INCORPORATED

B. Is the name listed in Item VIII-A also the owner? ☒ YES ☐ NO

C. STATUS OF OPERATOR (Enter the appropriate letter into the answer box; if "Other", specify.)

F = FEDERAL; S = STATE; P = PRIVATE; M = PUBLIC (other than federal or state); O = OTHER (specify)

P (specify) Private

D. PHONE (area code & no.) A 601 545 3450

E. STREET OR P.O. BOX

P O BOX 1937

F. CITY OR TOWN	G. STATE	H. ZIP CODE
HATTIESBURG	MS	39401

IX. INDIAN LAND

Is the facility located on Indian lands? ☐ YES ☒ NO

X. EXISTING ENVIRONMENTAL PERMITS

A. NPDES (Discharges to Surface Water) 9 N MS0001830	**D. PSD** (Air Emissions from Proposed Sources) 9 P NA
B. UIC (Underground Injection of Fluids) 9 U NA	**E. OTHER** (specify) 9 0800-00001 (specify) Air Permit
C. RCRA (Hazardous Wastes) 9 R NA	**E. OTHER** (specify) 9 NA (specify) NA

XI. MAP

Attach to this application a topographic map of the area extending to at least one mile beyond property bounderies. The map must show the outline of the facility, the location of each of its existing and proposed intake and discharge structures, each of its hazardous waste treatment, storage, or disposal facilities, and each well where it injects fluids underground. Include all springs, rivers and other surface water bodies in the map area. See instructions for precise requirements. (See attached)

XII. NATURE OF BUSINESS (provide a brief description)

Manufacture of wood naval stores products; rosin, turpentine and pine oil. Manufacture modified resins, polyamides, Ketene dimer, wax emulsions, synthetic rubber, and an agricultural pesticide. Also, crude tall oil and pulp mill liquid refining, rosin, fatty acids, and terpene derivatives.

XIII. CERTIFICATION (see instructions)

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this application and all attachments and that, based on my inquiry of those persons immediately responsible for obtaining the information contained in the application, I believe that the information is true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

A. NAME & OFFICIAL TITLE (type or print)	B. SIGNATURE	C. DATE SIGNED
D. H. Little Vice President - Production		Nov. 18. 1980

COMMENTS FOR OFFICIAL USE ONLY

C

Please print or type in the unshaded areas only
(fill-in areas are spaced for elite type, i.e., 12 chara... /inch).

Form Approved OMB No. 158-S80004

FORM 3 RCRA

U.S. ENVIRONMENTAL PROTECTION AGENCY

HAZARDOUS WASTE PERMIT APPLICATION

Consolidated Permits Program

(This information is required under Section 3005 of RCRA.)

I. EPA I.D. NUMBER: F M S D 0 0 8 1 8 2 0 8 1

FOR OFFICIAL USE ONLY

APPLICATION APPROVED	DATE RECEIVED (yr., mo., & day)	COMMENTS

II. FIRST OR REVISED APPLICATION

Place an "X" in the appropriate box in A or B below *(mark one box only)* to indicate whether this is the first application you are submitting for your facility or a revised application. If this is your first application and you already know your facility's EPA I.D. Number, or if this is a revised application, enter your facility's EPA I.D. Number in Item I above.

A. FIRST APPLICATION *(place an "X" below and provide the appropriate date)*

[X] 1. EXISTING FACILITY *(See instructions for definition of "existing" facility. Complete item below.)*

FOR EXISTING FACILITIES, PROVIDE THE DATE *(yr., mo., & day)* OPERATION BEGAN OR THE DATE CONSTRUCTION COMMENCED *(use the boxes to the left)*: YR. 82, MO. 03, DAY 20

[ ] 2. NEW FACILITY *(Complete item below.)*

FOR NEW FACILITIES PROVIDE THE DATE *(yr., mo., & day)* OPERATION BEGAN OR IS EXPECTED TO BEGIN: YR. , MO. , DAY

B. REVISED APPLICATION *(place an "X" below and complete Item I above)*

[ ] 1. FACILITY HAS INTERIM STATUS

[ ] 2. FACILITY HAS A RCRA PERMIT

III. PROCESSES – CODES AND DESIGN CAPACITIES

A. PROCESS CODE – Enter the code from the list of process codes below that best describes each process to be used at the facility. Ten lines are provided for entering codes. If more lines are needed, enter the code(s) in the space provided. If a process will be used that is not included in the list of codes below, then describe the process *(including its design capacity)* in the space provided on the form *(Item III-C)*.

B. PROCESS DESIGN CAPACITY – For each code entered in column A enter the capacity of the process.

1. AMOUNT – Enter the amount.
2. UNIT OF MEASURE – For each amount entered in column B(1), enter the code from the list of unit measure codes below that describes the unit of measure used. Only the units of measure that are listed below should be used.

PROCESS	PROCESS CODE	APPROPRIATE UNITS OF MEASURE FOR PROCESS DESIGN CAPACITY
Storage:		
CONTAINER *(barrel, drum, etc.)*	S01	GALLONS OR LITERS
TANK	S02	GALLONS OR LITERS
WASTE PILE	S03	CUBIC YARDS OR CUBIC METERS
SURFACE IMPOUNDMENT	S04	GALLONS OR LITERS
Disposal:		
INJECTION WELL	D79	GALLONS OR LITERS
LANDFILL	D80	ACRE-FEET *(the volume that would cover one acre to a depth of one foot)* OR HECTARE-METER
LAND APPLICATION	D81	ACRES OR HECTARES
OCEAN DISPOSAL	D82	GALLONS PER DAY OR LITERS PER DAY
SURFACE IMPOUNDMENT	D83	GALLONS OR LITERS
Treatment:		
TANK	T01	GALLONS PER DAY OR LITERS PER DAY
SURFACE IMPOUNDMENT	T02	GALLONS PER DAY OR LITERS PER DAY
INCINERATOR	T03	TONS PER HOUR OR METRIC TONS PER HOUR; GALLONS PER HOUR OR LITERS PER HOUR
OTHER *(Use for physical, chemical, thermal or biological treatment processes not occurring in tanks, surface impoundments or incinerators. Describe the processes in the space provided; Item III-C.)*	T04	GALLONS PER DAY OR LITERS PER DAY

UNIT OF MEASURE	UNIT OF MEASURE CODE
GALLONS	G
LITERS	L
CUBIC YARDS	Y
CUBIC METERS	C
GALLONS PER DAY	U
LITERS PER DAY	V
TONS PER HOUR	D
METRIC TONS PER HOUR	W
GALLONS PER HOUR	E
LITERS PER HOUR	H
ACRE-FEET	A
HECTARE-METER	F
ACRES	B
HECTARES	Q

EXAMPLE FOR COMPLETING ITEM III *(shown in line numbers X-1 and X-2 below)*: A facility has two storage tanks, one tank can hold 200 gallons and the other can hold 400 gallons. The facility also has an incinerator that can burn up to 20 gallons per hour.

C DUP 1

LINE NUMBER	A. PROCESS CODE (from list above)	B. PROCESS DESIGN CAPACITY 1. AMOUNT (specify)	B. PROCESS DESIGN CAPACITY 2. UNIT OF MEASURE (enter code)	FOR OFFICIAL USE ONLY	LINE NUMBER	A. PROCESS CODE (from list above)	B. PROCESS DESIGN CAPACITY 1. AMOUNT	B. PROCESS DESIGN CAPACITY 2. UNIT OF MEASURE (enter code)	FOR OFFICIAL USE ONLY
X-1	S02	600	G		5				
X-2	T03	20	E		6				
1	T02	5,900	U		7				
2	S02	28,000	G		8				
3					9				
4					10				

ntinued from the front.

I. PROCESSES *(continued)*

SPACE FOR ADDITIONAL PROCESS CODES OR FOR DESCRIBING OTHER PROCESSES *(code "T04")*. FOR EACH PROCESS ENTERED HERE INCLUDE DESIGN CAPACITY.

T02 - The plant neutralizes ~~5,000~~ 5900 gals./day of waste H_2SO_4 from the rosin polymerization operation.

should be design capacity

V. DESCRIPTION OF HAZARDOUS WASTES

EPA HAZARDOUS WASTE NUMBER – Enter the four–digit number from 40 CFR, Subpart D for each listed hazardous waste you will handle. If you handle hazardous wastes which are not listed in 40 CFR, Subpart D, enter the four–digit number*(s)* from 40 CFR, Subpart C that describes the characteristics and/or the toxic contaminants of those hazardous wastes.

ESTIMATED ANNUAL QUANTITY – For each **listed waste** entered in column A estimate the quantity of that waste that will be handled on an annual basis. For each **characteristic** or **toxic contaminant** entered in column A estimate the total annual quantity of all the non–listed waste*(s)* that will be handled which possess that characteristic or contaminant.

UNIT OF MEASURE – For each quantity entered in column B enter the unit of measure code. Units of measure which must be used and the appropriate codes are:

ENGLISH UNIT OF MEASURE	CODE	METRIC UNIT OF MEASURE	CODE
POUNDS	P	KILOGRAMS	K
TONS	T	METRIC TONS	M

If facility records use any other unit of measure for quantity, the units of measure must be converted into one of the required units of measure taking into account the appropriate density or specific gravity of the waste.

PROCESSES

1. PROCESS CODES:
   For listed hazardous waste: For each **listed** hazardous waste entered in column A select the code*(s)* from the list of process codes contained in Item III to indicate how the waste will be stored, treated, and/or disposed of at the facility.
   For non–listed hazardous wastes: For each characteristic or toxic contaminant entered in column A, select the code*(s)* from the list of process codes contained in Item III to indicate **all** the processes that will be used to store, treat, and/or dispose of all the non–listed hazardous wastes that possess that characteristic or toxic contaminant.
   Note: Four spaces are provided for entering process codes. If more are needed: (1) Enter the first three as described above; (2) Enter "000" in the extreme right box of Item IV-D(1); and (3) Enter in the space provided on page 4, the line number and the additional code*(s)*.
2. PROCESS DESCRIPTION: If a code is not listed for a process that will be used, describe the process in the space provided on the form.

OTE: HAZARDOUS WASTES DESCRIBED BY MORE THAN ONE EPA HAZARDOUS WASTE NUMBER – Hazardous wastes that can be described by ore than one EPA Hazardous Waste Number shall be described on the form as follows:

1. Select one of the EPA Hazardous Waste Numbers and enter it in column A. On the same line complete columns B,C, and D by estimating the total annual quantity of the waste and describing all the processes to be used to treat, store, and/or dispose of the waste.
2. In column A of the next line enter the other EPA Hazardous Waste Number that can be used to describe the waste. In column D(2) on that line enter "included with above" and make no other entries on that line.
3. Repeat step 2 for each other EPA Hazardous Waste Number that can be used to describe the hazardous waste.

XAMPLE FOR COMPLETING ITEM IV *(shown in line numbers X-1, X-2, X-3, and X-4 below)* – A facility will treat and dispose of an estimated 900 pounds r year of chrome shavings from leather tanning and finishing operation. In addition, the facility will treat and dispose of three non–listed wastes. Two wastes e corrosive only and there will be an estimated 200 pounds per year of each waste. The other waste is corrosive and ignitable and there will be an estimated 0 pounds per year of that waste. Treatment will be in an incinerator and disposal will be in a landfill.

NO.	A. EPA HAZARD. WASTE NO. (enter code)	B. ESTIMATED ANNUAL QUANTITY OF WASTE	C. UNIT OF MEASURE (enter code)	D. PROCESSES 1. PROCESS CODES (enter)	D. PROCESSES 2. PROCESS DESCRIPTION (if a code is not entered in D(1))
X-1	K054	900	P	T03 D80	
X-2	D002	400	P	T03 D80	
X-3	D001	100	P	T03 D80	
	002				included with above

Continued from page 2.
NOTE: Photocopy this page before completing if you have more than 26 wastes to list.

Form Approved OMB No. 158-S80004

EPA I.D. NUMBER (enter from page 1)	FOR OFFICIAL USE ONLY
W M S D 0 0 8 1 8 2 0 8 1 — T/A: — C: 1	W — DUP — T/A: 2 — DUP

IV. DESCRIPTION OF HAZARDOUS WASTES (continued)

LINE NO.	A. EPA HAZARD. WASTE NO. (enter code)	B. ESTIMATED ANNUAL QUANTITY OF WASTE	C. UNIT OF MEASURE (enter code)	D. PROCESSES 1. PROCESS CODES (enter)	D. PROCESSES 2. PROCESS DESCRIPTION (if a code is not entered in D(1))
1	D 0 0 2	3,500	T	S 0 2 T 0 2	
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					

Continued from the front.

IV. DESCRIPTION OF HAZARDOUS WASTE (continued)

E. USE THIS SPACE TO LIST ADDITIONAL PROCESS CODES FROM ITEM D(1) ON PAGE 3.

EPA I.D. NO. *(enter from page 1)*

													T/A	C
F	M	S	D	0	0	8	1	8	2	0	8	1		6

V. FACILITY DRAWING

All existing facilities must include in the space provided on page 5 a scale drawing of the facility *(see instructions for more detail)*.

VI. PHOTOGRAPHS

All existing facilities must include photographs *(aerial or ground–level)* that clearly delineate all existing structures; existing storage, treatment and disposal areas; and sites of future storage, treatment or disposal areas *(see instructions for more detail)*.

VII. FACILITY GEOGRAPHIC LOCATION

LATITUDE *(degrees, minutes, & seconds)*	LONGITUDE *(degrees, minutes, & seconds)*
89 18 30	31 20 30

VIII. FACILITY OWNER

[X] A. If the facility owner is also the facility operator as listed in Section VIII on Form 1, "General Information", place an "X" in the box to the left and skip to Section IX below.

B. If the facility owner is not the facility operator as listed in Section VIII on Form 1, complete the following items:

1. NAME OF FACILITY'S LEGAL OWNER	2. PHONE NO. *(area code & no.)*
E	

3. STREET OR P.O. BOX	4. CITY OR TOWN	5. ST.	6. ZIP CODE
F	G		

IX. OWNER CERTIFICATION

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this and all attached documents, and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

A. NAME *(print or type)*	B. SIGNATURE	C. DATE SIGNED
D. H. Little Vice President - Production	D. H. Little	Nov. 18, 1980

X. OPERATOR CERTIFICATION

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this and all attached documents, and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

A. NAME *(print or type)*	B. SIGNATURE	C. DATE SIGNED
D. H. Little Vice President - Production	D. H. Little	Nov. 18, 1980

Please print or type with ELITE type *(12 characters/inch)* in the unshaded areas only.

Form Approved OMB No. 158-S79016
No. 0246-EPA-OT

U.S. ENVIRONMENTAL PROTECTION AGENCY

NOTIFICATION OF HAZARDOUS WASTE ACTIVITY

INSTALLATION'S EPA I.D. NO.

I. NAME OF INSTALLATION

II. INSTALLATION MAILING ADDRESS

III. LOCATION OF INSTALLATION

AMENDED NOTIFICATION

PLEASE PLACE LABEL IN THIS SPACE

INSTRUCTIONS: If you received a preprinted label, affix it in the space at left. If any of the information on the label is incorrect, draw a line through it and supply the correct information in the appropriate section below. If the label is complete and correct, leave Items I, II, and III below blank. If you did not receive a preprinted label, complete all items. "Installation" means a single site where hazardous waste is generated, treated, stored and/or disposed of, or a transporter's principal place of business. Please refer to the INSTRUCTIONS FOR FILING NOTIFICATION before completing this form. The information requested herein is required by law *(Section 3010 of the Resource Conservation and Recovery Act).*

DETACH

FOR OFFICIAL USE ONLY

COMMENTS: C

INSTALLATION'S EPA I.D. NUMBER	APPROVED	DATE RECEIVED (yr., mo., & day)
F MSD008182081 T/A C 1		80 12 23

I. NAME OF INSTALLATION

HERCULES INCORPORATED

II. INSTALLATION MAILING ADDRESS

STREET OR P.O. BOX: 3 PO BOX 1937

CITY OR TOWN	ST.	ZIP CODE
4 HATTIESBURG	MS	39401

III. LOCATION OF INSTALLATION

STREET OR ROUTE NUMBER: 5 WEST 7TH STREET

CITY OR TOWN	ST.	ZIP CODE
6 HATTIESBURG	MS	39401

IV. INSTALLATION CONTACT

NAME AND TITLE (last, first, & job title)	PHONE NO. (area code & no.)
2 BUCKLEY HR PLANT MANAGER	601-545-3450

V. OWNERSHIP

DETACH

A. NAME OF INSTALLATION'S LEGAL OWNER: 8 HERCULES INCORPORATED

B. TYPE OF OWNERSHIP *(enter the appropriate letter into box)*: M

F = FEDERAL
M = NON-FEDERAL

VI. TYPE OF HAZARDOUS WASTE ACTIVITY *(enter "X" in the appropriate box(es))*

- [X] A. GENERATION
- [ ] B. TRANSPORTATION *(complete item VII)*
- [ ] C. TREAT/STORE/DISPOSE
- [X] D. UNDERGROUND INJECTION

VII. MODE OF TRANSPORTATION *(transporters only – enter "X" in the appropriate box(es))*

- [ ] A. AIR
- [ ] B. RAIL
- [ ] C. HIGHWAY
- [ ] D. WATER
- [ ] E. OTHER *(specify)*:

VIII. FIRST OR SUBSEQUENT NOTIFICATION

Mark "X" in the appropriate box to indicate whether this is your installation's first notification of hazardous waste activity or a subsequent notification. If this is not your first notification, enter your Installation's EPA I.D. Number in the space provided below.

- [ ] A. FIRST NOTIFICATION
- [X] B. SUBSEQUENT NOTIFICATION *(complete item C)*

C. INSTALLATION'S EPA I.D. NO.: MSD008182081

IX. DESCRIPTION OF HAZARDOUS WASTES

Please go to the reverse of this form and provide the requested information.

CONTINUE ON REVERSE

I.D. – FOR OFFICIAL USE ONLY

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
S	W											T/A	C	1

IX. DESCRIPTION OF HAZARDOUS WASTES *(continued from front)*

A. HAZARDOUS WASTES FROM NON–SPECIFIC SOURCES. Enter the four–digit number from 40 CFR Part 261.31 for each listed hazardous waste from non–specific sources your installation handles. Use additional sheets if necessary.

1	2	3	4	5	6
7	8	9	10	11	12

B. HAZARDOUS WASTES FROM SPECIFIC SOURCES. Enter the four–digit number from 40 CFR Part 261.32 for each listed hazardous waste from specific industrial sources your installation handles. Use additional sheets if necessary.

13	14	15	16	17	18
19	20	21	22	23	24
25	26	27	28	29	30

C. COMMERCIAL CHEMICAL PRODUCT HAZARDOUS WASTES. Enter the four–digit number from 40 CFR Part 261.33 for each chemical substance your installation handles which may be a hazardous waste. Use additional sheets if necessary.

31	32	33	34	35	36
37	38	39	40	41	42
43	44	45	46	47	48

D. LISTED INFECTIOUS WASTES. Enter the four–digit number from 40 CFR Part 261.34 for each listed hazardous waste from hospitals, veterinary hospitals, medical and research laboratories your installation handles. Use additional sheets if necessary.

49	50	51	52	53	54

E. CHARACTERISTICS OF NON–LISTED HAZARDOUS WASTES. Mark "X" in the boxes corresponding to the characteristics of non–listed hazardous wastes your installation handles. *(See 40 CFR Parts 261.21 – 261.24.)*

☐ 1. IGNITABLE (D001) ☐ 2. CORROSIVE (D002) ☐ 3. REACTIVE (D003) ☐ 4. TOXIC (D000)

X. CERTIFICATION

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this and all attached documents, and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

SIGNATURE	NAME & OFFICIAL TITLE *(type or print)*	DATE SIGNED
H R Buckley	H. R. Buckley Plant Manager	2/18/83

14

HAZARD RANKING SYSTEM

DATA COLLECTION AND DOCUMENTATION TECHNIQUES FOR HRS SCORING O HAZARDOUS WASTE SITES

DECEMBER, 1988

Prepared By

U.S. Corporation
Superfund Division

In Cooperation With

U.S. Environmental Protection Ag
Investigations and Compliance
Region IV

15

~~Charles O. Cleveland~~

Jim Hardage

U.S. Fish and Wildlife Service
Vicksburg Office

SPECIES LIST BY COUNTY

E - Endangered Species
T - Threatened Species
P - Proposed Species
C - Candidate Species
CA - Conservation Agreement
CH - Critical Habitat

MISSISSIPPI

Amite	E - Red-cockaded woodpecker (Picoides borealis)
Bolivar	E - Pondberry
Claiborne	T - Bayou darter (Etheostoma rubrum)
Clark	C - Yellowblotched sawback - Graptemys flavimaculata
Copiah	T - Bayou darter (Etheostoma rubrum) T - Ringed sawback turtle (Graptemys oculifera)
Covington	T - Gopher tortoise (Gopherus polyphemus)
Forrest	E - Red-cockaded woodpecker (Picoides borealis) T - Gopher tortoise (Gopherus polyphemus) C - Yellowblotched sawback - Graptemys flavimaculata
Franklin	E - Red-cockaded woodpecker (Picoides borealis)
George	E - Red-cockaded woodpecker (Picoides borealis) T - Gopher tortoise (Gopherus polyphemus) C - Maureen's symnocthebius minute moss beetle C - Yellowblotched sawback - Graptemys flavimaculata
Greene	E - Red-cockaded woodpecker (Picoides borealis) T - Gopher tortoise (Gopherus polyphemus) C - Yellowblotched sawback - Graptemys flavimaculata
Hancock	E - Brown pelican (Pelecanus occidentalis) T - Gopher tortoise (Gopherus polyphemus)
Harrison	E - Red-cockaded woodpecker (Picoides borealis) E - Bald eagle (Haliaeetus leucocephalus) E - Eastern indigo snake (Drymarchon corais couperi) E - Brown pelican (Pelecanus occidentalis) T - Gopher tortoise (Gopherus polyphemus)
Hinds	T - Bayou darter (Etheostoma rubrum) T - Ringed sawback turtle (Graptemys oculifera)
Itawamba	E - Curtus' mussel (Pleurobema curtum) E - Penitent shell mussel (Epioblasma penita) E - Judge Tait's mussel (Pleurobema taitianum) C - Southern clubshell Pleurobema decisum
Jackson	E - Brown pelican (Pelecanus occidentalis) E - Red-cockaded woodpecker (Picoides borealis) E - Mississippi sandhill crane (CH) (Grus canadensis pulla) T - Gopher tortoise (Gopherus polyphemus) C - Yellowblotched sawback - Graptemys flavimaculata

Jasper	E - Red-cockaded woodpecker (Picoides borealis)
Jones	E - Red-cockaded woodpecker (Picoides borealis) T - Gopher tortoise (Gopherus polyphemus) C - Yellowblotched sawback - Graptemys flavimaculata
Lawrence	T - Ringed sawback turtle (Graptemys oculifera)
Lamar	T - Gopher tortoise (Gopherus polyphemus)
Leake	T - Ringed sawback turtle (Graptemys oculifera)
Lowndes	E - Judge Tait's mussel (Pleurobema taitianum) E - Penitent shell mussel (Pleurobema penita)
Madison	T - Ringed sawback turtle (Graptemys oculifera)
Marion	T - Ringed sawback turtle (Graptemys oculifera) T - Gopher tortoise (Gopherus polyphemus)
Monroe	E - Curtus' mussel (Pleurobema curtum) E - Penitent shell mussel (Epioblasma penita) E - Judge Tait's mussel (Pleurobema taitianum) C - Southern clubshell Pleurobema decisum
Neshoba	T - Ringed sawback turtle (Graptemys oculifera)
Noxubee	E - Red-cockaded woodpecker (Picoides borealis)
Oktibbeha	E - Red-cockaded woodpecker (Picoides borealis)
Pearl River	T - Ringed sawback turtle (Graptemys oculifera) T - Gopher tortoise (Gopherus polyphemus)
Perry	E - Red-cockaded woodpecker (Picoides borealis) T - Gopher tortoise (Gopherus polyphemus) C - Yellowblotched sawback - Graptemys flavimaculata
Rankin	T - Ringed sawback turtle (Graptemys oculifera)
Scott	E - Red-cockaded woodpecker (Picoides borealis) T - Ringed sawback turtle (Graptemys oculifera)
Simpson	T - Ringed sawback turtle (Graptemys oculifera)
Smith	E - Red-cockaded woodpecker (Picoides borealis)
Stone	E - Red-cockaded woodpecker (Picoides borealis) E - Eastern indigo snake (Drymarchon corais couperi) T - Gopher tortoise (Gopherus polyphemus)
Sharkey	E - Pondberry (Lindera melissifolia)
Sunflower	E - Pondberry (Lindera melissifolia)

Wayne	E - Red-cockaded woodpecker (Picoides borealis) T - Gopher tortoise (Gopherus polyphemus) C - Yellowblotched sawback - Graptemys flavimaculata
Wilkinson	E - Red-cockaded woodpecker (Picoides borealis)
Winston	E - Red-cockaded woodpecker (Picoides borealis)

16

Forrest
D 109
1-15-88

Coded

MISSISSIPPI DEPARTMENT OF NATURAL RESOURCES

Bureau of Land and Water Resources
Southport Mall
P.O. Box 10631
Jackson, Mississippi 39209

WATER WELL DRILLERS LOG

Jan. 15 (date well completed) 1988 Layne-Central Co (firm name) Forrest (county well located)

LANDOWNER: B.F. Goodrich Chemical Group
C/o Hercules, Inc. / Herclor Unit
West 7th St., PO Box 1897
Hattiesburg, MS 39403
(mailing address)

WELL LOCATION: SW 1/4 of SW 1/4 of NW 1/4
sec. 4 T 4 N/S R 13 E/W

(distance) miles (direction) of (nearest town)

WELL PURPOSE: Industrial
(home, irrigation, municipal, industrial)

WELL COMPLETION DATA:

(1) diameter (inches) 8"
(2) total depth (feet) 1650'
(3) static water level (feet) 59' below/above top of ground.
(4) casing Steel (material), 1610'10" (depth), 8" (size) if telescope see back.
(5) screen 30'4" (length), 1610'10" (depth to top) 4" (size), Stainless Steel (material)
(6) pump 15 (HP). 150 gpm (yield gpm) Electrical (type power)
(7) electric log Yes (yes or no) Layne-Central Co. (organization running log)
(8) how well bottom plugged Cement

DRILLERS REMARKS: Permit No. MSGW074603

description of formations encountered	from	to
Fill Dirt	0	3'
Clay	3'	45'
Sand	45'	50'
Clay	50'	225'
Sandy Clay	225'	275'
Sand	275'	295'
Sand & Clay	295'	335'
Hard Clay	335'	367'
Sand	367'	460'
Shale	460'	565'
Sand	565'	591'
Shale	591'	611'
Sand	611'	680'
Sandy Shale	680'	702

RECEIVED
APR 18 1988
Department of Natural Resources
Bureau of Land & Water Resources

FORREST MISSISSIPPI BOARD OF WATER COMMISSIONERS

D 38 (3) USGS File

9-21-65

WATER WELL DRILLERS LOG

Date: 9-21-, 1965, Driller: Layne-Central Co. (Name) County: Forrest

(1) Owner of Land: Hercules Powder Co. (Name)

Hattiesburg, Miss. (Address)

(2) Location: NW ¼, SW ¼, Sec. 4 T 4N R 13W,

____ miles (distance) ____ (direction) of ____ (Nearest Town),

(3) Topography: ____ (Hilly) (Flat) (Level)

(4) Purpose of Well: Industrial (Domestic Irrigation Municipal, Industrial, Other)

Description & Color of Materials Sand, Clay, Red Clay, Shell, etc.	Thickness Feet	Depth Feet
top soil	3	0-3
pipe clay	187	3-190
shale	50	190-240
fine sand-stks		
shale	29	240-269
sand	22	269-291
shale, stks sand	71	291-362
sand	138	362-500
hard shale	28	500-528
sand-shale	57	528-585
sand	105	585-690
shale	15	690-705

Information upon completion of well:

(1) Diameter 18 inches.

(2) Total Depth 687 feet.

(3) Water Level 24 feet below top of ground.

(4) Cased to 591', Size 18",

(5) Screen: Size 10", Length 70'.

(6) Were any formations sealed against pollution?

x yes, ____ no.

If YES depth of formation 591',

Why required

Drillers Remarks: ____

RECEIVED SEP 23 1965 MISS. BOARD OF WATER COMM.

(Use Back Side)

Well No.

Mail this copy to Board of Water Commissioners, 410 Miss. St., Jackson, Miss.

FORREST MISSISSIPPI BOARD OF WATER COMMISSIONERS

D 39 ③ USGS Fld. J

6-18-65

WATER WELL DRILLERS LOG

Date: June 18, 1965, Driller: Layne-Central Co. County Forrest
(Name)

(1) Owner of Land: Coastal Chem. Co.
(Name)
Hattiesburg, Miss.
(Address)

(2) Location: NW ¼, SW ¼, Sec. 3 T 2N R 13W,
____ miles ____, of ____,
(distance) (direction) (Nearest Town)

(3) Topography: ____
(Hilly) (Flat) (Level)

(4) Purpose of Well: Industrial
(Domestic Irrigation Municipal, Industrial, Other)

Information upon completion of well:

(1) Diameter 12" inches.

(2) Total Depth 353' feet.

(3) Water Level 5' feet below top of ground.

(4) Cased to 310', Size 8",

(5) Screen: Size 6", Length 40'.

(6) Were any formations sealed against pollution?

x yes, ____ no.

If YES depth of formation 353',

Why required

Drillers Remarks: ____

Description & Color of Materials Sand, Clay, Red Clay, Shell, etc.		Thickness Feet	Depth Feet
top soil	0-5	5	
sand & gravel	5-10	5	
blue clay	10-75	65	
shale stks sand	75-100	25	
blue clay	100-120	20	
sandy shale	120-148	28	
sand rock	148-158	10	
shale	158-200	42	
fine sand-shale	200-224	24	
sand	224-352	128	

RECEIVED
JUN 21 1965
MISS. BOARD OF WATER COMM.

(Use Back Side)

Well No.

Mail this copy to Board of Water Commissioners 429 Miss. St. Jackson, Miss

CODED

C. P. CLARK
WATER WELL DRILLI
ROUTE 2
LAUREL, MISS. 3944C

Forrest
B 67
6-27-69

MISSISSIPPI
BOARD OF WATER COMMISSIONERS
416 North State Street
Jackson, Mississippi 39201

WATER WELL DRILLERS LOG

6/27 1969 — date well completed
C. P. Clark — firm name
Forest — county well located

LANDOWNER: Laurel Holmes Store
Laurel Miss
(mailing address)

WELL LOCATION:
sec. 34 T 5 (N) S R 13 E (W)
1 miles N of Hattiesburg
(distance) (direction) (nearest town)

WELL PURPOSE: Ind
(home, irrigation, municipal, industrial)

WELL COMPLETION DATA:
(1) diameter (inches) 2
(2) total depth (feet) 106
(3) static water level (feet) 34 below above top of ground.
(4) casing Bald Drive, (material) (depth)
(size) if telescope see back.
(5) screen 10, 86 (length) (depth to top)
1 1/4, S.S. (size) (material)
(6) pump 1 H.P. 18 (HP) (yield gpm)
230 S.P. (type power)
(7) electric log No (yes or no)
(organization running log)
(8) how well bottom plugged

DRILLERS REMARKS:

description of formations encountered	from	to
Sand	0	11
Blue Clay	11	17
Sand & Red Gravel	17	106
Blue Clay	106	11

JUL 2 - 1969
MISS. BD. OF WATER COMM.

Forrest
D 85
6-20-70

MISSISSIPPI
BOARD OF WATER COMMISSIONERS
416 North State Street
Jackson, Mississippi 39201

CODED

WATER WELL DRILLERS LOG

June 20 (date well completed) 1970 L.E. Chisum (firm name) Forrest (county well located)

LANDOWNER: M. Burnes
Rt. 6 Hattiesburg Miss
Lake Geiger
(mailing address)

WELL LOCATION:
sec. 10 T. 4 (N) (S) R. 13 (E) (W)
5 (distance) miles west (direction) of Mt. Land (nearest town)

WELL PURPOSE: House use
(home, irrigation, municipal, industrial)

WELL COMPLETION DATA:

(1) diameter (inches) 4"
(2) total depth (feet) 358'
(3) static water level (feet) 70 below ~~above~~ top of ground.
(4) casing PVC (material), 348' (depth),
(size) if telescope see back.
(5) screen 10' (length), 348-358 (depth to top)
2" (size), PVC (material)
(6) pump 1 (HP) 14 (yield gpm)
220 (type power)
(7) electric log No (yes or no)
(organization running log)
(8) how well bottom plugged

DRILLERS REMARKS:
Well in use
June 21-1970

description of formations encountered	from	to
Surface Sand	0	50
Blue Clay	50	300
Sand	300	358

CODED

JUL 14 1970

MISS. BD. OF WATER COMM.

Forrest
D100
11-10-79
Flwg #144

MISSISSIPPI
BOARD OF WATER COMMISSIONERS
416 North State Street
Jackson, Mississippi 39201

CODED

WATER WELL DRILLERS LOG

Nov 10 1979 Roy V West Wtr Wells Forrest
date well completed — firm name — county well located

LANDOWNER: Miss Power
Co Hattiesburg Miss
(mailing address)

WELL LOCATION:
sec 10 T 4 (N) S R 13 E W Petal
0 miles 0 of
(distance) (direction) (nearest town)

WELL PURPOSE:
(home, irrigation, municipal, industrial)

WELL COMPLETION DATA:
(1) diameter (inches) 6
(2) total depth (feet) 650
(3) static water level (feet) 80 below above top of ground
(4) casing PVC Pipe 620
(material) (depth)
(size) If telescope see back.
(5) screen 30 , 620
(length) (depth to top)
4 , St steel
(size) (material)
(6) pump 5 70
(HP) (yield gpm)
Miss Power
(type power)
(7) electric log (yes or no)
Miss Geo Survey
(organization running log)
(8) how well bottom plugged Washrock

DRILLERS REMARKS: This log is for two wells. The formation for both wells is the same. Well about 200 ft apart

description of formations encountered	from	to
Clay	0	4
sand & gravel	4	14
Blue clay	14	60
sand gravel	60	120
Clay	120	275
Sand	275	300
Clay	300	340
sand	340	540
Clay	540	560
Sand	560	585
Clay	585	605
Sand	605	670
Clay	670	675
Sand	675	710

CODED

DEPT OF NATURAL RESOURCES
BUREAU OF LAND & WATER RESOURCES

NOV 24 1980

RECEIVED

FORREST
D104
12-10-80
ELog #167

CODED

MISSISSIPPI
BOARD OF WATER COMMISSIONERS
416 North State Street
Jackson, Mississippi 39201

RECEIVED
FEB 11 1981
MISSISSIPPI DEPT. OF NATURAL RESOURCES

WATER WELL DRILLERS LOG

12-10-80 19 BRADEN PUMP AND WELL SERVICE INC Forrest
date well completed | firm name | county well located

LANDOWNER:
Miss. Tank Company
4th Street
Hattiesburg, MS
(mailing address)

WELL LOCATION:
sec. 6 T 4 (N) (S) R 13 (E) (W)
10 miles (distance) (direction) of Hattiesburg (nearest town)

WELL PURPOSE: Industrial
(home, irrigation, municipal, industrial)

WELL COMPLETION DATA:
(1) diameter (inches) 10"
(2) total depth (feet) 700'
(3) static water level (feet) 80 (below) (above) top of ground.
(4) casing PVC (material), total (depth)
6" (size) if telescope see back.
(5) screen 40' (length), 660 (depth to top)
4" (size), Stainless steel (material)
(6) pump 20 (HP) 300 (yield gpm)
230 (type power) @ 40'
(7) electric log yes (yes or no)
(organization running log)
(8) how well bottom plugged

DRILLERS REMARKS:
No tail pipe

description of formations encountered	from	to
White clay	0	120
Sand	120	150
Clay & Rock	150	300
Sand	300	430
Clay	430	580
Sand	580	700
CODED		
CODED		
160 pump setting		

Forrest
D 73
7-68
Miss Geo Surv.

MISSISSIPPI
BOARD OF WATER COMMISSIONERS
416 North State Street
Jackson, Mississippi 39201

CODED

WATER WELL DRILLERS LOG

7/11 1968 — date well completed
S&R — firm name
Forrest. — county well located

LANDOWNER Masonite Corp. Co
Hattiesburg, Miss.
(mailing address)

WELL LOCATION:
sec. 4 T 4 N S R 13 E W
(distance) miles (direction) of (nearest town)

WELL PURPOSE:
(home, irrigation, municipal, industrial)

WELL COMPLETION DATA:
(1) diameter (inches) 6"
(2) total depth (feet) 422
(3) static water level (feet) 21 below above top of ground.
(4) casing Stl (material), 402 (depth),
6 X 4 (size) if telescope see back.
(5) screen 20 (length), 402 (depth to top)
4" (size), S/S (material)
(6) pump 10 (HP) 158 (yield gpm)
Sub (type power)
(7) electric log YES (yes or no)
M A S (organization running log)
(8) how well bottom plugged Valve

DRILLERS REMARKS:

description of formations encountered	from	to
Blue Clay	0	85
Sand	88	10
White Clay	105	11
Rock Hard	155	17
Blue Clay	172	22
Blue Sand	225	27
Shell	277	28
Sand Fine	281	31
Sand & Clay Strips	315	37
CW B Sand	370	42

AUG 13 1968
MISS. BD. OF WATER COMM.

17

(DO NOT USE) (1-5)

FORM A: GENERAL FACILITY INFORMATION

Company Name: Hercules Incorporated
Division/Subsidiary
Facility Name: Hattiesburg Plant

Address: West 7th Street
No. Street

Hattiesburg, Mississippi 39401
City State Zip Code

Name of Person Completing Form: R. H. Heller

Position: Plant Manager

Phone Number: (601) 545-3450

1. Year Facility Opened ..... 19 [2 3] (10-11)

2. Primary SIC Code ..... [2 8 6 1] (12-15)

3. Estimate the total amounts of process wastes (excluding wastes sold for use) generated by this facility during 1978:
USE ONLY TONS IF POSSIBLE - right justify response

thousand gallons ..... [ ] (16-24)

hundred tons ..... [3 5 0] (25-32)

thousand cubic yards ..... [ ] (33-41)

4. Estimate (in whole percents) how these process wastes generated in 1978 were disposed of:

in landfill ..... [9 8] (42-44)

in pit/pond/lagoon ..... [2] (45-47)

in deep well ..... [ ] (48-50)

incinerated ..... [ ] (51-53)

reprocessed/recycled ..... [ ] (54-56)

evaporated ..... [ ] (57-59)

unknown ..... [ ] (60-62)

other (Specify_____)..... [ ] (63-65)

5. What is the total number of known sites (including disposal on the property where this facility is located as one site) that have been used for the disposal of process wastes from this facility since 1950?..... [1 4] (66-68)

COMPLETE ONE FORM "B" FOR EACH OF THE SITES

6. Have any of the process wastes generated at this facility been hauled (removed) from this facility for disposal? (Yes=1; no=2) ..... [1] (69)

IF YES, COMPLETE FORM "C"

7. Do you know the disposal site locations of all of the process waste hauled from your facility since 1950? (Yes=1; no=2) ..... [2] (70)

IF NO, COMPLETE ONE FORM "D" FOR EACH FIRM OR CONTRACTOR WHO TOOK WASTE TO AN UNKNOWN LOCATION

8. Specify the earliest year represented by information from company or facility records supplied on this and other forms .....19[7 1] (71-72)

9. Specify the earliest year represented by information from employee knowledge supplied on this and other forms .....19[6 7] (73-74)

FORM B: DISPOSAL SITE INFORMATION

[| | | | | | |] (1-8)
(DO NOT USE)

COMPLETE THIS FORM FOR EVERY SITE (INCLUDING THE LOCATION OF THIS FACILITY AS ONE SITE) USED FOR THE DISPOSAL OF PROCESS WASTES GENERATED BY THIS FACILITY SINCE 1950.

Company Name: Hercules Incorporated Division/Subsidiary
Facility Name: Hattiesburg Plant
Name of Site: Back 40
Address of Site: West 7th St.
no. street

Hattiesburg Mississippi 39401
city state zip code

Name of Owner (while used by facility): Hercules Incorporated
Address: West 7th St.
no. street

Hattiesburg Mississippi 39401
city state zip code

Current Owner (if different from above): Same
Address:
no. street

city state zip code

1. Location (1= the property on which facility is located; 2= off-site) ..... [1] (10)
2. Ownership at time of use (1= company ownership; 2=private but not company ownership) 3=public ownership) ..... [1] (11)
3. Current status (1= closed; 2= still in use; 9=don't know) ..... [2] (12)
   IF CLOSED, specify year closed ..... 19[|] (13-14)
4. Year first used for process waste from this facility ..... 19[2 3] (15-16)
5. Year last used for process waste from this facility (enter "79" if still in use) ..... 19[7 9] (17-18)
6. Total amount of process waste from this facility disposed at site:
   USE TONS ONLY IF POSSIBLE
   Right justify response
   thousand gallons ..... [| | | | | | |] (19-26)
   hundred tons ..... [| | | 3 4 7 1] (27-33)
   thousand cubic yards ..... [| | | | | | |] (34-41)
7. Specify type(s) of disposal method(s) used at site and whether method is still in use (1=currently in use; 2=no longer in use; 3=never used; 9=don't know)

landfill, mono industrial waste	[1]	(42)
landfill, mixed industrial waste	[1]	(43)
landfill, drummed waste	[1]	(44)
landfill, municipal refuse co-disposed	[3]	(45)
pits/ponds/lagoons	[1]	(46)
deep well injection	[3]	(47)
land farming	[3]	(48)
incineration	[2]	(49)
treatment (eg. neutralizing)	[3]	(50)
reprocessing/recycling	[3]	(51)
other (specify) ____	[3]	(52)

8. Users of this site (1=this facility; 2=this facility and other company facilities only; 3=this company and others; 9=don't know) ..... [1] (53)

LIST NAMES AND ADDRESSES OF OTHER KNOWN USERS BELOW

FORM B CONTINUED ON SECOND PAGE

[1] (80)

(1-8)
(DO NOT USE)

Company Name: Hercules Incorporated
Division/Subsidiary
Facility Name: Hattiesburg Plant

Site Name: Back 40

9. Components (or characteristics) of process waste from this facility disposed at site: (1=present in waste; 2=not present in waste; 9=don't know)

FILL IN EVERY BLOCK SPACE

Acid solutions, with pH<3	2	(10)
pickling liquor	2	(11)
metal plating waste	2	(12)
circuit etchings	2	(13)
inorganic acid manufacture	2	(14)
organic acid manufacture	2	(15)
Base solutions, with pH> 12	2	(16)
caustic soda manufacture	2	(17)
nylon and similar polymer generation	2	(18)
scrubber residual	2	(19)
Heavy metals & trace metals (bonded organically & inorganically)	2	(20)
arsenic, selenium, antimony	2	(21)
mercury	2	(22)
iron, manganese, magnesium	1	(23)Trace
zinc, cadmium, copper, chromium (trivalent)	1	(24)Trace
chromium (hexavalent)	2	(25)
lead	2	(26)
Radioactive residues, >50pico curies/liter	2	(27)
uranium residuals & residuals for UF_6 recycling	2	(28)
lathanide series elements and rare earth salts	2	(29)
phosphate slag	2	(30)
thorium	2	(31)
radium	2	(32)
other alpha, beta & gamma emitters	2	(33)
Organics	1	(34)
pesticides & intermediates	1	(35)Trace
herbicides & intermediates	2	(36)
fungicides & intermediates	2	(37)
rodenticides & intermediates	2	(38)
halogenated aliphatics	1	(39)Trace
halogenated aromatics	2	(40)
acrylates & latex emulsions	2	(41)
PCB/PBB's	2	(42)
amides, amines, imides	1	(43)Trace
plastizers	2	(44)
resins	1	(45)
elastomers	1	(46)
solvents polar (except water)	1	(47)Trace
carbontetrachloride	2	(48)
trichloroethylene	2	(49)
other solvents nonpolar	1	(50)Trace
solvents halogenated aliphatic	1	(51)Trace
solvents halogenated aromatic	2	(52)
oils and oil sludges	1	(53)
esters and ethers	1	(54)
alcohols	1	(55)Trace
ketones & aldehydes	1	(56)Trace
dioxins	2	(57)
Inorganics	1	(58)
salts	1	(59)
mercaptans	1	(60)
Misc	2	(61)
pharmaceutical wastes	2	(62)
paints & pigments	2	(63)
catalysts (eg. vanadium, platinum, palladium)	2	(64)
asbestos	2	(65)
shock sensitive wastes (eg. nitrated toluenes)	2	(66)
air water reactive wastes (eg. P_4, aluminum chloride)	2	(67)
wastes with flash point below 100° F	2	(68)

FORM C: HAULER INFORMATION

(DO NOT USE) (1-5)

PROVIDE A COMPLETE LIST OF ALL FIRMS AND INDEPENDENT CONTRACTORS, INCLUDING THE COMPANY AND ITS AFFILIATES AND SUBSIDIARIES, USED TO REMOVE PROCESS WASTES FROM THIS FACILITY SINCE 1950.

Company Name: Hercules Incorporated
Division/Subsidiary
Facility Name: Hattiesburg Plant

Name of Firm or Contractor	Address	ICC # (If Known)	Years Used
Hercules Incorporated	Hattiesburg, Mississippi		9
Rollings Enviromental Services Inc.	Baton Rouge, LA.		9
City of Hattiesburg	Hattiesburg, Mississippi		7
Hover Gravel Co.	Hattiesburg, Mississippi		3
Chem Dyne Corp.	Hamilton, Ohio		1

18

[illegible] COP[illegible]

April 2[illegible], 19[illegible]

Mr. Charle[illegible] Jordan, [illegible] Coordinator
Hercules, Inc.
P. O. Box 1937
Hattiesbur[illegible], M[illegible] [illegible]

Dear Mr. Jordan:

RE: MSD0081820[illegible]

This letter acknowledges [illegible] telephone [illegible] of April 2[illegible], 198[illegible]. The [illegible] has reviewed your letter of [illegible] 18, 1983 [illegible] this letter [illegible] amended notification form to [illegible] in order to [illegible] data [illegible] system. The [illegible] subject to the [illegible] requirements [illegible] Mississippi Hazardous [illegible] Rule 26[illegible] has been [illegible] under the [illegible] Rule 26[illegible].

If you have any further questions, please don't hesitate to contact me at [illegible].

Sincerely,

John P. [illegible]
Division of Solid Waste Management

[illegible]

FILE COPY

April 21, 1983

Mr. James Scarbrough, Chief
Residuals Management Branch
U. S. Environmental Protection Agency
Region IV
345 Courtland Street, N.E.
Atlanta, GA 30365

Dear Mr. Scarbrough:

Attached is a letter which we received from Hercules, Inc. which requests their storage facility be delisted. We agree with the company that the waste is being beneficially reused in their wastewater treatment system, and is therefore exempted under Mississippi Hazardous Waste Rule 261.6(d). Consequently, we will update the ADP system to reflect this change in status.

If you have any questions, please contact me.

Sincerely,

Jack M. McMillan, Director
Division of Solid Waste Management

JMM:TPH:cbl
Enclosure

HERCULES

Hercules Incorporated
West 7th Street
P.O. Box 1937
Hattiesburg, MS 39401
(601) 545-3450

February 18, 1983

Mississippi Department of Natural Resources
Bureau of Pollution Control
Division of Solid Waste Management
P. O. Box 10385
Jackson, MS 39209
Attn: Mr. John Herrmann

Dear Mr. Herrmann:

On January 27, 1983, we met with you to review our initial notification of hazardous waste activity and subsequent hazardous waste permit application. The meeting was very beneficial with your clarification of several aspects of hazardous waste activity.

In summary, we agreed that our initial notification and subsequent hazardous waste permit application as a storer and treater of hazardous waste (spent sulfuric acid) was misleading. All of the acid is beneficially used for pH control during primary wastewater treatment and supplemented with the purchase of additional fresh acid. In fact, the spent acid does not meet any of the criteria in part 261.2 (definition of a solid waste) and therefore we conclude if it is not a solid waste it is not a hazardous waste. The "storage" tanks are only used to control optimum discharge of the spent acid. As you requested, we also looked at heavy metals, using the EP toxicity procedure, in our impounding basin sludge (the continuous flowthrough basin is for wastewater equalization and pH control) and also in the wastewater from the process generating the spent acid. No levels were found anywhere near the levels listed as maximum concentration of contaminants characteristic of EP toxicity. Also, the only reason underground injection was marked on our original notification was because of sanitary septic tanks and after talking to David Lee on February 17, 1983, we concur that underground injection should also be removed. Therefore, we are submitting the enclosed amended notification of hazardous waste activity.

With your concurrence that the spent sulfuric acid is not a hazardous waste, we respectfully request that we be removed as a storer and treater of hazardous waste and be listed only as a generator of hazardous waste. Although we are not generating any hazardous waste on a regular basis we do feel that in the future we may generate non-specific hazardous waste from non-specific sources on occasions as the result of process malfunctions, contamination, etc., and therefore we wish to retain our EPA ID number. Please advise us on the procedure to accomplish being removed as a storer and treater of hazardous waste (eliminating the hazardous waste permit application) while retaining our EPA ID number.

If I can answer any questions or be of any help, please call me.

Yours truly,

Charles S. Jordan

Charles S. Jordan
Environmental Coordinator

CSJ:ps

Enclosure

19

FILE COPY

State of Mississippi Water Pollution Control PERMIT

TO DISCHARGE WASTEWATER IN ACCORDANCE WITH THE NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

THIS CERTIFIES THAT

HERCULES, INC.
Hattiesburg, Mississippi

has been granted permission to discharge wastewater into

Bowie River

in accordance with effluent limitations, monitoring requirements and other conditions set forth in Parts I, II, and III hereof. This permit is issued in accordance with the provisions of the Mississippi Water Pollution Control Law (Section 49-17-1 et seq., Mississippi Code of 1972), and the regulations and standards adopted and promulgated thereunder, and under authority granted pursuant to Section 402 (b) of the Federal Water Pollution Control Act.

MISSISSIPPI NATURAL RESOURCES PERMIT BOARD

Original Signed By
CHARLES H. CHISOLM

DIRECTOR, BUREAU OF POLLUTION CONTROL
MISSISSIPPI DEPARTMENT OF NATURAL RESOURCES

Issued: September 29, 1986

Permit No. MS0001830

Expires: September 28, 1991

20

STATE OF MISSISSIPPI
AIR POLLUTION CONTROL
PERMIT

TO OPERATE AIR EMISSIONS EQUIPMENT

THIS CERTIFIES THAT

Hercules, Incorporated
West 7th Street
Hattiesburg, Mississippi

has been granted permission to operate air emissions equipment in accordance with emission limitations, monitoring requirements and conditions set forth herein. This permit is issued in accordance with the provisions of the Mississippi Air and Water Pollution Control Law (Section 49-17-1 et. seq., Mississippi Code of 1972), and the regulations and standards adopted and promulgated thereunder.

Issued this 24th, day of March, 1987

MISSISSIPPI NATURAL RESOURCES PERMIT BOARD

_____

DIRECTOR, BUREAU OF POLLUTION CONTROL
MISSISSIPPI DEPARTMENT OF NATURAL RESOURCES

Expires 1st day of April, 1990

Permit No. 0800-00001

Permit Modified: October 27, 1987, February 9, 1988, March 8, 1988, & May 9, 1989

PART I
GENERAL CONDITIONS

1. All emissions authorized herein shall be consistent with the terms and conditions of this permit. The discharge of any air pollutant identified in this permit more frequently than or at a level in excess of that authorized shall constitute a violation of the permit. Any anticipated facility expansions or modifications which will result in new, different, or increased emission of air pollutants must be reported by submission of a new application.

2. The permittee shall at all times maintain in good working order and operate as efficiently as possible all air pollution control facilities or systems installed or used by the permittee to achieve compliance with the terms and conditions of this permit.

3. Solids removed in the course of control of air emissions shall be disposed of in a manner such as to prevent the solids from becoming windborne and to prevent the materials from entering state waters.

4. Any diversion from or bypass of collection and control facilities is prohibited except (i) where unavoidable to prevent loss of life or severe property damage or (ii) when approved by the Mississippi Department of Natural Resources Permit Board.

5. Whenever any emergency, accidental or excessive discharge of air contaminants occurs, the office of the Mississippi Department of Natural Resources Bureau of Pollution Control shall be notified immediately of all information concerning cause of the discharge, point of discharge, volume and characteristics, and whether discharge is continuing or stopped.

6. Should the Executive Director of the Mississippi Department of Natural Resources declare an Air Pollution Control Episode, the permittee will be required to operate in accordance with the permittee's previously approved Emissions Reduction Schedule.

7. The permittee shall allow the Mississippi Department of Natural Resources Bureau of Pollution Control and the Mississippi Natural Resources Permit Board and/or their authorized representatives, upon the presentation of credentials:

   a. To enter upon the permittee's premises where an air emission source is located or in which any records are required to be kept under the terms and conditions of this permit, and

b. At reasonable times to have access to and copy any records required to be kept under the terms and conditions of this permit; to inspect any monitoring equipment or monitoring method required in this permit; and to sample any air emission.

8. After notice and opportunity for a hearing, this permit may be modified, suspended, or revoked in whole or in part during its term for cause including, but not limited to:

   a. Violation of any terms or conditions of this permit.

   b. Obtaining this permit by misrepresentation or failure to disclose fully all relevant facts; or

   c. A change in any condition that required either a temporary or permanent reduction or elimination of authorized air emissions.

9. For renewal of this permit the applicant shall make application not less than one-hundred eighty (180) days prior to the expiration date of the permit substantiated with current emissions data, test results or reports or other data as deemed necessary by the Mississippi Department of Natural Resources Permit Board.

10. Except for data determined to be confidential under the Mississippi Air & Water Pollution Control Law, all reports prepared in accordance with the terms of this permit shall be available for public inspection at the offices of the Mississippi Department of Natural Resources Bureau of Pollution Control.

11. The issuance of this permit does not convey any property rights in either real or personal property, or any exclusive privileges, nor does it authorize any injury to private property or any invasion of personal rights, nor any infringement of Federal, State or local laws or regulations.

12. Nothing herein contained shall be construed as releasing the permittee from any liability for damage to persons or property by reason of the installation, maintenance, or operation of the air cleaning facility, or from compliance with the applicable statutes of the State, or with local laws, regulations, or ordinances.

13. This permit is non-transferable.

14. This permit is for air pollution control purposes only.

PART II
EMISSION LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning March 24, 1987, and lasting until April 1, 1990, the permittee is authorized to operate air emissions equipment and emit air contaminants from the Rosin Processing Area, Emission Point 010, consisting of the following:

a) Emission Point 011, the Mill Room.
b) Emission Point 012, the Oil Scrubber preceded by water scrubber serving the extractor, the refinery, and the still house.
c) Emission Point 013, the Oil Scrubber preceded by a water scrubber serving the Pexite Plant.

Such air emissions equipment shall be operated as efficiently as possible to provide the maximum reduction of air contaminants.

PART II
EMISSION LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning March 24, 1987, and lasting until April 1, 1990, the permittee is authorized to operate air emissions equipment and emit air contaminants from the Delnav Plant, Emission Point 020, consisting of the following:

a) Emission Point 021, the Flare.
b) Emission Point 022, the Limestone Tank No. 1.
c) Emission Point 023, the Limestone Tank No. 2.
d) Emission Point 024, the Digestion Sump Vent.

Such air emissions equipment shall be operated as efficiently as possible to provide the maximum reduction of air contaminants.

PART II
EMISSION LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning March 24, 1987, and lasting until April 1, 1990, the permittee is authorized to operate air emissions equipment and emit air contaminants from the Poly-Pale Plant, Emission Point 030, consisting of the following:

a) Emission Point 031, a 1.6 MM BTU/hr McKee Boiler (Dowtherm)
b) Emission Point 032, a 1.6 MM BTU/hr McKee Boiler (Dowtherm)
c) Emission Point 033, the Water Scrubber Vent
d) Emission Point 034, the Heat Treatment Vent

Such air emissions equipment shall be operated as efficiently as possible to provide the maximum reduction of air contaminants.

PART II
EMISSION LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning May 9, 1989, and lasting until April 1, 1990, the permittee is authorized to operate air emissions equipment and emit air contaminants from the Neuphor production process, including a carbon adsorption scrubber, Emission Point 038.

Such air emissions equipment shall be operated as efficiently as possible to provide the maximum reduction of air contaminants.

PART II
EMISSION LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning March 24, 1987, and lasting until April 1, 1990, the permittee is authorized to operate air emissions equipment and emit air contaminants from the Rosin Shed, Emission Point 040, consisting of the following:

a) Emission Point 041, the Drumming Operation (no controls)
b) Emission Point 042, the Vapor Hood Water Scrubber serving the flaking operation
c) Emission Point 043, the Dust Wood Water Scrubber serving the flaking operation.

Such air emissions equipment shall be operated as efficiently as possible to provide the maximum reduction of air contaminants.

PART II
EMISSION LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning March 24, 1987, and lasting until April 1, 1990, the permittee is authorized to operate air emissions equipment and emit air contaminants from Package Boiler No. 5, Emission Point 050.

Such emissions shall be limited and monitored by the permittee as specified below:

EMISSION LIMITATIONS

SO_2	4.8 lb/10^6 BTU
Particulate Matter	59.2 lbs/hr
Opacity	40% or except as provided in APC-S-1.

MONITORING REQUIREMENTS

SO_2	See Part III, No. (1).

PART II
EMISSION LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning February 9, 1988, and lasting until April 1, 1990, the permittee is authorized to operate air emissions equipment and emit air contaminants from the Vinsol Resins Process, Emission Point 060, consisting of the following:

a) Emission Point 061, the Sealas Furnace No. 1 (process heater)
b) Emission Point 062, the Sealas Furnace No. 2 (process heater)
c) Emission Point 063, the Water Scrubber serving Vinsol Kettle No. 1
d) Emission Point 064, the Water Scrubber serving Vinsol Kettle No. 2

Such air emissions equipment shall be operated as efficiently as possible to provide the maximum reduction of air contaminants.

Beginning February 9, 1988, the permittee is authorized to also manufacture hard resins in this process area.

PART II
EMISSION LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning February 9, 1988, and lasting until April 1, 1990, the permittee is authorized to operate air emissions equipment and emit air contaminants from the Truline Flaking & Packaging Area, Emission Point 070, consisting of the following:

a) Emission Point 071, the Flaking Belt Vapor Hood Vent
b) Emission Point 072, the Dracco Baghouse Model 20-S
c) Emission Point 073, the Pangborn Baghouse Model 600

Such air emissions equipment shall be operated as efficiently as possible to provide the maximum reduction of air contaminants.

Beginning February 9, 1988, the permittee is authorized to also handle hard resins in this process area.

PART II
EMISSION LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning March 24, 1987, and lasting until April 1, 1990, the permittee is authorized to operate air emissions equipment and emit air contaminants from the Hard Resins Area, Emission Point 080, consisting of the following:

a) Emission Point 081, the 8.3 MM BTU/hr Struthers-Wells Dowtherm Boiler
b) Emission Point 082, the Water Scrubber preceded by an oil scrubber

Such air emissions equipment shall be operated as efficiently as possible to provide the maximum reduction of air contaminants.

PART II
EMISSION LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning March 24, 1987, and lasting until April 1, 1990, the permittee is authorized to operate air emissions equipment and emit air contaminants from the Continuous Esterification Process Area, Emission Point 090, consisting of the following:

a) Emission Point 091, the 5 MM BTU/hr Foster Wheeler Dowtherm Boiler
b) Emission Point 092, the Continuous Esterification Unit (no controls)

Such air emissions equipment shall be operated as efficiently as possible to provide the maximum reduction of air contaminants.

PART II
EMISSION LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning March 24, 1987, and lasting until April 1, 1990, the permittee is authorized to operate air emissions equipment and emit air contaminants from the Hard Resins Flaking House, Emission Point 100, consisting of the following:

a) Emission Point 101, the Bvell Norblo Dust Collector Model No. 396-14-20.

b) Emission Point 102, the Vapor Hood Vent Scrubber.

Such air emissions equipment shall be operated as efficiently as possible to provide the maximum reduction of air contaminants.

PART II
EMISSION LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning March 24, 1987, and lasting until April 1, 1990, the permittee is authorized to operate air emissions equipment and emit air contaminants from the Foral and Staybelite Hydrogenation Plant, Emission Point 110, consisting of the following:

a) Emission Point 111, the 3.3 MM BTU/hr Struthers Wells Dowtherm Boiler
b) Emission Point 112, the Hydrogenation Process (no controls)

Such air emissions equipment shall be operated as efficiently as possible to provide the maximum reduction of air contaminants.

PART II
EMISSION LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning March 24, 1987, and lasting until April 1, 1989, the permittee is authorized to operate air emissions equipment and emit air contaminants from the Hydrogen Furnace, Emission Point 120.

Such air emissions equipment shall be operated as efficiently as possible to provide the maximum reduction of air contaminants.

PART II
EMISSION LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning March 24, 1987, and lasting until April 1, 1990, the permittee is authorized to operate air emissions equipment and emit air contaminants from the Pilot Plant Area, Emission Point 130, consisting of the following:

a) Emission Point 131, the 3.3 MM BTU/hr Struthers Wells Dowtherm Boiler
b) Emission Point 132, Vent No. 1
c) Emission Point 133, Vent No. 2

Such air emissions equipment shall be operated as efficiently as possible to provide the maximum reduction of air contaminants.

PART II
EMISSION LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning March 24, 1987, and lasting until April 1, 1990, the permittee is authorized to operate air emissions equipment and emit air contaminants from the Resin 731 Area, Emission Point 140, with no controls.

Such air emissions equipment shall be operated as efficiently as possible to provide the maximum reduction of air contaminants.

PART II
EMISSION LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning March 24, 1987, and lasting until April 1, 1990, the permittee is authorized to operate air emissions equipment and emit air contaminants from the Stills & Dresinate Area, Emission Point 150, consisting of the following:

a) Emission Point 151, the 5 MM BTU/hr Foster Wheeler Boiler (Dowtherm)

There are to be no emissions to the atmosphere from the process.

Such air emissions equipment shall be operated as efficiently as possible to provide the maximum reduction of air contaminants.

PART II
EMISSION LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning March 24, 1987, and lasting until April 1, 1990, the permittee is authorized to operate air emissions equipment and emit air contaminants from the Kymene Plant, Emission Point 160, consisting of the following:

a) Emission Point 161, the Kettle Vent Water Aspirator.

b) Emission Point 162, the Dust Collector

Such air emissions equipment shall be operated as efficiently as possible to provide the maximum reduction of air contaminants.

PART II
EMISSION LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning March 24, 1987, and lasting until April 1, 1990, the permittee is authorized to operate air emissions equipment and emit air contaminants from the Defoamer Plant, Emission Point 170, consisting of the following:

a) Emission Point 171, the Silica Drier Furnace

b) Emission Point 172, the Dust Bag

Such air emissions equipment shall be operated as efficiently as possible to provide the maximum reduction of air contaminants.

PART II
EMISSION LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning March 24, 1987, and lasting until April 1, 1990, the permittee is authorized to operate air emissions equipment and emit air contaminants from the Rosin Amine D Plant, Emission Point 180, consisting of the following:

a) Emission Point 181, the 8.3 MM BTU/hr Struthers Wells Dowtherm Boiler
b) Emission Point 182, the Ammoniation Vent Scrubber
c) Emission Point 183, the Amine Reactor Vent (no controls)

Such air emissions equipment shall be operated as efficiently as possible to provide the maximum reduction of air contaminants.

PART II
EMISSION LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning March 24, 1987, and lasting until April 1, 1990, the permittee is authorized to operate air emissions equipment and emit air contaminants from the Polyrad and Polyol Process Area with water scrubber, Emission Point 190.

Such air emissions equipment shall be operated as efficiently as possible to provide the maximum reduction of air contaminants.

PART II
EMISSION LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning March 24, 1987, and lasting until April 1, 1990, the permittee is authorized to operate air emissions equipment and emit air contaminants from the Para-Menthane Unit with no controls, Emission Point 200.

Such air emissions equipment shall be operated as efficiently as possible to provide the maximum reduction of air contaminants.

PART II
EMISSION LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning March 24, 1987, and lasting until April 1, 1990, the permittee is authorized to operate air emissions equipment and emit air contaminants from the Para-Menthane Hydroperoxide Unit Oxidizer Vent, Emission Point 210.

Such air emissions equipment shall be operated as efficiently as possible to provide the maximum reduction of air contaminants.

PART II
EMISSION LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning March 24, 1987, and lasting until April 1, 1990, the permittee is authorized to operate air emissions equipment and emit air contaminants from the Sulfate Turpentine Refining Unit with a water scrubber, Emission Point 220.

Such air emissions equipment shall be operated as efficiently as possible to provide the maximum reduction of air contaminants.

PART II
EMISSION LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning March 24, 1987, and lasting until April 1, 1990, the permittee is authorized to operate air emissions equipment and emit air contaminants from Carbon Regeneration Furnace with Scrubber, Emission Point 230.

Such air emissions equipment shall be operated as efficiently as possible to provide the maximum reduction of air contaminants.

PART II
EMISSION LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning March 24, 1987, and lasting until April 1, 1990, the permittee is authorized to operate air emissions equipment and emit air contaminants from the 65 MM BTU/hr Murray MCF 3 Series 59 boiler (Package Boiler No. 6), Emission Point 240.

Such emissions shall be limited and monitored by the permittee as specified below:

EMISSION LIMITATIONS

Particulate Matter	0.44 lb/MM BTU
SO_2	59.3 TPY and 4.8 lb/MM BTU
Opacity	40%

MONITORING REQUIREMENTS

SO_2	See Part III, Part 5

PART III
OTHER REQUIREMENTS

(1) For Emission Point 050, the following condition shall apply:

By this condition the stated facility is allowed sulfur dioxide emissions exceeding those emitted by the facility in 1970. This condition is authorized by the Bureau until August 1, 1987

Operation of this facility at higher sulfur dioxide emission levels than in 1970 after August 1, 1987, is not allowed unless and until subsequent and additional Bureau authorization is given.

Attendant to the authorization stated above, this facility shall make written quarterly reports to the Bureau with the first report to be made ninety (90) days after the natural gas curtailment begins or at the time of reapplication for Permit to Operate, whichever comes first. The reports shall state density, hating value, daily usage (pounds/day), date of use and sulfur content of any and all fuels which exceed 2.2 percent sulfur by weight.

(2) For Emission Point 060, the following additional condition will also apply:

Records of the operation of the facility must be kept and must show the duration of operation (time and dates) and amount of material processed. These records shall be made available to the Mississippi Bureau of Pollution Control upon request.

(3) For Emission Point 130, the following condition shall apply.

Since this unit is used for experimental purposes and emissions may change depending on the conditions of the experiments, semi-annual reports shall be made to the Mississippi Bureau of Pollution Control explaining all work done including, as a minimum, the duration of tests, types of raw materials used and products produced, and an assessment of emissions caused.

(4) For Emission Point 230, the following condition shall apply:

If the scrubber should fail or its effectiveness be reduced, the permittee shall notify the Bureau immediately by phone and follow-up with a letter. The information reported shall include the nature of the failure, time of, estimated repair time, and action taken to preclude a recurrence.

PART III
OTHER REQUIREMENTS

(5) For Emission Point 240, the following condition shall apply:

The permittee is limited to a usage of 260,925 gallons/calendar year of No. 6 fuel oil with sulfur content not to exceed 2.9%. A quarterly report shall be submitted detailing the amount of fuel oil used and the fuel oil characteristics. The report shall be postmarked by the 30th day of the month following the end of the calendar quarter.

(6) The following process areas are assigned Emission Point designations for record keeping purposes. However, all of the following are closed processes, and there should be no emissions from any of them.

Emission Point No.	Description
152	Stills & Dresinate Area
250	Para-Cymene Unit
260	Synthetic Pine Oil Facility
270	Paracol Plant

(7) For all Emission Points, the following additional condition shall apply:

Good housekeeping shall be maintained to prevent fugitive emissions. Should fugitive emissions become excessive as determined by Bureau inspection or by complaints, additional control measures may be required.

(8) By June 1, 1988, the permittee shall submit current emissions data for each emission point using the Bureau-approved plan and current storage tank data forms for each storage tank.

SR:358

21

BUREAU OF POLLUTION CONTROL
SAMPLE REQUEST FORM Lab Bench No. 374

I. GENERAL INFORMATION: Facility Name Hercules
County Code Forrest NPDES Permit No.
Discharge No. Date Requested
Sample Point Identification South gw monitoring well
Requested By John Herrmann Data To Sam Mabry
Type of Sample: Grab ( ) Composite (Flow) (Time) Other ( )

II. SAMPLE IDENTIFICATION:
Environment Condition Overcast and cool Collected By John Herrmann
Where Taken South well located near neutral impoundment

	Type	Parameters	Preservative	Date	Time
1.	Grab	EPT-Hex. Cr.	Cool 4°C	3-23-83	100
2.	Grab	EPT-All Other EPT Metals	5 ml HNO_3	3-23-83	100
3.	Grab	Phenol	5 ml H_2SO_4	3-23-83	100
4.					
5.					

III. FIELD:

Analysis	Computer Code	Request	Results	Analyst	Date
pH	(000400)	( )			
D.O.	(000300)	( )			
Temperature	(000010)	( )			
Residual Chlorine	(050060)	( )			
Flow	(074060)	( )			

IV. TRANSPORTATION OF SAMPLE: Bus ( ) RO Vehicle ( ) Other ( )

V. LABORATORY: Received By DeJonnette King Date 3-23-83 Time 1545
Recorded By Dorothy Lewis Date Sent to State Office 5-31-83

Analysis	Computer Code	Request	Result		Analyst	Date Measured
BOD_5	(000310)	( )		mg/l		*
COD	(000340)	( )		mg/l		
TOC	(000680)	( )		mg/l		
Suspended Solids	(099000)	( )		mg/l		
TKN	(000625)	( )		mg/l		
Ammonia-N	(000610)	( )		mg/l		
Fecal Coliform(1)	(074055)	( )		colonies/100 ml		*
Fecal Coliform(2)	(074055)	( )		colonies/100 ml		*
Total Phosphorus	(000665)	( )		mg/l		
Oil and Grease(1)	(000550)	( )		mg/l		
Oil and Grease(2)	(000550)	( )		mg/l		
Chlorides	(099016)	( )		mg/l		
Phenol	(032730)	(X)	< .10	mg/l	DK	3-24-83
Total Chromium	(001034)	(X)	< 0.01	mg/l	MDP	4-18-83
Hex. Chromium	(001032)	(X)	< .05	mg/l	DK	3-24-83
Zinc	(001092)	( )		mg/l		
Copper	(001042)	( )		mg/l		
Lead	(017501)	(X)	< 0.10	mg/l	MDP	4-27-83
Cyanide	(000722)	( )		mg/l		
Cadmium		(X)	< .01	mg/l	MDP	4-15-83
Arsenic		(X)	< 10	ug/l	MDP	4-18-83
Barium		(X)	< 1.0	mg/l	MDP	4-27-83
Mercury		(X)	< 0.50	ug/l	MDP	5-4-83
Silver		(X)	< 0.01	mg/l	MDP	4-28-83
		( )				
		( )				
		( )				
		( )				
		( )				

Remarks These are groundwater samples; low concentrations results should be reported in parts per billion Selenium results will follow when completed.
*Date of Test Initiation

BUREAU OF POLLUTION CONTROL
SAMPLE REQUEST FORM Lab Bench No. 373

I. GENERAL INFORMATION: Facility Name Hercules
County Code Forrest NPDES Permit No.
Discharge No. Date Requested
Sample Point Identification North g.w. monitoring well
Requested By John Herrmann Data To Sam Mabry
Type of Sample: Grab ( ) Composite (Flow) (Time) Other ( )

II. SAMPLE IDENTIFICATION:
Environment Condition Clear and cool Collected By John Herrmann
Where Taken North well near sludge pits

	Type	Parameters	Preservative	Date	Time
1.	Grab	EPT-Hex. Cr.	Cool 4°C	3-22-83	1100
2.	Grab	EPT-All other EPT Metals	5 ml HNO_3	3-22-83	1100
3.	Grab	Phenol	5 ml H_2SO_4	3-22-83	1100
4.					
5.					

II. FIELD:

Analysis	Computer Code	Request	Results	Analyst	Date
pH	(000400)	( )			
D.O.	(000300)	( )			
Temperature	(000010)	( )			
Residual Chlorine	(050060)	( )			
Flow	(074060)	( )			

IV. TRANSPORTATION OF SAMPLE: Bus ( ) RO Vehicle ( ) Other ( )

V. LABORATORY: Received By DeJonnette King Date 3-23-83 Time 1545
Recorded By Dorothy Lewis Date Sent to State Office 5-31-83

Analysis	Computer Code	Request	Result	Analyst	Date Measured
BOD_5	(000310)	( )	mg/l		*
COD	(000340)	( )	mg/l		
TOC	(000680)	( )	mg/l		
Suspended Solids	(099000)	( )	mg/l		
TKN	(000625)	( )	mg/l		
Ammonia-N	(000610)	( )	mg/l		
Fecal Coliform(1)	(074055)	( )	colonies/100 ml		*
Fecal Coliform(2)	(074055)	( )	colonies/100 ml		*
Total Phosphorus	(000665)	( )	mg/l		
Oil and Grease(1)	(000550)	( )	mg/l		
Oil and Grease(2)	(000550)	( )	mg/l		
Chlorides	(099016)	( )	mg/l		
Phenol	(032730)	(X)	<.10 mg/l	DK	3-24-83
Total Chromium	(001034)	(X)	<0.01 mg/l	MDP	4-18-83
Hex. Chromium	(001032)	( )	mg/l		
Zinc	(001092)	(X)	<.05 mg/l	DK	3-24-83
Copper	(001042)	( )	mg/l		
Lead	(017501)	(X)	<0.10 mg/l	MDP	4-27-83
Cyanide	(000722)	( )	mg/l		
Cadmium		(X)	<.01 mg/l	MDP	4-15-83
Arsenic		(X)	<10 ug/l	MDP	4-18-83
Barium		(X)	<1.0 mg/l	MDP	4-25-83
Mercury		(X)	<0.50 ug/l	MDP	5-4-83
Silver		(X)	<0.01 mg/l	MDP	4-28-83
Selenium		(X)			
		( )			
		( )			
		( )			

Remarks These are groundwater samples; concentrations should be in the parts per billion range
Selenium results will follow when completed
*Date of Test Initiation

BUREAU OF POLLUTION CONTROL
SAMPLE REQUEST FORM Lab Bench No. _____

I. GENERAL INFORMATION: Facility Name HERCULES
County Code FORREST NPDES Permit No. _____
Discharge No. _____ Date Requested _____
Sample Point Identification NORTH G.W. MONITORING WELL.
Requested By JOHN HERRMANN. Data To SAM HABAY.
Type of Sample: Grab (X) Composite (Flow) (Time) Other ( ) _____

II. SAMPLE IDENTIFICATION:
Environment Condition CLEAR & COOL Collected By JOHN HERRMANN
Where Taken NORTH WELL - NEAR SLUDGE PITS

	Type	Parameters	Preservative	Date	Time
1.	GRAB	EPT - HEXAVALENT Cr	- COOL - 4°C	3/22	11:00a
2.	GRAB	EPT - ALL OTHER			
3.		EPT METALS	5ml HNO_3	3/22	11:00a
4.	GRAB	PHENOL	5ml H_2SO_4	3/22	11:00a
5.					

III. FIELD:

Analysis	Computer Code	Request	Results	Analyst	Date
pH	(000400)	( )			
D.O.	(000300)	( )			
Temperature	(000010)	( )			
Residual Chlorine	(050060)	( )			
Flow	(074060)	( )			

IV. TRANSPORTATION OF SAMPLE: Bus ( ) ~~By~~ Vehicle ( ) Other ( )
V. LABORATORY: Received By Lillian Bell King Date 3-23-83 Time 0645
Recorded By Dorothy Jones Date Sent to State Office 5-31-83

Analysis	Computer Code	Request	Result		Analyst	Date Measured
BOD_5	(000310)	( )		mg/l		*
COD^5	(000340)	( )		mg/l		
TOC	(000680)	( )		mg/l		
Suspended Solids	(099000)	( )		mg/l		
TKN	(000625)	( )		mg/l		
Ammonia-N	(000610)	( )		mg/l		
Fecal Coliform(1)	(074055)	( )		colonies/100 ml		*
Fecal Coliform(2)	(074055)	( )		colonies/100 ml		*
Total Phosphorus	(000665)	( )		mg/l		
Oil and Grease(1)	(000550)	( )		mg/l		
Oil and Grease(2)	(000550)	( )		mg/l		
Chlorides	(099016)	( )		mg/l		
Phenol	(032730)	(X)	<.10	mg/l	AK	3-24-83
Total Chromium	(001034)	(X)	<0.01	mg/l	MDP	4-18-83
Hex. Chromium	(001032)	( )		mg/l		
Zinc	(001092)	(X)	<.05	mg/l	AK	3-24-83
Copper	(001042)	( )		mg/l		
Lead	(017501)	( )	<0.10	mg/l	MDP	4-27-83
Cyanide	(000722)	( )		mg/l		
Cadmium		(X)	<.01	mg/l	MDP	4-15-83
Arsenic		( )	< 10	ug/l	MDP	4-18-83
Barium		( )	< 1.0	mg/l	MDP	4-25-83
Mercury		(X)	<0.50	ug/l	MDP	5-4-83
Selenium		( )				
Silver		( )	<0.01	mg/l	MDP	4-28-83
		( )				
		( )				
		( )				
		( )				

Remarks THESE ARE GROUNDWATER SAMPLES; CONCENTRATIONS SHOULD BE IN THE PARTS PER BILLION RANGE. Silver
*Date of Test Initiation results will follow when Completed

BUREAU OF POLLUTION CONTROL
SAMPLE REQUEST FORM

Lab Bench No. 372

I. GENERAL INFORMATION: Facility Name Hercules
County Code Forrest NPDES Permit No.
Discharge No. Date Requested
Sample Point Identification Sludge pit
Requested By John Herrmann Data To Sam Mabry
Type of Sample: Grab ( ) Composite (Flow) (Time) Other ( )

II. SAMPLE IDENTIFICATION:
Environment Condition Overcast and cool Collected By John Herrmann
Where Taken Sludge pit adjacent to road

	Type	Parameters	Preservative	Date	Time
1.	Grab/Composite	EPT (extraction)	NA	3-23-83	130
2.		All EPT Metals			
3.					
4.					
5.					

III. FIELD:

Analysis	Computer Code	Request	Results	Analyst	Date
pH	(000400)	( )			
D.O.	(000300)	( )			
Temperature	(000010)	( )			
Residual Chlorine	(050060)	( )			
Flow	(074060)	( )			

IV. TRANSPORTATION OF SAMPLE: Bus ( ) RO Vehicle ( ) Other ( )

V. LABORATORY: Received By DeJonnette King Date 3-23-83 Time 1545
Recorded By Dorothy Lewis Date Sent to State Office 5-31-83

Analysis	Computer Code	Request	Result		Analyst	Date Measured
BOD_5	(000310)	( )		mg/l		*
COD	(000340)	( )		mg/l		
TOC	(000680)	( )		mg/l		
Suspended Solids	(099000)	( )		mg/l		
TKN	(000625)	( )		mg/l		
Ammonia-N	(000610)	( )		mg/l		
Fecal Coliform(1)	(074055)	( )		colonies/100 ml		*
Fecal Coliform(2)	(074055)	( )		colonies/100 ml		*
Total Phosphorus	(000665)	( )		mg/l		
Oil and Grease(1)	(000550)	( )		mg/l		
Oil and Grease(2)	(000550)	( )		mg/l		
Chlorides	(099016)	( )		mg/l		
Phenol	(032730)	( )		mg/l		
Total Chromium	(001034)	(X)	.02	mg/l	MDP	4-27-83
Hex. Chromium	(001032)	( )		mg/l		
Zinc	(001092)	( )		mg/l		
Copper	(001042)	( )		mg/l		
Lead	(017501)	(X)	<0.10	mg/l	MDP	4-27-83
Cyanide	(000722)	( )		mg/l		
Barium		(X)	≤1.0	mg/l	MDP	4-25-83
Arsenic		(X)	29.1	ug/l	MDP	4-18-83
Cadmium		(X)	<0.01	mg/l	MDP	4-27-83
Mercury		(X)	<0.50	ug/l	MDP	4-29-83
Selenium		(X)	<0.01	mg/l	MDP	4-28-83
		( )				
		( )				
		( )				
		( )				
		( )				

Remarks Analysis for purpose of determining whether hazardous see 261.24 for limits.
Selenium results will follow when completed
*Date of Test Initiation

BUREAU OF POLLUTION CONTROL
SAMPLE REQUEST FORM

Lab Bench No. 371

I. GENERAL INFORMATION: Facility Name Hercules
County Code Forrest NPDES Permit No.
Discharge No. Date Requested
Sample Point Identification Ash from boiler
Requested By John Herrmann Data To Sam Mabry
Type of Sample: Grab ( ) Composite (Flow) (Time) Other ( )

II. SAMPLE IDENTIFICATION:
Environment Condition Overcast and cool Collected By John Herrmann
Where Taken North end of ash pile

	Type	Parameters	Preservative	Date	Time
1.	Grab/composite	EPT (extraction)	NA	3-23-83	130
2.		All EPT Metals			
3.					
4.					
5.					

III. FIELD:

Analysis	Computer Code	Request	Results	Analyst	Date
pH	(000400)	( )			
D.O.	(000300)	( )			
Temperature	(000010)	( )			
Residual Chlorine	(050060)	( )			
Flow	(074060)	( )			

IV. TRANSPORTATION OF SAMPLE: Bus ( ) RO Vehicle ( ) Other ( )

V. LABORATORY: Received By DeJonnette King Date 3-23-83 Time 1545
Recorded By Dorothy Lewis Date Sent to State Office 5-31-83

Analysis	Computer Code	Request	Result		Analyst	Date Measured
BOD_5	(000310)	( )		mg/l		*
COD	(000340)	( )		mg/l		
TOC	(000680)	( )		mg/l		
Suspended Solids	(099000)	( )		mg/l		
TKN	(000625)	( )		mg/l		
Ammonia-N	(000610)	( )		mg/l		
Fecal Coliform(1)	(074055)	( )		colonies/100 ml		*
Fecal Coliform(2)	(074055)	( )		colonies/100 ml		*
Total Phosphorus	(000665)	( )		mg/l		
Oil and Grease(1)	(000550)	( )		mg/l		
Oil and Grease(2)	(000550)	( )		mg/l		
Chlorides	(099016)	( )		mg/l		
Phenol	(032730)	( )		mg/l		
Total Chromium	(001034)	(X)	0.08	mg/l	MDP	4-27-83
Hex. Chromium	(001032)	( )		mg/l		
Zinc	(001092)	( )		mg/l		
Copper	(001042)	( )		mg/l		
Lead	(017501)	(X)	< 0.10	mg/l	MDP	4-27-83
Cyanide	(000722)	( )		mg/l		
Barium		(X)	≤ 1.0	mg/l	MDP	4-25-83
Arsenic		(X)	≤ 10.9	mg/l	MDP	4-18-83
Cadmium		(X)	< 0.01	mg/l	MDP	4-27-83
Mercury		(X)	< 0.50	ug/l	MDP	4-29-83
Silver		(X)	< 0.01	mg/l	MDP	4-28-83
Selenium		(X)				
		( )				
		( )				
		( )				
		( )				

Remarks Analysis for determining whether hazardous see 261.24 for limits.
Selenium results will follow when completed

*Date of Test Initiation

22

June 22, 1983

Mr. Charles Jordan, Environmental Coordinator
Hercules Inc.
P. O. Box 1937
Hattiesburg, MS 39401

Dear Mr. Jordan:

Re: MSD008182081

Enclosed are the results of analyses which were performed on March 22 and 23
Groundwater quality is acceptable. In addition, analysis of the waste
(i.e., the sludge pit, ash pit) indicates that these wastes would not be
sidered hazardous under the Mississippi Hazardous Waste Rules.

I appreciated your cooperation in obtaining the samples.

Sincerely,

John P. Herrmann
Division of Solid Waste Management

JPH:cbl
Enclosures

23

August 25, 1981

Mr. Charles Jordan
Hercules, Incorporated
P. O. Box 1937
Hattiesburg, MS 39401

Dear Mr. Jordan:

Enclosed is a copy of the laboratory report concerning the waste samples collected at your facility on July 9, 1981.

If you should have any questions regarding this matter, please contact me.

Sincerely yours,

Jim Hardage, Chemist
Division of Solid Waste Management

JH/dm

Enclosure

ENVIRONMENTAL PROTECTION SYSTEMS, INC.

P O Box 1519
2206 Old Mobile Hwy.
Pascagoula, Ms 39567
601.762-4842

P O Box 20382
106 Upton Dr
Jackson, Ms 39209
601/922-8242

LABORATORY REPORT

6/10

Client: Mississippi State Board of Health
Location: Jackson, Mississippi
Date: 8/4/81
Invoice No.: 5980

Date Collected: By Client
Date Received: 7/10/81
Date Analyzed: 7/10/81

LABORATORY SAMPLE IDENTIFICATION

81072350 - H-001
81072351 - H-001
81072352 - H-001
81072353 - H-002

ANALYSES	IDENTIFICATION NUMBER 2350	2351	2352	2353
Arsenic, Total, ppm	<0.02	----	----	0.03
Barium, Total, ppm	0.10	----	----	0.07
Cadmium, Total, ppm	0.09	----	----	<0.01
Chromium, Total, ppm	<0.01	----	----	<0.01
Chromium, Hexavalent, ppm	<0.005	----	----	<0.005
Lead, Total, ppm	<0.001	----	----	0.087
Mercury, Total, ppm	<0.002	----	----	<0.002
Selenium, Total, ppm	<0.01	----	----	<0.01
Silver, Total, ppm	0.17	----	----	<0.01
Oil and Grease, Total Recoverable, ppm	----	103	----	----
Delnav, ppm[1]	----	----	<0.10	----

COMMENTS

Analyses conducted in accordance with 40 CFR, Part 261, May, 1980, Test Methods for Evaluating Solid Waste. [1]Analyzed by GC/MS.

CERTIFICATION

Cindy Peeples
Manager of Laboratory Services

E. C. McGriff, Jr., Ph.D., P.E., Director

ENVIRONMENTAL PROTECTION SYSTEMS, INC.

P O Box 1519
2206 Old Mobile Hwy
Pascagoula, Ms 39567
601/762-4842

P O Box 20382
106 Upton Dr
Jackson, Ms 39209
601/922-8242

LABORATORY REPORT

7/10

Client: Mississippi State Board of Health
Location: Jackson, Mississippi
Date: 8/4/81
Invoice No.: 5980

Date Collected: By Client
Date Received: 7/10/81
Date Analyzed: 7/10/81

LABORATORY SAMPLE IDENTIFICATION

81072354 - H-002

ANALYSES	IDENTIFICATION NUMBER			
	2354			
Delnav, ppm[1]	<0.10			

COMMENTS

CERTIFICATION

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U.S. ENVIRONMENTAL PROTECTION AGENCY
SURVEILLANCE AND ANALYSIS DIVISION

REGION IV — ATHENS, GEORGIA

DISCHARGER _____ SAMPLING STATION NO. _____
ADDRESS _____ SAMPLING LOCATION _____
CONTACT _____

SAMPLE AND WASTE FLOW INFORMATION

SAMPLE ☐ MUN. ☐ IND. ☒ INF. ☐ EFF. ☐ _____ ☐ _____ HR. COMP. AT _____ MIN. INTERVALS ☐ FLOW PRO.
SAMPLER ☐ EPA ☐ DISCHARGER ☒ MAN. ☐ AUTO. ☐ TYPE _____
FLOW ☐ EPA ☐ DISCHARGER ☐ AVG. ☐ INST. ☐ EST. ☐ _____ EQUIP _____
COMPUTED FROM _____

SAMPLE COLLECTION

	COMPOSITE	GRAB SAMPLES				SAMPLE CODE [2]	
SAD NO.						BACTERIAL	0
DATE	/	7/9/81				BOD, COD, TOC	1
TIME	/	1320				CYANIDE	2
FLOW ( ) [1]						METALS	3
TEMPERATURE °C						N, P	4
pH						ORG, O&G, PEST	5
TOT. Cl_2 RES, mg/l						PHENOLS	6
						SOLIDS	7
							8
SAMPLE CODE	1	SEE TAG					9
SAMPLED BY (Sig)							A
SEALED BY (Sig)							B
DATE AND TIME		7/9/81 1				PRESERVED	P

[1] Use Avg. Flow for Composites and Inst. Flow for Grabs [2] Circle or Indicate Analysis and Enter Numerical Code

SAMPLE CUSTODY AND SHIPPING INFORMATION

SAMPLES RELEASED TO (SIG) OR SHIPPED VIA	DATE	TIME	NO. CONT.	NO CART.	RECEIPT NO.
			4		

REMARKS AND SKETCHES

— CONTAINERS —

1 qt GLASS OIL & GREASE
1 qt GLASS DELNAV
1 pt GLASS phenol
1 pt GLASS METALS (primary drinking water)

4

* G P O 1980 — 640-198 / 1988. REGION NO. 4

U.S. ENVIRONMENTAL PROTECTION AGENCY
SURVEILLANCE AND ANALYSIS DIVISION

REGION IV — ATHENS, GEORGIA

DISCHARGER
ADDRESS
CONTACT

SAMPLING STATION NO. H-62
SAMPLING LOCATION [illegible] ROAD

SAMPLE AND WASTE FLOW INFORMATION

SAMPLE ☐ MUN. ☒ IND. ☐ INF. ☐ EFF. ☐ ____ ☒ [illegible] HR. COMP. AT ____ MIN. INTERVALS ☐ FLOW PRO.
SAMPLER ☐ EPA ☐ DISCHARGER ☒ MAN. ☐ AUTO. ☐ TYPE ____
FLOW ☐ EPA ☐ DISCHARGER ☐ AVG. ☐ INST. ☐ EST. ☐ ____ EQUIP ____
COMPUTED FROM ____

SAMPLE COLLECTION

	COMPOSITE	GRAB SAMPLES			SAMPLE CODE [2]	
SAD NO.					BACTERIAL	0
DATE	/	7/9/81			BOD, COD, TOC	1
TIME	/	1200			CYANIDE	2
FLOW ( ) [1]					METALS	3
TEMPERATURE °C					N, P	4
pH					ORG, O&G, PEST	5
TOT. Cl2 RES, mg/l					PHENOLS	6
					SOLIDS	7
						8
SAMPLE CODE		SEE TAG				9
SAMPLED BY (Sig)		[illegible]				A
SEALED BY (Sig)		[illegible]				B
DATE AND TIME		7/9/81 1445			PRESERVED	P

[1] Use Avg. Flow for Composites and Inst. Flow for Grabs [2] Circle or Indicate Analysis and Enter Numerical Code

SAMPLE CUSTODY AND SHIPPING INFORMATION

SAMPLES RELEASED TO (SIG) OR SHIPPED VIA	DATE	TIME	NO. CONT.	NO CART.	RECEIPT NO.
			2		

REMARKS AND SKETCHES

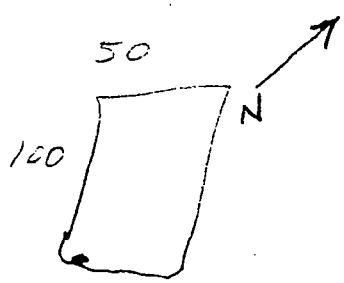
SAMPLE SPLIT W/ FACILITY

2 CONTAINERS TOTAL

1 Qt GLASS DELNAV

1 Qt GLASS ~~Cr, Ba, Zn, Pb~~ (primary drinking water metals)

2



* G P O 1980—640-188 / 1088. REGION NO. 4

SOLID WASTE MANAGEMENT BRANCH ACTIVITIES FORM

FACILITY NAME: Hercules Inc.

FACILITY ADDRESS: West 7th Street

FACILITY LOCATION: Hattiesburg, Ms.

FACILITY CONTACT: Mr Charles Jordan PHONE NO: 545-3450

Samples were collected from influent to primary treatment impoundment and from sludge impoundment pond. Samples were split with Mr. Charles Jordan, who accompanied me during sample collection. Refer to lab report and photographs.

Jim Hardage
Signature of Inspector
Robert A. Lee

FACILITY ID NUMBER	DATE
MSD 008 182 081	07 09 81

INSPECTOR (Single letter code)

H O R + MARK Koenig - EPA, Athens Lab

TYPE ACTIVITY (Enter code(s))

MO

CI - compliance inspection
FO - follow-up inspection
CO - complaint investigation
IS - interim status inspection
SI - site investigation
GB - geological boring
TO - training operator
MO - monitoring
TA - technical assistance
SR - special request
OR - other (specify)

TYPE FACILITY (Enter code(s))

GN TR SL

GN - generator
TR - treater
TP - transporter
SS - storage (short-term)
SL - storage (long-term)
LF - landfill
SF - sanitary landfill
OD - open dump
LM - landfarm
LO - lagoon (impoundment)
UI - UIC
IN - incinerator
PF - processing facility
TS - transfer station
OR - other (specify)

VIOLATIONS

Section No.	Subsection

U. S. ENVIRONMENTAL PROTECTION AGENCY
REGION IV

RECEIPT FOR SAMPLES

The samples described below were collected in connection with the administration and enforcement of the:

(X) Resource Conservation and Recovery Act (RCRA) 42 U.S.C. §6901, et seq., specifically Section 3007 of RCRA, 42 U.S.C. §6927.

( ) Toxic Substances Control Act (TSCA) 15 U.S.C. §2601, et seq., specifically Section 11 of TSCA, 15 U.S.C. §2610.

MARK E KOENIG — Inspector Name:
COLLEGE STATION ROAD ATHENS, GA — Inspector Address:

HERCULES INC. — Name of Firm:
W 7th street HATTIESBURG, MS — Firm Address:

MR CHARLES JORDAN — Firm Owner, Operator or Agent:
CHEMICAL ENGINEER — Title:

SAMPLE NUMBER	COLLECTED DATE	COLLECTED TIME	SAMPLE TYPE WATER	SOIL	OTHER	DUPLICATE SAMPLES OFFERED	ACCEPTED	REJECTED	SAMPLE LOCATION ON-SITE	OFF-SITE
H-001	7/9/81	1330	X				X		X	
H-002	7/9/81	1400			X		X		X	

Receipt for the sample(s) described above is hereby acknowledged:

Mark E Koenig
Signature of Inspector

ENVIRONMENTAL ENGINEER
Title

Receipt/Rejection of Duplicate or Split Samples is hereby acknowledged:

Charles Jordan
Signature of Firm Owner, Operator or Agent

CHEMICAL ENGINEER
Title

ADDITIONAL COMMENTS

24

READ 3

Cadmium; CASRN 7440-43-9 (12/01/89)

Health risk assessment information on a chemical is included in IRIS only after a comprehensive review of chronic toxicity data by work groups composed of U.S. EPA scientists from several Program Offices. The summaries presented in Sections I and II represent a consensus reached in the review process. The other sections contain U.S. EPA information which is specific to a particular EPA program and has been subject to review procedures prescribed by that Program Office. The regulatory actions in Section IV may not be based on the most current risk assessment, or may be based on a current, but unreviewed, risk assessment, and may take into account factors other than health effects (e.g., treatment technology). When considering the use of regulatory action data for a particular situation, note the date of the regulatory action, the date of the most recent risk assessment relating to that action, and whether technological factors were considered. Background information and explanations of the methods used to derive the values given in IRIS are provided in the five Background Documents in Service Code 5, which correspond to Sections I through V of the chemical files.

STATUS OF DATA FOR Cadmium

File On-Line 03/31/87

Category (section)	Status	Last Revised
Oral RfD Assessment (I.A.)	on-line	10/01/89
Inhalation RfD Assessment (I.B.)	pending	
Carcinogenicity Assessment (II.)	on-line	03/01/88
Drinking Water Health Advisories (III.A.)	no data	
U.S. EPA Regulatory Actions (IV.)	on-line	01/01/89

==========

_I. CHRONIC HEALTH HAZARD ASSESSMENT FOR NONCARCINOGENIC EFFECTS

Substance Name -- Cadmium
CASRN -- 7440-43-9
Last Revised -- 10/01/89

The Reference Dose (RfD) is based on the assumption that thresholds exist for certain toxic effects such as cellular necrosis, but may not exist for other toxic effects such as carcinogenicity. In general, the RfD is an estimate (with uncertainty spanning perhaps an order of magnitude) of a daily exposure to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious effects during a lifetime. Please refer to Background Document 1 in Service Code 5 for an elaboration of these concepts. RfDs can also be derived for the noncarcinogenic health effects of

compounds which are also carcinogens. Therefore, it is essential to refer to other sources of information concerning the carcinogenicity of this substance. If the U.S. EPA has evaluated this substance for potential human carcinogenicity, a summary of that evaluation will be contained in Section II of this file when a review of that evaluation is completed.

<<< Cadmium >>>

I.A. REFERENCE DOSE FOR CHRONIC ORAL EXPOSURE (RfDo)

I.A.1. ORAL RfD SUMMARY

Critical Effect	Experimental Doses*	UF	MF	RfD
Significant proteinuria	NOAEL (water): 0.005 mg/kg/day	10	1	5E-4 mg/kg/day (water)
Human studies involving chronic exposures	NOAEL (food): 0.01 mg/kg/day	10	1	1E-3 mg/kg/day (food)
U.S. EPA, 1985				

*Conversion Factors: See text for discussion

<<< Cadmium >>>

I.A.2. PRINCIPAL AND SUPPORTING STUDIES (ORAL RfD)

U.S. EPA. 1985. Drinking Water Criteria Document on Cadmium. Office of Drinking Water, Washington, DC. (Final draft)

A concentration of 200 ug cadmium (Cd)/gm wet human renal cortex is the highest renal level not associated with significant proteinuria (U.S. EPA, 1985). A toxicokinetic model is available to determine the level of chronic human oral exposure (NOAEL) which results in 200 ug Cd/gm wet human renal cortex; the model assumes that 0.01% day of the Cd body burden is eliminated per day (U.S. EPA, 1985). Assuming 2.5% absorption of Cd from food or 5% from water, the toxicokinetic model predicts that the NOAEL for chronic Cd exposure is 0.005 and 0.01 mg Cd/kg/day from water and food, respectively (i.e., levels which would result in 200 ug Cd/gm wet weight human renal cortex). Thus, based on an estimated NOAEL of 0.005 mg Cd/kg/day for Cd in drinking water and an UF of 10, an RfD of 0.0005 mg Cd/kg/day (water) was calculated; an equivalent RfD for Cd in food is 0.001 mg Cd/kg/day (see Section VI.A. for references).

I.A.3. UNCERTAINTY AND MODIFYING FACTORS (ORAL RfD)

UF = 10. This uncertainty factor is used to account for intrahuman variability to the toxicity of this chemical in the absence of specific data on sensitive individuals.

MF = 1.

<<< Cadmium >>>

I.A.4. ADDITIONAL COMMENTS (ORAL RfD)

Cd is unusual in relation to most, if not all, of the substances for which an oral RfD has been determined in that a vast quantity of both human and animal toxicity data are available. The RfD is based on the highest level of

Cd in the human renal cortex (i.e., the critical level) not associated with significant proteinuria (i.e., the critical effect). A toxicokinetic model has been used to determine the highest level of exposure associated with the lack of a critical effect. Since the fraction of ingested Cd that is absorbed appears to vary with the source (e.g., food vs. drinking water), it is necessary to allow for this difference in absorption when using the toxicokinetic model to determine an RfD.

I.A.5. CONFIDENCE IN THE ORAL RfD

Study: Not applicable
Data Base: High
RfD: High

The choice of NOAEL does not reflect the information from any single study. Rather, it reflects the data obtained from many studies on the toxicity of cadmium in both humans and animals. These data also permit calculation of pharmacokinetic parameters of cadmium absorption, distribution, metabolism and elimination. All of this information considered together gives high confidence in the data base. High confidence in either RfD follows as well.

<<< Cadmium >>>

I.A.6. EPA DOCUMENTATION AND REVIEW OF THE ORAL RfD

U.S. EPA. 1985. Drinking Water Criteria Document on Cadmium. Office of Drinking Water, Washington, DC. (Final draft)

Agency RfD Work Group Review: 05/15/86, 08/19/86, 09/17/87, 12/15/87, 01/20/88, 05/25/88

Verification Date: 05/25/88

I.A.7. EPA CONTACTS (ORAL RfD)

Ken Bailey / ODW -- (202)382-5535 / FTS 382-5535

Warren Banks / OWRS -- (202)382-7893 / FTS 382-7893

------<<< Cadmium >>>------

I.B. REFERENCE DOSE FOR CHRONIC INHALATION EXPOSURE (RfDi)

A risk assessment for this chemical is under review by an EPA work group.

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II. CARCINOGENICITY ASSESSMENT FOR LIFETIME EXPOSURE

Substance Name -- Cadmium
CASRN -- 7440-43-9
Last Revised -- 03/01/88

Section II provides information on three aspects of the carcinogenic risk assessment for the agent in question; the U.S. EPA classification, and quant-

itative estimates of risk from oral exposure and from inhalation exposure. The classification reflects a weight-of-evidence judgment of the likelihood that the agent is a human carcinogen. The quantitative risk estimates are presented in three ways. The slope factor is the result of application of a low-dose extrapolation procedure and is presented as the risk per mg/kg/day. The unit risk is the quantitative estimate in terms of either risk per ug/L drinking water or risk per ug/cu.m air breathed. The third form in which risk is presented is a drinking water or air concentration providing cancer risks of 1 in 10,000, 1 in 100,000 or 1 in 1,000,000. Background Document 2 (Service Code 5) provides details on the rationale and methods used to derive the carcinogenicity values found in IRIS. Users are referred to Section I for information on long-term toxic effects other than carcinogenicity.

<<< Cadmium >>>

II.A. EVIDENCE FOR CLASSIFICATION AS TO HUMAN CARCINOGENICITY

II.A.1. WEIGHT-OF-EVIDENCE CLASSIFICATION

Classification -- B1; probable human carcinogen by inhalation

Basis -- Limited evidence from epidemiologic studies and sufficient evidence of carcinogenicity in rats and mice by two routes

<<< Cadmium >>>

II.A.2. HUMAN CARCINOGENICITY DATA

Limited. A 2-fold excess risk of lung cancer was observed in cadmium smelter workers. The cohort consisted of 602 white males who had been employed in production work a minimum of 6 months during the years 1940-1969. The population was followed to the end of 1978. Urine cadmium data available for 261 workers employed after 1960 suggested a highly exposed population. The authors were able to ascertain that of these possible confounding factors the increased lung cancer risk was probably not due to the presence of arsenic or to smoking (Thun et al., 1985). An evaluation by the Carcinogen Assessment Group of these possible confounding factors has indicated that the assumptions and methods used in accounting for them may not be valid. As the SMRs observed were low and there is a lack of clear cut evidence of a causal relationship of the cadmium exposure only, this study is considered to supply only limited evidence of human carcinogenicity.

An excess lung cancer risk was also observed in three other studies which were, however, compromised by the presence of other carcinogens (arsenic, smoking) in the exposure or by a small population (Varner, 1983; Sorahan and Waterhouse, 1983; Armstrong and Kazantzis, 1983).

Four studies of workers exposed to cadmium dust or fumes provided evidence of a statistically significant positive association with prostate cancer (Kipling and Waterhouse, 1967; Lemen et al., 1976; Holden, 1980; Sorahan and Waterhouse, 1983), but the total number of cases was small in each study. The Thun et al. (1985) study is an update of an earlier study (Lemen et al., 1976) and does not show excess prostate cancer risk in these workers. Studies of human ingestion of cadmium are inadequate to assess carcinogenicity.

<<< Cadmium >>>

II.A.3. ANIMAL CARCINOGENICITY DATA

Exposure of Wistar rats to cadmium as cadmium chloride at concentrations of 12.5, 25 and 50 ug/cu.m for 18 months, with an additional 13-month observation period, resulted in significant increases in lung tumors (Takenaka et al., 1983). Intratracheal instillation of cadmium oxide did not produce lung tumors in Fischer 344 rats but rather mammary tumors in females and tumors at multiple sites in males (Sanders and Mahaffey, 1984). Injection site tumors

and distant site tumors (for example, testicular) have been reported by a number of authors as a consequence of intramuscular or subcutaneous administration of cadmium metal and chloride, sulfate, oxide and sulfide compounds of cadmium to rats and mice (U.S. EPA, 1985). Seven studies in rats and mice where cadmium salts (acetate, sulfate, chloride) were administered orally have shown no evidence of a carcinogenic response.

II.A.4. SUPPORTING DATA FOR CARCINOGENICITY

Results of mutagenicity tests in bacteria and yeast have been inconclusive. Positive responses have been obtained in mutation assays in Chinese hamster cells (Dom and V79 lines) and in mouse lymphoma cells (Casto, 1976; Ochi and Ohsawa, 1983; Oberly et al., 1982).

Conflicting results have been obtained in assays of chromosomal aberrations in human lymphocytes treated in vitro or obtained from exposed workers. Cadmium treatment in vivo or in vitro appears to interfere with spindle formation and to result in aneuploidy in germ cells of mice and hamsters (Shimada et al., 1976; Watanabe et al., 1979; Gilliavod and Leonard, 1975).

------<<< Cadmium >>>------

II.B. QUANTITATIVE ESTIMATE OF CARCINOGENIC RISK FROM ORAL EXPOSURE

Insufficient data exist to classify cadmium as carcinogenic to humans by the oral route.

------<<< Cadmium >>>------

II.C. QUANTITATIVE ESTIMATE OF CARCINOGENIC RISK FROM INHALATION EXPOSURE

II.C.1. SUMMARY OF RISK ESTIMATES

Inhalation Slope Factor -- 6.1E+0/mg/kg/day

Inhalation Unit Risk -- 1.8E-3/ug/cu.m

Extrapolation Method -- Two stage; only first affected by exposure; extra risk

Air Concentrations at Specified Risk Levels:

Risk Level	Concentration
E-4 (1 in 10,000)	6E-2 ug/cu.m
E-5 (1 in 100,000)	6E-3 ug/cu.m
E-6 (1 in 1,000,000)	6E-4 ug/cu.m

<<< Cadmium >>>

II.C.2. DOSE-RESPONSE DATA FOR CARCINOGENICITY, INHALATION EXPOSURE

Species/Strain Tumor Type	Dose Administered	Dose Human Equivalent	Tumor Incidence	Reference
Human/white male; lung, trachea,	Route: Inhalation exposure in the workplace			Thun et al.,

bronchus cancer deaths 1985

Cumulative Exposure (mg/day/cu.m)	Median Observation	24 hour/ ug/cu.m Equivalent	No. of Expected Lung, Trachea and Bronchus Cancers Assuming No Cadmium Effect	Observed No. of Deaths (lung, trachea, bronchus cancers)
less than or equal to 584	280	168	3.77	2
585-2920	1210	727	4.61	7
greater than or equal to 2921	4200	2522	2.50	7

The 24-hour equivalent = median observation x 10E-3 x 8/24 x 1/365 x 240/365.

<<< Cadmium >>>

___II.C.3. ADDITIONAL COMMENTS (CARCINOGENICITY, INHALATION EXPOSURE)

The unit risk should not be used if the air concentration exceeds 6 ug/cu.m, since above this concentration the slope factor may differ from that stated.

___II.C.4. DISCUSSION OF CONFIDENCE (CARCINOGENICITY, INHALATION EXPOSURE)

The data were derived from a relatively large cohort. Effects of arsenic and smoking were accounted for in the quantitative analysis for cadmium effects.

A slope factor derived from cadmium chloride inhalation assay data in rats (Takenaka et al., 1983) equals 3.4E-1/ug/kg/day for elemental cadmium or 2.1E-1/ug/kg/day for cadmium chloride. An inhalation unit risk for cadmium based on this analysis is 9.2E-2/ug/cu.m. While this estimate is higher than that derived from human data (1.8E-3/ug/cu.m) and thus more conservative, it was felt that the use of available human data was more reliable because of species variations in response and the type of exposure (cadmium salt vs. cadmium fume and cadmium oxide).

------<<< Cadmium >>>------

__II.D. EPA DOCUMENTATION, REVIEW, AND CONTACTS (CARCINOGENICITY ASSESSMENT)

___II.D.1. EPA DOCUMENTATION

U.S. EPA. 1985. Updated Mutagenicity and Carcinogenicity Assessment of Cadmium: Addendum to the Health Assessment Document for Cadmium (May 1981, EPA 600/8-81-023). EPA 600/8-83-025F.

___II.D.2. REVIEW (CARCINOGENICITY ASSESSMENT)

The Addendum to the Cadmium Health Assessment has received both Agency and external review.

Agency Work Group Review: 11/12/86

Verification Date: 11/12/86

___II.D.3. U.S. EPA CONTACTS (CARCINOGENICITY ASSESSMENT)

William E. Pepelko / ORD -- (202)382-5904 / FTS 382-5904

David Bayliss / ORD -- (202)382-5726 / FTS 382-5726

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_III. HEALTH HAZARD ASSESSMENTS FOR VARIED EXPOSURE DURATIONS

Substance Name -- Cadmium
CASRN -- 7440-43-9

Not available at this time

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_IV. U.S. EPA REGULATORY ACTIONS

Substance Name -- Cadmium
CASRN -- 7440-43-9
Last Revised -- 01/01/89

EPA risk assessments may be updated as new data are published and as assessment methodologies evolve. Regulatory actions are frequently not updated at the same time. Compare the dates for the regulatory actions in this section with the verification dates for the risk assessments in sections I and II, as this may explain inconsistencies. Also note that some regulatory actions consider factors not related to health risk, such as technical or economic feasibility. Such considerations are indicated for each action. In addition, not all of the regulatory actions listed in this section involve enforceable federal standards. Please direct any questions you may have concerning these regulatory actions to the U.S. EPA contact listed for that particular action. Users are strongly urged to read the background information on each regulatory action in Background Document 4 in Service Code 5.

<<< Cadmium >>>

__IV.A. CLEAN AIR ACT (CAA)

___IV.A.1. CAA REGULATORY DECISION

Action -- Intent to list under Section 112

Considers technological or economic feasibility? -- NO

Discussion -- Cadmium is a probable human caracinogen (IARC category 2A) and according to EPA's preliminary risk assessment from ambient air exposures, public health risks are significant (3-7 cancer cases/year and maximum lifetime individual risks of 0.003. Thus, EPA indicated that it intends to add cadmium to the list of hazardous air pollutants for which it intends to establish emission standards under section 112(b)(1)(A) of the Clean Air Act. The EPA will decide whether to add cadmium to the list only after studying

possible techniques that might be used to control emissions and further assessing the public health risks. The EPA will add cadmium to the list if emission standards are warranted.

Reference -- 50 FR 42000 (10/16/85)

EPA Contact -- Emissions Standards Division, OAQPS
(917)541-5571 / FTS 629-5571

------<<< Cadmium >>>------

__IV.B. SAFE DRINKING WATER ACT (SDWA)

___IV.B.1. MAXIMUM CONTAMINANT LEVEL GOAL (MCLG) for Drinking Water

Value (status) -- 0.005 mg/L (Proposed, 1985)

Considers technological or economic feasibility? -- NO

Discussion -- An MCLG of 0.005 mg/L for cadmium is proposed based on a provisional DWEL of 0.018 mg/L and drinking water contribution (plus aquatic organism) of 25%. A DWEL of 0.018 mg/L was calculated from a LOAEL of 0.352 mg/day for renal toxicity in humans (calculated), with an uncertainty factor of 10 applied and consumption of 2 L of water/day assumed.

Reference -- 50 FR 46936 Part IV (11/13/85)

EPA Contact -- Criteria and Standards Division, ODW /
(202)382-7571 / FTS 382-7571; or Drinking Water Hotline / (800)426-4791

<<< Cadmium >>>

___IV.B.2. MAXIMUM CONTAMINANT LEVEL (MCL) for Drinking Water

Value (status) -- 0.01 mg/L (Interim, 1980)

Considers technological or economic feasibility? -- YES

Discussion --

Reference -- 45 FR 57332

EPA Contact -- Kenneth Bailey / Criteria and Standards Division, ODW /
(202)382-7571 / FTS 382-7571; or Drinking Water Hotline / (800)426-4791

------<<< Cadmium >>>------

__IV.C. CLEAN WATER ACT (CWA)

___IV.C.1. AMBIENT WATER QUALITY CRITERIA, Human Health

Water and Fish Consumption: 1E+1 ug/L

Fish Consumption Only: None

Considers technological or economic feasibility? -- NO

Discussion -- The criteria is the same as the existing standard for drinking water.

Reference -- 45 FR 79318 (11/28/80)

EPA Contact -- Criteria and Standards Division, OWRS
(202)475-7315 / FTS 475-7315

<<< Cadmium >>>

___IV.C.2. AMBIENT WATER QUALITY CRITERIA, Aquatic Organisms

Freshwater:

Acute -- 3.9E+0 ug/L (1-hour average)
Chronic -- 1.1E+0 ug/L (4-day average)

Marine:

Acute -- 4.3E+1 ug/L (1-hour average)
Chronic -- 9.3E+0 ug/L (4-day average)

Considers technological or economic feasibility? -- NO

Discussion -- The freshwater criteria are hardness dependent. Values given here are calculated at a hardness of 100 mg/L CaCO3. A complete discussion can be found in the referenced notice.

Reference -- 50 FR 30784 (07/29/85)

EPA Contact -- Criteria and Standards Division, OWRS
(202)475-7315 / FTS 475-7315

------<<< Cadmium >>>------

__IV.D. FEDERAL INSECTICIDE, FUNGICIDE, AND RODENTICIDE ACT (FIFRA)

___IV.D.1. PESTICIDE ACTIVE INGREDIENT, Registration Standard

None

___IV.D.2. PESTICIDE ACTIVE INGREDIENT, Special Review

Action -- Final regulatory action - PD4 (1987)

Considers technological or economic feasibility? -- YES

Summary of regulatory action -- The basis for selection of the final regulatory option is presented in Position Document 4.

Reference -- 52 FR 31076 (08/19/87)

EPA Contact -- Special Review Branch, OPP / (703)557-7400 / FTS 557-7400

------<<< Cadmium >>>------

__IV.E. TOXIC SUBSTANCES CONTROL ACT (TSCA)

No data available

------<<< Cadmium >>>------

__IV.F. RESOURCE CONSERVATION AND RECOVERY ACT (RCRA)

___IV.F.1. RCRA APPENDIX IX, for Ground Water Monitoring

Status -- Listed

Reference -- 52 FR 25942 (07/09/87)

EPA Contact -- Jerry Garman / OSW / (202)382-4658 / FTS 382-4658

------<<< Cadmium >>>------

__IV.G. SUPERFUND (CERCLA)

___IV.G.1. REPORTABLE QUANTITY (RQ) for Release into the Environment

Value (status) -- 10 pounds (Proposed, 1987)

Considers technological or economic feasibility? -- NO

Discussion -- The proposed RQ for cadmium is 10 pounds, based on potential carcinogenicity. Available data indicate a hazard ranking of medium, based on a potency factor of 57.87/mg/kg/day and weight-of-evidence group B1, which corresponds to an RQ of 10 pounds. Cadmium has also been found to bioaccumulate in the tissues of aquatic and marine organisms, and has the potential to concentrate in the food chain.

Reference -- 52 FR 8140 (03/16/87)

EPA Contact -- RCRA/Superfund Hotline
(800)424-9346 / (202)382-3000 / FTS 382-3000

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_V. SUPPLEMENTARY DATA

Substance Name -- Cadmium
CASRN -- 7440-43-9

Not available at this time

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_VI. BIBLIOGRAPHY

Substance Name -- Cadmium
CASRN -- 7440-43-9
Last Revised -- 10/01/89

__VI.A. ORAL RfD REFERENCES

Foulkes, E.C. 1986. Absorption of cadmium. In: Handbook of Experimental Pharmacology, E.C. Foulkes, Ed. Springer Verlag, Berlin. Vol. 80, p. 75-100.

Friberg, L., M. Piscator, G.F. Nordberg and T. Kjellstrom. 1974. Cadmium in the environment, 2nd ed. CRC Press, Inc., Boca Raton, FL.

Shaikh, Z.A. and J.C. Smith. 1980. Metabolism of orally ingested cadmium in humans. In: Mechanisms of Toxicity and Hazard Evaluation, B. Holmstedt et al., Ed. Elsevier Publishing Co., Amsterdam. p. 569-574.

U.S. EPA. 1985. Drinking Water Criteria Document on Cadmium. Office of Drinking Water, Washington, DC. (Final draft)

WHO (World Health Organization). 1972. Evaluation of certain food additives and the contaminants mercury, lead, and cadmium. Sixteenth Report of the Joint FAO/WHO Expert Committee on Food Additives. WHO Technical Report Series No. 505, FAO Nutrition Meetings Report Series No. 51. Geneva, Switzerland.

WHO (World Health Organization). 1984. Guidelines for drinking water quality -- recommendations. Vol. 1. Geneva, Switzerland.

------<<< Cadmium >>>------

__VI.B. INHALATION RfD REFERENCES

None

------<<< Cadmium >>>------

__VI.C. CARCINOGENICITY ASSESSMENT REFERENCES

Armstrong, B.G. and G. Kazantzis. 1983. The mortality of cadmium workers. Lancet. June 25, 1983: 1425-1427.

Casto, B. 1976. Letter to Richard Troast, U.S. EPA. Enclosing mutagenicity data on cadmium chloride and cadmium acetate.

Gilliavod, N. and A. Leonard. 1975. Mutagenicity tests with cadmium in the mouse. Toxicology. 5: 43-47.

Holden, H. 1980. Further mortality studies on workers exposed to cadmium fumes. Presented at Seminar on Occupational Exposure to Cadmium, March 20, 1980, London, England.

Kipling, M.D. and J.A.H. Waterhouse. 1967. Cadmium and prostatic carcinoma. Lancet. 1: 730.

Lemen, R.A., J.S. Lee, J.K. Wagoner and H.P. Blejer. 1976. Cancer mortality among cadmium production workers. Ann. N.Y. Acad. Sci. 271: 273.

Oberly, T., C.E. Piper and D.S. McDonald. 1982. Mutagenicty of metal salts in the L5178 Y mouse lymphoma assay. J. Toxicol. Environ. Health. 9: 367-376.

Ochi, T. and M. Ohsawa. 1983. Induction of 6-thioguanine-resistant mutants and single-strand scission DNA by cadmium chloride in cultured Chinese hamster cells. Mutat. Res. 111: 69-78.

Sanders, C.L. and J.A. Mahaffey. 1984. Carcinogenicity of single and multiple intratracheal instillations of cadmium oxide in the rat. Environ. Res. 33: 227-233.

Shimada, T., T. Watanabe and A. Endo. 1976. Potential mutagenicity of cadmium in mammalian oocytes. Mutat. Res. 40: 389-396.

Sorahan, T. and J.A.H. Waterhouse. 1983. Mortality study of nickel-cadmium battery workers by the method of regression models in life tables. Br. J. Ind. Med. 40: 293-300.

Takenaka, S., H. Oldiges, H. Konig, D. Hochrainer and G. Oberdoerster. 1983. Carcinogenicity of cadmium aerosols in Wistar rats. J. Natl. Cancer Inst. 70: 367-373.

Thun, M.J., T.M. Schnorr, A.B. Smith and W.E. Halperin. 1985. Mortality among a cohort of U.S. cadmium production workers: An update. J. Natl. Cancer Inst. 74(2): 325-333.

U.S. EPA. 1985. Updated Mutagenicity and Carcinogenicity Assessment of Cadmium. Addendum to the Health Assessment Document for Cadmium (EPA 600/B-81-023). EPA 600/B-83-025F.

Varner, M.O. 1983. Updated epidemiologic study of cadmium smelter workers. Presented at the Fourth International Cadmium Conference. Unpublished.

Watanabe, T., T. Shimada and A. Endo. 1979. Mutagenic effects of cadmium on mammalian oocyte chromosomes. Mutat. Res. 67: 349-356.

VI.D. DRINKING WATER HA REFERENCES

None

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SYNONYMS

7440-43-9
C.I. 77180
Cadmium
KADMIUM

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Chromium(VI); CASRN 7440-47-3 (12/01/89)

Health risk assessment information on a chemical is included in IRIS only after a comprehensive review of chronic toxicity data by work groups composed of U.S. EPA scientists from several Program Offices. The summaries presented in Sections I and II represent a consensus reached in the review process. The other sections contain U.S. EPA information which is specific to a particular EPA program and has been subject to review procedures prescribed by that Program Office. The regulatory actions in Section IV may not be based on the most current risk assessment, or may be based on a current, but unreviewed, risk assessment, and may take into account factors other than health effects (e.g., treatment technology). When considering the use of regulatory action data for a particular situation, note the date of the regulatory action, the date of the most recent risk assessment relating to that action, and whether technological factors were considered. Background information and explanations of the methods used to derive the values given in IRIS are provided in the five Background Documents in Service Code 5, which correspond to Sections I through V of the chemical files.

STATUS OF DATA FOR Chromium(VI)

File On-Line 03/31/87

Category (section)	Status	Last Revised
Oral RfD Assessment (I.A.)	on-line	03/01/88
Inhalation RfD Assessment (I.B.)	pending	
Carcinogenicity Assessment (II.)	on-line	03/01/88
Drinking Water Health Advisories (III.A.)	on-line	03/01/88
U.S. EPA Regulatory Actions (IV.)	on-line	03/01/88

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_I. CHRONIC HEALTH HAZARD ASSESSMENT FOR NONCARCINOGENIC EFFECTS

Substance Name -- Chromium(VI)
CASRN -- 7440-47-3
Last Revised -- 03/01/88

The Reference Dose (RfD) is based on the assumption that thresholds exist for certain toxic effects such as cellular necrosis, but may not exist for other toxic effects such as carcinogenicity. In general, the RfD is an estimate (with uncertainty spanning perhaps an order of magnitude) of a daily exposure to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious effects during a lifetime. Please

Refer to Background Document 1 in Service Code 5 for an elaboration of these concepts. RfDs can also be derived for the noncarcinogenic health effects of compounds which are also carcinogens. Therefore, it is essential to refer to other sources of information concerning the carcinogenicity of this substance. If the U.S. EPA has evaluated this substance for potential human carcinogenicity, a summary of that evaluation will be contained in Section II of this file when a review of that evaluation is completed.

<<< Chromium(VI) >>>

I.A. REFERENCE DOSE FOR CHRONIC ORAL EXPOSURE (RfDo)

I.A.1. ORAL RfD SUMMARY

Critical Effect	Experimental Doses*	UF	MF	RfD
No effects reported Rat, 1-Year Drinking Study MacKenzie et al., 1958	NOAEL: 25 mg/L of chromium as K_2CrO_4 (converted to 2.4 mg of chromium(VI)/kg/day) LOAEL: none	500	1	5E-3 mg/kg/day

*Dose Conversion Factors & Assumptions: Drinking water consumption = 0.097 L/kg/day (reported)

<<< Chromium(VI) >>>

I.A.2. PRINCIPAL AND SUPPORTING STUDIES (ORAL RfD)

MacKenzie, R.D., R.U. Byerrum, C.F. Decker, C.A. Hoppert and R.F. Langham. 1958. Chronic toxicity studies. II. Hexavalent and trivalent chromium administered in drinking water to rats. Am. Med. Assoc. Arch. Ind. Health. 18: 232-234.

Groups of eight male and eight female Sprague-Dawley rats were supplied with drinking water containing 0-11 ppm (0-11 mg/L) hexavalent chromium (as K_2CrO_4) for 1 year. The control group (10/sex) received distilled water. A second experiment involved three groups of 12 males and 9 female rats. One group was given 25 ppm (25 mg/L) chromium (as K_2CrO_4); a second received 25 ppm chromium in the form of chromic chloride; and the controls again received distilled water. No significant adverse effects were seen on appearance, weight gain, or food consumption, and there were no pathologic changes in the blood or other tissues in any treatment group. The rats receiving 25 ppm of chromium (as K_2CrO_4) showed an approximate 20% reduction in water consumption. This dose corresponds to 2.4 mg chromium(VI)/kg/day based on actual body weight and water consumption data.

For rats treated with 0-11 ppm (in the diet), blood was examined monthly, and tissues (livers, kidneys and femurs) were examined at 6 months and 1 year. Spleens were also examined at 1 year. The 25 ppm groups (and corresponding controls) were examined similarly, except that no animals were killed at 6 months. An abrupt rise in tissue chromium concentrations was noted in rats treated with greater than 5 ppm. The authors stated that "apparently, tissues can accumulate considerable quantities of chromium before pathological changes result." In the 25 ppm treatment groups, tissue concentrations of chromium were approximately 9 times higher for those treated with hexavalent chromium than for the trivalent group.

Similar no-effect levels have been observed in dogs and humans. Anwar et al. (1961) observed no significant effects in female dogs (2/dose group) given up to 11.2 ppm chromium(VI) (as K_2CrO_4) in drinking water for 4 years. The

calculated doses were 0.012-0.30 mg/kg of chromium(VI). In humans, no adverse health effects were detected (by physical examination) in a family of four persons who drank for 3 years from a private well containing chromium(VI) at approximately 1 mg/L (0.03 mg/kg/day for a 70-kg human).

<<< Chromium(VI) >>>

___I.A.3. UNCERTAINTY AND MODIFYING FACTORS (ORAL RfD)

UF = 500. The uncertainty factor of 500 represents two 10-fold decreases in dose to account for both the expected interhuman and interspecies variability in the toxicity of the chemical in lieu of specific data, and an additional factor of 5 to compensate for the less-than-lifetime exposure duration of the principal study.

MF = 1

___I.A.4. ADDITIONAL COMMENTS (ORAL RfD)

This RfD is limited to metallic chromium(VI) of soluble salts. Examples of soluble salts include potassium dichromate ($K_2Cr_2O_7$), sodium dichromate ($Na_2Cr_2O_7$), potassium chromate (K_2CrO_4) and sodium chromate (Na_2CrO_4).

Trivalent chromium is an essential nutrient. There is some evidence to indicate that hexavalent chromium is reduced in part to trivalent chromium in vivo (Petrilli and DeFlora, 1977, 1978; Gruber and Jennette, 1978).

The literature available on possible fetal damage caused by chromium compounds is limited. No studies were located on teratogenic effects resulting from ingestion of chromium.

<<< Chromium(VI) >>>

___I.A.5. CONFIDENCE IN THE ORAL RfD

Study: Low
Data Base: Low
RfD: Low

Confidence in the chosen study is low because of the small number of animals tested, the small number of parameters measured and the lack of toxic effect at the highest dose tested. Confidence in the data base is low because the supporting studies are of equally low quality, and teratogenic and reproductive endpoints are not well studied. Low confidence in the RfD follows.

___I.A.6. EPA DOCUMENTATION AND REVIEW OF THE ORAL RfD

U.S. EPA. 1984. Health Effects Assessment for Hexavalent Chromium. Prepared by the Office of Health and Environmental Assessment, Environmental Criteria and Assessment Office, Cincinnati, OH for the Office of Solid Waste and Emergency Response, Washington, DC.

U.S. EPA. 1985. Drinking Water Health Advisory for Chromium. Prepared by the Office of Health and Environmental Assessment, Environmental Criteria and Assessment Office, Cincinnati, OH for the Office of Drinking Water, Washington, DC. (Draft)

Agency RfD Work Group Review: 11/21/85, 02/05/86

Verification Date: 02/05/86

___I.A.7. EPA CONTACTS (ORAL RfD)

Kenneth L. Bailey / ODW -- (202)382-5535 / FTS 382-5535

Christopher T. DeRosa / ORD -- (513)569-7534 / FTS 684-7534

------<<< Chromium(VI) >>>------

__I.B. REFERENCE DOSE FOR CHRONIC INHALATION EXPOSURE (RfDi)

A risk assessment for this chemical is under review by an EPA work group.

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_II. CARCINOGENICITY ASSESSMENT FOR LIFETIME EXPOSURE

Substance Name -- Chromium(VI)
CASRN -- 7440-47-3
Last Revised -- 03/01/88

Section II provides information on three aspects of the carcinogenic risk assessment for the agent in question; the U.S. EPA classification, and quantitative estimates of risk from oral exposure and from inhalation exposure. The classification reflects a weight-of-evidence judgment of the likelihood that the agent is a human carcinogen. The quantitative risk estimates are presented in three ways. The slope factor is the result of application of a low-dose extrapolation procedure and is presented as the risk per mg/kg/day. The unit risk is the quantitative estimate in terms of either risk per ug/L drinking water or risk per ug/cu.m air breathed. The third form in which risk is presented is a drinking water or air concentration providing cancer risks of 1 in 10,000, 1 in 100,000 or 1 in 1,000,000. Background Document 2 (Service Code 5) provides details on the rationale and methods used to derive the carcinogenicity values found in IRIS. Users are referred to Section I for information on long-term toxic effects other than carcinogenicity.

<<< Chromium(VI) >>>

__II.A. EVIDENCE FOR CLASSIFICATION AS TO HUMAN CARCINOGENICITY

___II.A.1. WEIGHT-OF-EVIDENCE CLASSIFICATION

Classification -- A; human carcinogen by the inhalation route

Basis -- Results of epidemiologic studies are consistent across investigators and locations. Dose-response relationships for lung tumors have been established.

<<< Chromium(VI) >>>

___II.A.2. HUMAN CARCINOGENICITY DATA

Sufficient. Epidemiologic studies of chromate production facilities in the United States (Machle and Gregorius, 1948; Brinton et al., 1952; Mancuso and Hueper, 1951, Mancuso, 1975; Baetjer, 1950; Taylor, 1966; Enterline, 1974; Hayes et al., 1979; Hill and Ferguson, 1979), Great Britain (Bidstrup, 1951; Bidstrup and Case, 1956; Alderson et al., 1981), Japan (Watanabe and Fukuchi, 1975; Ohsaki et al., 1978; Sano and Mitohara, 1978; Satoh et al., 1981) and

West Germany (Korallus et al., 1982; Bittersohl, 1971) have established an association between chromium (Cr) exposure and lung cancer. Most of these studies did not attempt to determine whether Cr III or Cr VI compounds were the etiologic agents.

Three studies of the chrome pigment industry, one in Norway (Langard and Norseth, 1975), one in England (Davies, 1978, 1979), and the third in the Netherlands and Germany (Frentzel-Beyme, 1983) also found an association between occupational chromium exposure (predominantly to Cr VI) and lung cancer.

Results of two studies of the chromium plating industry (Royle, 1975; Silverstein et al., 1981) were inconclusive, while the findings of a Japanese study of chrome platers were negative (Okubo and Tsuchiya, 1979). The results of studies of ferrochromium workers (Pokrovskaya and Shabynina, 1973; Langard et al., 1980; Axelsson et al., 1980) were inconclusive as to lung cancer risk.

<<< Chromium(VI) >>>

II.A.3. ANIMAL CARCINOGENICITY DATA

Sufficient. Hexavalent chromium compounds were carcinogenic in animal assays producing the following tumor types: intramuscular injection site tumors in Fischer 344 and Bethesda Black rats and in C57BL mice (Furst et al., 1976; Maltoni, 1974, 1976; Payne, 1960; Heuper and Payne, 1959); intrapleural implant site tumors for various chromium VI compounds in Sprague-Dawley and Bethesda Black rats (Payne, 1960; Heuper 1961; Heuper and Payne, 1962); intrabronchial implantation site tumors for various Cr VI compounds in Wistar rats (Levy and Martin, 1983; Laskin et al., 1970; Levy as quoted in NIOSH, 1975); and subcutaneous injection site sarcomas in Sprague-Dawley rats (Maltoni, 1974, 1976).

<<< Chromium(VI) >>>

II.A.4. SUPPORTING DATA FOR CARCINOGENICITY

A large number of chromium compounds have been assayed in in vitro genetic toxicology assays. In general, hexavalent chromium is mutagenic in bacterial assays whereas trivalent chromium is not (Lofroth, 1978; Petrellie and Flora, 1977, 1978). Likewise Cr VI but not Cr III was mutagenic in yeasts (Bonatti et al., 1976) and in V79 cells (Newbold et al., 1979). Chromium III and VI compounds decrease the fidelity of DNA synthesis in vitro (Loeb et al., 1977), while Cr VI compounds inhibit replicative DNA synthesis in mammalian cells (Levis et al., 1978) and produce unscheduled DNA synthesis, presumably repair synthesis, as a consequence of DNA damage (Raffetto, 1977). Chromate has been shown to transform both primary cells and cell lines (Fradkin et al., 1975; Tsuda and Kato, 1977; Casto et al., 1979). Chromosomal effects produced by treatment with chromium compounds have been reported by a number of authors; for example, both Cr VI and Cr III salts were clastogenic for cultured human leukocytes (Nakamuro et al., 1978).

------<<< Chromium(VI) >>>------

II.B. QUANTITATIVE ESTIMATE OF CARCINOGENIC RISK FROM ORAL EXPOSURE

Not available.

There are no studies indicating that Cr VI is carcinogenic by oral administration. Because there appears to be significant in vivo conversion of Cr VI to Cr III and III to VI, exposure to one form of chromium involves exposure to all forms of chromium. Cr III is an essential trace element.

------<<< Chromium(VI) >>>------

II.C. QUANTITATIVE ESTIMATE OF CARCINOGENIC RISK FROM INHALATION EXPOSURE

II.C.1. SUMMARY OF RISK ESTIMATES

Inhalation Slope Factor -- 4.1E+1/mg/kg/day

Inhalation Unit Risk -- 1.2E-2/ug/cu.m

Extrapolation Method -- Multistage, extra risk

Air Concentrations at Specified Risk Levels:

Risk Level	Concentration
E-4 (1 in 10,000)	8E-3 ug/cu.m
E-5 (1 in 100,000)	8E-4 ug/cu.m
E-6 (1 in 1,000,000)	8E-5 ug/cu.m

<<< Chromium(VI) >>>

II.C.2. DOSE-RESPONSE DATA FOR CARCINOGENICITY, INHALATION EXPOSURE

Species/Strain Tumor Type	Dose	Tumor Incidence		Reference
human	Route: Occupational exposure (inhalation)			
Age (years)	Midrange (ug/cu.m)	Deaths from Lung Cancer	Person Years	
50	5.66	3	1345	Mancuso, 1975
	25.27	6	931	
	46.83	6	299	
60	4.68	4	1063	
	20.79	5	712	
	39.08	5	211	
70	4.41	2	401	
	21.29	4	345	

<<< Chromium(VI) >>>

II.C.3. ADDITIONAL COMMENTS (CARCINOGENICITY, INHALATION EXPOSURE)

The cancer mortality in Mancuso (1975) was assumed to be due to Cr VI, which was further assumed to be no less than one-seventh of total chromium. It was also assumed that the smoking habits of chromate workers were similar to those of the U.S. white male population. Slope factors based on Langard et al. (1980), Axelsson et al. (1980), and Pokrovskaya and Shabynina (1973) result in air unit risk estimates of 1.3E-1, 3.5E-2 and 9.2E-2 ug/cu.m, respectively.

Hexavalent chromium compounds have not produced lung tumors in animals by inhalation. Trivalent chromium compounds have not been reported as carcinogenic by any route of administration.

The unit risk should not be used if the air concentration exceeds 8E-1 ug/cu.m, since above this concentration the slope factor may differ from that stated.

II.C.4. DISCUSSION OF CONFIDENCE (CARCINOGENICITY, INHALATION EXPOSURE)

Results of studies of chromium exposure are consistent across investigators and countries. A dose-relationship for lung tumors has been established. The assumption that the ratio of Cr III to Cr VI is 6:1 may lead to a 7-fold underestimation of risk. The use of 1949 hygiene data, which may underestimate worker exposure, may result in an overestimation of risk. Further overestimation of risk may be due to the implicit assumption that the smoking habits of chromate workers were similar to those of the general white male population, since it is generally accepted that the proportion of smokers is higher for industrial workers than for the general population.

II.D. EPA DOCUMENTATION, REVIEW, AND CONTACTS (CARCINOGENICITY ASSESSMENT)

II.D.1. EPA DOCUMENTATION

Mancuso, T.F. 1975. International Conference on Heavy Metals in the Environment. Toronto, Ontario, Canada.

U.S. EPA. 1984. Health Assessment Document for Chromium. Prepared by the Office of Health and Environmental Assessment, Environmental Criteria and Assessment Office, Cincinnati, OH. EPA 600/8-83-014F.

II.D.2. REVIEW (CARCINOGENICITY ASSESSMENT)

The quantification of cancer risk in the 1984 Health Assessment Document has received peer review in public sessions of the Environmental Health Committee of the U.S. EPA's Science Advisory Board.

Agency Work Group Review: 06/26/86

Verification Date: 06/26/86

II.D.3. U.S. EPA CONTACTS (CARCINOGENICITY ASSESSMENT)

Herman J. Gibb / ORD -- (202)382-5898 / FTS 382-5898

Chao W. Chen / ORD -- (202)382-5719 / FTS 382-5719

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III. HEALTH HAZARD ASSESSMENTS FOR VARIED EXPOSURE DURATIONS

Substance Name -- Chromium(VI)
CASRN -- 7440-47-3
Last Revised -- 03/01/88

III.A. DRINKING WATER HEALTH ADVISORIES

The Office of Drinking Water provides Drinking Water Health Advisories (HAs) as technical guidance for the protection of public health. HAs are not enforceable Federal standards. HAs are concentrations of a substance in

drinking water estimated to have negligible deleterious effects in humans, when ingested, for a specified period of time. Exposure to the substance from other media is considered only in the derivation of the lifetime HA. Given the absence of chemical-specific data, the assumed fraction of total intake from drinking water is 10% for inorganic contaminants and 20% for organic contaminants. The lifetime HA is calculated from the Drinking Water Equivalent Level (DWEL) which, in turn, is based on the Oral Chronic Reference Dose. Lifetime HAs are not derived for compounds which are potentially carcinogenic for humans because of the difference in assumptions concerning toxic threshold for carcinogenic and noncarcinogenic effects. A more detailed description of the assumptions and methods used in the derivation of HAs is provided in Background Document 3 in Service Code 5.

<<< Chromium(VI) >>>

NOTE: All chromium HAs are based on total chromium (III and VI).

III.A.1. ONE-DAY HEALTH ADVISORY FOR A CHILD

Appropriate data for calculating a One-day HA are not available. It is recommended that the Ten-day HA of 1.4 mg/L be used as the One-day HA.

III.A.2. TEN-DAY HEALTH ADVISORY FOR A CHILD

Ten-day HA -- 1.4E+0 mg/L

NOAEL -- 14.4 mg/kg/day
UF -- 100 (allows for interspecies and intrahuman variability with the use of a NOAEL from an animal study)
Assumptions -- 1 L/day water consumption for a 10-kg child

Principal Study -- Gross and Heller, 1946

Rats were exposed to drinking water containing Cr(VI) (K_2CrO_4) at levels of 80 or 134 mg Cr(VI)/L for 60 days (8.3 or 14.4 mg Cr(VI)/kg/day, respectively) without adverse effects. Therefore, a NOAEL of 14.4 mg/kg/day is identified.

<<< Chromium(VI) >>>

III.A.3. LONGER-TERM HEALTH ADVISORY FOR A CHILD

Longer-term (Child) HA -- 2.4E-1 mg/L

NOAEL -- 2.4 mg/kg/day
UF -- 100 (allows for interspecies and intrahuman variability with the use of a NOAEL from an animal study)
Assumptions -- 1 L/day water consumption for a 10-kg child

Principal study -- MacKenzie et al., 1958

In a 1-year drinking water study, consumption of water containing either Cr(III) ($CrCl_3$) or Cr(VI) (K_2CrO_4) (0 to 1.87 mg/kg/day for male rats and 0 to 2.41 mg/kg/day for female rats) produced no significant differences in weight gain, appearance, or pathological changes in the blood or other tissue. Therefore, a NOAEL of 2.41 mg/kg/day is identified.

III.A.4. LONGER-TERM HEALTH ADVISORY FOR AN ADULT

Longer-term (Adult) HA -- 8.4E-1 mg/L

NOAEL -- 2.4 mg/kg/day
UF -- 100 (allows for interspecies and intrahuman variability with the use of a NOAEL from an animal study)
Assumptions -- 2 L/day water consumption for a 70-kg adult

Principal study -- MacKenzie et al., 1958 (study described in III.A.3.)

<<< Chromium(VI) >>>

___III.A.5. DRINKING WATER EQUIVALENT LEVEL / LIFETIME HEALTH ADVISORY

DWEL -- 1.7E-1 mg/L

Assumptions -- 2 L/day water consumption for a 70-kg adult

RfD Verification Date = 02/05/86 (see Section I.A. of this file)

Lifetime HA -- 1.2E-1 mg/L

Assumptions -- 71% exposure by drinking water

Principal study -- MacKenzie et al., 1958 (This study was used in the derivation of the chronic oral RfD; see Section I.A.2.)

___III.A.6. ORGANOLEPTIC PROPERTIES

No data available

<<< Chromium(VI) >>>

___III.A.7. ANALYTICAL METHODS FOR DETECTION IN DRINKING WATER

Determination of chromium is by an atomic absorption technique using either direct aspiration into a flame or a furnace.

___III.A.8. WATER TREATMENT

The treatment technologies that are available to remove chromium from water include coagulation/filtration, lime softening, ion exchange, and reverse osmosis.

<<< Chromium(VI) >>>

___III.A.9. DOCUMENTATION AND REVIEW OF HAs

Gross, W.G., and V.G. Heller. 1946. Chromates in animal nutrition. J. Ind. Hyg. Toxicol. 28: 52-56.

MacKenzie, R.D., R.U. Byerrum, C.F. Decker, C.A. Hoppert and R.F. Langham. 1958. Chronic toxicity studies. II. Hexavalent and trivalent chromium administered in drinking water to rats. Am. Med. Assoc. Arch. Ind. Health. 18: 232-234.

U.S. EPA. 1985. Draft of the Drinking Water Criteria Document on Chromium. Office of Drinking Water, Washington, DC.

EPA review of HAs in 1985.

Public review of HAs following notification of availability in October, 1985.

Scientific Advisory Panel review of HAs in January, 1986.

Preparation date of this IRIS summary -- 06/22/07

___III.A.10. EPA CONTACTS

Kenneth Bailey / ODW -- (202)382-5535 / FTS 382-5535

Edward V. Ohanian / ODW -- (202)382-7571 / FTS 382-7571

------<<< Chromium(VI) >>>------

__III.B. OTHER ASSESSMENTS

Content to be determined

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_IV. U.S. EPA REGULATORY ACTIONS

Substance Name -- Chromium(VI)
CASRN -- 7440-47-3
Last Revised -- 03/01/88

EPA risk assessments may be updated as new data are published and as assessment methodologies evolve. Regulatory actions are frequently not updated at the same time. Compare the dates for the regulatory actions in this section with the verification dates for the risk assessments in sections I and II, as this may explain inconsistencies. Also note that some regulatory actions consider factors not related to health risk, such as technical or economic feasibility. Such considerations are indicated for each action. In addition, not all of the regulatory actions listed in this section involve enforceable federal standards. Please direct any questions you may have concerning these regulatory actions to the U.S. EPA contact listed for that particular action. Users are strongly urged to read the background information on each regulatory action in Background Document 4 in Service Code 5.

<<< Chromium(VI) >>>

__IV.A. CLEAN AIR ACT (CAA)

___IV.A.1. CAA REGULATORY DECISION

Action -- Intent to list under Section 112

Considers technological or economic feasibility? -- NO

Discussion -- Chromium VI is considered a human carcinogen (IARC Group I), and according to EPA's preliminary risk assessment from ambient air exposures, public health risks are significant. There is considerable uncertainty as to the carcinogenicity of other valence states of chromium and the proportion of chromium VI in emission or ambient air samples. The EPA indicated that it intends to add total chromium or chromium VI to the list of hazardous air pollutants for which it intends to establish emission standards under section 112(b)(1)(A) of the Clean Air Act. The EPA will decide whether to add total chromium or chromium VI to the list only after studying possible techniques that might be used to control emissions and further assessing the public health risks. The EPA will add total chromium or chromium VI to the list if emission standards are warranted.

Reference -- 50 FR 24317 (06/10/85)

EPA Contact -- Emissions Standards Division, OAQPS
(917)541-5571 / FTS 629-5571

------<<< Chromium(VI) >>>------

__IV.B. SAFE DRINKING WATER ACT (SDWA)

___IV.B.1. MAXIMUM CONTAMINANT LEVEL GOAL (MCLG) for Drinking Water

Value (status) -- 0.12 mg/L [total chromium] (Proposed, 1985)

Considers technological or economic feasibility? -- NO

Discussion -- An MCLG of 0.12 mg/L for total chromium (Cr III and Cr VI) is proposed based on a provisional DWEL of 0.17 mg/L with data on human exposure factored in (0.10 mg/day in the diet and 0 mg/day by air). A DWEL of 0.17 mg/L was calculated from a NOAEL of 2.41 mg/kg/day in rats [1-year drinking water study (Cr VI)], with an uncertainty factor of 500 applied and consumption of 2 L of water/day assumed.

Reference -- 50 FR 46936 Part IV (11/13/85)

EPA Contact -- Kenneth Bailey / Criteria and Standards Division, ODW /
(202)382-7571 / FTS 382-7571; or Drinking Water Hotline / (800)426-4791

<<< Chromium(VI) >>>

___IV.B.2. MAXIMUM CONTAMINANT LEVEL (MCL) for Drinking Water

Value (status) -- 0.05 mg/L [total chromium] (Interim, 1980)

Considers technological or economic feasibility? -- NO

Discussion --

Reference -- 45 FR 57332

EPA Contact -- Kenneth Bailey / Criteria and Standards Division, ODW /
(202)382-7571 / FTS 382-7571; or Drinking Water Hotline / (800)426-4791

------<<< Chromium(VI) >>>------

__IV.C. CLEAN WATER ACT (CWA)

___IV.C.1. AMBIENT WATER QUALITY CRITERIA, Human Health

Water and Fish Consumption -- 5.0E+1 ug/L

Fish Consumption Only -- None

Considers technological or economic feasibility? -- NO

Discussion --

Reference -- 45 FR 79318 (11/28/80)

EPA Contact -- Criteria and Standards Division, OWRS

(202)475-7315 / FTS 475-7315

<<< Chromium(VI) >>>

___IV.C.2. AMBIENT WATER QUALITY CRITERIA, Aquatic Organisms

Freshwater:

Acute -- 1.6E+1 ug/L (1-hour average)
Chronic -- 1.1E+1 ug/L (4-day average)

Marine:

Acute -- 1.1E+3 ug/L (1-hour average)
Chronic -- 5.0E+1 ug/L (4-day average)

Considers technological or economic feasibility? -- NO

Discussion --

Reference -- 50 FR 30784 (07/28/85)

EPA Contact -- Criteria and Standards Division, OWRS
(202)475-7315 / FTS 475-7315

------<<< Chromium(VI) >>>------

__IV.D. FEDERAL INSECTICIDE, FUNGICIDE, AND RODENTICIDE ACT (FIFRA)

No data available

------<<< Chromium(VI) >>>------

__IV.E. TOXIC SUBSTANCES CONTROL ACT (TSCA)

No data available

------<<< Chromium(VI) >>>------

__IV.F. RESOURCE CONSERVATION AND RECOVERY ACT (RCRA)

___IV.F.1. RCRA APPENDIX IX, for Ground Water Monitoring

Status -- Listed

Reference -- 52 FR 25942 (07/09/87)

EPA Contact -- Jerry Garman / OSW / (202)382-4658 / FTS 382-4658

------<<< Chromium(VI) >>>------

__IV.G. SUPERFUND (CERCLA)

___IV.G.1. REPORTABLE QUANTITY (RQ) for Release into the Environment

Value (status) -- 1 pound (Proposed, 1987)

Considers technological or economic feasibility? -- NO

Discussion -- The proposed RQ for chromium is based on potential carcinogenicity. Available epidemiological data on inhalation of hexavalent chromium indicate a hazard ranking of high based on a potency factor of 388.99/mg/kg/day and assignment to weight-of-evidence group A. This corresponds to an RQ of 1 pound.

Reference -- 52 FR 8140 (03/16/87)

EPA Contact -- RCRA/Superfund Hotline
(800)424-9346 / (202)382-3000 / FTS 382-3000

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_V. SUPPLEMENTARY DATA

Substance Name -- Chromium(VI)
CASRN -- 7440-47-3

Not available at this time

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_VI. BIBLIOGRAPHY

Substance Name -- Chromium(VI)
CASRN -- 7440-47-3

Not available at this time

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SYNONYMS

7440-47-3
CHROMIC ION
CHROMIUM
CHROMIUM, ION
Chromium(VI)
CHROMIUM (VI) ION

Enter keywords or Read or Scan or Mail
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READ 1

Manganese; CASRN 7439-96-5 (09/01/89)

Health risk assessment information on a chemical is included in IRIS only after a comprehensive review of chronic toxicity data by work groups composed of U.S. EPA scientists from several Program Offices. The summaries presented in Sections I and II represent a consensus reached in the review process. The other sections contain U.S. EPA information which is specific to a particular EPA program and has been subject to review procedures prescribed by that Program Office. The regulatory actions in Section IV may not be based on the most current risk assessment, or may be based on a current, but unreviewed, risk assessment, and may take into account factors other than health effects (e.g., treatment technology). When considering the use of regulatory action data for a particular situation, note the date of the regulatory action, the date of the most recent risk assessment relating to that action, and whether technological factors were considered. Background information and explanations of the methods used to derive the values given in IRIS are provided in the five Background Documents in Service Code 5, which correspond to Sections I through V of the chemical files.

STATUS OF DATA FOR Manganese

File On-Line 09/26/88

Category (section)	Status	Last Revised
Oral RfD Assessment (I.A.)	no data	
Inhalation RfD Assessment (I.B.)	no data	
Carcinogenicity Assessment (II.)	on-line	09/26/88
Drinking Water Health Advisories (III.A.)	no data	
U.S. EPA Regulatory Actions (IV.)	no data	

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_I. CHRONIC HEALTH HAZARD ASSESSMENT FOR NONCARCINOGENIC EFFECTS

Substance Name -- Manganese
CASRN -- 7439-96-5

Not available at this time

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_II. CARCINOGENICITY ASSESSMENT FOR LIFETIME EXPOSURE

Section II provides information on three aspects of the carcinogenic risk assessment for the agent in question; the U.S. EPA classification, and quantitative estimates of risk from oral exposure and from inhalation exposure. The classification reflects a weight-of-evidence judgment of the likelihood that the agent is a human carcinogen. The quantitative risk estimates are presented in three ways. The slope factor is the result of application of a low-dose extrapolation procedure and is presented as the risk per mg/kg/day. The unit risk is the quantitative estimate in terms of either risk per ug/L drinking water or risk per ug/cu.m air breathed. The third form in which risk is presented is a drinking water or air concentration providing cancer risks of 1 in 10,000, 1 in 100,000 or 1 in 1,000,000. Background Document 2 (Service Code 5) provides details on the rationale and methods used to derive the carcinogenicity values found in IRIS. Users are referred to Section I for information on long-term toxic effects other than carcinogenicity.

<<< Manganese >>>

II.A. EVIDENCE FOR CLASSIFICATION AS TO HUMAN CARCINOGENICITY

II.A.1. WEIGHT-OF-EVIDENCE CLASSIFICATION

Classification -- D; not classifiable as to human carcinogenicity

Basis -- Existing studies are inadequate to assess the carcinogenicity of manganese.

II.A.2. HUMAN CARCINOGENICITY DATA

None.

<<< Manganese >>>

II.A.3. ANIMAL CARCINOGENICITY DATA - Inadequate

DiPaolo (1964) subcutaneously or intraperitoneally injected DBA/1 mice with 0.1 mL of an aqueous of solution 1% manganese chloride twice weekly for 6 months. A larger percentage of the mice exposed subcutaneously (24/36; 67%) and intraperitoneally (16/39; 41%) to manganese developed lymphosarcomas compared with controls injected with water (16/66; 24%). In addition, tumors appeared earlier in the exposed groups than in the control group. The incidence of tumors other than lymphosarcomas, (i.e., mammary adenocarcinomas, leukemias, injection site tumors) did not differ significantly between the exposed groups and controls. A thorough evaluation of the results of this study was not possible because the results were published in abstract form.

Stoner et al. (1976) tested manganous sulfate in a mouse lung adenoma screening bioassay. Groups of strain A/Strong mice (10/sex), 6-8 weeks old, were exposed by intraperitoneal injection to 0, 6, 15 or 30 mg/kg manganous sulfate 3 times per week for 7 weeks (a total of 22 injections). The animals were observed for an additional 22 weeks after the dosing period, before sacrifice at 30 weeks. There was an apparent increase in the average number of pulmonary adenomas per mouse both at the mid and high doses, as compared with the vehicle controls 10 mice/sex, but the increase was significant only at the high dose (Student's t-test, $p<0.05$). Lung tumors were observed in 12/20, 7/20 and 7/20 animals in the high, medium and low dosage groups, respectively. The percentage of mice with tumors was elevated slightly, but not significantly, at the highest dose level (Fisher Exact test) compared with that observed in the vehicle controls. In the mouse lung adenoma bioassay, certain specific criteria should be met in

order for a response to be considered positive (Shimkin and Stoner, 1975). Among these criteria are an increase in the mean number of tumors per mouse and an evident dose-response relationship. While the results of this study are suggestive of carcinogenicity, the data cannot be considered conclusive since the mean number of tumors per mouse was significantly increased at only one dose, and the evidence for a dose-response relationship was marginal.

Furst (1978) exposed groups of F344 rats (25/sex) intramuscularly or by gavage to manganese powder, manganese dioxide and manganese (II) acetylacetonate (MAA). Treatment consisted of either 9 i.m. doses of 10 mg each of manganese powder or manganese dioxide, six i.m. doses of 50 mg of MAA or 24 doses of 10 mg manganese powder by gavage. Female swiss mice (25/group) were exposed intramuscularly to manganese powder (single 10 mg dose) and manganese dioxide (six doses of 3 or 5 mg each). There was an increased incidence of fibrosarcomas at the injection site in male (40%) and female (24%) rats exposed intramuscularly to MAA compared with vehicle controls (4% male, 4% female). EPA (1984) determined that these increases were statistically significant. No difference in tumor incidence was found between rats and mice exposed to manganese powder and manganese oxide and controls. The U.S. EPA (1984) noted that the study results regarding MAA, an organic manganese compound, cannot necessarily be extrapolated to pure manganese or other inorganic manganese compounds.

Sunderman et al. (1974, 1976) exposed male 344 rats to 0.5 to 4.4 mg manganese dust intramuscularly and found that no tumors were induced at the injection site. It was further observed that co-administration of manganese with nickel subsulfide resulted in decreased sarcoma production by comparison to nickel subsulfide alone. Subsequent studies by Sunderman et al. (1980) suggest that manganese dust may inhibit local sarcoma induction by benzo(a)pyrene.

Witschi et al. (1981) exposed female A/J mice intraperitoneally to 80 mg/kg methylcyclopentadienyl manganese tricarbonyl (MMT) and found that although cell proliferation was produced in the lungs, lung tumor incidence did not increase.

<<< Manganese >>>

II.A.4. SUPPORTING DATA FOR CARCINOGENICITY

None.

Note: Manganese is an element considered essential to human health.

II.B. QUANTITATIVE ESTIMATE OF CARCINOGENIC RISK FROM ORAL EXPOSURE

Not available.

II.C. QUANTITATIVE ESTIMATE OF CARCINOGENIC RISK FROM INHALATION EXPOSURE

Not available.

II.D. EPA DOCUMENTATION, REVIEW, AND CONTACTS (CARCINOGENICITY ASSESSMENT)

II.D.1. EPA DOCUMENTATION

U.S. EPA. 1984. Health Assessment Document for Manganese. Office of Research and Development, Office of Health and Environmental Assessment, Environmental Criteria and Assessment Office, Cincinnati, OH. EPA 600/8-83-013F.

U.S. EPA. 1988. Drinking Water Criteria Document for Manganese. Prepared by the Office of Health and Environmental Assessment, Environmental Criteria and Assessment Office, Cincinnati, OH for the Office of Drinking Water, Washington, DC. ECAO-CIN-D008. (External Review Draft).

II.D.2. REVIEW (CARCINOGENICITY ASSESSMENT)

The Drinking Water Criteria Document for Manganese has received OHEA review.

Agency Work Group Review: 05/25/88

Verification Date: 05/25/88

II.D.3. U.S. EPA CONTACTS (CARCINOGENICITY ASSESSMENT)

Cynthia Sonich-Mullin / ORD -- (513)569-7523 / FTS 684-7523

Julie Du / ODW -- (202)382-7583 / FTS 382-7583

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III. HEALTH HAZARD ASSESSMENTS FOR VARIED EXPOSURE DURATIONS

Substance Name -- Manganese
CASRN -- 7439-96-5

Not available at this time

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IV. U.S. EPA REGULATORY ACTIONS

Substance Name -- Manganese
CASRN -- 7439-96-5

Not available at this time

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V. SUPPLEMENTARY DATA

Substance Name -- Manganese
CASRN -- 7439-96-5

Not available at this time

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VI. BIBLIOGRAPHY

Substance Name -- Manganese
CASRN -- 7439-96-5
Last Revised -- 09/01/89

VI.A. ORAL RfD REFERENCES

None

------<<< Manganese >>>------

VI.B. INHALATION RfD REFERENCES

None

------<<< Manganese >>>------

VI.C. CARCINOGENICITY ASSESSMENT REFERENCES

DiPaolo, J.A. 1964. The potentiation of lymphosarcomas in mice by manganous chloride. Fed. Proc. 23: 393. (Abstract).

Furst, A. 1978. Tumorigenic effect of an organomanganese compound on F344 rats and Swiss albino mice: brief communication. J. Natl. Cancer Inst. 60(5): 1171-1173.

Shimkin, M.B. and G.D. Stoner. 1975. Lung tumors in mice: Application to carcinogenesis bioassay. Adv. Cancer Res. 21: 1-58.

Stoner, G.D., M.B. Shimkin, M.C. Troxell, T.L. Thompson and L.S. Terry. 1976. Test for carcinogenicity of metallic compounds by the pulmonary tumor response in strain A mice. Cancer Res. 36: 1744-1747.

Sunderman, F.W., Jr., T.J. Lau and L.J. Cralley. 1974. Inhibitory effect of manganese upon muscle tumorigenesis by nickel subsulfide. Cancer Res. 34: 92-95.

Sunderman, F.W., Jr., K.S. Kasprzak, P.P. Minghetti, R.M. Maenza, N. Becker, C. Onkelinx and P.J. Goldblatt. 1976. Effects of manganese on carcinogenicity and metabolism of nickel subsulfide. Cancer Res. 36: 1790-1800.

Sunderman, F.W., Jr., M.C. Reid, P.R. Allpass and S.B. Taubman. 1980. Manganese inhibition of sarcoma induction by benzo(a)pyrene in Fischer rats. Proc. Am. Assoc. Cancer Res. 21: 72. (Abstract)

U.S. EPA. 1984. Health Assessment Document for Manganese. Office of Research and Development, Office of Health and Environmental Assessment, Environmental Criteria and Assessment Office, Cincinnati, OH. EPA 600/8-83-013F.

U.S. EPA. 1988. Drinking Water Criteria Document for Manganese. Prepared by the Office of Health and Environmental Assessment, Environmental Criteria and Assessment Office, Cincinnati, OH for the Office of Drinking Water, Washington, DC. ECAO-CIN-D008. (External Review Draft).

Witschi, H.P., P.J. Hakkinen and J.P. Kehrer. 1981. Modification of lung tumor development in A/J mice. Toxicology. 21: 37-45.

------<<< Manganese >>>------

__VI.D. DRINKING WATER HA REFERENCES

None

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SYNONYMS

7439-96-5
COLLOIDAL MANGANESE
MAGNACAT
MANGAN
Manganese
MANGAN NITRIDOVANY
TRONAMANG

Enter keywords or Read or Scan or Mail
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