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Transportation of Coal to Seaports via Mid-America Inland Waterway System

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The mid-America inland waterway system has long been recognized as one of the basic means for the movement of domestic coal. Yet, until the recent steam-coal export boom, insufficient attention had been paid to the economic advantages of shipping coal by river for export transshipment at Gulf Coast ports. The ports of Mobile in Alabama and New Orleans in Louisiana combined to handle 2.7 million tons of export coal in 1979, according to the U.S. Department of Commerce records. These two ports, however, offer much greater capacity than current demand requires. In addition, other Gulf Coast ports are exploring the potential for coal export, most notably Galveston, Texas.

The current congestion being experienced at the ports of Hampton Roads and Baltimore has dramatically altered the way in which the U.S. coal industry views itself within the context of world coal supply and demand. Hundreds of millions of dollars have been committed for the construction of new coal-loading terminals at these two ports and others located along the Atlantic Seaboard. Coal companies, previously involved with mining coal only, are now assisting financially in the development of new and/or expanded coal terminals. These commitments have received extensive documentation and will not be repeated here (1-3).

Likewise, the ports of Mobile and New Orleans and the entire mid-America inland waterway system are responding to the unprecedented demand for U.S. mined steam coal. In an effort to report the development of this portion of America's coal-handling capacity, this paper has three major objectives:

1. To place the mid-America inland waterway movement of coal for export in a broad domestic context of total U.S. coal movements for export;
2. To define the network of coal movement on mid-America inland waterways, including major points of origin; and
3. To describe the existing facilities and plans for expansion at the two leading Gulf Coast ports of New Orleans and Mobile, which receive a portion of their export coal via mid-American inland waterways.

RELATIONSHIP OF MID-AMERICA COAL EXPORTS TO TOTAL U.S. EXPORTS

Historically, the United States has exported a fairly stable level of bituminous coal since 1974 [Table 1 (4, pp. II-12 and II-16)]. With the exception of 1978, when a low of approximately 40 million tons was exported, a generally consistent level of between 54 million and 66 million tons of coal have left U.S. ports for consumption overseas. In 1977, approximately 78 percent of total coal exports was the metallurgical variety (met coal) processed into coke for use in steel production. The remaining 22 percent was steam coal used in the conversion of electricity, heat, steam, etc. (5). With the growing demand for U.S. steam coal, the relative shares of met coal and steam coal are expected to balance; steam coal will assume the larger share by the year 2000. The often-quoted Massachusetts Institute of Technology (MIT) text Coal: Bridge to the Future (5) offers two likely scenarios of future coal export demand. In scenario A, total exports are estimated at 125 million tons by the year 2000; steam coal accounts for 65 million tons, and met coal accounts for the remaining 60 million tons. In scenario B, a total of 200 million tons is forecast for export; steam coal represents 130 million tons and met coal, 70 million tons. Thus, in the minds of the MIT analysts, the volume of met coal could remain in a fairly well-defined range between 60 and 70 million tons for export by the year 2000. The steam-coal export market, on the

Table 1. U.S. exports of bituminous coal.

Seaport	Short Tons Exported (000s) 1974	1975	1976	1977	1978	1979
Hampton Roads	35 745	36 952	32 000	24 244	15 396	33 753
Baltimore	5 949	6 769	6 327	7 055	5 887	9 141
Philadelphia	1 431	802	447	187	90	55
New Orleans	992	1 292	1 297	1 432	1 388	1 410
Mobile	1 746	2 745	2 755	3 611	1 848	1 284
Great Lakes	14 063	17 108	16 580	17 158	15 214	19 140
Total	59 926	65 668	59 406	53 687	39 825	64 783

other hand, is not so clearly determined and could be subject to continued pressure from rising oil prices determined by the Organization of Petroleum Exporting Countries (OPEC). In this case, a range between 65 and 130 million tons was offered.

In 1979, 65 million tons of coal were exported from the United States. Of this total, the ports of Hampton Roads and Baltimore combined to account for 43 million tons, or 66 percent of total U.S. exports. Several Great Lakes ports are also handling considerable volumes of export coal to Canada. Most noted among these are the loading terminals at the ports of Ashtabula, Ohio; Toledo and Sandusky, Ohio; and Port Huron, Michigan. The Great Lakes ports as a whole exported 19 million tons to Canada in 1979. During this same year, the port of Philadelphia handled 0.6 million tons of coal for export, according to U.S. Department of Commerce statistics.

Obviously, preliminary data for 1980 reflect export tonnages moving out of ports that had previously never handled coal. The ports of New York, Wilmington, Long Beach, and others are all moving coal, sometimes in primitive and tedious fashions. For example, at one port where direct rail-to-vessel conveyor-belt equipment is not available, the logistics of loading the coal for export are as follows: (a) coal from rail cars is loaded into open-top heavy-duty trucks for delivery to the port apron area, (b) coal is dumped in piles onto the apron from trucks, and (c) grab-bucket crane equipment loads coal bucket by bucket into the berthed vessel. The approximate loading time for a small-bulk vessel of approximately 30 000 tons dead weight can be 7-10 days, or 3 tons/month.

The Gulf Coast ports of New Orleans and Mobile handled 1.4 million tons and 1.3 million tons of coal, respectively, for export in 1979, according to U.S. Department of Commerce statistics. In the case of New Orleans, the 1979 total was close to the largest handled over the past six years. For Mobile, the 1979 figure was the smallest level of activity since 1974. By 1986, the Tennessee-Tombigbee Waterway is expected to generate additional coal exports through Mobile. The source of this coal will be mines in Tennessee, north Alabama, and western Kentucky. Some of this coal now moves through New Orleans. The balance will be coal from new mines that will be opened in the future. Coal exports generated by the Tennessee-Tombigbee Waterway are expected to amount to 50 percent of the total coal exports through Mobile.

Table 2 (6) shows the relationship between total U.S. waterborne commerce and total waterborne coal movements. As shown, since 1972, the percentage of waterborne coal movements has ranged from 12.9 to 9.2 percent of total U.S. waterborne commerce in terms of gross tonnage. During the same time, the percentage of coal exports has ranged from 2 to 3.9 percent of total U.S. waterborne commerce. Recall that the ports of Mobile and New Orleans accounted for approximately 2.7 million tons of export coal in 1979, or 4.2 percent of total coal exports in that year.

Table 2. Total U.S. waterborne commerce, coal movements, and internal coal movements.

Year	Short Tons (000 000s): Total U.S. Waterborne Commerce	Total Coal	Coal Exports	Coal Exports as Percentage of Total Coal	Percentage of Total U.S. Waterborne Commerce: Total Coal	Coal Exports
1978	2021.3	185.9	40.3	21.7	9.2	2.0
1977	1908.2	212.0	53.9	25.4	11.1	2.8
1976	1835.0	215.1	59.8	27.8	11.7	3.3
1975	1695.0	219.0	65.3	29.8	12.9	3.9
1974	1746.8	208.5	61.6	29.5	11.9	3.5
1973	1761.6	197.7	53.0	26.8	11.2	3.0
1972	1616.8	204.9	55.9	27.3	12.7	3.5

Note: Coal export data for this table will not agree in all cases with coal export totals shown in Table 1, since information in Table 1 is from the U.S. Department of Commerce and the data in Table 2 are from the U.S. Army Corps of Engineers.

In more detail, Table 3 (6) shows the relationship between total U.S. waterborne coal movements and several subcategories of foreign and domestic coal movements. Foreign tonnage includes exports as well as imports. According to the U.S. Army Corps of Engineers' statistics, the United States as a whole imported 1.9 million tons of coal in 1978. [These figures do not include imports of refined coking coals. Since 1972, imports of coke have been rising at an alarming rate due in large part to the decline of the domestic coke production capacity (7).] Total domestic waterborne coal movements were 143.8 million tons in 1978. Internal domestic movements represented the greatest volume, 114.6 million tons, followed by lakewise, coastwise, and local movements at 22.9 million tons, 3.3 million tons, and 3.0 million tons, respectively. (For a definition of these terms, see any issue of the U.S. Army Corps of Engineers Waterborne Commerce Statistics, introductory material.)

With this information as background, the next section describes the major points of origin for coal that moves along the mid-America waterway system. Emphasis is placed on the terminals located on the Black Warrior River that serve Mobile and those on the Ohio River that serve New Orleans.

DEFINITION OF NETWORK OF COAL MOVEMENTS ON MID-AMERICA INLAND WATERWAYS

Physical Characteristics of Waterway System

The waterway system of the United States consists of 26 000 miles of commercial navigable waterways, the shipping lanes of the Great Lakes and coastal trade routes, and the more than 200 commercial inland and coastal harbors and ports. The inland system and the Great Lakes are improved by 265 locks, channel alignments, bank-stabilization modifications, and cutoffs. They are maintained by periodic dredging, cleaning, and snagging of the channels. The U.S. Army Corps of Engineers operates most of the locks

Table 3. Foreign and domestic waterborne movements of coal and lignite.

Year	Total U.S. Waterborne Coal	Foreign		Domestic				
		Imports	Exports	Total	Coastwise	Lakewise	Internal	Local
1978	185.9	1.9	40.3	143.8	3.3	22.9	114.6	3.0
1977	212.0	1.7	53.9	156.3	3.7	22.2	127.6	2.8
1976	215.1	1.2	59.8	154.2	2.8	21.6	128.0	1.8
1975	219.0	0.9	65.3	152.8	3.5	21.8	125.3	2.2
1974	208.5	2.1	61.6	144.8	4.0	21.7	116.4	2.7
1973	197.7	0.1	53.0	144.5	3.6	23.8	114.1	3.1
1972	204.9	0.0	55.9	149.0	3.6	25.2	118.2	2.0

Short Tons (000 000s)

Notes: Coal export data for this table will not agree in all cases with coal export totals shown in Table 1, since information in Table 1 is from the U.S. Department of Commerce and the data in Table 3 are from the U.S. Army Corps of Engineers.
Row totals may not add due to rounding.

and maintains most of the improved waterways and harbors (8).

No obvious constraints exist for water movement of Western coal, which is first transported by rail to the middle Mississippi River. However, various types of constraints generally appear for Ohio River movements of West Virginia, Kentucky, and Tennessee coal. Figure 1 depicts the major waterways for the United States. Table 4 (9) gives the characteristics of the selected locks on the system.

Tennessee River

Coal from the southern Appalachian area in eastern Tennessee could move on the Tennessee River to the lower Ohio River near Peducah, Kentucky, proceed through Locks and Dams 52 and 53 on the Ohio River, then proceed from Cairo, Illinois, on the lower Mississippi River (which is free from locks) to New Orleans. Locks on the Tennessee River upstream from Chattanooga would represent a major constraint to waterway commerce because the Chickamauga Lock would have a reserve capacity of less than 1 million tons/year (see Table 4). The most capacity-constrained lock on the Tennessee River between Chattanooga and its confluence with the Ohio River is the Kentucky Lock and Dam, which in 1976 had a reserve capacity of only 4 million tons. Tennessee Consolidated Coal operates a coal-loading terminal at Halesbar. Coal is trucked from distances of approximately 30-35 miles and loaded directly onto barges.

Ohio River

The Ohio River and its tributaries can best be described by dividing them into an upper and a lower system. The lower system extends from Cincinnati, Ohio, to the mouth of the river, where it enters the Mississippi River at Cairo, Illinois. The upper Ohio system is between Cincinnati and Pittsburgh, Pennsylvania.

Lower Ohio River

The primary constraint on the lower Ohio River is the McAlpine Lock at Louisville, Kentucky. In 1976, this lock had an estimated reserve capacity of about 23 million tons/year. Capacity for other locks on the Ohio River that are similar in size has been estimated to be 95 million tons. The lower capacity at the McAlpine Lock is attributable to the congestion problems experienced in the approach canal. The Green River is a tributary to the lower Ohio River and serves the coal-producing region in western Kentucky. The Green River has substantial reserve lock capacity downstream from Rochester; the reserve capacity is 55 million tons/year and the 1976 tonnage was 14 million tons for both Lock and Dam 1 and Lock and Dam 2. Owensboro, Kentucky, is the location of several barge-loading terminals, at approximately mile 756. Coal is trucked in from southern Indiana and Kentucky, stockpiled, and conveyed onto barges.

Upper Ohio River

The upper Ohio River serves coal-mining regions in northwestern West Virginia and southwestern Pennsylvania. Gallipolis on the upper Ohio River (near Huntington, West Virginia) represents a potential constraint in that it had a 1976 reserve capacity of less than 8 million tons. Studies to increase the capacity of the Gallipolis locks are under way. In addition, locks at Emsworth, Dashields, and Montgomery and the upper Ohio River below Pittsburgh are all potential candidates for capacity overloads if there were any significant increase in coal movement. These locks are represented by the characteristics of the Emsworth Lock and Dam, which had a reserve capacity of 11 million tons in 1976.

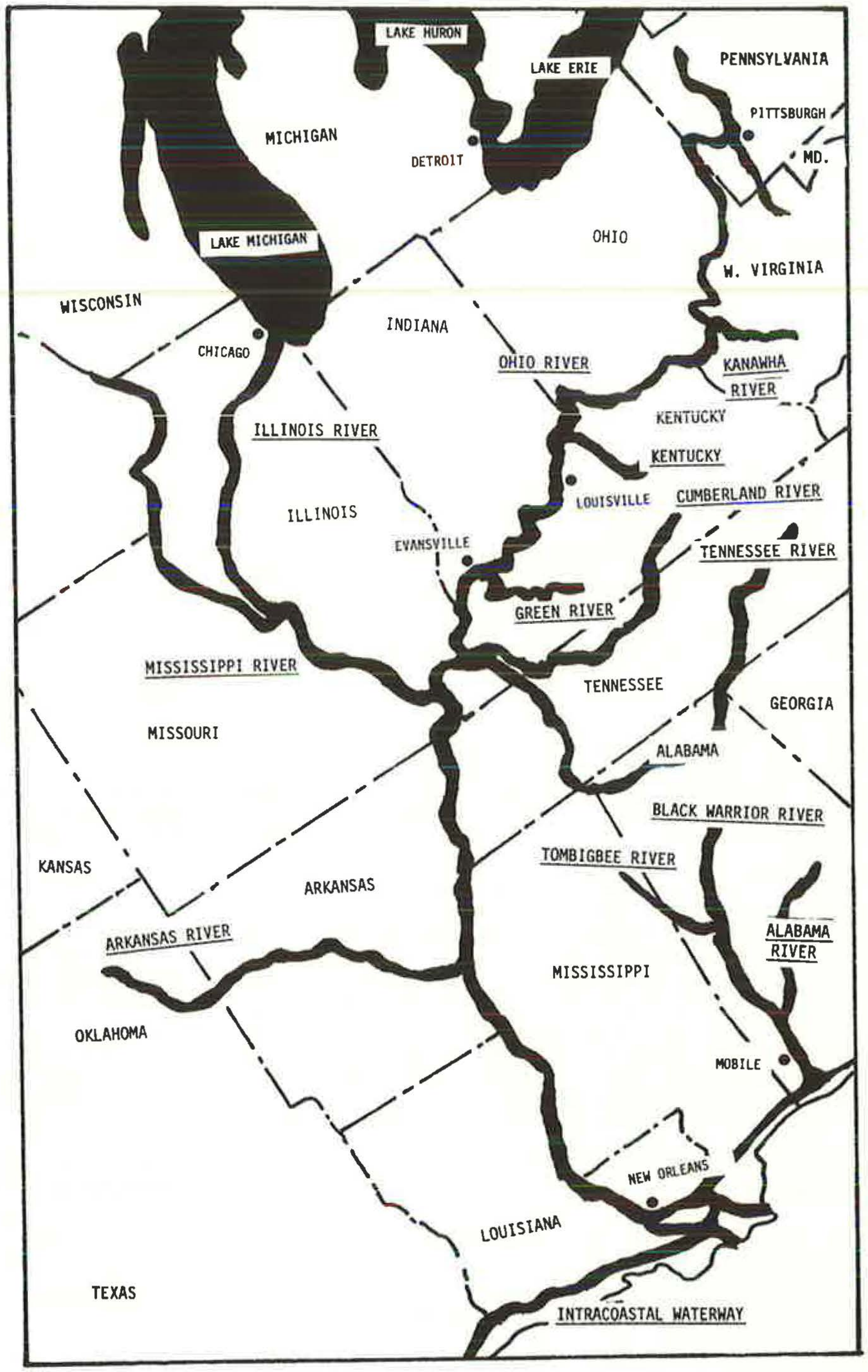
The Kanawha River flows into the Ohio River immediately upstream from the Gallipolis Locks and Dam and serves the coal-mining region in the vicinity of Charleston, West Virginia. The Kanawha River is constrained at Winfield Lock, which had a 1976 reserve capacity of about 7 million tons.

The Monongahela project extends upstream from Pittsburgh in Pennsylvania to Fairmont in West Virginia, and the most constraining lock would probably be Lock and Dam 3, which had a 1976 reserve capacity of 15 million tons. Locks 7 and 8 on the Monongahela River also constrain the coal traffic. The Gallipolis Locks on the upper Ohio River would represent a greater constraint to coal movements between West Virginia and New Orleans than those on the Monongahela.

Mississippi River

The Mississippi River between St. Louis in Missouri and New Orleans in Louisiana could easily carry many times its current level of commerce without being constrained. This section of the river is unobstructed by locks and dams. Inland navigation upstream from St. Louis, however, will face capacity problems if any substantial increase in coal movement occurs. Lock and Dam 26 on the Mississippi River above St. Louis represents an immediate constraint problem because traffic is rapidly approaching capacity. The estimated annual capacity of Lock and Dam 26 is 64 million tons and traffic levels had reached 58 million tons in 1976. A single 1200x110-ft lock is under construction and will replace the two existing locks. This new lock and dam will increase annual capacity by 9 million tons. The need for a second lock in the new structure for Lock

Figure 1. Mid-America inland waterway system.



and Dam 26 on the Mississippi River is also expected to be constrained. For example, Lock and Dam 25 had a 1976 reserve capacity of only 4 million tons.

Illinois River

The Illinois River connects the upper Mississippi River and the Great Lakes systems at Chicago. Historically, Illinois coal moved both north and south on the system. However, it is high-sulfur coal, and its use has been curbed. This waterway is already overloaded at seven locks, as illustrated by the Marseilles Lock (Table 4).

Kaskaskia River

The Kaskaskia River flows into the Mississippi River downstream from St. Louis. The Kaskaskia Valley, which lies in the heart of the Illinois coal-mining area, may have a great potential for increased coal mining. In 1976, the Kaskaskia River had substantial excess capacity.

Missouri River

The Missouri River has no locks and would appear to be relatively free from constraints; however, 9-ft channel depths are not dependable throughout the year. Controlling depths are only 8.5 ft below Boonville, Missouri, and navigation is shut down during winter and also when multipurpose water storage above Sioux City is insufficient to maintain minimum design flow.

Table 4. Characteristics of selected inland-waterway locks and dams.

River or Canal	Lock and Dam	Lock Size (ft)	Capacity (tons 000 000s) Annual[a]	1976 Traffic	Reserve in 1976
Upper Tennessee River	Chickamauga	360x60	5	4	1
Lower Tennessee River	Kentucky	600x110	30	26	4
Lower Ohio River	McAlpine	1200x110 600x110 360x56	67	44	23
Green River	1	600x84	55	14	41
Upper Ohio River	Gallipolis	600x110 360x110	49	41	8
Ohio River	Emsworth	600x110 360x56	37	26	11
Kanawha River	Winfield	360x56 360x56	20	13	7
Monongahela River	3	720x56 360x56	40	25	15
Upper Mississippi River	25	600x110	29	25	4
	26	600x110 360x110	64	58	6
Illinois River	Marseilles	600x110	26	26	0
Kaskaskia River	Kaskaskia	600x84	29	1	28
Arkansas River	Norrell	600x110	30	4	26
Inner Harbor navigation canal	Inner Harbor	640x75	26[b]	28	-2
Warrior River	W.B. Oliver	460x95	27	12	15
Welland Canal	1	730x80	75	64	11
Columbus-Snake River	Bonneville	500x76	9	6	3

[a]Capacity values are for "practical capacity," which is taken as 90 percent of net maximum technical capacity (for infinite queue length) after deductions for recreation and season.
[b]Based on limited data sample; lock is also used by ocean-going vessels.

Arkansas River

The Arkansas River project provides 9-ft channel depths to Catoosa, Oklahoma, near Tulsa. Coal traffic on the Arkansas from eastern Oklahoma has been increasing and the Arkansas River may have potential for substantial increases in coal traffic. The lock that had the most traffic on the Arkansas River (Norrell Lock) had a 1976 reserve capacity of 26 million tons.

Inner Harbor Lock

It is important to note that future coal movements down the Mississippi River destined for Mobile by way of the Inner Harbor Lock at New Orleans would be constrained by this lock. It was already overloaded in 1976 by 2 million tons.

Warrior River

Coal that moves from the Birmingham area to Mobile on the Warrior River would pass through several locks. The most constrained of these is the W.B. Oliver Lock.

Domestic Water Carriers

The inland waterways industry includes carrier firms of the order of 2000 or more. These range in size from operators of single vessels to operators of extensive fleets. The carriers are classified as regulated, exempt, and private. Some firms engage in activities in more than one of these categories.

The regulated carriers, which function under Interstate Commerce Commission jurisdiction, include common carriers, which extend service to all shippers without distinction, and contract carriers, which serve shippers under specific written contract. Many regulated carriers are subsidiaries of large companies, several of which have no direct connection with the inland waterways industry. Some of the regulated carriers also conduct unregulated operations. It should be noted that about 92 percent of all barge traffic is unregulated.

The rates charged by exempt carriers in the unregulated sector of the industry are not published, but they are often established by contract with the shipper. These exempt carriers are not required to report revenues, operating data, or financial information.

Private carriers operate primarily for the transport of their own products (usually coal, petroleum, chemicals, or grain), but they may also carry exempt commodities for others. Many of the private carriers own no towboats of their own but contract for towing service with regulated or exempt carriers.

Open-hopper barge carriers appear to be the most successful of any of the water-carrier groups; they exhibit the lowest operating expense level (83.6 percent) and the highest net income level (6.7 percent). Although these carriers have the greatest long-term debt percentage (66.1 percent), their low operating expenses allow for sufficient net income after interest expenses. Open-hopper barge carriers also show the largest expenditures for fuel (16.6 percent) and labor (20.6 percent), which reflects their prime emphasis on barge and towing operations and less emphasis on subsidiary activities. The ability of these firms to achieve high equipment utilization by negotiating long-term contracts for the movement of coal may partly explain their high profitability.

Coal is sold under long-term contracts as well as at spot prices. Historically, approximately 20 percent of the coal produced in the United States is sold on the spot market. This dichotomy in turn creates a contract market and a spot market for barge transportation. The barge carriers involved in coal trade participate in both contract and spot markets. In 1976, the percentage of spot movements reported varied among firms from 7 to 40 percent, which indicates that spot barge movements correspond closely to spot coal marketing.

EXISTING FACILITIES AND PLANS FOR EXPANSION AT GULF COAST PORTS THAT PLAN TO EXPORT COAL

The ports of Mobile and New Orleans occupy the most prominent position among the coal export transshipment facilities on the Gulf Coast. Other cities are in the process of evaluating the feasibility of coal-terminal development; however, detailed plans have not been presented at this time, except for Galveston.

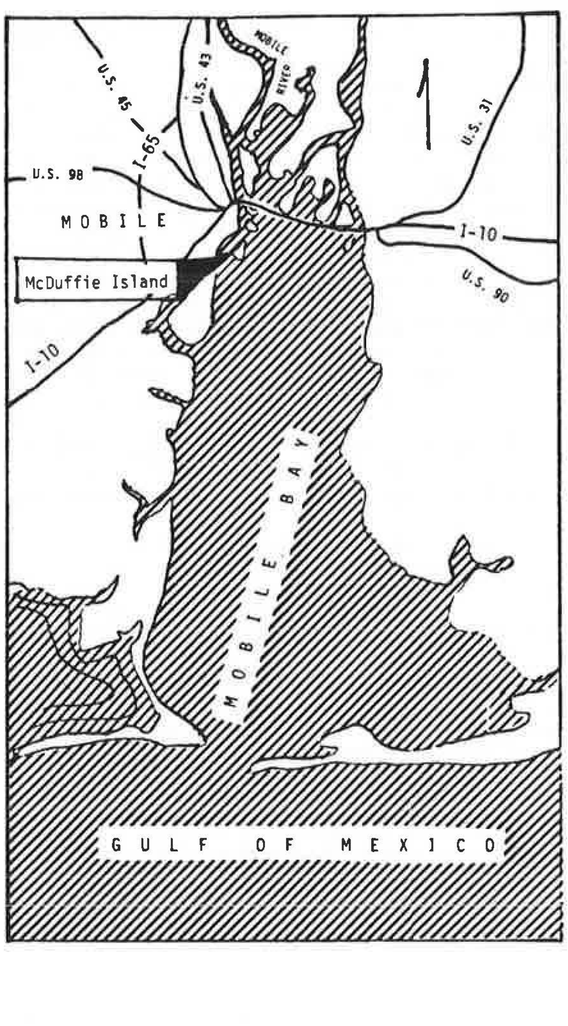
Mobile

The port of Mobile is located in the southwestern part of Alabama at the junction of the Mobile River and the head of Mobile Bay (Figure 2). The port is about 28 nautical miles north of the bay entrance from the Gulf of Mexico, and 170 nautical miles west of New Orleans. The port's principal waterfront facilities are located along the lower 5 miles of the Mobile River (10,11).

The outer harbor of Mobile consists of the deep-water channel that extends from the lower end of the Mobile Bay channel in the Gulf of Mexico to the mouth of the Mobile River. From the upper reach of the Mobile Bay channel, the Arlington channel leads northwest to a turning basin at the southwest end of Garrows Bend. Garrows Bend channel leads northeast from the turning basin and terminates south of the causeway that connects McDuffie Island with the mainland. McDuffie Island is just west of the Mobile Bay channel at the mouth of the Mobile River and is the location of all coal-exporting activities.

McDuffie Terminal is recognized as one of the most modern coal-handling facilities in the world. Most of the coal is now being mined in the north Alabama fields and shipped by barge to McDuffie for export. A small amount is being transported by rail

Figure 2. Port of Mobile.



for export. It is owned and operated by the Alabama State Docks Department, the only domestic coal-handling facility that involves direct public interest. It was placed into operation in January 1975 and incorporates the newest and most innovative approach to material handling and automatic barge unloading in the United States.

McDuffie Island is accessible from the mainland by a causeway and is served by the terminal railway of the Alabama State Docks Department. The island is adjoined on three sides by dedicated channels. The Mobile River channel on the east side is now authorized and maintained to a depth of 40 ft. The Arlington channel on the south side is authorized and maintained to a depth of 27 ft, and the Garrows Bend channel is authorized to a depth of 27 ft but has not been maintained since the construction of the causeway at the north end of the island (Figure 3).

The fact that McDuffie Island is south of the 44-ft-deep channel crossing of the tunnel for Interstate 10 places the facility in an advantageous position for the future handling of much larger bulk carriers. The U.S. Army Corps of Engineers in July 1979 held a public hearing in Mobile to address the matter of harbor improvements within the Mobile Harbor and ship channel. On finding economic justification, they rendered a plan for deepening the Mobile ship channel from a point south of the highway tunnels to the Gulf of Mexico from the current authorized depth of 40 ft to 55 ft.

The 40-ft channel depth now limits the size of vessels that call at Mobile to approximately 50 000 tons dead weight. Ships with capacities up to 100 000 tons dead weight with loaded drafts considerably in excess of 40 ft have called at Mobile. However, these larger vessels must leave the harbor only partly loaded due to existing channel-depth restrictions. The improvement and deepening of Mobile Harbor to a depth of 55 ft would permit vessels up to 120 000 tons dead weight to load fully at McDuffie.

The initial facilities constructed on McDuffie Island included an automatic barge unloader, rail-car dump, truck dump, two storage pads, a stacker/reclaimer and material-handling conveyor system, ship dock, ship loader, offices, and control tower as well as back-up maintenance buildings and receiving tracks for rail cars (Figure 4). Expansion facilities will include an additional barge unloader, additional stacker/reclaimer, two additional storage pads, the construction of a loop track for handling unit trains of coal, and an integrated conveyor system.

The McDuffie terminals began operation in 1975 with the loading of 25 barges of coal on the vessel Errandale. Since that time, the plant has averaged more than 3 million tons/year of annual throughput, if exports and internal movements are counted. With the completion of the expansion, the projected annual throughput of the plant will be 7 million tons/year. However, the plant will have the capability of handling in excess of 10 million tons/year if needed.

Coal that arrives by water is carried almost exclusively in open-hopper barges 195 ft long, 35 ft wide, and 12 ft deep. The barges are of a more-or-less standard design and average loading is approximately 1400 tons of coal/barge. The barges are fleeted in protected waters on the west side of the island. Space is now adequate for approximately 35 barges adjacent to the barge unloader, and directly contiguous areas are available for expansion of the barge fleeting and holding operations.

The barges are brought into the fleeting area and moored by various towing companies that also remove

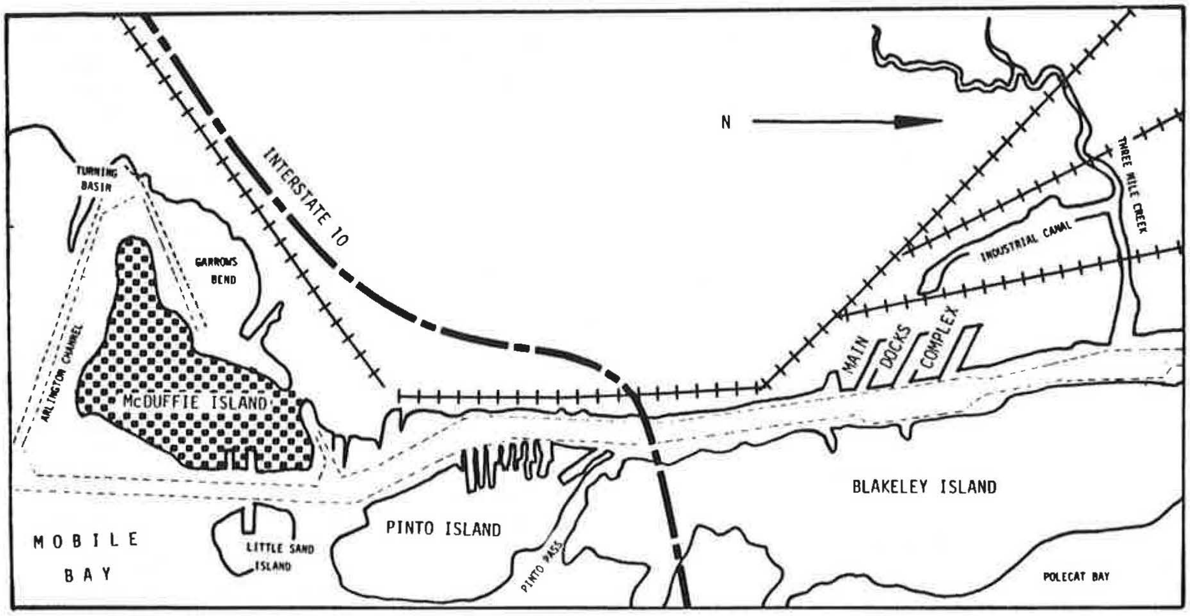


Figure 3. McDuffie Island and port of Mobile.

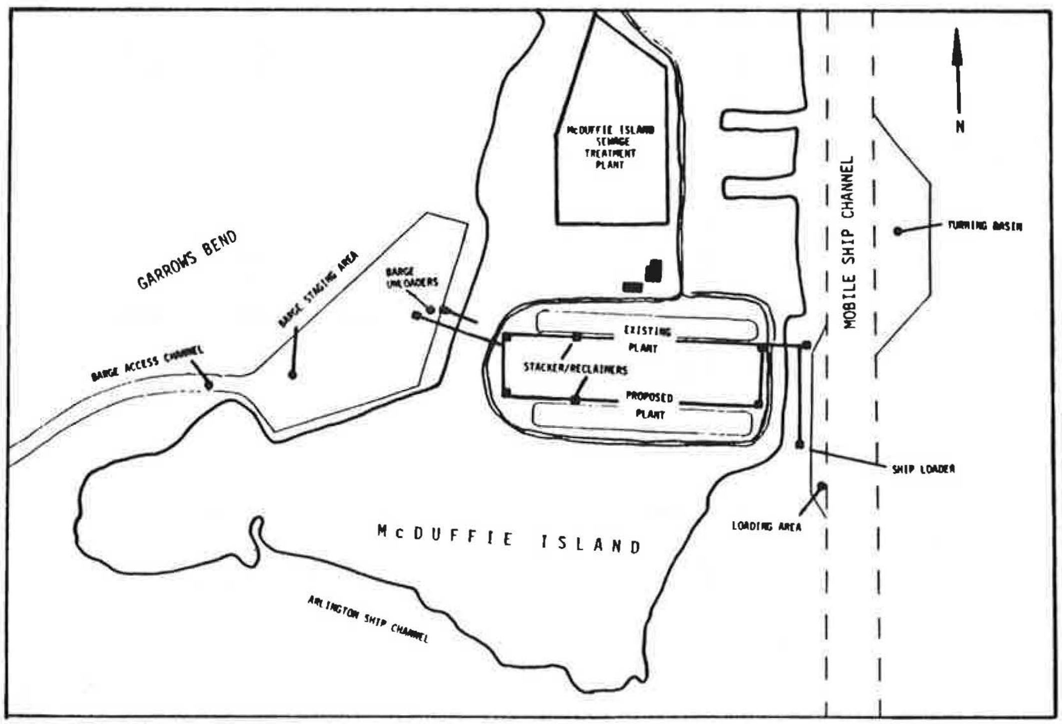


Figure 4. Physical layout of McDuffie Island coal-handling facilities.

the empty barges from the fleeting area. Movement of the barges within the fleeting area is accomplished by a work boat under contract to the various shippers. The barges are currently unloaded by a high-capacity, ladder-type bucket-elevator unloader. The bucket elevator remains stationary while the barge is moved back and forth beneath it to allow the unloader to remove the coal and place it on the conveyor system. The new barge unloader will be a similar design.

The average unloading rate, including time required to remove one barge and position another barge, is approximately 45 min, or a handling capacity of 10-11 barges/8-h shift. The coal removed from the barges is moved by the conveyor system and is discharged into the rotary-car dumper pit in which adjustable vibratory feeders place the material on a conveyor belt to be taken directly to a waiting ship or to be placed in stock for later reclamation and shipment. Barge-cleanout service is available through use of a small front-end loader placed in the barge. After residue has been accumulated at one end of the barge, a clamshell is used to complete the clean-up operation. Residue is deposited in hopper bins, which are then unloaded into dump trucks for final deposit in the storage area.

The open storage area has a capacity of 430 000 tons. The electric traveling stacker/reclaimer has a 180-ft boom equipped with a reversible 72-in belt conveyor and a continuous-bucket wheel. It has a stacking rate of 4000 tons/h and a reclaiming rate of 5000 tons/h.

By May 1981, the second phase of development should be complete. This will add a second stacker/reclaimer, two additional storage pads, one more barge unloader, and a rail facility that will accommodate unit trains in a loop track set-up. A total price of $20 million is estimated to complete this work.

Phase 3 of the development will include a new dock, ship loaders, and a third stacker/reclaimer, which will cost approximately $30-35 million. To allow for the second and third phases of development, a 143-acre site was recently acquired by the state immediately adjacent to the existing complex. The new area includes 2800 ft of riverfront berthing space.

According to U.S. Army Corps of Engineers' statistics, the port of Mobile handled 8 million tons of coal and lignite in 1978 [Table 5 (12)]. Of this total, 1.7 million tons were foreign imports, and 2.2 million tons were foreign exports. The remaining tonnage was either for the receipt or the shipment of internal domestic traffic or for local domestic movements. There were no coastwise receipts or shipments. The major sources of supply for this coal are the Coosa, Cahaba Plateau, and Warrier fields in north Alabama; western Kentucky; the Tracy City fields in Tennessee; and small shipments from eastern Kentucky, Illinois, and Indiana.

New Orleans

The port of New Orleans currently handles export coal at two terminals located in Plaquemines Parish. First, Electra-Coal Transfer Corporation, located about 50 miles downstream from New Orleans, is expecting to handle approximately 1.0 million tons of coal for export to Japan this year. Second, the Plaquemines Parish Terminal, operated by International Marine Terminals, Inc. (IMT), is located about 30 miles below New Orleans near Davant. IMT is primarily handling coal for domestic consumption, although the capability exists for export (Figure 5).

The IMT-operated facility first handled coal for export in 1978. It is contemplated that, ultimately, there will be a three-phase facility that can handle 12 million tons/year. The terminal currently accommodates shallow-draft, open-hopper river barges unloaded by a continuous unloader that has a capacity of 5500 tons/h. A 270 000-ton ground storage area is available. Coal is reclaimed by bulldozer at an average rate of 1000 tons/year.

Phase 2 calls for the addition of a new dock and installation of a traveling ship unloader that has an ultimate capacity of 7000 tons/h. In phase 3, a stacker/reclaimer is scheduled to be used at full development and nearly 1 million tons of active storage area will be available. IMT officials have indicated that it is their hope that five or six large-volume customers will require the greatest share of coal.

To accommodate deeper-draft vessels, the U.S. Army Corps of Engineers is reviewing a proposal to

Table 5. Movement of coal and lignite from Mobile Harbor, Alabama.

	Short Tons (000 000s)					
				Domestic		
	Total Mobile Harbor	Foreign		Internal		
Year	Movements	Imports	Exports	Receipts	Shipments	Local
1978	7.994	1.745	2.232[a]	2.261	1.751	0.004
1977	8.346	0.866	3.611	3.103	0.765	-
1976	6.797	0.781	2.756	2.541	0.718	-
1975	5.941	0.371	2.745	2.489	0.335	-
1974	3.970	0.143	1.748	2.011	0.070	-

[a]Also shown for Three Mile Creek, Alabama.

Figure 5. Coal export facilities, New Orleans.

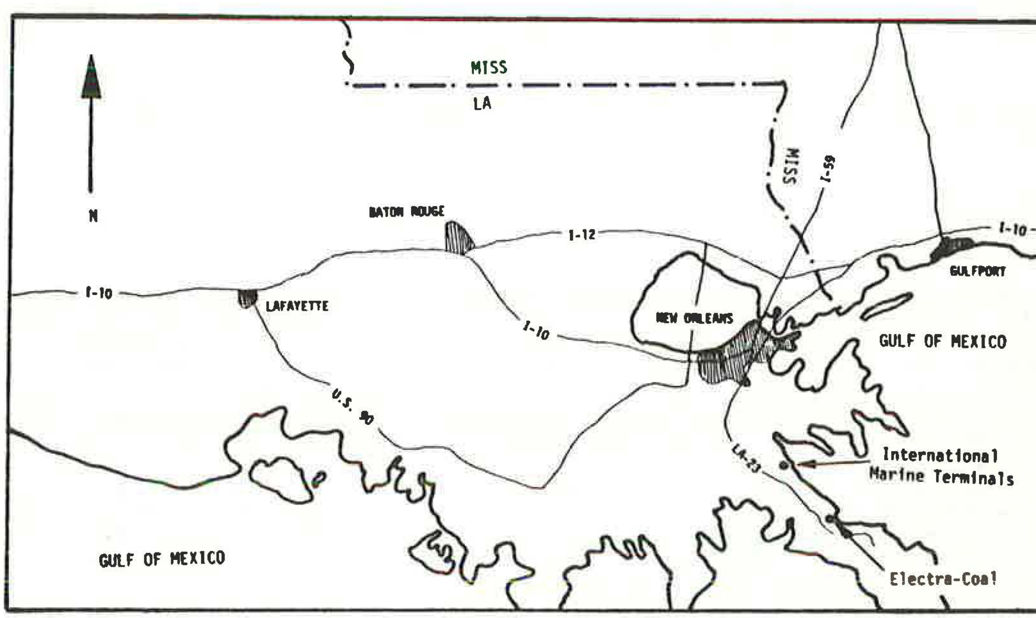


Table 6. Movement of coal and lignite from port of New Orleans.

	Short Tons (000 000s)							
				Domestic				
	Total New Orleans	Foreign		Coastwise		Internal		
Year	Movements	Imports	Exports	Receipts	Shipments	Receipts	Shipments	Local
1978	7.395	0.027	1.401	0.050	3.145	2.759	0.011	0.002
1977	9.452	0.142	1.438	-	3.587	4.274	0.010	-
1976	8.439	0.195	1.297	-	2.757	4.187	0.003	-
1975	8.711	-	1.236	-	3.096	4.375	0.004	-
1974	8.751	0.002	1.002	-	3.481	4.257	0.008	0.001

deepen the Southwest Pass through New Orleans from 40 ft to 55 ft. Preliminary environmental notifications have been submitted, and if timely congressional approval is obtained, the deepening could be accomplished by 1984.

In 1978, the port of New Orleans handled 7.4 million tons of coal and lignite [Table 6 (12)]. Of this total, 1.4 million tons were for export, 3.1 million tons were as coastwise shipments to other domestic points, and 2.8 million tons were receipts of domestic movements for local consumption.

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Impacts of Proposed Transshipment Facility on Price of Delivered Coal in New York

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Recent federal legislation has been directed toward reducing the use of imported oil, particularly by the utility sector. As a result, numerous oil-fired power plants have been targeted for reconversion to coal. Since transportation costs constitute a major portion of the total delivered-coal price to northeastern utilities, cost savings that might be achieved through efficient transportation methods will enhance the economic practicality of reconversions. The transportation cost savings that would accompany the construction of a large coal storage and transfer facility near the port of New York are estimated here. Total delivered-fuel costs are computed for plants that might reconvert to coal, assuming the use of coal from three supply regions and alternative mode and route configurations. Cost savings that would result from use of the proposed facility are estimated on a plant-specific basis. In addition, projections of annual throughput for a range of transshipment costs are estimated.

Development of intermodal transfer facilities follows logically in the general process of increasing the total efficiency of the national transportation system. Usually constructed at rail-water interfaces, transshipment terminals are designed to reduce the price of delivered bulk commodities.

Government policies currently being formulated will directly affect regional coal markets. The federally mandated program of reconverting oil-fired power plants to coal will increase the demand for coal by utilities in the New York region. Transportation costs will constitute a major portion of the delivered price to these users. Minimization of these costs will enhance the economic feasibility of the coal reconversion program. This paper examines the transportation cost savings that may be realized by New York State utilities through the development of a proposed coal-transfer and storage facility near the port of New York.

Estimates of delivered price from three alternative supply regions, assuming use of several mode and route configurations, are developed and compared to determine the cost savings that would accompany development and use of the proposed facility.

PROSPECT FOR INCREASED COAL USE

Use of coal to supplant imported petroleum products as a fuel for the generation of electricity has been the focus of the recent national energy policy. It has been estimated that coal reserves constitute 80 percent of our fossil-fuel energy reserves (1, pp.