POOR LEGIBILITY

PORTIONS OF THIS DOCUMENT MAY BE UNREADABLE, DUE TO THE QUALITY OF THE ORIGINAL

NUS CORPORATION
1927 LAKESIDE PARKWAY
SUITE 614
TUCKER, GEORGIA 30084
404-938-7710

2743

SISB/SAS
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EPA - REGION IV
ATLANTA, GA.

C-586-7-0-17

July 2, 1990

Mr. A. R. Hanke
Site Investigation and Support Branch
Waste Management Division
Environmental Protection Agency
345 Courtland Street, N. E.
Atlanta, Georgia 30365

Date: 7/25/90
Site Disposition: NFRAP
EPA Project Manager: [illegible]

Subject: Screening Site Inspection, Phase I
Celotex Corporation
Jacksonville, Duval County, Florida
FLD081365892
TDD No. F4-9002-33

Dear Mr. Hanke:

FIT 4 conducted a Phase I Screening Site Inspection at Celotex Corporation (Celotex) in Jacksonville, Duval County, Florida. The assessment included a comprehensive review of EPA and state file materials, completion of a target survey, and an offsite reconnaissance of the facility and surrounding area.

Celotex, a subsidiary of Celotex Corporation, is located at 9225 Dames Point Road in Jacksonville, Duval County, Florida. The entire facility covers 4 acres. Waste disposal at this property began in 1964 and continues to date (Refs. 1, 2, p. 8).

Celotex manufactures fiberboard. This production probably includes insulation boards, medium-density fiberboards, hardboards, laminated paperboards, and particleboards (including flakeboard, chipboard, chipcore and shavings board), which are made from reconstituted wood (or some lignocellulose-like bagasse) (Ref. 3, p. 17). The entire process consists of mechanical wood breakdown into small discrete particles followed by the bonding of these particles in the presence of heat, synthetic-resin adhesive, or other suitable binders, and the application of pressure (the latter is used to produce particleboard) (Ref. 3, pp. 17, 18). The adhesive/additives include rosin, alum, asphalt, paraffin, synthetic and natural resins, preservatives and fire-resistant chemicals, and drying oils. Urea-formaldehyde and phenol-formaldehyde are the primary resin binders used (Ref. 4, pp. 19, 405).

There have been no regulatory activities against Celotex. However, the waste quantity at the company's land treatment facility is 77.4 cubic feet per year consisting of organic and inorganic material (Ref. 1, pp. 1, 2).

Celotex Corporation is located in the Atlantic Coastal Plain Physiographic Province of northeastern Florida. This is a region of low relief that is underlain by poorly consolidated sediments (Ref. 5, p. 173). The climate is humid and subtropical, with a net annual precipitation of 7 inches (Ref. 6). One-year, 24-hour rainfall is 4 inches (Ref. 7, p. 93).

The major aquifers in this area are the shallow aquifer system and the Floridan Aquifer System (Ref. 8, p. 66). The shallow aquifer system consists of sand, clay, and limestone (Ref. 8, p. 18). It is an unconfined aquifer with a depth to water table at the facility of approximately 10 feet (Ref. 9). Typical hydraulic conductivities of this type range from 1×10^{-5} to 1×10^{-2} cm/sec (Ref. 10). The water-bearing units within this system consist of relatively discontinuous sand or limestone lenses. Zones most used by wells in the area are the surficial sand beds and a relatively continuous limestone and sand zone. These zones are known as the water-table zone and the shallow rock zone (Ref. 8, p. 66). Wells completed in the shallow rock zone are between 40 and 100 feet deep (Ref. 11, p. 6).

The Floridan Aquifer System consists of a series of limestone units (Ref. 8, p. 66). It is separated from the shallow aquifer system by confining clay beds within the Hawthorn Formation that are 350 feet thick (Ref. 12, Plate 25). The Floridan Aquifer System is a vertically continuous sequence of limestones. These limestones have high permeabilities and are hydraulically connected in varying degrees. The thickness of the Upper Floridan Aquifer System is 400 feet. Due to the large volumes of good quality water available from the Upper Floridan and the high chloride content of the Lower Floridan aquifer, very few wells draw water from the Lower Floridan (Ref. 12, p. 44, 45).

The population within 4 miles of Celotex Corporation obtain their potable water from both municipal water companies and private wells (Refs. 2, 9). The municipal wells are all completed in the confined Floridan aquifers. These are located south of the St. Johns River (Refs. 13, 14, 15). Residents north of the river obtain their potable water from private wells (Ref. 2). These wells vary in depth from 40 to 200 feet below land surface (bls) (Ref. 16). The wells located near the facility are completed approximately 1,000 feet bls due to saltwater intrusion in the shallow aquifers. In the area north of the facility, twenty-five percent of the private wells might be completed within the shallow aquifers (Refs. 2, 16). Approximately 25 residences obtain their potable water from the shallow aquifer (Ref. 9, 16).

There are two potential surface water drainage routes from Celotex. Surface water runoff northwest of Celotex drains overland 100 feet to the southwest into a small tributary. The tributary continues south and southeast for 3,500 feet south until entry into the Dames Point Turn of the St. Johns River. The southeastern pathway drains overland to the southeast (500 feet) until entry into Dames Point Turn (Refs. 2, p. 3; 4, p. 8). There are no surface water intakes along the 15-mile extended pathway (Ref. 8). The St. Johns River supports recreational boating and fishing (Ref. 17).

Endangered species that inhabit the St. Johns River include the West Indies manatee (Trichechus manatus) and the sea turtle (Dermochelys coriacea). Similarly, the bald eagle (Haliaeetus leucocephalus) and the wood stork (Mycteria americana) also inhabit the St. Johns River near the Atlantic Ocean (Ref. 18).

The population within a 1-mile radius of the facility is 373, within a 4-mile radius, 43,438 (Ref. 19). The offsite reconnaissance of the facility revealed extensive freshwater wetlands (0.4 mile north). The Fort State Historical Site is also close by (1,000 feet north). There are numerous parks and schools within the 4-mile radius but mostly at a distance of 2.8 miles or greater from Celotex (Refs. 2, p. 5; 8). The property is fenced and inaccessible to the public (Ref. 2, p. 2).

Based on the attachments, the lack of surface water targets, and the confining layer overlying the aquifer of concern, which essentially creates a lack of potentially affected groundwater targets, it is recommended that no further remedial action be planned at Celotex. If you have any questions, please feel free to contact me at NUS Corporation.

Very truly yours,

K D Pass

K. D. Pass for Soloman Pollard
Project Manager

Approved:

Bob Donaghue

KDP/SP/gwn

Enclosures

cc: John McKeown

REFERENCES

1. EPA Notification of Hazardous Waste Site (EPA Form 8900-1) for Celotex Corporation, Jacksonville, Florida. Filed by Lecil M. Colburn, Present Owner, June 8, 1981.

2. NUS Corporation Field Logbook No. F4-2215 for Celotex Corporation, TDD No. F4-9002-33. Documentation of facility reconnaissance, April 25, 1990.

3. John A. Youngquist, "Laminated Wood-Based Composites," Kirk-Othmer Encyclopedia of Chemical Technology, 3rd ed., Vol. 14, (New York: John Wiley & Sons, 1983).

4. George L. Brode, "Phenolic Resins," Kirk-Othmer Encyclopedia of Chemical Technology, 3rd ed., Vol. 17 (New York: John Wiley & Sons, 1983).

5. U.S. Geological Survey, National Water Summary 1984: Hydrologic Events, Selected Water Quality Trends and Ground-Water Resources, Water Supply Paper 2275 (1984), p. 173.

6. U.S. Department of Commerce, Climatic Atlas of the United States (Washington, D.C.: GPO June 1968) Reprint: 1983, National Oceanic and Atmospheric Administration, p. 63.

7. U.S. Department of Commerce, Rainfall Frequency Atlas of the United States, Technical Paper No. 40 (Washington, D.C.: GPO, 1961).

8. Gilbert W. Leve, Groundwater Water in Duval and Nassan Counties, Florida, State of Florida Department of Natural Resources Report of Investigations No. 43 (1966).

9. U.S. Geologic Survey, 7.5 minute series Topographic Quadrangle Maps of Florida: Trout River (Photorevised 1981), Eastport (PR 1981), Mayport (PR 1982), Jacksonville Beach (PR 1988), Arlington (PR 1988), Jacksonville (PR 1982), scale 1:24,000.

10. R. Allan Freeze and John A. Cherry, Groundwater (Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1979).

11. L.V. Causey and G.G. Phelps, Availability and Quality of Water from Shallow Aquifers in Duval County, Florida, U.S. Geological Survey, Water Resources Investigations 78-92 (1978).

12. James A. Miller, Hydrogeologic Framework of the Floridan Aquifer System in Florida and Parts of Georgia, Alabama, and South Carolina, U.S. Geological Survey Professional Paper 1403-B (1986).

13. Jim Dumond, JAX Suburban Utilities, telephone conversation with K.D. Pass, NUS Corporation, August 15, 1988. Subject: Water distribution.

14. Cheryl Phillips, JAX Suburban Utilities, telephone conversation with K.D. Pass, NUS Corporation, August 15, 1988. Subject: Water distribution.

15. John Welsh, Southern States Utilities, telephone conversation with K.D. Pass, NUS Corporation, August 16, 1988. Subject: Water distribution.

16. Hans Longnecker, Complete Services, telephone conversation with Terry Tanner, NUS Corporation, March 23, 1990. Subject: Water distribution.

17. Susan Banyas, Jacksonville Chamber of Commerce, telephone conversation with K.D. Pass, NUS Corporation, June 22, 1988. Subject: Recreational activities on the St. Johns River.

18. Linda Walker, U.S. Fish and Wildlife Service, telephone conversation with Daniel L. Howard, NUS Corporation, January 9, 1989. Subject: Endangered species in Duval County.

19. U.S. Environmental Protection Agency, Graphical Exposure Modeling System (GEMS) Data Base, compiled from U.S. Bureau of the Census data (1980).

SSI PHASE I
RECONNAISSANCE DOCUMENTATION CHECKLIST

This information is required for all SSI Phase Is. Much of it will be detailed in your letter report, logbook, or topo map. In such cases, provide only brief descriptions and reference citations on the checklist to avoid duplication. Cite the source for all information obtained for all sections. Lists of HRS-specific definitions and sensitive environment identifications are attached.

Site Name: Celotex Corporation

City, County, State: Jacksonville, Duval County, Florida

EPA ID No.: FLD081365892

Person responsible for form: K.D. Pass

Date: June 18, 1990

DESKTOP DATA COLLECTION
(Can be done before or after recon. Include attachments as necessary).

I. **Groundwater Use** (See project geologist for this information)

- Identify aquifer(s) of concern.

  25 wells completed in shallow aquifer
  8985 people obtain potable water in confined Floridan aquifer (Ref. letter).

- Identify any areas of karst terrain within the 4-mile site radius, and confining layers and hydraulic interconnections within 2 miles of the site.

  The Jacksonville area is not characterized by karst terrain (Ref. letter).

II. **Surface Water Use**

- Identify uses along the 15-stream-mile surface water pathway (i.e. drinking water, fishing, irrigation, industrial).

  The St. Johns river is used for fishing and recreational purposes (Ref. letter).

- Identify any designated recreational areas, sensitive environments, and fisheries along the surface water pathway. Specify whether fishing is recreational, subsistence, or commercial. Information for smaller water bodies can be confirmed or obtained from local sources during the recon.

  The St. Johns river is used for recreational fishing and boating. Two endangered species inhabit the river (Ref. letter).

III. **Sensitive Environments**

- Identify any sensitive environments within 4 radial miles of the site (See Table 4-23 of the February 15, 1990 HRS Draft Final Rule, attached). Remember, sensitive environments are not limited to critical habitats.

  Sensitive environments include the St. Johns river, wetlands, and the Fort State Historical site (Ref. letter).

DRIVE-BY RECONNAISSANCE DATA COLLECTION
(This information should be recorded in logbooks with attachments).

I. **Groundwater Use** (This information can generally be obtained from local water departments, or city hall in rural areas).

- Identify on copies of topos the extent of all municipal systems and areas served by private wells within 4 miles of the site.

  See topo.

- Locate on copies of topos all municipal well locations in the site area, including any wells of a blended system >4 miles from site. Specify if water from these wells is partially or fully blended prior to or during distribution, and if any surface water intakes contribute to a blended system (whether or not they draw from the target sw pathway).

  See topo.

- Note the depth, pumpage, and population served for all municipal wells within the 4-mile site radius. Complete well survey forms.

  All municipal wells and 75 percent of the private wells located 2 miles north of the site are completed in the Floridan aquifer.

- Document other groundwater uses (e.g. irrigation, industrial).

  Groundwater is commonly used for irrigation in the area.

II. **Surface Water Use**

- Identify on topos the 15-mile surface water pathway.

  See topo.

- Identify and locate on topos any surface water intakes within 15 miles downstream of the site (to be obtained from local water department).

  See topo.

III. **Site and Area Use Data Collection** (May be obtained before or during recon)

- Describe any barriers to travel (e.g. rivers) within 1 mile of the site (consult topo).

  The St. Johns River (see topo).

- Describe population within the immediate site vicinity and within the 4-mile radius (e.g. sparsely populated rural areas, commercial/industrial areas, densely populated urban areas, etc.).

  Population varies from industrial to sparsely residential (see logbook and topo).

- Obtain aerial photos of site and immediate vicinity whenever available (from county offices).

  Not obtained.

- Note if the facility is on sewers or septic tanks (consult water or public works department).

  The facility appears to be on sewer.

- Obtain current property owner information from the county tax assessor's office.

  Celotex Corporation is the owner of the property.

CERCLA ELIGIBILITY QUESTIONNAIRE

Site Name: Celotex Corporation

City: Jacksonville State: Florida

EPA ID Number: FLD081365892

I. CERCLA ELIGIBILITY	Yes	No
Did the facility cease operations prior to November 19, 1980?	___	X

If answer YES, STOP, facility is probably a CERCLA site.

If answer NO, Continue to Part II.

II. RCRA ELIGIBILITY	Yes	No
Did the facility file a RCRA Part A application?	___	X
If YES:		
1. Does the facility currently have interim status?	___	X
2. Did the facility withdraw its Part A application?	___	X
3. Is the facility a known or possible protective filer? (facility filed in error)	___	X
4. Type of facility: Generator_____ Transporter_____ Recycler_____ TSD (Treatment/Storage/Disposal)_____		
Does the facility have a RCRA operating or post closure permit?	___	X
Is the facility a late (after 11/19/80) or non-filer that has been identified by the EPA or the State? (facility did not know it needed to file under RCRA)	___	X

If all answers to questions in Part II are NO, STOP, the facility is a CERCLA eligible site.

If answer to #2 or #3 is YES, STOP, the facility is a CERCLA eligible site.

If answer #2 and #3 are NO and any OTHER answer is YES, site is RCRA, continue to Part III.

III. RCRA SITES ELIGIBLE FOR NPL	Yes	No
Has the facility owner filed for bankruptcy under federal or state laws?	___	___
Has the facility lost RCRA authorization to operate or shown probable unwillingness to carry out corrective action?	___	___
Is the facility a TSD that converted to a generator, transporter or recycler facility after November 19, 1980?	___	___

HAZARD RANKING SYSTEM SCORING SUMMARY

FOR

CELOTEX CORPORATION
EPA SITE NUMBER FLD081365892
JACKSONVILLE
DUVAL COUNTY, FL
EPA REGION: 4

SCORE STATUS: IN PREPARATION

SCORED BY K.D. PASS
OF NUS
ON 05/08/90

DATE OF THIS REPORT: 06/18/90
DATE OF LAST MODIFICATION: 06/18/90

GROUND WATER ROUTE SCORE	:	28.57
SURFACE WATER ROUTE SCORE	:	17.45
AIR ROUTE SCORE	:	0.00
MIGRATION SCORE	:	19.35

Shallow Aquifer

HRS GROUND WATER ROUTE SCORE

CATEGORY/FACTOR	RAW DATA	ASN. VALUE	SCORE
1. OBSERVED RELEASE	NO	0	0
2. ROUTE CHARACTERISTICS			
DEPTH TO WATER TABLE	10 FEET		
DEPTH TO BOTTOM OF WASTE	6 FEET		
DEPTH TO AQUIFER OF CONCERN	4 FEET	3	6
PRECIPITATION	51.8 INCHES		
EVAPORATION	46.0 INCHES		
NET PRECIPITATION	5.8 INCHES	2	2
PERMEABILITY	1.0X10-2 CM/SEC	3	3
PHYSICAL STATE		3	3
TOTAL ROUTE CHARACTERISTICS SCORE:			14
3. CONTAINMENT		3	3
4. WASTE CHARACTERISTICS			
TOXICITY/PERSISTENCE:ASSIGNED VALUE,18			18
WASTE QUANTITY CUBIC YDS	1360382		
DRUMS	0		
GALLONS	0		
TONS	0		
TOTAL	1360382 CU. YDS	8	8
TOTAL WASTE CHARACTERISTICS SCORE:			26
5. TARGETS			
GROUND WATER USE		3	9
DISTANCE TO NEAREST WELL	10000 FEET		
AND	MATRIX VALUE	6	6
TOTAL POPULATION SERVED	95 PERSONS		
NUMBER OF HOUSES	25		
NUMBER OF PERSONS	0		
NUMBER OF CONNECTIONS	0		
NUMBER OF IRRIGATED ACRES	0		
TOTAL TARGETS SCORE:			15

GROUND WATER ROUTE SCORE (Sgw) = 28.57

HRS SURFACE WATER ROUTE SCORE

CATEGORY/FACTOR	RAW DATA	ASN. VALUE	SCORE
1. OBSERVED RELEASE	NO	0	0
2. ROUTE CHARACTERISTICS			
SITE LOCATED IN SURFACE WATER	NO		
SITE WITHIN CLOSED BASIN	NO		
FACILITY SLOPE	1.0 %		
INTERVENING SLOPE	0.0 %	0	0
24-HOUR RAINFALL	4.0 INCHES	3	3
DISTANCE TO DOWN-SLOPE WATER	500 FEET	3	6
PHYSICAL STATE	3		3
TOTAL ROUTE CHARACTERISTICS SCORE:			12
3. CONTAINMENT	3		3
4. WASTE CHARACTERISTICS			
TOXICITY/PERSISTENCE:ASSIGNED VALUE,18			18
WASTE QUANTITY CUBIC YDS	1360382		
DRUMS	0		
GALLONS	0		
TONS	0		
TOTAL	1360382 CU. YDS	8	8
TOTAL WASTE CHARACTERISTICS SCORE:			26
5. TARGETS			
SURFACE WATER USE		2	6
DISTANCE TO SENSITIVE ENVIRONMENTS		3	6
COASTAL WETLANDS	NONE		
FRESH-WATER WETLANDS	2112 FEET		
CRITICAL HABITAT	500 FEET		
DISTANCE TO STATIC WATER	2112 FEET		
DISTANCE TO WATER SUPPLY INTAKE	> 1 MILE		
AND	MATRIX VALUE	0	0
TOTAL POPULATION SERVED	0		
NUMBER OF HOUSES	0		
NUMBER OF PERSONS	0		
NUMBER OF CONNECTIONS	0		
NUMBER OF IRRIGATED ACRES	0		
TOTAL TARGETS SCORE:			12

SURFACE WATER ROUTE SCORE (Ssw) = 17.45

HRS AIR ROUTE SCORE

CATEGORY/FACTOR	RAW DATA	ASN. VALUE	SCORE
1. OBSERVED RELEASE	NO	0	0

2. WASTE CHARACTERISTICS

REACTIVITY:

MATRIX VALUE

INCOMPATIBILITY

TOXICITY

WASTE QUANTITY CUBIC YARDS
DRUMS
GALLONS
TONS

TOTAL

TOTAL WASTE CHARACTERISTICS SCORE: N/A

3. TARGETS

POPULATION WITHIN 4-MILE RADIUS
- 0 to 0.25 mile
- 0 to 0.50 mile
- 0 to 1.0 mile
- 0 to 4.0 miles

DISTANCE TO SENSITIVE ENVIRONMENTS
- COASTAL WETLANDS
- FRESH-WATER WETLANDS
- CRITICAL HABITAT

DISTANCE TO LAND USES
- COMMERCIAL/INDUSTRIAL
- PARK/FOREST/RESIDENTIAL
- AGRICULTURAL LAND
- PRIME FARMLAND
- HISTORIC SITE WITHIN VIEW?

TOTAL TARGETS SCORE: N/A

AIR ROUTE SCORE (Sa) = 0.00

HAZARD RANKING SYSTEM SCORING CALCULATIONS
FOR
SITE: CELOTEX CORPORATION
AS OF 06/18/90

GROUND WATER ROUTE SCORE

ROUTE CHARACTERISTICS		14
CONTAINMENT	X	3
WASTE CHARACTERISTICS	X	26
TARGETS	X	15

= 16380 /57,330 X 100 = 28.57 = S_{gw}

SURFACE WATER ROUTE SCORE

ROUTE CHARACTERISTICS		12
CONTAINMENT	X	3
WASTE CHARACTERISTICS	X	26
TARGETS	X	12

= 11232 /64,350 X 100 = 17.45 = S_{sw}

AIR ROUTE SCORE

OBSERVED RELEASE 0 /35,100 X 100 = 0.00 = S_{air}

SUMMARY OF MIGRATION SCORE CALCULATIONS

	S	S^2
GROUND WATER ROUTE SCORE (S_{gw})	28.57	816.24
SURFACE WATER ROUTE SCORE (S_{sw})	17.45	304.50
AIR ROUTE SCORE (S_{air})	0.00	0.00
$S^2_{gw} + S^2_{sw} + S^2_{air}$		1120.74
$\sqrt{(S^2_{gw} + S^2_{sw} + S^2_{air})}$		33.48
$S_M = \sqrt{(S^2_{gw} + S^2_{sw} + S^2_{air})}/1.73$		19.35

HAZARD RANKING SYSTEM SCORING SUMMARY

FOR

CELOTEX CORPORATION
EPA SITE NUMBER FLD081365892
JACKSONVILLE
DUVAL COUNTY, FL
EPA REGION: 4

SCORE STATUS: IN PREPARATION

SCORED BY K.D. PASS
OF NUS
ON 05/08/90

DATE OF THIS REPORT: 06/18/90
DATE OF LAST MODIFICATION: 06/18/90

GROUND WATER ROUTE SCORE	:	29.93
SURFACE WATER ROUTE SCORE	:	17.45
AIR ROUTE SCORE	:	0.00
MIGRATION SCORE	:	20.03

Floridan Aquifer

HRS GROUND WATER ROUTE SCORE

CATEGORY/FACTOR	RAW DATA	ASN. VALUE	SCORE
1. OBSERVED RELEASE	NO	0	0
2. ROUTE CHARACTERISTICS			
DEPTH TO WATER TABLE	450 FEET		
DEPTH TO BOTTOM OF WASTE	6 FEET		
DEPTH TO AQUIFER OF CONCERN	444 FEET	0	0
PRECIPITATION	51.8 INCHES		
EVAPORATION	46.0 INCHES		
NET PRECIPITATION	5.8 INCHES	2	2
PERMEABILITY	1.0X10-7 CM/SEC	0	0
PHYSICAL STATE		3	3
TOTAL ROUTE CHARACTERISTICS SCORE:			5
3. CONTAINMENT		3	3
4. WASTE CHARACTERISTICS			
TOXICITY/PERSISTENCE:ASSIGNED VALUE,18			18
WASTE QUANTITY CUBIC YDS	1360382		
DRUMS	0		
GALLONS	0		
TONS	0		
TOTAL	1360382 CU. YDS	8	8
TOTAL WASTE CHARACTERISTICS SCORE:			26
5. TARGETS			
GROUND WATER USE		3	9
DISTANCE TO NEAREST WELL	1500 FEET		
AND	MATRIX VALUE	35	35
TOTAL POPULATION SERVED	8985 PERSONS		
NUMBER OF HOUSES	0		
NUMBER OF PERSONS	8985		
NUMBER OF CONNECTIONS	0		
NUMBER OF IRRIGATED ACRES	0		
TOTAL TARGETS SCORE:			44

GROUND WATER ROUTE SCORE (Sgw) = 29.93

HRS SURFACE WATER ROUTE SCORE

CATEGORY/FACTOR	RAW DATA	ASN. VALUE	SCORE
1. OBSERVED RELEASE	NO	0	0
2. ROUTE CHARACTERISTICS			
SITE LOCATED IN SURFACE WATER	NO		
SITE WITHIN CLOSED BASIN	NO		
FACILITY SLOPE	1.0 %		
INTERVENING SLOPE	0.0 %	0	0
24-HOUR RAINFALL	4.0 INCHES	3	3
DISTANCE TO DOWN-SLOPE WATER	500 FEET	3	6
PHYSICAL STATE	3		3
TOTAL ROUTE CHARACTERISTICS SCORE:			12
3. CONTAINMENT	3		3
4. WASTE CHARACTERISTICS			
TOXICITY/PERSISTENCE:ASSIGNED VALUE,18			18
WASTE QUANTITY CUBIC YDS	1360382		
DRUMS	0		
GALLONS	0		
TONS	0		
TOTAL	1360382 CU. YDS	8	8
TOTAL WASTE CHARACTERISTICS SCORE:			26
5. TARGETS			
SURFACE WATER USE		2	6
DISTANCE TO SENSITIVE ENVIRONMENTS		3	6
COASTAL WETLANDS	NONE		
FRESH-WATER WETLANDS	2112 FEET		
CRITICAL HABITAT	500 FEET		
DISTANCE TO STATIC WATER	2112 FEET		
DISTANCE TO WATER SUPPLY INTAKE	> 1 MILE		
AND	MATRIX VALUE	0	0
TOTAL POPULATION SERVED	0		
NUMBER OF HOUSES	0		
NUMBER OF PERSONS	0		
NUMBER OF CONNECTIONS	0		
NUMBER OF IRRIGATED ACRES	0		
TOTAL TARGETS SCORE:			12

SURFACE WATER ROUTE SCORE (Ssw) = 17.45

HRS AIR ROUTE SCORE

CATEGORY/FACTOR	RAW DATA	ASN. VALUE	SCORE
1. OBSERVED RELEASE	NO	0	0

2. WASTE CHARACTERISTICS

REACTIVITY:

MATRIX VALUE

INCOMPATIBILITY

TOXICITY

WASTE QUANTITY CUBIC YARDS
DRUMS
GALLONS
TONS

TOTAL

TOTAL WASTE CHARACTERISTICS SCORE: N/A

3. TARGETS

POPULATION WITHIN 4-MILE RADIUS
- 0 to 0.25 mile
- 0 to 0.50 mile
- 0 to 1.0 mile
- 0 to 4.0 miles

DISTANCE TO SENSITIVE ENVIRONMENTS
- COASTAL WETLANDS
- FRESH-WATER WETLANDS
- CRITICAL HABITAT

DISTANCE TO LAND USES
- COMMERCIAL/INDUSTRIAL
- PARK/FOREST/RESIDENTIAL
- AGRICULTURAL LAND
- PRIME FARMLAND
- HISTORIC SITE WITHIN VIEW?

TOTAL TARGETS SCORE: N/A

AIR ROUTE SCORE (Sa) = 0.00

HAZARD RANKING SYSTEM SCORING CALCULATIONS
FOR
SITE: CELOTEX CORPORATION
AS OF 06/18/90

GROUND WATER ROUTE SCORE

ROUTE CHARACTERISTICS		5
CONTAINMENT	X	3
WASTE CHARACTERISTICS	X	26
TARGETS	X	44

= 17160 /57,330 X 100 = 29.93 = S_{gw}

SURFACE WATER ROUTE SCORE

ROUTE CHARACTERISTICS		12
CONTAINMENT	X	3
WASTE CHARACTERISTICS	X	26
TARGETS	X	12

= 11232 /64,350 X 100 = 17.45 = S_{sw}

AIR ROUTE SCORE

OBSERVED RELEASE 0 /35,100 X 100 = 0.00 = S_{air}

SUMMARY OF MIGRATION SCORE CALCULATIONS

	S	S^2
GROUND WATER ROUTE SCORE (S_{gw})	29.93	895.80
SURFACE WATER ROUTE SCORE (S_{sw})	17.45	304.50
AIR ROUTE SCORE (S_{air})	0.00	0.00
$S^2_{gw} + S^2_{sw} + S^2_{air}$		1200.30
$\sqrt{(S^2_{gw} + S^2_{sw} + S^2_{air})}$		34.65
$S_M = \sqrt{(S^2_{gw} + S^2_{sw} + S^2_{air})}/1.73$		20.03

Site Inspection Report

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 1 - SITE LOCATION AND INSPECTION INFORMATION

I. IDENTIFICATION

01 STATE: FL | 02 SITE NUMBER: D081365892

II. SITE NAME AND LOCATION

01 SITE NAME (Legal, common, or descriptive name of site): Celotex Corporation

02 STREET, ROUTE NO., OR SPECIFIC LOCATION IDENTIFIER: 9225 Dames Point Rd.

03 CITY: Jacksonville | 04 STATE: FL | 05 ZIP CODE: 32229 | 06 COUNTY: Duval | 07 COUNTY CODE | 08 CONG DIST

09 COORDINATES: LATITUDE 30 15 06.0 | LONGITUDE 081 31 30.0

10 TYPE OF OWNERSHIP (Check one): ☒ A. PRIVATE ☐ B. FEDERAL ☐ C. STATE ☐ D. COUNTY ☐ E. MUNICIPAL ☐ F. OTHER ☐ G. UNKNOWN

III. INSPECTION INFORMATION

01 DATE OF INSPECTION: 4 25 90 (MONTH DAY YEAR)

02 SITE STATUS: ☒ ACTIVE ☐ INACTIVE

03 YEARS OF OPERATION: ~1964 (BEGINNING YEAR), Current (ENDING YEAR) ___ UNKNOWN

04 AGENCY PERFORMING INSPECTION (Check all that apply): ☐ A. EPA ☒ B. EPA CONTRACTOR (Name of firm): NUS Corp ☐ C. MUNICIPAL ☐ D. MUNICIPAL CONTRACTOR (Name of firm) ☐ E. STATE ☐ F. STATE CONTRACTOR (Name of firm) ☐ G. OTHER (Specify)

05 CHIEF INSPECTOR	06 TITLE	07 ORGANIZATION	08 TELEPHONE NO
Solomon Pollard, Jr.	Project Manager	NUS/FIT	(404) 938-7710

09 OTHER INSPECTORS	10 TITLE	11 ORGANIZATION	12 TELEPHONE NO
			( )
			( )
			( )
			( )
			( )

13 SITE REPRESENTATIVES INTERVIEWED	14 TITLE	15 ADDRESS	16 TELEPHONE NO
			( )
			( )
			( )
			( )
			( )
			( )

17 ACCESS GAINED BY (Check one): ☐ PERMISSION ☐ WARRANT

18 TIME OF INSPECTION: 1201

19 WEATHER CONDITIONS: Sunny, Clear

IV. INFORMATION AVAILABLE FROM

01 CONTACT	02 OF (Agency/Organization)	03 TELEPHONE NO
John Mckeown	EPA Region 4	(404) 347-5065

04 PERSON RESPONSIBLE FOR SITE INSPECTION FORM	05 AGENCY	06 ORGANIZATION	07 TELEPHONE NO.	08 DATE
Solomon Pollard Jr	NUS Corp.	FIT	(404) 938 7710	05/10/90 (MONTH DAY YEAR)

EPA FORM 2070-13 (7-81)

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 2 - WASTE INFORMATION

I. IDENTIFICATION

01 STATE	02 SITE NUMBER
FL	D081365892

II. WASTE STATES, QUANTITIES, AND CHARACTERISTICS

01 PHYSICAL STATES (Check all that apply)

A SOLID
B POWDER, FINES
X C SLUDGE
D OTHER _____ (Specify)
E SLURRY
X F LIQUID
G GAS

02 WASTE QUANTITY AT SITE (Measures of waste quantities must be independent)

TONS _____
CUBIC YARDS 22.2
NO. OF DRUMS _____

03 WASTE CHARACTERISTICS (Check all that apply)

A TOXIC
B CORROSIVE
C RADIOACTIVE
D PERSISTENT
E SOLUBLE
F INFECTIOUS
G FLAMMABLE
H IGNITABLE
I HIGHLY VOLATILE
J EXPLOSIVE
K REACTIVE
L INCOMPATIBLE
M NOT APPLICABLE

III. WASTE TYPE

CATEGORY	SUBSTANCE NAME	01 GROSS AMOUNT	02 UNIT OF MEASURE	03 COMMENTS
SLU	SLUDGE			
OLW	OILY WASTE			
SOL	SOLVENTS			
PSD	PESTICIDES			
OCC	OTHER ORGANIC CHEMICALS	unknown		Urea / formaldehyde
IOC	INORGANIC CHEMICALS			
ACD	ACIDS			
BAS	BASES			
MES	HEAVY METALS			

IV. HAZARDOUS SUBSTANCES (See Appendix for most frequently cited CAS Numbers)

01 CATEGORY	02 SUBSTANCE NAME	03 CAS NUMBER	04 STORAGE/DISPOSAL METHOD	05 CONCENTRATION	06 MEASURE OF CONCENTRATION
OCC	Phenol	U188	108-95-2 unk	unk	unk
OCC	Urea	unk	unk unk	unk	unk
OCC	formaldehyde	U122	50-00-0 unk	unk	unk

V. FEEDSTOCKS (See Appendix for CAS Numbers)

CATEGORY	01 FEEDSTOCK NAME	02 CAS NUMBER	CATEGORY	01 FEEDSTOCK NAME	02 CAS NUMBER
FDS			FDS		
FDS			FDS		
FDS			FDS		
FDS			FDS		

VI. SOURCES OF INFORMATION (Cite specific references, e.g., state files, sample analysis, reports)

State & EPA files

EPA FORM 2070-13 (7-81)

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 3 - DESCRIPTION OF HAZARDOUS CONDITIONS AND INCIDENTS

I. IDENTIFICATION	
01 STATE	02 SITE NUMBER
FL	D081365892

II. HAZARDOUS CONDITIONS AND INCIDENTS

01 ☐ A GROUNDWATER CONTAMINATION — 02 ☐ OBSERVED (DATE: _____) — ☒ POTENTIAL — ☐ ALLEGED
03 POPULATION POTENTIALLY AFFECTED: _____ — 04 NARRATIVE DESCRIPTION

None documented (ND): Potential if landfill waste reaches ~~soil~~ and enters soil.

01 ☐ B SURFACE WATER CONTAMINATION — 02 ☐ OBSERVED (DATE: _____) — ☒ POTENTIAL — ☐ ALLEGED
03 POPULATION POTENTIALLY AFFECTED: _____ — 04 NARRATIVE DESCRIPTION

ND: If wastes enter St. Johns River from SW runoff.

01 ☐ C CONTAMINATION OF AIR — 02 ☐ OBSERVED (DATE: _____) — ☐ POTENTIAL — ☐ ALLEGED
03 POPULATION POTENTIALLY AFFECTED: _____ — 04 NARRATIVE DESCRIPTION

ND

01 ☐ D FIRE EXPLOSIVE CONDITIONS — 02 ☐ OBSERVED (DATE: _____) — ☐ POTENTIAL — ☐ ALLEGED
03 POPULATION POTENTIALLY AFFECTED: _____ — 04 NARRATIVE DESCRIPTION

ND

01 ☐ E. DIRECT CONTACT — 02 ☐ OBSERVED (DATE: _____) — ☒ POTENTIAL — ☐ ALLEGED
03 POPULATION POTENTIALLY AFFECTED: _____ — 04 NARRATIVE DESCRIPTION

ND: Depending on waste characteristic and worker exposure.

01 ☐ F CONTAMINATION OF SOIL — 02 ☐ OBSERVED (DATE: _____) — ☒ POTENTIAL — ☐ ALLEGED
03 AREA POTENTIALLY AFFECTED: _____ (Acres) — 04 NARRATIVE DESCRIPTION

ND: If landfill waste, enter soil.

01 ☐ G DRINKING WATER CONTAMINATION — 02 ☐ OBSERVED (DATE: _____) — ☒ POTENTIAL — ☐ ALLEGED
03 POPULATION POTENTIALLY AFFECTED: _____ — 04 NARRATIVE DESCRIPTION

ND: If waste reach soil and enters shallow then ADC.

01 ☐ H WORKER EXPOSURE/INJURY — 02 ☐ OBSERVED (DATE: _____) — ☒ POTENTIAL — ☐ ALLEGED
03 WORKERS POTENTIALLY AFFECTED: _____ — 04 NARRATIVE DESCRIPTION

ND: Numerous workers on site.

01 ☐ I. POPULATION EXPOSURE/INJURY — 02 ☐ OBSERVED (DATE: _____) — ☒ POTENTIAL — ☐ ALLEGED
03 POPULATION POTENTIALLY AFFECTED: _____ — 04 NARRATIVE DESCRIPTION

ND: Residents are 1000-1500 ft away, thus potential ongoing depending on release mechanism.

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 3 - DESCRIPTION OF HAZARDOUS CONDITIONS AND INCIDENTS

I. IDENTIFICATION
01 STATE: FL | 02 SITE NUMBER: D089365892

II. HAZARDOUS CONDITIONS AND INCIDENTS (Continued)

01 ☐ J. DAMAGE TO FLORA — 02 ☐ OBSERVED (DATE: _____) — ☒ POTENTIAL — ☐ ALLEGED
04 NARRATIVE DESCRIPTION
ND: Depending on runoff path.

01 ☐ K. DAMAGE TO FAUNA — 02 ☐ OBSERVED (DATE: _____) — ☐ POTENTIAL — ☐ ALLEGED
04 NARRATIVE DESCRIPTION (Include name(s) of species)
ND

01 ☐ L. CONTAMINATION OF FOOD CHAIN — 02 ☐ OBSERVED (DATE: _____) — ☒ POTENTIAL — ☐ ALLEGED
04 NARRATIVE DESCRIPTION
ND: SW runoff enters St. Johns River and enters food chain. Fish + River game has observed.

01 ☐ M. UNSTABLE CONTAINMENT OF WASTES (Spills/Runoff/Standing liquids/Leaking drums) — 02 ☐ OBSERVED (DATE: _____) — ☒ POTENTIAL — ☐ ALLEGED
03 POPULATION POTENTIALLY AFFECTED: _____ — 04 NARRATIVE DESCRIPTION
ND: Depending on containment of wastes under land pile.

01 ☐ N. DAMAGE TO OFFSITE PROPERTY — 02 ☐ OBSERVED (DATE: _____) — ☒ POTENTIAL — ☐ ALLEGED
04 NARRATIVE DESCRIPTION
ND: Numerous homes are adjacent to the St. Johns River.

01 ☐ O. CONTAMINATION OF SEWERS, STORM DRAINS, WWTPs — 02 ☐ OBSERVED (DATE: _____) — ☐ POTENTIAL — ☐ ALLEGED
04 NARRATIVE DESCRIPTION
ND:

01 ☐ P. ILLEGAL/UNAUTHORIZED DUMPING — 02 ☐ OBSERVED (DATE: _____) — ☐ POTENTIAL — ☐ ALLEGED
04 NARRATIVE DESCRIPTION
ND

05 DESCRIPTION OF ANY OTHER KNOWN, POTENTIAL, OR ALLEGED HAZARDS
Potential for waste leakage from 5,000 gal above ground storage tank.
Large mountain of possibly wood chips/sharings. If wood is treated, the exposure to outside environmental conditions might lead to soil + water contamination.

III. TOTAL POPULATION POTENTIALLY AFFECTED: _____

IV. COMMENTS

V. SOURCES OF INFORMATION (Cite specific references, e.g., state files, sample analysis, reports)
State + EPA files

EPA FORM 2070-13 (7-81)

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION
PART 4 - PERMIT AND DESCRIPTIVE INFORMATION

I. IDENTIFICATION

01 STATE	02 SITE NUMBER
FL	D081365892

II. PERMIT INFORMATION

01 TYPE OF PERMIT ISSUED (Check all that apply)	02 PERMIT NUMBER	03 DATE ISSUED	04 EXPIRATION DATE	05 COMMENTS
A NPDES				
B UIC				
C AIR				
D RCRA				
E RCRA INTERIM STATUS				
F SPCC PLAN				
G STATE (Specify)				
H LOCAL (Specify)				
I OTHER (Specify)				
J NONE				

III. SITE DESCRIPTION

01 STORAGE/DISPOSAL (Check all that apply)	02 AMOUNT	03 UNIT OF MEASURE
A. SURFACE IMPOUNDMENT		
B. PILES		
C. DRUMS, ABOVE GROUND		
D. TANK, ABOVE GROUND		
E. TANK, BELOW GROUND		
F. LANDFILL		
G. LANDFARM	≥ 2.4	Cubic Feet
H. OPEN DUMP		
I. OTHER (Specify)		

04 TREATMENT (Check all that apply)
A. INCENERATION
B. UNDERGROUND INJECTION
C. CHEMICAL/PHYSICAL
D. BIOLOGICAL
E. WASTE OIL PROCESSING
F. SOLVENT RECOVERY
G. OTHER RECYCLING/RECOVERY
H. OTHER (Specify)

05 OTHER

A. BUILDINGS ON SITE

3-4 buildings

06 AREA OF SITE

4 acres

07 COMMENTS

IV. CONTAINMENT

01 CONTAINMENT OF WASTES (Check one)

A. ADEQUATE, SECURE B. MODERATE C. INADEQUATE, POOR D. INSECURE, UNSOUND, DANGEROUS

02 DESCRIPTION OF DRUMS, DIKING, LINERS, BARRIERS, ETC.

V. ACCESSIBILITY

01 WASTE EASILY ACCESSIBLE: YES NO

02 COMMENTS

Property is fenced and has guard on duty.

VI. SOURCES OF INFORMATION (Cite specific references, e.g. state files, sample analysis, reports)

State & EPA files

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 5 - WATER, DEMOGRAPHIC, AND ENVIRONMENTAL DATA

I. IDENTIFICATION

01 STATE	02 SITE NUMBER
FL	D081365893

II. DRINKING WATER SUPPLY

01 TYPE OF DRINKING SUPPLY (Check as applicable)

	SURFACE	WELL
COMMUNITY	A ☐	B ☒
NON-COMMUNITY	C ☐	D ☒

02 STATUS — unk —

ENDANGERED	AFFECTED	MONITORED
A. ☐	B. ☐	C. ☐
D. ☐	E. ☐	F. ☐

03 DISTANCE TO SITE
A. .2 (mi)
B. 2 (mi)

III. GROUNDWATER

01 GROUNDWATER USE IN VICINITY (Check one)

☒ A. ONLY SOURCE FOR DRINKING ☐ B. DRINKING (Other sources available) COMMERCIAL, INDUSTRIAL, IRRIGATION (No other water sources available) ☐ C. COMMERCIAL, INDUSTRIAL, IRRIGATION (Limited other sources available) ☐ D. NOT USED, UNUSEABLE

02 POPULATION SERVED BY GROUND WATER 8 985

03 DISTANCE TO NEAREST DRINKING WATER WELL .2 (mi)

04 DEPTH TO GROUNDWATER	05 DIRECTION OF GROUNDWATER FLOW	06 DEPTH TO AQUIFER OF CONCERN	07 POTENTIAL YIELD OF AQUIFER	08 SOLE SOURCE AQUIFER
Shallow 10 (ft)		450 (ft)	(gpd)	☐ YES ☒ NO

09 DESCRIPTION OF WELLS (Including usage, depth, and location relative to population and buildings)

Shallow Aquifer provides water for uses other than consumption (Brackish)
Deep aquifer is The Floridan which has a clay confining layer and is 450 feet bls

10 RECHARGE AREA
☐ YES
☐ NO
COMMENTS

11 DISCHARGE AREA
☐ YES
☐ NO
COMMENTS

IV. SURFACE WATER

01 SURFACE WATER USE (Check one)

☐ A. RESERVOIR, RECREATION DRINKING WATER SOURCE ☐ B. IRRIGATION, ECONOMICALLY IMPORTANT RESOURCES ☐ C. COMMERCIAL, INDUSTRIAL ☒ D. NOT CURRENTLY USED

02 AFFECTED/POTENTIALLY AFFECTED BODIES OF WATER

NAME	AFFECTED	DISTANCE TO SITE
St. John River	☐	500 ft. (mi)
	☐	(mi)
	☐	(mi)

V. DEMOGRAPHIC AND PROPERTY INFORMATION

01 TOTAL POPULATION WITHIN

ONE (1) MILE OF SITE	TWO (2) MILES OF SITE	THREE (3) MILES OF SITE
A. 373 NO. OF PERSONS	B. 3528 NO. OF PERSONS	C. 8485 NO. OF PERSONS

02 DISTANCE TO NEAREST POPULATION .2 (mi)

03 NUMBER OF BUILDINGS WITHIN TWO (2) MILES OF SITE

04 DISTANCE TO NEAREST OFF-SITE BUILDING .2 (mi)

05 POPULATION WITHIN VICINITY OF SITE (Provide narrative description of nature of population within vicinity of site (e.g., rural, village, densely populated urban area)

Rural location; property is boardered by forestry.

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 5 - WATER, DEMOGRAPHIC, AND ENVIRONMENTAL DATA

I. IDENTIFICATION
01 STATE: FL
02 SITE NUMBER: D091365892

VI. ENVIRONMENTAL INFORMATION

01 PERMEABILITY OF UNSATURATED ZONE (Check one)

A. 10^{-6} – 10^{-4} cm/sec B. 10^{-4} – 10^{-6} cm/sec C. 10^{-4} – 10^{-3} cm/sec D. GREATER THAN 10^{-3} cm/sec

02 PERMEABILITY OF BEDROCK (Check one)

A. IMPERMEABLE (Less than 10^{-6} cm/sec) B. RELATIVELY IMPERMEABLE (10^{-4} – 10^{-6} cm/sec) ☑ C. RELATIVELY PERMEABLE (10^{-2} – 10^{-4} cm/sec) D. VERY PERMEABLE (Greater than 10^{-2} cm/sec)

03 DEPTH TO BEDROCK	04 DEPTH OF CONTAMINATED SOIL ZONE	05 SOIL pH
(ft)	(ft)	

06 NET PRECIPITATION	07 ONE YEAR 24 HOUR RAINFALL	08 SLOPE: SITE SLOPE	DIRECTION OF SITE SLOPE	TERRAIN AVERAGE SLOPE
51.9 (in)	4 (in)	1 %	SE	<1 %

09 FLOOD POTENTIAL
SITE IS IN _____ YEAR FLOODPLAIN

10 ☐ SITE IS ON BARRIER ISLAND, COASTAL HIGH HAZARD AREA, RIVERINE FLOODWAY

11 DISTANCE TO WETLANDS (5 acre minimum)
ESTUARINE: A. _____ (mi)
OTHER: B. 2112 ft. (mi)

12 DISTANCE TO CRITICAL HABITAT (of endangered species)
500 ft. (mi)
ENDANGERED SPECIES: _____

13 LAND USE IN VICINITY

DISTANCE TO:

COMMERCIAL/INDUSTRIAL	RESIDENTIAL AREAS; NATIONAL/STATE PARKS, FORESTS, OR WILDLIFE RESERVES	AGRICULTURAL LANDS: PRIME AG LAND	AGRICULTURAL LANDS: AG LAND
A. _____ (mi)	B. 1500 ft (mi)	C. _____ (mi)	D. _____ (mi)

14 DESCRIPTION OF SITE IN RELATION TO SURROUNDING TOPOGRAPHY

Site is bordered by forestry except for St. Johns River to the East.
Residents are ≈ 1000 feet West, southwest, and Northeast.

VII. SOURCES OF INFORMATION (Cite specific references, e.g., state files, sample analysis, reports)

EPA + State files

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 6 - SAMPLE AND FIELD INFORMATION

I. IDENTIFICATION

01 STATE	02 SITE NUMBER
FL	D081365892

II. SAMPLES TAKEN

SAMPLE TYPE	01 NUMBER OF SAMPLES TAKEN	02 SAMPLES SENT TO	03 ESTIMATED DATE RESULTS AVAILABLE
GROUNDWATER			
SURFACE WATER			
WASTE			
AIR			
RUNOFF			
SPILL			
SOIL			
VEGETATION			
OTHER			

III. FIELD MEASUREMENTS TAKEN

01 TYPE	02 COMMENTS

IV. PHOTOGRAPHS AND MAPS

01 TYPE ☒ GROUND ☐ AERIAL

02 IN CUSTODY OF NUS Corp
(Name of organization or individual)

03 MAPS ☒ YES ☐ NO

04 LOCATION OF MAPS NUS Corp

V. OTHER FIELD DATA COLLECTED (Provide narrative description)

VI. SOURCES OF INFORMATION (Cite specific references, e.g., state files, sample analysis, reports)

State + EPA Files

EPA FORM 2070-13 (7-81)

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 7 - OWNER INFORMATION

I. IDENTIFICATION

01 STATE	02 SITE NUMBER
FL	D081365992

II. CURRENT OWNER(S)

01 NAME	02 D+B NUMBER
Celotex Corp.	

03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE
9225 Dames Point Rd	

05 CITY	06 STATE	07 ZIP CODE
Jacksonville	FL	32229

PARENT COMPANY (If applicable)

08 NAME	09 D+B NUMBER

10 STREET ADDRESS (P.O. Box, RFD #, etc.)	11 SIC CODE

12 CITY	13 STATE	14 ZIP CODE

01 NAME	02 D+B NUMBER

03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE

05 CITY	06 STATE	07 ZIP CODE

08 NAME	09 D+B NUMBER

10 STREET ADDRESS (P.O. Box, RFD #, etc.)	11 SIC CODE

12 CITY	13 STATE	14 ZIP CODE

01 NAME	02 D+B NUMBER

03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE

05 CITY	06 STATE	07 ZIP CODE

08 NAME	09 D+B NUMBER

10 STREET ADDRESS (P.O. Box, RFD #, etc.)	11 SIC CODE

12 CITY	13 STATE	14 ZIP CODE

01 NAME	02 D+B NUMBER

03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE

05 CITY	06 STATE	07 ZIP CODE

08 NAME	09 D+B NUMBER

10 STREET ADDRESS (P.O. Box, RFD #, etc.)	11 SIC CODE

12 CITY	13 STATE	14 ZIP CODE

III. PREVIOUS OWNER(S) (List most recent first)

01 NAME	02 D+B NUMBER

03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE

05 CITY	06 STATE	07 ZIP CODE

01 NAME	02 D+B NUMBER

03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE

05 CITY	06 STATE	07 ZIP CODE

01 NAME	02 D+B NUMBER

03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE

05 CITY	06 STATE	07 ZIP CODE

IV. REALTY OWNER(S) (If applicable, list most recent first)

01 NAME	02 D+B NUMBER

03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE

05 CITY	06 STATE	07 ZIP CODE

01 NAME	02 D+B NUMBER

03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE

05 CITY	06 STATE	07 ZIP CODE

01 NAME	02 D+B NUMBER

03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE

05 CITY	06 STATE	07 ZIP CODE

V. SOURCES OF INFORMATION (Cite specific references, e.g. state files, sample analysis, reports)

Stat + EPA files

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 8 - OPERATOR INFORMATION

I. IDENTIFICATION

01 STATE	02 SITE NUMBER
FL	D081365892

II. CURRENT OPERATOR *(Provide if different from owner)*

01 NAME	02 D+B NUMBER	03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE
05 CITY	06 STATE / 07 ZIP CODE	08 YEARS OF OPERATION	09 NAME OF OWNER

OPERATOR'S PARENT COMPANY *(If applicable)*

10 NAME	11 D+B NUMBER	12 STREET ADDRESS (P.O. Box, RFD #, etc.)	13 SIC CODE
14 CITY	15 STATE / 16 ZIP CODE		

III. PREVIOUS OPERATOR(S) *(List most recent first; provide only if different from owner)*

01 NAME	02 D+B NUMBER	03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE
05 CITY	06 STATE / 07 ZIP CODE	08 YEARS OF OPERATION	09 NAME OF OWNER DURING THIS PERIOD

PREVIOUS OPERATORS' PARENT COMPANIES *(If applicable)*

10 NAME	11 D+B NUMBER	12 STREET ADDRESS (P.O. Box, RFD #, etc.)	13 SIC CODE
14 CITY	15 STATE / 16 ZIP CODE		

01 NAME	02 D+B NUMBER	03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE
05 CITY	06 STATE / 07 ZIP CODE	08 YEARS OF OPERATION	09 NAME OF OWNER DURING THIS PERIOD

10 NAME	11 D+B NUMBER	12 STREET ADDRESS (P.O. Box, RFD #, etc.)	13 SIC CODE
14 CITY	15 STATE / 16 ZIP CODE		

01 NAME	02 D+B NUMBER	03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE
05 CITY	06 STATE / 07 ZIP CODE	08 YEARS OF OPERATION	09 NAME OF OWNER DURING THIS PERIOD

10 NAME	11 D+B NUMBER	12 STREET ADDRESS (P.O. Box, RFD #, etc.)	13 SIC CODE
14 CITY	15 STATE / 16 ZIP CODE		

IV. SOURCES OF INFORMATION *(Cite specific references, e.g., state files, sample analysis, reports)*

State + EPA files

EPA FORM 2070-13 (7-81)

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 9 - GENERATOR/TRANSPORTER INFORMATION

I. IDENTIFICATION	
01 STATE	02 SITE NUMBER
FL	D081365892

II. ON-SITE GENERATOR

01 NAME	02 D+B NUMBER	
03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE	
05 CITY	06 STATE	07 ZIP CODE

III. OFF-SITE GENERATOR(S)

01 NAME	02 D+B NUMBER	01 NAME	02 D+B NUMBER
03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE	03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE
05 CITY / 06 STATE	07 ZIP CODE	05 CITY / 06 STATE	07 ZIP CODE
01 NAME	02 D+B NUMBER	01 NAME	02 D+B NUMBER
03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE	03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE
05 CITY / 06 STATE	07 ZIP CODE	05 CITY / 06 STATE	07 ZIP CODE

IV. TRANSPORTER(S)

01 NAME	02 D+B NUMBER	01 NAME	02 D+B NUMBER
03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE	03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE
05 CITY / 06 STATE	07 ZIP CODE	05 CITY / 06 STATE	07 ZIP CODE
01 NAME	02 D+B NUMBER	01 NAME	02 D+B NUMBER
03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE	03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE
05 CITY / 06 STATE	07 ZIP CODE	05 CITY / 06 STATE	07 ZIP CODE

V. SOURCES OF INFORMATION (Cite specific references, e.g., state files, sample analysis, reports)

State + EPA files

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 10 - PAST RESPONSE ACTIVITIES

I. IDENTIFICATION	
01 STATE	02 SITE NUMBER
FL	D081365892

II. PAST RESPONSE ACTIVITIES. None Known

01 ☐ A. WATER SUPPLY CLOSED 04 DESCRIPTION	02 DATE	03 AGENCY
01 ☐ B. TEMPORARY WATER SUPPLY PROVIDED 04 DESCRIPTION	02 DATE	03 AGENCY
01 ☐ C. PERMANENT WATER SUPPLY PROVIDED 04 DESCRIPTION	02 DATE	03 AGENCY
01 ☐ D. SPILLED MATERIAL REMOVED 04 DESCRIPTION	02 DATE	03 AGENCY
01 ☐ E. CONTAMINATED SOIL REMOVED 04 DESCRIPTION	02 DATE	03 AGENCY
01 ☐ F. WASTE REPACKAGED 04 DESCRIPTION	02 DATE	03 AGENCY
01 ☐ G. WASTE DISPOSED ELSEWHERE 04 DESCRIPTION	02 DATE	03 AGENCY
01 ☐ H. ON SITE BURIAL 04 DESCRIPTION	02 DATE	03 AGENCY
01 ☐ I. IN SITU CHEMICAL TREATMENT 04 DESCRIPTION	02 DATE	03 AGENCY
01 ☐ J. IN SITU BIOLOGICAL TREATMENT 04 DESCRIPTION	02 DATE	03 AGENCY
01 ☐ K. IN SITU PHYSICAL TREATMENT 04 DESCRIPTION	02 DATE	03 AGENCY
01 ☐ L. ENCAPSULATION 04 DESCRIPTION	02 DATE	03 AGENCY
01 ☐ M. EMERGENCY WASTE TREATMENT 04 DESCRIPTION	02 DATE	03 AGENCY
01 ☐ N. CUTOFF WALLS 04 DESCRIPTION	02 DATE	03 AGENCY
01 ☐ O. EMERGENCY DIKING SURFACE WATER DIVERSION 04 DESCRIPTION	02 DATE	03 AGENCY
01 ☐ P. CUTOFF TRENCHES/SUMP 04 DESCRIPTION	02 DATE	03 AGENCY
01 ☐ Q. SUBSURFACE CUTOFF WALL 04 DESCRIPTION	02 DATE	03 AGENCY

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 10 - PAST RESPONSE ACTIVITIES

I. IDENTIFICATION
01 STATE: FL
02 SITE NUMBER: D091365892

II PAST RESPONSE ACTIVITIES (Continued)

01 ☐ R. BARRIER WALLS CONSTRUCTED — 02 DATE _____ 03 AGENCY _____
04 DESCRIPTION

01 ☐ S. CAPPING/COVERING — 02 DATE _____ 03 AGENCY _____
04 DESCRIPTION

01 ☐ T. BULK TANKAGE REPAIRED — 02 DATE _____ 03 AGENCY _____
04 DESCRIPTION

01 ☐ U. GROUT CURTAIN CONSTRUCTED — 02 DATE _____ 03 AGENCY _____
04 DESCRIPTION

01 ☐ V. BOTTOM SEALED — 02 DATE _____ 03 AGENCY _____
04 DESCRIPTION

01 ☐ W. GAS CONTROL — 02 DATE _____ 03 AGENCY _____
04 DESCRIPTION

01 ☐ X. FIRE CONTROL — 02 DATE _____ 03 AGENCY _____
04 DESCRIPTION

01 ☐ Y. LEACHATE TREATMENT — 02 DATE _____ 03 AGENCY _____
04 DESCRIPTION

01 ☐ Z. AREA EVACUATED — 02 DATE _____ 03 AGENCY _____
04 DESCRIPTION

01 ☐ 1. ACCESS TO SITE RESTRICTED — 02 DATE _____ 03 AGENCY _____
04 DESCRIPTION

01 ☐ 2. POPULATION RELOCATED — 02 DATE _____ 03 AGENCY _____
04 DESCRIPTION

01 ☐ 3. OTHER REMEDIAL ACTIVITIES — 02 DATE _____ 03 AGENCY _____
04 DESCRIPTION

III. SOURCES OF INFORMATION (Cite specific references, e.g. state files, sample analysis, reports)

State & EPA files

EPA FORM 2070-13 (7-81)

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 11 - ENFORCEMENT INFORMATION

I. IDENTIFICATION	
01 STATE	02 SITE NUMBER
FL	D081361892

II. ENFORCEMENT INFORMATION

01 PAST REGULATORY ENFORCEMENT ACTION YES ✓NO

02 DESCRIPTION OF FEDERAL, STATE, LOCAL REGULATORY ENFORCEMENT ACTION

III. SOURCES OF INFORMATION (Cite specific references, e.g., state files, sample analysis, reports)

State + EPA files.

APPENDIX

I. FEEDSTOCKS

CAS Number	Chemical Name
1. 7664-41-7	Ammonia
2. 7440-36-0	Antimony
3. 1309-64-4	Antimony Trioxide
4. 7440-38-2	Arsenic
5. 1327-53-3	Arsenic Trioxide
6. 21109-95-5	Barium Sulfide
7. 7726-95-6	Bromine
8. 106-99-0	Butadiene
9. 7440-43-9	Cadmium
10. 7782-50-5	Chlorine
11. 12737-27-8	Chromite
12. 7440-47-3	Chromium
13. 7440-48-4	Cobalt
14. 1317-38-0	Cupric Oxide
15. 7758-98-7	Cupric Sulfate
16. 1317-39-1	Cuprous Oxide
17. 74-85-1	Ethylene
18. 7647-01-0	Hydrochloric Acid
19. 7664-39-3	Hydrogen Fluoride
20. 1335-25-7	Lead Oxide
21. 7439-97-6	Mercury
22. 74-82-8	Methane
23. 91-20-3	Napthalene
24. 7440-02-0	Nickel
25. 7697-37-2	Nitric Acid
26. 7723-14-0	Phosphorus
27. 7778-50-9	Potassium Dichromate
28. 1310-58-3	Potassium Hydroxide
29. 115-07-1	Propylene
30. 10588-01-9	Sodium Dichromate
31. 1310-73-2	Sodium Hydroxide
32. 7646-78-8	Stannic Chloride
33. 7772-99-8	Stannous Chloride
34. 7664-93-9	Sulfuric Acid
35. 108-88-3	Toluene
36. 1330-20-7	Xylene
37. 7646-85-7	Zinc Chloride
38. 7733-02-0	Zinc Sulfate

II. HAZARDOUS SUBSTANCES

CAS Number	Chemical Name
1. 75-07-0	Acetaldehyde
2. 64-19-7	Acetic Acid
3. 108-24-7	Acetic Anhydride
4. 75-86-5	Acetone Cyanohydrin
5. 506-96-7	Acetyl Bromide
6. 75-36-5	Acetyl Chloride
7. 107-02-8	Acrolein
8. 107-13-1	Acrylonitrile
9. 124-04-9	Adipic Acid
10. 309-00-2	Aldrin
11. 10043-01-3	Aluminum Sulfate
12. 107-18-6	Allyl Alcohol
13. 107-05-1	Allyl Chloride
14. 7664-41-7	Ammonia
15. 631-61-8	Ammonium Acetate
16. 1863-63-4	Ammonium Benzoate
17. 1066-33-7	Ammonium Bicarbonate
18. 7789-09-5	Ammonium Bichromate
19. 1341-49-7	Ammonium Bifluoride
20. 10192-30-0	Ammonium Bisulfite
21. 1111-78-0	Ammonium Carbamate
22. 12125-02-9	Ammonium Chloride
23. 7788-98-9	Ammonium Chromate
24. 3012-65-5	Ammonium Citrate, Dibasic
25. 13826-83-0	Ammonium Fluoborate
26. 12125-01-8	Ammonium Fluoride
27. 1336-21-6	Ammonium Hydroxide
28. 6009-70-7	Ammonium Oxalate
29. 16919-19-0	Ammonium Silicofluoride
30. 7773-06-0	Ammonium Sulfamate
31. 12135-76-1	Ammonium Sulfide
32. 10196-04-0	Ammonium Sulfite
33. 14307-43-8	Ammonium Tartrate
34. 1762-95-4	Ammonium Thiocyanate
35. 7783-18-8	Ammonium Thiosulfate
36. 628-63-7	Amyl Acetate
37. 62-53-3	Aniline
38. 7647-18-9	Antimony Pentachloride
39. 7789-61-9	Antimony Tribromide
40. 10025-91-9	Antimony Trichloride
41. 7783-56-4	Antimony Trifluoride
42. 1309-64-4	Antimony Trioxide
43. 1303-32-8	Arsenic Disulfide
44. 1303-28-2	Arsenic Pentoxide
45. 7784-34-1	Arsenic Trichloride
46. 1327-53-3	Arsenic Trioxide
47. 1303-33-9	Arsenic Trisulfide
48. 542-62-1	Barium Cyanide
49. 71-43-2	Benzene
50. 65-85-0	Benzoic Acid
51. 100-47-0	Benzonitrile
52. 98-88-4	Benzoyl Chloride
53. 100-44-7	Benzyl Chloride
54. [illegible]-41-7	Beryllium
55. 7787-47-5	Beryllium Chloride
56. 7787-49-7	Beryllium Fluoride
57. 13597-99-4	Beryllium Nitrate
58. 123-86-4	Butyl Acetate
59. 84-74-2	n-Butyl Phthalate
60. 109-73-9	Butylamine
61. 107-92-6	Butyric Acid
62. 543-90-8	Cadimium Acetate
63. 7789-42-6	Cadmium Bromide
64. 10108-64-2	Cadmium Chloride
65. 7778-44-1	Calcium Arsenate
66. 52740-16-6	Calcium Arsenite
67. 75-20-7	Calcium Carbide
68. 13765-19-0	Calcium Chromate
69. 592-01-8	Calcium Cyanide
70. 26264-06-2	Calcium Dodecylbenzene Sulfonate
71. 7778-54-3	Calcium Hypochlorite
72. 133-06-2	Captan
73. 63-25-2	Carbaryl
74. 1563-66-2	Carbofuran
75. 75-15-0	Carbon Disulfide
76. 56-23-5	Carbon Tetrachloride
77. 57-74-9	Chlordane
78. 7782-50-5	Chlorine
79. 108-90-7	Chlorobenzene
80. 67-66-3	Chloroform
81. 7790-94-5	Chlorosulfonic Acid
82. 2921-88-2	Chlorpyrifos
83. 1066-30-4	Chromic Acetate
84. 7738-94-5	Chromic Acid
85. 10101-53-8	Chromic Sulfate
86. 10049-05-5	Chromous Chloride
87. 544-18-3	Cobaltous Formate
88. 14017-41-5	Cobaltous Sulfamate
89. 56-72-4	Coumaphos
90. 1319-77-3	Cresol
91. 4170-30-3	Crotonaldehyde
92. 142-71-2	Cupric Acetate
93. 12002-03-8	Cupric Acetoarsenite
94. 7447-39-4	Cupric Chloride
95. 3251-23-8	Cupric Nitrate
96. 5893-66-3	Cupric Oxalate
97. 7758-98-7	Cupric Sulfate
98. 10380-29-7	Cupric Sulfate Ammoniated
99. 815-82-7	Cupric Tartrate
100. 506-77-4	Cyanogen Chloride
101. 110-82-7	Cyclohexane
102. 94-75-7	2,4-D Acid
103. 94-11-1	2,4-D Esters
104. 50-29-3	DDT
105. 333-41-5	Diazinon
106. 1918-00-9	Dicamba
107. 1194-65-6	Dichlobenil
108. 117-80-6	Dichlone
109. 25321-22-6	Dichlorobenzene (all isomers)
110. 26638-19-7	Dichloropropene (all isomers)
111. 26952-23-8	Dichloropropene (all isomers)
112. 8003-19-8	Dichloropropene-Dichloropropane Mixture
113. 75-99-0	2-2-Dichloropropionic Acid
114. 62-73-7	Dichlorvos
115. 60-57-1	Dieldrin
116. 109-89-7	Diethylamine
117. 124-40-3	Dimethylamine
118. 25154-54-6	Dinitrobenzene (all isomers)
119. 51-28-5	Dinitrophenol
120. 25321-14-6	Dinitrotoluene (all isomers)
121. 85-00-7	Diquat
122. 298-04-4	Disulfoton
123. 330-54-1	Diuron
124. 27176-87-0	Dodecylbenzenesulfonic Acid
125. 115-29-7	Endosulfan (all isomers)
126. 72-20-8	Endrin and Metabolites
127. 106-89-8	Epichlorohydrin
128. 563-12-2	Ethion
129. 100-41-4	Ethyl Benzene
130. 107-15-3	Ethylenediamine
131. 106-93-4	Ethylene Dibromide
132. 107-06-2	Ethylene Dichloride
133. 60-00-4	EDTA
134. 1185-57-5	Ferric Ammonium Citrate
135. 2944-67-4	Ferric Ammonium Oxalate
[illegible]	[illegible]

II. HAZARDOUS SUBSTANCES

CAS Number	Chemical Name
137. 7783-50-8	Ferric Fluoride
138. 10421-48-4	Ferric Nitrate
139. 10028-22-5	Ferric Sulfate
140. 10045-89-3	Ferrous Ammonium Sulfate
141. 7758-94-3	Ferrous Chloride
142. 7720-78-7	Ferrous Sulfate
143. 206-44-0	Fluoranthene
144. 50-00-0	Formaldehyde
145. 64-18-6	Formic Acid
146. 110-17-8	Fumaric Acid
147. 98-01-1	Furfural
148. 86-50-0	Guthion
149. 76-44-8	Heptachlor
150. 118-74-1	Hexachlorobenzene
151. 87-68-3	Hexachlorobutadiene
152. 67-72-1	Hexachloroethane
153. 70-30-4	Hexachlorophene
154. 77-47-4	Hexachlorocyclopentadiene
155. 7647-01-0	Hydrochloric Acid (Hydrogen Chloride)
156. 7664-39-3	Hydrofluoric Acid (Hydrogen Fluoride)
157. 74-90-8	Hydrogen Cyanide
158. 7783-06-4	Hydrogen Sulfide
159. 78-79-5	Isoprene
160. 42504-46-1	Isopropanolamine Dodecylbenzenesulfonate
161. 115-32-2	Kelthane
162. 143-50-0	Kepone
163. 301-04-2	Lead Acetate
164. 3687-31-8	Lead Arsenate
165. 7758-95-4	Lead Chloride
166. 13814-96-5	Lead Fluoborate
167. 7783-46-2	Lead Fluoride
168. 10101-63-0	Lead Iodide
169. 18256-98-9	Lead Nitrate
170. 7428-48-0	Lead Stearate
171. 15739-80-7	Lead Sulfate
172. 1314-87-0	Lead Sulfide
173. 592-87-0	Lead Thiocyanate
174. 58-89-9	Lindane
175. 14307-35-8	Lithium Chromate
176. 121-75-5	Malthion
177. 110-16-7	Maleic Acid
178. 108-31-6	Maleic Anhydride
179. 2032-65-7	Mercaptodimethur
180. 592-04-1	Mercuric Cyanide
181. 10045-94-0	Mercuric Nitrate
182. 7783-35-9	Mercuric Sulfate
183. 592-85-8	Mercuric Thiocyanate
184. 10415-75-5	Mercurous Nitrate
185. 72-43-5	Methoxychlor
186. 74-93-1	Methyl Mercaptan
187. 80-62-6	Methyl Methacrylate
188. 298-00-0	Methyl Parathion
189. 7786-34-7	Mevinphos
190. 315-18-4	Mexacarbate
191. 75-04-7	Monoethylamine
192. 74-89-5	Monomethylamine
193. 300-76-5	Naled
194. 91-20-3	Naphthalene
195. 1338-24-5	Naphthenic Acid
196. 7440-02-0	Nickel
197. 15699-18-0	Nickel Ammonium Sulfate
198. 37211-05-5	Nickel Chloride
199. 12054-48-7	Nickel Hydroxide
200. 14216-75-2	Nickel Nitrate
201. 7786-81-4	Nickel Sulfate
202. 7697-37-2	Nitric Acid
203. 98-95-3	Nitrobenzene
204. 10102-44-0	Nitrogen Dioxide
205. 25154-55-6	Nitrophenol (all isomers)
206. 1321-12-6	Nitrotoluene
207. 30525-89-4	Paraformaldehyde
208. 56-38-2	Parathion
209. 608-93-5	Pentachlorobenzene
210. 87-86-5	Pentachlorophenol
211. 85-01-8	Phenanthrene
212. 108-95-2	Phenol
213. 75-44-5	Phosgene
214. 7664-38-2	Phosphoric Acid
215. 7723-14-0	Phosphorus
216. 10025-87-3	Phosphorus Oxychloride
217. 1314-80-3	Phosphorus Pentasulfide
218. 7719-12-2	Phosphorus Trichloride
219. 7784-41-0	Potassium Arsenate
220. 10124-50-2	Potassium Arsenite
221. [illegible]38-50-9	Potassium Bichromate
222. 7789-00-6	Potassium Chromate
223. 7722-64-7	Potassium Permanganate
224. 2312-35-8	Propargite
225. 79-09-4	Propionic Acid
226. 123-62-6	Propionic Anhydride
227. 1336-36-3	Polychlorinated Biphenyls
228. 151-50-8	Potassium Cyanide
229. 1310-58-3	Potassium Hydroxide
230. 75-56-9	Propylene Oxide
231. 121-29-9	Pyrethrins
232. 91-22-5	Quinoline
233. 108-46-3	Resorcinol
234. 7446-08-4	Selenium Oxide
235. 7761-88-8	Silver Nitrate
236. 7631-89-2	Sodium Arsenate
237. 7784-46-5	Sodium Arsenite
238. 10588-01-9	Sodium Bichromate
239. 1333-83-1	Sodium Bifluoride
240. 7631-90-5	Sodium Bisulfite
241. 7775-11-3	Sodium Chromate
242. 143-33-9	Sodium Cyanide
243. 25155-30-0	Sodium Dodecylbenzene Sulfonate
244. 7681-49-4	Sodium Fluoride
245. 16721-80-5	Sodium Hydrosulfide
246. 1310-73-2	Sodium Hydroxide
247. 7681-52-9	Sodium Hypochlorite
248. 124-41-4	Sodium Methylate
249. 7632-00-0	Sodium Nitrate
250. 7558-79-4	Sodium Phosphate, Dibasic
251. 7601-54-9	Sodium Phosphate, Tribasic
252. 10102-18-8	Sodium Selenite
253. 7789-06-2	Strontium Chromate
254. 57-24-9	Strychnine and Salts
255. 100-420-5	Styrene
256. 12771-08-3	Sulfur Monochloride
257. 7664-93-9	Sulfuric Acid
258. 93-76-5	2,4,5-T Acid
259. 2008-46-0	2,4,5-T Amines
260. 93-79-8	2,4,5-T Esters
261. 13560-99-1	2,4,5-T Salts
262. 93-72-1	2,4,5-TP Acid
263. 32534-95-5	2,4,5-TP Acid Esters
264. 72-54-8	TDE
265. 95-94-3	Tetrachlorobenzene
266. 127-18-4	Tetrachloroethane
267. 78-00-2	Tetraethyl Lead
268. 107-49-3	Tetraethyl Pyrophosphate
269. 7446-18-6	Thallium (I) Sulfate
270. 108-88-3	Toluene
271. 8001-35-2	Toxaphene
272. 12002-48-1	Trichlorobenzene (all isomers)
273. 52-68-6	Trichlorfon
274. 25323-89-1	Trichloroethane (all isomers)
275. 79-01-6	Trichloroethylene
276. 25167-82-2	Trichlorophenol (all isomers)
277. 27323-41-7	Triethanolamine Dodecylbenzenesulfonate
278. 121-44-8	Triethylamine
279. 75-50-3	Trimethylamine
280. 541-09-3	Uranyl Acetate
281. 10102-06-4	Uranyl Nitrate
282. 1314-62-1	Vanadium Pentoxide
283. 27774-13-6	Vanadyl Sulfate
284. 108-05-4	Vinyl Acetate
285. 75-35-4	Vinylidene Chloride
286. 1300-71-6	Xylenol
287. 557-34-6	Zinc Acetate
288. 52628-25-8	Zinc Ammonium Chloride
289. 1332-07-6	Zinc Borate
290. 7699-45-8	Zinc Bromide
291. 3486-35-9	Zinc Carbonate
292. 7646-85-7	Zinc Chloride
293. 557-21-1	Zinc Cyanide
294. 7783-49-3	Zinc Fluoride
295. 557-41-5	Zinc Formate
296. 7779-86-4	Zinc Hydrosulfite
297. 7779-88-6	Zinc Nitrate
298. 127-82-2	Zinc Phenolsulfonate
299. 1314-84-7	Zinc Phosphide
300. 16871-71-9	Zinc Silicofluoride
301. 7733-02-0	Zinc Sulfate
302. 13746-89-9	Zirconium Nitrate
303. 16923-95-8	Zirconium Potassium Fluoride
304. 14644-61-2	Zirconium Sulfate
305. 10026-11-6	Zirconium Tetrachloride

EPA Notification of Hazardous Waste Site

United States Environmental Protection Agency Washington DC 20460

R

This initial notificat required by Section hensive Environme sation, and Liability be mailed by June

REFERENCE # 1

f you need te sheets of the item

810609

FL5000001110

A Person Required to Notify:
Enter the name and address of the person or organization required to notify.

Name: CELOTEX CORPORATION
Street: 9225 DAMES POINT RD.
City: JACKSONVILLE State: FL Zip Code: 32229

B Site Location:
Enter the common name (if known) and actual location of the site.

FLD081365892

Name of Site: CELOTEX CORPORATION
Street: 9225 DAMES POINT RD.
City: JACKSONVILLE County: DUVAL State: FL Zip Code: 32229

C Person to Contact:
Enter the name, title (if applicable), and business telephone number of the person to contact regarding information submitted on this form.

Name (Last, First and Title): McKENNA, J.J. PLT. MANAGER
Phone: 904-751-4400

D Dates of Waste Handling:
Enter the years that you estimate waste treatment, storage, or disposal began and ended at the site.

From (Year): ≈1964 To (Year): ~~PRESENT~~ 1981

E Waste Type: Choose the option you prefer to complete

Option 1: Select general waste types and source categories. If you do not know the general waste types or sources, you are encouraged to describe the site in Item I—Description of Site.

General Type of Waste:
Place an X in the appropriate boxes. The categories listed overlap. Check each applicable category.

1. ☒ Organics
2. ☒ Inorganics
3. ☐ Solvents
4. ☐ Pesticides
5. ☐ Heavy metals
6. ☐ Acids
7. ☐ Bases
8. ☐ PCBs
9. ☐ Mixed Municipal Waste
10. ☐ Unknown
11. ☐ Other (Specify)

Source of Waste:
Place an X in the appropriate boxes.

1. ☐ Mining
2. ☐ Construction
3. ☐ Textiles
4. ☐ Fertilizer
5. ☐ Paper/Printing
6. ☐ Leather Tanning
7. ☐ Iron/Steel Foundry
8. ☐ Chemical, General
9. ☐ Plating/Polishing
10. ☐ Military/Ammunition
11. ☐ Electrical Conductors
12. ☐ Transformers
13. ☐ Utility Companies
14. ☐ Sanitary Refuse
15. ☐ Photofinish
16. ☐ Lab Hospital
17. ☐ Unknown
18. ☒ Other (Specify) FIBER BOARD

Option 2: This option is available to persons familiar with the Resource Conservation and Recovery Act (RCRA) Section 3001 regulations (40 CFR Part 261).

Specific Type of Waste:
EPA has assigned a four-digit number to each hazardous waste listed in the regulations under Section 3001 of RCRA. Enter the appropriate four-digit number in the boxes provided. A copy of the list of hazardous wastes and codes can be obtained by contacting the EPA Region serving the State in which the site is located.

RECEIVED EPA/REGION IV JUN 8 12 43 PM '81 ENFORCEMENT DIVISION

0227

Form Approved OMB No. 2060-0138

Notification of Hazardous Waste Site **Side Two**

F Waste Quantity

Place an X in the appropriate boxes to indicate the facility types found at the site.

In the "total facility waste amount" space give the estimated combined quantity (volume) of hazardous wastes at the site using cubic feet or gallons.

In the "total facility area" space, give the estimated area size which the facilities occupy using square feet or acres.

Facility Type

1. ☐ Piles
2. ☒ Land Treatment
3. ☐ Landfill
4. ☐ Tanks
5. ☐ Impoundment
6. ☐ Underground Injection
7. ☐ Drums, Above Ground
8. ☐ Drums, Below Ground
9. ☐ Other (Specify) _____

Total Facility Waste Amount

cubic feet 77.4

gallons _____

Total Facility Area

square feet _____

acres 4

G Known, Suspected or Likely Releases to the Environment:

Place an X in the appropriate boxes to indicate any known, suspected, or likely releases of wastes to the environment.

☐ Known ☐ Suspected ☐ Likely ☒ None

Note: Items H and I are optional. Completing these items will assist EPA and State and local governments in locating and assessing hazardous waste sites. Although completing the items is not required, you are encouraged to do so.

H Sketch Map of Site Location: (Optional)

Sketch a map showing streets, highways, routes or other prominent landmarks near the site. Place an X on the map to indicate the site location. Draw an arrow showing the direction north. You may substitute a publishing map showing the site location.

I Description of Site: (Optional)

Describe the history and present conditions of the site. Give directions to the site and describe any nearby wells, springs, lakes, or housing. Include such information as how waste was disposed and where the waste came from. Provide any other information or comments which may help describe the site conditions.

J Signature and Title:

The person or authorized representative (such as plant managers, superintendents, trustees or attorneys) of persons required to notify must sign the form and provide a mailing address (if different than address in item A). For other persons providing notification, the signature is optional. Check the boxes which best describe the relationship to the site of the person required to notify. If you are not required to notify check "Other".

Name LECIL M. COLBURN

Street P.O. BOX 22601

City TAMPA State FL Zip Code 33622

Signature Lecil M Colburn 6/8/81

☒ Owner, Present
☐ Owner, Past
☐ Transporter
☐ Operator, Present
☐ Operator, Past
☐ Other

[FR Doc. 81-11500 Filed 4-14-81; 8:45 am]

BILLING CODE 6560-29-C

REFERENCE # 2

33

"Rite in the Rain"®

ALL-WEATHER

LEVEL

Notebook No. 311

F4-2215

Celotex Corp
Jacksonville (Duval) FL
4-25-90
Solomon Pollard
F4-9002-33

[illegible]

[illegible] operational checks [illegible] of equipment used [illegible]

Provide reference to Sampling Field Sheets for detailed sampling information.

8. Describe sampling locations in detail and document all changes from project planning documents.

[illegible]

[illegible]

Bldg 1 is a Truck
loading bldg (possibly
maintenance also) look
[illegible] Truck [illegible]
[illegible] Bldg 2 is [illegible]
[illegible] bldg [illegible]
[illegible] flue.
Bldg 3 [illegible] below
grade [illegible] height tanks
[illegible] stacks and
is possibly used in
manufacturing. There
is a large mound
[illegible]
[illegible] Bldg 3
[illegible]

[illegible]

AUG [illegible]
30 [illegible] 00

[illegible] being [illegible]
[illegible] as [illegible]
[illegible] The [illegible]
[illegible]

[illegible]

indication [illegible]
[illegible]
[illegible]

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the mound of material
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[illegible] truck [illegible]
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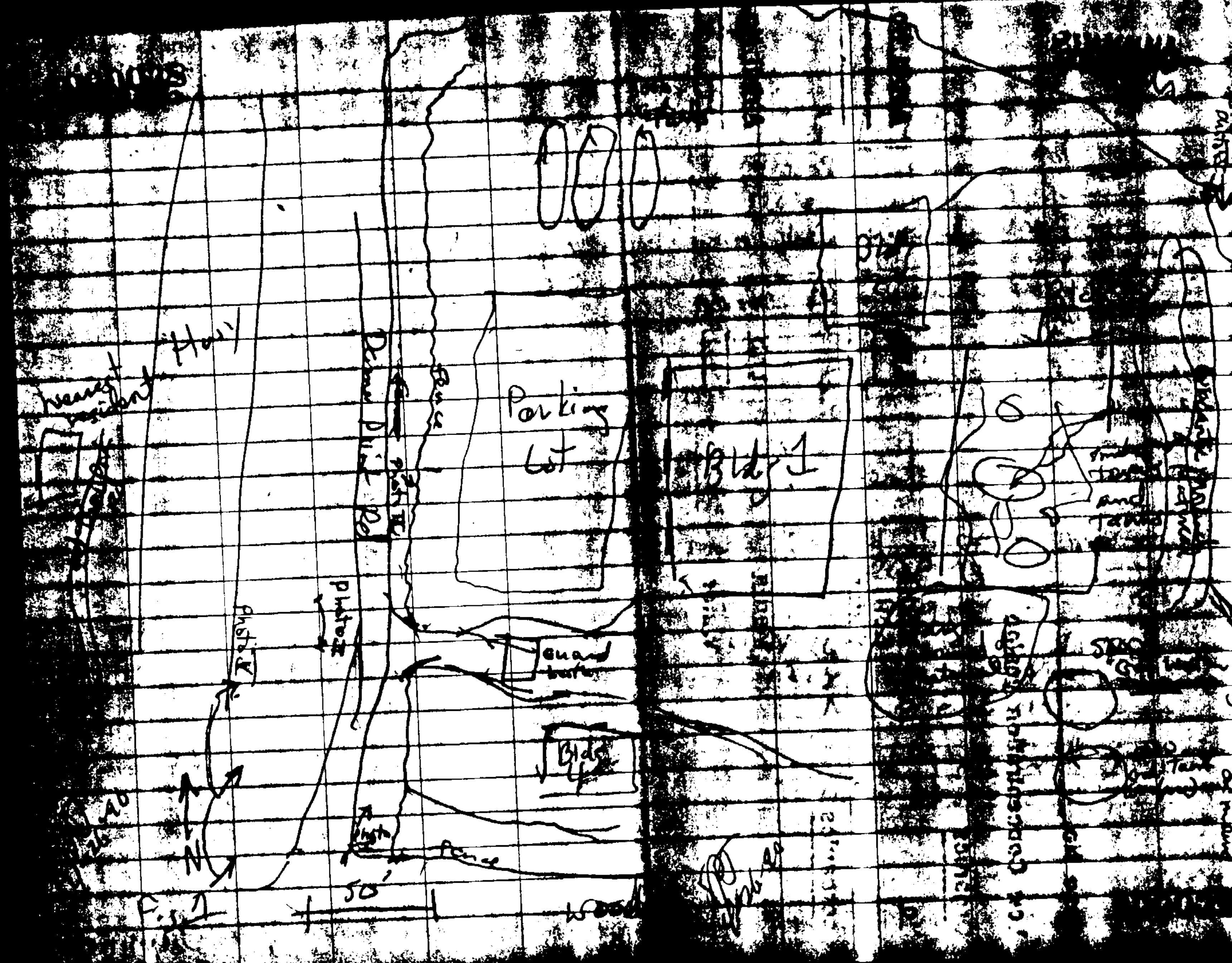

Parking Lot
Bldg 1
Bldg 4
Guard house
N
50'

Case No. _____

Low Concentration yes/no

Organics

No.	Media	Lab	Airbill No.
	Soil		
	Water		

Inorganics

No.	Media	Lab	Airbill No.
	Soil		
	Water		

TDD # F4-9002-33

Date 4-26-90

Time 1205

Location

Picture of

TDD # F4-9002-33

Date 4-26-90

Time 1228

Location

Picture of Pan

TDD # F4-9002-33

Date 4-26-90

Time 1228

Location

Picture of Mud

000011

TDD # F4-9002-33
Date 4-26-90 By Whom: Sil
Time: 1235 # keyed to map: Photo IV
Location: NE of property
Picture of: Pair of material Mound and conveyor app

TDD # F4-9002-33
Date 4-26-90 By Whom: Sil
Time: 1300 # keyed to map: Photo V
Location: W of prop. on Hwy
Picture of: S to N view of property (3 views)

TDD #
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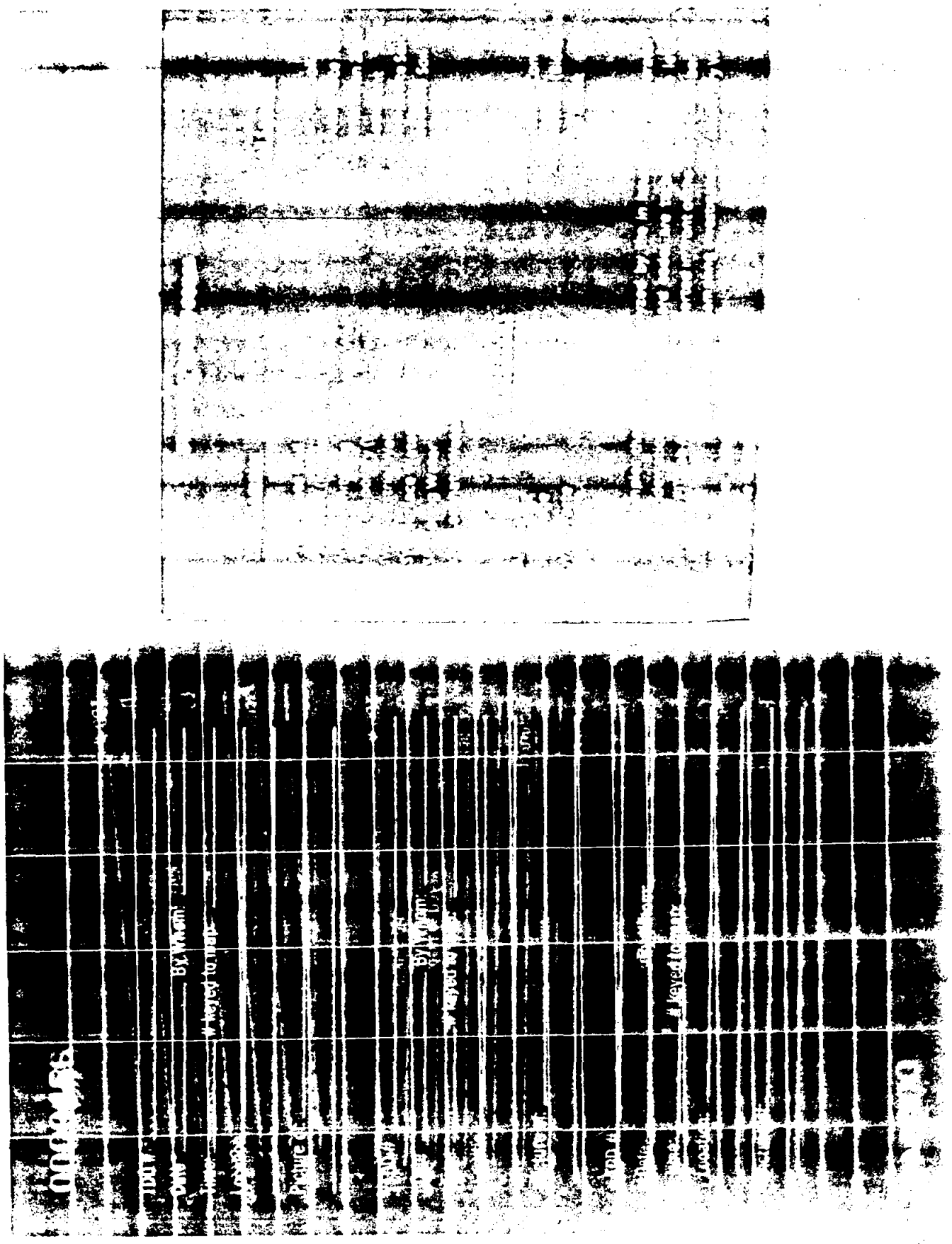

KIRK-OTHMER

ENCYCLOPEDIA OF CHEMICAL TECHNOLOGY

THIRD EDITION

VOLUME 14

LAMINATED WOOD-BASED COMPOSITES
TO
MASS TRANSFER

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or consumed in a one-year period because a large amount of hardwood plywood is imported into the United States each year.

Specifications. The most commonly used specifications for plywood are the product standards established by the industry with the assistance of the U.S. Department of Commerce, NBS. Softwood plywood is covered by *U.S. Product Standard PS 1-74* (4); hardwood and decorative plywood is covered by *PS 51-71* (5). These specifications include requirements for species, grade, thickness of veneer and panels, glue bonds, moisture content, etc. They also provide standardized definitions of terminology, suitability, and performance test specifications, expected minimum test results, and explanations of the codes which normally are stamped on each panel. Some of the allowable stresses for softwood plywood that conform to *PS 1* are given in Table 4 (4).

Imported plywood generally is not produced in conformance with United States product specifications. However, some countries have their own specifications for plywood that is manufactured for export to the United States, and some of these follow the requirements of our applicable domestic product standards.

Uses. The American Plywood Association has published information on the projections of softwood-plywood-structural panel demand in the United States by market area for the years 1977, 1978, and 1979 (10). The estimated demand for softwood plywood by five broad market categories and information on the larger volume uses in each of these five categories is listed in Table 8. The bulk of softwood plywood is used where strength, stiffness, and construction convenience are more important than appearance. Some grades of softwood plywood are made with faces that are selected primarily for appearance and are used either with clear natural finishes or with pigmented finishes.

Hardwood plywood is used normally where appearance is more important than strength. Most of the production is intended for interior or protected uses, although a very small proportion is made with glues that are suitable for exterior service. A significant portion of all hardwood plywood is available completely finished. Typical uses of unfinished hardwood plywood include containers, curved or molded products, door skins, die boards, marine-grade materials, pin blocks, kitchen cabinets, furniture components, and exterior siding. Examples of prefinished hardwood-plywood uses include wall paneling or interior use surface-covering material, laminated hardwood block flooring, furniture components, door skins, kitchen and bathroom cabinets, and laminated door sides.

Wood-Based Fiber and Particle Panel Materials. Wood-based fiber and particle panel materials include insulation boards, medium-density fiberboards, hardboards, particleboards, and laminated paperboards. Various particleboards are known by the kind of particle used such as flakeboard, chipboard, chipcore, or shavings board. These panel materials are reconstituted wood (or some other lignocelluloselike bagasse) in that the wood is first reduced to small fractions of the original size and then is combined by special forms of manufacture into large and moderately thick panels. In final form, these materials retain some of the properties of the original wood but, because of the manufacturing methods, gain new and different properties than those of the wood. Because they are manufactured, they can be tailored to satisfy desired uses.

The wood-based panel materials are manufactured either by converting wood substance to fibers and then interfelting them into the panel material classed as building fiberboard, or by strictly mechanical means of cutting or breaking wood into

John A Youngquist

Table 8. Estimated United States Demand for Softwood Plywood by Market, 1977–1979 10^6 m^2[a] (9.5-mm basis)

Market	Year 1977	1978	1979
new residential construction			
floor systems	310	280	300
roof decks	360	300	330
exterior siding	110	100	110
mobile homes	14	15	16
other	120	80	80
Total	*914*	*775*	*836*
distribution			
home repair and remodeling	210	220	230
other homeowner uses	130	140	140
miscellaneous other markets	70	80	90
Total	*410*	*440*	*460*
industrial			
material handling	50	60	70
transportation	50	50	50
other products made for sale	90	100	100
in-plant repair, maintenance, patterns, and jigs	80	80	80
Total	*270*	*290*	*300*
nonresidential construction			
building construction	80	90	90
concrete form	70	80	80
agricultural buildings	30	30	30
other	10	10	10
Total	*190*	*210*	*210*
international markets	30	30	60
Total market demand	*1814*	*1745*	*1866*
changes in mill and wholesale industry	−30	+20	+20
Total production	*1784*	*1765*	*1886*

[a] Ref. 10. To convert m^2 to ft^2, multiply by 10.76.

small discrete particles and then, with a synthetic-resin adhesive or other suitable binder, bonding them together in the presence of heat and pressure. These latter products are called particleboards (11–12).

Building fiberboards are made of fiberlike components of wood that are interfelted in the reconstitution and are characterized by a bond produced by the interfelting, and they are classified as fibrous-felted board products. Binding agents and other materials may be added during manufacture to increase strength, resistance to fire, moisture, or decay, or to improve some other property. Among the materials added are rosin, alum, asphalt (qv), paraffin, synthetic and natural resins, preservative and fire-resistant chemicals, and drying oils (qv). At certain densities and under controlled conditions of hot pressing, rebonding of the lignin effects an additional bond in the panel product.

Particleboards are manufactured from small components of wood that are glued together with a thermosetting synthetic resin or equivalent binder. Wax sizing is added to all commercially produced particleboard to improve water resistance. Other additives may be introduced during manufacture to improve some property or to provide added resistance to fire, insects (eg, termites), or decay. Particleboard is among the

newest of the wood-
panel product beca
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and curing in a heat
urea–formaldehyde
and is the binder used
or other nonsevere e
melamine–urea–form
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newest of the wood-based panel materials. It has become a successful and economical panel product because of the availability and economy of thermosetting synthetic resins, which permit consolidation of blends of wood particles and the synthetic resin and curing in a heated press. The thermosetting resins that are used are primarily urea–formaldehyde and phenol–formaldehyde. Urea–formaldehyde is lowest in cost and is the binder used in greatest quantity for particleboard that is intended for interior or other nonsevere exposures. Where moderate water or heat resistance is required, melamine–urea–formaldehyde resin blends are used. For severe exposures, eg, exteriors, or where some heat resistance is required, phenolics generally are used.

The kinds of wood particles that are used in the manufacture of particleboard range from specially cut flakes 2.5 cm or more in length (parallel to the grain of the wood) and only a few hundredths of a centimeter thick to fine particles approaching fibers or flour in size. The synthetic resin solids usually are 5–10 wt % of the dry wood. These resins are set by heat as the wood particle–resin blend is compressed either in flat-platen presses (similar to those used for hot-pressing hardboard and plywood) or in extrusion presses where the wood–resin mixture is squeezed through a long, wide, and thin die that is heated to provide the energy to set the resin. Particleboards produced by flat-platen presses are called mat-formed or platen-pressed particleboards and those produced in an extrusion press are called extruded particleboards.

Building fiberboards and particleboards are produced from small components of wood, hence the raw material need not be in log form. Many processes for manufacture of board materials start with wood in the form of pulp chips. Coarse residues from other primary forest products manufacture, therefore, are an important source of raw materials for both kinds of wood-based panel products. Particleboards and, to a lesser extent, building fiberboards, use fine residues as raw material (eg, planar shavings). Overall, about 70% of the raw material requirements for wood-base, fiber and particle panel materials are satisfied by residues.

Wood-based fiber and particle panel materials form an important part of the forest products industry in the United States. Not only are they valuable from the standpoint of integrated utilization, but the total production of more than 6.5×10^8 m^2 (7×10^9 ft^2) is important in terms of forest products consumed. Along with softwood plywood, wood-based fiber and particle panel materials are among the fastest growing components of the industry.

Fiber Panel. Broadly, the wood-based fiber panel materials (building fiberboards) are divided into two groups—insulation board (lower density products) and hardboard, which requires consolidation under heat and pressure as a separate step in manufacture. Insulation board and hardboard dimensional and quality requirements are given in refs. 13 and 14, respectively. The dividing point between an insulation board and a hardboard, on a density basis, is a specific gravity of 0.5 g/cm^3. Practically, because of the range of uses and specially developed products within the broad classification, further breakdowns are necessary to classify adequately the various products. Table 9 shows the building fiberboards identified by density.

Laminated paperboards require a special classification because the density of these products is slightly greater than the maximum for non-hot-pressed, fibrous-felted, wood-based panel materials. Also, because these products are made by laminating plies of paper about 2.5 mm thick, they have different properties along the direction of the plies than across the machine direction. The other fibrous-felted products have nearly equal properties along and across the panel.

Table 9. Densities of Building Fiberboards

Material	Density, g/cm^3 [a]
insulation board	0.02–0.50
semirigid insulation board	0.02–0.16
rigid insulation board	0.16–0.50
hardboard	0.50–1.44
medium density hardboard	0.50–0.80
high density hardboard	0.80–1.20
special densified hardboard	1.35–1.45
laminated paperboard	0.50–0.59

[a] To convert g/cm^3 to lb/ft^3, multiply by 62.43.

Particle Panel. Mat-formed particleboards, because of differences in properties and uses, generally are classified by density into low (<0.59 g/cm^3), medium (0.59–0.80 g/cm^3), and high (>0.80 g/cm^3) categories. All mat-formed particleboards are hot-pressed to cure the resins that are used as binders.

These mat-formed particleboards are homogeneous (the same kind, size, and quality of particle throughout the thickness), graduated (a gradation of particle size from coarsest in the center of the thickness to finest at each surface), or three layer (the material on and near each surface is different than that in the core). These boards also may be described by the predominant kind of particle, as shavings, flakes, slivers, or the combination in the instance of layered construction as flake-faced or fines-surfaced boards.

A generalized manufacturing flow diagram for a particleboard manufacturing process is presented in Figure 3. Particleboard production begins when the raw material

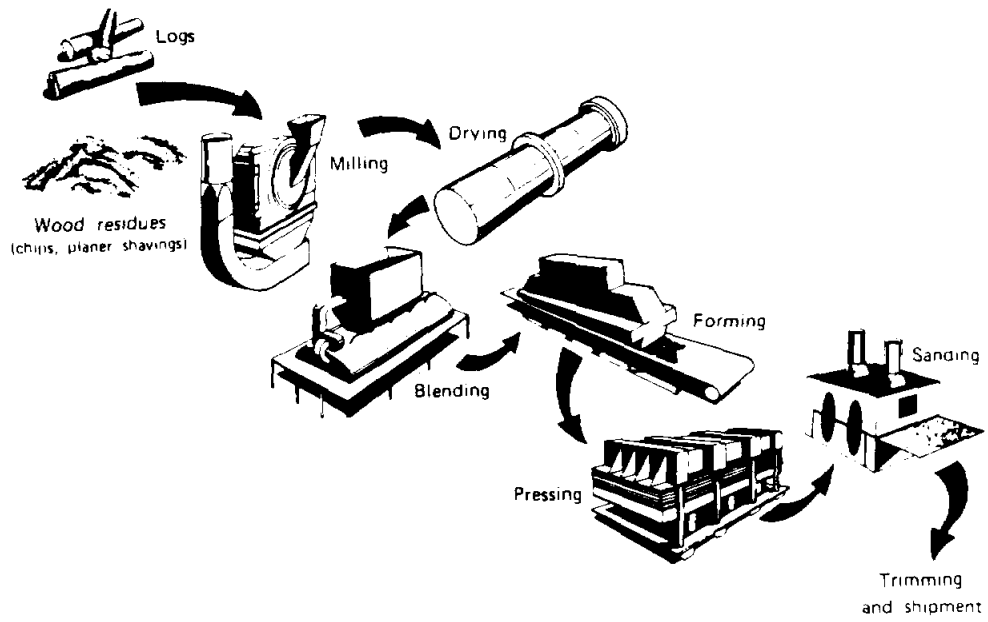

Figure 3. Manufacture of particleboard. Courtesy of the National Particleboard Association.

(wood chips, planer shavings, or logs) is reduced by flakers, hammermills, or other types of milling equipment to produce the desired types of tiny wood particles. Screens classify the particles into the proper mixture of sizes. Dryers remove excess moisture and uniformly control the moisture content to the desired level. Resin binders and other chemicals are sprayed onto the wood particles at a controlled rate in a blending operation. Forming machines deposit the treated particles onto belts or metal cauls, thereby forming mats. Particle mats are consolidated and the binders are cured in heated hydraulic presses with temperatures up to 200°C and pressures up to 6.9 MPa (1000 psi). After being pressed, boards are trimmed to the desired length and width. Sanding in high-speed belt sanders produces the smooth surfaces and accurate thickness tolerances characteristic of particleboards.

Extruded boards account for less than 5% of the total production of particleboard, and standards have not been developed for them to any appreciable extent. Most extruded particleboard is medium density because the compression applied to the wood particles during extruding does not increase the density beyond 0.80 g/cm^3. Particleboards thicker than about 16 mm can be extruded with hollow core sections similar to those molded in concrete blocks. Because of these hollow core sections, the equivalent density may fall below that of medium density, mat-formed particleboard. Extruded particleboards of that type, usually called fluted particleboards, are classified on the basis of weight per square meter for a specified thickness.

Waferboard and Other Structural Composite Panels. Waferboard is a structural board made of wood wafers that are cut to predetermined dimensions, randomly distributed, and bonded with a phenolic adhesive. The product generally is made from roundwood or forest residue rather than mill residue, and has been manufactured in Canada in considerable quantity since the late 1960s. A plant in the United States has had a waferboard plant in continuous production since the early 1970s, and in 1978 and 1979, seven waferboard plants have been announced, and two plant expansions are in the planning stages. Reasons for this strong interest in waferboard include a continuing strong demand for structural board products, a recognition of changing raw material supplies, and rapidly rising softwood plywood prices.

Another type of structural board, which has been manufactured in the Federal Republic of Germany and which soon will be manufactured in the United States in commercial quantities, uses flakes or strands that are narrower than those commonly used in waferboard. These flakes or strands are incorporated into three-layer panels that are composed entirely of oriented-strand-particleboard layers, which substitute for veneer. These panels, which represent one type of a family of panels commonly referred to as oriented-strand board (OSB) panels, initially will be used in floor and roof-sheathing markets where structural strength is important. It is anticipated that future markets for these types of products will expand from sheathing applications to uses in single-layer flooring, textured siding, and overlaid interior panels.

Another type of new structural panel combines an OSB core with veneer face and back material, each component produced separately, and laid-up on a conventional plywood line. The resultant panel looks like a plywood panel and frequently is used interchangeably with plywood. It has had very good market acceptance in the United States. One plant has been in production for more than 3 years and several others soon will begin production. A similar board with a nonaligned particle core has been introduced using an isocyanate adhesive as the binder. This is the first commercial use of this binder for a wood-board product in the United States. Markets include wall and roof sheathing and concrete forms.

Properties and Uses. *Semirigid Insulation Board.* Semirigid insulation board describes fiberboard products that are manufactured primarily for insulation and cushioning. These very low density fiberboards have about the same heat-flow characteristics as conventional blanket or batt insulation but have sufficient stiffness and strength to maintain their position and form without being attached to the structure. They may be bent around curves or corners and, when cemented, mechanically fastened, or placed between framing members, hold their shape and position even though subjected to considerable vibration.

Semirigid insulation boards are manufactured in sheets 13–38 mm thick. When greater thicknesses are required, two or more sheets are cemented together. Sheet sizes vary from 30 × 61 cm to 1.2 × 1.2 m. The thermal resistance factors R are 35–39 mW/(m·K) [0.24–0.27 (Btu·in.)/(h·ft^2·°F)] (see Insulation, thermal). Semirigid insulation boards are used for heat insulation in truck and bus bodies, automobiles, refrigerators, railway cars, on the outside of ductwork, and wherever vibrations are so severe that loose fill or batt insulation may pack or shift.

Rigid Insulation Board. Rigid insulation board is the oldest of the wood-based fiber and particle panel materials and is a structural insulation board. Structural insulating board is manufactured mainly for specific uses in construction although some is fabricated for special padding and blocking in packaging and a variety of other industrial uses. Interior-quality boards are used where high water resistance is not required but where a light-colored product is desired. Sheathing-quality boards are used where water resistance is required and are manufactured with added water-resistant materials (usually asphalt by impregnation and/or coating). Density is somewhat greater for sheathing-quality boards than for interior boards.

Strength and related properties of insulating board are included in Table 10 with those properties of other building fiberboards. The two basic insulating-board products, with only minor composition modifications in manufacture, are fabricated into a group of products designed to satisfy specific use requirements in construction. These requirements may call for structural strength and either high thermal insulation or good acoustical properties or both.

General-Purpose Board. There are two general-purpose structural insulating boards—building board and wallboard (the latter sometimes is called thin board because it is either 7.9- or 9.5-mm thick, whereas most other insulating board is 13-mm thick or thicker). Both general-purpose boards may be converted for a multiplicity of uses not specifically covered in the other products. The general-use boards usually are furnished with a factory-applied flame-resistant finish. Building board is 13-mm thick and may be obtained in panels 1.2 × 2.4, 2.7, 3.0, or 3.7 m with square edges. Wallboard is furnished regularly 1.2 m wide in either 2.4- or 3.0-m lengths. Quality limits are set for these and other regular products in the standards.

Insulating Roof Deck. Insulating roof deck is a laminated structural insulating board product that is manufactured of several layers of sheathing-grade board and one layer of factory-finished interior board (either perforated or plain). It is used in exposed-beam ceiling constructions where the factory-finished interior board is applied face down. Insulating roof deck is made in 38-, 51-, and 76-mm nominal thicknesses in 0.6 × 2.4-m panels. The 38-mm-thick panel is made to span 61 cm, the 51-mm-thick panel to span 81 cm, and the 76-mm-thick material to span 1.2 m. Panel ends are square and sides are tongued and grooved.

Table 10. Strength and Mechanical Properties of Wood-Based Building Fiberboards[a]

Property	Structural insulating board	Medium density hardboard	High density hardboard	Tempered hardboard	Special densified hardboard
density, g/cm^3	0.16–0.42	0.53–0.80	0.80–1.28	0.93–1.28	1.36–1.44
modulus of elasticity, GPa[b]	0.17–0.86	2.24–4.83	2.76–5.52	4.48–7.59	8.62
modulus of rupture, MPa[b]	1.4–5.5	13.1–41.4	20.7–48.3	38.6–69.0	69.0–86.2
tensile strength parallel to surface, MPa[b]	1.4–3.4	6.9–27.6	20.7–41.4	24.8–53.8	53.8
tensile strength perpendicular to surface, MPa[b]	0.069–0.17	0.28–1.4	0.52–2.8	1.1–3.1	3.4
compressive strength parallel to surface, MPa[b]		6.9–24.1	12.4–41.4	25.5–41.4	183
shear strength (in plane of board), MPa[b]		0.69–3.3	2.1–4.1	3.0–5.9	
shear strength (across plane of board), MPa[b]		4.1–17.2	13.8–20.7	19.3–23.4	
24-h water absorption, vol %	1–10				
24-h water absorption, wt %		5–20	3–30	3–20	0.3–1.2
thickness swelling (24-h soaking), %		2–10	10–25	8–15	
linear expansion (50–90% rh), %[c]	0.2–0.5	0.2–0.4	0.15–0.45	0.15–0.45	
thermal conductivity (at 24°C), mW/(m·K)[d]	39–65	65–108	108–202	108–216	267

[a] The data presented are general, round-figure values, accumulated from numerous sources (see also ref. 2); for more exact figures on a specific product, individual manufacturers should be consulted or tests should be conducted. Values are for general laboratory conditions of temperature and humidity.
[b] To convert MPa to psi, multiply by 145; to convert GPa to psi, multiply by 145,000.
[c] Measurements made on material at equilibrium at each condition at room temperature.
[d] To convert mW/(m·K) to (Btu·in)/(h·ft^2·°F), divide by 144.1.

In climates where condensation occurs, insulating roof deck is furnished with a vapor-barrier membrane that is installed in the glueline between the layer of 13-mm-thick, interior-finish board and the first sheathing-quality layer. In this construction, the roof decking furnishes structural rigidity to support snow and water or wind loads, besides providing interior ceiling finish and thermal insulation. Thermal conductance factors for the various thicknesses are specified at 35, 26, and 17 mW/(m·K) [0.24, 0.18, and 0.12 (Btu·in.)/(h·ft^2·°F)] for the thickness of 38, 51, and 76 mm, respectively. For flat roofs, a built-up roof is applied directly to the top surface of the deck. If the pitch (slope) of the roof is sufficient, asphalt shingles may be attached to 51- and 76-mm-thick decking with special annular-grooved nails.

Roof Insulation. Above-deck, thermal insulation made of structural insulating board is manufactured in blocks 0.58 × 1.19 m or 0.61 × 1.2 m in 13-mm multiples of thickness between 13 and 78 mm. The blocks usually are multiple 13-mm thicknesses of insulation board and may be laminated or stapled together in the greater thicknesses. Insulation-board roof insulation is applied where the final roofing is of the built-up variety. It is secured in place by hot asphalt or roofing pitch or by mechanical fasteners, and has enough internal bond strength to resist uplift forces on the roof structure.

Ceiling Tile and Lay-in Panels. Ceiling tile, either plain or perforated, has a paint finish applied in the factory to provide resistance to flame spread. Interior-finish insulating board, when perforated or provided with special fissures or other sound traps, also will provide a substantial reduction in noise reflectance. Ceiling tiles usually are 30 × 30 cm and 30 × 61 cm in size, 13-mm thick, and have tongue and groove or butt and chamfered edges. They are applied to nailing strips with nails, staples, or special mechanical fastenings, or directly to a surface with adhesives.

A panel product similar to tile, but nominally 61 × 61 cm or 61 × 122 cm, is gaining popularity. These panels, called lay-in ceiling panels, are installed in metal tees and angles in suspended ceiling systems. They usually are 13-mm thick and are supported in place along all four edges. They frequently are used in combination with translucent plastic panels that conceal light fixtures. Finishes and perforation treatments for sound absorption are the same as for regular ceiling tile (see Insulation, acoustic).

Plank. Structural insulating-board plank is installed on side walls, often in remodeling, where it is used in conjunction with ceiling tile installations. Plank is 30-cm wide with matching long edges and is finished with a flame-resistant paint applied at the factory. Because of its low density, it is subject to abrasion when used for the lower part of walls where chairs or other furniture can bump it. It is used frequently in conjunction with wainscoting of wood paneling or one of the other wood-based panel materials like hardboard or particleboard.

Sheathing. Insulation board frequently is used to sheath houses in the United States. Sheathing is manufactured in three grades: regular density, intermediate density, and nail base. Regular-density sheathing is manufactured in both 13- and 20-mm thicknesses. Intermediate and nail base are made only 13 mm thick. Regular-density sheathing is furnished in two sizes, 0.61 × 2.4 m, or 1.2 × 2.4, 2.7, 3.0, or 3.7 m; the other two grades are furnished only in 1.2-m widths and 2.4- or 2.7-m lengths.

Regular-density sheathing usually is about 0.290 g/cm^3 in density and is sold with a thermal resistance R rating of 297 mW/(m·K) [2.06 (Btu·in.)/(h·ft^2·°F)] for 20-mm material and 190 mW/(m·K) [1.32 (Btu·in.)/(h·ft^2·°F)] for the 13-mm thickness. If the 0.6 × 2.4-m material is used as sheathing, it is applied with the long edges horizontal and adequate fastening (either nails or staples) around the perimeter and along intermediate framing, and requirements for racking resistance of the wall construction usually are satisfied. Horizontal applications with the 20-mm material require additional bracing in the wall system to meet code requirements for rigidity, as do some applications of the 13-mm-thick, regular-density sheathing applied with the long edges being vertical.

Costs of heating and requirements for air conditioning from summer heat may justify added thermal insulation over that required by minimum standards. When such added thermal insulation is used in construction of walls, intermediate and nail-base sheathing (with lower thermal resistance) is used. They are applied with their long edges vertical. With recommended fastening, such sheathing provides the racking rigidity and strength for the wall without added bracing.

The density of intermediate sheathing usually is about 0.350 g/cm^3 and that of nail base is about 0.40 g/cm^3. The insulation-board industry provides intermediate density and nail-base sheathing with rated thermal resistance R values: the R values are 176 and 164 mW/(m·K) [1.22 and 1.14 (Btu·in.)/(h·ft^2·°F)], respectively. Nail-base

sheathing has adequate nail-holding strength so that asbestos (qv) and wood shingles for weather course (siding) can be attached directly to the nail-base sheathing with special annular-grooved nails. With the other grades of sheathing, siding materials must be nailed directly to framing members or to nailing strips attached through the sheathing to the framing. Because the method and amount of fastening are critical to racking resistance, local building codes should be consulted for requirements in different areas.

Sound-Deadening Board. Sound-deadening board is specially manufactured to provide a meaningful reduction in sound transmission through walls. Standard sizes are 13-mm thick, 1.2 m-wide, and 2.4- or 2.7-m long. In light-frame construction, sound-deadening board usually is applied to the wall framing; the final wall finish, such as gypsum board, is applied to the outside faces of the sound-deadening board. Acoustic efficiency of walls constructed with sound-deadening board depends on tight construction with no air leaks around the edges of panels, and close adherence to prescribed methods of installation.

Medium Density Hardboard. Medium density hardboard, formerly classified as medium density building fiberboard, is a relatively new wood-based panel product. Nearly all of the material being manufactured by the conventional methods that are used for other hardboard is being tailored for use as house siding. Medium density hardboard for house siding use is 9.5- and 11-mm thick and is fabricated for application as either panel or lap siding. Medium density hardboard sometimes is manufactured by a process that involves radio-frequency energy for curing thicker panels (usually about 19 mm although it is possible to make panels as thick as 76 mm) used mainly in furniture and cabinets as core stock or panel stock (see Radiation curing).

Panel siding is 1.2 m wide and commonly is furnished in 2.4-, 2.7-, or 3.0-m lengths. Surfaces may be grooved 51 mm or more on center parallel to the long dimension to simulate reversed board and batten or may be pressed with ridges simulating a raised batten. Lap siding usually is 30-cm wide with lengths to 4.9 m and is applied in the same way as conventional wood lap siding. Some manufacturers offer lap-siding products with special attachment systems that provide either concealed fastening or a wide shadow line at the bottom of the lap.

Most siding is furnished with some kind of a factory-applied finish, eg, the surface and edges are given a prime coat of paint and finishing is completed by application of one or more coats of paint. Two coats of additional paint, one of a second primer and one of topcoat, provide for a longer interval before repainting. However, there is a trend towards complete prefinishing of medium density hardboard siding. The complete prefinishing ranges from several coats of liquid finishes to cementing various films to the surfaces and edges of boards. Surfaces of medium density hardboard for house siding range from very smooth to textured; one of the newest simulates weathered wood with the latewood grain raised as though earlywood has been eroded away. Siding remains the most important use of medium density hardboard. This product is also marketed for industrial use under the name, Industrialite.

High Density Hardboard. Properties of high density hardboard are summarized in Table 10 but, in the trade, the various qualities are subdivided in smaller groups beyond those shown. An overlapping of properties is shown by the limiting values in the various standards for hardboard. Standard hardboard has a density of about 0.960–1.04 g/cm^3 which, usually, is unaltered except by humidification as it is produced

by hot pressing. Tempered hardboard is a standard-quality hardboard treated with a blend of siccative resins (drying-oil blends or synthetics) after hot-pressing. The resins are stabilized by baking after the board has been impregnated. Usually about 5% solids are required to produce a hardboard of tempered quality. Tempering improves water resistance, hardness, and strength but embrittles the board making it less shock resistant.

Service-quality hardboard has a lower density than standard hardboard, usually 0.80–0.88 g/cm^3 and satisfies needs where the higher strength of standard quality is not required. Because of its lower density, service-quality hardboard has better dimensional stability than the denser products. It is used where water resistance is required but where the higher strength of regular treatment is not. Underlayment is service-quality hardboard, nominally 6.1 mm thick, that is sanded or planed on the back surface to provide a thickness of 5.461 ± 0.127 mm.

A substantial amount of high density hardboard is manufactured for special industrial use. Hardboard that is manufactured for concrete forms frequently is given a double tempering treatment. For some uses where high impact resistance is required (eg, backs of television cabinets), boards are formulated from specially prepared fiber and additives.

High density and medium density conventional hardboards are manufactured in several ways, and the result is reflected in the appearance of the final product. Hardboard is screen-backed or S-2-S (smooth two sides). When the mat from which the board is made is formed from a water slurry (wet-felted) and the wet mat is hot-pressed, a screen is required to permit steam to escape. In the final board, the reverse impression of the screen is apparent on the back of the board, hence the screen-back designation. A screen is required with mats formed from an air suspension (air-felted) when moisture contents going into the hot press are sufficiently high so as to require venting.

In some variations of hardboard manufacture, a wet-felted mat is dried before being hot-pressed which makes possible hot-pressing without using the screen, and an S-2-S board is produced. In air-felting hardboard manufacture, it also is possible to press without the screen, if the moisture content of the mats entering the hot press is low. In an adaptation of pressing hardboard mats, a caul with slots or small circular holes is used to vent steam; the board that is produced has a series of small ridges or circular nubbins which, when planed or sanded off, yield an S-2-S board.

Medium density hardboard that is manufactured using radio-frequency curing is produced from dry, fiber–resin blends. The mats are pressed between heated platens where the high frequency heat provides additional heat energy to cure the resin binder (usually urea–formaldehyde instead of the phenolics used with the more conventional hardboards); the product is S-2-S hardboard.

Commercial thicknesses of high density hardboard generally range 9.5–13 mm. Not all thicknesses are produced in all grades. The thicknesses of 2.5 and 2.1 mm are produced regularly only in the standard grade. Tempered hardboards are produced regularly in thicknesses of 3.2–7.9 mm. Service and tempered service are produced regularly in fewer thicknesses; however, none is less than 3.2 mm or is produced by all manufacturers or in screenback and S-2-S types. The appropriate standard specification or source of material should be consulted for specific thicknesses of each kind.

High density hardboards are produced in 1.2- and 1.5-m widths. Standard commercial lengths are 1.2, 1.8, 2.4, 3.7, and 4.9 m with a 5.5-m length being available in

the 1.2-m width. Most manufacturers maintain cut-to-size departments for special orders. Retail lumberyards and warehouses commonly stock 2.4-m lengths; underlayment, however, is usually 1.2 m square.

About 15% of the hardboard used in the United States is imported. Imported board may or may not be manufactured to the same standards as domestically produced products. Before substituting an imported product in a use where specific properties are required, it should be determined that it has properties required for the use. Canadian products usually are produced according to the same standards as are United States products.

In addition to the standard smooth-surface hardboards, special products are made using patterned cauls so the surface is striated or produced with a relief to simulate ceramic tile, leather, basket weave, etched wood, or other texture. Hardboards are punched to provide holes for anchoring fittings for shelves and fixtures (perforated board) or with holes comprising 15% or more of the area (for installation in ceilings with sound-absorbent material behind it as an acoustical treatment or as air diffusers above plenums). High density hardboard is harder than most natural wood and, because of its grainless character, it has nearly equal properties in all directions in the plane of the board. It is not as stiff nor as strong as natural wood along the grain but it is substantially stronger and stiffer than wood across the grain. Specific properties in Table 10 can be compared with similar properties for wood, wood-base, and other materials.

Hardboard is used in construction as floor underlayment to provide a smooth undercourse under plastic or linoleum flooring, as a facing for concrete forms for architectural concrete, facings for flush doors, as insert panels and facings for garage doors, and material punched with holes for wall linings in storage walls and in built-ins where ventilation is desired. In furniture, furnishings, and cabinet work, conventional hardboard is used extensively for drawer bottoms, dust dividers, case goods and mirror backs, insert panels, television, radio, and stereo-cabinet sides, backs (die-cut openings for ventilation), and as crossbands and balancing sheets in laminated or overlay panels. Hardboard also is used in interior linings of automobiles, trucks, buses, and railway cars.

Densified Hardboard. Densified hardboard is manufactured mainly as diestock and electrical panel material. It has a density of 1.36–1.44 g/cm^3 and is produced in thicknesses of 3.2–51 mm in panel sizes of 0.91 × 1.2 m, 1.2 × 1.8 m, and 1.2 × 3.7 m. The 3.2-mm-thick board is specially manufactured for use as lofting board. As diestock, it finds use for stretch- and press-forming and spinning of metal parts, particularly when few of the manufactured items are required and where the cost of making the die is important in the choice of material. The electrical properties of the special densified hardboard meet many of the requirements set forth by the National Electrical Manufacturers Association (NEMA) for insulation resistance and dielectric capacity in electrical components; therefore, it is used extensively in electronic and communication equipment.

Laminated Paperboards. Laminated paperboards are made in two general qualities: interior and weather resistant. The main differences between the two qualities are in the kind of bond used to laminate the layers and in the amount of sizing used in the pulp stock from which the individual layers are made. For interior-quality boards, the laminating adhesives commonly originate from starch. Synthetic-resin adhesives are used for the weather-resistant board. Laminated paperboard regularly

is manufactured in thicknesses of 4.8, 6.1, and 9.5 mm for construction uses although 3.2-mm thickness is common for industrial uses, eg, dust dividers in case goods, furniture, and automotive liners. Important properties are presented in Table 11.

Considerable amounts go into the prefabricated housing and mobile-home construction industry as interior wall and ceiling finish. In the more conventional building construction market, interior-quality boards are also used for wall and ceiling finish, often in remodeling to cover cracked plaster.

The common width of laminated paperboard is 1.2 m although 2.4-m widths are available in 3.7-, 4.3-, 4.9-m and longer lengths for building applications, eg, sheathing entire walls. Laminated paperboard intended for use where the surface is exposed has a surface that is ply-coated with a high quality pulp to improve surface appearance and performance. The surface finish may be smooth or textured.

Particleboard. Important properties for mat-formed particleboards are presented in Table 12. Similar values are not presented for extruded particleboards since they are never used without facings glued to them, and the facings influence the physical and strength properties. Extruded particleboards have a distinct zone of weakness across the length of the panel as extruded. They also have a strong tendency to swell in the lengthwise (extruded) direction because of the compression and orientation of particles from the extrusion pressures. Consequently, extruded particleboards always are used as corestock; mat-formed boards are used both as corestock and as panel stock where the only thing added to the surface is finish.

Table 11. Strength and Mechanical Properties of Laminated Paperboard[a]

Property	Value
density, g/cm^3	0.51–0.53
modulus of elasticity (compression), MPa[b]	
along the length of the panel[c]	2.1–2.7
across the length of the panel[c]	0.69–0.97
modulus of rupture, MPa[b]	
span parallel to length of panel[c]	9.7–13.1
span perpendicular to length of panel[c]	6.2–7.6
tensile strength parallel to surface, MPa[b]	
along the length of the panel[c]	11.7–14.5
across the length of the panel[c]	4.1–5.5
compressive strength parallel to surface, MPa[b]	
along the length of the panel[c]	4.8–6.2
across the length of the panel[c]	3.4–5.5
24-h water absorption, wt %	10–170
linear expansion of 50–90% rh, %[d]	
along the length of the panel[c]	0.2–0.3
across the length of the panel[c]	1.1–1.3
thermal conductivity (at 24°C), mW/(m·K)[e]	73

[a] The data presented are general round-figure values, accumulated from numerous sources; for more exact figures on a specific product, individual manufacturers should be consulted or actual tests made. Values are for general laboratory conditions of temperature and humidity. (See also ref. 2).

[b] To convert MPa to psi, multiply by 145.

[c] Because of directional properties, values are presented for two principal directions, along the usual length of the panel (machine direction) and across it.

[d] Measurements made on material at equilibrium at each condition at room temperature.

[e] To convert mW/(m·K) to (Btu·in.)/(h·ft^2·°F), divide by 144.1.

Table 12. **Strength and Mechanical Properties of Mat-Formed (Platen-Pressed) Wood Particleboard**[a]

Property	Low density particleboard	Medium density particleboard	High density particleboard
density, g/cm³	0.40–0.59[b]	0.59–0.80	0.80–1.12
modulus of elasticity (bending), MPa[c]	1.0–1.7[d]	1.7–4.8	2.4–6.9
modulus of rupture, MPa[c]	5.5–9.7[d]	11.0–55.2	16.6–51.7
tensile strength, parallel to surface, MPa[c]		3.4–27.6	6.9–34.5
perpendicular to surface, MPa[c]	0.14–0.21[d]	0.28–1.4	0.86–3.1
compressive strength parallel to surface, MPa[c]		9.7–20.7	24.1–35.9
shear strength (in the plane of board), MPa[c]		0.60–3.1	1.4–5.5
(across the plane of the board), MPa[c]		1.4–12.4	
24-h water absorption, wt %		10–50	15–40
thickness swelling from 24-h soaking, %		5–50	15–40
linear expansion[e] (50–90% rh), %	0.30[f]	0.2–0.6	0.2–0.85
thermal conductivity (at 24°C), mW/(m·K)[g]	79–108	108–144	144–180

[a] The data presented are general round-figure values, accumulated from numerous sources; for more exact figures on a specific product, individual manufacturers should be consulted or actual tests made. Values are for general laboratory conditions of temperature and humidity. (See also ref. 2.)

[b] Lower limit is for boards as generally manufactured; lower density products with lower properties may be made.

[c] To convert MPa to psi, multiply by 145.

[d] Only limited production of low density particleboard so values presented are specification limits.

[e] Measurements made on material at equilibrium at each condition at room temperature.

[f] Maximum permitted by specification.

[g] To convert mW/(m·K) to (Btu·in.)/(h·ft²·°F), divide by 144.1.

Quality criteria, testing, labeling, rating, and certification methods for mat-formed particleboard are established in *Commercial Standard CS 236-66* (15). For certain uses where special requirements must be satisfied, additional specifications outline the requirements for the particleboard. Particleboard is manufactured in both 1.2- and 1.5-m widths and wider, although for industrial sales, much is cut to size for the purchaser. In construction, as for other panel materials, the common size panel is 1.2 × 2.4 m.

The uses for particleboard are under development, and parallel those for lumber core in veneered or overlaid construction and for plywood. The two properties of particleboard that have the greatest influence on its selection for a use are that the panels have a uniform surface and stay flat as manufactured, particularly in applications where edges are not fastened to a rigid framework. For the majority of uses where exposures are interior or equivalent (furniture, cabinetwork, interior doors, and most floor underlayment), urea–formaldehyde resins are used. Boards with that kind of bond are classed as type 1 in the specifications (15). Where greater resistance to heat, moisture, or a combination of heat and moisture is required, type 2 boards that generally are bonded with phenolic resin are required.

In general, particleboards are manufactured in about the same thicknesses as softwood plywood; most manufacture is in thicknesses between 13 and 25 mm, although there are new developments for particleboard that are thinner than 13 mm or thicker than 25 mm. Much extruded particleboard is fluted in thicknesses that satisfy the need for cores for flush doors. Similarly, low density, mat-formed particleboard is manufactured for solid-core doors in thicknesses so that, when facings are applied, final door thicknesses are the standard 35 and 44 mm.

Recently, there has been a trend toward thinner particleboard products. Thicknesses of 6.1 and 9.5 mm are becoming common, both for special and general use, in the United States. In terms of volume, the main two uses for particleboard are as furniture and cabinet core, and floor underlayment. As corestock, particleboard has moved into a market formerly held by lumber core and, to a limited extent, by plywood. For example, certain grades of hardwood plywood now permit the use of particleboard as the core ply where, formerly, lumber core was specified.

Both three and five plies are employed in built-up constructions where particleboard is used as the core. Extruded particleboard nearly always requires five-ply construction because of the board's instability and low strength in one direction. A relatively thick crossband that has the grain direction parallel to the extruded direction, stiffens, strengthens, and stabilizes the core. Thinner face plies are laid with the grain at right angles to the crossband to provide the final finish.

The use of three- or five-ply construction with mat-formed particleboard corestock depends on the class and type of particleboard core (stiffness and strength), kind of facings being applied (plastic or veneer), and the requirements of the final construction. Balanced construction in lay-ups using particleboard is important; facings or crossbands with different properties can cause objectionable warping, cupping, or twisting in service. Edge-bonding of wood or of the facing material frequently is employed in panelized units that have particleboard as the corestock.

As a floor underlayment, particleboard provides leveling, the thickness of construction required to bring the final floor to elevation, and the indentation-resistant, smooth surface necessary as the base for resilient-finish floors of linoleum, rubber, vinyl, and vinyl–asbestos tile and sheet material. Particleboard for this use is produced in 1.2 × 2.4-m panels that commonly are 6.1-, 9.5-, or 16-mm thick. Separate use specifications cover particleboard floor underlayment.

Particleboard for siding, combined siding–sheathing, and as soffit linings and ceilings for carports, porches, and the like requires the durable adhesive, phenol–formaldehyde. For these uses, type 2, medium density board is required. Agencies, eg, the Federal Housing Administration, have established requirements for particleboard for such use. The satisfactory performance of particleboard in exterior exposure depends not only on the manufacture and kind of adhesive used, but on the protection afforded by the finish. Manufacturers recognize the importance of the combination by providing both paint-primed panels and those that are completely finished with liquid-paint systems or factory-applied plastic films.

Mobile-home manufacture and factory building of conventional housing are important and increasing users of forest products. Since particleboard is manufactured in hot presses as large as 2.4 × 12 m, panels are available in sizes larger than those generally used for conventional construction. With mechanical handling available in factories, large-sized panels can be attached effectively and economically. Two particleboard products have been developed to satisfy these uses. Mobile-home decking is used for combined subfloor and underlayment and has a type 1 bond but is protected from moisture in use by a bottom board, so that it generally provides a satisfactory service life. The United States industry has established separate standards for these products. They are marketed under a certified product-quality program.

Another use that commonly requires the more durable bond of a type 2 quality is a special corestock where laminated plastic sheets are formed on the face and back of a particleboard at the same time as they are bonded to it and, usually, a high density

particleboard is used. The temperatures used in curing the resin-impregnated plastic sheets may reduce the strength of the bonds in boards made with urea–formaldehyde resins.

The properties of particleboard depend on the shape and quality of the particles used as well as on the kinds and amount of resin binder. Although most particleboard is produced using particles that yield a board of intermediate strength and stiffness, a substantial volume is comprised of flakes or other engineered particles for boards of higher strength and stiffness. Sometimes the boards of intermediate stiffness and bending strength are designated class 1 and those of the higher stiffness and bending strengths are designated class 2. Class 2 particleboards are more expensive than those in class 1, but they usually are justified for uses where the greater stiffness and strength are required. The same applies to those applications where a special surface such as a fine surface provides either a better base for finishing or less showthrough for an overlaid construction.

Production. The U.S. Department of Commerce has published production and market information for particleboard and medium density fiberboard for the year 1975 (16). A portion of the information presented in this Census Bureau document is given in Table 13. Reference 16 has complete production information by geographic area, and export–import breakdowns.

United States Panel Price Trends. Prices for every principal panel product group rose, albeit at varying rates depending on industry conditions, in the United States in the 1970s. Softwood plywood producer prices increased most, rising by 280% from 1970 to 1978 (Table 14). This rise reflected, in part, the strong demand for the product in the wake of the construction boom during this period. But the biggest factor was the escalation of the costs of materials and labor. Western softwood-plywood mills, which were dependent on a diminishing supply of high quality sawlogs, were forced to bid in a highly competitive log market with eager foreign and domestic buyers. The result was a substantial leap in log costs.

The price of no. 2 Douglas-fir sawlogs, which were used extensively for plywood sheathing, rose from \$34.70/1000 cm^3 (\$82 per thousand board feet (MBF)) in 1970 to about \$127/1000 cm^3 (\$300 MBF) in 1979. This fourfold jump in price was representative of the cost-push experienced by West Coast plywood producers. The supply of logs in southern United States, by contrast, was somewhat better, resulting in lower but still sizable cost increases for that segment of the industry. The cost and availability of resins also became a problem toward the end of the decade. The higher use of benzene in gasoline, caused by environmental laws, resulted in a rapid upward price spiral in benzene-derived resins. Plywood producers attempted to diminish the impact of this by using alternative glues and glue extenders, but nevertheless, were forced to absorb a large cost increase in this area as well.

Hardwood plywood prices exhibited a more moderate trend, rising by only 60% and can be attributed to the better supply of hardwood logs in the eastern United States where hardwood timber growth has exceeded removals consistently for the past three decades. Delivered oak prices in southern United States, eg, were estimated to have risen by 125%, a figure which contrasts sharply with the 265% increase in western United States log prices that are noted above.

Hardboard and insulating board do not require high-grade logs as input; thus, they were not subject to the same intense cost pressures experienced by softwood-plywood manufacturers. Hardboard prices rose by 60% over the period and insulat-

member configuration, loading condition, and desired appearance. Where horizontal members are not provided with adequate slope to allow for drainage, the possibility of ponding should be investigated (29). When a beam cross section is varied in depth along its length to meet specific requirements, consideration must be given to the combined effects of bending, compression, tension, shear, and radial stresses. The analysis involves an interaction formula in which stresses occur simultaneously to reduce beam capacity below that calculated by simple theory. Formulas also are used to calculate deflections of such beams (29,31). In cases such as purlins, where members are subjected to biaxial bending so the loading is not in the plane of the vertical axis of the member, the allowable stress in the member should be checked using conventional formulas (29).

Treatments. *Pressure Preservative.* Some use conditions require that members undergo pressure-preservative treatment to ensure long life. Design considerations, such as special connection details, flashing, and coatings, can provide some degree of protection; however, when the details of the design and construction are not sufficient to resist decay, fungi, insects, or marine borers, pressure preservative treatment is necessary. The effectiveness of the treatment depends on the chemicals used and their penetration and retention in the wood. Depending on the type of preservative used, the finished laminated timber can be treated, or the individual laminations may be treated prior to laminating. Creosote or oilborne chemicals may be used for treating after laminating. The use of waterborne salt treatments for treating glued laminated members after gluing is not recommended because of the degree of dimensional change and magnitude of checking which may occur in the laminated timber as the wood dries after treatment. The waterborne salts and oilborne chemicals in mineral spirits or volatile solvent carriers are the only preservatives recommended for treating individual laminations prior to gluing. Standards used in choosing and specifying preservative treatments are available (32–33); additional details related to preservative treatments are given in ref. 27.

Flame-Retardant Treatment. Laminated timber may be pressure-impregnated with mineral salts as flame-retardant treatments so as to reduce surface flamespread, smoke density, and fuel contribution from the laminated timber (34). When flame-retardant treatments are used, the reduction of strength of the member and its fastenings (27), the compatibility of treatment and adhesive, the use of special gluing procedures, and the effect on fabricating procedures should be investigated (33).

Coatings and Finishes. Glulam timbers are available with satins, sealers, or other finishes that are applied in the plant to satisfy an appearance requirement. If timbers will be subjected to low humidity conditions, end-grain coatings are recommended to minimize end-grain checking caused by rapid moisture loss through the end grain.

Uses. The American Institute of Timber Construction estimates that 590×10^6 cm^3 (250×10^6 board feet) of sawed, structurally graded dimension lumber was consumed by the glulam producers in 1978. Of this total, about 90% was used in making straight or slightly cambered members for use in roof-support structures. Curved members for arch-type roof supports accounted for the other 10% of the production.

In addition to fabricating glulam members in virtually any size or shape for simple bending members or axially loaded members, glulam fabrication is readily adaptable to other structural configurations. These include trusses, arches, domes, and other

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Toxicology. ***Formaldehyde.*** The present NIOSH TLV–TWA for formaldehyde exposure in the air is 3 ppm. The ACGIH's current TLV–threshold ceiling (TLV–C) is 2 ppm. Whereas the TLV–TWA is the maximum recommended TWA for a normal 8-h work day or 40-h work week, the TLV–C is the concentration that never should be exceeded. The human olfactory sense can detect airborne formaldehyde at 1 ppm, whereas at 3 ppm lachrimatory reactions result and include nasal irritation, coughing, eye tearing, etc. In studies performed for the Chemical Industry Institute of Toxicology (CIIT), internal cancer of the nose occurred at the sixteenth month in 3 out of 120 rats at an exposure level of 15 ppm (68). Since tumors were not observed in the control rats (0 ppm formaldehyde exposure) or at exposure levels of 2 ppm and 6 ppm, CIIT's provisional conclusion is that occurence of the tumors may be related to formaldehyde exposure.

Phenol. Phenol is a highly toxic, protein-degenerating compound. The TLV–TWA is 5 ppm. Phenol is absorbed by the skin and causes severe blistering. Contact with large quantities can cause paralysis of the central nervous system and, ultimately, death. Phenol is reported to cause skin cancer in one strain of mice (69). All other skin tumors reported in the same study were benign papillomas which visually disappeared when skin painting was stopped. Alkyl phenols have been studied less, but their destructive effect on the skin, as compared to phenol, may be somewhat reduced.

Chemical Process Pollution Control. Air and water pollution-control regulations have resulted in a number of process and product changes in the phenolic-resin and resin-application industries, eg, changes in resin chemistry, in manufacture, and in methods for handling reaction by-products, effluents, and emissions. For example, resins with lower, ie, <5%, free phenol or formaldehyde content are produced under conditions of higher formaldehyde concentrations to reduce the former with stripping to reduce the latter. Resin molecular weight distribution and functionality have been altered, eg, in water-soluble resins which are used as glass-insulation binders, to reduce stack emissions and particulates. In some cases, catalysts have been changed or modified to achieve higher conversions. Solvents from solvent-based resins are largely unrecovered and are incinerated at >700°C. Closed-loop operations are employed in certain operations. Also, phenol is extracted from the distillate in phenolic-resin manufacture or phenol production, eg, in the Lurgi phenosolvan process involving the use of isopropyl or butyl ether with countercurrent extraction. Another method for removing organic substances includes gas scrubbing which is applied to exhaust gas containing small amounts of formaldehyde, phenol, or organic solvents. Activated carbon for phenol removal is used frequently and some work also has been done with polymeric absorbents (see Air pollution control methods).

Uses

Wood Composites. Wood composites include plywood, particle board, fiberboard, wafer board, and macroscopic wood composites such as beams, arches, etc (see Laminated wood-based composites). Phenol- and/or resorcinol-based resins are the products of choice where durability in high humidity is required. Where this is not required, other products can be and are employed, including urea–formaldehyde and melamine–formaldehyde resins (see Amino resins), polyurethanes, lignin sulfonates, and poly(vinyl acetate) emulsions.

Plywood manufacture involves adhering three or more layers of wood with a

Phenolic Resins
George L. B.

phenolic resin under heat and pressure. Caustic-catalyzed water-soluble resoles are employed at a solids content of ca 45 wt %. Resin formulation depends on whether a wet or dry manufacturing process is used. As a result of the high caustic content, the products are water-soluble in either case and are characterized by fast gel times, ie, 20–30 min at 100°C. Storage stability is less than one month at 20°C for the higher molecular weight products but up to one year for the lower viscosity materials. The resin generally is combined with fillers and diluents in order to control wetting and to avoid substrate penetration. For phenol-based resoles, board curing time is ca 5 min at 140–150°C for medium thickness boards, and ca 1–1.5 min/mm for boards up to 10-mm thick. By contrast, resorcinol–formaldehyde resins, which are used as two-component systems, may be cured at room temperature.

Particle board is based on wood chips, shavings, and wood flour rather than on wood sheeting. Liquid resoles also are the principal resin used in particle-board manufacture. Curing temperatures and pressures depend on the density of the finished composite but may be somewhat higher than in plywood and press cycles are somewhat reduced. Plywood, particle board, and wafer board display low thermal conductivity, resulting in a broad temperature profile and, therefore, a varying curing rate across the composite. Hot stacking of the product allows continuation of cure after press removal.

Wafer board is the most recent version of wood composites and offers a number of significant advantages over other wood composites. Small-diameter trees of the fast-growing variety are cut into wafers of specific size and thickness. The wafers, which have lower surface areas than particles or chips, can be bonded economically with a solid resin in pulverized form.

Fiber Bonding. A large outlet for low molecular weight, highly functional water-soluble resoles is in the bonding of glass and rock-wool fibers for insulation (see Insulation, thermal). The diluted resin, of which 10–15 wt % are solids, is sprayed on the fibers shortly after they emerge from the spinnerettes. Evaporation of water from the resin cools the fiber as it is collected in a mat chamber. Concurrently, the latent heat advances the resin molecular weight, providing a nonabrasive finish for the glass. Subsequent resin cure is carried out as the mat is compressed and heated in a curing oven to effect the final thickness and density of the composite. Recent advances in resin technology have effected reduced airborne pollution of low molecular weight, high formaldehyde/phenol resins of this type. Phenolic dispersions offer one approach to resin advancement, low volatile concentration, and water dilutability. The sensitivity of glass to alkaline media prevents use of those resins that are used in wood-bonding applications.

A dry process is employed in the manufacture of another type of glass- or organic-fiber composite. The organic or scrap glass fiber is prepared as a preform mat and is dusted with a pulverized phenolic resin in a lapping operation. The lapped composite is compressed and heated in a curing oven until the desired density is achieved. Resins that are preferred in these operations are high ortho resins or combinations of solid one-step/two-step resins. Applications include acoustical insulation, carpet underlay, etc (see Insulation, acoustic).

Laminates. A wide variety of applications exist for phenolic-bonded laminates that are based on paper, cotton, or glass substrates. Laminates are either decorative or industrial. Commercial items in the latter category include electronic circuit boards, gears, rods, bearings, tubes, etc. Decorative laminates are used primarily for furniture,

wall paneling, and home and office furnishings; often a melamine–formaldehyde or vinyl facing is used where light color, colorfastness, or abrasion resistance is important. Decorative laminates are further divided into postforming or nonpostformable types; the latter are characterized by high cross-link densities and low extensibility. The former are sufficiently low in cross-link density to allow preformed laminates to be heated and shaped to various contours. Postforming properties can be imparted by choice of substrate and/or resin composition.

Laminate manufacture involves impregnation of a preformed sheet or mat by dip coating in a phenolic-resin solution. Fiber penetration is an important requirement and is a function of resin viscosity and molecular structure. The saturated sheet is passed through an oven where the solvent evaporates and the resin advances. Depending on the intended use, the emerging sheet is either cut and stored as a preimpregnated product or stacked and hot-pressed directly. Resin content in the finished laminate varies as a function of substrate and use but generally is 30–70 wt % of the cured laminate. Curing temperatures and pressures generally are 150–175°C and 3.4–14 MPa (500–2000 psi), respectively. Core resins in decorative laminates are almost exclusively phenol-based. Phenol/alkyl phenol mixtures are more generally used in industrial laminates to improve moisture resistance and electrical properties under humid use conditions. Plasticizers, including natural products, eg, rosin, tung oil, etc, may be added to laminating formulations to increase elongation and toughness to allow for such postoperations as cold stamping, punching, and cutting. Resins generally are low molecular weight resole types prepared in low boiling ketone, alcohol, or aromatic hydrocarbon solvents, eg, toluene. Barium, calcium, and magnesium hydroxide are the catalysts of choice since, after neutralization with sulfuric acid at the end of the reaction, the insoluble salt residue can be removed by filtration. Where very low levels of metal-ion contamination are required, amine catalysts can be used which either react with the resin or are removed in the solvent-distillation step.

Foundry Resins. The foundry industry provides a large outlet for phenolic resins, even though the amount of binding agent employed for sand consolidation usually is only 2–3 wt % or less. Casting of molten metals into synthetic, resin-bonded sand molds is used to produce numerous finished parts, eg, machine housings, automotive transmissions, cylinder heads, and various types of large metal parts and intricate metal objects. Although phenolic resins are one of the most often used binders, furfuraldehyde, urea–formaldehyde, and urethane–phenol blends also are employed. Depending on the type of foundry-resin process, phenolic one-step resins or novolak/hexa compositions may be employed. Gaseous by-products are released as a result of the porous nature of the composite; however, resin composition and the quantity of gaseous by-products need to be controlled to prevent build-up of excess pressure.

Abrasives. Phenolic-based abrasives are of two types: bonded abrasives, including grinding wheels, snagging wheels, etc, and coated abrasives, including sandpaper, disks, belts, etc (see Abrasives). Bonded abrasives that are based on phenolic resins display greater strength and thermal-shock resistance than those based on ceramic or vitrified compositions. Metal grinding is a principal application for phenolic-bonded abrasives for which surface temperatures are $\geq 1000°C$. Synthetic alumina (Al_2O_3) and silicon carbide are the main abrasive materials and are used in the largest quantity. Boron carbide and diamond-containing grinding wheels also are manufactured for specialty applications. Manufacture includes first contacting the abrasive grit with a liquid resole; careful control of humidity is required to avoid agglomeration. The coated grit

is combined with additives, filler, and a pulverized high molecular weight novolak and hexamethylenetetramine (hexa). The amount of resin and hexa is ca 6–10 wt % and 6–14 wt % of resin, respectively. The homogeneous mixture is transferred to molds and is pressed to preforms at 14–34 MPa (2000–5000 psi), at either room temperature or elevated temperatures. The preforms are cured under a carefully programmed heating cycle to avoid inhomogeniety or deformation. Curing cycles of 24–30 h are common for cold-pressed wheels and are shorter for the higher density, hot-pressed composites.

Coated abrasives are phenolic bonded if they are intended for use in high temperatures or where water-cooling is required. Either the cloth or paper backing is coated with a medium viscosity resole to which the abrasive material is electrostatically deposited. The make coat is partially dried at low temperatures, ca 100°C, and then a top coat of lower viscosity resole is applied. Further drying and postcure in rolled form at 120–130°C for 3–4 h effects the final cure. Abrasive materials include ground glass, flint, emery, etc; aluminum oxide or silicon carbide are the most common.

Friction Materials. Brake linings, clutch facings, and transmission bands are bonded largely with phenolic resins. Automotive applications are the largest outlet for friction elements, though many other vehicles and machines depend on such composites, including aircraft, trains, drilling rigs, etc. Two important recent developments have occurred in automotive-brake elements: conversion from drum brakes to disk brakes and the development of nonasbestos composites. Both developments require that the binder resins exhibit higher temperature performance without deleteriously affecting the coefficient of friction, coefficient stability over a broad temperature range, wear of the composite, and improved adhesion to the semimetallic additive which replaces asbestos.

Manufacturing processes include impregnation, extrusion, dough molding, or dry compounding, depending on the type of friction element being produced. The phenolic resin, either a novolak/hexa blend or a liquid or solid resole, generally is employed at 10–20 wt % of the composite mix. Other ingredients include fillers at 20–30 wt %; friction granules, ie, a cross-linked particle based on alkenyl phenol extracted from cashew-nut shells; asbestos or semimetallic fibers at 40–60 wt %; etc. The combination of the different additives, phenolic resin type, concentration and cross-link density, and the process employed determines the friction properties, wear characteristics, noise development level, and thermal resistance of the finished composite (see Brake linings and clutch facings).

Molding Materials. Phenolic molding materials are highly consolidated composites containing particulate and/or fibrous fillers, various additives, and a high concentration of resin binder. Resin functionality and curing conditions are such that a high cross-link density is developed in the finished part. Important properties of the cured product include temperature resistance, modulus retention at elevated temperatures, good electrical properties, solvent resistance, and a high gloss surface. Applications for the cured products include electrical sockets, switch gear, circuit breakers, and many other devices where good electrical properties, eg, dielectric constant of ca 5.0, dissipation factor of ca 0.01, etc, are required. Applications based on thermal resistance and modulus retention include automotive distributor caps, relays, brake pistons, etc, and coffee makers, utensil handles, and general appliance parts that are exposed to elevated temperatures. Molding-material properties depend not only on the type of resin but also on the fillers used and their concentrations.

The phenolic resins that are used in molding materials are predominantly novolaks and hexamethylenetetramine is the curing agent. Resin/curing-agent content is 30–50 wt %. Oxalic acid-catalyzed novolaks are used in greatest amount, although high ortho novolaks and sulfuric or hydrochloric acid-catalyzed resins also are employed. One-step resins or one-step/two-step resin combinations are used in specialty molding applications for electrical applications or in certain cases where ammonia by-product would be deleterious to the substrate, eg, copper or glass fiber. New phenolic molding materials are being developed, eg, in 1979, four manufacturers introduced new and improved impact-resistant products (70). Use temperatures are also being improved. For example, a recently commercialized product (70) displays increasing flexural strength during long-term heat exposure with a 30% increase after 100 h at 225°C. This particular product contains nine different unspecified additives that contribute to the superior performance.

Molding materials in either powder or pellet form are fabricated into final parts by compression, transfer, or injection-molding processes. Because molded materials are thermosetting compositions, a processing problem results from cross-linking in mold flashing or runners or sprues. However, two solutions are scrap regrind with readdition to the reaction mixture and warm-runner or cold-manifold molding, where the resin is designed to have an extended barrel life. The latter technique has received considerable impetus since the early 1970s with the design of molding equipment that insulates the curing mold section from the feeder streams. Significant reduction in scrap loss is achieved as a result of the combination of the new molding-equipment design with the use of resins that are characterized by delayed curing at lower temperatures (71).

Coatings and Adhesives. Most coating and adhesive applications involving phenolic resins are based on combinations with other thermoplastic or thermosetting polymers. In the area of coatings, automotive primers, can coatings, drum linings, anticorrosion paints, printing inks, wire enamels, and varnishes are some of the chief outlets (see Adhesives; Coatings; Paint). Formulation with epoxies, alkyds, drying oils, poly(vinyl formvar), poly(vinyl butyral), acrylics, etc, provides different and useful properties in the cured systems. Most systems are applied with organic solvents, although there is a significant effort to reformulate to water-based systems. Solvent evaporation and resin advancement/cross-linking is carried out at 150–500°C. In essentially all cases, the phenolic is coreactive with the second resin. Phenolic-resin compositions vary depending on the polymer with which the resin is to be combined. For example, low molecular weight novolaks of narrow molecular weight distribution have been developed for combination with epoxy resin. Alkyl phenol resins, including *tertiary*-butyl-, amyl-, nonyl-, or styrenated phenol, are used with alkyds, linseed oil, tung oil, etc, ie, where compatibility in the uncured state would be poor with unadulterated phenol-based systems. Where better color stability and very low extractable levels are required, bisphenol-A-based resins are preferred; *p*-phenylphenol novolaks or resoles also offer advantages in such applications (71) (see Alkyd resins).

Some of the more recent developments in coating resins include polyetheramide–imide/*t*-butylphenolic-resin blends which are used as powder coatings for high temperature wire insulation (72), polypropylene glycol–maleic anhydride/phenolic copolymers for impregnating and coating cellulosic fibers to obtain rapid-wetting battery separators (73), and maleinized oil-modified phenolic resins which are water-dilutable and cure at lower temperatures than correspondingly modified nov-

olaks (74). Essentially all modified phenolic resins that are used in coatings display one or more of the following properties: good solvent resistance, abrasion resistance, thermal stability, sufficiently low extractables to meet FDA requirements, anticorrosion properties, insulating properties, etc.

Adhesives and tackifier applications also result from the synergistic properties of various phenolic/polymer combinations. Nitrile/phenolic or chloroprene/phenolic mixtures are used where high peel strength, thermal stability, and moisture resistance are required. Chloroprene/phenolic mixtures also display excellent contact adhesive properties. Formvar/phenolic blends display both thermal stability and toughness; butadiene/phenolic compositions are used to obtain initial tackifying properties in the manufacture of rollers, hoses, and tires without detracting from the properties of the cured elastomer. Phenolic resins also have been combined with ethylene–propylene–diene rubber, urethane elastomers, and neoprene- and terpene-based resins for pressure-sensitive adhesive applications.

New Developments. The flame resistance of phenolic resins and the low smoke density and relatively nontoxic by-products of phenolic-resin combustion mainly is responsible for the development of glass-reinforced, long-fiber phenolics, phenolic fibers, and phenolic foam (see also Flame retardants).

Glass-Reinforced Phenolics. Thermosetting-resin/glass-fiber composites of the sheet-molding or bulk-molding variety normally are based on styrene/polyester binders. Unless more expensive flame-resistant polyesters are employed, such systems are flammable and emit dense smoke on combustion. Halogen-, nitrogen-, or phosphorus-modified polyester systems reduce the flammability of glass composites but at the expense of toxic and corrosive by-product emissions; opacity of fumes generated in a fire also are high with these modified systems. Phenolic resins, that are comparable in viscosity and cure time to polyesters and which can be handled in similar processes have been developed (75); storage stability, however, is significantly poorer. Physical properties, eg, flexural strength, flexural modulus, tensile strength, elongation, and impact strength of the phenolic/glass composites, are essentially equivalent to polyester/glass systems. Water absorption is higher in the former but modulus retention at elevated temperatures is significantly better. A comparison of flammable ratings, limiting oxygen-index values, smoke-density ratings, and by-products of decomposition for the two systems shows that the phenolic composites are superior in all categories. The phenolic resins display viscosities and cure rates that permit their application in hand lay-up, spray-gun, resin-transfer casting, filament-winding, and sheet-molding operations. Commercialization of these products has occurred in the automotive and building industries (see Laminated and reinforced plastics).

Phenolic Fibers. Flame retardance and low smoke density of phenolic resins have prompted the development of phenolic fibers. Since phenolic resins are low molecular weight materials in the uncross-linked form, propensity for fiber formation is minimal. The process used to produce phenolic fibers involves chemical reaction of a precursor novolak filament. Such filaments are extremely brittle as formed but greatly increase in strength by postcross-linking (76). The melt-drawn novolak filaments are cross-linked by exposure to formaldehyde/hydrochloric acid for several hours at up to 100°C; fiber fusion is not observed. Optimum mechanical properties develop provided the precursor novolak filaments are less than 25 μm in diameter to insure sufficient diffusion of the formaldehyde and catalyst into the fiber. Elongations of 50% and tenacities of 177 mN/tex (2 gf/den) $\times 10^3 \times$ density are typical of the cross-linked product.

By comparison, the starting novolak filaments are characterized by elongation of less than 0.1% and a tenacity of 26.5 mN/tex (0.3 gf/den) × 10^3 × density (see Novoloid fibers).

Phenolic Foam. The escalation in energy prices and the impending legislation directed at the use of flame-retardant insulation has prompted activity to improve phenolic-foam properties. Improvements include compositions of predominantly closed-cell structure and improved physical properties and continuous processing of foam insulation board (77–78). The compositions of choice are sodium hydroxide-catalyzed liquid resoles, which are neutralized and dehydrated in a controlled fashion to optimize molecular weight, viscosity, and reactivity (79). The resole product is combined with a surface-active agent, eg, a nonionic alkylene oxide–alkyl phenol or polysiloxane–oxyalkylene copolymer, a blowing agent, and an acid catalyst under high shear mixing conditions (see Surfactants and detersive systems). Depending on the preceding variables, foams of different densities and physical properties can be obtained. For example, foams of ca 0.03 g/cm^3 with compressive strengths of 172–207 kPa (25–30 psi), low friability, and with good insulation properties can be obtained (see Foamed plastics).

A specialty application for phenolic foam is in the flower-arrangement/decorative-arts industry. Lower density rapid-wetting open-cell water-saturated foam is employed. Unlike insulation foam, lack of toughness is preferred. A wetting agent is included in the formulation to ensure rapid water pick-up.

Another type of phenolic foam is made from preformed hollow microspheres. Microballoons are manufactured by spray-drying a liquid, one-step resin containing a nitrogen blowing agent into a heated dryer. The heat liberates the blowing agent, causes evaporation of the solvent and by-product water, and advances the hollow particle to the cross-linked state. Microballoons are used for density control in dynamite, bowling balls, etc (see Microencapsulation).

Graphite-Reinforced Composites. Phenolic resins developed for nonflammability, low smoke emission, and long-term elevated temperature stability to 230°C have been studied in carbon-fiber composites (see Fibers, chemical; Carbon, graphite) (80). Potential for such composites lies in advanced aircraft applications. Performance properties of the phenolic composites are evaluated in terms of thermal stability, ease of ignition, propensity to burn, smoke emission, moisture absorption, and mechanical

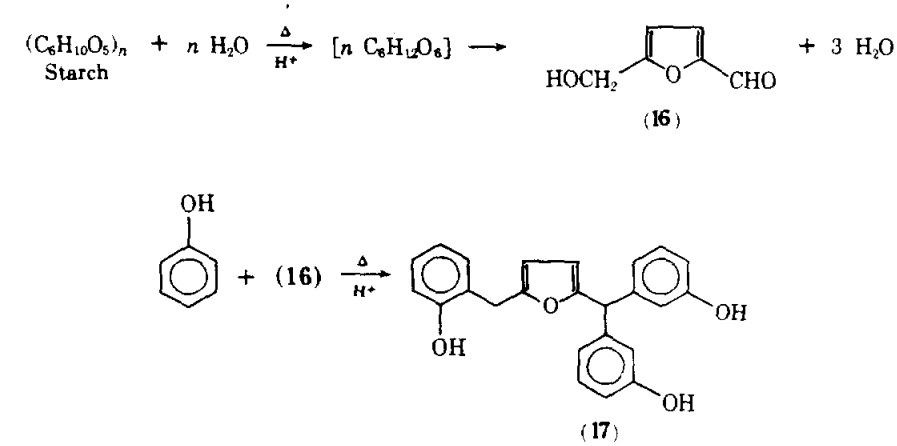

Figure 8. Hydroxymethylfurfural/phenol resins.

Editorial Board
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of New York
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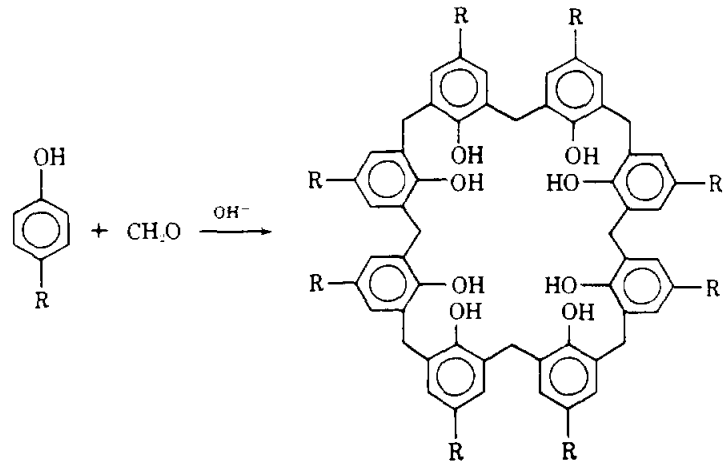
Martin Grayson
David Eckroth, .

properties at ambient and elevated temperatures. The chemical structure of the phenolic resin affects various properties.

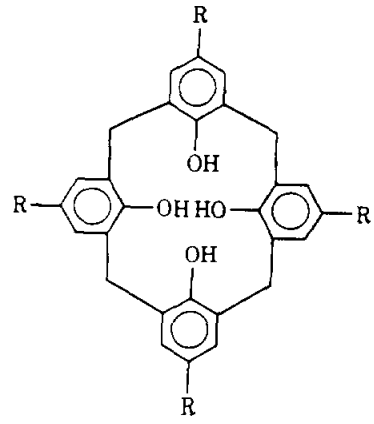
Hydroxymethylfurfural/Phenol Resins. Higher aldehydes, eg, acetaldehyde, butyraldehyde, furfuraldehyde, etc, react with phenol, but only furfuraldehyde is used in sizeable quantity in phenolic-resin applications, eg, furfuryl alcohol foundry resins. Furfural can be condensed with phenol using a basic catalyst but the mechanism of polymerization is not clear; ring opening of the furfuraldehyde has been suggested. The use of starch to generate glucose and, subsequently, hydroxymethylfurfural *in situ* has been described (see Fig. 8) (81). Whereas hydroxymethylfurfural (16) is an unstable compound, its generation in the presence of phenol leads to rapid reaction and the suppression of resinous side products. Novolak resins (17), that display properties that are comparable to conventional novolaks when cured with hexamethylenetetramine can be produced. The process involves the reaction of two mols



(18)

calixarenes

(22)



(19)

R = $C(CH_3)_3$

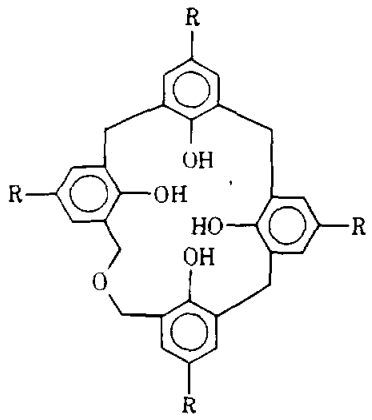
Jacket Design Rick Ho

of phenol with one mol of corn-starch glucose with an acid catalyst at 115°C. An initial high viscosity is observed which dissipates rapidly. Ultimate heating to 160°C over a two-hour period, and neutralization with calcium hydroxide produces a phenol/furfural novolak-type resin (17). The use of starch would be expected to substantially reduce the raw-material costs of the resulting resin (see Furan derivatives).

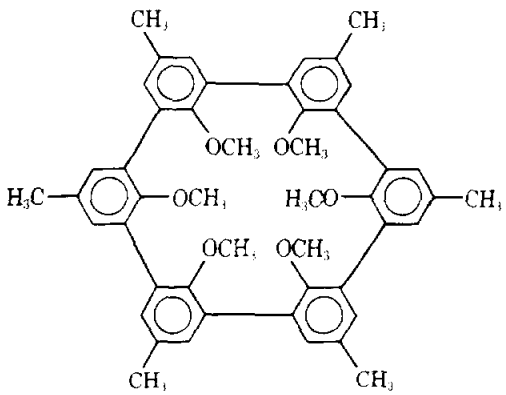
Macrocyclic Compositions

Phenol and derivatized phenol-based cyclic oligomers have been known for some time, although it has been only recently that a rigorous structural elucidation has been made (82–84). For example, the base-catalyzed condensation of *t*-butyl phenol and formaldehyde can produce a significant yield, ca 90%, of cyclic as opposed to linear condensation products. The cyclooctamer (18) and cyclotetramer (19) are formed in greatest yield, with either the cyclopentamer or cyclohexamer present in lesser amounts as a third component (see eq. 22). The relative yields of the three components can be modified to some extent by varying the reaction conditions, although the cyclooctamer (18) is the principal product. The name calixarene has been suggested for this class of compounds in view of the chalicelike molecular configuration (note the hydroxyl group orientation) and the multiplicity of arene groups in the compounds (83). Calixarenes that contain diverse functional groups, eg, nitro, acetoxy, or sulfonyl, of varying substitution levels on the phenol hydroxyl groups have been reported (85).

Other cyclic, phenol-based compounds related to (18) and (19) have been described, including those with methylene ether linkages (20) (84,86). A spherand is a different type of macrocyclic compound, that is based on *p*-cresol, etc (81). Unlike (15), (18), or (19), spherands are more rigid as a result of the absence of methylene or methylene ether bridges between the arene nuclei.



(20)



(21)

spherands

Compounds (20) and (21) are representative of a much larger group of phenol-based cyclic derivatives. Potential utilization of such compounds may include metal complexing and sequestering agents, mining chemicals, and polyfunctional catalysts (see Chelating agents).

REFERENCE #

National Water Summary 1984

Hydrologic Events, Selected Water-Quality Trends, and Ground-Water Resources

United States Geological Survey
Water-Supply Paper 2275

FLORI[illegible]
Ground-[illegible]rces

Florida contains abundant ground-water resources. Large quantities of water are obtainable from each of the principal aquifers in most areas of the State. The State also contains 27 of the 78 first-magnitude springs in the United States (Heath and Conover, 1981, p. 131). Because of its abundance and availability, ground water is the principal source of freshwater for public-supply, rural, and industrial uses, and is the source for about half of the water used for irrigation. More than one-half of the 7,300 million gallons per day (Mgal/d) of freshwater used in Florida for all purposes comes from ground-water sources (Leach, 1983), and about 90 percent of Florida's population depends on ground water for its drinking water (table 1). Nationally, Florida ranks eighth among States in total fresh ground-water withdrawals for all uses, second for public supply, first for rural domestic and livestock, third for industrial uses, and ninth for irrigation withdrawals (Solley and others, 1983). Ground water is one of Florida's most valuable natural resources.

GENERAL SETTING

The entire State is in the Coastal Plain physiographic province, which is a region that has generally low relief and is underlain by unconsolidated to poorly consolidated sediments and indurated carbonate rocks. Florida is mantled nearly everywhere by surficial sands that overlie a thick sequence of bedded limestone and dolomite. Together, the surficial sands and the limestone and dolomite form an enormous ground-water reservoir that provides proportionally larger quantities of ground water in Florida than in any other State (McGuinness, 1963, p. 244). Nearly all of Florida's ground water originates from precipitation. Relatively small amounts also are supplied by subsurface inflow from adjacent areas of Alabama and Georgia and by leakage from streams that enter Florida.

Average annual precipitation (1951-80) exceeds 50 inches (in.) over most of the State. Part of this precipitation percolates to the water table and recharges the ground-water reservoir. Annual recharge rates range from near zero in perennially wet, lowland areas to as much as 20 in. or more in well-drained upland areas. In much of the State, most of this recharge moves through the surficial aquifers and discharges to nearby streams; only a small fraction, ranging from nearly 0 to 5 in. (Bush, 1982), percolates downward to recharge deeper aquifers.

PRINCIPAL AQUIFERS

Principal aquifers of Florida are described below and in table 2, from youngest to oldest; their areal distribution is shown in figure 1.

BISCAYNE AQUIFER

The Biscayne aquifer is the most intensively developed of all the Florida aquifers. It supplies the densely populated Miami-Palm Beach coastal area with virtually all of its water needs. The Biscayne aquifer underlies all of Dade and Broward Counties and adjoining parts of Palm Beach and Monroe Counties. It is primarily highly permeable limestone in south and west Dade County but becomes increasingly sandy and less permeable to the north and east. The high permeability is caused largely by extensive carbonate dissolution. Large-diameter public-supply wells in Dade County produce as much as 7,000 gallons per minute (gal/min), with little water-level drawdown. Water in the Biscayne aquifer is unconfined and in hydraulic continuity with the many canals that cross the area. Induced recharge from the canals occurs where the water table is depressed below canal stage near well fields. Water-level stages in the canals are controlled by structures near their mouths to prevent saltwater from flowing inland to the well fields and, there, infiltrating the aquifer.

Because the Biscayne aquifer is very permeable and very vulnerable to contamination and is the sole source of drinking water for more than 3 million people in southeast Florida, the U.S. Environmental Protection Agency has designated it as a

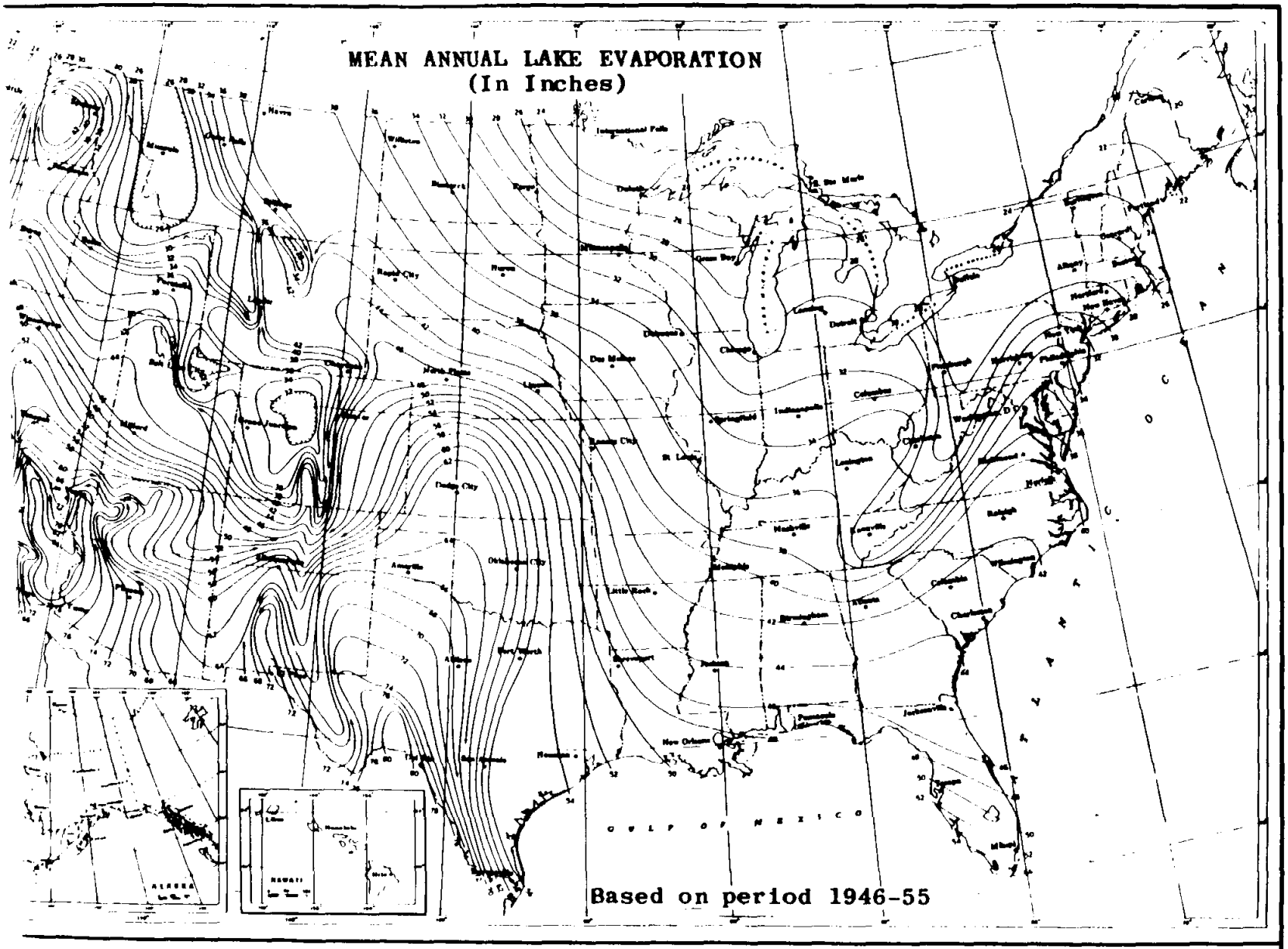
Table 1. Ground-water facts for Florida

[Withdrawal data rounded to two significant figures and may not add to totals because of independent rounding. Mgal/d = million gallons per day; gal/d = gallons per day. Source: Solley, Chase, and Mann, 1983]

Population served by ground water, 1980	
Number (thousands)	8,750
Percentage of total population	90
From public water-supply systems:	
Number (thousands)	6,800
Percentage of total population	70
From rural self-supplied systems:	
Number (thousands)	1,950
Percentage of total population	20
Freshwater withdrawals, 1980	
Surface water and ground water, total (Mgal/d)	7,300
Ground water only (Mgal/d)	3,800
Percentage of total	52
Percentage of total excluding withdrawals for thermoelectric power	69
Category of use	
Public-supply withdrawals:	
Ground water (Mgal/d)	1,200
Percentage of total ground water	31
Percentage of total public supply	86
Per capita (gal/d)	176
Rural-supply withdrawals:	
Domestic:	
Ground water (Mgal/d)	250
Percentage of total ground water	7
Percentage of total rural domestic	100
Per capita (gal/d)	128
Livestock:	
Ground water (Mgal/d)	39
Percentage of total ground water	1
Percentage of total livestock	66
Industrial self-supplied withdrawals:	
Ground water (Mgal/d)	710
Percentage of total ground water	19
Percentage of total industrial self-supplied:	
Including withdrawals for thermoelectric power	27
Excluding withdrawals for thermoelectric power	82
Irrigation withdrawals:	
Ground water (Mgal/d)	1,600
Percentage of total ground water	42
Percentage of total irrigation	53

REFERENCE #

APORATION


MEAN ANNUAL LAKE EVAPORATION
(In Inches)
Based on period 1946-55
GULF OF MEXICO

MEAN MAY-OCTOBER EVAPORATION IN PERCENT OF ANNUAL

ON (inches) BY STATE CLIMATIC DIVISIONS

U.S. DEPARTMENT OF COMMERCE
Luther H. Hodges, Secretary

WEATHER BUREAU
F. W. Reichelderfer, Chief

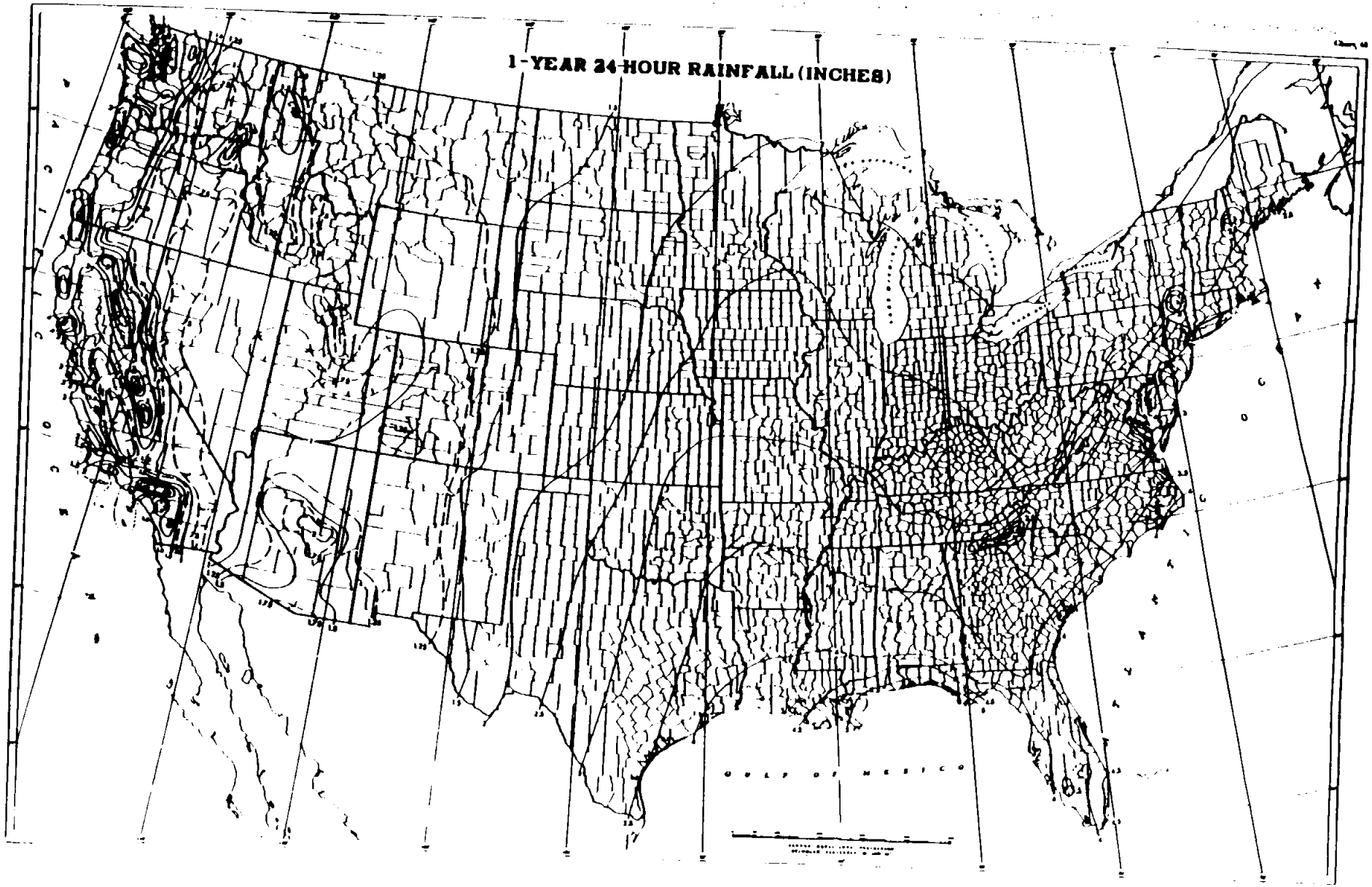
TECHNICAL PAPER NO. 40

RAINFALL FREQUENCY ATLAS OF THE UNITED STATES

for Durations from 30 Minutes to 24 Hours and Return Periods from 1 to 100 Years

Prepared by
DAVID M. HERSHFIELD
Cooperative Studies Section, Hydrologic Services Division
for
Engineering Division, Soil Conservation Service
U.S. Department of Agriculture

PROPERTY OF EPA
FIT IV


1-YEAR 24-HOUR RAINFALL (INCHES)

REFERENCE = 9

STATE OF FLORIDA
STATE BOARD OF CONSERVATION
DIVISION OF GEOLOGY

FLORIDA GEOLOGICAL SURVEY
Robert O. Vernon, Director

REPORT OF INVESTIGATIONS NO. 43

GROUND WATER IN DUVAL AND NASSAU COUNTIES, FLORIDA

By
Gilbert W. Leve, Geologist

Prepared by the
UNITED STATES GEOLOGICAL SURVEY
in cooperation with the
DIVISION OF GEOLOGY
and
DUVAL COUNTY
and the
CITY OF JACKSONVILLE

1966

Cushman, *Lepidocyclina ocalana pseudomarginata* Cushman, *Operculinoides ocalana* Cushman, *Operculinoides floridensis* (Heilprin), *Sphaerogypsina globula* (Ruess), *Nummulites vanderstoki* Rutten and Vermunt, *Heterostegina ocalana* Cushman.

HAWTHORN FORMATION

Rocks of middle Miocene age in peninsular Florida were first named the Hawthorn Formation by Dall and Harris (1892, p. 107). The Hawthorn Formation lies unconformably on the eroded surface of the Ocala Group throughout all of northeast Florida.

As shown in the geologic cross sections in figure 4, the thickness of the Hawthorn Formation ranges from about 250 feet in southern Duval County to about 500 feet in north-central Duval and central Nassau counties. Locally, the formation may vary in thickness by as much as 50 feet where it fills depressions in the irregular surface of the Crystal River Formation.

The Hawthorn Formation consists of gray to blue-green calcareous, phosphatic sandy clays and clayey sands, interbedded with thin, discontinuous lenses of fine to medium phosphatic sand, phosphatic sandy limestone, and gray hard dolomite. The limestone and dolomite lenses are thicker and more prevalent near the base of the formation than in the higher parts. They occasionally contain some poorly preserved mollusk casts and molds. The only other fossils in the formation are sharks' teeth, which are most often found in the clay beds.

UPPER MIOCENE OR PLIOCENE DEPOSITS

Deposits overlying the Hawthorn Formation in peninsular Florida were described by Cooke and Mossom (1929, p. 152) and Cooke (1945) as being Pliocene in age. They have been more recently described by Vernon (1951, figs. 13,33) as late Miocene in age. Because their age has not been determined exactly, they are referred to in this report as Pliocene or upper Miocene deposits.

Pliocene and upper Miocene deposits are the oldest rocks exposed at the surface in northeast Florida. They are exposed in road cuts, excavations, and the banks and beds of many streams in the area. As shown in the geologic cross sections (fig. 4), these deposits are about 100 feet thick adjacent to the St. Johns River in central Duval County and in central and eastern Nassau County, and less than 20 feet thick in western Duval and eastern Baker counties.

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The Pliocene or upper Miocene deposits consist of interbedded gray-green calcareous silty clay and clayey sand; fine-to medium-grained, well-sorted sand; shell; and cream to brown soft, friable limestone. They differ from the underlying Hawthorn Formation in that they contain little or no phosphate. The limestone is most prevalent at the base of the deposits and together with sand and shell form a laterally extensive, continuous, relatively permeable zone which locally is as much as 40 feet thick.

The contact between the Pliocene or upper Miocene deposits and the Hawthorn Formation is an unconformity generally marked by a course phosphatic sand and gravel bed. However, the contact between the Pliocene or upper Miocene deposits and the overlying Pleistocene and Recent deposits is not clearly defined. In some wells, particularly in the eastern and northern parts of the area, the contact appears to be gradational.

PLEISTOCENE AND RECENT DEPOSITS

Undifferentiated sediments of Pleistocene and Recent age blanket most of northeast Florida, except where they have been completely eroded by streams. As shown in the geologic cross sections (fig. 4), the deposits are more than 150 feet thick in eastern Baker County and average about 20 feet in thickness in central and eastern Duval and Nassau counties.

The Pleistocene and Recent deposits in the western part of the area consist primarily of fine- to medium-grained, poorly sorted sand and clayey sand, locally stained yellow or orange by iron oxide. In the central and eastern parts of the area, the deposits are predominantly loose sand and gray to green clayey sand, containing some shell beds near the coast.

STRUCTURE

The structural contour lines in figure 5 reflect the eroded surface of the Avon Park Limestone and Crystal River Formation. At the contour interval shown in the figure, the small irregularities on the surface of the formations are not apparent and the configuration of the lines reflects the approximate subsurface structure of the formations. As shown, the surface of the Avon Park Limestone strikes approximately northwest-southeast and dips northeast at about 9 feet per mile in the western part of the area, and strikes northeast-southwest and irregularly dips northwest about 16 to 20 feet per mile in the eastern part.

The shallow aquifer system, which is 300 to 550 feet thick in the area, extends from the surface into the Hawthorn Formation. The aquifers within the system consist of relatively discontinuous, porous limestone, shell, and sand lenses within the Hawthorn Formation, the upper Miocene or Pliocene deposits, and the Pleistocene to Recent deposits. The aquifers are recharged directly by local rainfall and by downward infiltration of water from shallower aquifers in the system.

The aquifers in the shallow aquifer system most utilized by wells in the area are the surficial sand beds and a relatively continuous limestone, shell, and sand zone at the base of the upper Miocene or Pliocene deposits. As the thickness and lithology of these aquifers vary both vertically and laterally, the amount of water available from them depends on the location and depth of the well. Generally, the surficial sand beds yield about 10 to 25 gpm, and the aquifer at the base of the upper Miocene or Pliocene deposits yields between 15 and 20 gpm to small-diameter wells.

As more information is obtained on these aquifers, it may be possible to determine the proper location and construction of wells to obtain more water. It may also be possible to recharge artificially one or more of the aquifers so that more water is available to wells. These aquifers may become a major source of ground water, particularly if the water in the underlying Floridan aquifer system becomes contaminated by salt water.

The Floridan aquifer system, which is composed primarily of limestones of Eocene age, is the principal source of fresh water in northeast Florida. The top of the Floridan aquifer system, which ranges from 300 to 550 feet below msl, is overlain by an aquiclude of relatively impermeable clay, sandy clay, and dolomite beds in the Hawthorn Formation and in the upper Miocene or Pliocene deposits that separate it from the shallow aquifer system.

Current-meter studies and information obtained while wells were being constructed indicate that there are at least three separate permeable zones within the Floridan aquifer system in northeast Florida. The first zone includes all the formations of the Ocala Group and, locally, limestone at the base of the Hawthorn Formation and at the top of the Avon Park Limestone. In the vicinity of Jacksonville, the second zone is in the top part of the Lake City Limestone, and the third zone is within the Lake City Limestone, below a depth of about 1,200 feet. However, in Fernandina Beach, the Lake City Limestone contains only one permeable zone, and a third zone is present below the Lake City

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MAP

REFERENCE # 10

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GROUNDWATER

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Table 2.2 Range of Values of Hydraulic Conductivity and Permeability

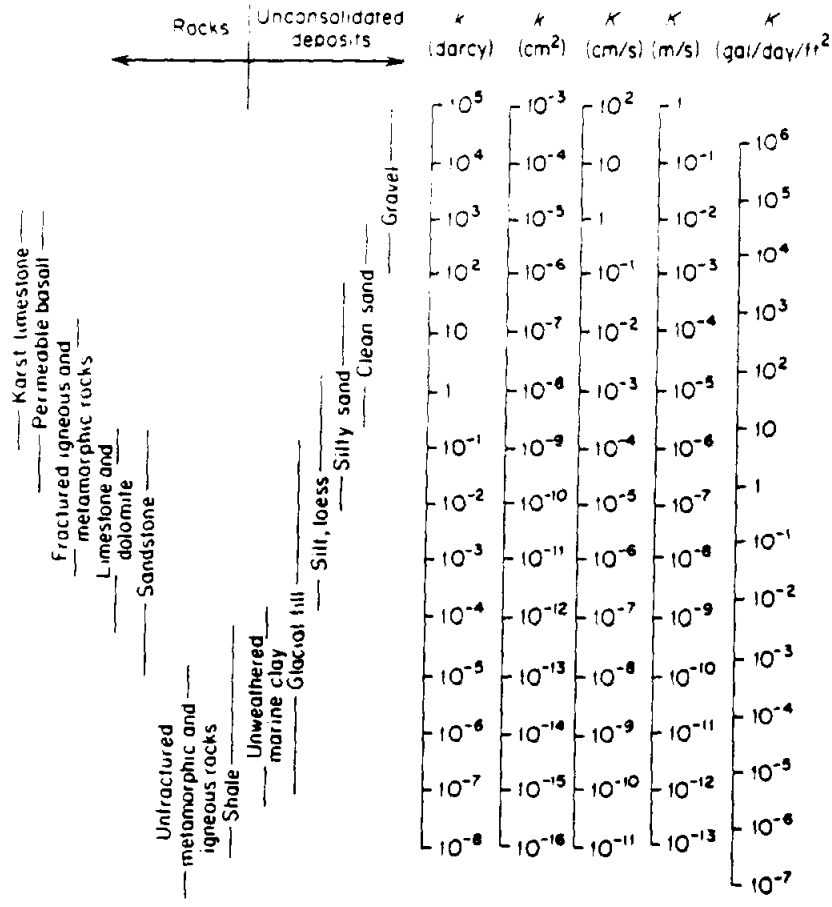

Table 2.3 Conversion Factors for Permeability and Hydraulic Conductivity Units

	Permeability, k*			Hydraulic conductivity, K		
	cm^2	ft^2	darcy	m/s	ft/s	U.S. gal/day/ft^2
cm^2	1	1.08×10^{-3}	1.01×10^{8}	9.80×10^{2}	3.22×10^{3}	1.85×10^{9}
ft^2	9.29×10^{2}	1	9.42×10^{10}	9.11×10^{5}	2.99×10^{6}	1.71×10^{12}
darcy	9.87×10^{-9}	1.06×10^{-11}	1	9.66×10^{-6}	3.17×10^{-5}	1.82×10^{1}
m/s	1.02×10^{-3}	1.10×10^{-6}	1.04×10^{5}	1	3.28	2.12×10^{6}
ft/s	3.11×10^{-4}	3.35×10^{-7}	3.15×10^{4}	3.05×10^{-1}	1	6.46×10^{5}
U.S. gal/day/ft^2	5.42×10^{-10}	5.83×10^{-13}	5.49×10^{-2}	4.72×10^{-7}	1.55×10^{-6}	1

*To obtain k in ft^2, multiply k in cm^2 by 1.08×10^{-3}.

AVAILABILITY AND QUALITY OF WATER FROM SHALLOW AQUIFERS IN DUVAL COUNTY, FLORIDA

By L. V. Causey and G. G. Phelps

U.S. GEOLOGICAL SURVEY

Water-Resources Investigations 78-92

Prepared in cooperation with

U.S. ARMY CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

1978

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AVAILABILITY AND QUALITY OF WATER FROM SHALLOW AQUIFERS IN DUVAL COUNTY, FLORIDA

By

L. V. Causey and G. G. Phelps

ABSTRACT

The shallow-aquifer system in Duval County overlies the Floridan aquifer and is composed chiefly of sand, clay, sandy clay, and limestone. Thickness of the system ranges from about 300 to 600 feet. The upper 150 feet of deposits, consisting of the water-table and shallow-rock zones, are the most dependable and economical source of supplemental water supply. The principal shallow water-bearing zone is a limestone bed 40 to 100 feet below land surface.

Aquifer tests conducted at 13 sites in Duval County show that yields from the shallow aquifer vary from place to place within the county owing chiefly to variations in lithology of the saturated rocks and sediments. The limestone of the shallow-rock zone will yield as much as 200 gallons per minute to wells; the maximum yield at most of the sites tested was between 30 and 100 gallons per minute. The water-table zone generally yields 10 gallons per minute or less but at one site, where a water-table well tapped a shell bed near land surface, the well yielded more than 40 gallons per minute.

The quality of water in the shallow aquifer system in Duval County is generally acceptable for most domestic, commercial, and industrial uses. In some places, however, it has a high iron concentration and is hard. The iron concentration exceeds 0.3 milligrams per liter in water from the water-table or shallow-rock zones at 7 of the 13 aquifer test sites. The hardness of water from the aquifer ranges from about 60 to about 180 milligrams per liter.

INTRODUCTION

Jacksonville, which includes most of Duval County, is the largest city in northern Florida. Rapid growth in parts of the city has created a need for information on sources of water for future supplies. At the present time (1977), practically all of the water used in Jacksonville comes from wells in the Floridan aquifer. Potential sources of additional freshwater in the area are surface streams and shallow aquifers above the Floridan aquifer.

As part of a Metropolitan Jacksonville Water Resources Investigation, the U.S. Army Corps of Engineers, Jacksonville District, is conducting an investigation to determine the feasibility of utilizing various sources of water in the area to supplement present supplies. The U.S. Geological Survey is assisting the U.S. Army Corps of Engineers in obtaining data to determine if using the shallow-aquifer system as a supplemental supply of fresh water in Jacksonville is feasible.

For those readers who prefer metric units rather than U.S. customary units, the conversion factors for terms used in this report are listed below:

Multiply U.S. customary unit	By	To obtain metric unit
inch (in)	25.40	millimeter (mm)
foot (ft)	0.305	meter (m)
mile (mi)	1.609	kilometer (km)
gallon per minute (gal/min)	0.0631	liter per second (L/s)
feet per day (ft/d)	.305	meters per day (m/day)
feet^2/day (ft^2/d)	.0929	meters squared per day (m^2/day)

Purpose and Scope

The purpose of this investigation is to obtain information about the shallow aquifer system, including the location of waterbearing zones, their water-yielding characteristics, the quality of water obtained, the hydraulic interrelation of zones within the shallow aquifers, and the variability of all these. The information will be used by the U.S. Army Corps of Engineers to evaluate the water-supply potential of the shallow aquifer system in Duval County. To obtain information at as many sites as possible, numerous small diameter test holes were drilled and cased. Casing diameters were 1 1/4 to 2 in. This report also outlines field procedures that can be used to evaluate the potential yield of shallow aquifers at sites not studied in this investigation.

Area of Investigation

Duval County occupies about 840 mi^2 in northeastern Florida (fig. 1). Most of the county is within the corporate limits of the Consolidated City of Jacksonville.

The county has a humid, semitropical climate and an average annual rainfall of about 54 in. Rainfall is generally greatest from May to August when summer thunderstorms may yield several inches of rain in one part of the county and only a trace or none in other parts.

The topography in Duval County is mostly flat, but slopes gradually from sea level along the coast to about 190 ft above sea level in the southwest corner. Salt marshes cover much of the eastern part of the county and many freshwater swamps occupy the flat upland areas.

Surface drainage is primarily through the St. Johns and St. Marys Rivers, and their tributaries. The St. Johns River flows northeastward through the county and empties into the Atlantic Ocean. It is affected by tide throughout its length in Duval County.

Previous Investigations

Fairchild (1972) describes the geology, extent, some of the hydrologic characteristics of the shallow aquifer system, and the general geography of Duval County. Derragon (1955), Leve (1961; 1966), and Leve and Goolsby (1969) cite general information on the shallow aquifer system and Cooke (1945), Vernon (1951), Puri and Vernon (1964), and Leve (1966) describe the formations that make up the system.

Well-Numbering System

Two well numbering systems are used in this report. The U.S. Geological Survey identification number is based on latitude-longitude coordinates and a sequential number for the particular area proscribed by the final digit of seconds for those coordinates (table 1). Also used is a local well number prefixed by the letters, DS, indicating a shallow well in Duval County. Any available historic data may be obtained from computer files by using the U.S. Geological Survey identification number. Inquiries regarding availability of such data may be made to the U.S. Geological Survey District Office in Tallahassee, Florida.

Acknowledgments

The authors express appreciation to Oscar Rawls, City Engineer, Department of Public Works, Jacksonville, for granting permission to construct test wells on City road rights-of-way; to J. A. Moss, District Maintenance Engineer, Florida Department of Transportation, Lake City, for granting permission to construct test wells along State road rights-of-way; and to D. F. Duggins, Manager of Plant Services, Duval County School Board, Jacksonville, for permission to construct wells on Duval County Schools property.

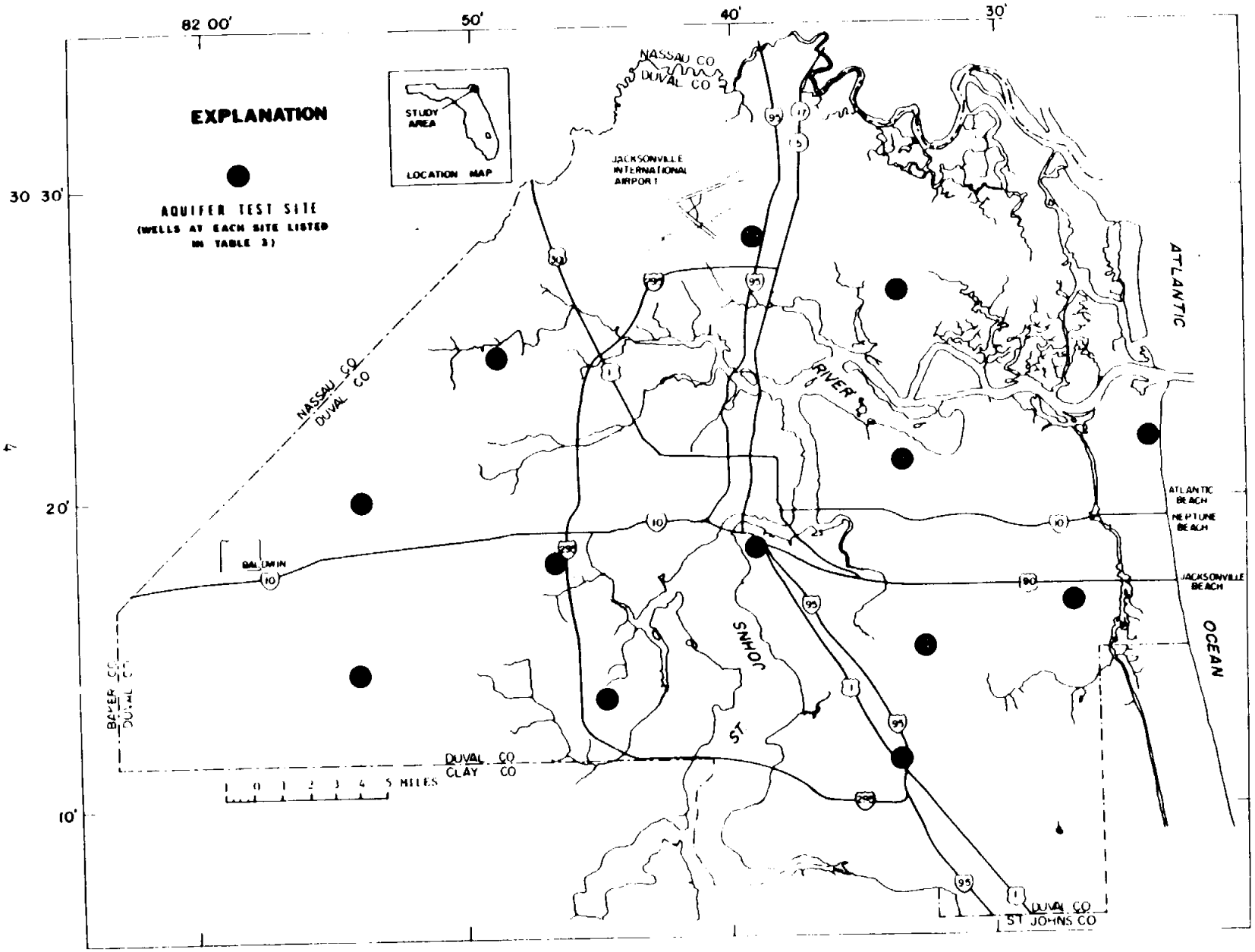


Figure 1.--Area of investigation and location of shallow aquifer test sites.

TABLE 1.--Well numbers

	Well number	Local number	U.S. Geological Survey identification number
Site 1	1	DS-244(b)	301647 0812741 01
	2	DS-245	301647 0812741 02
	3	DS-262	301647 0812741 03
	4	(a)	
Site 2	1	DS-256(b)	302215 0812431 01
	2	DS-257	302215 0812431 02
	3	DS-263	302215 0812431 03
	4	(a)	
Site 3	1	DS-248	302113 0813337 01
	2	DS-249(b)	302113 0813337 02
	3	DS-260	302113 0813337 03
	4	(a)	
Site 4	1	DS-246(b)	301503 0813311 01
	2	DS-247	301503 0813311 02
	3	DS-261	301503 0813311 03
	4	(a)	
Site 5	1	DS-242	301111 0813334 01
	2	DS-243(b)	301111 0813334 02
	3	DS-269	301111 0813334 03
	4	(a)	
Site 6	1	DS-252	301333 0814425 01
	2	DS-253(b)	301333 0814425 02
	3	DS-264	301333 0814425 03
	4	(a)	
Site 7	1	DS-240(b)	301758 0814631 03
	2	DS-241	301758 0814631 03
	3	(a)	
Site 8	1	DS-254	302003 0815412 01
	2	DS-255(b)	302003 0815412 02
	3	(a)	
Site 9	1	DS-238(b)	301422 0815412 03
	2	DS-239	301422 0815412 04
	3	(a)	
Site 10	1	DS-232(b)	302427 0814910 01
	2	DS-233	302427 0814910 02
	3	DS-272	302427 0814910 03
	4	(a)	
Site 11	1	DS-250(b)	301806 0813850 05
	2	DS-251	301806 0813850 06
	3	(a)	
Site 12	1	DS-236(b)	302633 0813330 01
	2	DS-237	302633 0813330 02
	3	DS-265	302633 0813330 03
	4	(a)	
Site 13	1	DS-234	302835 0813903 01
	2	DS-235(b)	302835 0813903 02
	3	(a)	

[a] Indicates temporary water-table well constructed by driving plastic pipe into the ground. These wells were removed at the end of the investigation and so were not cataloged by the U. S. Geological Survey.

[b] Indicates pumped well in aquifer tests.

SHALLOW-AQUIFER SYSTEM

The shallow-aquifer system overlies the Floridan aquifer and consists chiefly of sand, clay, sandy clay, and limestone. It ranges in thickness from about 300 ft in the south-central part of the county to about 600 ft in the northcentral part (figs. 2 and 3). The deposits between about 150 ft below land surface and the top of the Floridan aquifer are mostly clay and sandy clay interbedded with thin, discontinuous layers or local lenses of limestone and sand. Aquifers within that zone are not usually dependable sources of water. Because the shallower zone is generally more productive and less expensive to develop than the deeper zone, this study describes only the upper 150 ft of the shallow-aquifer system.

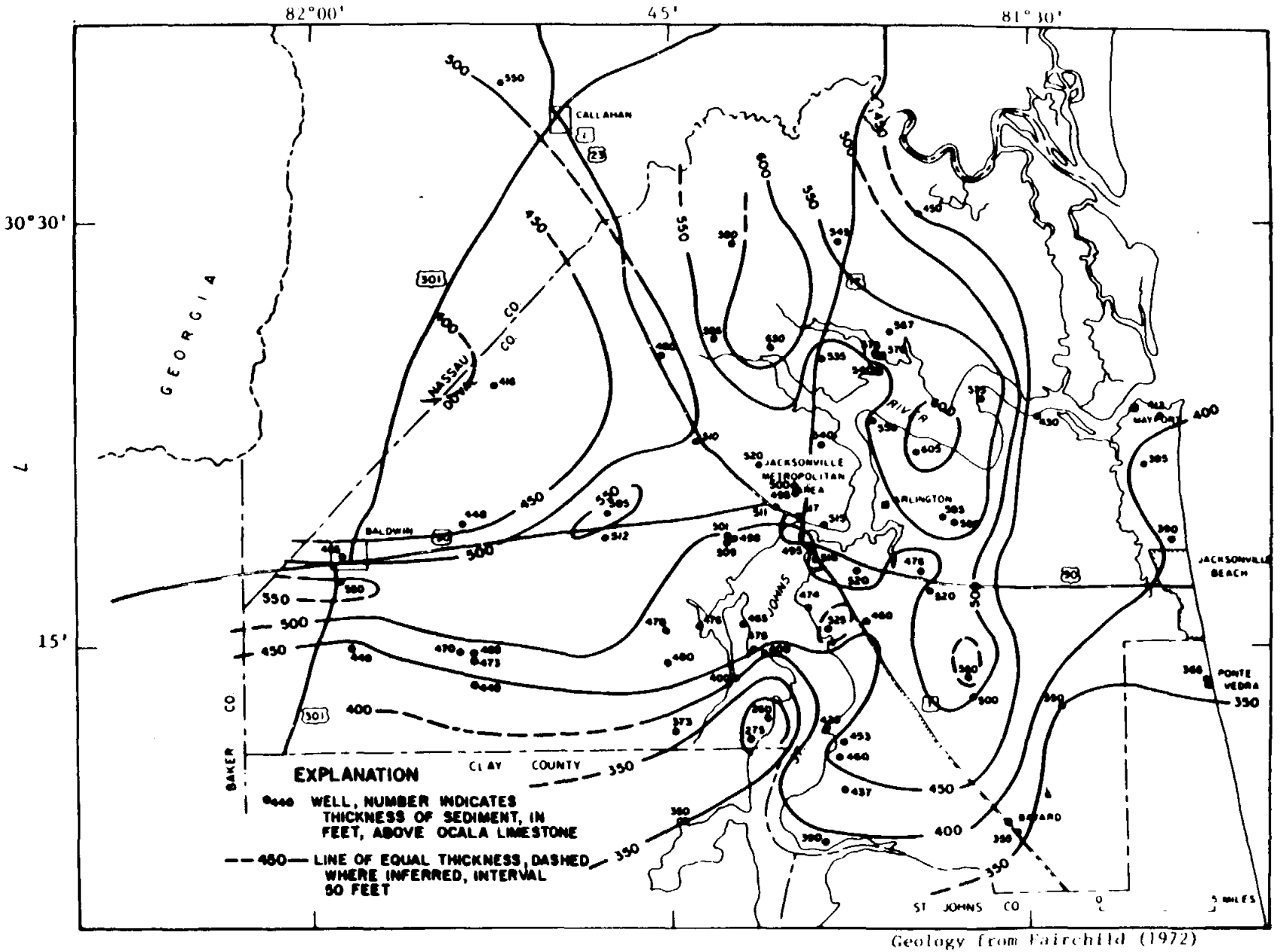
The sediments from land surface to a depth of about 25 to 50 ft comprise the water table zone. Below the surficial sands of the water table zone, beds of lower permeability occur in most parts of the county. These beds are underlain by the principal shallow water-bearing zone, a limestone bed 40 to 100 ft below land surface. This limestone is absent along the coast and locally in the south-central part of the county. In those areas the principal shallow water-bearing zone is a medium- to coarse-grained sand. The principal shallow water-bearing zone is known locally as the shallow-rock aquifer.

The permeability of the beds between the water table zone and the shallow-rock aquifer zone varies widely throughout the county. In some areas the shallow-rock aquifer is confined and is under artesian or leaky-artesian conditions, whereas in other areas the water table and shallow-rock zones function as a single hydrologic unit.

SHALLOW-AQUIFER TESTS

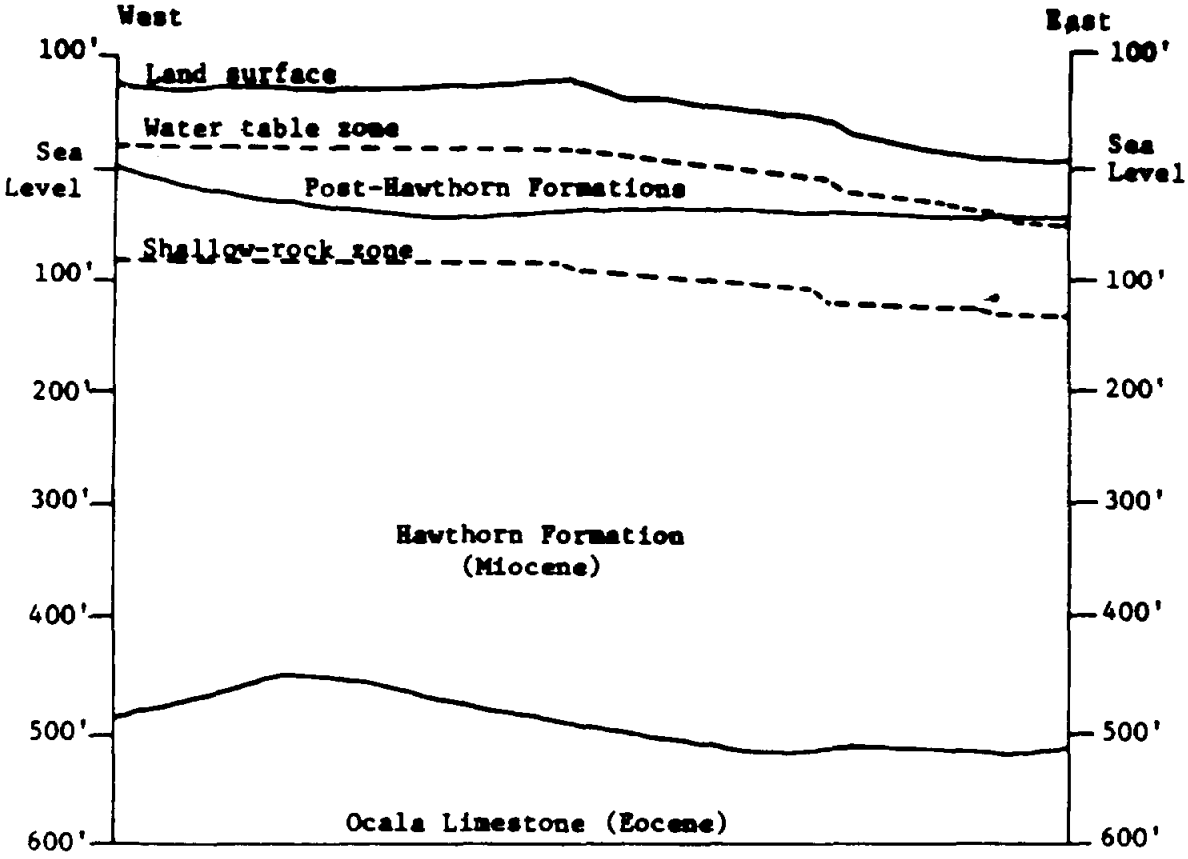
Method

Thirteen test sites were selected in Duval County (fig. 1, table 1) to better define the hydraulic characteristics of the shallow system. Two shallow-rock wells and one or two water-table wells were drilled at each site. Because little was known about the thickness of water-bearing zones, hydraulic characteristics, and yield of the shallow aquifer system, instrumentation and the tests were simplified so maximum areal coverage could be obtained with available funding. Well logs showing well design, water level on the date of drilling, lithology, and principal aquifer at each site are depicted in figure 4. The logs were prepared from driller's logs and examination of well cuttings. The completion depths of the shallow-rock wells range from 46 ft to 104.5 ft except at site 10 where they are 210 and 241 ft. Mud-filled cavities in the limestone at depths of 100 to 120 ft at site 10 made it necessary to drill the wells deeper to obtain clear water. The water table wells are 3.2 to 30 ft deep. Pertinent drilling and well-construction information for each site is listed in table 2.



Geology from Fairchild (1972)

Figure 2.—Thickness of the sediments overlying the Floridan aquifer.



Geohydrology modified from Fairchild, 1972.

Explanation--Dashed lines represent approximate lower limit of the respective shallow-aquifer zones.

Series	Formation	Lithologic Description
Holocene Pleistocene	Holocene and Pleistocene Deposits	Sand, tan to yellow, loose, medium to fine quartz, sometimes with shells and/or minor clay content--often has hardpan layer of iron oxide-cemented, rusty red to dark brown medium to find sand in upper part of section--source of water to shallow sandpoint wells.
Pliocene or Miocene	Pliocene or Upper Miocene Deposits	Upper part-tan to buff, fine to coarse sand and gray to light gray sandy clay, clayey sand, and shell beds; clay often contains abundant mollusk shells. Lower part-limestone, tan to yellow, often highly sandy, porous, and cavernous--also few thin beds of brown crystalline, dolomitic, limestone--section is major source of water to shallow wells.
Miocene	Hawthorn Formation	Gray to blue-green and olive-green clay, sandy clay, and sandy limestone--usually phosphatic with abundant, well-rounded, polished, granules and pebbles of phosphate. Formation not usually considered a good source of water; some wells tap lenses of sand and limestone in the upper part.

Figure 3.--Schematic geohydrologic section showing stratigraphic units of the shallow-aquifer system.

Hydrogeologic Framework of the Floridan Aquifer System in Florida and in Parts of Georgia, Alabama, and South Carolina

REFERENCE

By JAMES A. MILLER

REGIONAL AQUIFER-SYSTEM ANALYSIS

U.S. GEOLOGICAL SURVEY PROFESSIONAL PAPER 1403–B

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UNITED STATES GOVERNMENT PRINTING OFFICE, WASHINGTON: 1986

about 13,000 ft^2/d (Ryder, 1982). Hawthorn limestone beds that are local aquifers yield up to 750 gal/min (Boggess, 1974).

FLORIDAN AQUIFER SYSTEM

GENERAL

The Floridan aquifer system is a thick sequence of carbonate rocks generally referred to in the literature as the "Floridan aquifer" in Florida and the "principal artesian aquifer" in Georgia, Alabama, and South Carolina. As defined in this report, the Floridan aquifer system encompasses more of the geologic section and extends over a wider geographic area than either the Floridan or the principal artesian aquifer, as those aquifers have been described in the literature. Figure 7 shows the geologic formations in Florida and southeastern Georgia that were called "principal artesian formations" by Stringfield (1936), those that were included in the "Floridan aquifer" as defined by Parker and others (1955), and those placed in the "principal artesian aquifer" as defined by Stringfield (1966). Subsequent deep drilling and hydraulic testing have shown that highly permeable carbonate rocks extend to deeper stratigraphic horizons than those included in either the "Floridan" or "principal artesian" aquifers as originally described. Accordingly, this author (cited by Franks, 1982) extended the base of the Floridan aquifer downward to include part of the upper Cedar Keys Limestone (fig. 7). Limestone and dolomite beds that commonly occur at the base of the Hawthorn Formation have been included as part of the "Floridan" or "principal artesian" aquifer in most previous reports. However, data collected for the present study show that, except very locally, there are no high-permeability carbonate rocks in the lower part of the Hawthorn Formation that are in direct hydraulic contact with the main body of the Floridan aquifer system.

The Hawthorn Formation was thus excluded from the aquifer system in a report by Miller (1982a) that was one of a series of several interim reports published during the present study. In these interim reports, the aquifer system was called the "Tertiary limestone aquifer system of the Southeastern United States." This cumbersome, albeit more accurate, terminology has subsequently been abandoned, and the aquifer system is referred to in this professional paper as the "Floridan aquifer system" (see Johnston and Bush, 1985 for a more detailed history of the terminology applied to the aquifer system).

The Floridan aquifer system is defined in this report

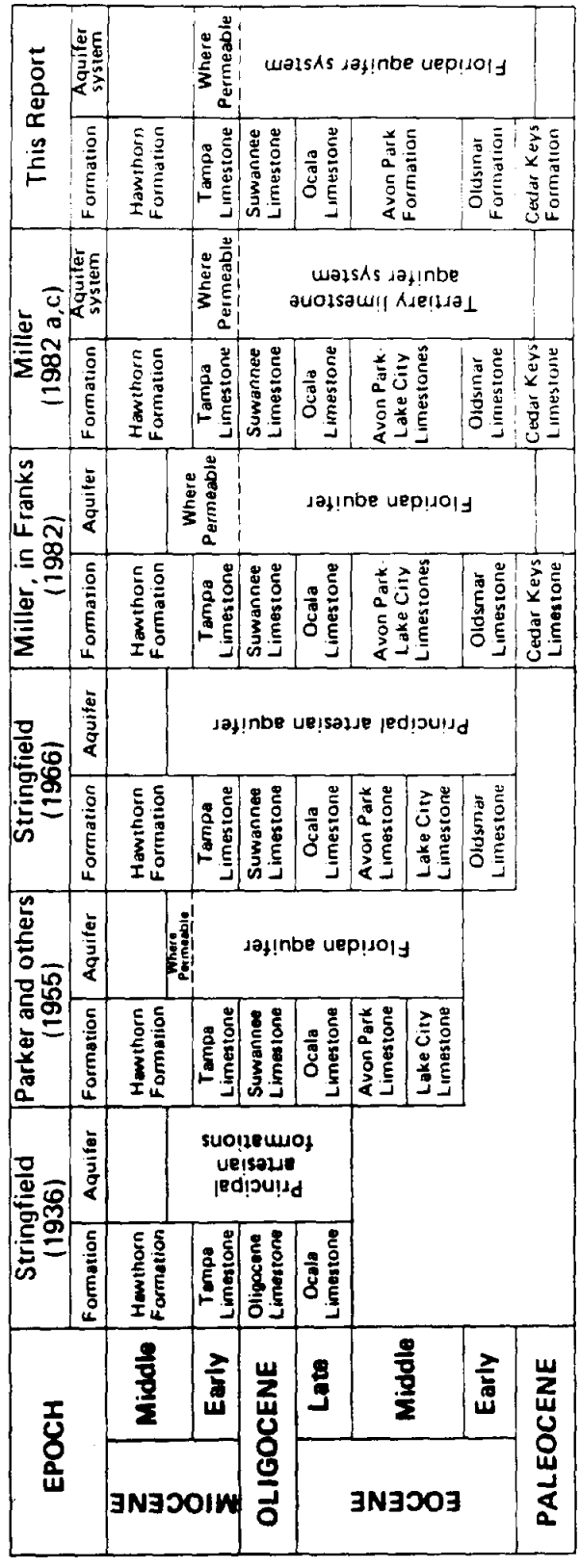


Figure 7. Comparison of aquifer terminologies.

as a vertically continuous sequence of carbonate rocks of generally high permeability that are mostly of middle and late Tertiary age and hydraulically connected in varying degrees and whose permeability is, in general, an order to several orders of magnitude greater than that of those rocks that bound the system above and below. As plate 2 shows, the Floridan aquifer system includes units of late Paleocene to early Miocene age. Very locally, in the Brunswick, Ga., area, the entire Paleocene section plus a thick sequence of rocks of Late Cretaceous age are part of the aquifer system. In and just downdip of the area where the aquifer system crops out, the entire system consists of one vertically continuous permeable unit. Farther downdip, less permeable carbonate units of subregional extent separate the system into two aquifers, herein called the Upper and Lower Floridan aquifers (fig. 8). These less permeable units may be very leaky to virtually nonleaky, depending on the lithologic character of the rock comprising the unit. Because they lie at considerable depth, the hydrologic character and the importance of the subregional low-permeability units are known from only a few scattered deep test wells. Local low-permeability zones may occur within either the Upper or the Lower Floridan aquifer. In places (for example, southeastern Florida), low-permeability rocks account for slightly more than half of the rocks included in the aquifer system.

Even though the rocks that comprise the base of the Upper Floridan aquifer are not everywhere at the same altitude or geologic horizon or of the same rock type, the presence of a middle confining unit over about two-thirds of the study area has led to a conceptual model for the Floridan aquifer system that consists of two active permeable zones (the Upper and Lower Floridan aquifers) separated by a zone of low permeability (a middle confining unit). Because of this simplified layering scheme, it is necessary to greatly generalize the highly complex sequence of high- and low-permeability rocks that comprise the aquifer system. Local confining beds (see, for example, cross section E-E', pl. 21) are either disregarded because they are regionally unimportant or lumped with one of the major layers. The purpose of the conceptual model, and of the digital computer model derived from it and described by Bush and Johnston (1985) is to portray the major aspects of ground-water flow within the Floridan aquifer system. In like manner, the descrip-

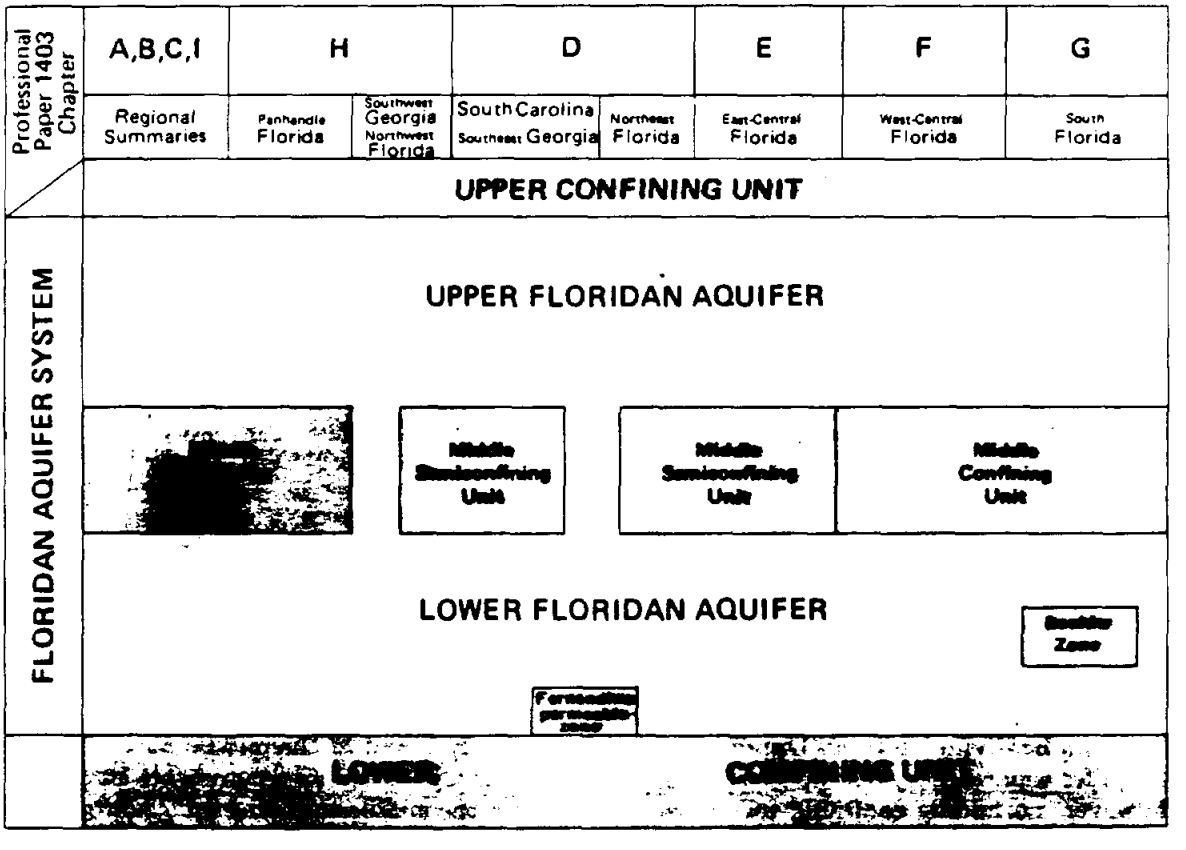


Figure 8. Aquifers and confining units of the Floridan aquifer system.

tion of the aquifer system's geohydrologic framework in this report is intended to show the principal variations in permeability within the aquifer system. In both cases, local anomalies that do not fit with overall (regional) conditions are ignored.

Regionally, the top of the Floridan aquifer system in most places lies at the top of rocks of Oligocene age (Suwannee Limestone) where these strata are preserved. Where Oligocene rocks are absent, the aquifer system's top is generally at the top of upper Eocene rocks (Ocala Limestone). Locally, in eastern panhandle Florida and in west-central peninsular Florida, rocks of early Miocene age (Tampa Limestone) are highly permeable and hydraulically connected to the aquifer system. In places, upper Eocene through lower Miocene rocks are either missing owing to erosion or nondeposition or of low permeability; at these places, rocks of middle Eocene age (Avon Park Formation) mark the top of the aquifer system. It is important to note that there are some places where the upper part of a given formation that comprises the top of the aquifer system consists of low-permeability rocks. At such places, the low-permeability beds are excluded from the aquifer system, and the top of the system is considered to be the top of the uppermost high-permeability carbonate rock. The top of the system, then, may lie within a stratigraphic unit rather than at its top. Because the permeability contrast between the aquifer system and its upper confining unit does not everywhere follow stratigraphic horizons, neither does the top of the aquifer system. Likewise, the top of the aquifer system may locally lie within a limestone unit if the upper part of the limestone consists of low-permeability rock and the lower part is highly permeable.

The time-stratigraphic units or parts of units that mark the top of the Floridan aquifer system at selected localities are shown in figure 9, as well as the time-rock units that comprise the Upper and Lower Floridan aquifers and the units that are considered to represent the aquifer system's base. Figure 9 shows a series of idealized chronostratigraphic columns compiled from well data at several locations in the study area, along with the permeability characteristics of each chronostratigraphic unit at each location. Examination of this figure shows that, in addition to the variations in the top and base of the aquifer system, the degree of complexity varies greatly within the system. Generally speaking (and as figure 9 shows), the aquifer system in most places can be divided into an Upper and Lower Floridan aquifer separated by less-permeable rock. In places, however, no middle confining unit exists (for example, the Baxley, Ga., and Gainesville, Fla., columns on fig. 9), and the aquifer system is highly permeable throughout its vertical extent. In other places, thick sequences of low-permeability rock occur at several levels within the aquifer system (for example, the Savannah, Ga., and West Palm Beach, Fla., areas in fig. 9), and the several discrete permeable zones of the system may be hydraulically separated.

Regionally, and in a fashion similar to the way in which the top is defined, the base of the aquifer system is defined as the level below which there is no high-permeability carbonate rock. The base of the system is generally either (1) glauconitic, calcareous, argillaceous to arenaceous rock that ranges in age from late Eocene to late Paleocene (fig. 9) or (2) massively bedded anhydrite that commonly occurs in the lower two-thirds of the Paleocene Cedar Keys Formation. Locally, near Brunswick, Ga., micritic limestone and argillaceous limestone of Late Cretaceous (Tayloran) age mark the base of the aquifer system. The permeability of the micritic and argillaceous carbonate rocks, the anhydrite beds, and the various clastic rocks that comprise the base of the system is much less than that of the carbonate rocks above. Regardless of its lithologic character, the lower confining unit, whose top is mapped in this report as the base of the aquifer system, everywhere separates the system from deeper, predominantly clastic aquifers of early Tertiary and Late Cretaceous age.

The upper confining unit of the Floridan aquifer system generally consists of rocks of middle and late Miocene age. Where older rocks such as the lower Miocene Tampa or Oligocene Suwannee Limestones are of low permeability, they are also included in the upper confining unit. In parts of the study area, the upper confining unit has been removed by erosion and the aquifer system either: crops out, is covered by only a surficial sand aquifer, or is covered very locally by clayey residuum. Hydraulic conditions within the aquifer system accordingly vary from confined to unconfined. Where thick sequences of less permeable rocks of subregional extent are present within the aquifer system, they divide it into two major aquifers. The uppermost aquifer (Upper Floridan) generally consists of rocks of Oligocene, late Eocene, and late middle Eocene age (fig. 9). The lower aquifer (Lower Floridan) generally consists of rocks of early middle Eocene to late Paleocene age. Where no middle confining unit separates the two aquifers, all the permeable rock comprising the aquifer system is referred to as the Upper Floridan aquifer. The middle confining unit separating the Upper and Lower Floridan aquifers is generally found in the middle part of rocks of middle Eocene age. The less permeable material that comprises the middle confining unit, however, is not everywhere of the same age (fig. 9), nor does it everywhere consist of the same rock type, as a later section of this report discusses in detail.

NUS CORPORATION AND SUBSIDIARIES — **TELECON NOTE**

CONTROL NO:	DATE:	TIME:
F4-8804-42	8/15/88	1035

DISTRIBUTION:

Dames Point PCB Spill

BETWEEN:	OF:	PHONE:
Jim Dumond	JAX Suburban Utilities	(904) 725-2865

AND:

K.D. Pass KDP

DISCUSSION:

Wells located in the Arlington Park area:

1) Cavamaugh Dr. & Bradshaw St.
2) Cesery Blvd. & Lucina Dr. S.
3) Columbine & Gaillardia St.
4) Greenfern & Townsond
5) Woolery & Elvia Dr. & Wedeville Blvd.

Wells located in the Holly Oaks area:

1) Fort Carolina & Holly Oaks River Dr.
2) Monument Rd. & Lee Rd.
3) St. John Bluff Rd. & Joylnn Rd.

All of these wells have an approximate depth of: 1000 ft. bls.

ACTION ITEMS:

NUS CORPORATION AND SUBSIDIARIES — **TELECON NOTE**

CONTROL NO:	DATE:	TIME:
F4-8804-42	8/15/88	1055

DISTRIBUTION:

Dames Point PCB Spill

BETWEEN:	OF:	PHONE:
Cheryl Phillips	JAX Suburban Utilities	(904) 725-2865

AND:

K.D. Pass, NUS Corporation

DISCUSSION:

JAX Surburban Utilities serve approximately 4,823 residents in the Arlington & University Park areas. they serve roughly 2,264 residents in the Holly Oaks area.

Southern Utilities is a part of the JAX Surburban Utility Co.

ACTION ITEMS:

NUS CORPORATION AND SUBSIDIARIES — **TELECON NOTE**

CONTROL NO:	DATE:	TIME:
F4-8804-42	8/16/88	0900

DISTRIBUTION:

Dames Point PCB Spill

BETWEEN:	OF:	PHONE:
John Welsh	Southern States Utilities	(904) 743-1888

AND:

K.D. Pass KDP

DISCUSSION:

Southern States has two areas of water distribution within 4 miles of Dames Point.

Woodmere area has two wells; one is located at the intersection of University Blvd. & Edenfield Rd. and one at 5710 Edenfield Rd. These wells are over 1000 feet deep in the Floridan aquifer and serve 695 mainly residential units.

The Beacon Hills area has wells located on Sweet Cherry Lane. These wells are also 1000 feet bls and they serve roughly 1600 residential units.

ACTION ITEMS:

NUS CORPORATION AND SUBSIDIARIES **TELECON NOTE**

CONTROL NO.	DATE: 3-23-90	TIME: 0940

DISTRIBUTION:

BETWEEN: Hans Longnecker	OF: Complete Services (Well Drillers)	PHONE: (904) 387-5394

AND: Terry Tanner, NUS Corporation

DISCUSSION:

Depth of private wells in Jacksonville area varies with an average depth range of 40' to 200' depending upon the area.

NUS CORPORATION AND SUBSIDIARIES — **TELECON NOTE**

CONTROL NO:	DATE:	TIME:
	June 22, 1988	0955 hrs.

DISTRIBUTION:

Doeboy Dump File

REFERENCE # 17

BETWEEN:	OF:	PHONE:
Susan Banyas	Jacksonville Chamber of Commerce	(904) 353-0300

AND:

K.D. Pass, NUS Corporation

DISCUSSION:

Both the St. John and Trout Rivers have recreational activities, such as boating & fishing. The Trout River also has commericial fishing activity.

ACTION ITEMS:

NUS CORPORATION AND SUBSIDIARIES **TELECON NOTE**

CONTROL NO.	DATE: 1-9-89	TIME: 9:30

DISTRIBUTION:

BETWEEN: Linda Walker	OF: U.S. Fish and Wildlife Service Jacksonville, Florida	PHONE: (904) 791-2580

AND: Daniel L. Howard, NUS Corporation

DISCUSSION:

Endangered species along the St. Johnsriver. Ms. Walker said that the endangered species along the St. Johns River in the Duval County area are the West Indies Manatee, the Sea Turtle, closer to the Atlantic Ocean, the Bald Eagle, and the Wood Stork. She also stated that the St. Johns River contains saltwater near the Atlantic Ocean, but has freshwater around the Jacksonville area and further downstream. The river is also fished and used for recreation.

ACTION ITEMS:

None

Enter the next ring distance
GEMS>
No city found ! press RETURN to try again.

REFERENCE # 19

COVERAGE

STATE	COUNTY	STATE NAME	COUNTY NAME
12	31	Florida	Duval Co
12	39	Florida	Nassau Co

CENTER POINT AT STATE : 12 Florida
COUNTY : 31 Duval Co

Press RETURN key to continue...

REGION OF THE COUNTRY

Zipcode found: 32229 at a distance of 0.0 Km

STATE	CITY NAME	FIPSCODE	LATITUDE	LONGITUDE
FL	JACKSONVILLE	12031	30.4183	81.6250

Press RETURN key to continue ...

CENSUS DATA

Celotex Corporation·
LATITUDE 30:25: 6 **LONGITUDE** 81:37:30 1980 POPULATION

KM	0.00-.400	.400-.810	.810-1.60	1.60-3.20	3.20-4.80	4.80-6.40	SECTOR TOTALS
S 1	0	0	0	3002	2478	1820	7300
S 2	0	0	0	0	0	0	0
S 3	0	0	0	0	32	1413	1445
S 4	0	0	0	0	0	5732	5732
S 5	0	0	0	0	453	5261	5714
S 6	0	0	373	0	3005	8190	11568
S 7	0	0	0	526	3017	8136	11679
S 8	0	0	0	0	0	0	0
RING TOTALS	0	0	373	3528	8985	30552	43438

Press RETURN key to continue ...

==========

INDEX NUMBER	STATION NAME	LATITUDE DEGREE	LONGITUDE DEGREE	PERIOD OF RECORD	STABILITY CLASSES	DISTANCE (km)
13889	JACKSONVILLE FL	30.5000	81.7000			5 11.57
93836	BRUNSWICK/GLYNCO GA	31.2500	81.4667			5 93.62
12824	DAYTONA BEACH FL	29.1833	81.0500			5147.99
13870	ALMA/BACON CO GA	31.5333	82.5167			5150.19
93845	VALDOSTA GA	30.7833	83.2833			6163.03
13824	SAVANNAH/HUNTER GA	32.0167	81.1333			5183.62
02822	SAVANNAH/TRAVIS GA	32.1333	81.2000			5194.74

Press RETURN key to continue ...

U.S. SOIL DATA

STATE : FLORIDA

LATITUDE : 30:25: 6 LONGITUDE : 81:37:30
THE STATION IS INSIDE H.U. 30713005

GROUND WATER ZONE	: 10			
RUNOFF SOIL TYPE	: 4			
EROSION	: 6.2750E-05			CM/MONTH
DEPTH TO GROUND WATER BETWEEN	: 9.0000E+00	AND	1.0000E+02	
FIELD CAPACITY FOR TOP SOIL	: 9.0000E-02			
EFFECTIVE POROSITY BETWEEN	: 2.0000E-02	AND	3.0000E-01	
SEEPAGE TO GROUNDWATER BETWEEN	: 4.6330E+03	AND	1.3900E+04	CM/MONTH
DISTANCE TO DRINKING WELL	: 2.7000E+04			CM

Press RETURN key to continue ...

U.S. CITY

MENU: Geodata Handling Data List procedures

1. Site level retrieval of data (SITERET)
2. Access Census Data (CENSUS)
3. Determine County Coverage (COVERAGE)
4. Geographic Data Management (GEODM)
5. HUCODE/SOIL locator (HUCODE)
6. Convert to Lat/Long (LATLON)
7. Lookup/Examine Star Station Data (STAR)
8. Find US cities (USCITY)
9. Find Soil Survey Status of Counties (SSURVEY)

Enter an option number or a procedure name (in parentheses)
or a command: HELP, HELP option, BACK, CLEAR, EXIT, TUTOR
GEMS>

Enter an option number or a procedure name (in parentheses)
or a command: HELP, HELP option, BACK, CLEAR, EXIT, TUTOR
GEMS>

Enter an option number or a procedure name (in parentheses)
or a command: HELP, HELP option, BACK, CLEAR, EXIT, TUTOR

```
Type YES to confirm the EXIT command; type NO to restart GEMS
GEMS> YES
$
$ LOGOUT
 WRT          logged out at  8-MAY-1990 14:17:59.61
 Itemized resource charges, for this session, follow:

NODE: VAXTM1
ACCT: NTIS                                START TIME:      8-MAY-1990 14:13:11.71
PROJ: NTISNUCN                            FINISH TIME:     8-MAY-1990 14:17:59.61
USER: WRT                                 BILLING PERIOD:900501
UIC:  [000750,000112]                     WEEKDAY:         TUESDAY
BAUD:                                     TERMINAL PORT:  VTA538

DESCRIPTION OF CHARGE                      QUANTITY                EXPENDITURE
-------------------------------------------------------------------------------

  ALL CHARGE LEVELS
    300  baud            (Seconds)          288                        0.7200
    CPU TIME             (Seconds)            7                        0.4628
                                                                     ----------
    TOTAL FOR THIS SESSION                                        $     1.1828
NODE 3157  HOST 1038: DROPPED BY HOST
please log in: X

password:
```

SSI PHASE I
RECONNAISSANCE DOCUMENTATION CHECKLIST

This information is required for all SSI Phase Is. Much of it will be detailed in your letter report, logbook, or topo map. In such cases, provide only brief descriptions and reference citations on the checklist to avoid duplication. Cite the source for all information obtained for all sections. Lists of HRS-specific definitions and sensitive environment identifications are attached.

Site Name: Celotex Corporation

City, County, State: Jacksonville, Duval County, Florida

EPA ID No.: FLD081365892

Person responsible for form: K.D. Pass

Date: June 18, 1990

DESKTOP DATA COLLECTION
(Can be done before or after recon. Include attachments as necessary).

I. **Groundwater Use** (See project geologist for this information)

- Identify aquifer(s) of concern.

  25 wells completed in shallow aquifer
  8985 people obtain potable water in confined Floridan aquifer (Ref. letter).

- Identify any areas of karst terrain within the 4-mile site radius, and confining layers and hydraulic interconnections within 2 miles of the site.

  The Jacksonville area is not characterized by karst terrain (Ref. letter).

II. **Surface Water Use**

- Identify uses along the 15-stream-mile surface water pathway (i.e. drinking water, fishing, irrigation, industrial).

  The St. Johns river is used for fishing and recreational purposes (Ref. letter).

- Identify any designated recreational areas, sensitive environments, and fisheries along the surface water pathway. Specify whether fishing is recreational, subsistence, or commercial. Information for smaller water bodies can be confirmed or obtained from local sources during the recon.

  The St. Johns river is used for recreational fishing and boating. Two endangered species inhabit the river (Ref. letter).

III. **Sensitive Environments**

- Identify any sensitive environments within 4 radial miles of the site (See Table 4-23 of the February 15, 1990 HRS Draft Final Rule, attached). Remember, sensitive environments are not limited to critical habitats.

  Sensitive environments include the St. Johns river, wetlands, and the Fort State Historical site (Ref. letter).

DRIVE-BY RECONNAISSANCE DATA COLLECTION
(This information should be recorded in logbooks with attachments).

I. **Groundwater Use** (This information can generally be obtained from local water departments, or city hall in rural areas).

- *Identify on copies of topos the extent of all municipal systems and areas served by* private wells within 4 miles of the site.

  See topo.

- Locate on copies of topos all municipal well locations in the site area, including any wells of a blended system >4 miles from site. Specify if water from these wells is partially or fully blended prior to or during distribution, and if any surface water intakes contribute to a blended system (whether or not they draw from the target sw pathway).

  See topo.

- Note the depth, pumpage, and population served for all municipal wells within the 4-mile site radius. Complete well survey forms.

  All municipal wells and 75 percent of the private wells located 2 miles north of the site are completed in the Floridan aquifer.

- Document other groundwater uses (e.g. irrigation, industrial).

  Groundwater is commonly used for irrigation in the area.

II. **Surface Water Use**

- Identify on topos the 15-mile surface water pathway.

  See topo.

- Identify and locate on topos any surface water intakes within 15 miles downstream of the site (to be obtained from local water department).

  See topo.

III. **Site and Area Use Data Collection** (May be obtained before or during recon)

- Describe any barriers to travel (e.g. rivers) within 1 mile of the site (consult topo).

  The St. Johns River (see topo).

- Describe population within the immediate site vicinity and within the 4-mile radius (e.g. sparsely populated rural areas, commercial/industrial areas, densely populated urban areas, etc.).

  Population varies from industrial to sparsely residential (see logbook and topo).

- Obtain aerial photos of site and immediate vicinity whenever available (from county offices).

  Not obtained.

- Note if the facility is on sewers or septic tanks (consult water or public works department).

  The facility appears to be on sewer.

- Obtain current property owner information from the county tax assessor's office.

  Celotex Corporation is the owner of the property.

CERCLA ELIGIBILITY QUESTIONNAIRE

Site Name: Celotex Corporation

City: Jacksonville State: Florida

EPA ID Number: FLD081365892

I. CERCLA ELIGIBILITY	Yes	No
Did the facility cease operations prior to November 19, 1980?	___	X

If answer YES, STOP, facility is probably a CERCLA site.

If answer NO, Continue to Part II.

II. RCRA ELIGIBILITY	Yes	No
Did the facility file a RCRA Part A application?	___	X
If YES:		
1. Does the facility currently have interim status?	___	X
2. Did the facility withdraw its Part A application?	___	X
3. Is the facility a known or possible protective filer? (facility filed in error)	___	X
4. Type of facility: Generator_____ Transporter_____ Recycler_____ TSD (Treatment/Storage/Disposal)_____		
Does the facility have a RCRA operating or post closure permit?	___	X
Is the facility a late (after 11/19/80) or non-filer that has been identified by the EPA or the State? (facility did not know it needed to file under RCRA)	___	X

If all answers to questions in Part II are NO, STOP, the facility is a CERCLA eligible site.

If answer to #2 or #3 is YES, STOP, the facility is a CERCLA eligible site.

If answer #2 and #3 are NO and any OTHER answer is YES, site is RCRA, continue to Part III.

III. RCRA SITES ELIGIBLE FOR NPL	Yes	No
Has the facility owner filed for bankruptcy under federal or state laws?	___	___
Has the facility lost RCRA authorization to operate or shown probable unwillingness to carry out corrective action?	___	___
Is the facility a TSD that converted to a generator, transporter or recycler facility after November 19, 1980?	___	___

Site Inspection Report

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 1 - SITE LOCATION AND INSPECTION INFORMATION

I. IDENTIFICATION

01 STATE: FL | 02 SITE NUMBER: D081365892

II. SITE NAME AND LOCATION

01 SITE NAME (Legal, common, or descriptive name of site): Colotex Corporation

02 STREET, ROUTE NO., OR SPECIFIC LOCATION IDENTIFIER: 9225 Dames Point Rd.

03 CITY: Jacksonville | 04 STATE: FL | 05 ZIP CODE: 32229 | 06 COUNTY: Duval | 07 COUNTY CODE | 08 CONG DIST

09 COORDINATES: LATITUDE 30 22 06.0 | LONGITUDE 081 37 30.0

10 TYPE OF OWNERSHIP (Check one): ☒ A. PRIVATE ☐ B. FEDERAL ____ ☐ C. STATE ☐ D. COUNTY ☐ E. MUNICIPAL ☐ F. OTHER ____ ☐ G. UNKNOWN

III. INSPECTION INFORMATION

01 DATE OF INSPECTION: 4 25 90 (MONTH DAY YEAR)

02 SITE STATUS: ☒ ACTIVE ☐ INACTIVE

03 YEARS OF OPERATION: ~1964 (BEGINNING YEAR), Current (ENDING YEAR) ____ UNKNOWN

04 AGENCY PERFORMING INSPECTION (Check all that apply): ☐ A. EPA ☒ B. EPA CONTRACTOR NUS Corp (Name of firm) ☐ C. MUNICIPAL ☐ D. MUNICIPAL CONTRACTOR ____ (Name of firm) ☐ E. STATE ☐ F. STATE CONTRACTOR ____ (Name of firm) ☐ G. OTHER ____ (Specify)

05 CHIEF INSPECTOR	06 TITLE	07 ORGANIZATION	08 TELEPHONE NO
Solomon Pollard, Jr.	Project Manager	NUS/FIT	(404) 938-7710

09 OTHER INSPECTORS	10 TITLE	11 ORGANIZATION	12 TELEPHONE NO
			( )
			( )
			( )
			( )
			( )

13 SITE REPRESENTATIVES INTERVIEWED	14 TITLE	15 ADDRESS	16 TELEPHONE NO
			( )
			( )
			( )
			( )
			( )
			( )

17 ACCESS GAINED BY (Check one): ☐ PERMISSION ☐ WARRANT

18 TIME OF INSPECTION: 1201

19 WEATHER CONDITIONS: Sunny, Clear

IV. INFORMATION AVAILABLE FROM

01 CONTACT	02 OF (Agency/Organization)	03 TELEPHONE NO
John Mckeown	EPA Region 4	(404) 347-3065

04 PERSON RESPONSIBLE FOR SITE INSPECTION FORM	05 AGENCY	06 ORGANIZATION	07 TELEPHONE NO.	08 DATE
Solomon Pollard Jr	NUS Corp	FIT	(404) 938 7710	05/10/90 (MONTH DAY YEAR)

EPA FORM 2070-13 (7-81)

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 2 - WASTE INFORMATION

I. IDENTIFICATION

01 STATE	02 SITE NUMBER
FL	D081365892

II. WASTE STATES, QUANTITIES, AND CHARACTERISTICS

01 PHYSICAL STATES (Check all that apply)

A SOLID
B POWDER, FINES
X C SLUDGE
D OTHER _____ (Specify)
E SLURRY
X F LIQUID
G GAS

02 WASTE QUANTITY AT SITE (Measure of waste quantities must be independent)

TONS _____
CUBIC YARDS 22.2
NO. OF DRUMS _____

03 WASTE CHARACTERISTICS (Check all that apply)

A TOXIC
B CORROSIVE
C RADIOACTIVE
D PERSISTENT
E SOLUBLE
F INFECTIOUS
G FLAMMABLE
H IGNITABLE
I HIGHLY VOLATILE
J EXPLOSIVE
K REACTIVE
L INCOMPATIBLE
M NOT APPLICABLE

III. WASTE TYPE

CATEGORY	SUBSTANCE NAME	01 GROSS AMOUNT	02 UNIT OF MEASURE	03 COMMENTS
SLU	SLUDGE			
OLW	OILY WASTE			
SOL	SOLVENTS			
PSO	PESTICIDES			
OCC	OTHER ORGANIC CHEMICALS	unknown		Urea / formaldehyde
IOC	INORGANIC CHEMICALS			
ACD	ACIDS			
BAS	BASES			
MES	HEAVY METALS			

IV. HAZARDOUS SUBSTANCES (See Appendix for most frequently cited CAS Numbers)

01 CATEGORY	02 SUBSTANCE NAME	03 CAS NUMBER	04 STORAGE/DISPOSAL METHOD	05 CONCENTRATION	06 MEASURE OF CONCENTRATION
OCC	Phenol	U188	INF 95-2 unk	unk	unk
OCC	Urea	unk	unk unk	unk	unk
OCC	formaldehyde	U122	Solution unk	unk	unk

V. FEEDSTOCKS (See Appendix for CAS Numbers)

CATEGORY	01 FEEDSTOCK NAME	02 CAS NUMBER	CATEGORY	01 FEEDSTOCK NAME	02 CAS NUMBER
FDS			FDS		
FDS			FDS		
FDS			FDS		
FDS			FDS		

VI. SOURCES OF INFORMATION (Cite specific references, e.g., state files, sample analysis, reports)

State & EPA files

EPA FORM 2070-13 (7-81)

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 3 - DESCRIPTION OF HAZARDOUS CONDITIONS AND INCIDENTS

I. IDENTIFICATION	
01 STATE	02 SITE NUMBER
FL	D081365892

II. HAZARDOUS CONDITIONS AND INCIDENTS

01 [ ] A. GROUNDWATER CONTAMINATION — 02 [ ] OBSERVED (DATE _____) — [X] POTENTIAL — [ ] ALLEGED
03 POPULATION POTENTIALLY AFFECTED _____ — 04 NARRATIVE DESCRIPTION

None documented (ND): Potential if landfill waste reaches ~~soils~~ and enters soil.

01 [ ] B. SURFACE WATER CONTAMINATION — 02 [ ] OBSERVED (DATE _____) — [X] POTENTIAL — [ ] ALLEGED
03 POPULATION POTENTIALLY AFFECTED _____ — 04 NARRATIVE DESCRIPTION

ND: If wastes enter St. Johns River from SW runoff.

01 [ ] C. CONTAMINATION OF AIR — 02 [ ] OBSERVED (DATE _____) — [ ] POTENTIAL — [ ] ALLEGED
03 POPULATION POTENTIALLY AFFECTED: _____ — 04 NARRATIVE DESCRIPTION

ND

01 [ ] D. FIRE EXPLOSIVE CONDITIONS — 02 [ ] OBSERVED (DATE _____) — [ ] POTENTIAL — [ ] ALLEGED
03 POPULATION POTENTIALLY AFFECTED: _____ — 04 NARRATIVE DESCRIPTION

ND

01 [ ] E. DIRECT CONTACT — 02 [ ] OBSERVED (DATE _____) — [X] POTENTIAL — [ ] ALLEGED
03 POPULATION POTENTIALLY AFFECTED: _____ — 04 NARRATIVE DESCRIPTION

ND: Depending on waste characteristic and worker exposure.

01 [ ] F. CONTAMINATION OF SOIL — 02 [ ] OBSERVED (DATE _____) — [X] POTENTIAL — [ ] ALLEGED
03 AREA POTENTIALLY AFFECTED: _____ (Acres) — 04 NARRATIVE DESCRIPTION

ND: If landfill waste, enter soil.

01 [ ] G. DRINKING WATER CONTAMINATION — 02 [ ] OBSERVED (DATE _____) — [X] POTENTIAL — [ ] ALLEGED
03 POPULATION POTENTIALLY AFFECTED: _____ — 04 NARRATIVE DESCRIPTION

ND: If waste reach soil and enters shallow then ADC.

01 [ ] H. WORKER EXPOSURE/INJURY — 02 [ ] OBSERVED (DATE _____) — [X] POTENTIAL — [ ] ALLEGED
03 WORKERS POTENTIALLY AFFECTED: _____ — 04 NARRATIVE DESCRIPTION

ND: Numerous workers on site.

01 [ ] I. POPULATION EXPOSURE/INJURY — 02 [ ] OBSERVED (DATE _____) — [X] POTENTIAL — [ ] ALLEGED
03 POPULATION POTENTIALLY AFFECTED: _____ — 04 NARRATIVE DESCRIPTION

ND: Residents are 1000-1500 ft away, thus potential ensuing depending on release mechanism.

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 3 - DESCRIPTION OF HAZARDOUS CONDITIONS AND INCIDENTS

I. IDENTIFICATION
01 STATE: FL | 02 SITE NUMBER: D091365892

II. HAZARDOUS CONDITIONS AND INCIDENTS (Continued)

01 ☐ J. DAMAGE TO FLORA — 02 ☐ OBSERVED (DATE: _____) — ☒ POTENTIAL — ☐ ALLEGED
04 NARRATIVE DESCRIPTION
ND: Depending on runoff path.

01 ☐ K. DAMAGE TO FAUNA — 02 ☐ OBSERVED (DATE: _____) — ☐ POTENTIAL — ☐ ALLEGED
04 NARRATIVE DESCRIPTION (Include name(s) of species)
ND

01 ☐ L. CONTAMINATION OF FOOD CHAIN — 02 ☐ OBSERVED (DATE: _____) — ☒ POTENTIAL — ☐ ALLEGED
04 NARRATIVE DESCRIPTION
ND: SW runoff enters St. Johns River and enters food chain. Fish + River game has decreased.

01 ☐ M. UNSTABLE CONTAINMENT OF WASTES (Spills, Runoff, Standing liquids, Leaking drums) — 02 ☐ OBSERVED (DATE: _____) — ☒ POTENTIAL — ☐ ALLEGED
03 POPULATION POTENTIALLY AFFECTED: _____ 04 NARRATIVE DESCRIPTION
ND: Depending on containment of wastes under land pile.

01 ☐ N. DAMAGE TO OFFSITE PROPERTY — 02 ☐ OBSERVED (DATE: _____) — ☒ POTENTIAL — ☐ ALLEGED
04 NARRATIVE DESCRIPTION
ND: Numerous homes are adjacent to the St. Johns River.

01 ☐ O. CONTAMINATION OF SEWERS, STORM DRAINS, WWTPs — 02 ☐ OBSERVED (DATE: _____) — ☐ POTENTIAL — ☐ ALLEGED
04 NARRATIVE DESCRIPTION
ND:

01 ☐ P. ILLEGAL/UNAUTHORIZED DUMPING — 02 ☐ OBSERVED (DATE: _____) — ☐ POTENTIAL — ☐ ALLEGED
04 NARRATIVE DESCRIPTION
ND

05 DESCRIPTION OF ANY OTHER KNOWN, POTENTIAL, OR ALLEGED HAZARDS
Potential for waste leakage from 5,000 gal above ground storage tank.
Large mountain of possibly wood chips/shavings. If wood is treated, the exposure to outside environmental conditions might lead to soil + water contamination

III. TOTAL POPULATION POTENTIALLY AFFECTED: _____

IV. COMMENTS

V. SOURCES OF INFORMATION (Cite specific references, e.g., state files, sample analysis, reports)
State + EPA files

EPA FORM 2070-13 (7-81)

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION
PART 4 - PERMIT AND DESCRIPTIVE INFORMATION

I. IDENTIFICATION

01 STATE	02 SITE NUMBER
FL	D081365892

II. PERMIT INFORMATION

01 TYPE OF PERMIT ISSUED (Check all that apply)	02 PERMIT NUMBER	03 DATE ISSUED	04 EXPIRATION DATE	05 COMMENTS
A NPDES				
B UIC				
C AIR				
D RCRA				
E RCRA INTERIM STATUS				
F SPCC PLAN				
G STATE (Specify)				
H LOCAL (Specify)				
I OTHER (Specify)				
J NONE				

III. SITE DESCRIPTION

01 STORAGE/DISPOSAL (Check all that apply)	02 AMOUNT	03 UNIT OF MEASURE
A SURFACE IMPOUNDMENT		
B PILES		
C DRUMS, ABOVE GROUND		
D TANK, ABOVE GROUND		
E TANK, BELOW GROUND		
F LANDFILL		
G LANDFARM	27.4	Cubic Feet
H OPEN DUMP		
I OTHER (Specify)		

04 TREATMENT (Check all that apply)
- A. INCENERATION
- B. UNDERGROUND INJECTION
- C. CHEMICAL/PHYSICAL
- D. BIOLOGICAL
- E. WASTE OIL PROCESSING
- F. SOLVENT RECOVERY
- G. OTHER RECYCLING/RECOVERY
- H. OTHER (Specify)

05 OTHER
- A. BUILDINGS ON SITE: 3-4 buildings

06 AREA OF SITE: 4 acres

07 COMMENTS

IV. CONTAINMENT

01 CONTAINMENT OF WASTES (Check one)

A. ADEQUATE, SECURE | B. MODERATE | C. INADEQUATE, POOR | D. INSECURE, UNSOUND, DANGEROUS

02 DESCRIPTION OF DRUMS, DIKING, LINERS, BARRIERS, ETC.

V. ACCESSIBILITY

01 WASTE EASILY ACCESSIBLE ☐ YES ☒ NO

02 COMMENTS

Property is fenced and has guard on duty.

VI. SOURCES OF INFORMATION (Cite specific references, e.g. state files, sample analysis, reports)

State & EPA files

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 5 - WATER, DEMOGRAPHIC, AND ENVIRONMENTAL DATA

I. IDENTIFICATION

01 STATE	02 SITE NUMBER
FL	D081365 592

II. DRINKING WATER SUPPLY

01 TYPE OF DRINKING SUPPLY (Check as applicable)

	SURFACE	WELL
COMMUNITY	A ☐	B ☒
NON-COMMUNITY	C ☐	D ☒

02 STATUS — unk —

ENDANGERED	AFFECTED	MONITORED
A ☐	B ☐	C ☐
D ☐	E ☐	F ☐

03 DISTANCE TO SITE

A .2 (mi)

B 2 (mi)

III. GROUNDWATER

01 GROUNDWATER USE IN VICINITY (Check one)

☒ A ONLY SOURCE FOR DRINKING

☐ B DRINKING (Other sources available) COMMERCIAL, INDUSTRIAL, IRRIGATION (No other water sources available)

☐ C COMMERCIAL, INDUSTRIAL, IRRIGATION (Limited other sources available)

☐ D NOT USED, UNUSEABLE

02 POPULATION SERVED BY GROUND WATER 8 985

03 DISTANCE TO NEAREST DRINKING WATER WELL .2 (mi)

04 DEPTH TO GROUNDWATER SP ~~450~~ 10 (ft)

05 DIRECTION OF GROUNDWATER FLOW

06 DEPTH TO AQUIFER OF CONCERN 450 (ft)

07 POTENTIAL YIELD OF AQUIFER (gpd)

08 SOLE SOURCE AQUIFER ☐ YES ☒ NO

09 DESCRIPTION OF WELLS (Including useage, depth and location relative to population and buildings)

Shallow Aquifer provides water for uses other than consumption (Brackish)
Deep aquifer is The Floridan which has a clay confining layer and is 450 feet bls

10 RECHARGE AREA

☐ YES ☐ NO

COMMENTS

11 DISCHARGE AREA

☐ YES ☐ NO

COMMENTS

IV. SURFACE WATER

01 SURFACE WATER USE (Check one)

☐ A RESERVOIR, RECREATION DRINKING WATER SOURCE

☐ B IRRIGATION, ECONOMICALLY IMPORTANT RESOURCES

☐ C. COMMERCIAL, INDUSTRIAL

☒ D. NOT CURRENTLY USED

02 AFFECTED/POTENTIALLY AFFECTED BODIES OF WATER

NAME	AFFECTED	DISTANCE TO SITE
St. John River	☐	500 ft. (mi)
	☐	(mi)
	☐	(mi)

V. DEMOGRAPHIC AND PROPERTY INFORMATION

01 TOTAL POPULATION WITHIN

ONE (1) MILE OF SITE	TWO (2) MILES OF SITE	THREE (3) MILES OF SITE
A 373 NO. OF PERSONS	B. 3528 NO. OF PERSONS	C 8985 NO. OF PERSONS

02 DISTANCE TO NEAREST POPULATION .2 (mi)

03 NUMBER OF BUILDINGS WITHIN TWO (2) MILES OF SITE

04 DISTANCE TO NEAREST OFF-SITE BUILDING .2 (mi)

05 POPULATION WITHIN VICINITY OF SITE (Provide narrative description of nature of population within vicinity of site, e.g., rural, village, densely populated urban area)

Rural location; property is boardered by forestry.

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 5 - WATER, DEMOGRAPHIC, AND ENVIRONMENTAL DATA

I. IDENTIFICATION

01 STATE	02 SITE NUMBER
FL	D091365892

VI. ENVIRONMENTAL INFORMATION

01 PERMEABILITY OF UNSATURATED ZONE (Check one)

A 10^{-1} – 10^{-4} cm/sec ☐ B 10^{-4} – 10^{-6} cm/sec ☐ C 10^{-4} – 10^{-3} cm/sec ☐ D GREATER THAN 10^{-3} cm/sec

02 PERMEABILITY OF BEDROCK (Check one)

☐ A IMPERMEABLE (Less than 10^{-6} cm/sec) ☐ B RELATIVELY IMPERMEABLE (10^{-4} – 10^{-6} cm/sec) ☑ C RELATIVELY PERMEABLE (10^{-2} – 10^{-4} cm/sec) ☐ D VERY PERMEABLE (Greater than 10^{-2} cm/sec)

03 DEPTH TO BEDROCK	04 DEPTH OF CONTAMINATED SOIL ZONE	05 SOIL pH
_____ (ft)	_____ (ft)	_____

06 NET PRECIPITATION	07 ONE YEAR 24 HOUR RAINFALL	08 SLOPE: SITE SLOPE	DIRECTION OF SITE SLOPE	TERRAIN AVERAGE SLOPE
51.8 (in)	4 (in)	1 %	SE	<1 %

09 FLOOD POTENTIAL

SITE IS IN _____ YEAR FLOODPLAIN

10 ☐ SITE IS ON BARRIER ISLAND, COASTAL HIGH HAZARD AREA, RIVERINE FLOODWAY

11 DISTANCE TO WETLANDS (5 acre minimum)

ESTUARINE: A _____ (mi)

OTHER: B. 2112 ft. (mi)

12 DISTANCE TO CRITICAL HABITAT (of endangered species)

500 ft (mi)

ENDANGERED SPECIES: _____

13 LAND USE IN VICINITY

DISTANCE TO:

COMMERCIAL INDUSTRIAL	RESIDENTIAL AREAS, NATIONAL/STATE PARKS, FORESTS, OR WILDLIFE RESERVES	AGRICULTURAL LANDS: PRIME AG LAND	AGRICULTURAL LANDS: AG LAND
A _____ (mi)	B 1500 ft (mi)	C. _____ (mi)	D. _____ (mi)

14 DESCRIPTION OF SITE IN RELATION TO SURROUNDING TOPOGRAPHY

Site is bordered by forestry except for St. Johns River to the East.
Residents are ≈ 1000 feet West, southwest, and Northeast.

VII. SOURCES OF INFORMATION (Cite specific references, e.g., state files, sample analysis, reports)

EPA + State files

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 6 - SAMPLE AND FIELD INFORMATION

I. IDENTIFICATION

01 STATE	02 SITE NUMBER
FL	D081365892

II. SAMPLES TAKEN

SAMPLE TYPE	01 NUMBER OF SAMPLES TAKEN	02 SAMPLES SENT TO	03 ESTIMATED DATE RESULTS AVAILABLE
GROUNDWATER			
SURFACE WATER			
WASTE			
AIR			
RUNOFF			
SPILL			
SOIL			
VEGETATION			
OTHER			

III. FIELD MEASUREMENTS TAKEN

01 TYPE	02 COMMENTS

IV. PHOTOGRAPHS AND MAPS

01 TYPE ☒ GROUND ☐ AERIAL

02 IN CUSTODY OF NUS Corp
Name of organization or individual

03 MAPS ☒ YES ☐ NO

04 LOCATION OF MAPS NUS Corp

V. OTHER FIELD DATA COLLECTED (Provide narrative description)

VI. SOURCES OF INFORMATION (Cite specific references, e.g., state files, sample analysis, reports)

State + EPA Files

EPA FORM 2070-13 (7-81)

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 7 - OWNER INFORMATION

I. IDENTIFICATION

01 STATE	02 SITE NUMBER
FL	D081365192

II. CURRENT OWNER(S)

01 NAME	02 D+B NUMBER	03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE	05 CITY	06 STATE	07 ZIP CODE
Celotex Corp.		9225 Dames Point Rd		Jacksonville	FL	32229

PARENT COMPANY (If applicable)

08 NAME	09 D+B NUMBER	10 STREET ADDRESS (P.O. Box, RFD #, etc.)	11 SIC CODE	12 CITY	13 STATE	14 ZIP CODE

III. PREVIOUS OWNER(S) (List most recent first)

01 NAME	02 D+B NUMBER	03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE	05 CITY	06 STATE	07 ZIP CODE

IV. REALTY OWNER(S) (If applicable, list most recent first)

01 NAME	02 D+B NUMBER	03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE	05 CITY	06 STATE	07 ZIP CODE

V. SOURCES OF INFORMATION (Cite specific references, e.g., state files, sample analysis, reports)

Stat + EPA files

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 8 - OPERATOR INFORMATION

I. IDENTIFICATION

01 STATE	02 SITE NUMBER
FL	D081365342

II. CURRENT OPERATOR (Provide if different from owner)

01 NAME	02 D+B NUMBER
03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE
05 CITY	06 STATE / 07 ZIP CODE
08 YEARS OF OPERATION	09 NAME OF OWNER

OPERATOR'S PARENT COMPANY (If applicable)

10 NAME	11 D+B NUMBER
12 STREET ADDRESS (P.O. Box, RFD #, etc.)	13 SIC CODE
14 CITY	15 STATE / 16 ZIP CODE

III. PREVIOUS OPERATOR(S) (List most recent first; provide only if different from owner)

01 NAME	02 D+B NUMBER
03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE
05 CITY	06 STATE / 07 ZIP CODE
08 YEARS OF OPERATION	09 NAME OF OWNER DURING THIS PERIOD

PREVIOUS OPERATORS' PARENT COMPANIES (If applicable)

10 NAME	11 D+B NUMBER
12 STREET ADDRESS (P.O. Box, RFD #, etc.)	13 SIC CODE
14 CITY	15 STATE / 16 ZIP CODE

01 NAME	02 D+B NUMBER
03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE
05 CITY	06 STATE / 07 ZIP CODE
08 YEARS OF OPERATION	09 NAME OF OWNER DURING THIS PERIOD

10 NAME	11 D+B NUMBER
12 STREET ADDRESS (P.O. Box, RFD #, etc.)	13 SIC CODE
14 CITY	15 STATE / 16 ZIP CODE

01 NAME	02 D+B NUMBER
03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE
05 CITY	06 STATE / 07 ZIP CODE
08 YEARS OF OPERATION	09 NAME OF OWNER DURING THIS PERIOD

10 NAME	11 D+B NUMBER
12 STREET ADDRESS (P.O. Box, RFD #, etc.)	13 SIC CODE
14 CITY	15 STATE / 16 ZIP CODE

IV. SOURCES OF INFORMATION (Cite specific references, e.g., state files, sample analysis, reports)

State + EPA files

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 9 - GENERATOR/TRANSPORTER INFORMATION

I. IDENTIFICATION	
01 STATE	02 SITE NUMBER
FL	D081365892

II. ON-SITE GENERATOR

01 NAME	02 D+B NUMBER	
03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE	
05 CITY	06 STATE	07 ZIP CODE

III. OFF-SITE GENERATOR(S)

01 NAME	02 D+B NUMBER	01 NAME	02 D+B NUMBER
03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE	03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE
05 CITY / 06 STATE	07 ZIP CODE	05 CITY / 06 STATE	07 ZIP CODE
01 NAME	02 D+B NUMBER	01 NAME	02 D+B NUMBER
03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE	03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE
05 CITY / 06 STATE	07 ZIP CODE	05 CITY / 06 STATE	07 ZIP CODE

IV. TRANSPORTER(S)

01 NAME	02 D+B NUMBER	01 NAME	02 D+B NUMBER
03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE	03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE
05 CITY / 06 STATE	07 ZIP CODE	05 CITY / 06 STATE	07 ZIP CODE
01 NAME	02 D+B NUMBER	01 NAME	02 D+B NUMBER
03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE	03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE
05 CITY / 06 STATE	07 ZIP CODE	05 CITY / 06 STATE	07 ZIP CODE

V. SOURCES OF INFORMATION (Cite specific references, e.g., state files, sample analysis, reports)

State + EPA files

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 10 - PAST RESPONSE ACTIVITIES

I. IDENTIFICATION	
01 STATE	02 SITE NUMBER
FL	D081365592

II. PAST RESPONSE ACTIVITIES. None Known

01 ☐ A. WATER SUPPLY CLOSED 04 DESCRIPTION	02 DATE	03 AGENCY
01 ☐ B. TEMPORARY WATER SUPPLY PROVIDED 04 DESCRIPTION	02 DATE	03 AGENCY
01 ☐ C. PERMANENT WATER SUPPLY PROVIDED 04 DESCRIPTION	02 DATE	03 AGENCY
01 ☐ D. SPILLED MATERIAL REMOVED 04 DESCRIPTION	02 DATE	03 AGENCY
01 ☐ E. CONTAMINATED SOIL REMOVED 04 DESCRIPTION	02 DATE	03 AGENCY
01 ☐ F. WASTE REPACKAGED 04 DESCRIPTION	02 DATE	03 AGENCY
01 ☐ G. WASTE DISPOSED ELSEWHERE 04 DESCRIPTION	02 DATE	03 AGENCY
01 ☐ H. ON SITE BURIAL 04 DESCRIPTION	02 DATE	03 AGENCY
01 ☐ I. IN SITU CHEMICAL TREATMENT 04 DESCRIPTION	02 DATE	03 AGENCY
01 ☐ J. IN SITU BIOLOGICAL TREATMENT 04 DESCRIPTION	02 DATE	03 AGENCY
01 ☐ K. IN SITU PHYSICAL TREATMENT 04 DESCRIPTION	02 DATE	03 AGENCY
01 ☐ L. ENCAPSULATION 04 DESCRIPTION	02 DATE	03 AGENCY
01 ☐ M. EMERGENCY WASTE TREATMENT 04 DESCRIPTION	02 DATE	03 AGENCY
01 ☐ N. CUTOFF WALLS 04 DESCRIPTION	02 DATE	03 AGENCY
01 ☐ O. EMERGENCY DIKING SURFACE WATER DIVERSION 04 DESCRIPTION	02 DATE	03 AGENCY
01 ☐ P. CUTOFF TRENCHES/SUMP 04 DESCRIPTION	02 DATE	03 AGENCY
01 ☐ Q. SUBSURFACE CUTOFF WALL 04 DESCRIPTION	02 DATE	03 AGENCY

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 10 - PAST RESPONSE ACTIVITIES

I. IDENTIFICATION

01 STATE	02 SITE NUMBER
FL	D003136592

II PAST RESPONSE ACTIVITIES (Continued)

01 ☐ R BARRIER WALLS CONSTRUCTED — 02 DATE _____ — 03 AGENCY _____
04 DESCRIPTION

01 ☐ S CAPPING/COVERING — 02 DATE _____ — 03 AGENCY _____
04 DESCRIPTION

01 ☐ T BULK TANKAGE REPAIRED — 02 DATE _____ — 03 AGENCY _____
04 DESCRIPTION

01 ☐ U GROUT CURTAIN CONSTRUCTED — 02 DATE _____ — 03 AGENCY _____
04 DESCRIPTION

01 ☐ V BOTTOM SEALED — 02 DATE _____ — 03 AGENCY _____
04 DESCRIPTION

01 ☐ W GAS CONTROL — 02 DATE _____ — 03 AGENCY _____
04 DESCRIPTION

01 ☐ X FIRE CONTROL — 02 DATE _____ — 03 AGENCY _____
04 DESCRIPTION

01 ☐ Y LEACHATE TREATMENT — 02 DATE _____ — 03 AGENCY _____
04 DESCRIPTION

01 ☐ Z AREA EVACUATED — 02 DATE _____ — 03 AGENCY _____
04 DESCRIPTION

01 ☐ 1 ACCESS TO SITE RESTRICTED — 02 DATE _____ — 03 AGENCY _____
04 DESCRIPTION

01 ☐ 2 POPULATION RELOCATED — 02 DATE _____ — 03 AGENCY _____
04 DESCRIPTION

01 ☐ 3 OTHER REMEDIAL ACTIVITIES — 02 DATE _____ — 03 AGENCY _____
04 DESCRIPTION

III. SOURCES OF INFORMATION (Cite specific references, e.g. state files, sample analysis, reports)

State + EPA files

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 11 - ENFORCEMENT INFORMATION

I. IDENTIFICATION	
01 STATE	02 SITE NUMBER
FL	D008136589 2

II. ENFORCEMENT INFORMATION

01 PAST REGULATORY ENFORCEMENT ACTION YES ~~NO~~

02 DESCRIPTION OF FEDERAL, STATE, LOCAL REGULATORY ENFORCEMENT ACTION

III. SOURCES OF INFORMATION (Cite specific references, e.g., state files, sample analysis, reports)

State & EPA files.

APPENDIX

I. FEEDSTOCKS

CAS Number	Chemical Name
1. 7664-41-7	Ammonia
2. 7440-36-0	Antimony
3. 1309-64-4	Antimony Trioxide
4. 7440-38-2	Arsenic
5. 1327-53-3	Arsenic Trioxide
6. 21109-95-5	Barium Sulfide
7. 7726-95-6	Bromine
8. 106-99-0	Butadiene
9. 7440-43-9	Cadmium
10. 7782-50-5	Chlorine
11. 12737-27-8	Chromite
12. 7440-47-3	Chromium
13. 7440-48-4	Cobalt
14. 1317-38-0	Cupric Oxide
15. 7758-98-7	Cupric Sulfate
16. 1317-39-1	Cuprous Oxide
17. 74-85-1	Ethylene
18. 7647-01-0	Hydrochloric Acid
19. 7664-39-3	Hydrogen Fluoride
20. 1335-25-7	Lead Oxide
21. 7439-97-6	Mercury
22. 74-82-8	Methane
23. 91-20-3	Napthalene
24. 7440-02-0	Nickel
25. 7697-37-2	Nitric Acid
26. 7723-14-0	Phosphorus
27. 7778-50-9	Potassium Dichromate
28. 1310-58-3	Potassium Hydroxide
29 115-07-1	Propylene
30. 10588-01-9	Sodium Dichromate
31. 1310-73-2	Sodium Hydroxide
32. 7646-78-8	Stannic Chloride
33. 7772-99-8	Stannous Chloride
34. 7664-93-9	Sulfuric Acid
35. 108-88-3	Toluene
36. 1330-20-7	Xylene
37. 7646-85-7	Zinc Chloride
38. 7733-02-0	Zinc Sulfate

II. HAZARDOUS SUBSTANCES

CAS Number	Chemical Name
1. 75-07-0	Acetaldehyde
2. 64-19-7	Acetic Acid
3. 108-24-7	Acetic Anhydride
4. 75-86-5	Acetone Cyanohydrin
5. 506-96-7	Acetyl Bromide
6. 75-36-5	Acetyl Chloride
7. 107-02-8	Acrolein
8. 107-13-1	Acrylonitrile
9. 124-04-9	Adipic Acid
10. 309-00-2	Aldrin
11. 10043-01-3	Aluminum Sulfate
12. 107-18-6	Allyl Alcohol
13. 107-05-1	Allyl Chloride
14. 7664-41-7	Ammonia
15. 631-61-8	Ammonium Acetate
16. 1863-63-4	Ammonium Benzoate
17. 1066-33-7	Ammonium Bicarbonate
18. 7789-09-5	Ammonium Bichromate
19. 1341-49-7	Ammonium Bifluoride
20. 10192-30-0	Ammonium Bisulfite
21. 1111-78-0	Ammonium Carbamate
22. 12125-02-9	Ammonium Chloride
23. 7788-98-9	Ammonium Chromate
24. 3012-65-5	Ammonium Citrate, Dibasic
25. 13826-83-0	Ammonium Fluoborate
26. 12125-01-8	Ammonium Fluoride
27. 1336-21-6	Ammonium Hydroxide
28. 6009-70-7	Ammonium Oxalate
29. 16919-19-0	Ammonium Silicofluoride
30. 7773-06-0	Ammonium Sulfamate
31. 12135-76-1	Ammonium Sulfide
32. 10196-04-0	Ammonium Sulfite
33. 14307-43-8	Ammonium Tartrate
34. 1762-95-4	Ammonium Thiocyanate
35. 7783-18-8	Ammonium Thiosulfate
36. 628-63-7	Amyl Acetate
37. 62-53-3	Aniline
38. 7647-18-9	Antimony Pentachloride
39. 7789-61-9	Antimony Tribromide
40. 10025-91-9	Antimony Trichloride
41. 7783-56-4	Antimony Trifluoride
42. 1309-64-4	Antimony Trioxide
43. 1303-32-8	Arsenic Disulfide
44. 1303-28-2	Arsenic Pentoxide
45. 7784-34-1	Arsenic Trichloride
46. 1327-53-3	Arsenic Trioxide
47. 1303-33-9	Arsenic Trisulfide
48. 542-62-1	Barium Cyanide
49. 71-43-2	Benzene
50. 65-85-0	Benzoic Acid
51. 100-47-0	Benzonitrile
52. 98-88-4	Benzoyl Chloride
53. 100-44-7	Benzyl Chloride
54. [illegible]0-41-7	Beryllium
55. 7787-47-5	Beryllium Chloride
56. 7787-49-7	Beryllium Fluoride
57. 13597-99-4	Beryllium Nitrate
58. 123-86-4	Butyl Acetate
59. 84-74-2	n-Butyl Phthalate
60. 109-73-9	Butylamine
61. 107-92-6	Butyric Acid
62. 543-90-8	Cadimium Acetate
63. 7789-42-6	Cadmium Bromide
64. 10108-64-2	Cadmium Chloride
65. 7778-44-1	Calcium Arsenate
66. 52740-16-6	Calcium Arsenite
67. 75-20-7	Calcium Carbide
68. 13765-19-0	Calcium Chromate
69. 592-01-8	Calcium Cyanide
70. 26264-06-2	Calcium Dodecylbenzene Sulfonate
71. 7778-54-3	Calcium Hypochlorite
72. 133-06-2	Captan
73. 63-25-2	Carbaryl
74. 1563-66-2	Carbofuran
75. 75-15-0	Carbon Disulfide
76. 56-23-5	Carbon Tetrachloride
77. 57-74-9	Chlordane
78. 7782-50-5	Chlorine
79. 108-90-7	Chlorobenzene
80. 67-66-3	Chloroform
81. 7790-94-5	Chlorosulfonic Acid
82. 2921-88-2	Chlorpyrifos
83. 1066-30-4	Chromic Acetate
84. 7738-94-5	Chromic Acid
85. 10101-53-8	Chromic Sulfate
86. 10049-05-5	Chromous Chloride
87. 544-18-3	Cobaltous Formate
88. 14017-41-5	Cobaltous Sulfamate
89. 56-72-4	Coumaphos
90. 1319-77-3	Cresol
91. 4170-30-3	Crotonaldehyde
92. 142-71-2	Cupric Acetate
93. 12002-03-8	Cupric Acetoarsenite
94. 7447-39-4	Cupric Chloride
95. 3251-23-8	Cupric Nitrate
96. 5893-66-3	Cupric Oxalate
97. 7758-98-7	Cupric Sulfate
98. 10380-29-7	Cupric Sulfate Ammoniated
99. 815-82-7	Cupric Tartrate
100. 506-77-4	Cyanogen Chloride
101. 110-82-7	Cyclohexane
102. 94-75-7	2,4-D Acid
103. 94-11-1	2,4-D Esters
104. 50-29-3	DDT
105. 333-41-5	Diazinon
106. 1918-00-9	Dicamba
107. 1194-65-6	Dichlobenil
108. 117-80-6	Dichlone
109. 25321-22-6	Dichlorobenzene (all isomers)
110. 266-38-19-7	Dichloropropane (all isomers)
111. 26952-23-8	Dichloropropene (all isomers)
112. 8003-19-8	Dichloropropene-Dichloropropane Mixture
113. 75-99-0	2-2-Dichloropropionic Acid
114. 62-73-7	Dichlorvos
115. 60-57-1	Dieldrin
116. 109-89-7	Diethylamine
117. 124-40-3	Dimethylamine
118. 25154-54-6	Dinitrobenzene (all isomers)
119. 51-28-5	Dinitrophenol
120. 25321-14-6	Dinitrotoluene (all isomers)
121. 85-00-7	Diquat
122. 298-04-4	Disulfoton
123. 330-54-1	Diuron
124. 27176-87-0	Dodecylbenzenesulfonic Acid
125. 115-29-7	Endosulfan (all isomers)
126. 72-20-8	Endrin and Metabolites
127. 106-89-8	Epichlorohydrin
128. 563-12-2	Ethion
129. 100-41-4	Ethyl Benzene
130. 107-15-3	Ethylenediamine
131. 106-93-4	Ethylene Dibromide
132. 107-06-2	Ethylene Dichloride
133. 60-00-4	EDTA
134. 1185-57-5	Ferric Ammonium Citrate
135. 2944-67-4	Ferric Ammonium Oxalate

II. HAZARDOUS SUBSTANCES

CAS Number	Chemical Name
137. 7783-50-8	Ferric Fluoride
138. 10421-48-4	Ferric Nitrate
139. 10028-22-5	Ferric Sulfate
140. 10045-89-3	Ferrous Ammonium Sulfate
141. 7758-94-3	Ferrous Chloride
142. 7720-78-7	Ferrous Sulfate
143. 206-44-0	Fluoranthene
144. 50-00-0	Formaldehyde
145. 64-18-6	Formic Acid
146. 110-17-8	Fumaric Acid
147. 98-01-1	Furfural
148. 86-50-0	Guthion
149. 76-44-8	Heptachlor
150. 118-74-1	Hexachlorobenzene
151. 87-68-3	Hexachlorobutadiene
152. 67-72-1	Hexachloroethane
153. 70-30-4	Hexachlorophene
154. 77-47-4	Hexachlorocyclopentadiene
155. 7647-01-0	Hydrochloric Acid (Hydrogen Chloride)
156. 7664-39-3	Hydrofluoric Acid (Hydrogen Fluoride)
157. 74-90-8	Hydrogen Cyanide
158. 7783-06-4	Hydrogen Sulfide
159. 78-79-5	Isoprene
160. 42504-46-1	Isopropanolamine Dodecylbenzenesulfonate
161. 115-32-2	Kelthane
162. 143-50-0	Kepone
163. 301-04-2	Lead Acetate
164. 3687-31-8	Lead Arsenate
165. 7758-95-4	Lead Chloride
166. 13814-96-5	Lead Fluoborate
167. 7783-46-2	Lead Fluoride
168. 10101-63-0	Lead Iodide
169. 18256-98-9	Lead Nitrate
170. 7428-48-0	Lead Stearate
171. 15739-80-7	Lead Sulfate
172. 1314-87-0	Lead Sulfide
173. 592-87-0	Lead Thiocyanate
174. 58-89-9	Lindane
175. 14307-35-8	Lithium Chromate
176. 121-75-5	Malthion
177. 110-16-7	Maleic Acid
178. 108-31-6	Maleic Anhydride
179. 2032-65-7	Mercaptodimethur
180. 592-04-1	Mercuric Cyanide
181. 10045-94-0	Mercuric Nitrate
182. 7783-35-9	Mercuric Sulfate
183. 592-85-8	Mercuric Thiocyanate
184. 10415-75-5	Mercurous Nitrate
185. 72-43-5	Methoxychlor
186. 74-93-1	Methyl Mercaptan
187. 80-62-6	Methyl Methacrylate
188. 298-00-0	Methyl Parathion
189. 7786-34-7	Mevinphos
190. 315-18-4	Mexacarbate
191. 75-04-7	Monoethylamine
192. 74-89-5	Monomethylamine
193. 300-76-5	Naled
194. 91-20-3	Naphthalene
195. 1338-24-5	Naphthenic Acid
196. 7440-02-0	Nickel
197. 15699-18-0	Nickel Ammonium Sulfate
198. 37211-05-5	Nickel Chloride
199. 12054-48-7	Nickel Hydroxide
200. 14216-75-2	Nickel Nitrate
201. 7786-81-4	Nickel Sulfate
202. 7697-37-2	Nitric Acid
203. 98-95-3	Nitrobenzene
204. 10102-44-0	Nitrogen Dioxide
205. 25154-55-6	Nitrophenol (all isomers)
206. 1321-12-6	Nitrotoluene
207. 30525-89-4	Paraformaldehyde
208. 56-38-2	Parathion
209. 608-93-5	Pentachlorobenzene
210. 87-86-5	Pentachlorophenol
211. 85-01-8	Phenanthrene
212. 108-95-2	Phenol
213. 75-44-5	Phosgene
214. 7664-38-2	Phosphoric Acid
215. 7723-14-0	Phosphorus
216. 10025-87-3	Phosphorus Oxychloride
217. 1314-80-3	Phosphorus Pentasulfide
218. 7719-12-2	Phosphorus Trichloride
219. 7784-41-0	Potassium Arsenate
220. 10124-50-2	Potassium Arsenite
221. [illegible]38-50-9	Potassium Bichromate
222. 7789-00-6	Potassium Chromate
223. 7722-64-7	Potassium Permanganate
224. 2312-35-8	Propargite
225. 79-09-4	Propionic Acid
226. 123-62-6	Propionic Anhydride
227. 1336-36-3	Polychlorinated Biphenyls
228. 151-50-8	Potassium Cyanide
229. 1310-58-3	Potassium Hydroxide
230. 75-56-9	Propylene Oxide
231. 121-29-9	Pyrethrins
232. 91-22-5	Quinoline
233. 108-46-3	Resorcinol
234. 7446-08-4	Selenium Oxide
235. 7761-88-8	Silver Nitrate
236. 7631-89-2	Sodium Arsenate
237. 7784-46-5	Sodium Arsenite
238. 10588-01-9	Sodium Bichromate
239. 1333-83-1	Sodium Bifluoride
240. 7631-90-5	Sodium Bisulfite
241. 7775-11-3	Sodium Chromate
242. 143-33-9	Sodium Cyanide
243. 25155-30-0	Sodium Dodecylbenzene Sulfonate
244. 7681-49-4	Sodium Fluoride
245. 16721-80-5	Sodium Hydrosulfide
246. 1310-73-2	Sodium Hydroxide
247. 7681-52-9	Sodium Hypochlorite
248. 124-41-4	Sodium Methylate
249. 7632-00-0	Sodium Nitrate
250. 7558-79-4	Sodium Phosphate, Dibasic
251. 7601-54-9	Sodium Phosphate, Tribasic
252. 10102-18-8	Sodium Selenite
253. 7789-06-2	Strontium Chromate
254. 57-24-9	Strychnine and Salts
255. 100-420-5	Styrene
256. 12771-08-3	Sulfur Monochloride
257. 7664-93-9	Sulfuric Acid
258. 93-76-5	2,4,5-T Acid
259. 2008-46-0	2,4,5-T Amines
260. 93-79-8	2,4,5-T Esters
261. 13560-99-1	2,4,5-T Salts
262. 93-72-1	2,4,5-TP Acid
263. 32534-95-5	2,4,5-TP Acid Esters
264. 72-54-8	TDE
265. 95-94-3	Tetrachlorobenzene
266. 127-18-4	Tetrachloroethane
267. 78-00-2	Tetraethyl Lead
268. 107-49-3	Tetraethyl Pyrophosphate
269. 7446-18-6	Thallium (I) Sulfate
270. 108-88-3	Toluene
271. 8001-35-2	Toxaphene
272. 12002-48-1	Trichlorobenzene (all isomers)
273. 52-68-6	Trichlorfon
274. 25323-89-1	Trichloroethane (all isomers)
275. 79-01-6	Trichloroethylene
276. 25167-82-2	Trichlorophenol (all isomers)
277. 27323-41-7	Triethanolamine Dodecylbenzenesulfonate
278. 121-44-8	Triethylamine
279. 75-50-3	Trimethylamine
280. 541-09-3	Uranyl Acetate
281. 10102-06-4	Uranyl Nitrate
282. 1314-62-1	Vanadium Pentoxide
283. 27774-13-6	Vanadyl Sulfate
284. 108-05-4	Vinyl Acetate
285. 75-35-4	Vinylidene Chloride
286. 1300-71-6	Xylenol
287. 557-34-6	Zinc Acetate
288. 52628-25-8	Zinc Ammonium Chloride
289. 1332-07-6	Zinc Borate
290. 7699-45-8	Zinc Bromide
291. 3486-35-9	Zinc Carbonate
292. 7646-85-7	Zinc Chloride
293. 557-21-1	Zinc Cyanide
294. 7783-49-3	Zinc Fluoride
295. 557-41-5	Zinc Formate
296. 7779-86-4	Zinc Hydrosulfite
297. 7779-88-6	Zinc Nitrate
298. 127-82-2	Zinc Phenolsulfonate
299. 1314-84-7	Zinc Phosphide
300. 16871-71-9	Zinc Silicofluoride
301. 7733-02-0	Zinc Sulfate
302. 13746-89-9	Zirconium Nitrate
303. 16923-95-8	Zirconium Potassium Fluoride
304. 14644-61-2	Zirconium Sulfate
305. 10026-11-6	Zirconium Tetrachloride

EPA Notification of Hazardous Waste Site

United States Environmental Protection Agency
Washington DC 20460

R

This initial notificat required by Section hensive Environme sation, and Liability be mailed by June

REFERENCE # 1

f you need te sheets of the item 810609

FL 5000001110

A Person Required to Notify:
Enter the name and address of the person or organization required to notify.

Name CELOTEX CORPORATION
Street 9225 DAMES POINT RD.
City JACKSONVILLE State FL Zip Code 32229

B Site Location:
Enter the common name (if known) and actual location of the site.

FLD081365892

Name of Site CELOTEX CORPORATION
Street 9225 DAMES POINT RD.
City JACKSONVILLE County DUVAL State FL Zip Code 32229

C Person to Contact:
Enter the name, title (if applicable), and business telephone number of the person to contact regarding information submitted on this form.

Name (Last, First and Title) McKENNA, J.J. PLT. MANAGER
Phone 904-751-4400

D Dates of Waste Handling:
Enter the years that you estimate waste treatment, storage, or disposal began and ended at the site.

From (Year) ≈1964 To (Year) ~~PRESENT~~ 1981

E Waste Type: Choose the option you prefer to complete

Option 1: Select general waste types and source categories. If you do not know the general waste types or sources, you are encouraged to describe the site in Item I—Description of Site.

General Type of Waste:
Place an X in the appropriate boxes. The categories listed overlap. Check each applicable category.

1. ☒ Organics
2. ☒ Inorganics
3. ☐ Solvents
4. ☐ Pesticides
5. ☐ Heavy metals
6. ☐ Acids
7. ☐ Bases
8. ☐ PCBs
9. ☐ Mixed Municipal Waste
10. ☐ Unknown
11. ☐ Other (Specify)

Source of Waste:
Place an X in the appropriate boxes.

1. ☐ Mining
2. ☐ Construction
3. ☐ Textiles
4. ☐ Fertilizer
5. ☐ Paper/Printing
6. ☐ Leather Tanning
7. ☐ Iron/Steel Foundry
8. ☐ Chemical, General
9. ☐ Plating/Polishing
10. ☐ Military/Ammunition
11. ☐ Electrical Conductors
12. ☐ Transformers
13. ☐ Utility Companies
14. ☐ Sanitary Refuse
15. ☐ Photofinish
16. ☐ Lab Hospital
17. ☐ Unknown
18. ☒ Other (Specify) FIBERBOARD

Option 2: This option is available to persons familiar with the Resource Conservation and Recovery Act (RCRA) Section 3001 regulations (40 CFR Part 261).

Specific Type of Waste:
EPA has assigned a four-digit number to each hazardous waste listed in the regulations under Section 3001 of RCRA. Enter the appropriate four-digit number in the boxes provided. A copy of the list of hazardous wastes and codes can be obtained by contacting the EPA Region serving the State in which the site is located.

RECEIVED
EPA/REGION IV
JUN 8 12 03 PM '81
ENFORCEMENT DIVISION

000227

Form Approved
OMB No. 2060-0138

Notification of Hazardous Waste Site **Side Two**

F Waste Quantity

Place an X in the appropriate boxes to indicate the facility types found at the site.

In the "total facility waste amount" space give the estimated combined quantity (volume) of hazardous wastes at the site using cubic feet or gallons.

In the "total facility area" space, give the estimated area size which the facilities occupy using square feet or acres.

Facility Type

1. ☐ Piles
2. ☒ Land Treatment
3. ☐ Landfill
4. ☐ Tanks
5. ☐ Impoundment
6. ☐ Underground Injection
7. ☐ Drums, Above Ground
8. ☐ Drums, Below Ground
9. ☐ Other (Specify) _____

Total Facility Waste Amount

cubic feet 77.4

gallons

Total Facility Area

square feet

acres 4

G Known, Suspected or Likely Releases to the Environment:

Place an X in the appropriate boxes to indicate any known, suspected, or likely releases of wastes to the environment. ☐ Known ☐ Suspected ☐ Likely ☒ None

Note: Items H and I are optional. Completing these items will assist EPA and State and local governments in locating and assessing hazardous waste sites. Although completing the items is not required, you are encouraged to do so.

H Sketch Map of Site Location: (Optional)

Sketch a map showing streets, highways, routes or other prominent landmarks near the site. Place an X on the map to indicate the site location. Draw an arrow showing the direction north. You may substitute a publishing map showing the site location.

I Description of Site: (Optional)

Describe the history and present conditions of the site. Give directions to the site and describe any nearby wells, springs, lakes, or housing. Include such information as how waste was disposed and where the waste came from. Provide any other information or comments which may help describe the site conditions.

J Signature and Title:

The person or authorized representative (such as plant managers, superintendents, trustees or attorneys) of persons required to notify must sign the form and provide a mailing address (if different than address in item A). For other persons providing notification, the signature is optional. Check the boxes which best describe the relationship to the site of the person required to notify. If you are not required to notify check "Other".

Name LECIL M. COLBURN

Street P.O. BOX 22601

City TAMPA State FL Zip Code 33622

Signature Lecil M Colburn Date 6/8/81

☒ Owner, Present
☐ Owner, Past
☐ Transporter
☐ Operator, Present
☐ Operator, Past
☐ Other

[FR Doc. 81-11500 Filed 4-14-81; 8:45 am]

BILLING CODE 6560-29-C

REFERENCE # 2

33

"Rite in the Rain"®

ALL-WEATHER

LEVEL

Notebook No. 311

F4-2215

Celotex Corp
Jacksonville (Duval) / FL
4-25-90
Solomon Pollard Jr
F4-9002-33

[illegible]

NOTE: ALL LANGUAGE SHOULD BE FACTUAL AND OBJECTIVE

[illegible]

Record on front cover of the [illegible] Site Location [illegible]

All [illegible] using [illegible]

[illegible] Safety [illegible]

[illegible]

[illegible] and pre-operational checks [illegible] serial numbers of equipment used [illegible]

Provide reference to Sampling Field Sheets for detailed sampling information.

8. Describe sampling locations in detail and document all changes from project planning documents.

[illegible]

[illegible]

000002

[illegible] Colston Cage
The weather is 89°(F),
sunny and clear.

The nearest resident is at
9144 Old [illegible]
road [illegible]
Earl Colston [illegible]
[illegible]
[illegible]
Colston [illegible]
entire property is
[illegible] and has
a [illegible]
[illegible]
[illegible]
[illegible]
of Colston [illegible]
[illegible]
[illegible]
[illegible] alone
[illegible]
[illegible] end of

[illegible]

There [illegible]
[illegible]
[illegible]
of [illegible]
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
money [illegible]
months [illegible]
[illegible]
[illegible]
[illegible]
[illegible]
The [illegible]
[illegible]
[illegible]
[illegible]
the side of [illegible]

000003

property [illegible]

Bldg 1 is a truck loading bldg (possibly maintenance also) w/ large truck entrance doors. Bldg 2 is smaller than bldg 1 and [illegible] office. Bldg 3 contains below ground (50' height) tanks and smoke stacks and is possibly used in manufacturing. There is a large mound of [illegible] beside bldg 3. [illegible] property [illegible] land surrounding [illegible]

[illegible] Colwell [illegible] is posted as [illegible] to The [illegible] of Celistes [illegible]

[illegible] indication of city [illegible] water source [illegible] wells (temporary) [illegible]

1228: Took Photo III of the mound of material [illegible] truck [illegible] State Historical [illegible] 1,000 feet N of the property

1236 Drive to the back of Celotex on Apollo.
I spoke to Elaine Seabrook
at 4240 Apollo Avenue.
Elaine states that
there has been a
significant drop in
fish yield ~~[illegible]~~
this location as well
as numerous [illegible]
fish. The [illegible]
dist. Photo IV (and)
belongs to Celotex.
(904) (757-4695) is the
where Elaine can
[illegible] also
state that [illegible]
[illegible]
water. Alfred [illegible]
[illegible] at 4241 Apollo
[illegible] Mrs. [illegible]
[illegible]
definitely a drop in
fish population.

He said [illegible] yrs [illegible]
the [illegible] and [illegible]
were [illegible] [illegible]
whereas [illegible] there is
a film on the lakes
bottom (black). He
also [illegible] that the
well [illegible] the area
are 500 to 1000 feet deep
in most [illegible] to avoid
the brackish water
found at 100'.
He said that the
city samples the
well at 4238 often
and that we could
sample his well
any time.

Also note that 4240
is [illegible] called
The Bluff.

Note:
The entire Celotex property covers ~5 acres.

Also, Brian Williams performed an ownership [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] that Celotex was owned and operated by Celotex Corp. at the same address.

1300 Took Photo V from highway located W of property (2 pictures while the car was moving).

1315 Left the area

4-26-90

4-26-90

Case No. ______

Low Concentration yes/no

Organics

No. | Media | Lab | Airbill No.
Soil
Water

Inorganics

No. | Media | Lab | Airbill No.
Soil
Water

Picture of: Moved Material

Location: Near pipe

Time: 1225 | Leveled to ... | ... from ...

Date: 6/26

TDD #: F4-9212-33

Picture of:

Location:

Time:

Date:

TDD #:

Picture of:

Location:

Time:

Date:

TDD #: F4-9002-33

000042

TDD # F4-9002-33
Date 4-26-90 By Whom: Sil
Time: 1235 # keyed to map: Photo IV
Location: NE of property
Picture of: Part of material
Mound and conveyor app

TDD # F4-9002-33
Date 4-26-90 By Whom: Sil
Time: 1300 # keyed to map: Photo V
Location: W of prop. on
Hwy
Picture of: S to N view of
property (3 views)

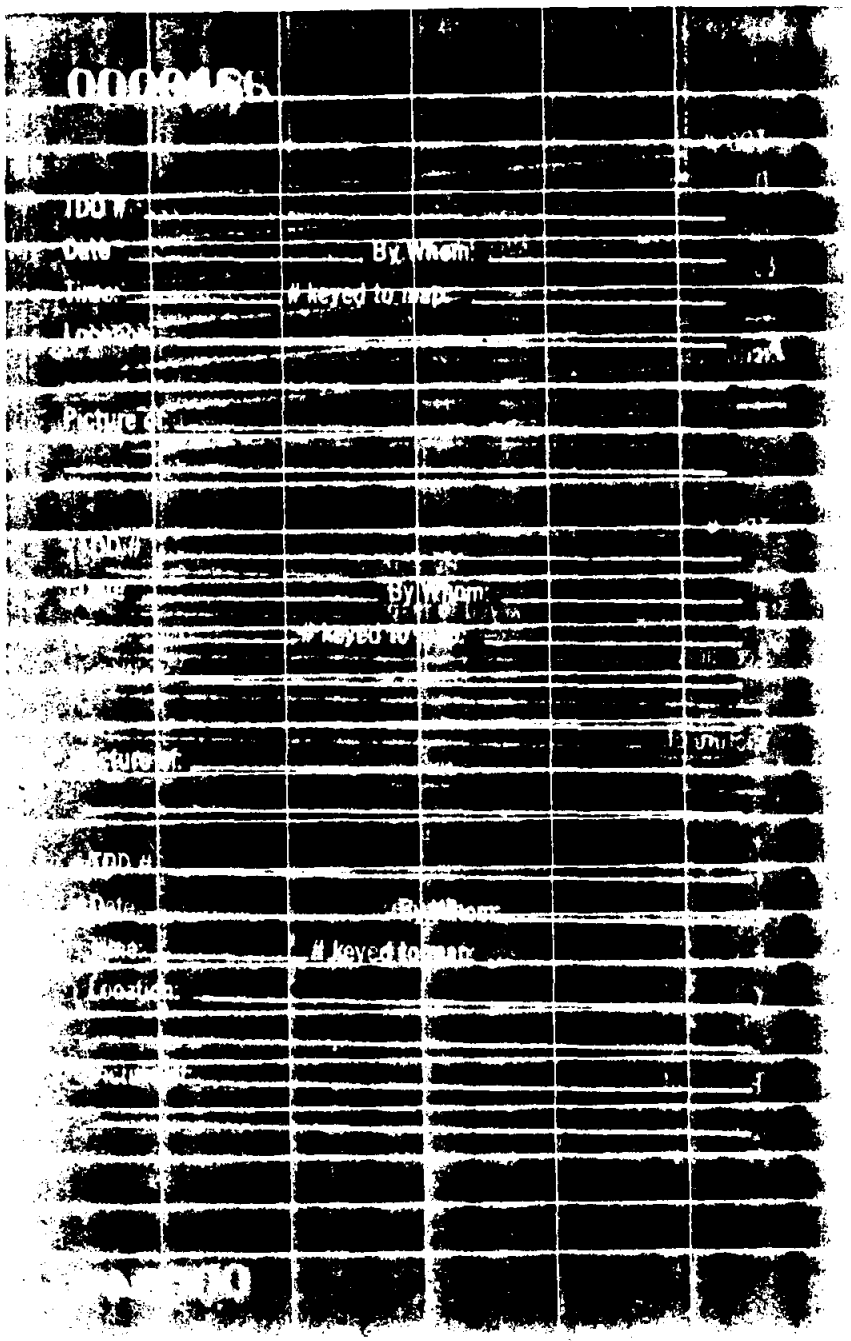
TDD #
Date By Whom:
Time: # keyed to map:
Location:
Picture of:

TDD #
Date By Whom:
Time: # keyed to map:
Location:
Picture of:

TDD #
Date By Whom:
Time: # keyed to map:
Location:
Picture of:

TDD #
Date By Whom:
Time: # keyed to map:
Location:
Picture of:

000043


TDD #
Date
By Whom:
Time:
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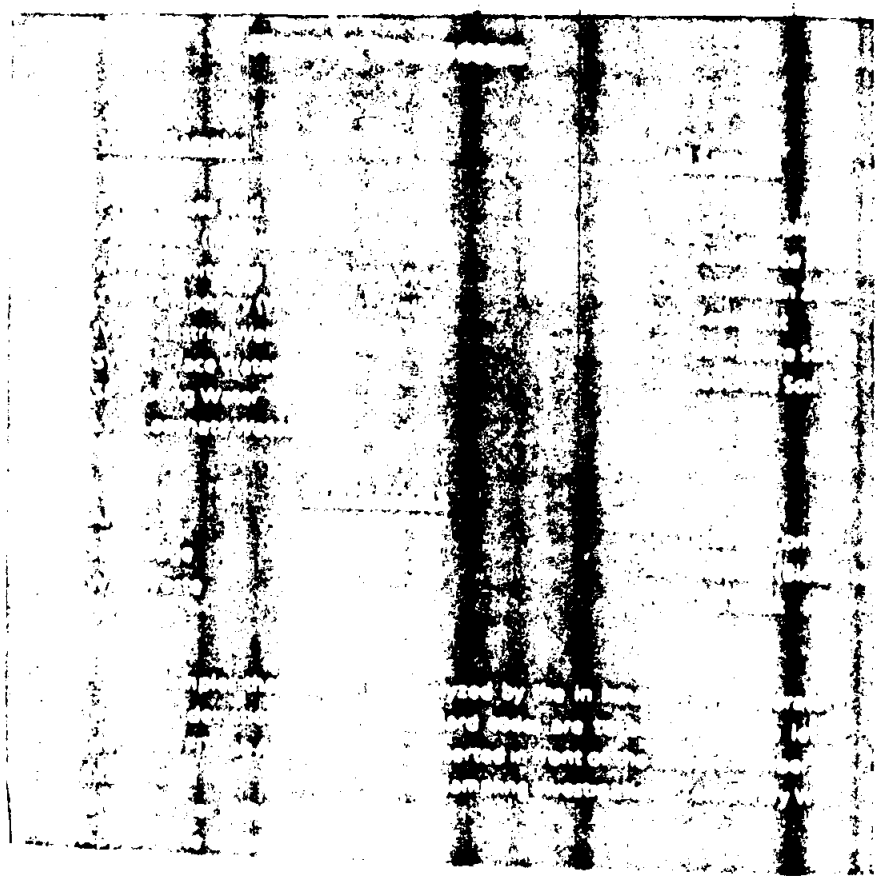

KIRK-OTHMER

ENCYCLOPEDIA OF CHEMICAL TECHNOLOGY

THIRD EDITION

VOLUME 14

LAMINATED WOOD-BASED COMPOSITES
TO
MASS TRANSFER

A WILEY-INTERSCIENCE PUBLICATION
John Wiley & Sons
NEW YORK • CHICHESTER • BRISBANE • TORONTO

or consumed in a one-year period because a large amount of hardwood plywood is imported into the United States each year.

Specifications. The most commonly used specifications for plywood are the product standards established by the industry with the assistance of the U.S. Department of Commerce, NBS. Softwood plywood is covered by *U.S. Product Standard PS 1-74* (4); hardwood and decorative plywood is covered by *PS 51-71* (5). These specifications include requirements for species, grade, thickness of veneer and panels, glue bonds, moisture content, etc. They also provide standardized definitions of terminology, suitability, and performance test specifications, expected minimum test results, and explanations of the codes which normally are stamped on each panel. Some of the allowable stresses for softwood plywood that conform to *PS 1* are given in Table 4 (4).

Imported plywood generally is not produced in conformance with United States product specifications. However, some countries have their own specifications for plywood that is manufactured for export to the United States, and some of these follow the requirements of our applicable domestic product standards.

Uses. The American Plywood Association has published information on the projections of softwood-plywood-structural panel demand in the United States by market area for the years 1977, 1978, and 1979 (10). The estimated demand for softwood plywood by five broad market categories and information on the larger volume uses in each of these five categories is listed in Table 8. The bulk of softwood plywood is used where strength, stiffness, and construction convenience are more important than appearance. Some grades of softwood plywood are made with faces that are selected primarily for appearance and are used either with clear natural finishes or with pigmented finishes.

Hardwood plywood is used normally where appearance is more important than strength. Most of the production is intended for interior or protected uses, although a very small proportion is made with glues that are suitable for exterior service. A significant portion of all hardwood plywood is available completely finished. Typical uses of unfinished hardwood plywood include containers, curved or molded products, door skins, die boards, marine-grade materials, pin blocks, kitchen cabinets, furniture components, and exterior siding. Examples of prefinished hardwood-plywood uses include wall paneling or interior use surface-covering material, laminated hardwood block flooring, furniture components, door skins, kitchen and bathroom cabinets, and laminated door sides.

Wood-Based Fiber and Particle Panel Materials. Wood-based fiber and particle panel materials include insulation boards, medium-density fiberboards, hardboards, particleboards, and laminated paperboards. Various particleboards are known by the kind of particle used such as flakeboard, chipboard, chipcore, or shavings board. These panel materials are reconstituted wood (or some other lignocelluloselike bagasse) in that the wood is first reduced to small fractions of the original size and then is combined by special forms of manufacture into large and moderately thick panels. In final form, these materials retain some of the properties of the original wood but, because of the manufacturing methods, gain new and different properties than those of the wood. Because they are manufactured, they can be tailored to satisfy desired uses.

The wood-based panel materials are manufactured either by converting wood substance to fibers and then interfelting them into the panel material classed as building fiberboard, or by strictly mechanical means of cutting or breaking wood into

John A Youngquist

Table 8. Estimated United States Demand for Softwood Plywood by Market, 1977–1979 10^6 m^2 [a] (9.5-mm basis)

Market	Year 1977	1978	1979
new residential construction			
floor systems	310	280	300
roof decks	360	300	330
exterior siding	110	100	110
mobile homes	14	15	16
other	120	80	80
Total	*914*	*775*	*836*
distribution			
home repair and remodeling	210	220	230
other homeowner uses	130	140	140
miscellaneous other markets	70	80	90
Total	*410*	*440*	*460*
industrial			
material handling	50	60	70
transportation	50	50	50
other products made for sale	90	100	100
in-plant repair, maintenance, patterns, and jigs	80	80	80
Total	*270*	*290*	*300*
nonresidential construction			
building construction	80	90	90
concrete form	70	80	80
agricultural buildings	30	30	30
other	10	10	10
Total	*190*	*210*	*210*
international markets	30	30	60
Total market demand	*1814*	*1745*	*1866*
changes in mill and wholesale industry	−30	+20	+20
Total production	*1784*	*1765*	*1886*

[a] Ref. 10. To convert m^2 to ft^2, multiply by 10.76.

small discrete particles and then, with a synthetic-resin adhesive or other suitable binder, bonding them together in the presence of heat and pressure. These latter products are called particleboards (11–12).

Building fiberboards are made of fiberlike components of wood that are interfelted in the reconstitution and are characterized by a bond produced by the interfelting, and they are classified as fibrous-felted board products. Binding agents and other materials may be added during manufacture to increase strength, resistance to fire, moisture, or decay, or to improve some other property. Among the materials added are rosin, alum, asphalt (qv), paraffin, synthetic and natural resins, preservative and fire-resistant chemicals, and drying oils (qv). At certain densities and under controlled conditions of hot pressing, rebonding of the lignin effects an additional bond in the panel product.

Particleboards are manufactured from small components of wood that are glued together with a thermosetting synthetic resin or equivalent binder. Wax sizing is added to all commercially produced particleboard to improve water resistance. Other additives may be introduced during manufacture to improve some property or to provide added resistance to fire, insects (eg, termites), or decay. Particleboard is among the

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panel product beca
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and curing in a heat
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newest of the wood-based panel materials. It has become a successful and economical panel product because of the availability and economy of thermosetting synthetic resins, which permit consolidation of blends of wood particles and the synthetic resin and curing in a heated press. The thermosetting resins that are used are primarily urea–formaldehyde and phenol–formaldehyde. Urea–formaldehyde is lowest in cost and is the binder used in greatest quantity for particleboard that is intended for interior or other nonsevere exposures. Where moderate water or heat resistance is required, melamine–urea–formaldehyde resin blends are used. For severe exposures, eg, exteriors, or where some heat resistance is required, phenolics generally are used.

The kinds of wood particles that are used in the manufacture of particleboard range from specially cut flakes 2.5 cm or more in length (parallel to the grain of the wood) and only a few hundredths of a centimeter thick to fine particles approaching fibers or flour in size. The synthetic resin solids usually are 5–10 wt % of the dry wood. These resins are set by heat as the wood particle–resin blend is compressed either in flat-platen presses (similar to those used for hot-pressing hardboard and plywood) or in extrusion presses where the wood–resin mixture is squeezed through a long, wide, and thin die that is heated to provide the energy to set the resin. Particleboards produced by flat-platen presses are called mat-formed or platen-pressed particleboards and those produced in an extrusion press are called extruded particleboards.

Building fiberboards and particleboards are produced from small components of wood, hence the raw material need not be in log form. Many processes for manufacture of board materials start with wood in the form of pulp chips. Coarse residues from other primary forest products manufacture, therefore, are an important source of raw materials for both kinds of wood-based panel products. Particleboards and, to a lesser extent, building fiberboards, use fine residues as raw material (eg, planar shavings). Overall, about 70% of the raw material requirements for wood-base, fiber and particle panel materials are satisfied by residues.

Wood-based fiber and particle panel materials form an important part of the forest products industry in the United States. Not only are they valuable from the standpoint of integrated utilization, but the total production of more than 6.5×10^8 m^2 (7×10^9 ft^2) is important in terms of forest products consumed. Along with softwood plywood, wood-based fiber and particle panel materials are among the fastest growing components of the industry.

Fiber Panel. Broadly, the wood-based fiber panel materials (building fiberboards) are divided into two groups—insulation board (lower density products) and hardboard, which requires consolidation under heat and pressure as a separate step in manufacture. Insulation board and hardboard dimensional and quality requirements are given in refs. 13 and 14, respectively. The dividing point between an insulation board and a hardboard, on a density basis, is a specific gravity of 0.5 g/cm^3. Practically, because of the range of uses and specially developed products within the broad classification, further breakdowns are necessary to classify adequately the various products. Table 9 shows the building fiberboards identified by density.

Laminated paperboards require a special classification because the density of these products is slightly greater than the maximum for non-hot-pressed, fibrous-felted, wood-based panel materials. Also, because these products are made by laminating plies of paper about 2.5 mm thick, they have different properties along the direction of the plies than across the machine direction. The other fibrous-felted products have nearly equal properties along and across the panel.

Table 9. Densities of Building Fiberboards

Material	Density, g/cm³ [a]
insulation board	0.02–0.50
semirigid insulation board	0.02–0.16
rigid insulation board	0.16–0.50
hardboard	0.50–1.44
medium density hardboard	0.50–0.80
high density hardboard	0.80–1.20
special densified hardboard	1.35–1.45
laminated paperboard	0.50–0.59

[a] To convert g/cm³ to lb/ft³, multiply by 62.43.

Particle Panel. Mat-formed particleboards, because of differences in properties and uses, generally are classified by density into low (<0.59 g/cm³), medium (0.59–0.80 g/cm³), and high (>0.80 g/cm³) categories. All mat-formed particleboards are hot-pressed to cure the resins that are used as binders.

These mat-formed particleboards are homogeneous (the same kind, size, and quality of particle throughout the thickness), graduated (a gradation of particle size from coarsest in the center of the thickness to finest at each surface), or three layer (the material on and near each surface is different than that in the core). These boards also may be described by the predominant kind of particle, as shavings, flakes, slivers, or the combination in the instance of layered construction as flake-faced or fines-surfaced boards.

A generalized manufacturing flow diagram for a particleboard manufacturing process is presented in Figure 3. Particleboard production begins when the raw material

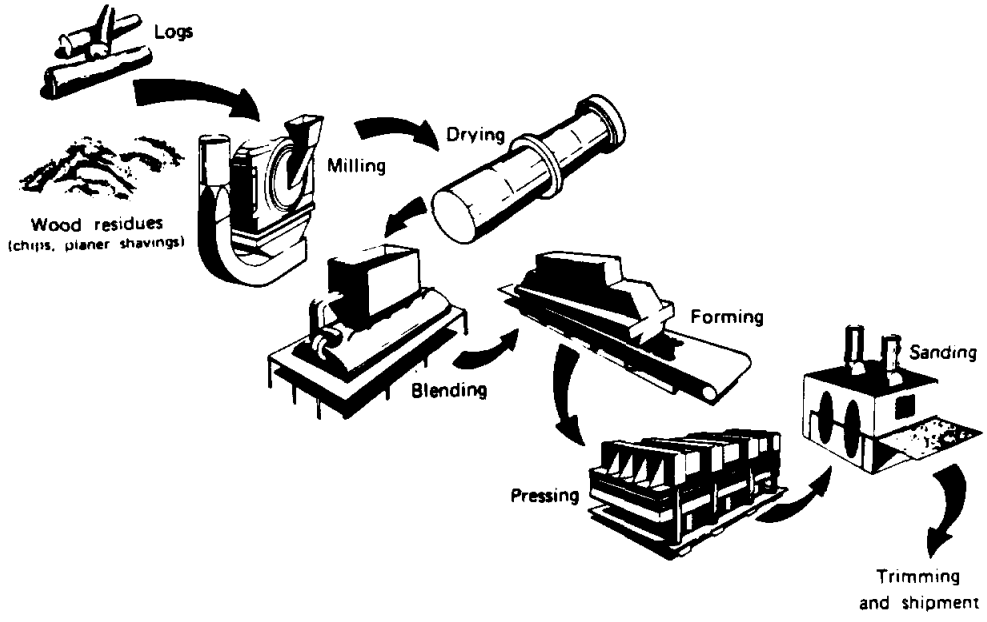

Figure 3. Manufacture of particleboard. Courtesy of the National Particleboard Association.

(wood chips, planer shavings, or logs) is reduced by flakers, hammermills, or other types of milling equipment to produce the desired types of tiny wood particles. Screens classify the particles into the proper mixture of sizes. Dryers remove excess moisture and uniformly control the moisture content to the desired level. Resin binders and other chemicals are sprayed onto the wood particles at a controlled rate in a blending operation. Forming machines deposit the treated particles onto belts or metal cauls, thereby forming mats. Particle mats are consolidated and the binders are cured in heated hydraulic presses with temperatures up to 200°C and pressures up to 6.9 MPa (1000 psi). After being pressed, boards are trimmed to the desired length and width. Sanding in high-speed belt sanders produces the smooth surfaces and accurate thickness tolerances characteristic of particleboards.

Extruded boards account for less than 5% of the total production of particleboard, and standards have not been developed for them to any appreciable extent. Most extruded particleboard is medium density because the compression applied to the wood particles during extruding does not increase the density beyond 0.80 g/cm^3. Particleboards thicker than about 16 mm can be extruded with hollow core sections similar to those molded in concrete blocks. Because of these hollow core sections, the equivalent density may fall below that of medium density, mat-formed particleboard. Extruded particleboards of that type, usually called fluted particleboards, are classified on the basis of weight per square meter for a specified thickness.

Waferboard and Other Structural Composite Panels. Waferboard is a structural board made of wood wafers that are cut to predetermined dimensions, randomly distributed, and bonded with a phenolic adhesive. The product generally is made from roundwood or forest residue rather than mill residue, and has been manufactured in Canada in considerable quantity since the late 1960s. A plant in the United States has had a waferboard plant in continuous production since the early 1970s, and in 1978 and 1979, seven waferboard plants have been announced, and two plant expansions are in the planning stages. Reasons for this strong interest in waferboard include a continuing strong demand for structural board products, a recognition of changing raw material supplies, and rapidly rising softwood plywood prices.

Another type of structural board, which has been manufactured in the Federal Republic of Germany and which soon will be manufactured in the United States in commercial quantities, uses flakes or strands that are narrower than those commonly used in waferboard. These flakes or strands are incorporated into three-layer panels that are composed entirely of oriented-strand-particleboard layers, which substitute for veneer. These panels, which represent one type of a family of panels commonly referred to as oriented-strand board (OSB) panels, initially will be used in floor and roof-sheathing markets where structural strength is important. It is anticipated that future markets for these types of products will expand from sheathing applications to uses in single-layer flooring, textured siding, and overlaid interior panels.

Another type of new structural panel combines an OSB core with veneer face and back material, each component produced separately, and laid-up on a conventional plywood line. The resultant panel looks like a plywood panel and frequently is used interchangeably with plywood. It has had very good market acceptance in the United States. One plant has been in production for more than 3 years and several others soon will begin production. A similar board with a nonaligned particle core has been introduced using an isocyanate adhesive as the binder. This is the first commercial use of this binder for a wood-board product in the United States. Markets include wall and roof sheathing and concrete forms.

Properties and Uses. *Semirigid Insulation Board.* Semirigid insulation board describes fiberboard products that are manufactured primarily for insulation and cushioning. These very low density fiberboards have about the same heat-flow characteristics as conventional blanket or batt insulation but have sufficient stiffness and strength to maintain their position and form without being attached to the structure. They may be bent around curves or corners and, when cemented, mechanically fastened, or placed between framing members, hold their shape and position even though subjected to considerable vibration.

Semirigid insulation boards are manufactured in sheets 13–38 mm thick. When greater thicknesses are required, two or more sheets are cemented together. Sheet sizes vary from 30 × 61 cm to 1.2 × 1.2 m. The thermal resistance factors R are 35–39 mW/(m·K) [0.24–0.27 (Btu·in.)/(h·ft^2·°F)] (see Insulation, thermal). Semirigid insulation boards are used for heat insulation in truck and bus bodies, automobiles, refrigerators, railway cars, on the outside of ductwork, and wherever vibrations are so severe that loose fill or batt insulation may pack or shift.

Rigid Insulation Board. Rigid insulation board is the oldest of the wood-based fiber and particle panel materials and is a structural insulation board. Structural insulating board is manufactured mainly for specific uses in construction although some is fabricated for special padding and blocking in packaging and a variety of other industrial uses. Interior-quality boards are used where high water resistance is not required but where a light-colored product is desired. Sheathing-quality boards are used where water resistance is required and are manufactured with added water-resistant materials (usually asphalt by impregnation and/or coating). Density is somewhat greater for sheathing-quality boards than for interior boards.

Strength and related properties of insulating board are included in Table 10 with those properties of other building fiberboards. The two basic insulating-board products, with only minor composition modifications in manufacture, are fabricated into a group of products designed to satisfy specific use requirements in construction. These requirements may call for structural strength and either high thermal insulation or good acoustical properties or both.

General-Purpose Board. There are two general-purpose structural insulating boards—building board and wallboard (the latter sometimes is called thin board because it is either 7.9- or 9.5-mm thick, whereas most other insulating board is 13-mm thick or thicker). Both general-purpose boards may be converted for a multiplicity of uses not specifically covered in the other products. The general-use boards usually are furnished with a factory-applied flame-resistant finish. Building board is 13-mm thick and may be obtained in panels 1.2 × 2.4, 2.7, 3.0, or 3.7 m with square edges. Wallboard is furnished regularly 1.2 m wide in either 2.4- or 3.0-m lengths. Quality limits are set for these and other regular products in the standards.

Insulating Roof Deck. Insulating roof deck is a laminated structural insulating board product that is manufactured of several layers of sheathing-grade board and one layer of factory-finished interior board (either perforated or plain). It is used in exposed-beam ceiling constructions where the factory-finished interior board is applied face down. Insulating roof deck is made in 38-, 51-, and 76-mm nominal thicknesses in 0.6 × 2.4-m panels. The 38-mm-thick panel is made to span 61 cm, the 51-mm-thick panel to span 81 cm, and the 76-mm-thick material to span 1.2 m. Panel ends are square and sides are tongued and grooved.

Table 10. Strength and Mechanical Properties of Wood-Based Building Fiberboards[a]

Property	Structural insulating board	Medium density hardboard	High density hardboard	Tempered hardboard	Special densified hardboard
density, g/cm^3	0.16–0.42	0.53–0.80	0.80–1.28	0.93–1.28	1.36–1.44
modulus of elasticity, GPa[b]	0.17–0.86	2.24–4.83	2.76–5.52	4.48–7.59	8.62
modulus of rupture, MPa[b]	1.4–5.5	13.1–41.4	20.7–48.3	38.6–69.0	69.0–86.2
tensile strength parallel to surface, MPa[b]	1.4–3.4	6.9–27.6	20.7–41.4	24.8–53.8	53.8
tensile strength perpendicular to surface, MPa[b]	0.069–0.17	0.28–1.4	0.52–2.8	1.1–3.1	3.4
compressive strength parallel to surface, MPa[b]		6.9–24.1	12.4–41.4	25.5–41.4	183
shear strength (in plane of board), MPa[b]		0.69–3.3	2.1–4.1	3.0–5.9	
shear strength (across plane of board), MPa[b]		4.1–17.2	13.8–20.7	19.3–23.4	
24-h water absorption, vol %	1–10				
24-h water absorption, wt %		5–20	3–30	3–20	0.3–1.2
thickness swelling (24-h soaking), %		2–10	10–25	8–15	
linear expansion (50–90% rh), %[c]	0.2–0.5	0.2–0.4	0.15–0.45	0.15–0.45	
thermal conductivity (at 24°C), mW/(m·K)[d]	39–65	65–108	108–202	108–216	267

[a] The data presented are general, round-figure values, accumulated from numerous sources (see also ref. 2); for more exact figures on a specific product, individual manufacturers should be consulted or tests should be conducted. Values are for general laboratory conditions of temperature and humidity.
[b] To convert MPa to psi, multiply by 145; to convert GPa to psi, multiply by 145,000.
[c] Measurements made on material at equilibrium at each condition at room temperature.
[d] To convert mW/(m·K) to (Btu·in)/(h·ft^2·°F), divide by 144.1.

In climates where condensation occurs, insulating roof deck is furnished with a vapor-barrier membrane that is installed in the glueline between the layer of 13-mm-thick, interior-finish board and the first sheathing-quality layer. In this construction, the roof decking furnishes structural rigidity to support snow and water or wind loads, besides providing interior ceiling finish and thermal insulation. Thermal conductance factors for the various thicknesses are specified at 35, 26, and 17 mW/(m·K) [0.24, 0.18, and 0.12 (Btu·in.)/(h·ft^2·°F)] for the thickness of 38, 51, and 76 mm, respectively. For flat roofs, a built-up roof is applied directly to the top surface of the deck. If the pitch (slope) of the roof is sufficient, asphalt shingles may be attached to 51- and 76-mm-thick decking with special annular-grooved nails.

Roof Insulation. Above-deck, thermal insulation made of structural insulating board is manufactured in blocks 0.58 × 1.19 m or 0.61 × 1.2 m in 13-mm multiples of thickness between 13 and 78 mm. The blocks usually are multiple 13-mm thicknesses of insulation board and may be laminated or stapled together in the greater thicknesses. Insulation-board roof insulation is applied where the final roofing is of the built-up variety. It is secured in place by hot asphalt or roofing pitch or by mechanical fasteners, and has enough internal bond strength to resist uplift forces on the roof structure.

Ceiling Tile and Lay-in Panels. Ceiling tile, either plain or perforated, has a paint finish applied in the factory to provide resistance to flame spread. Interior-finish insulating board, when perforated or provided with special fissures or other sound traps, also will provide a substantial reduction in noise reflectance. Ceiling tiles usually are 30 × 30 cm and 30 × 61 cm in size, 13-mm thick, and have tongue and groove or butt and chamfered edges. They are applied to nailing strips with nails, staples, or special mechanical fastenings, or directly to a surface with adhesives.

A panel product similar to tile, but nominally 61 × 61 cm or 61 × 122 cm, is gaining popularity. These panels, called lay-in ceiling panels, are installed in metal tees and angles in suspended ceiling systems. They usually are 13-mm thick and are supported in place along all four edges. They frequently are used in combination with translucent plastic panels that conceal light fixtures. Finishes and perforation treatments for sound absorption are the same as for regular ceiling tile (see Insulation, acoustic).

Plank. Structural insulating-board plank is installed on side walls, often in remodeling, where it is used in conjunction with ceiling tile installations. Plank is 30-cm wide with matching long edges and is finished with a flame-resistant paint applied at the factory. Because of its low density, it is subject to abrasion when used for the lower part of walls where chairs or other furniture can bump it. It is used frequently in conjunction with wainscoting of wood paneling or one of the other wood-based panel materials like hardboard or particleboard.

Sheathing. Insulation board frequently is used to sheath houses in the United States. Sheathing is manufactured in three grades: regular density, intermediate density, and nail base. Regular-density sheathing is manufactured in both 13- and 20-mm thicknesses. Intermediate and nail base are made only 13 mm thick. Regular-density sheathing is furnished in two sizes, 0.61 × 2.4 m, or 1.2 × 2.4, 2.7, 3.0, or 3.7 m; the other two grades are furnished only in 1.2-m widths and 2.4- or 2.7-m lengths.

Regular-density sheathing usually is about 0.290 g/cm^3 in density and is sold with a thermal resistance R rating of 297 mW/(m·K) [2.06 (Btu·in.)/(h·ft^2·°F)] for 20-mm material and 190 mW/(m·K) [1.32 (Btu·in.)/(h·ft^2·°F)] for the 13-mm thickness. If the 0.6 × 2.4-m material is used as sheathing, it is applied with the long edges horizontal and adequate fastening (either nails or staples) around the perimeter and along intermediate framing, and requirements for racking resistance of the wall construction usually are satisfied. Horizontal applications with the 20-mm material require additional bracing in the wall system to meet code requirements for rigidity, as do some applications of the 13-mm-thick, regular-density sheathing applied with the long edges being vertical.

Costs of heating and requirements for air conditioning from summer heat may justify added thermal insulation over that required by minimum standards. When such added thermal insulation is used in construction of walls, intermediate and nail-base sheathing (with lower thermal resistance) is used. They are applied with their long edges vertical. With recommended fastening, such sheathing provides the racking rigidity and strength for the wall without added bracing.

The density of intermediate sheathing usually is about 0.350 g/cm^3 and that of nail base is about 0.40 g/cm^3. The insulation-board industry provides intermediate density and nail-base sheathing with rated thermal resistance R values; the R values are 176 and 164 mW/(m·K) [1.22 and 1.14 (Btu·in.)/(h·ft^2·°F)], respectively. Nail-base

sheathing has adequate nail-holding strength so that asbestos (qv) and wood shingles for weather course (siding) can be attached directly to the nail-base sheathing with special annular-grooved nails. With the other grades of sheathing, siding materials must be nailed directly to framing members or to nailing strips attached through the sheathing to the framing. Because the method and amount of fastening are critical to racking resistance, local building codes should be consulted for requirements in different areas.

Sound-Deadening Board. Sound-deadening board is specially manufactured to provide a meaningful reduction in sound transmission through walls. Standard sizes are 13-mm thick, 1.2 m-wide, and 2.4- or 2.7-m long. In light-frame construction, sound-deadening board usually is applied to the wall framing; the final wall finish, such as gypsum board, is applied to the outside faces of the sound-deadening board. Acoustic efficiency of walls constructed with sound-deadening board depends on tight construction with no air leaks around the edges of panels, and close adherence to prescribed methods of installation.

Medium Density Hardboard. Medium density hardboard, formerly classified as medium density building fiberboard, is a relatively new wood-based panel product. Nearly all of the material being manufactured by the conventional methods that are used for other hardboard is being tailored for use as house siding. Medium density hardboard for house siding use is 9.5- and 11-mm thick and is fabricated for application as either panel or lap siding. Medium density hardboard sometimes is manufactured by a process that involves radio-frequency energy for curing thicker panels (usually about 19 mm although it is possible to make panels as thick as 76 mm) used mainly in furniture and cabinets as core stock or panel stock (see Radiation curing).

Panel siding is 1.2 m wide and commonly is furnished in 2.4-, 2.7-, or 3.0-m lengths. Surfaces may be grooved 51 mm or more on center parallel to the long dimension to simulate reversed board and batten or may be pressed with ridges simulating a raised batten. Lap siding usually is 30-cm wide with lengths to 4.9 m and is applied in the same way as conventional wood lap siding. Some manufacturers offer lap-siding products with special attachment systems that provide either concealed fastening or a wide shadow line at the bottom of the lap.

Most siding is furnished with some kind of a factory-applied finish, eg, the surface and edges are given a prime coat of paint and finishing is completed by application of one or more coats of paint. Two coats of additional paint, one of a second primer and one of topcoat, provide for a longer interval before repainting. However, there is a trend towards complete prefinishing of medium density hardboard siding. The complete prefinishing ranges from several coats of liquid finishes to cementing various films to the surfaces and edges of boards. Surfaces of medium density hardboard for house siding range from very smooth to textured; one of the newest simulates weathered wood with the latewood grain raised as though earlywood has been eroded away. Siding remains the most important use of medium density hardboard. This product is also marketed for industrial use under the name, Industrialite.

High Density Hardboard. Properties of high density hardboard are summarized in Table 10 but, in the trade, the various qualities are subdivided in smaller groups beyond those shown. An overlapping of properties is shown by the limiting values in the various standards for hardboard. Standard hardboard has a density of about 0.960–1.04 g/cm^3 which, usually, is unaltered except by humidification as it is produced

by hot pressing. Tempered hardboard is a standard-quality hardboard treated with a blend of siccative resins (drying-oil blends or synthetics) after hot-pressing. The resins are stabilized by baking after the board has been impregnated. Usually about 5% solids are required to produce a hardboard of tempered quality. Tempering improves water resistance, hardness, and strength but embrittles the board making it less shock resistant.

Service-quality hardboard has a lower density than standard hardboard, usually 0.80–0.88 g/cm^3 and satisfies needs where the higher strength of standard quality is not required. Because of its lower density, service-quality hardboard has better dimensional stability than the denser products. It is used where water resistance is required but where the higher strength of regular treatment is not. Underlayment is service-quality hardboard, nominally 6.1 mm thick, that is sanded or planed on the back surface to provide a thickness of 5.461 ± 0.127 mm.

A substantial amount of high density hardboard is manufactured for special industrial use. Hardboard that is manufactured for concrete forms frequently is given a double tempering treatment. For some uses where high impact resistance is required (eg, backs of television cabinets), boards are formulated from specially prepared fiber and additives.

High density and medium density conventional hardboards are manufactured in several ways, and the result is reflected in the appearance of the final product. Hardboard is screen-backed or S-2-S (smooth two sides). When the mat from which the board is made is formed from a water slurry (wet-felted) and the wet mat is hot-pressed, a screen is required to permit steam to escape. In the final board, the reverse impression of the screen is apparent on the back of the board, hence the screen-back designation. A screen is required with mats formed from an air suspension (air-felted) when moisture contents going into the hot press are sufficiently high so as to require venting.

In some variations of hardboard manufacture, a wet-felted mat is dried before being hot-pressed which makes possible hot-pressing without using the screen, and an S-2-S board is produced. In air-felting hardboard manufacture, it also is possible to press without the screen, if the moisture content of the mats entering the hot press is low. In an adaptation of pressing hardboard mats, a caul with slots or small circular holes is used to vent steam; the board that is produced has a series of small ridges or circular nubbins which, when planed or sanded off, yield an S-2-S board.

Medium density hardboard that is manufactured using radio-frequency curing is produced from dry, fiber–resin blends. The mats are pressed between heated platens where the high frequency heat provides additional heat energy to cure the resin binder (usually urea–formaldehyde instead of the phenolics used with the more conventional hardboards); the product is S-2-S hardboard.

Commercial thicknesses of high density hardboard generally range 9.5–13 mm. Not all thicknesses are produced in all grades. The thicknesses of 2.5 and 2.1 mm are produced regularly only in the standard grade. Tempered hardboards are produced regularly in thicknesses of 3.2–7.9 mm. Service and tempered service are produced regularly in fewer thicknesses; however, none is less than 3.2 mm or is produced by all manufacturers or in screenback and S-2-S types. The appropriate standard specification or source of material should be consulted for specific thicknesses of each kind.

High density hardboards are produced in 1.2- and 1.5-m widths. Standard commercial lengths are 1.2, 1.8, 2.4, 3.7, and 4.9 m with a 5.5-m length being available in

the 1.2-m width. Most manufacturers maintain cut-to-size departments for special orders. Retail lumberyards and warehouses commonly stock 2.4-m lengths; underlayment, however, is usually 1.2 m square.

About 15% of the hardboard used in the United States is imported. Imported board may or may not be manufactured to the same standards as domestically produced products. Before substituting an imported product in a use where specific properties are required, it should be determined that it has properties required for the use. Canadian products usually are produced according to the same standards as are United States products.

In addition to the standard smooth-surface hardboards, special products are made using patterned cauls so the surface is striated or produced with a relief to simulate ceramic tile, leather, basket weave, etched wood, or other texture. Hardboards are punched to provide holes for anchoring fittings for shelves and fixtures (perforated board) or with holes comprising 15% or more of the area (for installation in ceilings with sound-absorbent material behind it as an acoustical treatment or as air diffusers above plenums). High density hardboard is harder than most natural wood and, because of its grainless character, it has nearly equal properties in all directions in the plane of the board. It is not as stiff nor as strong as natural wood along the grain but it is substantially stronger and stiffer than wood across the grain. Specific properties in Table 10 can be compared with similar properties for wood, wood-base, and other materials.

Hardboard is used in construction as floor underlayment to provide a smooth undercourse under plastic or linoleum flooring, as a facing for concrete forms for architectural concrete, facings for flush doors, as insert panels and facings for garage doors, and material punched with holes for wall linings in storage walls and in built-ins where ventilation is desired. In furniture, furnishings, and cabinet work, conventional hardboard is used extensively for drawer bottoms, dust dividers, case goods and mirror backs, insert panels, television, radio, and stereo-cabinet sides, backs (die-cut openings for ventilation), and as crossbands and balancing sheets in laminated or overlay panels. Hardboard also is used in interior linings of automobiles, trucks, buses, and railway cars.

Densified Hardboard. Densified hardboard is manufactured mainly as diestock and electrical panel material. It has a density of 1.36–1.44 g/cm^3 and is produced in thicknesses of 3.2–51 mm in panel sizes of 0.91 × 1.2 m, 1.2 × 1.8 m, and 1.2 × 3.7 m. The 3.2-mm-thick board is specially manufactured for use as lofting board. As diestock, it finds use for stretch- and press-forming and spinning of metal parts, particularly when few of the manufactured items are required and where the cost of making the die is important in the choice of material. The electrical properties of the special densified hardboard meet many of the requirements set forth by the National Electrical Manufacturers Association (NEMA) for insulation resistance and dielectric capacity in electrical components; therefore, it is used extensively in electronic and communication equipment.

Laminated Paperboards. Laminated paperboards are made in two general qualities: interior and weather resistant. The main differences between the two qualities are in the kind of bond used to laminate the layers and in the amount of sizing used in the pulp stock from which the individual layers are made. For interior-quality boards, the laminating adhesives commonly originate from starch. Synthetic-resin adhesives are used for the weather-resistant board. Laminated paperboard regularly

is manufactured in thicknesses of 4.8, 6.1, and 9.5 mm for construction uses although 3.2-mm thickness is common for industrial uses, eg, dust dividers in case goods, furniture, and automotive liners. Important properties are presented in Table 11.

Considerable amounts go into the prefabricated housing and mobile-home construction industry as interior wall and ceiling finish. In the more conventional building construction market, interior-quality boards are also used for wall and ceiling finish, often in remodeling to cover cracked plaster.

The common width of laminated paperboard is 1.2 m although 2.4-m widths are available in 3.7-, 4.3-, 4.9-m and longer lengths for building applications, eg, sheathing entire walls. Laminated paperboard intended for use where the surface is exposed has a surface that is ply-coated with a high quality pulp to improve surface appearance and performance. The surface finish may be smooth or textured.

Particleboard. Important properties for mat-formed particleboards are presented in Table 12. Similar values are not presented for extruded particleboards since they are never used without facings glued to them, and the facings influence the physical and strength properties. Extruded particleboards have a distinct zone of weakness across the length of the panel as extruded. They also have a strong tendency to swell in the lengthwise (extruded) direction because of the compression and orientation of particles from the extrusion pressures. Consequently, extruded particleboards always are used as corestock; mat-formed boards are used both as corestock and as panel stock where the only thing added to the surface is finish.

Table 11. Strength and Mechanical Properties of Laminated Paperboard[a]

Property	Value
density, g/cm^3	0.51–0.53
modulus of elasticity (compression), MPa[b]	
along the length of the panel[c]	2.1–2.7
across the length of the panel[c]	0.69–0.97
modulus of rupture, MPa[b]	
span parallel to length of panel[c]	9.7–13.1
span perpendicular to length of panel[c]	6.2–7.6
tensile strength parallel to surface, MPa[b]	
along the length of the panel[c]	11.7–14.5
across the length of the panel[c]	4.1–5.5
compressive strength parallel to surface, MPa[b]	
along the length of the panel[c]	4.8–6.2
across the length of the panel[c]	3.4–5.5
24-h water absorption, wt %	10–170
linear expansion of 50–90% rh, %[d]	
along the length of the panel[c]	0.2–0.3
across the length of the panel[c]	1.1–1.3
thermal conductivity (at 24°C), mW/(m·K)[e]	73

[a] The data presented are general round-figure values, accumulated from numerous sources; for more exact figures on a specific product, individual manufacturers should be consulted or actual tests made. Values are for general laboratory conditions of temperature and humidity. (See also ref. 2).

[b] To convert MPa to psi, multiply by 145.

[c] Because of directional properties, values are presented for two principal directions, along the usual length of the panel (machine direction) and across it.

[d] Measurements made on material at equilibrium at each condition at room temperature.

[e] To convert mW/(m·K) to (Btu·in.)/(h·ft^2·°F), divide by 144.1.

Table 12. Strength and Mechanical Properties of Mat-Formed (Platen-Pressed) Wood Particleboard[a]

Property	Low density particleboard	Medium density particleboard	High density particleboard
density, g/cm^3	0.40–0.59[b]	0.59–0.80	0.80–1.12
modulus of elasticity (bending), MPa[c]	1.0–1.7[b]	1.7–4.8	2.4–6.9
modulus of rupture, MPa[c]	5.5–9.7[d]	11.0–55.2	16.6–51.7
tensile strength, parallel to surface, MPa[c]		3.4–27.6	6.9–34.5
perpendicular to surface, MPa[c]	0.14–0.21[d]	0.28–1.4	0.86–3.1
compressive strength parallel to surface, MPa[c]		9.7–20.7	24.1–35.9
shear strength (in the plane of board), MPa[c]		0.60–3.1	1.4–5.5
(across the plane of the board), MPa[c]		1.4–12.4	
24-h water absorption, wt %		10–50	15–40
thickness swelling from 24-h soaking, %		5–50	15–40
linear expansion[e] (50–90% rh), %	0.30[f]	0.2–0.6	0.2–0.85
thermal conductivity (at 24°C), mW/(m·K)[g]	79–108	108–144	144–180

[a] The data presented are general round-figure values, accumulated from numerous sources; for more exact figures on a specific product, individual manufacturers should be consulted or actual tests made. Values are for general laboratory conditions of temperature and humidity. (See also ref. 2.)
[b] Lower limit is for boards as generally manufactured; lower density products with lower properties may be made.
[c] To convert MPa to psi, multiply by 145.
[d] Only limited production of low density particleboard so values presented are specification limits.
[e] Measurements made on material at equilibrium at each condition at room temperature.
[f] Maximum permitted by specification.
[g] To convert mW/(m·K) to (Btu·in.)/(h·ft^2·°F), divide by 144.1.

Quality criteria, testing, labeling, rating, and certification methods for mat-formed particleboard are established in *Commercial Standard CS 236-66* (15). For certain uses where special requirements must be satisfied, additional specifications outline the requirements for the particleboard. Particleboard is manufactured in both 1.2- and 1.5-m widths and wider, although for industrial sales, much is cut to size for the purchaser. In construction, as for other panel materials, the common size panel is 1.2 × 2.4 m.

The uses for particleboard are under development, and parallel those for lumber core in veneered or overlaid construction and for plywood. The two properties of particleboard that have the greatest influence on its selection for a use are that the panels have a uniform surface and stay flat as manufactured, particularly in applications where edges are not fastened to a rigid framework. For the majority of uses where exposures are interior or equivalent (furniture, cabinetwork, interior doors, and most floor underlayment), urea–formaldehyde resins are used. Boards with that kind of bond are classed as type 1 in the specifications (15). Where greater resistance to heat, moisture, or a combination of heat and moisture is required, type 2 boards that generally are bonded with phenolic resin are required.

In general, particleboards are manufactured in about the same thicknesses as softwood plywood; most manufacture is in thicknesses between 13 and 25 mm, although there are new developments for particleboard that are thinner than 13 mm or thicker than 25 mm. Much extruded particleboard is fluted in thicknesses that satisfy the need for cores for flush doors. Similarly, low density, mat-formed particleboard is manufactured for solid-core doors in thicknesses so that, when facings are applied, final door thicknesses are the standard 35 and 44 mm.

Recently, there has been a trend toward thinner particleboard products. Thicknesses of 6.1 and 9.5 mm are becoming common, both for special and general use, in the United States. In terms of volume, the main two uses for particleboard are as furniture and cabinet core, and floor underlayment. As corestock, particleboard has moved into a market formerly held by lumber core and, to a limited extent, by plywood. For example, certain grades of hardwood plywood now permit the use of particleboard as the core ply where, formerly, lumber core was specified.

Both three and five plies are employed in built-up constructions where particleboard is used as the core. Extruded particleboard nearly always requires five-ply construction because of the board's instability and low strength in one direction. A relatively thick crossband that has the grain direction parallel to the extruded direction, stiffens, strengthens, and stabilizes the core. Thinner face plies are laid with the grain at right angles to the crossband to provide the final finish.

The use of three- or five-ply construction with mat-formed particleboard corestock depends on the class and type of particleboard core (stiffness and strength), kind of facings being applied (plastic or veneer), and the requirements of the final construction. Balanced construction in lay-ups using particleboard is important; facings or crossbands with different properties can cause objectionable warping, cupping, or twisting in service. Edge-bonding of wood or of the facing material frequently is employed in panelized units that have particleboard as the corestock.

As a floor underlayment, particleboard provides leveling, the thickness of construction required to bring the final floor to elevation, and the indentation-resistant, smooth surface necessary as the base for resilient-finish floors of linoleum, rubber, vinyl, and vinyl–asbestos tile and sheet material. Particleboard for this use is produced in 1.2 × 2.4-m panels that commonly are 6.1-, 9.5-, or 16-mm thick. Separate use specifications cover particleboard floor underlayment.

Particleboard for siding, combined siding–sheathing, and as soffit linings and ceilings for carports, porches, and the like requires the durable adhesive, phenol–formaldehyde. For these uses, type 2, medium density board is required. Agencies, eg, the Federal Housing Administration, have established requirements for particleboard for such use. The satisfactory performance of particleboard in exterior exposure depends not only on the manufacture and kind of adhesive used, but on the protection afforded by the finish. Manufacturers recognize the importance of the combination by providing both paint-primed panels and those that are completely finished with liquid-paint systems or factory-applied plastic films.

Mobile-home manufacture and factory building of conventional housing are important and increasing users of forest products. Since particleboard is manufactured in hot presses as large as 2.4 × 12 m, panels are available in sizes larger than those generally used for conventional construction. With mechanical handling available in factories, large-sized panels can be attached effectively and economically. Two particleboard products have been developed to satisfy these uses. Mobile-home decking is used for combined subfloor and underlayment and has a type 1 bond but is protected from moisture in use by a bottom board, so that it generally provides a satisfactory service life. The United States industry has established separate standards for these products. They are marketed under a certified product-quality program.

Another use that commonly requires the more durable bond of a type 2 quality is a special corestock where laminated plastic sheets are formed on the face and back of a particleboard at the same time as they are bonded to it and, usually, a high density

particleboard is used. The temperatures used in curing the resin-impregnated plastic sheets may reduce the strength of the bonds in boards made with urea–formaldehyde resins.

The properties of particleboard depend on the shape and quality of the particles used as well as on the kinds and amount of resin binder. Although most particleboard is produced using particles that yield a board of intermediate strength and stiffness, a substantial volume is comprised of flakes or other engineered particles for boards of higher strength and stiffness. Sometimes the boards of intermediate stiffness and bending strength are designated class 1 and those of the higher stiffness and bending strengths are designated class 2. Class 2 particleboards are more expensive than those in class 1, but they usually are justified for uses where the greater stiffness and strength are required. The same applies to those applications where a special surface such as a fine surface provides either a better base for finishing or less showthrough for an overlaid construction.

Production. The U.S. Department of Commerce has published production and market information for particleboard and medium density fiberboard for the year 1975 (16). A portion of the information presented in this Census Bureau document is given in Table 13. Reference 16 has complete production information by geographic area, and export–import breakdowns.

United States Panel Price Trends. Prices for every principal panel product group rose, albeit at varying rates depending on industry conditions, in the United States in the 1970s. Softwood plywood producer prices increased most, rising by 280% from 1970 to 1978 (Table 14). This rise reflected, in part, the strong demand for the product in the wake of the construction boom during this period. But the biggest factor was the escalation of the costs of materials and labor. Western softwood-plywood mills, which were dependent on a diminishing supply of high quality sawlogs, were forced to bid in a highly competitive log market with eager foreign and domestic buyers. The result was a substantial leap in log costs.

The price of no. 2 Douglas-fir sawlogs, which were used extensively for plywood sheathing, rose from \$34.70/1000 cm^3 (\$82 per thousand board feet (MBF)) in 1970 to about \$127/1000 cm^3 (\$300 MBF) in 1979. This fourfold jump in price was representative of the cost-push experienced by West Coast plywood producers. The supply of logs in southern United States, by contrast, was somewhat better, resulting in lower but still sizable cost increases for that segment of the industry. The cost and availability of resins also became a problem toward the end of the decade. The higher use of benzene in gasoline, caused by environmental laws, resulted in a rapid upward price spiral in benzene-derived resins. Plywood producers attempted to diminish the impact of this by using alternative glues and glue extenders, but nevertheless, were forced to absorb a large cost increase in this area as well.

Hardwood plywood prices exhibited a more moderate trend, rising by only 60% and can be attributed to the better supply of hardwood logs in the eastern United States where hardwood timber growth has exceeded removals consistently for the past three decades. Delivered oak prices in southern United States, eg, were estimated to have risen by 125%, a figure which contrasts sharply with the 265% increase in western United States log prices that are noted above.

Hardboard and insulating board do not require high-grade logs as input; thus, they were not subject to the same intense cost pressures experienced by softwood-plywood manufacturers. Hardboard prices rose by 60% over the period and insulat-

member configuration, loading condition, and desired appearance. Where horizontal members are not provided with adequate slope to allow for drainage, the possibility of ponding should be investigated (29). When a beam cross section is varied in depth along its length to meet specific requirements, consideration must be given to the combined effects of bending, compression, tension, shear, and radial stresses. The analysis involves an interaction formula in which stresses occur simultaneously to reduce beam capacity below that calculated by simple theory. Formulas also are used to calculate deflections of such beams (29,31). In cases such as purlins, where members are subjected to biaxial bending so the loading is not in the plane of the vertical axis of the member, the allowable stress in the member should be checked using conventional formulas (29).

Treatments. *Pressure Preservative.* Some use conditions require that members undergo pressure-preservative treatment to ensure long life. Design considerations, such as special connection details, flashing, and coatings, can provide some degree of protection; however, when the details of the design and construction are not sufficient to resist decay, fungi, insects, or marine borers, pressure preservative treatment is necessary. The effectiveness of the treatment depends on the chemicals used and their penetration and retention in the wood. Depending on the type of preservative used, the finished laminated timber can be treated, or the individual laminations may be treated prior to laminating. Creosote or oilborne chemicals may be used for treating after laminating. The use of waterborne salt treatments for treating glued laminated members after gluing is not recommended because of the degree of dimensional change and magnitude of checking which may occur in the laminated timber as the wood dries after treatment. The waterborne salts and oilborne chemicals in mineral spirits or volatile solvent carriers are the only preservatives recommended for treating individual laminations prior to gluing. Standards used in choosing and specifying preservative treatments are available (32–33); additional details related to preservative treatments are given in ref. 27.

Flame-Retardant Treatment. Laminated timber may be pressure-impregnated with mineral salts as flame-retardant treatments so as to reduce surface flamespread, smoke density, and fuel contribution from the laminated timber (34). When flame-retardant treatments are used, the reduction of strength of the member and its fastenings (27), the compatibility of treatment and adhesive, the use of special gluing procedures, and the effect on fabricating procedures should be investigated (33).

Coatings and Finishes. Glulam timbers are available with satins, sealers, or other finishes that are applied in the plant to satisfy an appearance requirement. If timbers will be subjected to low humidity conditions, end-grain coatings are recommended to minimize end-grain checking caused by rapid moisture loss through the end grain.

Uses. The American Institute of Timber Construction estimates that 590×10^6 cm^3 (250×10^6 board feet) of sawed, structurally graded dimension lumber was consumed by the glulam producers in 1978. Of this total, about 90% was used in making straight or slightly cambered members for use in roof-support structures. Curved members for arch-type roof supports accounted for the other 10% of the production.

In addition to fabricating glulam members in virtually any size or shape for simple bending members or axially loaded members, glulam fabrication is readily adaptable to other structural configurations. These include trusses, arches, domes, and other

REFERENCE #

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Toxicology. ***Formaldehyde.*** The present NIOSH TLV–TWA for formaldehyde exposure in the air is 3 ppm. The ACGIH's current TLV–threshold ceiling (TLV–C) is 2 ppm. Whereas the TLV–TWA is the maximum recommended TWA for a normal 8-h work day or 40-h work week, the TLV–C is the concentration that never should be exceeded. The human olfactory sense can detect airborne formaldehyde at 1 ppm, whereas at 3 ppm lachrimatory reactions result and include nasal irritation, coughing, eye tearing, etc. In studies performed for the Chemical Industry Institute of Toxicology (CIIT), internal cancer of the nose occurred at the sixteenth month in 3 out of 120 rats at an exposure level of 15 ppm (68). Since tumors were not observed in the control rats (0 ppm formaldehyde exposure) or at exposure levels of 2 ppm and 6 ppm, CIIT's provisional conclusion is that occurence of the tumors may be related to formaldehyde exposure.

Phenol. Phenol is a highly toxic, protein-degenerating compound. The TLV–TWA is 5 ppm. Phenol is absorbed by the skin and causes severe blistering. Contact with large quantities can cause paralysis of the central nervous system and, ultimately, death. Phenol is reported to cause skin cancer in one strain of mice (69). All other skin tumors reported in the same study were benign papillomas which visually disappeared when skin painting was stopped. Alkyl phenols have been studied less, but their destructive effect on the skin, as compared to phenol, may be somewhat reduced.

Chemical Process Pollution Control. Air and water pollution-control regulations have resulted in a number of process and product changes in the phenolic-resin and resin-application industries, eg, changes in resin chemistry, in manufacture, and in methods for handling reaction by-products, effluents, and emissions. For example, resins with lower, ie, <5%, free phenol or formaldehyde content are produced under conditions of higher formaldehyde concentrations to reduce the former with stripping to reduce the latter. Resin molecular weight distribution and functionality have been altered, eg, in water-soluble resins which are used as glass-insulation binders, to reduce stack emissions and particulates. In some cases, catalysts have been changed or modified to achieve higher conversions. Solvents from solvent-based resins are largely unrecovered and are incinerated at >700°C. Closed-loop operations are employed in certain operations. Also, phenol is extracted from the distillate in phenolic-resin manufacture or phenol production, eg, in the Lurgi phenosolvan process involving the use of isopropyl or butyl ether with countercurrent extraction. Another method for removing organic substances includes gas scrubbing which is applied to exhaust gas containing small amounts of formaldehyde, phenol, or organic solvents. Activated carbon for phenol removal is used frequently and some work also has been done with polymeric absorbents (see Air pollution control methods).

Uses

Wood Composites. Wood composites include plywood, particle board, fiberboard, wafer board, and macroscopic wood composites such as beams, arches, etc (see Laminated wood-based composites). Phenol- and/or resorcinol-based resins are the products of choice where durability in high humidity is required. Where this is not required, other products can be and are employed, including urea–formaldehyde and melamine–formaldehyde resins (see Amino resins), polyurethanes, lignin sulfonates, and poly(vinyl acetate) emulsions.

Plywood manufacture involves adhering three or more layers of wood with a

Phenolic Resins
George L B...

phenolic resin under heat and pressure. Caustic-catalyzed water-soluble resoles are employed at a solids content of ca 45 wt %. Resin formulation depends on whether a wet or dry manufacturing process is used. As a result of the high caustic content, the products are water-soluble in either case and are characterized by fast gel times, ie, 20–30 min at 100°C. Storage stability is less than one month at 20°C for the higher molecular weight products but up to one year for the lower viscosity materials. The resin generally is combined with fillers and diluents in order to control wetting and to avoid substrate penetration. For phenol-based resoles, board curing time is ca 5 min at 140–150°C for medium thickness boards, and ca 1–1.5 min/mm for boards up to 10-mm thick. By contrast, resorcinol–formaldehyde resins, which are used as two-component systems, may be cured at room temperature.

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Particle board is based on wood chips, shavings, and wood flour rather than on wood sheeting. Liquid resoles also are the principal resin used in particle-board manufacture. Curing temperatures and pressures depend on the density of the finished composite but may be somewhat higher than in plywood and press cycles are somewhat reduced. Plywood, particle board, and wafer board display low thermal conductivity, resulting in a broad temperature profile and, therefore, a varying curing rate across the composite. Hot stacking of the product allows continuation of cure after press removal.

Wafer board is the most recent version of wood composites and offers a number of significant advantages over other wood composites. Small-diameter trees of the fast-growing variety are cut into wafers of specific size and thickness. The wafers, which have lower surface areas than particles or chips, can be bonded economically with a solid resin in pulverized form.

Fiber Bonding. A large outlet for low molecular weight, highly functional water-soluble resoles is in the bonding of glass and rock-wool fibers for insulation (see Insulation, thermal). The diluted resin, of which 10–15 wt % are solids, is sprayed on the fibers shortly after they emerge from the spinnerettes. Evaporation of water from the resin cools the fiber as it is collected in a mat chamber. Concurrently, the latent heat advances the resin molecular weight, providing a nonabrasive finish for the glass. Subsequent resin cure is carried out as the mat is compressed and heated in a curing oven to effect the final thickness and density of the composite. Recent advances in resin technology have effected reduced airborne pollution of low molecular weight, high formaldehyde/phenol resins of this type. Phenolic dispersions offer one approach to resin advancement, low volatile concentration, and water dilutability. The sensitivity of glass to alkaline media prevents use of those resins that are used in wood-bonding applications.

A dry process is employed in the manufacture of another type of glass- or organic-fiber composite. The organic or scrap glass fiber is prepared as a preform mat and is dusted with a pulverized phenolic resin in a lapping operation. The lapped composite is compressed and heated in a curing oven until the desired density is achieved. Resins that are preferred in these operations are high ortho resins or combinations of solid one-step/two-step resins. Applications include acoustical insulation, carpet underlay, etc (see Insulation, acoustic).

Laminates. A wide variety of applications exist for phenolic-bonded laminates that are based on paper, cotton, or glass substrates. Laminates are either decorative or industrial. Commercial items in the latter category include electronic circuit boards, gears, rods, bearings, tubes, etc. Decorative laminates are used primarily for furniture,

wall paneling, and home and office furnishings; often a melamine–formaldehyde or vinyl facing is used where light color, colorfastness, or abrasion resistance is important. Decorative laminates are further divided into postforming or nonpostformable types; the latter are characterized by high cross-link densities and low extensibility. The former are sufficiently low in cross-link density to allow preformed laminates to be heated and shaped to various contours. Postforming properties can be imparted by choice of substrate and/or resin composition.

Laminate manufacture involves impregnation of a preformed sheet or mat by dip coating in a phenolic-resin solution. Fiber penetration is an important requirement and is a function of resin viscosity and molecular structure. The saturated sheet is passed through an oven where the solvent evaporates and the resin advances. Depending on the intended use, the emerging sheet is either cut and stored as a preimpregnated product or stacked and hot-pressed directly. Resin content in the finished laminate varies as a function of substrate and use but generally is 30–70 wt % of the cured laminate. Curing temperatures and pressures generally are 150–175°C and 3.4–14 MPa (500–2000 psi), respectively. Core resins in decorative laminates are almost exclusively phenol-based. Phenol/alkyl phenol mixtures are more generally used in industrial laminates to improve moisture resistance and electrical properties under humid use conditions. Plasticizers, including natural products, eg, rosin, tung oil, etc, may be added to laminating formulations to increase elongation and toughness to allow for such postoperations as cold stamping, punching, and cutting. Resins generally are low molecular weight resole types prepared in low boiling ketone, alcohol, or aromatic hydrocarbon solvents, eg, toluene. Barium, calcium, and magnesium hydroxide are the catalysts of choice since, after neutralization with sulfuric acid at the end of the reaction, the insoluble salt residue can be removed by filtration. Where very low levels of metal-ion contamination are required, amine catalysts can be used which either react with the resin or are removed in the solvent-distillation step.

Foundry Resins. The foundry industry provides a large outlet for phenolic resins, even though the amount of binding agent employed for sand consolidation usually is only 2–3 wt % or less. Casting of molten metals into synthetic, resin-bonded sand molds is used to produce numerous finished parts, eg, machine housings, automotive transmissions, cylinder heads, and various types of large metal parts and intricate metal objects. Although phenolic resins are one of the most often used binders, furfuraldehyde, urea–formaldehyde, and urethane–phenol blends also are employed. Depending on the type of foundry-resin process, phenolic one-step resins or novolak/hexa compositions may be employed. Gaseous by-products are released as a result of the porous nature of the composite; however, resin composition and the quantity of gaseous by-products need to be controlled to prevent build-up of excess pressure.

Abrasives. Phenolic-based abrasives are of two types: bonded abrasives, including grinding wheels, snagging wheels, etc, and coated abrasives, including sandpaper, disks, belts, etc (see Abrasives). Bonded abrasives that are based on phenolic resins display greater strength and thermal-shock resistance than those based on ceramic or vitrified compositions. Metal grinding is a principal application for phenolic-bonded abrasives for which surface temperatures are ≥1000°C. Synthetic alumina (Al_2O_3) and silicon carbide are the main abrasive materials and are used in the largest quantity. Boron carbide and diamond-containing grinding wheels also are manufactured for specialty applications. Manufacture includes first contacting the abrasive grit with a liquid resole; careful control of humidity is required to avoid agglomeration. The coated grit

is combined with additives, filler, and a pulverized high molecular weight novolak and hexamethylenetetramine (hexa). The amount of resin and hexa is ca 6–10 wt % and 6–14 wt % of resin, respectively. The homogeneous mixture is transferred to molds and is pressed to preforms at 14–34 MPa (2000–5000 psi), at either room temperature or elevated temperatures. The preforms are cured under a carefully programmed heating cycle to avoid inhomogeniety or deformation. Curing cycles of 24–30 h are common for cold-pressed wheels and are shorter for the higher density, hot-pressed composites.

Coated abrasives are phenolic bonded if they are intended for use in high temperatures or where water-cooling is required. Either the cloth or paper backing is coated with a medium viscosity resole to which the abrasive material is electrostatically deposited. The make coat is partially dried at low temperatures, ca 100°C, and then a top coat of lower viscosity resole is applied. Further drying and postcure in rolled form at 120–130°C for 3–4 h effects the final cure. Abrasive materials include ground glass, flint, emery, etc; aluminum oxide or silicon carbide are the most common.

Friction Materials. Brake linings, clutch facings, and transmission bands are bonded largely with phenolic resins. Automotive applications are the largest outlet for friction elements, though many other vehicles and machines depend on such composites, including aircraft, trains, drilling rigs, etc. Two important recent developments have occurred in automotive-brake elements: conversion from drum brakes to disk brakes and the development of nonasbestos composites. Both developments require that the binder resins exhibit higher temperature performance without deleteriously affecting the coefficient of friction, coefficient stability over a broad temperature range, wear of the composite, and improved adhesion to the semimetallic additive which replaces asbestos.

Manufacturing processes include impregnation, extrusion, dough molding, or dry compounding, depending on the type of friction element being produced. The phenolic resin, either a novolak/hexa blend or a liquid or solid resole, generally is employed at 10–20 wt % of the composite mix. Other ingredients include fillers at 20–30 wt %; friction granules, ie, a cross-linked particle based on alkenyl phenol extracted from cashew-nut shells; asbestos or semimetallic fibers at 40–60 wt %; etc. The combination of the different additives, phenolic resin type, concentration and cross-link density, and the process employed determines the friction properties, wear characteristics, noise development level, and thermal resistance of the finished composite (see Brake linings and clutch facings).

Molding Materials. Phenolic molding materials are highly consolidated composites containing particulate and/or fibrous fillers, various additives, and a high concentration of resin binder. Resin functionality and curing conditions are such that a high cross-link density is developed in the finished part. Important properties of the cured product include temperature resistance, modulus retention at elevated temperatures, good electrical properties, solvent resistance, and a high gloss surface. Applications for the cured products include electrical sockets, switch gear, circuit breakers, and many other devices where good electrical properties, eg, dielectric constant of ca 5.0, dissipation factor of ca 0.01, etc, are required. Applications based on thermal resistance and modulus retention include automotive distributor caps, relays, brake pistons, etc, and coffee makers, utensil handles, and general appliance parts that are exposed to elevated temperatures. Molding-material properties depend not only on the type of resin but also on the fillers used and their concentrations.

The phenolic resins that are used in molding materials are predominantly novolaks and hexamethylenetetramine is the curing agent. Resin/curing-agent content is 30–50 wt %. Oxalic acid-catalyzed novolaks are used in greatest amount, although high ortho novolaks and sulfuric or hydrochloric acid-catalyzed resins also are employed. One-step resins or one-step/two-step resin combinations are used in specialty molding applications for electrical applications or in certain cases where ammonia by-product would be deleterious to the substrate, eg, copper or glass fiber. New phenolic molding materials are being developed, eg, in 1979, four manufacturers introduced new and improved impact-resistant products (70). Use temperatures are also being improved. For example, a recently commercialized product (70) displays increasing flexural strength during long-term heat exposure with a 30% increase after 100 h at 225°C. This particular product contains nine different unspecified additives that contribute to the superior performance.

Molding materials in either powder or pellet form are fabricated into final parts by compression, transfer, or injection-molding processes. Because molded materials are thermosetting compositions, a processing problem results from cross-linking in mold flashing or runners or sprues. However, two solutions are scrap regrind with readdition to the reaction mixture and warm-runner or cold-manifold molding, where the resin is designed to have an extended barrel life. The latter technique has received considerable impetus since the early 1970s with the design of molding equipment that insulates the curing mold section from the feeder streams. Significant reduction in scrap loss is achieved as a result of the combination of the new molding-equipment design with the use of resins that are characterized by delayed curing at lower temperatures (71).

Coatings and Adhesives. Most coating and adhesive applications involving phenolic resins are based on combinations with other thermoplastic or thermosetting polymers. In the area of coatings, automotive primers, can coatings, drum linings, anticorrosion paints, printing inks, wire enamels, and varnishes are some of the chief outlets (see Adhesives; Coatings; Paint). Formulation with epoxies, alkyds, drying oils, poly(vinyl formvar), poly(vinyl butyral), acrylics, etc, provides different and useful properties in the cured systems. Most systems are applied with organic solvents, although there is a significant effort to reformulate to water-based systems. Solvent evaporation and resin advancement/cross-linking is carried out at 150–500°C. In essentially all cases, the phenolic is coreactive with the second resin. Phenolic-resin compositions vary depending on the polymer with which the resin is to be combined. For example, low molecular weight novolaks of narrow molecular weight distribution have been developed for combination with epoxy resin. Alkyl phenol resins, including *tertiary*-butyl-, amyl-, nonyl-, or styrenated phenol, are used with alkyds, linseed oil, tung oil, etc, ie, where compatibility in the uncured state would be poor with unadulterated phenol-based systems. Where better color stability and very low extractable levels are required, bisphenol-A-based resins are preferred; *p*-phenylphenol novolaks or resoles also offer advantages in such applications (71) (see Alkyd resins).

Some of the more recent developments in coating resins include polyetheramide–imide/*t*-butylphenolic-resin blends which are used as powder coatings for high temperature wire insulation (72), polypropylene glycol–maleic anhydride/phenolic copolymers for impregnating and coating cellulosic fibers to obtain rapid-wetting battery separators (73), and maleinized oil-modified phenolic resins which are water-dilutable and cure at lower temperatures than correspondingly modified nov-

olaks (74). Essentially all modified phenolic resins that are used in coatings display one or more of the following properties: good solvent resistance, abrasion resistance, thermal stability, sufficiently low extractables to meet FDA requirements, anticorrosion properties, insulating properties, etc.

Adhesives and tackifier applications also result from the synergistic properties of various phenolic/polymer combinations. Nitrile/phenolic or chloroprene/phenolic mixtures are used where high peel strength, thermal stability, and moisture resistance are required. Chloroprene/phenolic mixtures also display excellent contact adhesive properties. Formvar/phenolic blends display both thermal stability and toughness; butadiene/phenolic compositions are used to obtain initial tackifying properties in the manufacture of rollers, hoses, and tires without detracting from the properties of the cured elastomer. Phenolic resins also have been combined with ethylene–propylene–diene rubber, urethane elastomers, and neoprene- and terpene-based resins for pressure-sensitive adhesive applications.

New Developments. The flame resistance of phenolic resins and the low smoke density and relatively nontoxic by-products of phenolic-resin combustion mainly is responsible for the development of glass-reinforced, long-fiber phenolics, phenolic fibers, and phenolic foam (see also Flame retardants).

Glass-Reinforced Phenolics. Thermosetting-resin/glass-fiber composites of the sheet-molding or bulk-molding variety normally are based on styrene/polyester binders. Unless more expensive flame-resistant polyesters are employed, such systems are flammable and emit dense smoke on combustion. Halogen-, nitrogen-, or phosphorus-modified polyester systems reduce the flammability of glass composites but at the expense of toxic and corrosive by-product emissions; opacity of fumes generated in a fire also are high with these modified systems. Phenolic resins, that are comparable in viscosity and cure time to polyesters and which can be handled in similar processes have been developed (75); storage stability, however, is significantly poorer. Physical properties, eg, flexural strength, flexural modulus, tensile strength, elongation, and impact strength of the phenolic/glass composites, are essentially equivalent to polyester/glass systems. Water absorption is higher in the former but modulus retention at elevated temperatures is significantly better. A comparison of flammable ratings, limiting oxygen-index values, smoke-density ratings, and by-products of decomposition for the two systems shows that the phenolic composites are superior in all categories. The phenolic resins display viscosities and cure rates that permit their application in hand lay-up, spray-gun, resin-transfer casting, filament-winding, and sheet-molding operations. Commercialization of these products has occurred in the automotive and building industries (see Laminated and reinforced plastics).

Phenolic Fibers. Flame retardance and low smoke density of phenolic resins have prompted the development of phenolic fibers. Since phenolic resins are low molecular weight materials in the uncross-linked form, propensity for fiber formation is minimal. The process used to produce phenolic fibers involves chemical reaction of a precursor novolak filament. Such filaments are extremely brittle as formed but greatly increase in strength by postcross-linking (76). The melt-drawn novolak filaments are cross-linked by exposure to formaldehyde/hydrochloric acid for several hours at up to 100°C; fiber fusion is not observed. Optimum mechanical properties develop provided the precursor novolak filaments are less than 25 μm in diameter to insure sufficient diffusion of the formaldehyde and catalyst into the fiber. Elongations of 50% and tenacities of 177 mN/tex (2 gf/den) $\times 10^3 \times$ density are typical of the cross-linked product.

By comparison, the starting novolak filaments are characterized by elongation of less than 0.1% and a tenacity of 26.5 mN/tex (0.3 gf/den) × 10^3 × density (see Novoloid fibers).

Phenolic Foam. The escalation in energy prices and the impending legislation directed at the use of flame-retardant insulation has prompted activity to improve phenolic-foam properties. Improvements include compositions of predominantly closed-cell structure and improved physical properties and continuous processing of foam insulation board (77–78). The compositions of choice are sodium hydroxide-catalyzed liquid resoles, which are neutralized and dehydrated in a controlled fashion to optimize molecular weight, viscosity, and reactivity (79). The resole product is combined with a surface-active agent, eg, a nonionic alkylene oxide–alkyl phenol or polysiloxane–oxyalkylene copolymer, a blowing agent, and an acid catalyst under high shear mixing conditions (see Surfactants and detersive systems). Depending on the preceding variables, foams of different densities and physical properties can be obtained. For example, foams of ca 0.03 g/cm^3 with compressive strengths of 172–207 kPa (25–30 psi), low friability, and with good insulation properties can be obtained (see Foamed plastics).

A specialty application for phenolic foam is in the flower-arrangement/decorative-arts industry. Lower density rapid-wetting open-cell water-saturated foam is employed. Unlike insulation foam, lack of toughness is preferred. A wetting agent is included in the formulation to ensure rapid water pick-up.

Another type of phenolic foam is made from preformed hollow microspheres. Microballoons are manufactured by spray-drying a liquid, one-step resin containing a nitrogen blowing agent into a heated dryer. The heat liberates the blowing agent, causes evaporation of the solvent and by-product water, and advances the hollow particle to the cross-linked state. Microballoons are used for density control in dynamite, bowling balls, etc (see Microencapsulation).

Graphite-Reinforced Composites. Phenolic resins developed for nonflammability, low smoke emission, and long-term elevated temperature stability to 230°C have been studied in carbon-fiber composites (see Fibers, chemical; Carbon, graphite) (80). Potential for such composites lies in advanced aircraft applications. Performance properties of the phenolic composites are evaluated in terms of thermal stability, ease of ignition, propensity to burn, smoke emission, moisture absorption, and mechanical

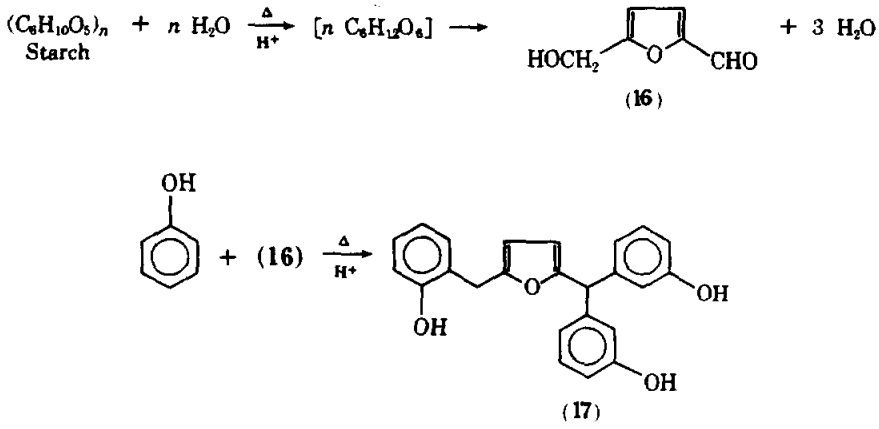
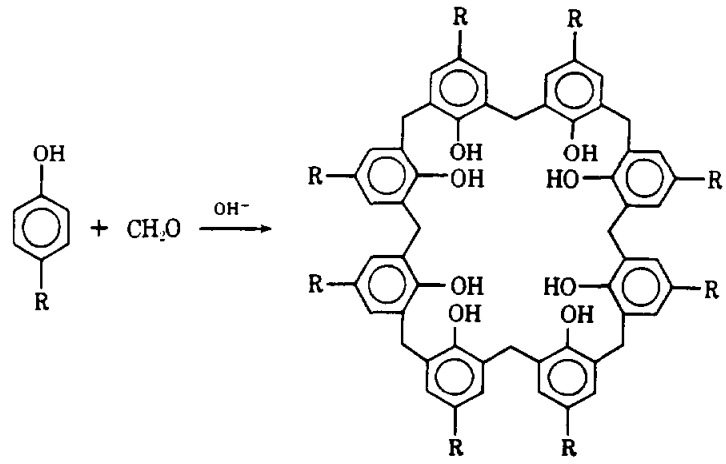


Figure 8. Hydroxymethylfurfural/phenol resins.

properties at ambient and elevated temperatures. The chemical structure of the phenolic resin affects various properties.

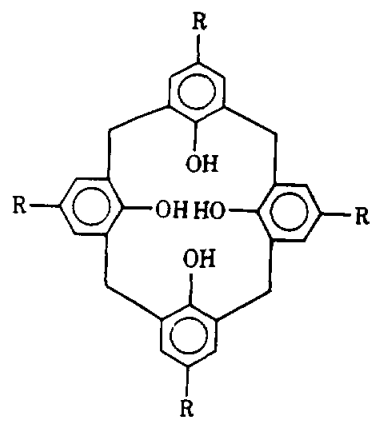
Hydroxymethylfurfural/Phenol Resins. Higher aldehydes, eg, acetaldehyde, butyraldehyde, furfuraldehyde, etc, react with phenol, but only furfuraldehyde is used in sizeable quantity in phenolic-resin applications, eg, furfuryl alcohol foundry resins. Furfural can be condensed with phenol using a basic catalyst but the mechanism of polymerization is not clear; ring opening of the furfuraldehyde has been suggested. The use of starch to generate glucose and, subsequently, hydroxymethylfurfural *in situ* has been described (see Fig. 8) (81). Whereas hydroxymethylfurfural (16) is an unstable compound, its generation in the presence of phenol leads to rapid reaction and the suppression of resinous side products. Novolak resins (17), that display properties that are comparable to conventional novolaks when cured with hexamethylenetetramine can be produced. The process involves the reaction of two mols



(18)

calixarenes

(22)



(19)

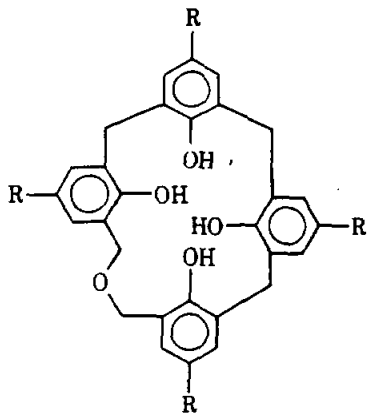
R = $C(CH_3)_3$

of phenol with one mol of corn-starch glucose with an acid catalyst at 115°C. An initial high viscosity is observed which dissipates rapidly. Ultimate heating to 160°C over a two-hour period, and neutralization with calcium hydroxide produces a phenol/furfural novolak-type resin (17). The use of starch would be expected to substantially reduce the raw-material costs of the resulting resin (see Furan derivatives).

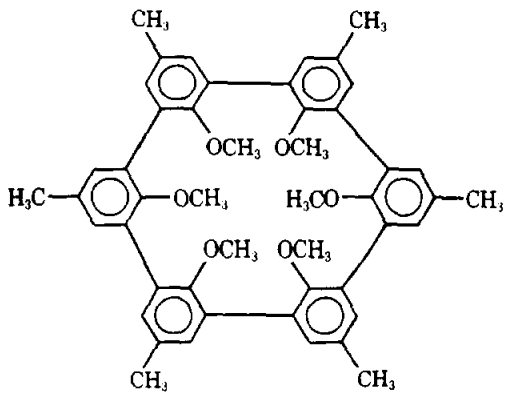
Macrocyclic Compositions

Phenol and derivatized phenol-based cyclic oligomers have been known for some time, although it has been only recently that a rigorous structural elucidation has been made (82–84). For example, the base-catalyzed condensation of *t*-butyl phenol and formaldehyde can produce a significant yield, ca 90%, of cyclic as opposed to linear condensation products. The cyclooctamer (18) and cyclotetramer (19) are formed in greatest yield, with either the cyclopentamer or cyclohexamer present in lesser amounts as a third component (see eq. 22). The relative yields of the three components can be modified to some extent by varying the reaction conditions, although the cyclooctamer (18) is the principal product. The name calixarene has been suggested for this class of compounds in view of the chalicelike molecular configuration (note the hydroxyl group orientation) and the multiplicity of arene groups in the compounds (83). Calixarenes that contain diverse functional groups, eg, nitro, acetoxy, or sulfonyl, of varying substitution levels on the phenol hydroxyl groups have been reported (85).

Other cyclic, phenol-based compounds related to (18) and (19) have been described, including those with methylene ether linkages (20) (84,86). A spherand is a different type of macrocyclic compound, that is based on *p*-cresol, etc (81). Unlike (15), (18), or (19), spherands are more rigid as a result of the absence of methylene or methylene ether bridges between the arene nuclei.



(20)



(21)

spherands

Compounds (20) and (21) are representative of a much larger group of phenol-based cyclic derivatives. Potential utilization of such compounds may include metal complexing and sequestering agents, mining chemicals, and polyfunctional catalysts (see Chelating agents).

REFERENCE # 5

National Water Summary 1984

Hydrologic Events, Selected Water-Quality Trends, and Ground-Water Resources

United States Geological Survey
Water-Supply Paper 2275

FLO[illegible]
Ground[illegible]ces

Florida contains abundant ground-water resources. Large quantities of water are obtainable from each of the principal aquifers in most areas of the State. The State also contains 27 of the 78 first-magnitude springs in the United States (Heath and Conover, 1981, p. 131). Because of its abundance and availability, ground water is the principal source of freshwater for public-supply, rural, and industrial uses, and is the source for about half of the water used for irrigation. More than one-half of the 7,300 million gallons per day (Mgal/d) of freshwater used in Florida for all purposes comes from ground-water sources (Leach, 1983), and about 90 percent of Florida's population depends on ground water for its drinking water (table 1). Nationally, Florida ranks eighth among States in total fresh ground-water withdrawals for all uses, second for public supply, first for rural domestic and livestock, third for industrial uses, and ninth for irrigation withdrawals (Solley and others, 1983). Ground water is one of Florida's most valuable natural resources.

GENERAL SETTING

The entire State is in the Coastal Plain physiographic province, which is a region that has generally low relief and is underlain by unconsolidated to poorly consolidated sediments and indurated carbonate rocks. Florida is mantled nearly everywhere by surficial sands that overlie a thick sequence of bedded limestone and dolomite. Together, the surficial sands and the limestone and dolomite form an enormous ground-water reservoir that provides proportionally larger quantities of ground water in Florida than in any other State (McGuinness, 1963, p. 244). Nearly all of Florida's ground water originates from precipitation. Relatively small amounts also are supplied by subsurface inflow from adjacent areas of Alabama and Georgia and by leakage from streams that enter Florida.

Average annual precipitation (1951–80) exceeds 50 inches (in.) over most of the State. Part of this precipitation percolates to the water table and recharges the ground-water reservoir. Annual recharge rates range from near zero in perennially wet, lowland areas to as much as 20 in. or more in well-drained upland areas. In much of the State, most of this recharge moves through the surficial aquifers and discharges to nearby streams; only a small fraction, ranging from nearly 0 to 5 in. (Bush, 1982), percolates downward to recharge deeper aquifers.

PRINCIPAL AQUIFERS

Principal aquifers of Florida are described below and in table 2, from youngest to oldest; their areal distribution is shown in figure 1.

BISCAYNE AQUIFER

The Biscayne aquifer is the most intensively developed of all the Florida aquifers. It supplies the densely populated Miami-Palm Beach coastal area with virtually all of its water needs. The Biscayne aquifer underlies all of Dade and Broward Counties and adjoining parts of Palm Beach and Monroe Counties. It is primarily highly permeable limestone in south and west Dade County but becomes increasingly sandy and less permeable to the north and east. The high permeability is caused largely by extensive carbonate dissolution. Large-diameter public-supply wells in Dade County produce as much as 7,000 gallons per minute (gal/min), with little water-level drawdown. Water in the Biscayne aquifer is unconfined and in hydraulic continuity with the many canals that cross the area. Induced recharge from the canals occurs where the water table is depressed below canal stage near well fields. Water-level stages in the canals are controlled by structures near their mouths to prevent saltwater from flowing inland to the well fields and, there, infiltrating the aquifer.

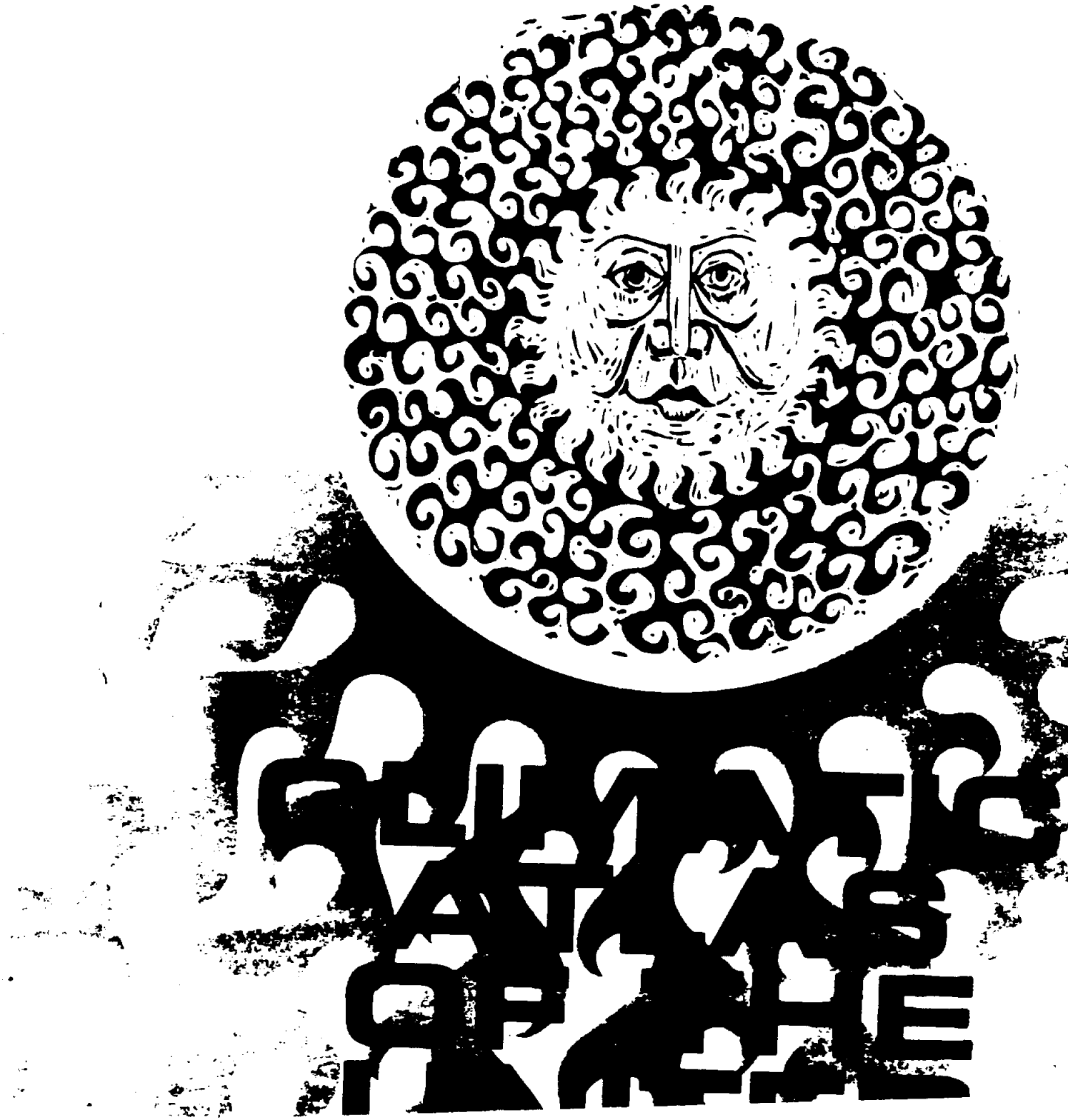
Because the Biscayne aquifer is very permeable and very vulnerable to contamination and is the sole source of drinking water for more than 3 million people in southeast Florida, the U.S. Environmental Protection Agency has designated it as a

Table 1. Ground-water facts for Florida

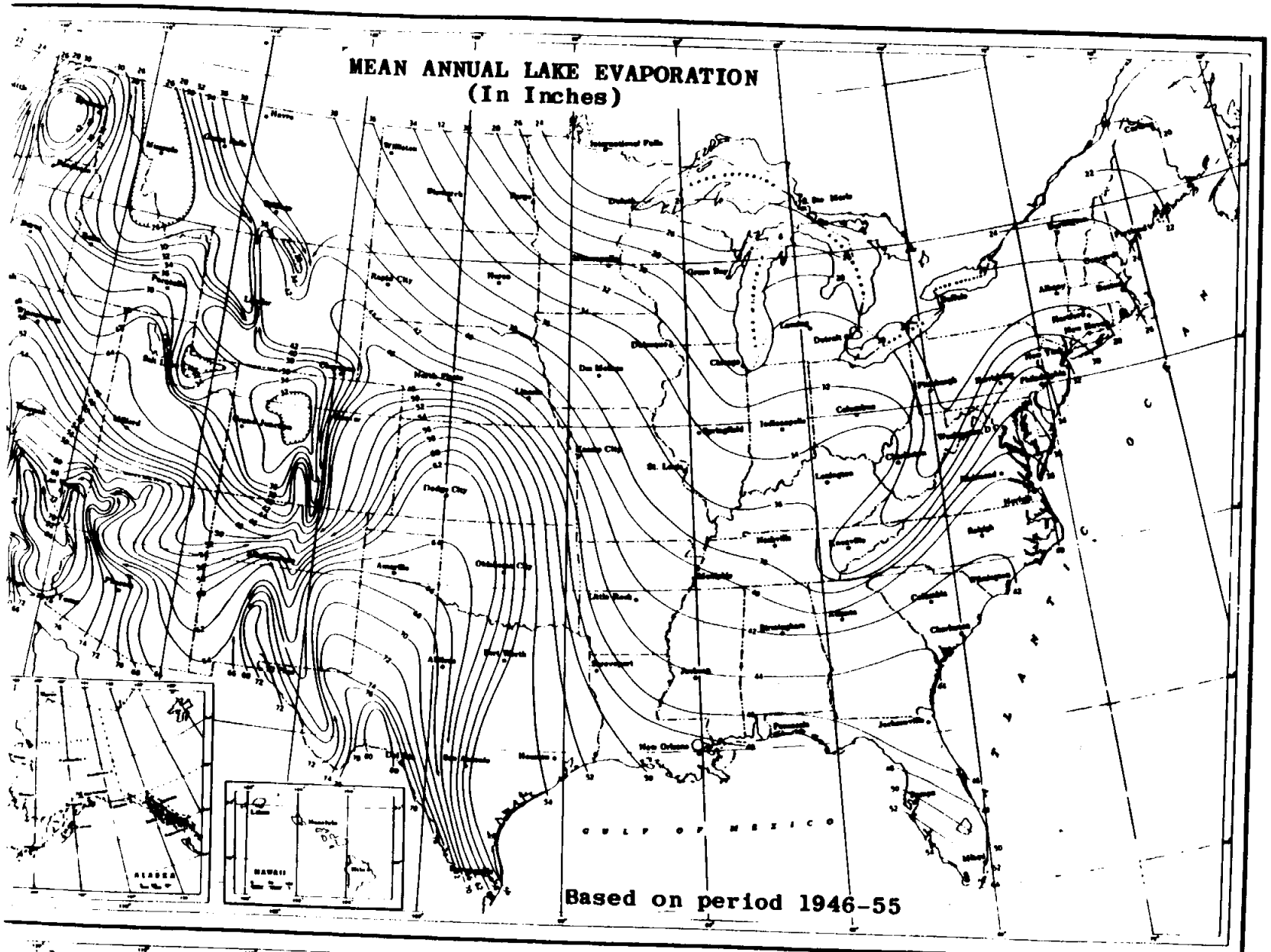
[Withdrawal data rounded to two significant figures and may not add to totals because of independent rounding. Mgal/d = million gallons per day; gal/d = gallons per day. Source: Solley, Chase, and Mann, 1983]

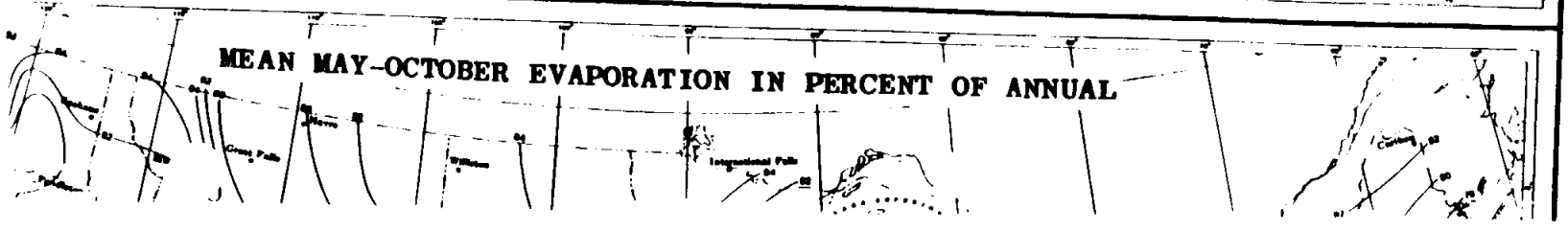
Population served by ground water, 1980	
Number (thousands)	8,750
Percentage of total population	90
From public water-supply systems:	
Number (thousands)	6,800
Percentage of total population	70
From rural self-supplied systems:	
Number (thousands)	1,950
Percentage of total population	20
Freshwater withdrawals, 1980	
Surface water and ground water, total (Mgal/d)	7,300
Ground water only (Mgal/d)	3,800
Percentage of total	52
Percentage of total excluding withdrawals for thermoelectric power	69
Category of use	
Public-supply withdrawals:	
Ground water (Mgal/d)	1,200
Percentage of total ground water	31
Percentage of total public supply	86
Per capita (gal/d)	176
Rural-supply withdrawals:	
Domestic:	
Ground water (Mgal/d)	250
Percentage of total ground water	7
Percentage of total rural domestic	100
Per capita (gal/d)	128
Livestock:	
Ground water (Mgal/d)	39
Percentage of total ground water	1
Percentage of total livestock	66
Industrial self-supplied withdrawals:	
Ground water (Mgal/d)	710
Percentage of total ground water	19
Percentage of total industrial self-supplied:	
Including withdrawals for thermoelectric power	27
Excluding withdrawals for thermoelectric power	82
Irrigation withdrawals:	
Ground water (Mgal/d)	1,600
Percentage of total ground water	42
Percentage of total irrigation	53

REFERENCE # 6

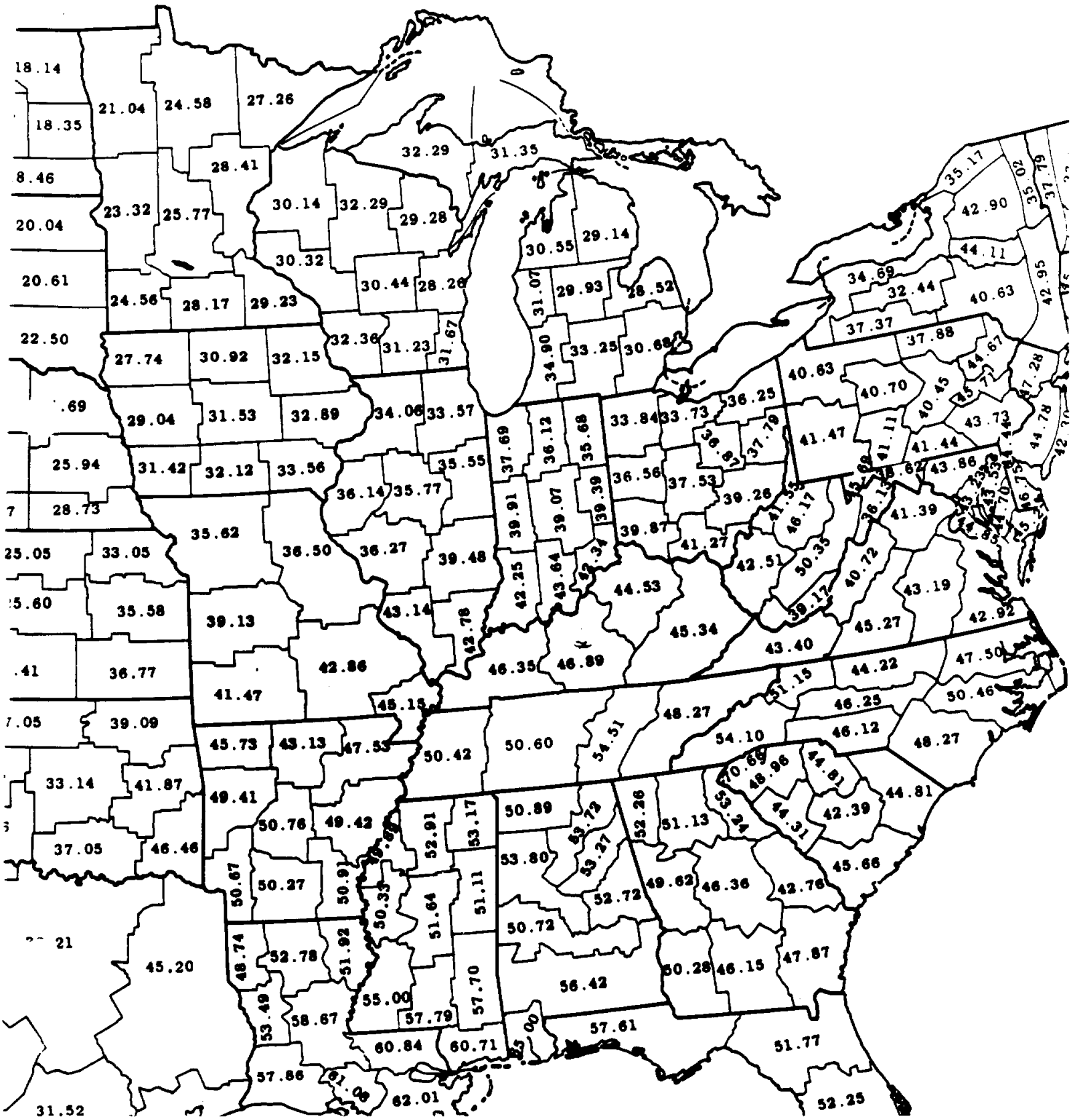


APORATION


MEAN ANNUAL LAKE EVAPORATION
(In Inches)
GULF OF MEXICO
Based on period 1946-55


MEAN MAY-OCTOBER EVAPORATION IN PERCENT OF ANNUAL

ION (inches) BY STATE CLIMATIC DIVISIONS



U.S. DEPARTMENT OF COMMERCE
Luther H. Hodges, Secretary

WEATHER BUREAU
F. W. Reichelderfer, Chief

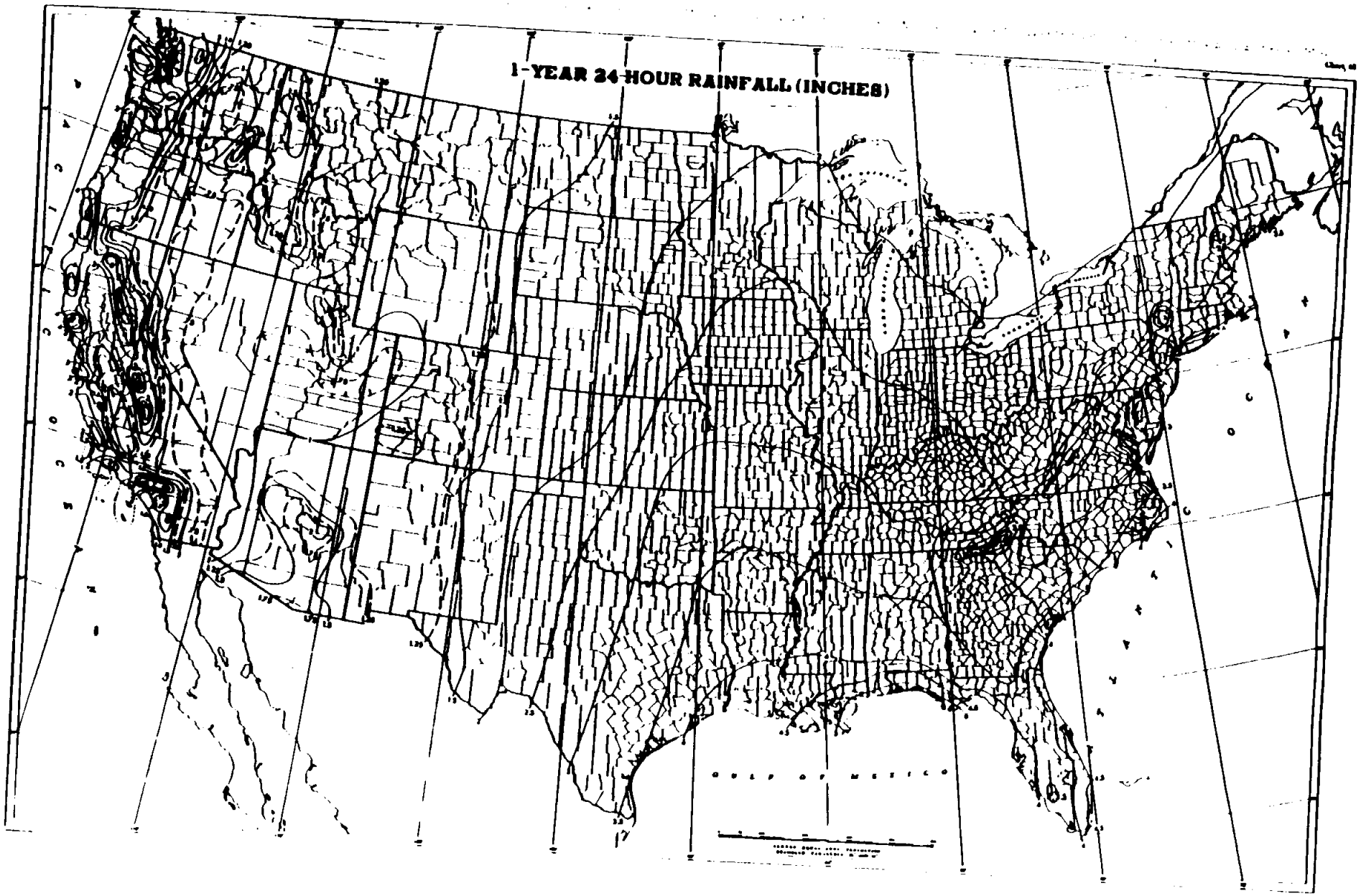
TECHNICAL PAPER NO. 40

RAINFALL FREQUENCY ATLAS OF THE UNITED STATES

for Durations from 30 Minutes to 24 Hours and Return Periods from 1 to 100 Years

Prepared by
DAVID M. HERSHFIELD
Cooperative Studies Section, Hydrologic Services Division
for
Engineering Division, Soil Conservation Service
U.S. Department of Agriculture

PROPERTY OF EPA
FIT IV


1-YEAR 24-HOUR RAINFALL (INCHES)

REFERENCE # 9

STATE OF FLORIDA
STATE BOARD OF CONSERVATION
DIVISION OF GEOLOGY

FLORIDA GEOLOGICAL SURVEY
Robert O. Vernon, Director

REPORT OF INVESTIGATIONS NO. 43

GROUND WATER IN DUVAL AND NASSAU COUNTIES, FLORIDA

By
Gilbert W. Leve, Geologist

Prepared by the
UNITED STATES GEOLOGICAL SURVEY
in cooperation with the
DIVISION OF GEOLOGY
and
DUVAL COUNTY
and the
CITY OF JACKSONVILLE

1966

Cushman, *Lepidocyclina ocalana pseudomarginata* Cushman, *Operculinoides ocalana* Cushman, *Operculinoides floridensis* (Heilprin), *Sphaerogypsina globula* (Ruess), *Nummulites vanderstoki* Rutten and Vermunt, *Heterostegina ocalana* Cushman.

HAWTHORN FORMATION

Rocks of middle Miocene age in peninsular Florida were first named the Hawthorn Formation by Dall and Harris (1892, p. 107). The Hawthorn Formation lies unconformably on the eroded surface of the Ocala Group throughout all of northeast Florida.

As shown in the geologic cross sections in figure 4, the thickness of the Hawthorn Formation ranges from about 250 feet in southern Duval County to about 500 feet in north-central Duval and central Nassau counties. Locally, the formation may vary in thickness by as much as 50 feet where it fills depressions in the irregular surface of the Crystal River Formation.

The Hawthorn Formation consists of gray to blue-green calcareous, phosphatic sandy clays and clayey sands, interbedded with thin, discontinuous lenses of fine to medium phosphatic sand, phosphatic sandy limestone, and gray hard dolomite. The limestone and dolomite lenses are thicker and more prevalent near the base of the formation than in the higher parts. They occasionally contain some poorly preserved mollusk casts and molds. The only other fossils in the formation are sharks' teeth, which are most often found in the clay beds.

UPPER MIOCENE OR PLIOCENE DEPOSITS

Deposits overlying the Hawthorn Formation in peninsular Florida were described by Cooke and Mossom (1929, p. 152) and Cooke (1945) as being Pliocene in age. They have been more recently described by Vernon (1951, figs. 13,33) as late Miocene in age. Because their age has not been determined exactly, they are referred to in this report as Pliocene or upper Miocene deposits.

Pliocene and upper Miocene deposits are the oldest rocks exposed at the surface in northeast Florida. They are exposed in road cuts, excavations, and the banks and beds of many streams in the area. As shown in the geologic cross sections (fig. 4), these deposits are about 100 feet thick adjacent to the St. Johns River in central Duval County and in central and eastern Nassau County, and less than 20 feet thick in western Duval and eastern Baker counties.

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PLEISTO

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The Pliocene or upper Miocene deposits consist of interbedded gray-green calcareous silty clay and clayey sand; fine-to medium-grained, well-sorted sand; shell; and cream to brown soft, friable limestone. They differ from the underlying Hawthorn Formation in that they contain little or no phosphate. The limestone is most prevalent at the base of the deposits and together with sand and shell form a laterally extensive, continuous, relatively permeable zone which locally is as much as 40 feet thick.

The contact between the Pliocene or upper Miocene deposits and the Hawthorn Formation is an unconformity generally marked by a course phosphatic sand and gravel bed. However, the contact between the Pliocene or upper Miocene deposits and the overlying Pleistocene and Recent deposits is not clearly defined. In some wells, particularly in the eastern and northern parts of the area, the contact appears to be gradational.

PLEISTOCENE AND RECENT DEPOSITS

Undifferentiated sediments of Pleistocene and Recent age blanket most of northeast Florida, except where they have been completely eroded by streams. As shown in the geologic cross sections (fig. 4), the deposits are more than 150 feet thick in eastern Baker County and average about 20 feet in thickness in central and eastern Duval and Nassau counties.

The Pleistocene and Recent deposits in the western part of the area consist primarily of fine- to medium-grained, poorly sorted sand and clayey sand, locally stained yellow or orange by iron oxide. In the central and eastern parts of the area, the deposits are predominantly loose sand and gray to green clayey sand, containing some shell beds near the coast.

STRUCTURE

The structural contour lines in figure 5 reflect the eroded surface of the Avon Park Limestone and Crystal River Formation. At the contour interval shown in the figure, the small irregularities on the surface of the formations are not apparent and the configuration of the lines reflects the approximate subsurface structure of the formations. As shown, the surface of the Avon Park Limestone strikes approximately northwest-southeast and dips northeast at about 9 feet per mile in the western part of the area, and strikes northeast-southwest and irregularly dips northwest about 16 to 20 feet per mile in the eastern part.

The shallow aquifer system, which is 300 to 550 feet thick in the area, extends from the surface into the Hawthorn Formation. The aquifers within the system consist of relatively discontinuous, porous limestone, shell, and sand lenses within the Hawthorn Formation, the upper Miocene or Pliocene deposits, and the Pleistocene to Recent deposits. The aquifers are recharged directly by local rainfall and by downward infiltration of water from shallower aquifers in the system.

The aquifers in the shallow aquifer system most utilized by wells in the area are the surficial sand beds and a relatively continuous limestone, shell, and sand zone at the base of the upper Miocene or Pliocene deposits. As the thickness and lithology of these aquifers vary both vertically and laterally, the amount of water available from them depends on the location and depth of the well. Generally, the surficial sand beds yield about 10 to 25 gpm, and the aquifer at the base of the upper Miocene or Pliocene deposits yields between 15 and 20 gpm to small-diameter wells.

As more information is obtained on these aquifers, it may be possible to determine the proper location and construction of wells to obtain more water. It may also be possible to recharge artificially one or more of the aquifers so that more water is available to wells. These aquifers may become a major source of ground water, particularly if the water in the underlying Floridan aquifer system becomes contaminated by salt water.

The Floridan aquifer system, which is composed primarily of limestones of Eocene age, is the principal source of fresh water in northeast Florida. The top of the Floridan aquifer system, which ranges from 300 to 550 feet below msl, is overlain by an aquiclude of relatively impermeable clay, sandy clay, and dolomite beds in the Hawthorn Formation and in the upper Miocene or Pliocene deposits that separate it from the shallow aquifer system.

Current-meter studies and information obtained while wells were being constructed indicate that there are at least three separate permeable zones within the Floridan aquifer system in northeast Florida. The first zone includes all the formations of the Ocala Group and, locally, limestone at the base of the Hawthorn Formation and at the top of the Avon Park Limestone. In the vicinity of Jacksonville, the second zone is in the top part of the Lake City Limestone, and the third zone is within the Lake City Limestone, below a depth of about 1,200 feet. However, in Fernandina Beach, the Lake City Limestone contains only one permeable zone, and a third zone is present below the Lake City

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REFERENCE # 10

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GROUNDWATER

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Table 2.2 Range of Values of Hydraulic Conductivity and Permeability

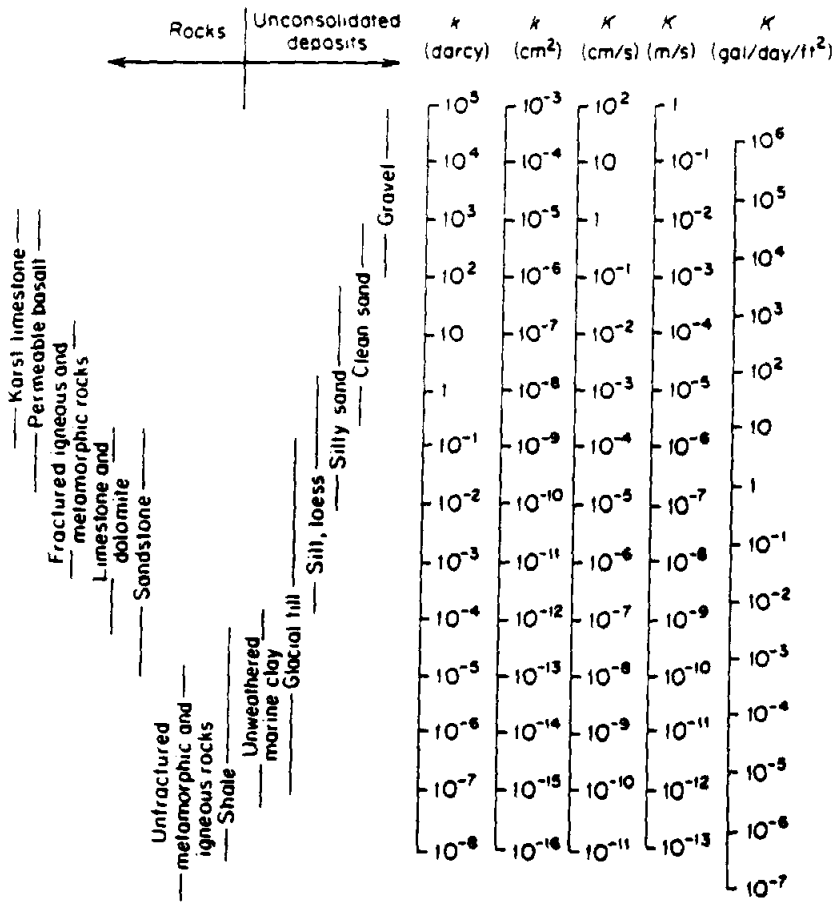

Table 2.3 Conversion Factors for Permeability and Hydraulic Conductivity Units

	Permeability, k*			Hydraulic conductivity, K		
	cm²	ft²	darcy	m/s	ft/s	U.S. gal/day/ft²
cm²	1	1.08×10^{-3}	1.01×10^{8}	9.80×10^{2}	3.22×10^{3}	1.85×10^{9}
ft²	9.29×10^{2}	1	9.42×10^{10}	9.11×10^{5}	2.99×10^{6}	1.71×10^{12}
darcy	9.87×10^{-9}	1.06×10^{-11}	1	9.66×10^{-6}	3.17×10^{-5}	1.82×10^{1}
m/s	1.02×10^{-3}	1.10×10^{-6}	1.04×10^{5}	1	3.28	2.12×10^{6}
ft/s	3.11×10^{-4}	3.35×10^{-7}	3.15×10^{4}	3.05×10^{-1}	1	6.46×10^{5}
U.S. gal/day/ft²	5.42×10^{-10}	5.83×10^{-13}	5.49×10^{-2}	4.72×10^{-7}	1.55×10^{-6}	1

*To obtain k in ft², multiply k in cm² by 1.08×10^{-3}.

REFERENCE # 11

AVAILABILITY AND QUALITY OF WATER FROM SHALLOW AQUIFERS IN DUVAL COUNTY, FLORIDA

By L. V. Causey and G. G. Phelps

U.S. GEOLOGICAL SURVEY

Water-Resources Investigations 78-92

Prepared in cooperation with

U.S. ARMY CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

1978

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AVAILABILITY AND QUALITY OF WATER FROM SHALLOW AQUIFERS IN DUVAL COUNTY, FLORIDA

By

L. V. Causey and G. G. Phelps

ABSTRACT

The shallow-aquifer system in Duval County overlies the Floridan aquifer and is composed chiefly of sand, clay, sandy clay, and limestone. Thickness of the system ranges from about 300 to 600 feet. The upper 150 feet of deposits, consisting of the water-table and shallow-rock zones, are the most dependable and economical source of supplemental water supply. The principal shallow water-bearing zone is a limestone bed 40 to 100 feet below land surface.

Aquifer tests conducted at 13 sites in Duval County show that yields from the shallow aquifer vary from place to place within the county owing chiefly to variations in lithology of the saturated rocks and sediments. The limestone of the shallow-rock zone will yield as much as 200 gallons per minute to wells; the maximum yield at most of the sites tested was between 30 and 100 gallons per minute. The water-table zone generally yields 10 gallons per minute or less but at one site, where a water-table well tapped a shell bed near land surface, the well yielded more than 40 gallons per minute.

The quality of water in the shallow aquifer system in Duval County is generally acceptable for most domestic, commercial, and industrial uses. In some places, however, it has a high iron concentration and is hard. The iron concentration exceeds 0.3 milligrams per liter in water from the water-table or shallow-rock zones at 7 of the 13 aquifer test sites. The hardness of water from the aquifer ranges from about 60 to about 180 milligrams per liter.

INTRODUCTION

Jacksonville, which includes most of Duval County, is the largest city in northern Florida. Rapid growth in parts of the city has created a need for information on sources of water for future supplies. At the present time (1977), practically all of the water used in Jacksonville comes from wells in the Floridan aquifer. Potential sources of additional freshwater in the area are surface streams and shallow aquifers above the Floridan aquifer.

As part of a Metropolitan Jacksonville Water Resources Investigation, the U.S. Army Corps of Engineers, Jacksonville District, is conducting an investigation to determine the feasibility of utilizing various sources of water in the area to supplement present supplies. The U.S. Geological Survey is assisting the U.S. Army Corps of Engineers in obtaining data to determine if using the shallow-aquifer system as a supplemental supply of fresh water in Jacksonville is feasible.

For those readers who prefer metric units rather than U.S. customary units, the conversion factors for terms used in this report are listed below:

Multiply U.S. customary unit	By	To obtain metric unit
inch (in)	25.40	millimeter (mm)
foot (ft)	0.305	meter (m)
mile (mi)	1.609	kilometer (km)
gallon per minute (gal/min)	0.0631	liter per second (L/s)
feet per day (ft/d)	.305	meters per day (m/day)
feet^2/day (ft^2/d)	.0929	meters squared per day (m^2/day)

Purpose and Scope

The purpose of this investigation is to obtain information about the shallow aquifer system, including the location of waterbearing zones, their water-yielding characteristics, the quality of water obtained, the hydraulic interrelation of zones within the shallow aquifers, and the variability of all these. The information will be used by the U.S. Army Corps of Engineers to evaluate the water-supply potential of the shallow aquifer system in Duval County. To obtain information at as many sites as possible, numerous small diameter test holes were drilled and cased. Casing diameters were 1 1/4 to 2 in. This report also outlines field procedures that can be used to evaluate the potential yield of shallow aquifers at sites not studied in this investigation.

Area of Investigation

Duval County occupies about 840 mi^2 in northeastern Florida (fig. 1). Most of the county is within the corporate limits of the Consolidated City of Jacksonville.

The county has a humid, semitropical climate and an average annual rainfall of about 54 in. Rainfall is generally greatest from May to August when summer thunderstorms may yield several inches of rain in one part of the county and only a trace or none in other parts.

The topography in Duval County is mostly flat, but slopes gradually from sea level along the coast to about 190 ft above sea level in the southwest corner. Salt marshes cover much of the eastern part of the county and many freshwater swamps occupy the flat upland areas.

Surface drainage is primarily through the St. Johns and St. Marys Rivers, and their tributaries. The St. Johns River flows northeastward through the county and empties into the Atlantic Ocean. It is affected by tide throughout its length in Duval County.

Previous Investigations

Fairchild (1972) describes the geology, extent, some of the hydrologic characteristics of the shallow aquifer system, and the general geography of Duval County. Derragon (1955), Leve (1961; 1966), and Leve and Goolsby (1969) cite general information on the shallow aquifer system and Cooke (1945), Vernon (1951), Puri and Vernon (1964), and Leve (1966) describe the formations that make up the system.

Well-Numbering System

Two well numbering systems are used in this report. The U.S. Geological Survey identification number is based on latitude-longitude coordinates and a sequential number for the particular area proscribed by the final digit of seconds for those coordinates (table 1). Also used is a local well number prefixed by the letters, DS, indicating a shallow well in Duval County. Any available historic data may be obtained from computer files by using the U.S. Geological Survey identification number. Inquiries regarding availability of such data may be made to the U.S. Geological Survey District Office in Tallahassee, Florida.

Acknowledgments

The authors express appreciation to Oscar Rawls, City Engineer, Department of Public Works, Jacksonville, for granting permission to construct test wells on City road rights-of-way; to J. A. Moss, District Maintenance Engineer, Florida Department of Transportation, Lake City, for granting permission to construct test wells along State road rights-of-way; and to D. F. Duggins, Manager of Plant Services, Duval County School Board, Jacksonville, for permission to construct wells on Duval County Schools property.

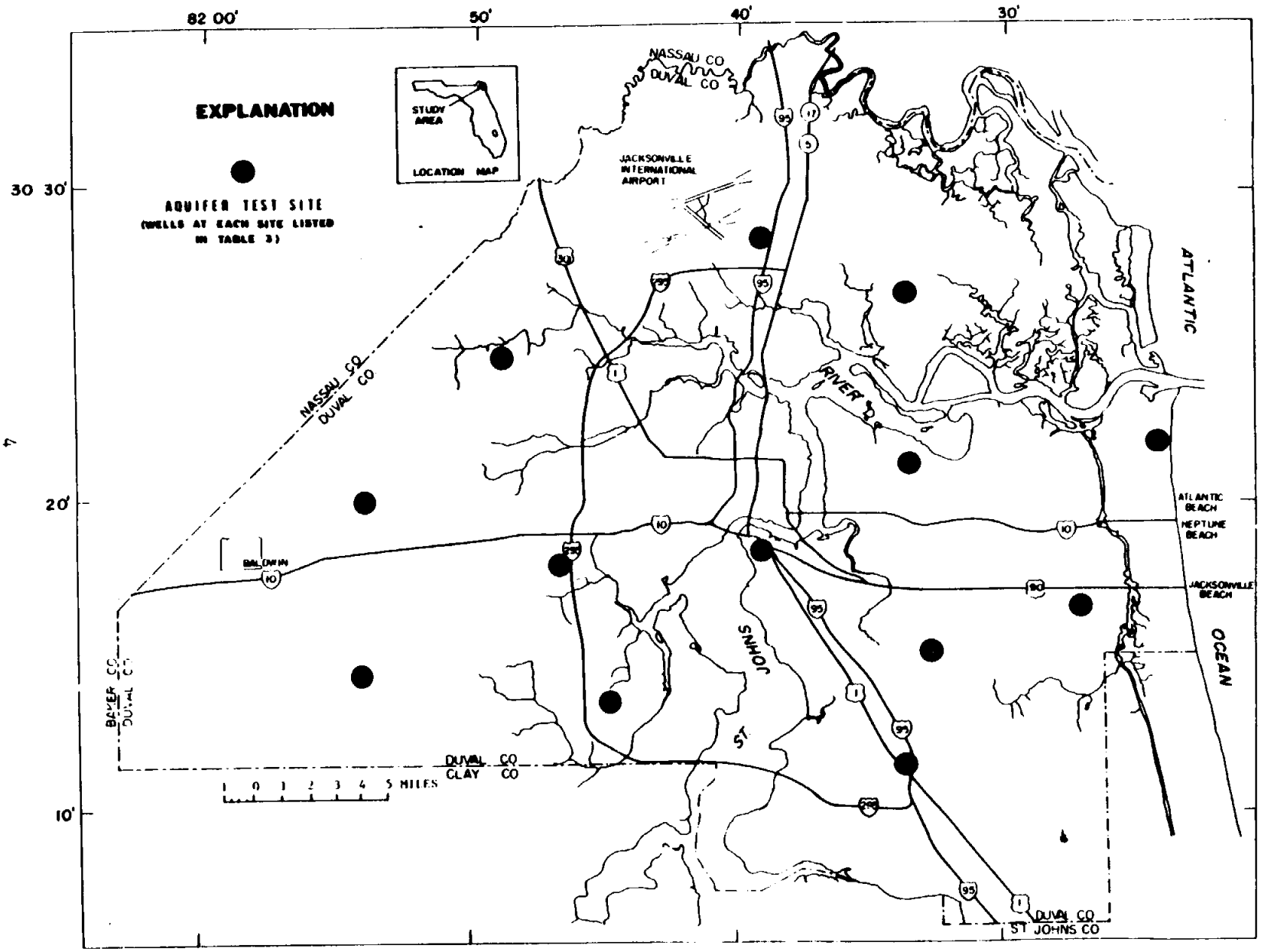


Figure 1.--Area of investigation and location of shallow aquifer test sites.

TABLE 1.--Well numbers

	Well number	Local number	U.S. Geological Survey identification number
Site 1	1	DS-244(b)	301647 0812741 01
	2	DS-245	301647 0812741 02
	3	DS-262	301647 0812741 03
	4	(a)	
Site 2	1	DS-256(b)	302215 0812431 01
	2	DS-257	302215 0812431 02
	3	DS-263	302215 0812431 03
	4	(a)	
Site 3	1	DS-248	302113 0813337 01
	2	DS-249(b)	302113 0813337 02
	3	DS-260	302113 0813337 03
	4	(a)	
Site 4	1	DS-246(b)	301503 0813311 01
	2	DS-247	301503 0813311 02
	3	DS-261	301503 0813311 03
	4	(a)	
Site 5	1	DS-242	301111 0813334 01
	2	DS-243(b)	301111 0813334 02
	3	DS-269	301111 0813334 03
	4	(a)	
Site 6	1	DS-252	301333 0814425 01
	2	DS-253(b)	301333 0814425 02
	3	DS-264	301333 0814425 03
	4	(a)	
Site 7	1	DS-240(b)	301758 0814631 03
	2	DS-241	301758 0814631 03
	3	(a)	
Site 8	1	DS-254	302003 0815412 01
	2	DS-255(b)	302003 0815412 02
	3	(a)	
Site 9	1	DS-238(b)	301422 0815412 03
	2	DS-239	301422 0815412 04
	3	(a)	
Site 10	1	DS-232(b)	302427 0814910 01
	2	DS-233	302427 0814910 02
	3	DS-272	302427 0814910 03
	4	(a)	
Site 11	1	DS-250(b)	301806 0813850 05
	2	DS-251	301806 0813850 06
	3	(a)	
Site 12	1	DS-236(b)	302633 0813330 01
	2	DS-237	302633 0813330 02
	3	DS-265	302633 0813330 03
	4	(a)	
Site 13	1	DS-234	302835 0813903 01
	2	DS-235(b)	302835 0813903 02
	3	(a)	

[a] Indicates temporary water-table well constructed by driving plastic pipe into the ground. These wells were removed at the end of the investigation and so were not cataloged by the U. S. Geological Survey.

[b] Indicates pumped well in aquifer tests.

SHALLOW-AQUIFER SYSTEM

The shallow-aquifer system overlies the Floridan aquifer and consists chiefly of sand, clay, sandy clay, and limestone. It ranges in thickness from about 300 ft in the south-central part of the county to about 600 ft in the northcentral part (figs. 2 and 3). The deposits between about 150 ft below land surface and the top of the Floridan aquifer are mostly clay and sandy clay interbedded with thin, discontinuous layers or local lenses of limestone and sand. Aquifers within that zone are not usually dependable sources of water. Because the shallower zone is generally more productive and less expensive to develop than the deeper zone, this study describes only the upper 150 ft of the shallow-aquifer system.

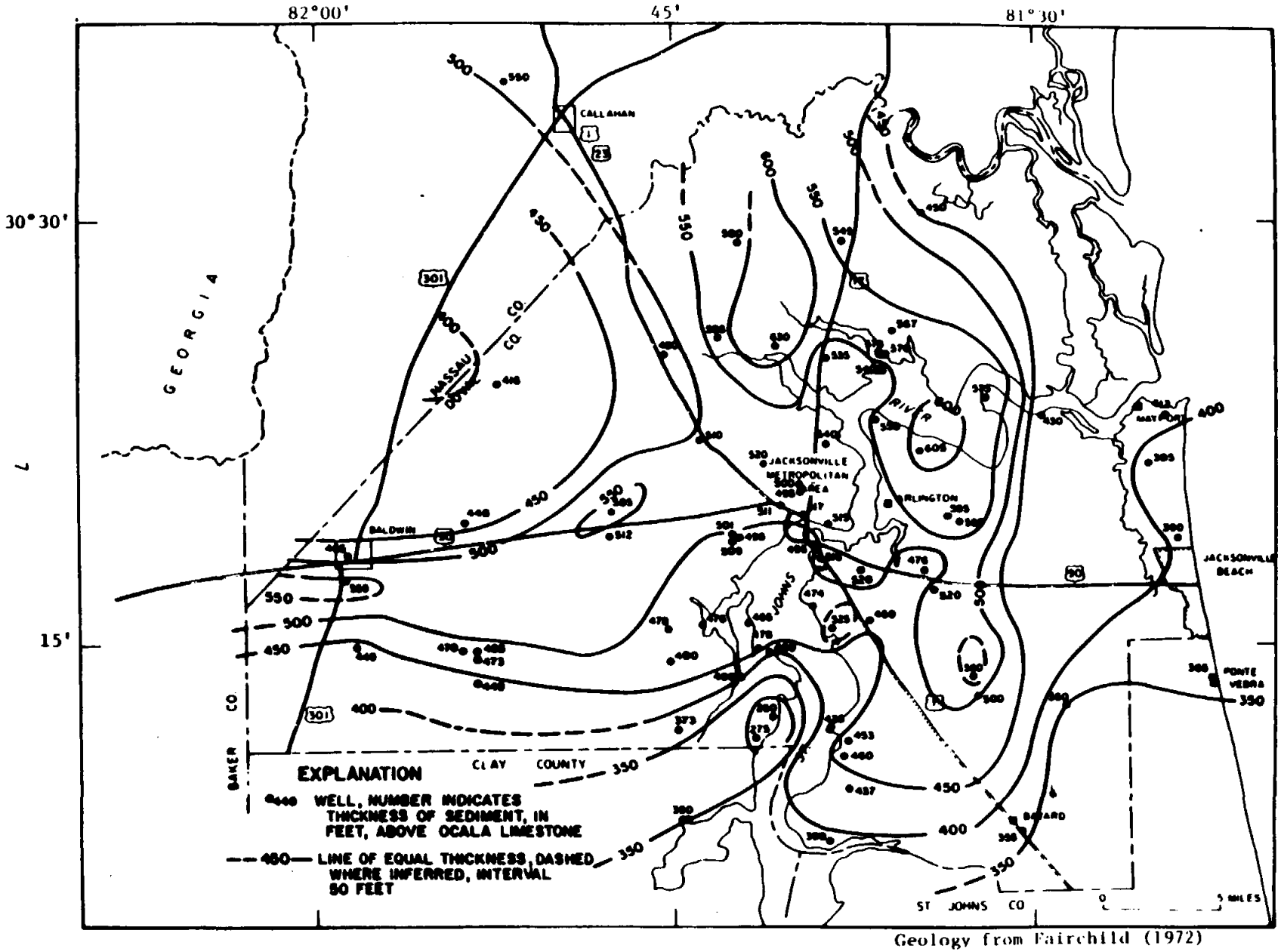
The sediments from land surface to a depth of about 25 to 50 ft comprise the water table zone. Below the surficial sands of the water table zone, beds of lower permeability occur in most parts of the county. These beds are underlain by the principal shallow water-bearing zone, a limestone bed 40 to 100 ft below land surface. This limestone is absent along the coast and locally in the south-central part of the county. In those areas the principal shallow water-bearing zone is a medium- to coarse-grained sand. The principal shallow water-bearing zone is known locally as the shallow-rock aquifer.

The permeability of the beds between the water table zone and the shallow-rock aquifer zone varies widely throughout the county. In some areas the shallow-rock aquifer is confined and is under artesian or leaky-artesian conditions, whereas in other areas the water table and shallow-rock zones function as a single hydrologic unit.

SHALLOW-AQUIFER TESTS

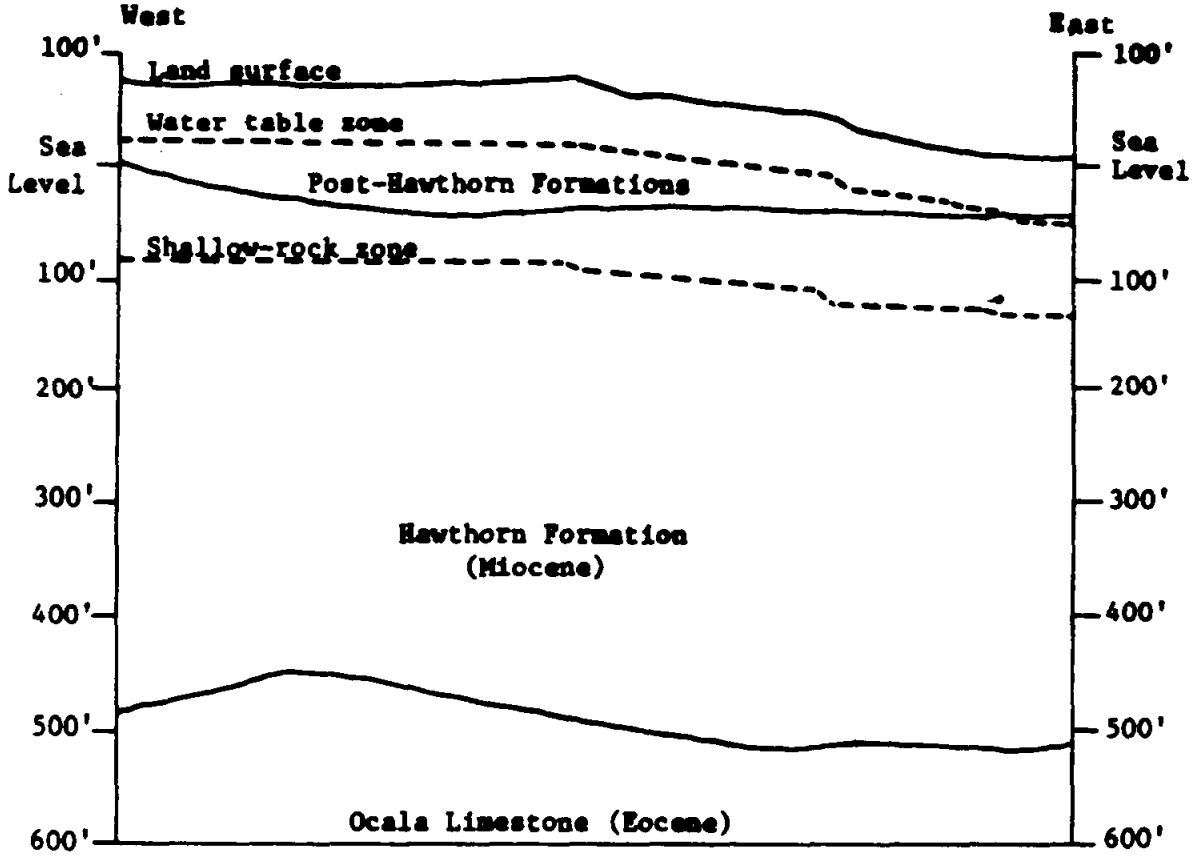
Method

Thirteen test sites were selected in Duval County (fig. 1, table 1) to better define the hydraulic characteristics of the shallow system. Two shallow-rock wells and one or two water-table wells were drilled at each site. Because little was known about the thickness of water-bearing zones, hydraulic characteristics, and yield of the shallow aquifer system, instrumentation and the tests were simplified so maximum areal coverage could be obtained with available funding. Well logs showing well design, water level on the date of drilling, lithology, and principal aquifer at each site are depicted in figure 4. The logs were prepared from driller's logs and examination of well cuttings. The completion depths of the shallow-rock wells range from 46 ft to 104.5 ft except at site 10 where they are 210 and 241 ft. Mud-filled cavities in the limestone at depths of 100 to 120 ft at site 10 made it necessary to drill the wells deeper to obtain clear water. The water table wells are 3.2 to 30 ft deep. Pertinent drilling and well-construction information for each site is listed in table 2.



Geology from Fairchild (1972)

Figure 2.—Thickness of the sediments overlying the Floridan aquifer.



Geohydrology modified from Fairchild, 1972.

Explanation--Dashed lines represent approximate lower limit of the respective shallow-aquifer zones.

Series	Formation	Lithologic Description
Holocene Pleistocene	Holocene and Pleistocene Deposits	Sand, tan to yellow, loose, medium to fine quartz, sometimes with shells and/or minor clay content--often has hardpan layer of iron oxide-cemented, rusty red to dark brown medium to find sand in upper part of section--source of water to shallow sandpoint wells.
Pliocene or Miocene	Pliocene or Upper Miocene Deposits	Upper part-tan to buff, fine to coarse sand and gray to light gray sandy clay, clayey sand, and shell beds; clay often contains abundant mollusk shells. Lower part-limestone, tan to yellow, often highly sandy, porous, and cavernous--also few thin beds of brown crystalline, dolomitic, limestone--section is major source of water to shallow wells.
Miocene	Hawthorn Formation	Gray to blue-green and olive-green clay, sandy clay, and sandy limestone--usually phosphatic with abundant, well-rounded, polished, granules and pebbles of phosphate. Formation not usually considered a good source of water; some wells tap lenses of sand and limestone in the upper part.

Figure 3.--Schematic geohydrologic section showing stratigraphic units of the shallow-aquifer system.

Hydrogeologic Framework of the Floridan Aquifer System in Florida and in Parts of Georgia, Alabama, and South Carolina

REFERENCE # 13

By JAMES A. MILLER

REGIONAL AQUIFER-SYSTEM ANALYSIS

U.S. GEOLOGICAL SURVEY PROFESSIONAL PAPER 1403–B

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FIT IV

UNITED STATES GOVERNMENT PRINTING OFFICE, WASHINGTON: 1986

about 13,000 ft^2/d (Ryder, 1982). Hawthorn limestone beds that are local aquifers yield up to 750 gal/min (Boggess, 1974).

FLORIDAN AQUIFER SYSTEM

GENERAL

The Floridan aquifer system is a thick sequence of carbonate rocks generally referred to in the literature as the "Floridan aquifer" in Florida and the "principal artesian aquifer" in Georgia, Alabama, and South Carolina. As defined in this report, the Floridan aquifer system encompasses more of the geologic section and extends over a wider geographic area than either the Floridan or the principal artesian aquifer, as those aquifers have been described in the literature. Figure 7 shows the geologic formations in Florida and southeastern Georgia that were called "principal artesian formations" by Stringfield (1936), those that were included in the "Floridan aquifer" as defined by Parker and others (1955), and those placed in the "principal artesian aquifer" as defined by Stringfield (1966). Subsequent deep drilling and hydraulic testing have shown that highly permeable carbonate rocks extend to deeper stratigraphic horizons than those included in either the "Floridan" or "principal artesian" aquifers as originally described. Accordingly, this author (cited by Franks, 1982) extended the base of the Floridan aquifer downward to include part of the upper Cedar Keys Limestone (fig. 7). Limestone and dolomite beds that commonly occur at the base of the Hawthorn Formation have been included as part of the "Floridan" or "principal artesian" aquifer in most previous reports. However, data collected for the present study show that, except very locally, there are no high-permeability carbonate rocks in the lower part of the Hawthorn Formation that are in direct hydraulic contact with the main body of the Floridan aquifer system.

The Hawthorn Formation was thus excluded from the aquifer system in a report by Miller (1982a) that was one of a series of several interim reports published during the present study. In these interim reports, the aquifer system was called the "Tertiary limestone aquifer system of the Southeastern United States." This cumbersome, albeit more accurate, terminology has subsequently been abandoned, and the aquifer system is referred to in this professional paper as the "Floridan aquifer system" (see Johnston and Bush, 1985 for a more detailed history of the terminology applied to the aquifer system).

The Floridan aquifer system is defined in this report

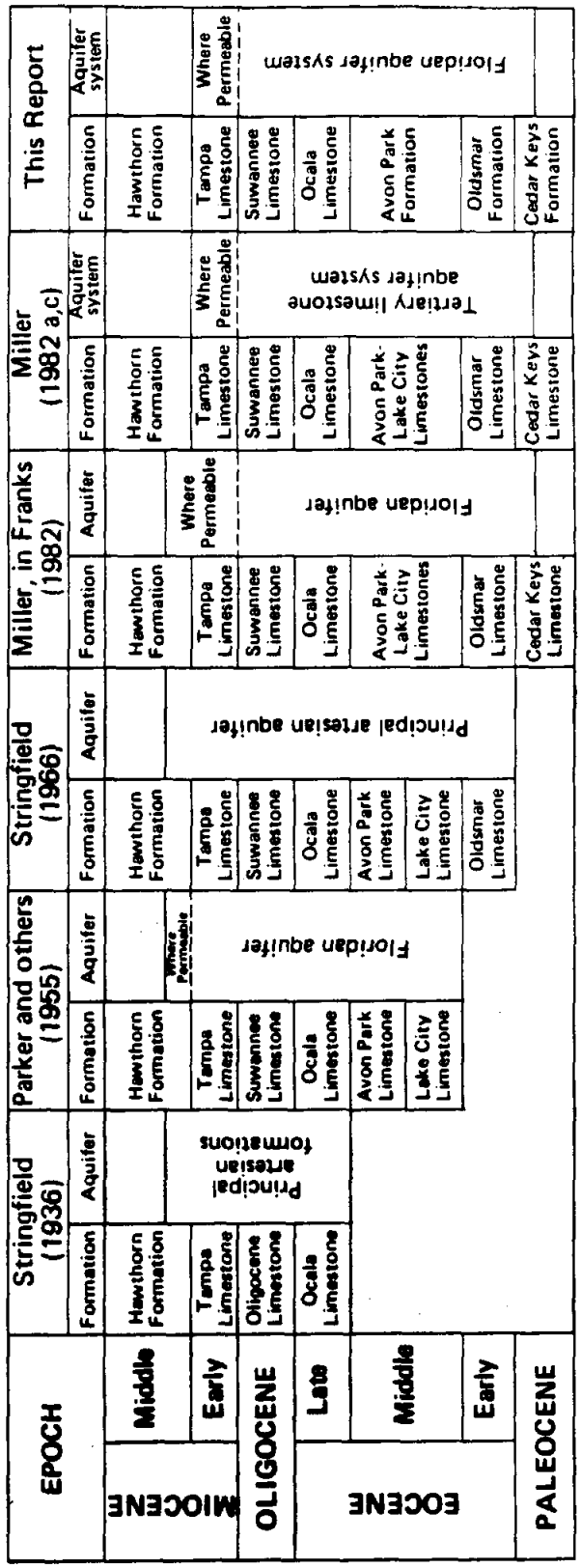

Figure 7. Comparison of aquifer terminologies.

as a vertically continuous sequence of carbonate rocks of generally high permeability that are mostly of middle and late Tertiary age and hydraulically connected in varying degrees and whose permeability is, in general, an order to several orders of magnitude greater than that of those rocks that bound the system above and below. As plate 2 shows, the Floridan aquifer system includes units of late Paleocene to early Miocene age. Very locally, in the Brunswick, Ga., area, the entire Paleocene section plus a thick sequence of rocks of Late Cretaceous age are part of the aquifer system. In and just downdip of the area where the aquifer system crops out, the entire system consists of one vertically continuous permeable unit. Farther downdip, less permeable carbonate units of subregional extent separate the system into two aquifers, herein called the Upper and Lower Floridan aquifers (fig. 8). These less permeable units may be very leaky to virtually nonleaky, depending on the lithologic character of the rock comprising the unit. Because they lie at considerable depth, the hydrologic character and the importance of the subregional low-permeability units are known from only a few scattered deep test wells. Local low-permeability zones may occur within either the Upper or the Lower Floridan aquifer. In places (for example, southeastern Florida), low-permeability rocks account for slightly more than half of the rocks included in the aquifer system.

Even though the rocks that comprise the base of the Upper Floridan aquifer are not everywhere at the same altitude or geologic horizon or of the same rock type, the presence of a middle confining unit over about two-thirds of the study area has led to a conceptual model for the Floridan aquifer system that consists of two active permeable zones (the Upper and Lower Floridan aquifers) separated by a zone of low permeability (a middle confining unit). Because of this simplified layering scheme, it is necessary to greatly generalize the highly complex sequence of high- and low-permeability rocks that comprise the aquifer system. Local confining beds (see, for example, cross section E-E', pl. 21) are either disregarded because they are regionally unimportant or lumped with one of the major layers. The purpose of the conceptual model, and of the digital computer model derived from it and described by Bush and Johnston (1985) is to portray the major aspects of ground-water flow within the Floridan aquifer system. In like manner, the descrip-

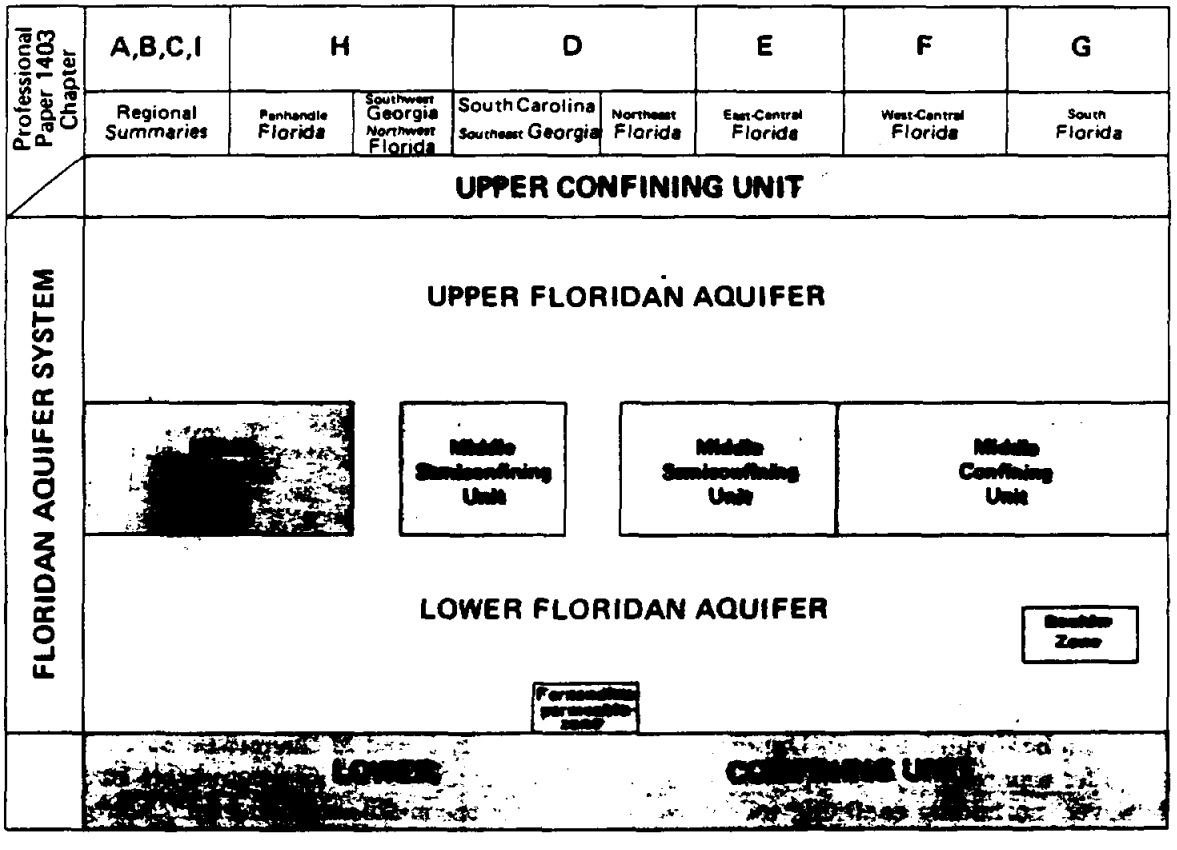

Figure 8. Aquifers and confining units of the Floridan aquifer system.

tion of the aquifer system's geohydrologic framework in this report is intended to show the principal variations in permeability within the aquifer system. In both cases, local anomalies that do not fit with overall (regional) conditions are ignored.

Regionally, the top of the Floridan aquifer system in most places lies at the top of rocks of Oligocene age (Suwannee Limestone) where these strata are preserved. Where Oligocene rocks are absent, the aquifer system's top is generally at the top of upper Eocene rocks (Ocala Limestone). Locally, in eastern panhandle Florida and in west-central peninsular Florida, rocks of early Miocene age (Tampa Limestone) are highly permeable and hydraulically connected to the aquifer system. In places, upper Eocene through lower Miocene rocks are either missing owing to erosion or nondeposition or of low permeability; at these places, rocks of middle Eocene age (Avon Park Formation) mark the top of the aquifer system. It is important to note that there are some places where the upper part of a given formation that comprises the top of the aquifer system consists of low-permeability rocks. At such places, the low-permeability beds are excluded from the aquifer system, and the top of the system is considered to be the top of the uppermost high-permeability carbonate rock. The top of the system, then, may lie within a stratigraphic unit rather than at its top. Because the permeability contrast between the aquifer system and its upper confining unit does not everywhere follow stratigraphic horizons, neither does the top of the aquifer system. Likewise, the top of the aquifer system may locally lie within a limestone unit if the upper part of the limestone consists of low-permeability rock and the lower part is highly permeable.

The time-stratigraphic units or parts of units that mark the top of the Floridan aquifer system at selected localities are shown in figure 9, as well as the time-rock units that comprise the Upper and Lower Floridan aquifers and the units that are considered to represent the aquifer system's base. Figure 9 shows a series of idealized chronostratigraphic columns compiled from well data at several locations in the study area, along with the permeability characteristics of each chronostratigraphic unit at each location. Examination of this figure shows that, in addition to the variations in the top and base of the aquifer system, the degree of complexity varies greatly within the system. Generally speaking (and as figure 9 shows), the aquifer system in most places can be divided into an Upper and Lower Floridan aquifer separated by less-permeable rock. In places, however, no middle confining unit exists (for example, the Baxley, Ga., and Gainesville, Fla., columns on fig. 9), and the aquifer system is highly permeable throughout its vertical extent. In other places, thick sequences of low-permeability rock occur at several levels within the aquifer system (for example, the Savannah, Ga., and West Palm Beach, Fla., areas in fig. 9), and the several discrete permeable zones of the system may be hydraulically separated.

Regionally, and in a fashion similar to the way in which the top is defined, the base of the aquifer system is defined as the level below which there is no high-permeability carbonate rock. The base of the system is generally either (1) glauconitic, calcareous, argillaceous to arenaceous rock that ranges in age from late Eocene to late Paleocene (fig. 9) or (2) massively bedded anhydrite that commonly occurs in the lower two-thirds of the Paleocene Cedar Keys Formation. Locally, near Brunswick, Ga., micritic limestone and argillaceous limestone of Late Cretaceous (Tayloran) age mark the base of the aquifer system. The permeability of the micritic and argillaceous carbonate rocks, the anhydrite beds, and the various clastic rocks that comprise the base of the system is much less than that of the carbonate rocks above. Regardless of its lithologic character, the lower confining unit, whose top is mapped in this report as the base of the aquifer system, everywhere separates the system from deeper, predominantly clastic aquifers of early Tertiary and Late Cretaceous age.

The upper confining unit of the Floridan aquifer system generally consists of rocks of middle and late Miocene age. Where older rocks such as the lower Miocene Tampa or Oligocene Suwannee Limestones are of low permeability, they are also included in the upper confining unit. In parts of the study area, the upper confining unit has been removed by erosion and the aquifer system either: crops out, is covered by only a surficial sand aquifer, or is covered very locally by clayey residuum. Hydraulic conditions within the aquifer system accordingly vary from confined to unconfined. Where thick sequences of less permeable rocks of subregional extent are present within the aquifer system, they divide it into two major aquifers. The uppermost aquifer (Upper Floridan) generally consists of rocks of Oligocene, late Eocene, and late middle Eocene age (fig. 9). The lower aquifer (Lower Floridan) generally consists of rocks of early middle Eocene to late Paleocene age. Where no middle confining unit separates the two aquifers, all the permeable rock comprising the aquifer system is referred to as the Upper Floridan aquifer. The middle confining unit separating the Upper and Lower Floridan aquifers is generally found in the middle part of rocks of middle Eocene age. The less permeable material that comprises the middle confining unit, however, is not everywhere of the same age (fig. 9), nor does it everywhere consist of the same rock type, as a later section of this report discusses in detail.

NUS CORPORATION AND SUBSIDIARIES — **TELECON NOTE**

CONTROL NO:	DATE:	TIME:
F4-8804-42	8/15/88	1035

DISTRIBUTION:

Dames Point PCB Spill

REFERENCE # 13

BETWEEN:	OF:	PHONE:
Jim Dumond	JAX Suburban Utilities	(904) 725-2865

AND:

K.D. Pass KDP

DISCUSSION:

Wells located in the Arlington Park area:

1) Cavamaugh Dr. & Bradshaw St.
2) Cesery Blvd. & Lucina Dr. S.
3) Columbine & Gaillardia St.
4) Greenfern & Townsond
5) Woolery & Elvia Dr. & Wedeville Blvd.

Wells located in the Holly Oaks area:

1) Fort Carolina & Holly Oaks River Dr.
2) Monument Rd. & Lee Rd.
3) St. John Bluff Rd. & Joylnn Rd.

All of these wells have an approximate depth of: 1000 ft. bls.

ACTION ITEMS:

NUS CORPORATION AND SUBSIDIARIES — **TELECON NOTE**

CONTROL NO:	DATE:	TIME:
F4-8804-42	8/15/88	1055

DISTRIBUTION:

Dames Point PCB Spill

REFERENCE # 14

BETWEEN:	OF:	PHONE:
Cheryl Phillips	JAX Suburban Utilities	(904) 725-2865

AND:

K.D. Pass, NUS Corporation

DISCUSSION:

JAX Surburban Utilities serve approximately 4,823 residents in the Arlington & University Park areas. they serve roughly 2,264 residents in the Holly Oaks area.

Southern Utilities is a part of the JAX Surburban Utility Co.

ACTION ITEMS:

NUS 067 REVISED 0685

NUS CORPORATION AND SUBSIDIARIES — **TELECON NOTE**

CONTROL NO:	DATE:	TIME:
F4-8804-42	8/16/88	0900

DISTRIBUTION:

Dames Point PCB Spill

REFERENCE # 13

BETWEEN:	OF:	PHONE:
John Welsh	Southern States Utilities	(904) 743-1888

AND:

K.D. Pass KDP

DISCUSSION:

Southern States has two areas of water distribution within 4 miles of Dames Point.

Woodmere area has two wells; one is located at the intersection of University Blvd. & Edenfield Rd. and one at 5710 Edenfield Rd. These wells are over 1000 feet deep in the Floridan aquifer and serve 695 mainly residential units.

The Beacon Hills area has wells located on Sweet Cherry Lane. These wells are also 1000 feet bls and they serve roughly 1600 residential units.

ACTION ITEMS:

NUS 067 REVISED 0686

NUS CORPORATION AND SUBSIDIARIES **TELECON NOTE**

CONTROL NO.	DATE: 3-23-90	TIME: 0940

DISTRIBUTION:

REFERENCE # [illegible]

BETWEEN: Hans Longnecker	OF: Complete Services (Well Drillers)	PHONE: (904) 387-5394

AND: Terry Tanner, NUS Corporation

DISCUSSION:

Depth of private wells in Jacksonville area varies with an average depth range of 40' to 200' depending upon the area.

NUS CORPORATION AND SUBSIDIARIES — **TELECON NOTE**

CONTROL NO:	DATE:	TIME:
	June 22, 1988	0955 hrs.

DISTRIBUTION:

Doeboy Dump File

REFERENCE # 17

BETWEEN:	OF:	PHONE:
Susan Banyas	Jacksonville Chamber of Commerce	(904) 353-0300

AND:

K.D. Pass, NUS Corporation

DISCUSSION:

Both the St. John and Trout Rivers have recreational activities, such as boating & fishing. The Trout River also has commericial fishing activity.

ACTION ITEMS:

NUS CORPORATION AND SUBSIDIARIES **TELECON NOTE**

CONTROL NO.	DATE: 1-9-89	TIME: 9:30

DISTRIBUTION:

REFERENCE = 1B

BETWEEN: Linda Walker	OF: U.S. Fish and Wildlife Service Jacksonville, Florida	PHONE: (904) 791-2580

AND: Daniel L. Howard, NUS Corporation

DISCUSSION:

Endangered species along the St. Johnsriver. Ms. Walker said that the endangered species along the St. Johns River in the Duval County area are the West Indies Manatee, the Sea Turtle, closer to the Atlantic Ocean, the Bald Eagle, and the Wood Stork. She also stated that the St. Johns River contains saltwater near the Atlantic Ocean, but has freshwater around the Jacksonville area and further downstream. The river is also fished and used for recreation.

ACTION ITEMS:

None

Enter the next ring distance
GEMS>
No city found ! press RETURN to try again.

REFERENCE # 19

COVERAGE

STATE	COUNTY	STATE NAME	COUNTY NAME
12	31	Florida	Duval Co
12	89	Florida	Nassau Co

CENTER POINT AT STATE : 12 Florida
COUNTY : 31 Duval Co

Press RETURN key to continue...

REGION OF THE COUNTRY

Zipcode found: 32229 at a distance of 0.0 Km

STATE	CITY NAME	FIPSCODE	LATITUDE	LONGITUDE
FL	JACKSONVILLE	12031	30.4183	81.6250

Press RETURN key to continue ...

CENSUS DATA

Celotex Corporation
LATITUDE 30:25: 6 LONGITUDE 81:37:30 1980 POPULATION

KM	0.00-.400	.400-.810	.810-1.60 (1)	1.60-3.20 (2)	3.20-4.80 (3)	4.80-6.40 (4)	SECTOR TOTALS
S 1	0	0	0	3002	2478	1820	7300
S 2	0	0	0	0	0	0	0
S 3	0	0	0	0	32	1413	1445
S 4	0	0	0	0	0	5732	5732
S 5	0	0	0	0	453	5261	5714
S 6	0	0	373	0	3005	8190	11568
S 7	0	0	0	526	3017	8136	11679
S 8	0	0	0	0	0	0	0
RING TOTALS	0	0	373	3528	8985	30552	43438

Press RETURN key to continue ...

==========

INDEX NUMBER	STATION NAME	LATITUDE DEGREE	LONGITUDE DEGREE	PERIOD OF RECORD	STABILITY CLASSES	DISTANCE (km)
13889	JACKSONVILLE FL	30.5000	81.7000			6 11.57
93836	BRUNSWICK/GLYNCO GA	31.2500	81.4667			5 93.62
12834	DAYTONA BEACH FL	29.1833	81.0500			6147.98
13870	ALMA/BACON CO GA	31.5333	82.5167			5150.19
93845	VALDOSTA GA	30.7833	83.2833			6163.68
13824	SAVANNAH/HUNTER GA	32.0167	81.1333			5183.62
03822	SAVANNAH/TRAVIS GA	32.1333	81.2000			6194.75

Press RETURN key to continue ...

U.S. SOIL DATA

STATE : FLORIDA

LATITUDE : 30:25: 6 LONGITUDE : 81:37:30
THE STATION IS INSIDE H.U. 3070205

GROUND WATER ZONE	: 10			
RUNOFF SOIL TYPE	: 4			
EROSION	: 6.2250E-05			CM/MONTH
DEPTH TO GROUND WATER BETWEEN	: 0.0000E+00	AND	1.0000E+02	
FIELD CAPACITY FOR TOP SOIL	: 9.0000E-02			
EFFECTIVE POROSITY BETWEEN	: 2.0000E-02	AND	3.0000E-01	
SEEPAGE TO GROUNDWATER BETWEEN	: 4.6330E+03	AND	1.3900E+04	CM/MONTH
DISTANCE TO DRINKING WELL	: 2.7000E+04			CM

Press RETURN key to continue ...

U.S. CITY

MENU: Geodata Handling Data List procedures

1. Site level retrieval of data (SITERET)
2. Access Census Data (CENSUS)
3. Determine County Coverage (COVERAGE)
4. Geographic Data Management (GEODM)
5. HUCODE/SOIL locator (HUCODE)
6. Convert to Lat/Long (LATLON)
7. Lookup/Examine Star Station Data (STAR)
8. Find US cities (USCITY)
9. Find Soil Survey Status of Counties (SSURVEY)

Enter an option number or a procedure name (in parentheses)
or a command: HELP, HELP option, BACK, CLEAR, EXIT, TUTOR
GEMS>

Enter an option number or a procedure name (in parentheses)
or a command: HELP, HELP option, BACK, CLEAR, EXIT, TUTOR
GEMS>

Enter an option number or a procedure name (in parentheses)
or a command: HELP, HELP option, BACK, CLEAR, EXIT, TUTOR

```
Type YES to confirm the EXIT command; type NO to restart GEMS
GEMS> YES

$ LOGOUT
 WRT          logged out at  8-MAY-1990 14:17:59.61
 Itemized resource charges, for this session, follow:

NODE: VAXTM1
ACCT: NTIS                                START TIME:      8-MAY-1990 14:13:11.71
PROJ: NTISNUCN                            FINISH TIME:     8-MAY-1990 14:17:59.61
USER: WRT                                 BILLING PERIOD:900501
UIC:  [000750,000112]                     WEEKDAY:         TUESDAY
BAUD:                                     TERMINAL PORT: VTA538

DESCRIPTION OF CHARGE                     QUANTITY                EXPENDITURE
-------------------------------------------------------------------------------

  ALL CHARGE LEVELS
    300  baud            (Seconds)          288                      0.7200
    CPU TIME             (Seconds)            7                      0.4628
                                                                  ------------
    TOTAL FOR THIS SESSION                                      $     1.1828
NODE 3157  HOST 1038: DROPPED BY HOST
please log in: X

password:
```

NUS CORPORATION
1927 LAKESIDE PARKWAY
SUITE 614
TUCKER, GEORGIA 30084
404-938-7710

STSB/SAS
AUG 07 1990
EPA - REGION IV
ATLANTA, GA.

-8-0-22

August 2, 1990

Mr. A. R. Hanke
Waste Programs Branch
Waste Management Division
Environmental Protection Agency
345 Courtland Street, N. E.
Atlanta, Georgia 30365

Date: Aug 31 1990
Site Disposition: NFRAP
EPA Project Manager: J. McCann

Subject: Celotex Corporation
Jacksonville, Duval County, Florida
FLD081365892
TDD No. F4-9002-33

Dear Mr. Hanke:

Your comments on the letter report dated July 2, 1990 on the above referenced subject have been incorporated in the report and attachments as follows.

FIT 4 conducted a Phase I Screening Site Inspection at Celotex Corporation (Celotex) in Jacksonville, Duval County, Florida. The assessment included a comprehensive review of EPA and state file materials, completion of a target survey, and an offsite reconnaissance of the facility and surrounding area.

Celotex, a subsidiary of Celotex Corporation, is located at 9225 Dames Point Road in Jacksonville, Duval County, Florida. The entire facility covers 4 acres. Waste disposal at this property began in 1964 and continues to date (Refs. 1, 2, p. 8).

Celotex manufactures fiberboard. This production probably includes insulation boards, medium-density fiberboards, hardboards, laminated paperboards, and particleboards (including flakeboard, chipboard, chipcore and shavings board), which are made from reconstituted wood (or some lignocellulose-like bagasse) (Ref. 3, p. 17). The entire process consists of mechanical wood breakdown into small discrete particles followed by the bonding of these particles in the presence of heat, synthetic-resin adhesive, or other suitable binders, and the application of pressure (the latter is used to produce particleboard) (Ref. 3, pp. 17, 18). The adhesive/additives include rosin, alum, asphalt, paraffin, synthetic and natural resins, preservatives and fire-resistant chemicals, and drying oils. Urea-formaldehyde and phenol-formaldehyde are the primary resin binders used (Ref. 4, pp. 19, 405).

There have been no regulatory activities against Celotex. However, the waste quantity at the company's land treatment facility is 77.4 cubic feet per year consisting of organic and inorganic material (Ref. 1, pp. 1, 2).

Celotex Corporation is located in the Atlantic Coastal Plain Physiographic Province of northeastern Florida. This is a region of low relief that is underlain by poorly consolidated sediments (Ref. 5, p. 173). The climate is humid and subtropical, with a net annual precipitation of 7 inches (Ref. 6). One-year, 24-hour rainfall is 4 inches (Ref. 7, p. 93).

The major aquifers in this area are the shallow aquifer system and the Floridan Aquifer System (Ref. 8, p. 66). The shallow aquifer system consists of sand, clay, and limestone (Ref. 8, p. 18). It is an unconfined aquifer with a depth to water table at the facility of approximately 10 feet (Ref. 9). Typical hydraulic conductivities of this type range from 1×10^{-5} to 1×10^{-2} cm/sec (Ref. 10). The water-bearing units within this system consist of relatively discontinuous sand or limestone lenses. Zones most used by wells in the area are the surficial sand beds and a relatively continuous limestone and sand zone. These zones are known as the water-table zone and the shallow rock zone (Ref. 8, p. 66). Wells completed in the shallow rock zone are between 40 and 100 feet deep (Ref. 11, p. 6).

The Floridan Aquifer System consists of a series of limestone units (Ref. 8, p. 66). It is separated from the shallow aquifer system by confining clay beds within the Hawthorn Formation that are 350 feet thick (Ref. 12, Plate 25). The Floridan Aquifer System is a vertically continuous sequence of limestones. These limestones have high permeabilities and are hydraulically connected in varying degrees. The thickness of the Upper Floridan Aquifer System is 400 feet. Due to the large volumes of good quality water available from the Upper Floridan and the high chloride content of the Lower Floridan aquifer, very few wells draw water from the Lower Floridan (Ref. 12, p. 44, 45).

The population within 4 miles of Celotex Corporation obtain their potable water from both municipal water companies and private wells (Refs. 2, 9). The municipal wells are all completed in the confined Floridan aquifers. These are located south of the St. Johns River (Refs. 13, 14, 15). Residents north of the river obtain their potable water from private wells (Ref. 2). These wells vary in depth from 40 to 1,000 feet below land surface (bls) (Refs. 2, 16). The wells located near the river are completed in the Floridan aquifer due to saltwater intrusion in the shallow aquifers (Ref. 2). Approximately 25 percent of the wells located further north of the river are completed in the shallow aquifer (Ref. 16). Roughly 100 houses are in this area; therefore, it is assumed that 25 houses use shallow wells for their drinking water. The nearest deep well is located 1,500 feet west of the facility, and the nearest shallow well is loctaed 1.5 miles north of Celotex (Refs. 2, 9).

There are two potential surface water drainage routes from Celotex. Surface water runoff northwest of Celotex drains overland 100 feet to the southwest into a small tributary. The tributary continues south and southeast for 3,500 feet south until entry into the Dames Point Turn of the St. Johns River. The southeastern pathway drains overland to the southeast (500 feet) until entry into Dames Point Turn (Refs. 2, p. 3; 4, p. 8). There are no surface water intakes along the 15-mile extended pathway (Ref. 8). The St. Johns River supports recreational boating and fishing (Ref. 17).

Endangered species that inhabit the St. Johns River include the West Indies manatee (Trichechus manatus) and the sea turtle (Dermochelys coriacea). Similarly, the bald eagle (Haliaeetus leucocephalus) and the wood stork (Mycteria americana) also inhabit the St. Johns River near the Atlantic Ocean (Ref. 18).

The population within a 1-mile radius of the facility is 373, within a 4-mile radius, 43,438 (Ref. 19). The offsite reconnaissance of the facility revealed extensive freshwater wetlands (0.4 mile north). The Fort State Historical Site is also close by (1,000 feet north). There are numerous parks and schools within the 4-mile radius but mostly at a distance of 2.8 miles or greater from Celotex (Refs. 2, p. 5; 8). The property is fenced and inaccessible to the public (Ref. 2, p. 2).

Based on the attachments, the lack of surface water targets, and the confining layer overlying the aquifer of concern, which essentially creates a lack of potentially affected groundwater targets, it is recommended that no further remedial action be planned at Celotex. If you have any questions, please feel free to contact me at NUS Corporation.

Very truly yours,

K D Pass

K. D. Pass
Project Manager

Approved:

Greg Schank

KDP/gwn

Enclosures

cc: John McKeown

REFERENCES

1. EPA Notification of Hazardous Waste Site (EPA Form 8900-1) for Celotex Corporation, Jacksonville, Florida. Filed by Lecil M. Colburn, Present Owner, June 8, 1981.

2. NUS Corporation Field Logbook No. F4-2215 for Celotex Corporation, TDD No. F4-9002-33. Documentation of facility reconnaissance, April 25, 1990.

3. John A. Youngquist, "Laminated Wood-Based Composites," Kirk-Othmer Encyclopedia of Chemical Technology, 3rd ed., Vol. 14, (New York: John Wiley & Sons, 1983).

4. George L. Brode, "Phenolic Resins," Kirk-Othmer Encyclopedia of Chemical Technology, 3rd ed., Vol. 17 (New York: John Wiley & Sons, 1983).

5. U.S. Geological Survey, National Water Summary 1984: Hydrologic Events, Selected Water Quality Trends and Ground-Water Resources, Water Supply Paper 2275 (1984), p. 173.

6. U.S. Department of Commerce, Climatic Atlas of the United States (Washington, D.C.: GPO June 1968) Reprint: 1983, National Oceanic and Atmospheric Administration, p. 63.

7. U.S. Department of Commerce, Rainfall Frequency Atlas of the United States, Technical Paper No. 40 (Washington, D.C.: GPO, 1961).

8. Gilbert W. Leve, Groundwater Water in Duval and Nassan Counties, Florida, State of Florida Department of Natural Resources Report of Investigations No. 43 (1966).

9. U.S. Geologic Survey, 7.5 minute series Topographic Quadrangle Maps of Florida: Trout River (Photorevised 1981), Eastport (PR 1981), Mayport (PR 1982), Jacksonville Beach (PR 1988), Arlington (PR 1988), Jacksonville (PR 1982), scale 1:24,000.

10. R. Allan Freeze and John A. Cherry, Groundwater (Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1979).

11. L.V. Causey and G.G. Phelps, Availability and Quality of Water from Shallow Aquifers in Duval County, Florida, U.S. Geological Survey, Water Resources Investigations 78-92 (1978).

12. James A. Miller, Hydrogeologic Framework of the Floridan Aquifer System in Florida and Parts of Georgia, Alabama, and South Carolina, U.S. Geological Survey Professional Paper 1403-B (1986).

13. Jim Dumond, JAX Suburban Utilities, telephone conversation with K.D. Pass, NUS Corporation, August 15, 1988. Subject: Water distribution.

14. Cheryl Phillips, JAX Suburban Utilities, telephone conversation with K.D. Pass, NUS Corporation, August 15, 1988. Subject: Water distribution.

15. John Welsh, Southern States Utilities, telephone conversation with K.D. Pass, NUS Corporation, August 16, 1988. Subject: Water distribution.

16. Hans Longnecker, Complete Services, telephone conversation with Terry Tanner, NUS Corporation, March 23, 1990. Subject: Water distribution.

17. Susan Banyas, Jacksonville Chamber of Commerce, telephone conversation with K.D. Pass, NUS Corporation, June 22, 1988. Subject: Recreational activities on the St. Johns River.

18. Linda Walker, U.S. Fish and Wildlife Service, telephone conversation with Daniel L. Howard, NUS Corporation, January 9, 1989. Subject: Endangered species in Duval County.

19. U.S. Environmental Protection Agency, Graphical Exposure Modeling System (GEMS) Data Base, compiled from U.S. Bureau of the Census data (1980).

PRE REMEDIAL INVESTIGATION REVIEW FORM

Site Name: Celotex Corporation
City, County, State: Jacksonville, Duval County, Florida
EPA ID No.: FL0081365292
SI Review Conducted By: [illegible]
Date: [illegible]
Author: [illegible]

Check one:
- ____ Preliminary Assessment
- ____ Screening Site Inspection-Phase I (PAR)
- ____ Screening Site Inspection-Phase II (PAR)
- ____ Listing Site Inspection

Content of the report. Does the report address the following subjects (if applicable) in an adequate manner. Comments concerning tables or figures pertaining to the report should be addressed within the appropriate section(s) below.

Site Location and Description (Waste Characteristics): Excellent – a question on waste quantity – [illegible]

Site History: Excellent

Groundwater Pathway:

1) Hydrogeology: [illegible]

2) Groundwater Targets: – [illegible] – Municipal wells south of St. Johns River completed in Florida Aquifer
– Residents north of St. Johns River obtain water from private well
– So well located 1500 feet from site (needs ID) is private well completed over 400 deep

Surface Water Pathway:

1) Overland Drainage: [illegible]

2) Surface Water Targets:

Air Pathway:

On-Site Exposure Pathway:

Sampling Investigation (if applicable):

1) Sampling Stratagies, Procedures and Rationale:

2) Interpretation of Analytical Data:

Summaries and Conclusions: EPA concurs with NFRAP

Field Analytical Screening or Geophysical Studies: NA

Topographic Map: Needs wells ID'd

Site Inspection Form: Good

HRS Package: See packages

References and Attatchments: Good

Please send 2 copies of the HRS packages & letter report only. [illegible]

NUS CORPORATION
1927 LAKESIDE PARKWAY
SUITE 614
TUCKER, GEORGIA 30084
404-938-7710

SISB/SAS
RECEIVED
JUL 09 1990
EPA - REGION IV
ATLANTA, GA.

C-586-7-0-17

July 2, 1990

Mr. A. R. Hanke
Site Investigation and Support Branch
Waste Management Division
Environmental Protection Agency
345 Courtland Street, N. E.
Atlanta, Georgia 30365

Date: 7/26/90
Site Disposition: [illegible]
EPA Project Manager: [illegible]

Subject: Screening Site Inspection, Phase I
Celotex Corporation
Jacksonville, Duval County, Florida
FLD081365892
TDD No. F4-9002-33

Dear Mr. Hanke:

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There have been no regulatory activities against Celotex. However, the waste quantity at the company's land treatment facility is 77.4 cubic feet per year consisting of organic and inorganic material (Ref. 1, pp. 1, 2).

Where does these quantities come from [illegible]

Celotex Corporation is located in the Atlantic Coastal Plain Physiographic Province of northeastern Florida. This is a region of low relief that is underlain by poorly consolidated sediments (Ref. 5, p. 173). The climate is humid and subtropical, with a net annual precipitation of 7 inches (Ref. 6). One-year, 24-hour rainfall is 4 inches (Ref. 7, p. 93).

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The population within 4 miles of Celotex Corporation obtain their potable water from both municipal water companies and private wells (Refs. 2, 9). The municipal wells are all completed in the confined Floridan aquifers. These are located south of the St. Johns River (Refs. 13, 14, 15). Residents north of the river obtain their potable water from private wells (Ref. 2). These wells vary in depth from 40 to 200 feet below land surface (bls) (Ref. 16). The wells located near the facility are completed approximately 1,000 feet bls due to saltwater intrusion in the shallow aquifers. In the area north of the facility, twenty-five percent of the private wells might be completed within the shallow aquifers (Refs. 2, 16). Approximately 25 residences obtain their potable water from the shallow aquifer (Ref. 9, 16).

There are two potential surface water drainage routes from Celotex. Surface water runoff northwest of Celotex drains overland 100 feet to the southwest into a small tributary. The tributary continues south and southeast for 3,500 feet south until entry into the Dames Point Turn of the St. Johns River. The southeastern pathway drains overland to the southeast (500 feet) until entry into Dames Point Turn (Refs. 2, p. 3; 4, p. 8). There are no surface water intakes along the 15-mile extended pathway (Ref. 8). The St. Johns River supports recreational boating and fishing (Ref. 17).

Endangered species that inhabit the St. Johns River include the West Indies manatee (Trichechus manatus) and the sea turtle (Dermochelys coriacea). Similarly, the bald eagle (Haliaeetus leucocephalus) and the wood stork (Mycteria americana) also inhabit the St. Johns River near the Atlantic Ocean (Ref. 18).

The population within a 1-mile radius of the facility is 373, within a 4-mile radius, 43,438 (Ref. 19). The offsite reconnaissance of the facility revealed extensive freshwater wetlands (0.4 mile north). The Fort State Historical Site is also close by (1,000 feet north). There are numerous parks and schools within the 4-mile radius but mostly at a distance of 2.8 miles or greater from Celotex (Refs. 2, p. 5, 8). The property is fenced and inaccessible to the public (Ref. 2, p. 2).

Based on the attachments, the lack of surface water targets, and the confining layer overlying the aquifer of concern, which essentially creates a lack of potentially affected groundwater targets, it is recommended that no further remedial action be planned at Celotex. If you have any questions, please feel free to contact me at NUS Corporation.

Very truly yours,

K D Pass

K. D. Pass for Soloman Pollard
Project Manager

Approved:

Bob Dougherty

KDP/SP/gwn

Enclosures

cc: John McKeown

REFERENCES

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HAZARD RANKING SYSTEM SCORING SUMMARY

FOR

CELOTEX CORPORATION
EPA SITE NUMBER FLD081365892
JACKSONVILLE
DUVAL COUNTY, FL
EPA REGION: 4

SCORE STATUS: IN PREPARATION

SCORED BY K.D. PASS
OF NUS
ON 05/08/90

DATE OF THIS REPORT: 08/01/90
DATE OF LAST MODIFICATION: 08/01/90

GROUND WATER ROUTE SCORE :	12.93
SURFACE WATER ROUTE SCORE:	17.45
AIR ROUTE SCORE :	0.00
MIGRATION SCORE :	12.55

Floridan Aquifer
Maximum Quantity

HRS GROUND WATER ROUTE SCORE

CATEGORY/FACTOR	RAW DATA	ASN. VALUE	SCORE
1. OBSERVED RELEASE	NO	0	0
2. ROUTE CHARACTERISTICS			
DEPTH TO WATER TABLE	450 FEET		
DEPTH TO BOTTOM OF WASTE	6 FEET		
DEPTH TO AQUIFER OF CONCERN	444 FEET	0	0
PRECIPITATION	51.9 INCHES		
EVAPORATION	46.0 INCHES		
NET PRECIPITATION	5.9 INCHES	2	2
PERMEABILITY	1.0X10-7 CM/SEC	0	0
PHYSICAL STATE		3	3
TOTAL ROUTE CHARACTERISTICS SCORE:			5
3. CONTAINMENT		3	3
4. WASTE CHARACTERISTICS			
TOXICITY/PERSISTENCE:ASSIGNED VALUE,18			18
WASTE QUANTITY CUBIC YDS	2501		
DRUMS	0		
GALLONS	0		
TONS	0		
TOTAL	2501 CU. YDS	8	8
TOTAL WASTE CHARACTERISTICS SCORE:			26
5. TARGETS			
GROUND WATER USE		3	9
DISTANCE TO NEAREST WELL	1500 FEET		
AND	MATRIX VALUE	10	10
TOTAL POPULATION SERVED	95 PERSONS		
NUMBER OF HOUSES	25		
NUMBER OF PERSONS	0		
NUMBER OF CONNECTIONS	0		
NUMBER OF IRRIGATED ACRES	0		
TOTAL TARGETS SCORE:			19

GROUND WATER ROUTE SCORE (Sgw) = 12.93

HRS SURFACE WATER ROUTE SCORE

CATEGORY/FACTOR	RAW DATA	ASN. VALUE	SCORE
1. OBSERVED RELEASE	NO	0	0
2. ROUTE CHARACTERISTICS			
SITE LOCATED IN SURFACE WATER	NO		
SITE WITHIN CLOSED BASIN	NO		
FACILITY SLOPE	1.0 %		
INTERVENING SLOPE	0.0 %	0	0
24-HOUR RAINFALL	4.0 INCHES	3	3
DISTANCE TO DOWN-SLOPE WATER	500 FEET	3	6
PHYSICAL STATE	3		3
TOTAL ROUTE CHARACTERISTICS SCORE:			12
3. CONTAINMENT	3		3
4. WASTE CHARACTERISTICS			
TOXICITY/PERSISTENCE:ASSIGNED VALUE,18			18
WASTE QUANTITY CUBIC YDS	2501		
DRUMS	0		
GALLONS	0		
TONS	0		
TOTAL	2501 CU. YDS	8	8
TOTAL WASTE CHARACTERISTICS SCORE:			26
5. TARGETS			
SURFACE WATER USE		2	6
DISTANCE TO SENSITIVE ENVIRONMENTS		3	6
COASTAL WETLANDS	NONE		
FRESH-WATER WETLANDS	2112 FEET		
CRITICAL HABITAT	500 FEET		
DISTANCE TO STATIC WATER	2112 FEET		
DISTANCE TO WATER SUPPLY INTAKE	> 1 MILE		
AND	MATRIX VALUE	0	0
TOTAL POPULATION SERVED	0		
NUMBER OF HOUSES	0		
NUMBER OF PERSONS	0		
NUMBER OF CONNECTIONS	0		
NUMBER OF IRRIGATED ACRES	0		
TOTAL TARGETS SCORE:			12

SURFACE WATER ROUTE SCORE (Ssw) = 17.45

HRS AIR ROUTE SCORE

CATEGORY/FACTOR	RAW DATA	ASN. VALUE	SCORE
1. OBSERVED RELEASE	NO	0	0

2. WASTE CHARACTERISTICS

REACTIVITY:

INCOMPATIBILITY:

TOXICITY

WASTE QUANTITY CUBIC YARDS
DRUMS
GALLONS
TONS

TOTAL

MATRIX VALUE

TOTAL WASTE CHARACTERISTICS SCORE: N/A

3. TARGETS

POPULATION WITHIN 4-MILE RADIUS
0 to 0.25 mile
0 to 0.50 mile
0 to 1.0 mile
0 to 4.0 miles

DISTANCE TO SENSITIVE ENVIRONMENTS
COASTAL WETLANDS
FRESH-WATER WETLANDS
CRITICAL HABITAT

DISTANCE TO LAND USES
COMMERCIAL/INDUSTRIAL
PARK/FOREST/RESIDENTIAL
AGRICULTURAL LAND
PRIME FARMLAND
HISTORIC SITE WITHIN VIEW?

TOTAL TARGETS SCORE: N/A

AIR ROUTE SCORE (Sa) = 0.00

HAZARD RANKING SYSTEM SCORING CALCULATIONS
FOR
SITE: CELOTEX CORPORATION
AS OF 08/01/90

GROUND WATER ROUTE SCORE

ROUTE CHARACTERISTICS		5
CONTAINMENT	X	3
WASTE CHARACTERISTICS	X	26
TARGETS	X	19

= 7410 /57,350 X 100 = 12.93 = S_{gw}

SURFACE WATER ROUTE SCORE

ROUTE CHARACTERISTICS		12
CONTAINMENT	X	3
WASTE CHARACTERISTICS	X	26
TARGETS	X	12

= 11232 /64,350 X 100 = 17.45 = S_{sw}

AIR ROUTE SCORE

OBSERVED RELEASE 0 /35,100 X 100 = 0.00 = S_{air}

SUMMARY OF MIGRATION SCORE CALCULATIONS

	S	S^2
GROUND WATER ROUTE SCORE (S_{gw})	12.93	167.18
SURFACE WATER ROUTE SCORE (S_{sw})	17.45	304.50
AIR ROUTE SCORE (S_{air})	0.00	0.00
$S^2_{gw} + S^2_{sw} + S^2_{air}$		471.68
$\sqrt{(S^2_{gw} + S^2_{sw} + S^2_{air})}$		21.72
$S_M = \sqrt{(S^2_{gw} + S^2_{sw} + S^2_{air})}/1.73$		12.55

HAZARD RANKING SYSTEM SCORING SUMMARY

FOR

CELOTEX CORPORATION
EPA SITE NUMBER FLD081365892
JACKSONVILLE
DUVAL COUNTY, FL
EPA REGION: 4

SCORE STATUS: IN PREPARATION

SCORED BY K.D. FASS
OF NUS
ON 05/08/90

DATE OF THIS REPORT: 08/01/90
DATE OF LAST MODIFICATION: 08/01/90

GROUND WATER ROUTE SCORE	:	28.57
SURFACE WATER ROUTE SCORE	:	17.45
AIR ROUTE SCORE	:	0.00
MIGRATION SCORE	:	19.35

Shallow Aquifer

Maximum Quantity

HRS GROUND WATER ROUTE SCORE

CATEGORY/FACTOR	RAW DATA	ASN. VALUE	SCORE
1. OBSERVED RELEASE	NO	0	0
2. ROUTE CHARACTERISTICS			
DEPTH TO WATER TABLE	10 FEET		
DEPTH TO BOTTOM OF WASTE	6 FEET		
DEPTH TO AQUIFER OF CONCERN	4 FEET	3	6
PRECIPITATION	51.8 INCHES		
EVAPORATION	46.0 INCHES		
NET PRECIPITATION	5.8 INCHES	2	2
PERMEABILITY	1.0X10-2 CM/SEC	3	3
PHYSICAL STATE		3	3
TOTAL ROUTE CHARACTERISTICS SCORE:			14
3. CONTAINMENT		3	3
4. WASTE CHARACTERISTICS			
TOXICITY/PERSISTENCE:ASSIGNED VALUE,18			18
WASTE QUANTITY CUBIC YDS	2501		
DRUMS	0		
GALLONS	0		
TONS	0		
TOTAL	2501 CU. YDS	8	3
TOTAL WASTE CHARACTERISTICS SCORE:			26
5. TARGETS			
GROUND WATER USE		3	9
DISTANCE TO NEAREST WELL	7920 FEET		
AND	MATRIX VALUE	6	6
TOTAL POPULATION SERVED	95 PERSONS		
NUMBER OF HOUSES	25		
NUMBER OF PERSONS	0		
NUMBER OF CONNECTIONS	0		
NUMBER OF IRRIGATED ACRES	0		
TOTAL TARGETS SCORE:			15

GROUND WATER ROUTE SCORE (Sgw) = 28.57

HRS SURFACE WATER ROUTE SCORE

CATEGORY/FACTOR	RAW DATA	ASN. VALUE	SCORE
1. OBSERVED RELEASE	NO	0	0
2. ROUTE CHARACTERISTICS			
SITE LOCATED IN SURFACE WATER	NO		
SITE WITHIN CLOSED BASIN	NO		
FACILITY SLOPE	1.0 %		
INTERVENING SLOPE	0.0 %	0	0
24-HOUR RAINFALL	4.0 INCHES	3	3
DISTANCE TO DOWN-SLOPE WATER	500 FEET	3	6
PHYSICAL STATE	3		3
TOTAL ROUTE CHARACTERISTICS SCORE:			12
3. CONTAINMENT	3		3
4. WASTE CHARACTERISTICS			
TOXICITY/PERSISTENCE:ASSIGNED VALUE,18			18
WASTE QUANTITY CUBIC YDS	2501		
DRUMS	0		
GALLONS	0		
TONS	0		
TOTAL	2501 CU. YDS	8	8
TOTAL WASTE CHARACTERISTICS SCORE:			26
5. TARGETS			
SURFACE WATER USE		2	6
DISTANCE TO SENSITIVE ENVIRONMENTS		3	6
COASTAL WETLANDS	NONE		
FRESH-WATER WETLANDS	2112 FEET		
CRITICAL HABITAT	500 FEET		
DISTANCE TO STATIC WATER	2112 FEET		
DISTANCE TO WATER SUPPLY INTAKE	> 1 MILE		
AND	MATRIX VALUE	0	0
TOTAL POPULATION SERVED	0		
NUMBER OF HOUSES	0		
NUMBER OF PERSONS	0		
NUMBER OF CONNECTIONS	0		
NUMBER OF IRRIGATED ACRES	0		
TOTAL TARGETS SCORE:			12

SURFACE WATER ROUTE SCORE (Ssw) = 17.45

HRS AIR ROUTE SCORE

CATEGORY/FACTOR	RAW DATA	ASN. VALUE	SCORE
1. OBSERVED RELEASE	NO	0	0

2. WASTE CHARACTERISTICS

REACTIVITY:

MATRIX VALUE

INCOMPATIBILITY

TOXICITY

WASTE QUANTITY CUBIC YARDS
DRUMS
GALLONS
TONS

TOTAL

TOTAL WASTE CHARACTERISTICS SCORE: N/A

3. TARGETS

POPULATION WITHIN 4-MILE RADIUS
0 to 0.25 mile
0 to 0.50 mile
0 to 1.0 mile
0 to 4.0 miles

DISTANCE TO SENSITIVE ENVIRONMENTS
COASTAL WETLANDS
FRESH-WATER WETLANDS
CRITICAL HABITAT

DISTANCE TO LAND USES
COMMERCIAL/INDUSTRIAL
PARK/FOREST/RESIDENTIAL
AGRICULTURAL LAND
PRIME FARMLAND
HISTORIC SITE WITHIN VIEW?

TOTAL TARGETS SCORE: N/A

AIR ROUTE SCORE (Sa) = 0.00

HAZARD RANKING SYSTEM SCORING CALCULATIONS
FOR
SITE: CELOTEX CORPORATION
AS OF 08/01/90

GROUND WATER ROUTE SCORE

ROUTE CHARACTERISTICS		14
CONTAINMENT	X	3
WASTE CHARACTERISTICS	X	26
TARGETS	X	15

= 16380 /57,330 X 100 = 28.57 = S_{gw}

SURFACE WATER ROUTE SCORE

ROUTE CHARACTERISTICS		12
CONTAINMENT	X	3
WASTE CHARACTERISTICS	X	26
TARGETS	X	12

= 11232 /64,350 X 100 = 17.45 = S_{sw}

AIR ROUTE SCORE

OBSERVED RELEASE 0 /35,100 X 100 = 0.00 = S_{air}

SUMMARY OF MIGRATION SCORE CALCULATIONS

	S	S^2
GROUND WATER ROUTE SCORE (S_{gw})	28.57	816.24
SURFACE WATER ROUTE SCORE (S_{sw})	17.45	304.50
AIR ROUTE SCORE (S_{air})	0.00	0.00
$S^2_{gw} + S^2_{sw} + S^2_{air}$		1120.74
$\sqrt{(S^2_{gw} + S^2_{sw} + S^2_{air})}$		33.48
$S_M = \sqrt{(S^2_{gw} + S^2_{sw} + S^2_{air})}/1.73$		19.35

HAZARD RANKING SYSTEM SCORING SUMMARY

FOR

CELOTEX CORPORATION
EPA SITE NUMBER FLD081365892
JACKSONVILLE
DUVAL COUNTY, FL
EPA REGION: 4

SCORE STATUS: IN PREPARATION

SCORED BY K.D. PASS
OF NUS
ON 05/08/90

DATE OF THIS REPORT: 08/01/90
DATE OF LAST MODIFICATION: 08/01/90

GROUND WATER ROUTE SCORE	:	23.08
SURFACE WATER ROUTE SCORE	:	14.10
AIR ROUTE SCORE	:	0.00
MIGRATION SCORE	:	15.64

Shallow Aquifer

HRS GROUND WATER ROUTE SCORE

CATEGORY/FACTOR	RAW DATA	ASN. VALUE	SCORE
1. OBSERVED RELEASE	NO	0	0
2. ROUTE CHARACTERISTICS			
DEPTH TO WATER TABLE	10 FEET		
DEPTH TO BOTTOM OF WASTE	6 FEET		
DEPTH TO AQUIFER OF CONCERN	4 FEET	3	6
PRECIPITATION	51.8 INCHES		
EVAPORATION	46.0 INCHES		
NET PRECIPITATION	5.8 INCHES	2	2
PERMEABILITY	1.0X10-2 CM/SEC	3	3
PHYSICAL STATE		3	3
TOTAL ROUTE CHARACTERISTICS SCORE:			14
3. CONTAINMENT		3	3
4. WASTE CHARACTERISTICS			
TOXICITY/PERSISTENCE:ASSIGNED VALUE,18			18
WASTE QUANTITY CUBIC YDS	75		
DRUMS	0		
GALLONS	0		
TONS	0		
TOTAL	75 CU. YDS	3	3
TOTAL WASTE CHARACTERISTICS SCORE:			21
5. TARGETS			
GROUND WATER USE		3	9
DISTANCE TO NEAREST WELL	7920 FEET		
AND	MATRIX VALUE	6	6
TOTAL POPULATION SERVED	95 PERSONS		
NUMBER OF HOUSES	25		
NUMBER OF PERSONS	0		
NUMBER OF CONNECTIONS	0		
NUMBER OF IRRIGATED ACRES	0		
TOTAL TARGETS SCORE:			15

GROUND WATER ROUTE SCORE (Sgw) = 23.08

HRS SURFACE WATER ROUTE SCORE

CATEGORY/FACTOR	RAW DATA	ASN. VALUE	SCORE
1. OBSERVED RELEASE	NO	0	0
2. ROUTE CHARACTERISTICS			
SITE LOCATED IN SURFACE WATER	NO		
SITE WITHIN CLOSED BASIN	NO		
FACILITY SLOPE	1.0 %		
INTERVENING SLOPE	0.0 %	0	0
24-HOUR RAINFALL	4.0 INCHES	3	3
DISTANCE TO DOWN-SLOPE WATER	500 FEET	3	6
PHYSICAL STATE	3		3
TOTAL ROUTE CHARACTERISTICS SCORE:			12
3. CONTAINMENT	3		3
4. WASTE CHARACTERISTICS			
TOXICITY/PERSISTENCE:ASSIGNED VALUE,18			18
WASTE QUANTITY CUBIC YDS	75		
DRUMS	0		
GALLONS	0		
TONS	0		
TOTAL	75 CU. YDS	3	3
TOTAL WASTE CHARACTERISTICS SCORE:			21
5. TARGETS			
SURFACE WATER USE		2	6
DISTANCE TO SENSITIVE ENVIRONMENTS		3	6
COASTAL WETLANDS	NONE		
FRESH-WATER WETLANDS	2112 FEET		
CRITICAL HABITAT	500 FEET		
DISTANCE TO STATIC WATER	2112 FEET		
DISTANCE TO WATER SUPPLY INTAKE	> 1 MILE		
AND	MATRIX VALUE	0	0
TOTAL POPULATION SERVED	0		
NUMBER OF HOUSES	0		
NUMBER OF PERSONS	0		
NUMBER OF CONNECTIONS	0		
NUMBER OF IRRIGATED ACRES	0		
TOTAL TARGETS SCORE:			12

SURFACE WATER ROUTE SCORE (Ssw) = 14.10

HRS AIR ROUTE SCORE

CATEGORY/FACTOR	RAW DATA	ASN. VALUE	SCORE
1. OBSERVED RELEASE	NO	0	0

2. WASTE CHARACTERISTICS

REACTIVITY:

INCOMPATIBILITY — MATRIX VALUE

TOXICITY

WASTE QUANTITY
CUBIC YARDS
DRUMS
GALLONS
TONS

TOTAL

TOTAL WASTE CHARACTERISTICS SCORE: N/A

3. TARGETS

POPULATION WITHIN 4-MILE RADIUS
- 0 to 0.25 mile
- 0 to 0.50 mile
- 0 to 1.0 mile
- 0 to 4.0 miles

DISTANCE TO SENSITIVE ENVIRONMENTS
- COASTAL WETLANDS
- FRESH-WATER WETLANDS
- CRITICAL HABITAT

DISTANCE TO LAND USES
- COMMERCIAL/INDUSTRIAL
- PARK/FOREST/RESIDENTIAL
- AGRICULTURAL LAND
- PRIME FARMLAND
- HISTORIC SITE WITHIN VIEW?

TOTAL TARGETS SCORE: N/A

AIR ROUTE SCORE (Sa) = 0.00

HAZARD RANKING SYSTEM SCORING CALCULATIONS
FOR
SITE: CELOTEX CORPORATION
AS OF 08/01/90

GROUND WATER ROUTE SCORE

ROUTE CHARACTERISTICS		14
CONTAINMENT	X	3
WASTE CHARACTERISTICS	X	21
TARGETS	X	15

= 13230 /57,330 X 100 = 23.08 = S_{gw}

SURFACE WATER ROUTE SCORE

ROUTE CHARACTERISTICS		12
CONTAINMENT	X	3
WASTE CHARACTERISTICS	X	21
TARGETS	X	12

= 9072 /64,350 X 100 = 14.10 = S_{sw}

AIR ROUTE SCORE

OBSERVED RELEASE 0 /35,100 X 100 = 0.00 = S_{air}

SUMMARY OF MIGRATION SCORE CALCULATIONS

	S	S^2
GROUND WATER ROUTE SCORE (S_{gw})	23.08	532.69
SURFACE WATER ROUTE SCORE (S_{sw})	14.10	198.81
AIR ROUTE SCORE (S_{air})	0.00	0.00
$S^2_{gw} + S^2_{sw} + S^2_{air}$		731.50
$\sqrt{(S^2_{gw} + S^2_{sw} + S^2_{air})}$		27.05
$S_M = \sqrt{(S^2_{gw} + S^2_{sw} + S^2_{air})}/1.73$		15.64

HAZARD RANKING SYSTEM SCORING SUMMARY

FOR

CELOTEX CORPORATION
EPA SITE NUMBER FLD081365892
JACKSONVILLE
DUVAL COUNTY, FL
EPA REGION: 4

SCORE STATUS: IN PREPARATION

SCORED BY K.D. PASS
OF NUS
ON 05/08/90

DATE OF THIS REPORT: 08/01/90
DATE OF LAST MODIFICATION: 08/01/90

GROUND WATER ROUTE SCORE	:	10.44
SURFACE WATER ROUTE SCORE	:	14.10
AIR ROUTE SCORE	:	0.00
MIGRATION SCORE	:	10.14

Floridan Aquifer

HRS GROUND WATER ROUTE SCORE

CATEGORY/FACTOR	RAW DATA	ASN. VALUE	SCORE
1. OBSERVED RELEASE	NO	0	0
2. ROUTE CHARACTERISTICS			
DEPTH TO WATER TABLE	450 FEET		
DEPTH TO BOTTOM OF WASTE	6 FEET		
DEPTH TO AQUIFER OF CONCERN	444 FEET	0	0
PRECIPITATION	51.8 INCHES		
EVAPORATION	46.0 INCHES		
NET PRECIPITATION	5.8 INCHES	2	2
PERMEABILITY	1.0X10-7 CM/SEC	0	0
PHYSICAL STATE		3	3
TOTAL ROUTE CHARACTERISTICS SCORE:			5
3. CONTAINMENT		3	3
4. WASTE CHARACTERISTICS			
TOXICITY/PERSISTENCE:ASSIGNED VALUE,18			18
WASTE QUANTITY CUBIC YDS	75		
DRUMS	0		
GALLONS	0		
TONS	0		
TOTAL	75 CU. YDS	3	3
TOTAL WASTE CHARACTERISTICS SCORE:			21
5. TARGETS			
GROUND WATER USE		3	9
DISTANCE TO NEAREST WELL	1500 FEET		
AND	MATRIX VALUE	10	10
TOTAL POPULATION SERVED	95 PERSONS		
NUMBER OF HOUSES	25		
NUMBER OF PERSONS	0		
NUMBER OF CONNECTIONS	0		
NUMBER OF IRRIGATED ACRES	0		
TOTAL TARGETS SCORE:			19

GROUND WATER ROUTE SCORE (Sgw) = 10.44

HRS SURFACE WATER ROUTE SCORE

CATEGORY/FACTOR	RAW DATA	ASN. VALUE	SCORE
1 OBSERVED RELEASE	NO	0	0
2. ROUTE CHARACTERISTICS			
SITE LOCATED IN SURFACE WATER	NO		
SITE WITHIN CLOSED BASIN	NO		
FACILITY SLOPE	1.0 %		
INTERVENING SLOPE	0.0 %	0	0
24-HOUR RAINFALL	4.0 INCHES	3	3
DISTANCE TO DOWN-SLOPE WATER	500 FEET	3	6
PHYSICAL STATE	3		3
TOTAL ROUTE CHARACTERISTICS SCORE:			12
3. CONTAINMENT	3		3
4. WASTE CHARACTERISTICS			
TOXICITY/PERSISTENCE:ASSIGNED VALUE,18			18
WASTE QUANTITY CUBIC YDS	75		
DRUMS	0		
GALLONS	0		
TONS	0		
TOTAL	75 CU. YDS	3	3
TOTAL WASTE CHARACTERISTICS SCORE:			21
5. TARGETS			
SURFACE WATER USE		2	6
DISTANCE TO SENSITIVE ENVIRONMENTS		3	6
COASTAL WETLANDS	NONE		
FRESH-WATER WETLANDS	2112 FEET		
CRITICAL HABITAT	500 FEET		
DISTANCE TO STATIC WATER	2112 FEET		
DISTANCE TO WATER SUPPLY INTAKE	> 1 MILE		
AND	MATRIX VALUE	0	0
TOTAL POPULATION SERVED	0		
NUMBER OF HOUSES	0		
NUMBER OF PERSONS	0		
NUMBER OF CONNECTIONS	0		
NUMBER OF IRRIGATED ACRES	0		
TOTAL TARGETS SCORE:			12

SURFACE WATER ROUTE SCORE (Ssw) = 14.10

HRS AIR ROUTE SCORE

CATEGORY/FACTOR	RAW DATA	ASN. VALUE	SCORE
1. OBSERVED RELEASE	NO	0	0

2. WASTE CHARACTERISTICS

REACTIVITY:

INCOMPATIBILITY — MATRIX VALUE

TOXICITY

WASTE QUANTITY
- CUBIC YARDS
- DRUMS
- GALLONS
- TONS

TOTAL

TOTAL WASTE CHARACTERISTICS SCORE: N/A

3. TARGETS

POPULATION WITHIN 4-MILE RADIUS
- 0 to 0.25 mile
- 0 to 0.50 mile
- 0 to 1.0 mile
- 0 to 4.0 miles

DISTANCE TO SENSITIVE ENVIRONMENTS
- COASTAL WETLANDS
- FRESH-WATER WETLANDS
- CRITICAL HABITAT

DISTANCE TO LAND USES
- COMMERCIAL/INDUSTRIAL
- PARK/FOREST/RESIDENTIAL
- AGRICULTURAL LAND
- PRIME FARMLAND
- HISTORIC SITE WITHIN VIEW?

TOTAL TARGETS SCORE: N/A

AIR ROUTE SCORE (Sa) = 0.00

HAZARD RANKING SYSTEM SCORING CALCULATIONS
FOR
SITE: CELOTEX CORPORATION
AS OF 08/01/90

GROUND WATER ROUTE SCORE

ROUTE CHARACTERISTICS		5
CONTAINMENT	X	3
WASTE CHARACTERISTICS	X	21
TARGETS	X	19

= 5985 /57,330 X 100 = 10.44 = S_{gw}

SURFACE WATER ROUTE SCORE

ROUTE CHARACTERISTICS		12
CONTAINMENT	X	3
WASTE CHARACTERISTICS	X	21
TARGETS	X	12

= 9072 /64,350 X 100 = 14.10 = S_{sw}

AIR ROUTE SCORE

OBSERVED RELEASE 0 /35,100 X 100 = 0.00 = S_{air}

SUMMARY OF MIGRATION SCORE CALCULATIONS

	S	S^2
GROUND WATER ROUTE SCORE (S_{gw})	10.44	108.99
SURFACE WATER ROUTE SCORE (S_{sw})	14.10	198.81
AIR ROUTE SCORE (S_{air})	0.00	0.00
$S^2_{gw} + S^2_{sw} + S^2_{air}$		307.80
$\sqrt{(S^2_{gw} + S^2_{sw} + S^2_{air})}$		17.54
$S_M = \sqrt{(S^2_{gw} + S^2_{sw} + S^2_{air})}/1.73$		10.14

OVERSIZED

DOCUMENT

MAP

DIVISION OF
SUPERFUND

ATT Robert Morris
US EPA Region IV

May 25, 1993

1993 MAY 26 PM 1:01

TENNESSEE DEPARTMENT
OF ENVIRONMENT

TO: Nancy Thomas

FROM: Ron Sells

SUBJECT: Colotex Site SI 40-511

In response to your request I have obtained the following information:

1. The attached field report states there are 49 drums and 22 (5-gal) buckets inside the building. The opinion as to what is in the drums is stated in the report. As stated in the SSI there are 11 drums with unknown contents located outside the buildings.

2. The owner of the site has changed since an auction was held in April 1993. Although not official yet (deeds not final) it appears that John Brooks from Jackson, TN purchased the manufacturing facility. Mr Cutherson of Paris, TN purchased the sprayfield area.

3. The drums and buckets in the building have not been removed. Mr. Crosser, former owner, is still working on the project.

If you have any further questions please contact me at the Jackson Office.

Ron Sells

SFD File

DIVISION OF SUPERFUND
Trip Report

OWNER/FACILITY: Celotex Corp. Site
TYPE FACILITY: abandoned fiberboard mfg **ACCT#:** 40-511
COUNTY: Henry **CITY:** Paris
DATE OF VISIT: 04-19-93
PURPOSE OF VISIT: inspect drums left at the site by Celotex

INDIVIDUALS CONTACTED: Bill Crosser- owner

SUPERFUND PERSONNEL PRESENT: Sid Ledbetter-TDSWM

WEATHER CONDITIONS: clear
SAMPLES COLLECTED: (NO)
PHOTOS TAKEN: (NO)

COMMENTS AND DISCUSSION:

I asked Sid to accompany me to the site because he was involved in the drum removal activities in 1985-1986.
We met Mr. Crosser at the site and discussed the disposition of the drums. He was under the impression that Celotex would eventually be required to remove the drums. I stated the Celotex Corp. was bankrupt and could not be depended upon to do anything.

We counted 49 drums and 22 (5-gal) buckets inside the mfg building. There were approx. 10 (50#) bags of a pesticide called Dowcil 13 manufactured by Dow Chemical. All the buckets appeared to never have been opened. Four drums of glycerine were intact. These probably will not have to be sampled. Sid estimated that one drum contained glue, (2) drums contained tar, (4) contained oil waste, (5) contained a dispersant with rainwater on top. He was able to estimate this by observation of the contents because the tops of the drums were open to some extent.

Mr. Crosser asked how the drums, etc. may be properly disposed. Sid stated H & H Recycling in Camden, Tn may have an interest in the oil. Briefly, we explained that the contents in the unsealed drums need to be sampled and identified so proper disposal can occur. He stated he will begin this process by calling the above company.

Ron Sells

SITE DATA
****

EPA ID NO.: FLD081365892 SHEET 01

(ACTION : *__* - FOR DATA ENTRY USE ONLY)

SF ID: *___* *___* *___* SITE NAME: CELOTEX CORP SOURCE: N SOURCE COUNTS:

___ *___* STREET: 9225 DAMES POINT RD CONG. DIST: 03 NOTIS: 1

NATL PRIORITY: N CITY: JACKSONVILLE ST: FL ZIP: 32229-_____ STS: 0

HRS: *____.__* CNTY NAME: DUVAL CNTY CODE: 031 HWDMS: 0

HRS DATE (YY/MM): *___/___* LATITUDE: 30/25/06.0 LONGITUDE: 081/37/30.0 COMPOSITE: 0

RESPONSE TERMINATION (CHECK ONE IF APPLICABLE): PENDING *__* NO FURTHER ACTION X OTHER: 0

ENF. DISP. (CHECK ANY THAT APPLY): NO VIABLE RESP. PARTY *__* VOL. RESP. *__* ENF. RESP. *__* COST RECOV. *__*

RSPO NAME: *_____* RSPO PHONE: *____-____-_____* FED. FAC. (Y/N): N NON-SITE: *__*

SMSA: 3600 USGS HYDRO. UNIT: 03070205 REG. FLD1: *_____* REG. FLD2: *__*

SITE DESCRIPTION: *_____*
_____
_____
_____

EVENTS
******

	(ACTION - FOR DATA ENTRY USE ONLY)		EVENT TYPE	DATE (YY/MM) STARTED	DATE (YY/MM) COMPLETED	CONDUCTED BY EPA	STATE	RESP/PARTY	OTHER	COUNTS
RESPONSE EVENTS	*__*	(X)	SITE DISCOVERY (SD)		81/06					
	__	(X)	PRELIMINARY ASSESSMENT (PA)	*___/___*	82/07	*__*	*__*			
	__		SITE INVESTIGATION (SI)	*___/___*	*___/___*	*__*	*__*			
	__		REMEDIAL ACTION (RD)	*___/___*	*___/___*	*__*	*__*	*__*	*__*	*___*
	__		REMOVAL ACTION (RV)	*___/___*	*___/___*	*__*	*__*	*__*	*__*	*___*
ENFORCE. EVENTS	*__*		ENFORCEMENT INVESTIGATION (EI)	*___/___*	*___/___*	*__*	*__*		*__*	
	__		ADMINISTRATIVE ORDER (AO)	*___/___*	*___/___*	*__*	*__*		*__*	
	__		JUDICIAL ACTION (JA)	*___/___*	*___/___*	*__*	*__*		*__*	

SITE NAME: CELOTEX CORP

ALIAS AND ALIAS LOCATION DATA
****

ALIAS (ACTION *__* - FOR DATA ENTRY USE ONLY)

SEQ. NO.: *___* ALIAS NAME: *_____* SOURCE: *__*

ALIAS LOCATION (ACTION *__* - FOR DATA ENTRY USE ONLY)

CONTIGUOUS PORTION OF SITE: *__*

STREET: *_____* CONG. DIST.: *___*

CITY: *_____* ST: *___* ZIP: *_____-_____*

CNTY NAME: *_____* CNTY CODE: *____*

LAT: *___/___/___.__* LONG.: *____/___/___.__* SMSA: *_____* USGS HYDRO. UNIT: *_____*

ALIAS (ACTION *__* - FOR DATA ENTRY USE ONLY)

SEQ. NO.: *___* ALIAS NAME: *_____* SOURCE: *__*

ALIAS LOCATION (ACTION *__* - FOR DATA ENTRY USE ONLY)

CONTIGUOUS PORTION OF SITE: *__*

STREET: *_____* CONG. DIST.: *___*

CITY: *_____* ST: *___* ZIP: *_____-_____*

CNTY NAME: *_____* CNTY CODE: *____*

LAT: *___/___/___.__* LONG.: *____/___/___.__* SMSA: *_____* USGS HYDRO. UNIT: *_____*

SITE NAME: CELOTEX CORP

SITE COMMENTS
****

(ACTION - FOR DATA ENTRY USE ONLY)	COMMENT NUMBER	COMMENT
* *	001	FLS000001110 -SEE FILE
* *	002	103 (C) NOTIFICATION ON FILE
* *	003	LAND TREATMENT/DOMESTIC WASTE WATER TREATMENT. NEITHER STATE NOR LOCAL
* *	004	OFFICE KNOW OF HAZ. WASTE PROBLEM.

EPA ID NO.: FLD081365892 SHEET 04

SITE NAME: CELOTEX CORP

REGIONAL ENTRIES
****

(ACTION - FOR DATA ENTRY USE ONLY)	ENTRY CODE	DESCRIPTION	DATE1 (YY/MM/DD)	DATE2 (YY/MM/DD)	DATE3 (YY/MM/DD)	FREE FIELD

EPA Notification of Hazardous Waste Site

United States Environmental Protection Agency Washington DC 20460

R

This initial notification information is required by Section 103(c) of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 and must be mailed by June 9, 1981.

Please type or print in ink. If you need additional space, use separate sheets of paper. Indicate the letter of the item which applies.

810609

FL S 000001110

A Person Required to Notify:
Enter the name and address of the person or organization required to notify.

Name: CELOTEX CORPORATION
Street: 9225 DAMES POINT RD.
City: JACKSONVILLE State: FL Zip Code: 32229

B Site Location:
Enter the common name (if known) and actual location of the site.

Name of Site: CELOTEX CORPORATION
Street: 9225 DAMES POINT RD.
City: JACKSONVILLE County: DUVAL State: FL Zip Code: 32229

FLD 081365892

C Person to Contact:
Enter the name, title (if applicable), and business telephone number of the person to contact regarding information submitted on this form.

Name (Last, First and Title): McKENNA, J.J. PLT. MANAGER
Phone: 904-751-4400

D Dates of Waste Handling:
Enter the years that you estimate waste treatment, storage, or disposal began and ended at the site.

From (Year): ≈1964 To (Year): ~~PRESENT~~ 1981

E Waste Type: Choose the option you prefer to complete

Option 1: Select general waste types and source categories. If you do not know the general waste types or sources, you are encouraged to describe the site in Item I—Description of Site.

General Type of Waste:
Place an X in the appropriate boxes. The categories listed overlap. Check each applicable category.

1. ☒ Organics
2. ☒ Inorganics
3. ☐ Solvents
4. ☐ Pesticides
5. ☐ Heavy metals
6. ☐ Acids
7. ☐ Bases
8. ☐ PCBs
9. ☐ Mixed Municipal Waste
10. ☐ Unknown
11. ☐ Other (Specify)

Source of Waste:
Place an X in the appropriate boxes.

1. ☐ Mining
2. ☐ Construction
3. ☐ Textiles
4. ☐ Fertilizer
5. ☐ Paper/Printing
6. ☐ Leather Tanning
7. ☐ Iron/Steel Foundry
8. ☐ Chemical, General
9. ☐ Plating/Polishing
10. ☐ Military/Ammunition
11. ☐ Electrical Conductors
12. ☐ Transformers
13. ☐ Utility Companies
14. ☐ Sanitary Refuse
15. ☐ Photofinish
16. ☐ Lab Hospital
17. ☐ Unknown
18. ☒ Other (Specify) FIBER BOARD

Option 2: This option is available to persons familiar with the Resource Conservation and Recovery Act (RCRA) Section 3001 regulations (40 CFR Part 261).

Specific Type of Waste:
EPA has assigned a four-digit number to each hazardous waste listed in the regulations under Section 3001 of RCRA. Enter the appropriate four-digit number in the boxes provided. A copy of the list of hazardous wastes and codes can be obtained by contacting the EPA Region serving the State in which the site is located.

RECEIVED EPA/REGION IV JUN 8 12 43 PM '81 ENFORCEMENT DIVISION

0 0 2 2 7

Form Approved OMB No. 2060-0138

Notification of Hazardous Waste Site **Side Two**

F Waste Quantity

Place an X in the appropriate boxes to indicate the facility types found at the site.

In the "total facility waste amount" space give the estimated combined quantity (volume) of hazardous wastes at the site using cubic feet or gallons.

In the "total facility area" space, give the estimated area size which the facilities occupy using square feet or acres.

Facility Type

1. ☐ Piles
2. ☒ Land Treatment
3. ☐ Landfill
4. ☐ Tanks
5. ☐ Impoundment
6. ☐ Underground Injection
7. ☐ Drums, Above Ground
8. ☐ Drums, Below Ground
9. ☐ Other (Specify) _____

Total Facility Waste Amount

cubic feet 77.4

gallons _____

Total Facility Area

square feet _____

acres 4

G Known, Suspected or Likely Releases to the Environment:

Place an X in the appropriate boxes to indicate any known, suspected, or likely releases of wastes to the environment.

☐ Known ☐ Suspected ☐ Likely ☒ None

Note: Items H and I are optional. Completing these items will assist EPA and State and local governments in locating and assessing hazardous waste sites. Although completing the items is not required, you are encouraged to do so.

H Sketch Map of Site Location: (Optional)

Sketch a map showing streets, highways, routes or other prominent landmarks near the site. Place an X on the map to indicate the site location. Draw an arrow showing the direction north. You may substitute a publishing map showing the site location.

I Description of Site: (Optional)

Describe the history and present conditions of the site. Give directions to the site and describe any nearby wells, springs, lakes, or housing. Include such information as how waste was disposed and where the waste came from. Provide any other information or comments which may help describe the site conditions.

J Signature and Title:

The person or authorized representative (such as plant managers, superintendents, trustees or attorneys) of persons required to notify must sign the form and provide a mailing address (if different than address in item A). For other persons providing notification, the signature is optional. Check the boxes which best describe the relationship to the site of the person required to notify. If you are not required to notify check "Other".

Name LECIL M. COLBURN

Street P.O. BOX 22601

City TAMPA State FL Zip Code 33622

Signature Lecil M Colburn 6/8/81

☒ Owner, Present
☐ Owner, Past
☐ Transporter
☐ Operator, Present
☐ Operator, Past
☐ Other

[FR Doc. 81-11500 Filed 4-14-81; 8:45 am]

BILLING CODE 6560-29-C

Charter

There is no evidence suggesting that anything other than fuel oils were stored at this site.

Recommendation: No action under CERCLA should be taken at this site.

"Low priority" Kenneth W. Richard
10/18/85

If only Fuel (i.e. gasolines) not waste oil was stored - NFA under CERCLA

FFB 1/22/88