The Navigation Economic Technologies Program

February 1, 2005

NETS

navigation · economics · technologies

Shipper and Carrier Response to the September-October 2003 Greenup Main Lock Closure

US Army Corps of Engineers®

IWR Report 05-NETS-R-02

Navigation Economic Technologies

The purpose of the Navigation Economic Technologies (NETS) research program is to develop a standardized and defensible suite of economic tools for navigation improvement evaluation. NETS addresses specific navigation economic evaluation and modeling issues that have been raised inside and outside the Corps and is responsive to our commitment to develop and use peer-reviewed tools, techniques and procedures as expressed in the Civil Works strategic plan. The new tools and techniques developed by the NETS research program are to be based on 1) reviews of economic theory, 2) current practices across the Corps (and elsewhere), 3) data needs and availability, and 4) peer recommendations.

The NETS research program has two focus points: expansion of the body of knowledge about the economics underlying uses of the waterways; and creation of a toolbox of practical planning models, methods and techniques that can be applied to a variety of situations.

Expanding the Body of Knowledge

NETS will strive to expand the available body of knowledge about core concepts underlying navigation economic models through the development of scientific papers and reports. For example, NETS will explore how the economic benefits of building new navigation projects are affected by market conditions and/or changes in shipper behaviors, particularly decisions to switch to non-water modes of transportation. The results of such studies will help Corps planners determine whether their economic models are based on realistic premises.

Creating a Planning Toolbox

The NETS research program will develop a series of practical tools and techniques that can be used by Corps navigation planners. The centerpiece of these efforts will be a suite of simulation models. The suite will include models for forecasting international and domestic traffic flows and how they may change with project improvements. It will also include a regional traffic routing model that identifies the annual quantities from each origin and the routes used to satisfy the forecasted demand at each destination. Finally, the suite will include a microscopic event model that generates and routes individual shipments through a system from commodity origin to destination to evaluate non-structural and reliability based measures.

This suite of economic models will enable Corps planners across the country to develop consistent, accurate, useful and comparable analyses regarding the likely impact of changes to navigation infrastructure or systems.

NETS research has been accomplished by a team of academicians, contractors and Corps employees in consultation with other Federal agencies, including the US DOT and USDA; and the Corps Planning Centers of Expertise for Inland and Deep Draft Navigation.

For further information on the NETS research program, please contact:

Mr. Keith Hofseth
NETS Technical Director
703-428-6468

Dr. John Singley
NETS Program Manager
703-428-6219

U.S. Department of the Army
Corps of Engineers
Institute for Water Resources
Casey Building, 7701 Telegraph Road
Alexandria, VA 22315-3868

The NETS program was overseen by Mr. Robert Pietrowsky, Director of the Institute for Water Resources.

February 1, 2005

NETS

navigation · economics · technologies

Shipper and Carrier Response to the September-October 2003 Greenup Main Lock Closure

Prepared by:

The Planning Center of Expertise for Inland Navigation

Huntington District

For the:

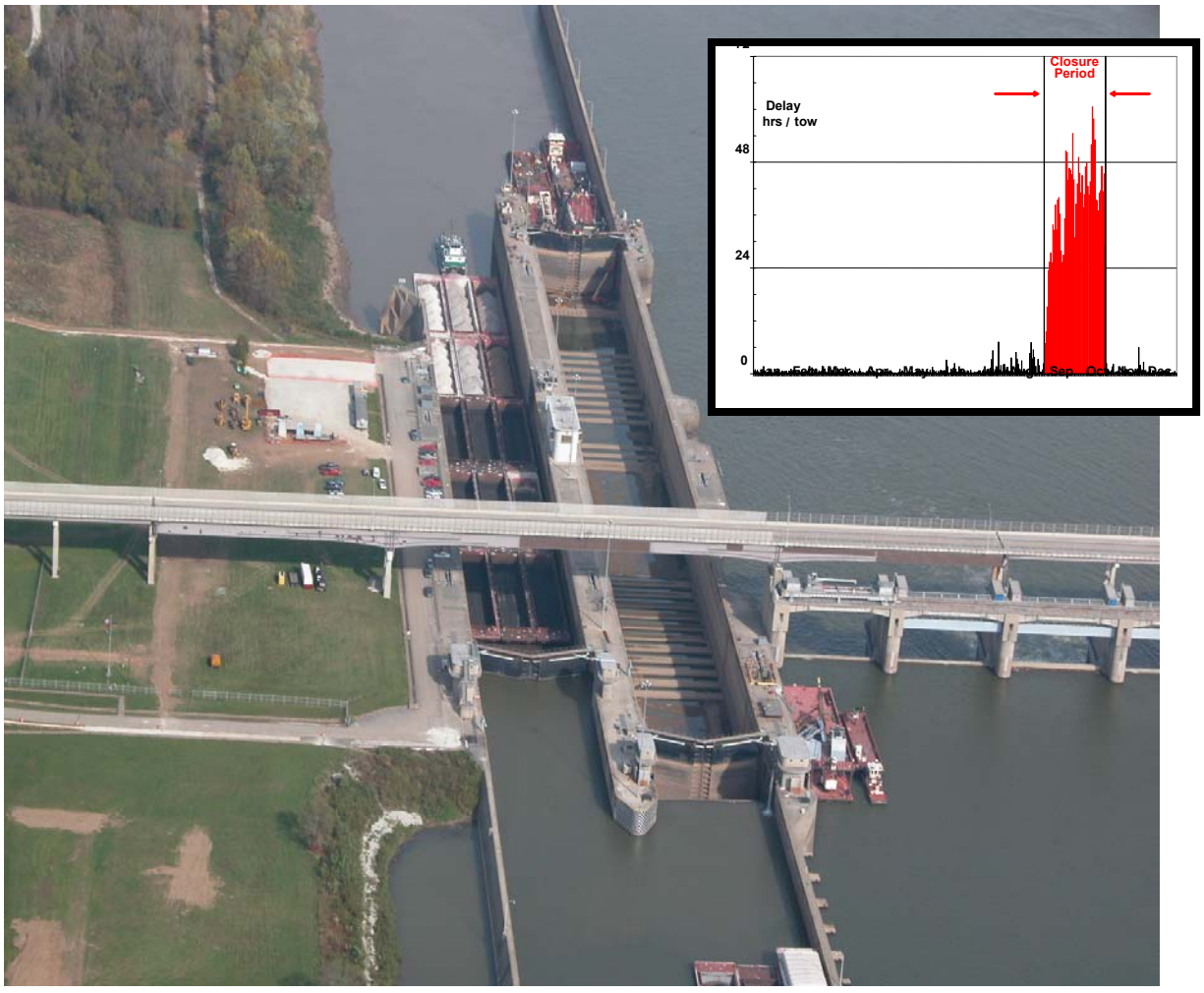
Institute for Water Resources
U.S. Army Corps of Engineers
Alexandria, Virginia

IWR Report 05-NETS-R-02

www.corpsnets.us

U.S. Army
Corps of Engineers
Great Lakes and Ohio River Division

Shipper and Carrier Response to the September-October 2003 Greenup Main Lock Closure



Shipper and Carrier Response to the September-October 2003 Greenup Main Lock Closure

Final Report

February 2005

Prepared for
the Institute for Water Resources
Navigation Economic Technologies (NETS) program

Prepared by
the Planning Center of Expertise for Inland Navigation
Huntington District

SHIPPER AND CARRIER RESPONSE TO THE

SEPTEMBER – OCTOBER 2003 GREENUP MAIN LOCK CLOSURE

C O N T E N T S

TABLES

FIGURES

APPENDICES

SUMMARY

Between 8 September and 31 October 2003, the main lock chamber at the Greenup Locks and Dam, at Ohio River mile 341.0, was closed to navigation traffic. Originally, the lock had been scheduled to close for an 18-day period for routine maintenance. However, during the course of the inspection process, some serious cracking in the lock gates was discovered, and the closure was extended for emergency repairs, with the eventual re-opening occurring on 31 October. The closure that was originally planned to last 18 days stretched to over 52 days.

Surveys of the shippers and carriers affected by the Greenup main lock closure were conducted between 1 June and 31 August 2004 for the purpose of discerning industry reactions to the closure and the associated costs. In addition to the industry surveys, an analysis of the Lock Performance Monitoring System (LPMS) data for Greenup was conducted. The purpose of this analysis was to examine the detailed LPMS data for the Greenup facility, particularly for the closure period, to identify changes in operating procedures attributable to the closure, and to draw comparisons with the industry survey responses.

The purposes of the shipper survey were to find out what measures were taken by industry, meaning primarily the commodity recipients, to mitigate the effects of the main chamber closure at Greenup and to estimate the associated costs. A total of 126 companies was selected for survey as a part of the formal shipper survey. The shippers accounted for about 64.3 million tons of Greenup traffic in 2002, which was about 98 percent of total traffic. Completed survey forms were received from 32 companies, representing a response rate of 25 percent, and accounting for about 43 percent of total traffic.

Shippers had a wide variety of reactions to the outage, ranging from no changes in procedures to shifting production to an entirely different facility. The most common response was to stockpile product and wait for Greenup traffic to clear. Most of the respondents felt that the closure was well-handled, that they had sufficient notification, and that they were able to adjust, but several indicated that the unscheduled portion of the closure was particularly problematic and expensive for them. Several respondents indicated that their experience with Greenup caused them to do such things as increase stockpiles, plan alternative transportation and to prepare for a worst-case scenario in other closure situations.

In addition to the shipper survey, a survey of the major carriers using the Greenup facility was conducted. The purpose of this survey was to find out what specific measures were taken by carriers to address the Greenup main chamber closure and to estimate the associated costs. A total of nine companies was surveyed in this effort. These companies handled a total of 56.7 million tons of Greenup commodity traffic in 2002, which was about 86 percent of total traffic through the facility. Completed survey forms were received back from six of the nine companies, representing a response rate of 67 percent.

These six companies accounted for about 78 percent of the traffic through the Greenup facility in 2002.

All but one of the carriers indicated that notification of the scheduled closure was adequate, but the companies were unanimous in their assessment that the unscheduled portion of the closure caused them severe difficulty. Although the companies pursued multiple courses of action during the closure, the most common seems to be that they simply remained in queue and broke tows to double lock through the auxiliary. One company complained about customers' failure to pre-ship to avoid the closure. Another company indicated that lock personnel failed to enforce agreed-upon procedures and that this caused needless delays.

Shippers and carriers were requested, in the survey process, to provide estimates of additional costs incurred as a result of the closure event at Greenup. The costs provided were compared to avoid double counting. Aside from delay costs, costs to industry were submitted totaling $28.7 million. Delay costs were computed separately using information from the Lock Performance Monitoring System (LPMS) and towing equipment costs. Delay costs were estimated to be about $13.2 million. The total costs associated with the Greenup main chamber closure event are estimated to be about $41.9 million. The specific costs to industry, by type of costs, and the number of survey respondents providing the cost detail are shown in the table that follows.

It should be noted that the $41.9 million in total costs to industry is compiled from partial information. Many companies, including some major users of the Greenup facility, declined to participate in the survey. Other companies participated in the survey and indicated that they had had added costs during the closure period, but were unable to isolate and provide those costs for a variety of reasons. For these reasons, it is acknowledged that the total costs cited are likely understated.

In addition to the survey work, an analysis of the LPMS data for the closure period was undertaken to assess carrier reactions to and the impacts of the closure event. Because tows were compelled to lock through the auxiliary lock, average processing times nearly doubled relative to the pre-closure period. Total delay during the outage at Greenup was more than 27,000 hours, which is the equivalent to the delay associated with about six years of normal operation. The maximum delay was about 93 hours for the closure period and the average delay per tow was about 37.5 hours. Carriers reacted to the closure, particularly the unscheduled portion, by increasing barges (and tons) per tow, decreasing the percentage of empty barges and reducing arrivals at the facility.

Greenup Closure Costs to Industry		
Type of Cost	Cost (Thousand $)	Respondents
Costs from Surveys:		
Modal Shift	8,600	4
Sourcing Shift	1,900	3
Stockpiling	25	1
Altered Production Processes	220	2
Shift in Production Location	36	1
Demurrage	10	1
Additional Equipment	2,500	1
Lost Sales	13,100	1
Other Costs	2,300	2
Subtotal	28,691	16
Computed Costs:		
Delay at Lock	13,200	-
Total	41,891	16

SHIPPER AND CARRIER RESPONSE TO THE SEPTEMBER – OCTOBER 2003 GREENUP MAIN LOCK CLOSURE

1. INTRODUCTION

Between 8 September and 31 October 2003, the main lock chamber at the Greenup Locks and Dam, at Ohio River mile 341.0, was closed to navigation traffic. Originally, the lock had been scheduled to close for an 18-day period (re-opening on 26 September) for de-watering, inspection and routine maintenance. However, during the course of the inspection process, some serious cracking in the upper and lower lock gates was discovered, and the closure was extended for emergency repairs, with the eventual re-opening occurring on 31 October. The closure that was originally planned to last 18 days stretched to over 52 days.

While queue and delay information is routinely collected at navigation projects under the Lock Performance Monitoring System (LPMS), this is an incomplete representation of the impacts of closure events. Because of this, a survey of the shippers and carriers affected by the Greenup main lock closure was conducted between 1 June and 31 August 2004 for the purpose of discerning industry reactions to the closure and the associated costs. This report documents the results of those industry surveys. In addition to the industry surveys, an analysis of the LPMS data for Greenup was conducted. The purpose of this analysis was to examine the detailed LPMS data for the Greenup facility, particularly for the closure period, to identify changes in operating procedures attributable to the closure, and to draw comparisons with the industry survey responses.

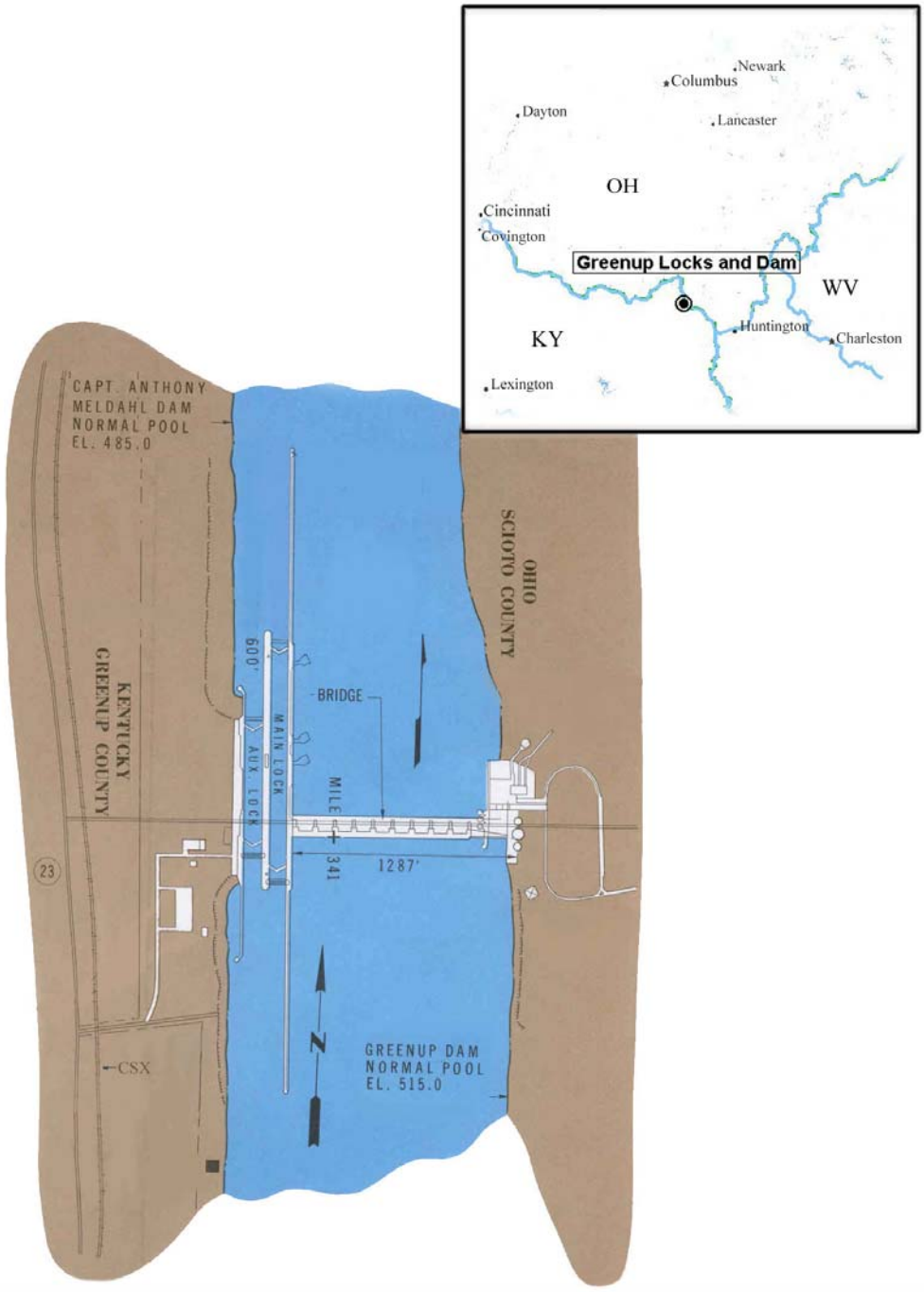
2. PROJECT DESCRIPTION

The Greenup Locks and Dam project is located at Ohio River Mile 341.0, downstream of the Huntington, West Virginia – Ashland, Kentucky urban area (See the attached area map and schematic). The navigation project has two parallel locks along the left descending bank: a 110’x1200’ main lock chamber and a 110’x600’ auxiliary chamber. Navigation through the Greenup pool is maintained by a 1,287-foot, non-navigable, gated high-lift dam. Both lock chambers were put into service in 1959.

The main chamber services the majority of commercial traffic during normal operations, while the smaller auxiliary chamber services recreational traffic and small tows. Tows on the Ohio River are typically sized to single-cut through the main 110’x1200’ chamber (15 jumbo barges). These main chamber-sized tows can take nearly three times longer to process in the smaller auxiliary chambers because the tow must be broken into smaller units to be processed. If traffic levels are high, queues and delays can escalate rapidly when the main chamber is closed.

The Greenup project is a highly important link in the Ohio River Navigation System, given its central location on the Ohio River. The Greenup main chamber is, in fact, the

Figure 1. Greenup Locks and Dam
Schematic/Vicinity Map



nation's eighth busiest navigation lock chamber. Commodity traffic transiting the Greenup locks, while mostly internal to the Ohio River System, moves to/from markets as distant as the Upper Mississippi, the Gulf Coast, Florida and overseas markets. Commodity traffic through the Greenup facility for the period 2000-2004 is displayed in Table 1. The 2004 traffic mix is dominated by coal (57.5 percent), followed by iron and steel (11.5 percent); petroleum (9.5 percent); aggregates (7.3 percent); and chemicals (5.9 percent).

The overall traffic orientation for 2004 displayed in Table 2 shows that most traffic through the facility is downbound (58.3 percent). Like total traffic, coal traffic at the facility is mostly downbound (82.0 percent), and this traffic consists primarily of Central Appalachian coal destined for utility plants in the middle Ohio Valley. Upbound coal traffic, for the most part, is Central Appalachian and, to a lesser extent western coal destined for utility plants in the middle and upper Ohio Valley. Iron and steel traffic moves mostly upbound through Greenup (80.0 percent). Upbound iron and steel consists, in large part, of iron ore. Downbound iron and steel is mostly intermediate iron and steel products destined for manufacturers and steel service centers. Petroleum products traffic at Greenup is largely downbound (71.8 percent) and consists of finished petroleum products destined for urban distribution centers. Aggregates traffic at the facility is almost entirely (95.7 percent) upbound, and consists of sand, gravel and crushed rock destined for highway and urban construction sites in the upper basin area. Chemicals traffic is also largely upbound (85.4 percent) and consists mostly of intermediate industrial chemicals destined for chemicals and plastics producers in the Kanawha and upper Ohio Valley.

3. ADVANCE CLOSURE NOTIFICATIONS

In an effort to enable industry to prepare for disruptive maintenance closures, standard procedure on the Ohio River is to announce a tentative maintenance schedule for locks about two years in advance of the expected closure. Such notification for the Greenup main chamber closure was contained in a 16 January 2002 Notice to Navigation Interests (02-02) (See Appendix A). In that notice, a tentative schedule for the closure was provided indicating that the maintenance would occur in the July-August 2003 timeframe and would last for six weeks. At the beginning of the maintenance year in question, a second notification is given that provides a firm schedule for the anticipated closure. This notification was provided in a 6 January 2003 Notice to Navigation Interests (03-01) and indicated that the maintenance closure would occur during the period 8-26 September.

TABLE 1

Commodity Traffic Through the Greenup Locks,
2000-2004
(Millions of Tons)

	2000	2001	2002	2003	2004	% of Total 2004
Coal	42.0	44.0	39.3	35.3	37.1	57.5
Petroleum	7.1	7.5	7.1	6.6	6.1	9.5
Aggregates	5.6	5.0	4.1	3.8	4.7	7.3
Grains	0.2	0.2	0.2	0.3	0.2	0.3
Chemicals	4.2	3.4	3.8	3.8	3.8	5.9
Ores & Minerals	2.6	2.0	2.3	2.8	2.3	3.6
Iron & Steel	5.3	4.6	5.7	6.9	7.4	11.5
Others	4.7	3.9	3.3	2.7	2.9	4.5
Total	71.7	70.6	65.8	62.2	64.5	100.0

SOURCE: LPMS Data

TABLE 2

Commodity Traffic Through the Greenup Locks
by Direction, 2004
(Thousands of Tons)

	Upbound	% of Total	Downbound	% of Total	Total
Coal	6,689	18.0	30,413	82.0	37,102
Petroleum	1,735	28.2	4,411	71.8	6,146
Aggregates	4,533	95.7	206	4.3	4,739
Grains	156	79.2	41	20.8	197
Chemicals	3,245	85.4	556	14.6	3,801
Ores & Minerals	2,153	94.3	130	5.7	2,283
Iron & Steel	5,900	80.0	1,474	20.0	7,374
Others	2,460	86.6	382	13.4	2,842
Total	26,871	41.7	37,613	58.3	64,484

SOURCE: LPMS Data

4. CHRONOLOGY OF EVENTS

a. On 11 August 2003, Notice to Navigation Interests 03-43 was issued to inform the navigation industry that the main lock chamber at Greenup would be closed for maintenance beginning on (or about) 8 September 2003 and ending on (or about) 26 September 2003. The notice indicated that all traffic would be using the auxiliary lock and that industry self-help would be in effect. The original scope of work called for dewatering and inspection of the main lock chamber; installation of automatic gate latching devices on the lower gate; and repair of structural cracking or operational anomalies that could be handled within the outage period.

b. On 8 September 2003 at 1744 hours, LPMS data indicate that the main lock chamber at the Greenup facility closed to navigation.

c. On 15 September 2003, after dewatering the main chamber, inspection uncovered serious cracks in the vicinity of the pintle castings on the downstream river wall leaf, the downstream middle wall leaf (See Appendix A), the upstream river wall leaf and the upstream middle wall leaf.

d. On 19 September 2003, Notice to Navigation Interests 03-49 was issued to inform the navigation industry that the main chamber closure would be extended to 24 October 2004 to undertake unanticipated emergency repairs that were determined to be necessary as a result of chamber dewatering and inspection, extending the original 18-day closure to 46 days.

e. On 7 October 2003, Notice to Navigation Interests 03-55 was issued to alert the navigation industry that the emergency repairs to the main lock chamber at Greenup would be inspected on (about) 17 October 2003, and that depending on the results of this inspection, the closure could be extended to 7 November 2003.

f. On 30 October 2003, Notice to Navigation Interests 03-64 was issued announcing that the Greenup main lock closure was expected to end on 31 October 2003.

g. On 31 October 2003 at 0140 hours, the closure of the Greenup main lock chamber ended. The total closure duration was 52 days, 8 hours.

h. On 1 November 2003 at 0707 hours, the delay at the Greenup facility returned to zero. The total closure-induced delay from the closure event was 27,561 hours. The time required for the delay at Greenup to return to zero was 29.5 hours.

5. SHIPPER SURVEY

a. Survey Procedures. The formal shipper survey was conducted between 1 June and 31 August 2004. The purposes of the survey were to find out what measures were taken by industry to mitigate the effects of the main chamber closure at Greenup and to

estimate the total costs to industry that resulted from the closure event. A wide range of survey responses was anticipated based on such factors as companies' intensity and frequency of usage of the Greenup facility; the time of year of the closure; the companies' transportation options; and the nature of the businesses.

At the outset of the process, several rules were adopted for including firms in the survey. First of all, all companies receiving 1 million tons or more through the Greenup facility in 2002 were included. These companies were sent a survey form and were contacted by telephone for follow-up. Since this group of companies was rather small, totaling only about nine, attempts were made to visit these companies for additional follow-up, when practical. For companies receiving between 100,000 and 1 million tons, survey forms were sent out and telephone follow-up conducted. In the case of companies receiving less than 100,000 annual tons of commodity traffic through the Greenup facility, a sample was selected based on such factors as the type of operation being served and the value of the commodity. Again, survey forms were sent to the selected companies and telephone follow-up was conducted. In addition to these traffic recipients, a list of 18 major traffic originators was added to the contact list and surveyed, based on the suggestion of industry representatives.

A total of 126 companies was selected for survey as a part of the formal shipper survey. Surveyed companies handled a total of 64.3 million tons transitting the Greenup project in 2002, which was about 98 percent of total traffic. Completed survey forms were received from 32 companies, representing a response rate of 25 percent and accounting for 43 percent of Greenup's total 2002 traffic. A listing of the types of responding companies is provided in Table 3.

Some of the companies that did not provide completed survey forms provided limited information during telephone follow-up. A common response during telephone follow-up was that the Greenup closure had no impact or very little impact on company operations or costs. Some of the companies were working from pre-existing stockpiles. For others, the time of year of the closure and the fact that the auxiliary chamber remained open mitigated any potential adverse impacts on their operations. A number of the contacts indicated that they were not aware of the Greenup closure at the time it occurred. Many of the companies contacted were concerned about the impending closure (9-20 August 2004) at the McAlpine facility, which closed the river to navigation entirely.

The survey process was impeded by the timing and circumstances of the survey effort, other on-going surveys, the complexity of the information requested and, in some cases, company policies against responding to surveys. In the case of the Greenup outage, the need for the survey was determined after the closure, and as a consequence, advance notification of the survey (in advance of the closure) was not possible. At the time of the Greenup survey, other industry surveys were being conducted and, taken together, the

TABLE 3

Companies Responding to the Shipper Survey

Company Type	Number Surveyed	Number Responding	% of Respondent Tonnage
Electric Utilities	10	3	43
Steel Companies	9	2	9
Petroleum/Asphalt Companies	12	3	16
Chemical Companies	13	5	4
General Cargo Terminals	25	6	8
Concrete/Aggregates Companies	20	7	6
Coal Companies/Docks	21	4	14
Other	16	2	1
Total	126	32	100

surveys were somewhat confusing and disruptive for the survey respondents. This became apparent during telephone follow-up. Additionally, the complexity of the information requested in the Greenup survey impeded the effort somewhat. In many instances, the information requested would have required the input of several departments. Frequently, the companies did not have the time/resources to devote to generating the information needed. Finally, in some instances, companies have policies against responding to government survey requests.

b. Shipper Interview. Attempts to arrange face-to-face meetings with major shippers were only partially successful. Some companies had declined to participate in the survey at all and face-to-face meetings were not pursued. Some companies were heavily involved at the time with the impending McAlpine closure. Some of the companies had supplied completed survey forms and face-to-face interviews were not pursued because of the impending McAlpine closure and other complications created by the multiple ongoing surveys.

Ultimately, a face-to-face meeting was successfully arranged with a major utility user of the Greenup facility. The company normally moves large volumes of coal through the Greenup locks. The company representative ranked the company's responses to lock closures. Generally, the company would attempt to (a) stockpile as much as possible and wait until the closure was over; (b) divert coal traffic to alternative modes; (c) shift

coal sources to avoid a closed facility; or (d) close plants that cannot receive coal and re-dispatch remaining plants or purchase power off the grid.

During the interview, the company representative explained that every closure is unique and their actual response to lock closures depends on coal and transportation market conditions at the time of the closure and on such issues as the transportation options available at each of their plants and the length of coal hauls. The strategy pursued for individual closures is a plant-by-plant strategy. The company's initial response to closures is to stockpile in advance and to position equipment above and below the affected lock to be ready when the lock re-opens. More transportation options at a plant means less stockpiling is necessary. The availability of rail cars and barges is more restricted before and during a lock closure, which impacts both the company's ability to stockpile coal and to switch to overland transportation. The company representative indicated that their ability to stockpile is also affected by the ability of coal suppliers to meet the increased demand. The length of coal hauls is important because the longer the haul the greater the impact of lock closures.

The company representative indicated that advance notification of scheduled closures is a very important issue. Advance notice of about 6 months is generally adequate for the company's purposes. The advance notification of the Greenup closure allowed them to make necessary adjustments, but the unscheduled portion of the closure forced them to consider some very expensive options. As a result of the Greenup closure experience, this company was prepared for a "worst-case" scenario at McAlpine, stockpiling much more than they would ordinarily consider necessary.

c. Survey Questionnaire Responses. Actual survey questions and response summaries are provided in italics in the following paragraphs. Please note that only survey questions that generated responses are included. Other questions are skipped.

Q1. Did your company have sufficient notice of the scheduled Greenup closure to prepare a response plan? Was your response preplanned or was it designed for this particular closure?

R1. All 32 of the responding companies provided a response of some kind to this question and 26 of the companies (81 percent) indicated that notification was sufficient to prepare a response. Three companies, two in the petroleum industry and one a cement manufacturer, felt that notice was adequate for the initial three-week closure, but they were completely unprepared for the additional unscheduled four-week closure. Four of the companies, a chemical manufacturer, a fertilizer dealer, a coal company and an aggregates company, indicated that notice was insufficient and one of the companies (the aggregates company) indicated that neither they nor their suppliers had heard of the closure at all. This final company indicated that they only became aware of the closure when they began to notice that they were having trouble getting material delivered. This type of "disconnect" resulted from a lack of communication on the part of a contract carrier. Twelve of the companies indicated that they developed responses specifically

for this closure event. Eight of the respondents said that they had no changes in procedures due to the closure event. Two of the companies, both river terminals, felt that no measures were necessary because the auxiliary chamber remained open during the main chamber outage. Several companies that use contract carriers indicated their knowledge/control of their traffic was minimal. This was particularly true of the public terminals.

Q2. During the period of closure of the main lock chamber at the Greenup facility, what was your company's response?

R2.
11 a. No change in procedures.
12 b. Stockpiled product and waited for Greenup traffic to clear.
6 c. Switched to all-overland mode for product delivery from existing sources.
0 d. Switched to different waterway routing for product delivery from existing sources
3 e. Switched product source to an entirely new source.
0 f. Ceased operations during the period of closure.
4 g. Altered production during the period of closure.
2 h. Switched production to another facility.
1 i. Purchased intermediate or final product, rather than produced.
3 j. Other or combinations of the above. (Please explain.)

Responses to this question were provided by 31 of the 32 companies. Eight of the companies indicated that they had pursued multiple courses of action during the closure period. The most frequently cited course of action was stockpiling product and waiting for the Greenup traffic to clear. The second most frequently cited measure was no change in procedures. The difficulties encountered by companies seemed to be closely related to the volume of traffic that they normally received through Greenup and seasonal variation of receipts through the facility. One chemical company indicated that this closure had occurred during their slow period and that if it had occurred in the spring it would have been particularly problematic for them. One respondent, a petroleum company, indicated they were prepared for only a three-week closure and that when it extended beyond that they and their supplier had some difficulty finding product. They did not run out of product, but came close. A cement manufacturer incurred additional cost and complications from having to hire an additional boat to move product, instead of one. Since the auxiliary lock remained open, a common solution for some of the companies involved was simply to allow additional time for product delivery.

Q3. If you have checked "c" or "d" in question 2, please complete the following table:

R3. The question refers to companies that switched to all-overland modes or alternative waterway routings for product delivery. Responses to this question were provided by four of the 32 companies. Table 4 lists the specific commodity tonnages supplied and differential delivered costs of product. The total differential cost incurred during

TABLE 4

Commodity Movements Switched to All-Overland or Alternative Waterway Routings During the Greenup Main Chamber Closure

Movement	Commodity	Affected Tonnage	Origin (City, State)	Destination (City, State)	Delivered Cost Per Ton Prior to Closure	Delivered Cost Per Ton During Closure
Examples:						
1	coke	8000	Louisville, KY	Weirton, WV	$95	$105
2	scrap iron	4000	Cincinnati, OH	Weirton, WV	$251	$271
1	coal	500-600 ktons	withheld	withheld	$30-50/ton	$50-60/ton
2	sand	30 ktons	withheld	withheld	$8.05/ton	$13.05/ton
3	gravel	20 ktons	withheld	withheld	$7.09/ton	$12.70/ton
4	limestone	12 ktons	withheld	withheld	$10.50/ton	$17.80/ton

closure at the Greenup facility was approximately $8.6 million for the movements supplied only. One respondent indicated that his company re-routed traffic, but at no additional cost to them.

Q4. If you checked "e" in question 1, please complete the following table:

R4. This question refers to traffic that was shipped from an entirely new source to the receiving plant(s) because of the closure event at Greenup. Responses to this question were received from three of the 32 companies. The re-directed movements provided by survey respondents are provided in Table 5. The total differential costs reflected in these movements is about $1.9 million. One respondent (for a terminal) indicated that his company had shifted barge receipts to a different origin because of the closure at Greenup and that they had begun receiving product by pipeline.

Q5. If you checked response "a" or "b" under question 2, how were your total production costs affected during the period of closure (total increase in cost, if applicable)? Please explain.

R5. This question refers to respondents that either had no change in procedures or that stockpiled product and waited for Greenup traffic to clear. Responses to this question were provided by 19 of the 32 companies. Many of the respondents indicated that they

TABLE 5

Commodity Traffic Re-Sourced as a Result of the Greenup Closure

Movement	Commodity	Affected Tonnage	Original Origin (City, State)	New Origin (City, State)	Destination (City, State)	Delivered Cost Per Ton Prior to Closure	Delivered Cost Per Ton During Closure
Examples:							
1	chemicals	5000	New Orleans, LA	Kenova, WV	Marietta, OH	$110	$115
2	steel	1500	Cincinnati, OH	Pittsburgh, PA	Wellsville, OH	$300	$335
1	coal	50-100 ktons	withheld	withheld	withheld	$30-35/ton	$50-60/ton
2	coal	10 ktons	wihheld	withheld	withheld	$60/ton	$85/ton

had no increase in production costs as a result of the closure at Greenup. Other companies indicated that although they did change their mode of operation somewhat, they had no increase in costs or the increase was minimal. One of these respondents, a utility, indicated that his company was working from a pre-existing stockpile and was unaffected by the closure. Another of these, a chemical manufacturer, indicated that his company stockpiled material but incurred no additional cost as a result.
Several of the respondents indicated that they changed their operations somewhat and did have an increase in costs, but the respondents did not know the total cost impact. One company (type withheld) indicated that they were asked to provide financial relief to their contract carrier, but declined to do so. Another company (a chemical manufacturer) indicated that they modified their delivery schedule, but the respondent was unable to specify the increased cost. Two companies cited demurrage costs as an issue. One of the companies (an asphalt company) indicated that they incurred demurrage costs because they did not have adequate land on which to store material when it was delivered. The second (an aggregates company) was, at first, unable to receive product and then received shipments too rapidly and was forced to store inventory on barges. Other respondents cited increases in overtime pay; shifts to rail and truck; stockpiling; and inventory costs.

Specific cost information was provided by only two of the respondents. The first company, a coal/coal sales company, indicated that they had lost sales amounting to 300,000 tons per month at $25/ton (1.75 months x 300,000 x 25 = $13.1 million). The second company, an aggregates company, cited overtime pay, land rental and inventory costs amounting to $25,000.

Q7. If you checked response "g" under question 2, what was the total estimated loss to your firm as a result of altering production processes during the closure period?

*R7. This question refers to companies that changed production processes as a result of the closure at the Greenup facility. Only **four** of the 32 companies responded to this question. One respondent, a utility, indicated that they had shut down units and had a significant (but unspecified) increase in costs as a result of the Greenup closure. A chemical manufacturer had an estimated increase in costs of around $100,000. An asphalt manufacturer cited increased costs, but was unable to provide specific information. An aggregates company indicated that they had had increased costs amounting to about $120,000.*

Q8. If you checked response "h" under question 2, what was the total increase in costs to your firm as a result of changing production locations during the closure period?

R8. This question is directed at companies that re-directed production to other facilities as a result of the Greenup closure. Two of the 32 companies responded to this question. One of the companies, a coal company, had cost increases as a result of the closure, but was unable to provide specific information. The second company, a chemical manufacturer, had estimated additional costs of $36,000.

Q10. If you checked response "j" under question 2, to what extent did the other measures or combination of measures undertaken as a result of the closure increase your company's total production costs during the period of closure?

R10. This question is directed at companies that pursued combinations of measures to address the Greenup closure. Responses to this question were provided by three of the 32 companies. The first respondent, a utility, indicated that they had incurred additional demurrage charges as a result of the Greenup closure that were likely in excess of $10,000. The second respondent, type withheld, indicated that they had chartered transportation equipment during the closure event at a total cost of about $2.5 million. A cement manufacturer indicated that they had a doubling of freight costs from having to hire an additional towboat, but no specific costs were cited.

Q11. Has the closure at the Greenup Locks caused your company to alter its long-term transportation strategy (e.g. switch to all-overland modes, increase stockpiles, etc.)? How will this impact your total commodity transportation or other costs (per year). Please explain.

R11. Responses to this question were received from 26 of the 32 companies. Most of the companies indicated that the Greenup closure had not caused them to alter their long-term transportation strategies. Three of the companies, a river terminal, a concrete company and aggregates company, indicated that the Greenup closure had caused them to increase stockpiles for the long term. The river terminal indicated that the Greenup closure had caused them to increase their costs by $250,000 (Q4). A utility company respondent said that the Greenup closure has had a serious (unspecified) impact on the

company's long-term transportation strategy. A chemical manufacturer indicated that the closure caused them to look into rail transportation as an alternative. An asphalt manufacturer, as a result of the closure, is looking into other barge-oriented sources of materials and an aggregates company is looking for closer sources of product to avoid these types of situations in the future. A cement manufacturer indicated that they had purchased an additional barge to handle product as a result of the Greenup experience.

Q12. Has the closure at the Greenup Locks caused your company to take any other long-term permanent measures? Please explain. How will this affect your company's long-term operating costs (per year)?

R12. This question is intended to detect other long-term changes at companies, not related to transportation issues. Responses to this question were supplied by 21 of the 32 companies. The predominant response was that the closure at Greenup caused the companies to take no other (non-transportation-related) long-term, permanent measures. A utility respondent indicated that the Greenup closure caused his company to become involved in waterway transportation organizations to learn more about the issues and to assure that their concerns are addressed. A concrete company representative said that their long-term operating expenses had increased 22 percent as a result of the closure. An aggregates company representative pointed out that when closures are scheduled, but go beyond the schedule period, costs to companies increase dramatically. A common theme was concern over the then-impending McAlpine closure. One respondent for a steel company said that the McAlpine closure was forcing them to look for all-overland routings at greatly-increased costs. Representatives for a petroleum company and a chemical manufacturer indicated that the Greenup closure was causing them to prepare for a "worst-case" scenario at McAlpine.

Q13. As you may be aware, the original closure period for the main chamber at Greenup was 3 weeks. This closure period was unexpectedly extended an additional 4 weeks. Did your company alter its plans in anticipation of the original closure? Did your company alter its plans in response to the additional delay? Please explain.

R13. This question is intended to draw a distinction between the preparations for the original, scheduled 3-week closure and the unscheduled 4-week extension. Responses were provided by 27 of the 32 companies. A preponderance of the respondents indicated that they made no additional extraordinary adjustments as a result of the 4-week closure extension. One respondent, a chemical manufacturer, indicated that his company altered production rates in response to the original closure and reduced them to an absolute minimum for the 4-week extension. Another chemical manufacturer said that his company increased receipts from an alternative waterside location to avoid the Greenup project. A petroleum company representative indicated that his company planned for a 3-week closure and that when the closure extended beyond that, their supplier had to look to alternative sources and modes. Another petroleum company representative said that his company was forced to alter plans by chartering barges when the closure

extended beyond 3 weeks. An asphalt company representative indicated that his company was forced to re-schedule some jobs when the closure extended beyond three weeks. An aggregates company representative indicated that the additional closure period caught them by surprise and cost them much more because of the additional adjustments required. The respondent for a cement company indicated that the extended closure simply increased the time during which they were using two towboats instead of one.

Q14. Has your company been impacted by other navigation system disruptions? Did they influence your response to the Greenup closure?

R14. This question seeks information on the companies' experiences with other navigation system disruptions of any type. Responses were provided by 25 of the 32 companies. Most respondents indicated that they knew of no other navigation disruptions that had affected their companies. Four of the respondents, two chemical manufacturers, a coal company and an aggregates company indicated that they had been impacted in the past by high water and ice conditions. A representative of a river terminal indicated that periodic navigation disruptions on the Cumberland river had acclimated their company to such events. Another coal company representative said that his company had been impacted by navigation system disruptions in the past, but that those events did not inform their response to the Greenup closure. A respondent for a cement manufacturer indicated that low water has limited drafts and increased costs for them and that high water had halted loadings at their facility and caused them to incur overtime costs once the pool dropped. Representatives of a fertilizer company, two river terminals and an aggregates expressed great concern over the impending closure of the McAlpine facility.

6. CARRIER SURVEY

a. Survey Procedures. Like the shipper survey, the formal carrier survey was conducted between 1 June and 31 August 2004. The purposes of the survey were to find out what measures were taken specifically by the carriers to adapt to the main chamber closure at Greenup and to estimate the total costs incurred by them as a result of the closure event.

The firms included in the carrier survey were the nine largest users of the Greenup facility in tonnage terms for year 2002. These companies were sent a survey form and were contacted by telephone for follow-up. The companies surveyed moved a total of 56.7 million tons through the Greenup project in 2002, which was about 86 percent of total traffic. Completed survey forms were received from 6 companies, representing a response rate of 67 percent. Responding companies moved about 51.1 million tons of traffic through Greenup in 2002, representing about 78 percent of total traffic.

b. Survey Questionnaire Responses. Like the shipper survey results, actual survey questions and response summaries are provided in the following paragraphs. Please note as well that only survey questions that generated responses are included and that other questions are skipped.

*Q1. Did your company have sufficient notice of the scheduled Greenup closure to prepare a response plan? What, if anything, did your company do in preparation for the **scheduled** portion of the closure? For example, did you concentrate your equipment in the middle Ohio Valley to maximize throughput at the Greenup facility prior to the closure? (Please explain)*

R1. The intent of this question is to gather information on the carriers' responses to the original, scheduled three-week portion of the outage. Responses were provided by all six of the companies. All but one of the company representatives indicated that notification was adequate for the scheduled portion of the closure. The remaining representative said that his company would appreciate more notification of closures. He also pointed out that the schedule of lock outages on the Corps website is outdated by about four years. While most of the company representatives seemed to feel that notification of the scheduled closure was adequate, they were also nearly universal in their assessment that the four-week extension of the closure was extremely challenging for them. Company responses to the scheduled three-week closure were varied. One company simply notified their customers of likely delays and continued to operate as usual, to the extent practicable. Another company hired four additional boats to move barges through this river reach as expeditiously as possible. A third company urged their customers to pre-ship in advance of the closure to the greatest extent possible. They complained that contingencies could not be developed for the additional closure because of lack of a definitive timeframe.

*Q2. How did your company operate during the **scheduled** portion of the main chamber outage at Greenup? Check as many items as are applicable and explain any unusual procedures.*

R2.
_1_ a. Barges were tied up at fleeting areas; towboats operated elsewhere in the system.
_6_ b. Towboats remained in queue with barges.
_0_ c. Towboats (light) held positions in queue.
_4_ d. Tows were dispatched ready-to-lock at Greenup.
_6_ e. Tows were broken to lock through the auxiliary lock.
_5_ f. Towboats (light) participated in industry self-help.
_5_ g. Towboats tied off barges and participated in industry self-help.
_1_ h. Company avoided the lock when possible.
_1_ i. Other (Please explain).

The intent of this question is to gather information on specific courses of action taken by the carriers during the scheduled portion of the Greenup lock closure. All of the companies involved answered this question and all pursued multiple courses of action. The most commonly cited responses were that towboats remained in queue with their barges and that the tows were broken up to lock through the auxiliary lock. Other common responses were that towboats tied off their barges and participated in industry self-help and that towboats independently (light) participated in industry self-help. A less common response was that tows were dispatched (at origin) ready-to-lock at Greenup. Only one company indicated that their boats tied up barges in fleeting areas so that the towboat could operate elsewhere in the system. This course of action is rare because leaving barges unattended has insurance implications for the towing companies. This same company indicated that they avoided the lock where possible. One company indicated that they re-arranged tows to accommodate critical commodities.

Q3. How did your company operate during the ***additional 4 weeks (unscheduled)*** *of main chamber outage at Greenup? Check as many items as are applicable and explain any unusual procedures.*

R3.

_2_ a. Barges were tied up at fleeting areas; towboats operated elsewhere in the system.
_6_ b. Towboats remained in queue with barges.
_0_ c. Towboats (light) held positions in queue.
_4_ d. Tows were dispatched ready-to-lock at Greenup.
_6_ e. Tows were broken to lock through the auxiliary lock.
_5_ f. Towboats (light) participated in industry self-help.
_5_ g. Towboats tied off barges and participated in industry self-help.
_1_ h. Company avoided the lock when possible.
_2_ i. Other (Please explain).

The intent of this question is to gather information on actions taken by the carriers during the unscheduled portion of the closure, and to distinguish, to the extent practicable, the scheduled portion of the closure from the unscheduled. Again, all of the companies responded and all had multiple responses to this question. Similar to the responses for the scheduled portion of the closure, the most frequently cited actions were that towboats remained in queue with their barges and that tows broke up to lock through the auxiliary lock. The next most frequent responses were that companies provided light boats to participate in industry self help and that towboats tied off barges to participate in industry self help. Four of the companies indicated that they tried to dispatch their tows ready-to-lock at Greenup. Two of the companies indicated that they tied up barges in fleeting areas and that the towboats operated elsewhere in the system. One respondent said that his company avoided the lock whenever possible. Another indicated that his company chartered additional boats and barges to keep products moving to/from supply areas/destinations to prevent terminals from running out of product (a major difference from the scheduled closure). Another respondent indicated that they re-arranged tows to accommodate critical commodities.

Q4. Did the experience with the outage at Greenup cause your company to adopt any new operating procedures to accommodate lock outages elsewhere in the system? (Please explain.)

R4. This question is intended to gather information on the carriers' long-term reactions to the closure experience at the Greenup facility. All of the companies responded to this question. Three of the companies indicated that they had adopted no new operating procedures as a result of their experience at Greenup. One of those companies indicated that they were doing nothing new because their customers' demands were the same and were manifest in contractual obligations. They did complain, however, about customers' failure to pre-ship when given advance notice of the closure. Another company representative said that the Greenup closure caused them to assume a worst-case timeline in their preparations for other such closures. One respondent indicated that the Greenup closure had caused his company to become more proactive in working with USACE in the scheduling of future outages. He cited the closure schedules for Meldahl and Markland as good signs of cooperation. The final respondent said that his company had adopted industry best practices established by the navigation community for minimizing lock delays.

Q5. Prior to the outage at the Greenup facility, towing industry representatives, in cooperation with the Corps of Engineers, developed some operating procedures that were put in place at the time of the closure. Do you believe this effort was effective, ineffective or only partially effective? (Please explain)

R5. All of the companies provided a response to this question. Only two of the respondents felt that the effort was effective. One of these felt that industry representatives could have been more involved in expediting double lockages and coordinating industry self help. Three of the respondents felt that the effort was only partially effective and two of these indicated that lock personnel, at times, did not follow agreed-upon procedures, creating some unnecessary delays. Only one of the respondents indicated that the effort was ineffective. His company was unaware of the planning and the procedures that had been established by industry representatives.

Q6. In what ways did your experiences with prior navigation system disruptions influence your preparations for this Greenup closure?

R6. Five out of six of the companies provided responses to this question. One respondent indicated that as a result of his company's prior experience with closures, they fully realized the advantages of the industry self-help program. Another respondent indicated that prior closure experience caused his company to become heavily involved with all aspects of the closure. The company participated in an outage pre-planning meeting with USACE and the navigation industry. They helped develop industry best practices, informed the towing companies of these practices and encouraged their use. They also hosted a weekly conference call involving USACE and the towing companies to

help minimize unnecessary delays that tended to result from the inattention of lock personnel or boat crews. A third respondent indicated that his company, as a result of prior experience with closures, realized the need to accelerate shipments through Greenup prior to the closure, although their ability to do this was somewhat limited. Another company respondent said that their prior experience prompted them to notify customers periodically about the outage; to position their fleet to take advantage of opportunities that arose as a result of their competitors' inabilities to perform; and to utilize downtime to perform vessel maintenance. The final respondent indicated that closure experience caused his company to identify tows that needed to be expedited. For customers in critical need of cargo, they exchanged lock queue positions to process this traffic more quickly.

Q7. If a reasonable estimate can be made, what additional costs (over and above normal operations) did you incur as a result of the closure event at Greenup?

R7. All of the companies responded to this question in varying levels of detail (see Table 6), although one company provided a partial response that could not be used to generate their total additional costs. Three of the companies provided a single cost number. One company provided a breakdown according the scheduled and unscheduled portions of the outage. The costs incurred by this company during the unscheduled portion of the

TABLE 6

Greenup Closure Costs Identified During Carrier Survey

Respondent	Costs During Scheduled Outage	Costs During Unscheduled Outage	Total Costs	Type of Cost
(1)	-	-	800	unknown
(2)	-	-	145	delay
(3)	-	-	2,500	equipment
(4)	-	-	1,500	unknown
(5)	-	-	-	delay
(6)	238	561	799	delay
Total	*	*	5,744	

closure are 135 percent of the costs incurred during the scheduled portion of the closure although the unscheduled portion of the closure was only one week longer than the scheduled portion. This lends some support to the notion that costs incurred during an unscheduled closure will likely be higher than the costs incurred during a scheduled closure of equal duration, owing to the inability to develop plans for an unscheduled outage. Most of the respondents cited additional delay costs, although the single highest cost was for additional equipment.

7. COST SUMMARY

Table 7 summarizes the costs identified, by type of cost, as a result of the shipper and carrier surveys, along with lock delay costs computed using LPMS data and equipment costs. These cost data were developed by screening/comparing the responses from the shipper and carrier surveys and using the appropriate operational data and towing equipment costs to calculate comprehensive lock delay costs for the closure period.

TABLE 7

Greenup Closure Costs to Industry

Type of Cost	Cost (Thousand $)	Respondents
Costs from Surveys:		
Modal Shift	8,600	4
Sourcing Shift	1,900	3
Stockpiling	25	1
Altered Production Processes	220	2
Shift in Production Location	36	1
Demurrage	10	1
Additional Equipment	2,500	1
Lost Sales	13,100	1
Other Costs	2,300	2
Subtotal	28,691	16
Computed Costs:		
Delay at Lock	13,200	-
Total	41,891	16

Costs from the completed survey forms were compared to eliminate double counting to the extent possible. Also, any costs reported specifically as delay costs in the carrier survey were disregarded. In their place, the delay costs for the closure period were computed using LPMS data for the closure period along with the appropriate equipment costs. Computed delay costs are a better, more comprehensive reflection of delay costs to the towing industry, since industry responses to the survey were incomplete.

It should be noted again that the total costs associated with the Greenup outage, $41.9 million for the seven-week period, are compiled from partial information. Many companies, including some major users of the Greenup facility, declined to participate in the survey. Other companies participated in the survey and acknowledged that they had had added costs during the closure period, but were unable to isolate and provide those costs for a variety of reasons. For these reasons, it is acknowledged that the total costs cited are likely understated.

8. LOCK PERFORMANCE MONITORING SYSTEM ANALYSIS

a. Introduction. In addition to the formal shipper and carrier surveys, Greenup data contained in the Lock Performance Monitoring System (LPMS) were examined to identify the operational effects of the closure and to associate these observations with information gathered in the surveys. The LPMS database contains highly-detailed, operational-type navigation data for every lock in the system. These data permit an examination of operational patterns during the main chamber closure. The data also permit a comparison of those patterns with normal operations to more clearly isolate the effects of the closure. Seasonality in commodity traffic patterns in addition to key operating statistics are examined to discern shipper/carrier reactions to the closure event and to more clearly explain any associated impacts.

b. Commodity Traffic During Closure. Table 8 contains commodity traffic by commodity group through the Greenup facility for periods prior to the closure event of September-October 2003, during the closure itself and for the period November-December 2003, following the closure.

As a part of the current analysis, the issue of possible seasonality in commodity traffic through the Greenup facility was considered. If seasonal surges in certain commodity groups typically occur during the period when a closure occurs, the traffic impact of a closure event could be understated. In the case of Greenup, the major concern would be that utilities receiving coal through the facility (which accounts for about half of the project's traffic) may typically stockpile during the September-October timeframe. In that regard, coal traffic through Greenup in 2001 and 2002 was examined for evidence of

TABLE 8

Comparison of Commodity Tonnages at Greenup Prior to, During and Following the Closure Event
(Traffic in Tons Per Day)

Commodity	Pre-Closure(1) 1 Jan-31 July 2003	Pre-Closure(2) 1 Aug-7 Sep 2003	Closure Period			Closure Period as % of Pre-Closure(1)	Post-Closure 1 Nov-31 Dec 2003
			Scheduled 8 Sep-26 Sep 2003	Unscheduled 27 Sep-31 Oct 2003	Total 8 Sep-31 Oct 2003		
Coal	98,033	109,205	84,560	93,209	90,166	92	89,019
Petroleum	18,662	17,673	16,223	19,732	18,497	99	16,492
Aggregates	10,028	13,122	9,811	14,062	12,566	125	10,932
Grains	808	695	1,005	673	790	98	543
Chemicals	10,724	7,796	8,202	13,084	11,366	106	9,845
Ores & Minerals	6,724	8,371	3,040	7,007	5,611	83	7,886
Iron & Steel	18,607	17,131	18,768	20,235	19,719	106	20,486
Others	7,515	6,629	7,617	9,885	9,087	121	6,457
Total	171,096	180,621	149,226	177,886	167,802	98	161,661

SOURCE: LPMS Data

stockpiling. Based on this limited examination, no indication of stockpiling on the part of the utilities was discovered. It should be noted, however, that other commodity groups, specifically aggregates and grains, did show some evidence of seasonality in their traffic levels.

Many of the respondents to the shipper survey indicated that their reaction to the main chamber closure at Greenup was to stockpile product prior to the closure. It was expected that this stockpiling would be evident in the tons per day during the immediate pre-closure period (1 August – 7 September). In fact, the only commodity groups that show an increase in tons per day relative to the pre-closure(1) period are coal, aggregates, and ores and minerals.

The traffic effects of the closure event at Greenup vary depending on the commodity and individual company decisions. As indicated from the survey results, a sizeable amount of coal traffic as well as some aggregates traffic diverted to other modes/sources during the closure. Additionally, some critical commodity movements were given priority by the towing companies; some companies chose to purchase rather than produce products; and some companies switched production to other facilities. Overall, the tons per day during the closure period amounted to about 98 percent of the pre-closure(1) period (87 percent during the scheduled period; 104 percent during the unscheduled). This high level of tonnage throughput at the auxiliary lock is somewhat misleading because of the substantial excess capacity in recent years at the main chamber. Industry strategy during the closure period for maximizing the tonnage throughput of the auxiliary chamber (especially during the unscheduled closure period) appears to have been increasing the barges per tow and reducing the percentage of empty barges, and thereby increasing tons per tow (Table 9). While this strategy appears to have been pursued intensely during the

unscheduled closure period, pre-closure preparations may have somewhat mitigated the need for improved efficiencies during the scheduled closure.

Once the closure period was extended pressures on the auxiliary chamber increased dramatically. Some commodity traffic was already in transit in anticipation of the main chamber's opening on the original schedule. Also, at the time of the closure extension, efficiency measures were applied much more intensively, to the extent that tonnage throughput for the unscheduled closure period was 104 percent of the pre-closure(1) period. The tonnage throughput, however, was not the same traffic as in the pre-closure period, because some traffic had been diverted and some companies were over-compensating by additional stockpiling wherever possible because of the closure. Throughout the closure period, it appears that some companies were well-prepared and some were poorly prepared, which resulted in some companies being well-served and some being under-served. In the post-closure period, commodity tonnages for several commodity groups remained below their pre-closure(1) levels, suggesting that some companies were adjusting their inventories to pre-closure conditions and that for other companies, arrangements made to accommodate the closure period (re-sourcing, diversions, etc.) persisted into the post-closure period, possibly because of contractual arrangements. Additionally, notice of the main chamber re-opening was issued only one day in advance of the actual re-opening. The actual re-opening date (31 October 2003) was seven days in advance of the previously-announced tentative re-opening date (7 November 2003).

c. Flotilla Characteristics. Table 9 displays flotilla characteristics of the vessel traffic through the Greenup facility for periods prior to the closure event of September-October 2003, during the closure and following the closure, in the months of November-

TABLE 9

Flotilla Characteristics of Vessels Using Greenup Prior to, During and Following the Closure Event

			Closure Period				
	Pre-Closure(1) 1Jan-31Jul 2003	Pre-Closure(2) 1 Aug-7 Sep 2003	Scheduled 8 Sep-26 Sep 2003	Unscheduled 27 Sep-31 Oct 2003	Total 8 Sep-31 Oct 2003	Closure as % of Pre-Closure(1)	Post-Closure 1 Nov-31Dec 2003
Tows/Day:	15.8	16.5	13.1	14.0	13.6	86	14.8
Barges/Day:							
Loaded	107.1	119.7	97.4	113.3	106.8	100	102.1
Empty	63.2	70.1	55.6	54.3	54.2	86	55.7
Percent Empty	37.1%	36.9%	36.3%	32.4%	33.7%		35.3%
Total	170.2	189.8	153.0	167.6	161.0	95	157.7
Barges Per Tow	10.8	11.5	11.7	12.0	11.8	110	10.7
Tons Per Tow	10,863	10,947	11,391	12,706	12,338	114	10,923
Tons Per Day	171,096	180,621	149,226	177,886	167,802	98	161,661

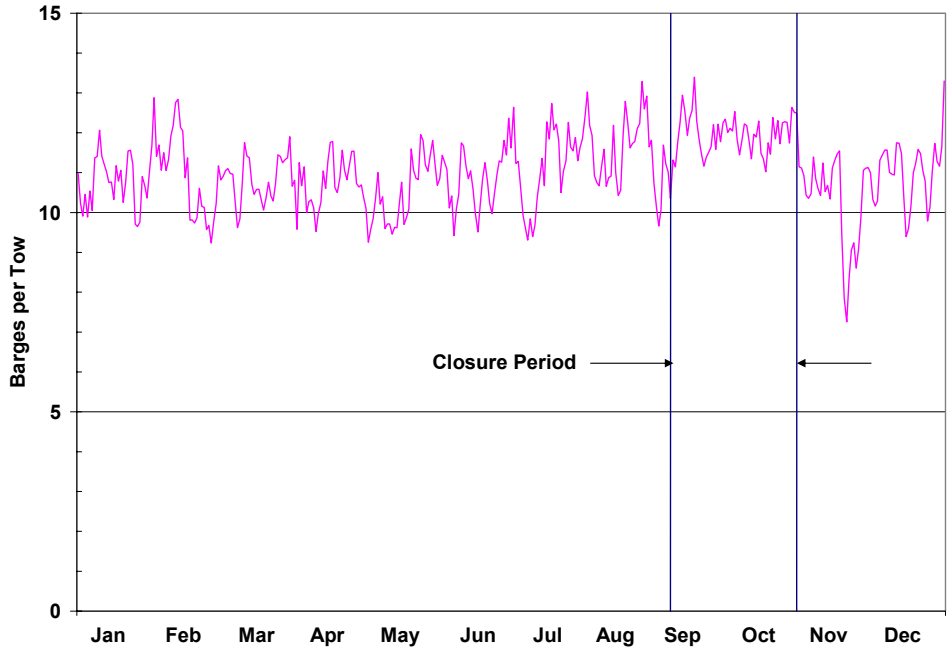
Source: LPMS Data

December 2003. Some clear results of the Greenup closure were a reduced number tows per day, a reduced number of barges per day and a reduction in tons per day during the closure period relative to the pre-closure(1) period. These impacts, however, were offset somewhat by an increase in barges per tow, a decrease in the percentage of empty barges and a consequent increase in tons per tow.

(1) Barges Per Tow. A typical way that shippers and carriers react to a main chamber closure is to change their flotilla configuration, typically by pushing larger tows during the closure. Figure 2 show a three-day moving average of barges per tow at the Greenup facility for calendar year 2003. The data in Table 9 show that, for the entire closure period, barges per tow averaged 110 percent of barges per tow during the pre-closure(1) period. Barges per tow increased from 10.8 during the pre-closure(1) period to 11.7 during the scheduled closure period. During the unscheduled closure, barges per tow trended higher to about 12.0. Following the closure, during the 1 November-31 December period, barges per tow returned to about the pre-closure(1) level. Increasing barges per tow was clearly a strategy that was implemented during the Greenup closure.

FIGURE 2

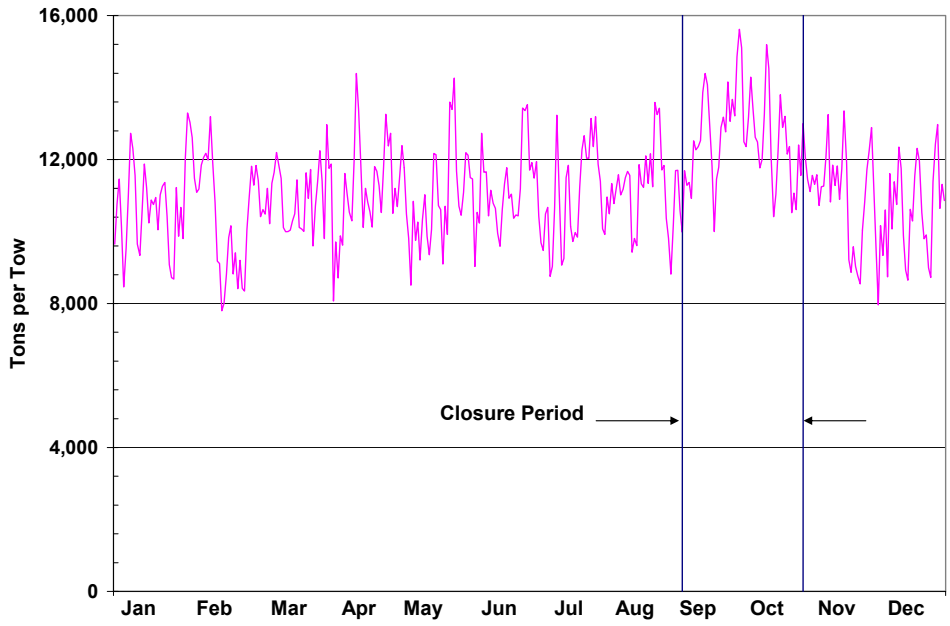
BARGES PER TOW AT GREENUP IN 2003



(2) Tons Per Tow. The tons per tow statistic is another measure of shippers' and carriers' reactions to the closure event. Tons per tow is a reflection of barges per tow and the percentage of empty barges, but is nonetheless a good single statistic to examine the effect of changes in tow configurations. Figure 3 shows the three-day moving average of tons per tow at Greenup for the closure period compared to the remainder of 2003. Prior to the closure, during pre-closure(1), tons per tow averaged 10,863 (Table 9). During the scheduled portion of the closure, tons per tow rose to 11,391 and during the unscheduled portion, to 12,706. Over the entire closure period, tons per tow averaged 12,338, which was 114 percent of the pre-closure tonnage. In the post-closure period, tons per tow returned to a level only slighty higher than the pre-closure(1) period. The tons-per-tow statistic appears to indicate that the shippers reacted to the closure by pushing more loaded barges as well as more barges per tow.

FIGURE 3

TONS PER TOW AT GREENUP IN 2003

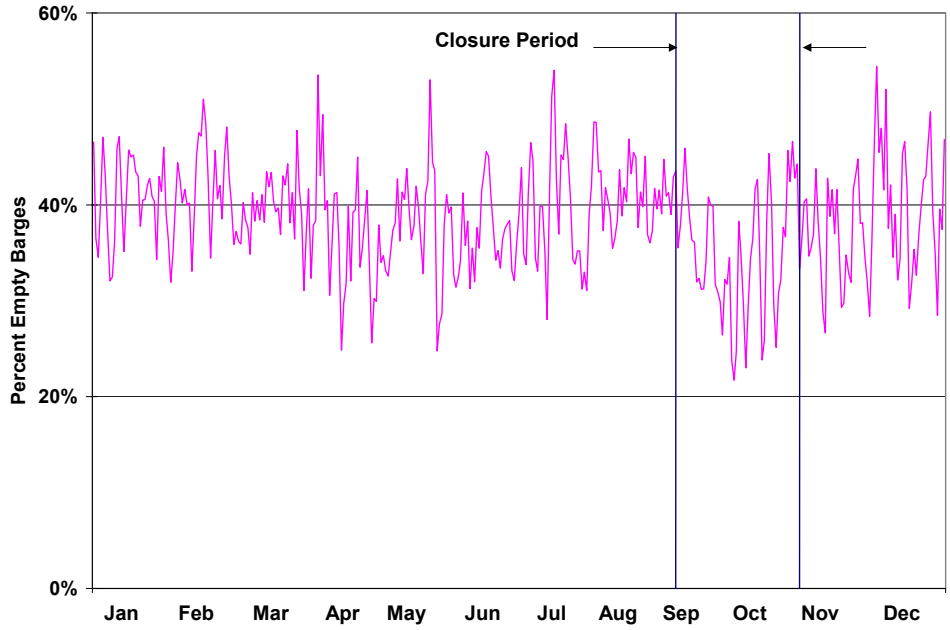


(3) Percentage of Empty Barges. Another method that shippers/carriers use to increase tonnage throughput at a lock chamber is to push tows that have fewer empty barges. This is a temporary strategy that obviously cannot be pursued indefinitely without creating serious equipment imbalances in the system. Table 9 shows that the percentage of empty barges per day for the entire closure period was about 33.7 percent, compared to 37.1 percent for the pre-closure(1) period. The percentage of empty barges diminished to 36.3 percent for the scheduled closure, but then dropped off steeply to 32.4

percent for the unscheduled closure. The data in Table 9 also show that the percentage of empty barges trended upward, but did not immediately return to pre-closure (1) levels once the main chamber re-opened. Figure 4 shows a three-day moving average of percentage of empty barges for the closure period relative to the entire year, confirming a downward movement in percentage of empties during the closure.

FIGURE 4

PERCENTAGE OF EMPTY BARGES AT GREENUP IN 2003



d. Lockage-Related Statistics. Table 10 displays lockage-related statistics for commercial traffic through the Greenup facility for periods prior to the closure event of September-October 2003, during the closure and following the closure, in the months of November and December 2003. These data dramatically illustrate the impact of the closure on commercial traffic. Because traffic was compelled to use the auxiliary lock chamber, the number of tows processed per day was reduced by about 16 percent during the closure period relative to the pre-closure(1) period. Prior to the closure, about 97 percent of tows locked in single-cuts, whereas during the closure period, 83 percent of commercial lockages were double-cut, because of the necessity of using the auxiliary chamber. Use of the auxiliary lock, with mostly double lockages, produced a near doubling in the average processing times. Normally, in moving from single-cut to double-cut lockages, experience suggests that average processing times should at least double. However, the average processing times in Table 10 include a mix of single- and

TABLE 10

Lockage-Related Statistics for Vessels Using Greenup Prior to, During and Following the Closure Event

	Pre-Closure(1) 1Jan-31Jul 2003	Pre-Closure(2) 1 Aug-7 Sep 2003	Closure Period: Scheduled 8 Sep-26 Sep 2003	Closure Period: Unscheduled 27 Sep-31 Oct 2003	Closure Period: Total 8 Sep-31 Oct 2003	Closure as % of Pre-Closure(1)	Post-Closure 1 Nov-31Dec 2003
Arrivals/Day	15.8	16.4	14.5	13.6	13.9	88	14.8
Total Delay (Hours)	2,345	1,135	6,133	21,182	27,561		721
Hours Delay Per Tow	0.7	1.8	24.6	43.2	37.5	5361	0.8
Commercial Lockages/Day	15.8	15.9	12.3	13.8	13.3	84	14.8
Commercial Lockage Cuts/Day							
1-cut	15.4	15.4	1.7	2.4	2.2	14	14.7
2-cut	1.2	0.5	10.6	11.4	11.1	905	1.8
Average Processing Time (Minutes)	51.6	57.6	100.6	92.0	94.9	184	54.3

Source: LPMS Data

double-cut lockages, with sufficient single-cuts to reduce average processing times to levels that are less than double those encountered in the pre-closure periods. The data in Table 10 show that arrivals at the locks were reduced somewhat during the closure period relative to pre-closure(1), while delays escalated dramatically.

(1) Arrivals. Tow arrivals are important in a closure situation because a change in the pattern of arrivals signals a change in the manner in which the shippers and carriers are using the facility. The type of changes at Greenup that potentially affected tow arrivals included traffic diversions to overland modes or alternate routings, increases in barges/tons per tow and a simple decision on the part of industry to stay away from the facility where practicable. Figures 5 and 6 compare three-day moving averages of tow arrivals for calendar years 2002 and 2003. Figure 7 shows the three-day moving averages of tow arrivals for the closure period. The data in Table 10 show that the arrival rate for the pre-closure(1) period was 15.8 tows per day. This was considerably below the arrival rates for all of 2002 (17.4), 2001 (18.7) and 2000 (18.7). For the scheduled closure period, tow arrivals per day fell to 14.5 and during the unscheduled closure to 13.6. Once the closure ended, tow arrivals continued to fall (to about 12.8) until such time as the queue returned to zero, which occurred about 29 hours and 27 minutes after the main chamber re-opened. For the entire post-closure period, the arrival rate averaged 14.8. It is unclear why the arrival rates did not return to their pre-closure levels. Although the annual arrival rates seem to be diminishing, traffic at the Greenup facility had also been declining in recent years.

The overall decline in traffic makes it difficult to separate closure-related impacts from long term traffic declines at Greenup by looking only at LPMS data. The shipper and carrier surveys, however, do shed some light on the closure-related impacts. Many of the survey respondents indicated that they had taken actions that could affect traffic levels at the auxiliary chamber. Respondents indicated that they did one or combinations

FIGURE 5

TOW ARRIVALS PER DAY AT GREENUP IN 2002

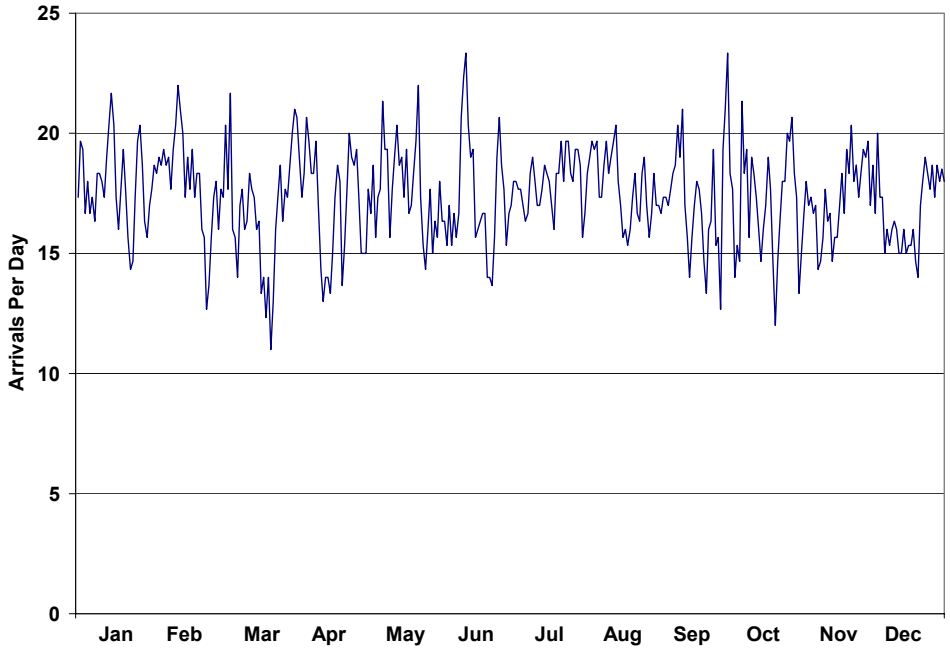


FIGURE 6

TOW ARRIVALS PER DAY AT GREENUP IN 2003

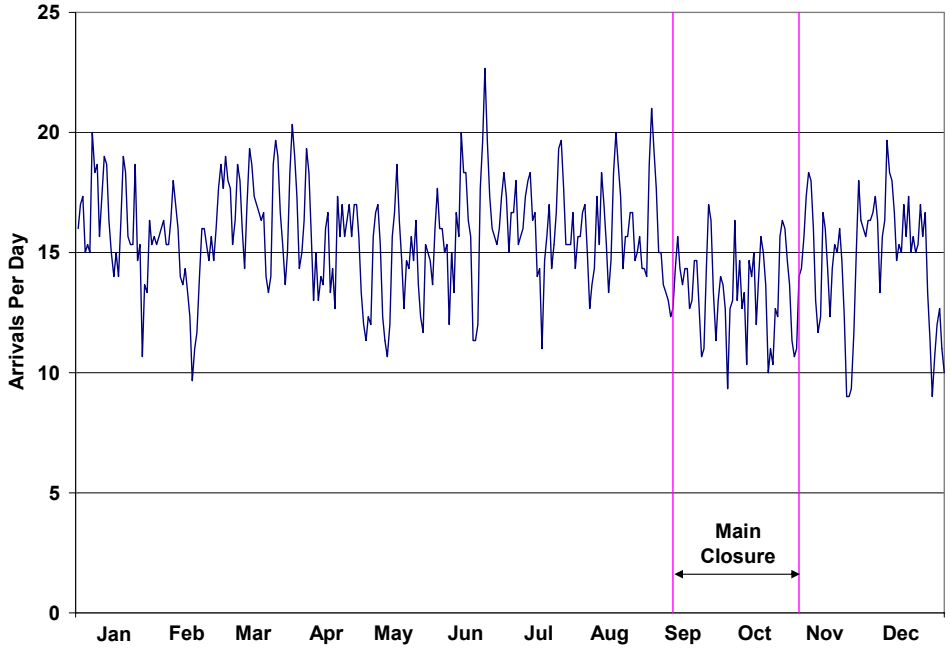
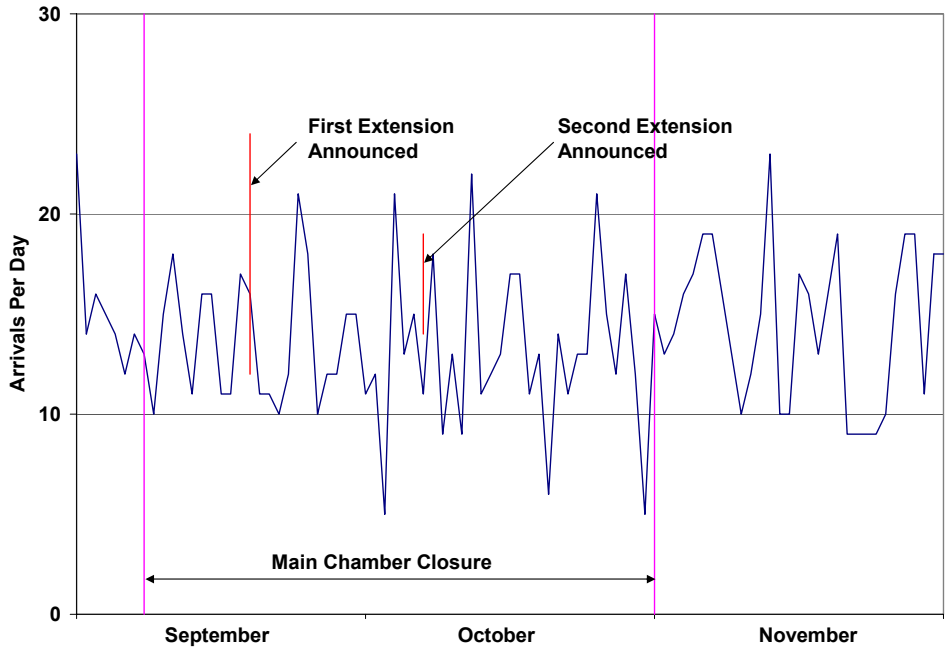


FIGURE 7

TOW ARRIVALS PER DAY AT GREENUP SEP-OCT 2003



of the following: stockpiled product and waited for traffic to clear; switched to all-overland modes for product delivery from existing sources; switched product sources to an entirely new source; switched production to another facility; purchased intermediate or final product, rather than produced; or avoided the Greenup facility where possible. Any of these responses, by themselves or in combination, can impact arrival rates.

Focusing solely on the closure period, the data indicate that the arrival rate gradually declined as the closure progressed. This phenomenon is common during most historic main chamber closures. Historically, arrival rates have been observed to remain high, at pre-closure levels, until about ten days after the closure began. By then, delays have normally risen to high levels. After about the first 10 days of the closure, arrival rates decrease to where they approximate the service rate of the open chamber. Arrival rates during the Greenup closure were unique in one regard. Historically, the arrival rate has been observed to increase sharply just before the closure, and remain relatively high until about 10 days to 2 weeks after the closure began. For this closure, the arrival rate decreased immediately before the closure began. The reason for this decrease in arrival rates cannot be determined from LPMS data alone. This may actually be indicative of improved communications and advance preparations for the scheduled portion of this outage relative to other closures.

(2) Delays. Table 10 shows total delays per time period as well as average delay per tow for the pre-closure periods, the closure itself, and the post-closure period. Figure 8 shows the average delay per tow for each day of 2003, with the dramatic increases caused by the main chamber outage. The total delay caused by the outage at the Greenup facility was the equivalent of about six years of normal operation. The accumulated delay amounted to more than 27,000 hours at a cost of about 13.2 million dollars. The maximum delay was 93 hours, with many tows waiting over two days for service.

FIGURE 8

AVERAGE DAILY TOW DELAYS AT GREENUP IN 2003

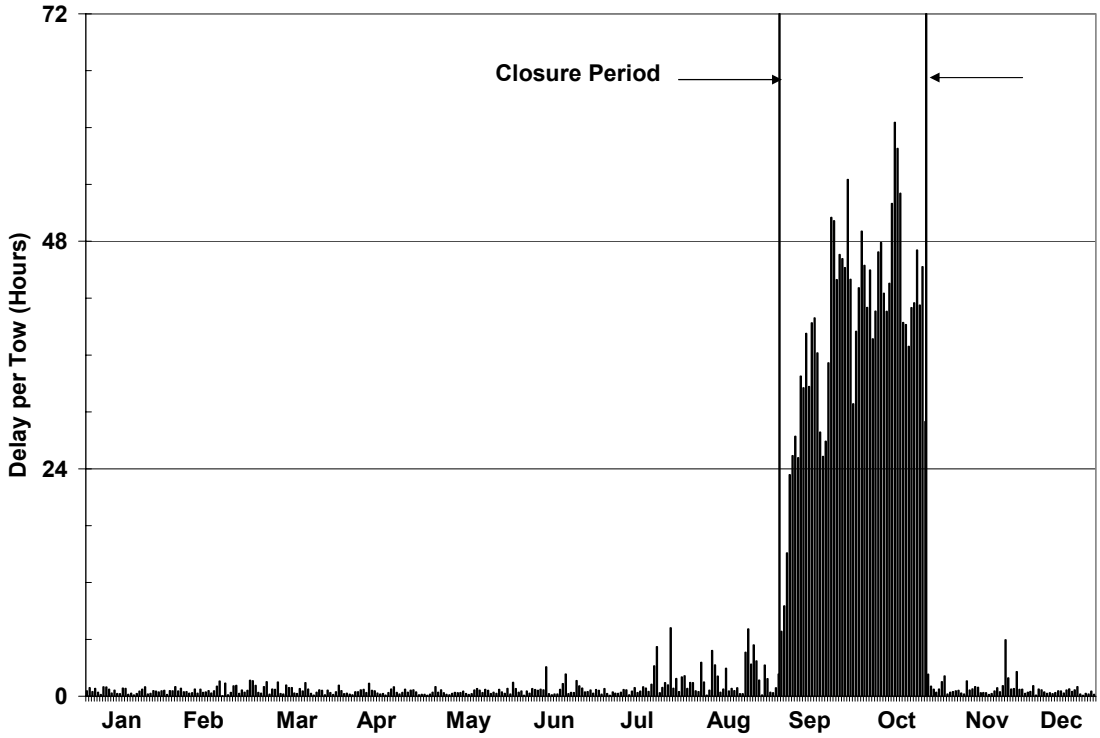
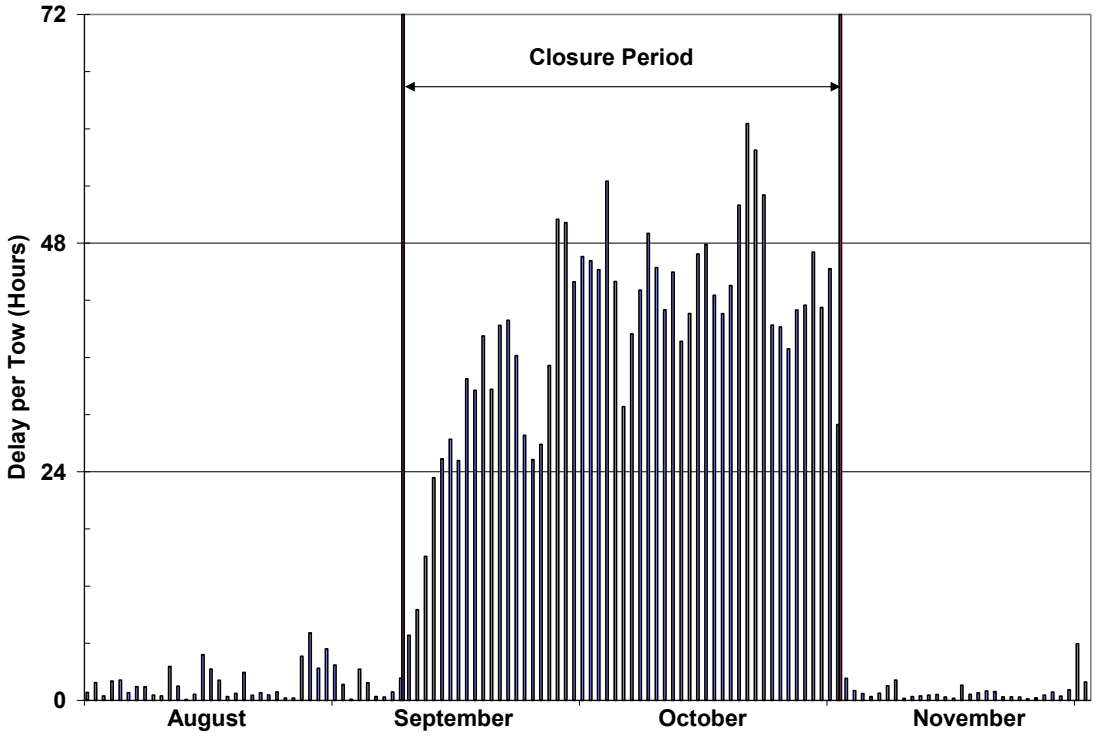


Figure 9 focuses on tow delays during the immediate pre-closure period, the closure period itself, and the immediate post-closure period. The data in Table 10 as well as the depiction in Figure 9 indicate a rapid rise in delays per tow during the period roughly corresponding to the scheduled portion of the closure. Following this initial run-up, delays plateaued at around 43 hours per tow for the remainder of the closure. The plateauing in delay time is typical of main chamber closures. For the entire closure period, delay time per tow averaged about 37.5 hours. The fact that a part of the closure was unscheduled could have produced higher delays than would have occurred

FIGURE 9

AVERAGE DAILY TOW DELAYS AT GREENUP
AUGUST - NOVEMBER, 2003



ordinarily. Shippers and carriers were prepared for a closure of only 18 days, with the lock opening on 26 September. Since industry was prepared for a closure of relatively short duration as confirmed in the shipper and carrier surveys, the extension of the closure prompted much more intensive use of the auxiliary chamber. Survey respondents repeatedly referred to the extraordinary (and expensive) measures they were compelled to pursue in order to cope with the unscheduled portion of the closure. For example, one company hired four additional towboats to assist in their operations during the unscheduled portion of the closure. A manufacturing company reduced production rates to an absolute minimum and a construction-related company had to re-schedule projects to accommodate the closure extension. After the main lock chamber opened, it took nearly 30 hours for delays to return to normal.

9. FINDINGS AND CONCLUSIONS

Most respondents to the shipper survey felt that the closure was well-handled, particularly the scheduled portion of the closure. Most had sufficient notification and were able to make necessary adjustments for the scheduled portion of the closure, although some indicated that they had not been notified at all. Several respondents indicated that the unscheduled portion of the closure was particularly problematic and expensive for them, causing them to take extraordinary measures to mitigate the adverse impacts on their operations.

Shippers had a wide variety of responses and combinations of responses to the closure, ranging from no changes in procedures to shifting production to an entirely different facility. The most common reaction was that they stockpiled product and waited for the facility to clear. While this was an adequate response to the scheduled portion of the closure, the unscheduled portion of the closure caused them to take more extraordinary and expensive measures.

The utility representatives interviewed as part of the shipper survey indicated that their strategy for lock closures is very much a plant-by-plant strategy, dependent on such things as coal and transportation market conditions at the time of the closure and the transportation options available at the plants in question. Subject to individual plant situations, the utility representatives ranked their responses to closure events. In the event of a lock closure they would attempt to (1) stockpile as much as possible and wait until the closure was over; (2) divert coal traffic to alternative modes; (3) shift coal sources to avoid a closed lock; (4) close plants that cannot receive coal and re-dispatch remaining plants or purchase power off the grid.

Experience with the Greenup closure has caused many shippers to do such things as increase stockpiles, plan alternative transportation and generally prepare for "worst-case" scenarios when lock closures are announced. This is evidence that shippers are in the process of internalizing the costs of reduced reliability on the navigation system. Most of the shippers did indicate, however, that the Greenup closure did not cause them to alter their long-term transportation or operational strategies.

Carriers contacted during the carrier survey were somewhat less positive than shippers in their assessments of the handling of the Greenup closure. Similar to the shippers, respondents to the carrier survey indicated that notification of the scheduled closure was adequate but the companies were unanimous in their assessment that the unscheduled portion of the closure caused them severe difficulty. Most of the carriers were critical of the operating procedures put in place at the time of the closure, with some citing a lack of adherence to the procedures on the part of lock personnel.

Like the shippers, the carriers had a variety of responses to the closure event, ranging from avoiding the lock entirely during the closure to simply remaining in queue and awaiting lockage through the auxiliary lock. The most common course of action was to remain in queue and break up to lock through the auxiliary. The carriers also commonly

participated in the industry self-help program. Carrier actions were similar between the scheduled and unscheduled portions of the closure, except that for the unscheduled portion of the closure, they took such measures as chartering additional towing equipment and re-configuring tows to accommodate critical commodities.

Carriers indicated that the Greenup closure had caused them to adopt no new long-term operating procedures. Some carriers indicated that the closure had caused them to assume worst-case timelines for future closures and some felt motivated to become involved in the management of future closures events.

The LPMS analysis shed additional information on carrier/shipper behavior before, during and after the closure event. The LPMS analysis appears to indicate that industry strategy for the Greenup main chamber closure was generally to pre-ship and stockpile in advance of the closure; to increase barges per tow; to decrease the percentage of empty barges; and to reduce arrivals at the facility during the closure period. The LPMS data indicate that this strategy was pursued from the outset of the closure, but that the operating strategy was pursued with much greater intensity during the unscheduled portion of the outage because of its unexpected nature. Since tows were compelled to use the auxiliary lock during the closure, average processing times nearly doubled relative to the pre-closure period. Total delay during the outage at Greenup was more than 27,000 hours, which amounts to the equivalent delay for about six years of normal operation.

Experience at the Greenup Locks during the September-October 2003 closure shows that open and timely communication involving the Corps, the Coast Guard and industry is highly-important to minimizing the adverse impacts to industry resulting from lock closures. For the scheduled closures, Notices to Navigation Interests should be (and generally are) distributed sufficiently far in advance for companies to make necessary adjustments. These notices should be given sufficient distribution, so that industry complaints of not having been notified can be avoided. Publicly-accessible Corps web sites that provide closure information should be kept up to date. Ongoing communication among suppliers, carriers and customers should be emphasized to enable all the parties involved to plan for the outages, and in the process, minimize costs to their respective companies.

Efforts should be made to adhere to agreed upon operating procedures at the locks during closure events. Some survey respondents felt that this was not done uniformly during the Greenup outage and that this resulted in avoidable delays.

Total costs associated with the closure, estimated at $41.9 million, are likely understated, given that they are based on a partial response to the surveys. Many companies declined to participate in the surveys and other companies acknowledged that they had incurred additional costs as a result of the closure but were unable to provide results.

APPENDIX A

DOWNSTREAM MIDDLE WALL LOCK LEAF CRACKING

Greenup Downstream Middle Wall Leaf

 # 9

 # 11

 # 15

 # 13

APPENDIX B

NOTICES TO NAVIGATION INTERESTS

US Army Corps
of Engineers
Huntington District

Notice to Navigation Interests

Notice No.: 02-02 Date: January 16, 2002

In Reply Refer to: CELRH-OR-TD 502 Eighth Street, Huntington, WV 25701-2070 Telephone: 304-529-5684

MAINTENANCE SCHEDULE FOR 2002

HUNTINGTON DISTRICT

It is anticipated that major maintenance and repairs will be performed at the following locations during Calendar Year 2002. This notice may require periodic revision. It is given so that industrial waterway users may have a general knowledge of the lock outages and can plan their operations accordingly. Factors which may affect this schedule are the delivery of materials, repairs required but not anticipated, emergency repairs as a result of accidents, and funding.

All interested parties should review the maintenance schedule for impact. Additional notices furnishing specific information and operating requirements will be published approximately two weeks in advance of commencing the work items listed.

PROJECT	REPAIRS	WEEKS	DATES (2002)	REMARKS
London	Land Lock Lower Miter Gate Concrete Repairs	***3***	4 Mar – 22 Mar	Land Lock Closed Self-Help
Winfield	Install New Stoney Gate Valves (7 Each)	***6***	25 Mar – 3 May	No Delays
Meldahl	Main Lock Upper Gate Machinery	***6***	6 May - 14 Jun	Main Lock Open No Delays
Meldahl	Main Lock Structural Repairs	***6***	17 Jun – 26 Jul	Main Lock Closed Self-Help
Meldahl	Auxiliary Lock Lower Gate Structural Repairs	***6***	29 Jul – 6 Sep	No Delays
Greenup	Main Lock Gate Latch Device	***1***	9 Sep – 13 Sep	No Delays

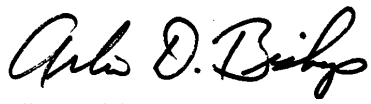
Huntington Riverfront Park	Repair Mooring Damages		CONCURRENT	No Delays
Belleville	Main Lock Strut Arms/Pins	***2***	16 Sep – 27 Sep	Main Lock Open No Delays
Willow Island	Auxiliary Lock Upper Gate Structural Repairs	***5***	30 Sep – 1 Nov	No Delays
Willow Island	Main Lock Upper Gate Structural Repairs	***6***	4 Nov – 13 Dec	Main Lock Closed Self-Help

TENTATIVE MAINTENANCE SCHEDULE FOR 2003

HUNTINGTON DISTRICT

PROJECT	REPAIRS	WEEKS	DATES (2003)	REMARKS
R.C. Byrd	Repairs to Auxiliary Lock Culvert Valves	***8***	Feb/Mar/Apr	No Delays
Meldahl	Repairs to Auxiliary Lock Culvert Valves	***8***	Apr/May/Jun	No Delays
Meldahl	Tainter Gate Side Arm Plates	***4***	Jun/Jul	No Delays
Greenup	Main Lock Lower Gate Structural Repairs	***6***	Jul/Aug	Main Lock Closed Self-Help
Winfield	Roller Gate Chain Rehabilitation	***2***	Sep	No Delays
Marmet	Dam Side Seals Modification/Lower Wall Ladders	***8***	Sep/Oct/Nov	Minor Delays

London	Dam Side Seal Modification	***6***	Nov/Dec	No Delays



Arlie D. Bishop
Chief, Technical Support Branch

US Army Corps of Engineers
Huntington District

Notice to Navigation Interests

Notice No.: 03-01 **Date:** January 06, 2003

In Reply Refer to: CELRH-OR-TD 502 Eighth Street, Huntington, WV 25701-2070 Telephone: 304-529-5684

MAINTENANCE SCHEDULE FOR 2003

HUNTINGTON DISTRICT

It is anticipated that major maintenance and repairs will be performed at the following locations during calendar year 2003. This notice may require periodic revision. It is given so that industrial waterway users may have a general knowledge of the lock outages and can plan their operations accordingly. Factors which may affect this schedule are the delivery of materials, repairs required but not anticipated, emergency repairs as a result of accidents, and funding.

All interested parties should review the maintenance schedule for impact. Additional notices furnishing specific information and operating requirements will be published approximately two weeks in advance of commencing the work items listed.

PROJECT	REPAIRS	WEEKS	DATES (2003)	REMARKS
Winfield	Main Lock – Repair Upper Middle Wall Gate Anchorage	2 Days	3 – 4 March	Main Lock Closed Self - Help
Winfield	Install New Stoney Gate Valves	***8***	5 Mar – 25 Apr	No Delays
Meldahl	Repair Culvert Valves LWF/LWE	***7***	28 Apr – 13 Jun	No Delays
Meldahl	Preparatory Work For Main Lock Outage	***1***	16 Jun – 20 Jun	No Delays
Meldahl	Main Lock Lower Gate Repairs/Upper Gate Modify For Lifting	***4***	23 Jun – 18 Jul	Main Lock Closed Self - Help

Greenup	Main Lock Culvert Valves RWF/MWE	***7***	21 Jul – 5 Sep	Minor Delays
Harris Riverfront Park	Repair Mooring Damages	Concurrent		No Delays
Greenup	Main Lock Miter Gate Inspection/Gate Latch Device	***3***	8 Sep – 26 Sep	Main Lock Closed Self Help
Marmet	Roller Gate No. 4 Seal Modification/Side Seal	***3***	29 Sep – 17 Oct	No Delays
Racine	Dam Tainter Gates Side Seal Repairs	***8***	20 Oct – 12 Dec	No Delays

TENTATIVE MAINTENANCE SCHEDULE FOR 2004

HUNTINGTON DISTRICT

PROJECT	REPAIRS	WEEKS	DATES (2004)	REMARKS
Belleville	Repairs to Auxiliary Lock Culvert Valves	***8***	Feb/Mar/Apr	No Delays
R. C. Byrd	Repairs to Auxiliary Lock Culvert Valves	***8***	Apr/May/Jun	No Delays
R. C. Byrd	Main Lock Dewater/Inspect Sector Gear Pins	***2***	Jul	Main Lock Closed Self Help
Racine	Aux Lock Upper Gate Repair	***5***	Jul/Aug	No Delays
Greenup	Main Lock Structural Repairs Modify Miter Gate For Lifting	***5***	Aug/Sep	Main Lock Closed Self Help
Meldahl	Dam Tainter Gate Side Seal Repair	***7***	Oct/Nov	No Delays

Belleville	Main Lock Strut Arms/Pins	***2***	Dec	Main Lock Open No Delays
Willow Island	Aux Lock Upper Gate Repairs	***5***	Nov/Dec	No Delays

Arlie D. Bishop
Chief, Technical Support Branch

US Army Corps of Engineers
Huntington District

Notice to Navigation Interests

Date: 11 August 2003 **Notice Number: 03-43**

~~In Reply Refer to: CELRH-OR-TD 502 Eighth Street, Huntington, WV 25701-2070 Telephone: 304-529-5684~~

STRUCTURAL REPAIRS, MAIN LOCK CHAMBER

GREENUP LOCKS

OHIO RIVER, MILE 341.0

Notice is given that on or about September 8, 2003, the U.S. Repair Fleet will commence repairs in the main lock chamber at Greenup Locks. The repairs will consist of dewatering and repairing the main lock chamber upper gate. The main lock chamber will be closed for approximately three weeks and is scheduled to reopen on or about September 26, 2003. During the time period of the main lock closure, all traffic will be required to use the auxiliary lock.

The industry SELF-HELP program will be utilized whenever a workable queue develops and where sufficient vessel power exists. The Lockmaster will be available to assist and provide coordination. The rules of the SELF-HELP program remain the same. When tows are not available to implement the SELF-HELP program, the Corps' assist boat will be utilized upon request to assist tows requiring double lockage.

All navigators are urged to use extreme caution when transiting the lock while one chamber is closed as closure of the one remaining chamber due to an accident would create a critical navigation stoppage.

ARLIE D. BISHOP
Chief, Technical Support Branch

US Army Corps of Engineers
Huntington District

Notice to Navigation Interests

Date: 19 September 2003 **Notice Number: 03-49**

~~In Reply Refer to: CELRH-OR-TD 502 Eighth Street, Huntington, WV 25701-2070 Telephone: 304-529-5684~~

REVISION TO NTN 03-43 AND 03-47

STRUCTURAL REPAIRS, MAIN LOCK CHAMBER, GREENUP LOCKS

UPPER MITER GATE REPAIRS, MAIN LOCK CHAMBER, MELDAHL LOCKS

OHIO RIVER, MILE 341.0 AND 436.0

Reference Notice to Navigation Interests No. 03-43, dated August 11, 2003. Due to unanticipated emergency repairs in the main lock chamber the main lock outage at Greenup Locks will be extended by four weeks. The anticipated completion date has been changed to October 24, 2003. All other information remains unchanged.

Reference Notice to Navigation Interests No. 03-47, dated September 10, 2003. Due to unanticipated emergency repairs at Greenup Locks repairs to the upper miter gates, main lock chamber, at Captain Anthony Meldahl Locks has been postponed until further notice.

All navigators are urged to use extreme caution when transiting the lock while one chamber is closed as closure of the one remaining chamber due to an accident would create a critical navigation stoppage.

ARLIE D. BISHOP
Chief, Technical Support Branch

US Army Corps of Engineers
Huntington District

Notice to Navigation Interests

Date: 7 October 2003 **Notice Number: 03-55**

~~In Reply Refer to: CELRH-OR-TD 502 Eighth Street, Huntington, WV 25701-2070 Telephone: 304-529-5684~~

REVISION TO NTN 03-49

STRUCTURAL REPAIRS, MAIN LOCK CHAMBER, GREENUP LOCKS

OHIO RIVER, MILE 341.0

Reference Notice to Navigation Interests No. 03-49, dated September 19, 2003. Due to unanticipated emergency repairs in the main lock chamber an inspection has been scheduled on or about October 17, 2003 to assess the status of repairs. Based on inspection results, the outage could be extended an additional two weeks changing the completion date to on or about November 7, 2003. All other information remains unchanged.

All navigators are urged to use extreme caution when transiting the lock while one chamber is closed as closure of the one remaining chamber due to an accident would create a critical navigation stoppage.

ARLIE D. BISHOP
Chief, Technical Support Branch

US Army Corps of Engineers
Huntington District

Notice to Navigation Interests

Date: 30 October 2003 **Notice Number: 03-64**

In Reply Refer to: CELRH-OR-TD 502 Eighth Street, Huntington, WV 25701-2070 Telephone: 304-399-5684

REOPENING OF MAIN LOCK CHAMBER

GREENUP LOCKS

OHIO RIVER, MILE 341.0

Notice is given that the repairs to the main lock chamber at Greenup Locks, Ohio River mile 341.0 has been completed. It is scheduled to be reopened on October 31, 2003.

ARLIE D. BISHOP
Chief, Technical Support Branch

APPENDIX C

SHIPPER AND CARRIER SURVEY FORMS

OMB Control # 0710-0001
Expiration date 11/30/2005

GREENUP LOCKS CLOSURE SHIPPER SURVEY

Date: _____

Firm: _____

Address: _____

_____

Phone: _____ FAX: _____

Point of Contact: _____ E-Mail_____

Title: _____

General Description of Firm and Products Produced: _____

_____

NOTE: ALL RESPONSES WILL BE TREATED AS CONFIDENTIAL

1. Did your company have sufficient notice of the scheduled Greenup closure to prepare a response plan? Was your response preplanned or was it designed for this particular closure?

_____

_____

2. During the period of closure of the main lock chamber at the Greenup facility, what was your company's response?

___a. No change in procedures.
___b. Stockpiled product and waited for Greenup traffic to clear.
___c. Switched to all-overland mode for product delivery from existing sources.
___d. Switched to different waterway routing for product delivery from existing sources
___e. Switched product source to an entirely new source.
___f. Ceased operations during the period of closure.
___g. Altered production during the period of closure.
___h. Switched production to another facility.
___i. Purchased intermediate or final product, rather than produced.
___j. Other or combinations of the above. (Please explain.) _____

(2.j. cont'd.)_____

3. If you have checked "c" or "d" in question 2, please complete the following table:

Movement	Commodity	Affected Tonnage	Origin (City, State)	Destination (City, State)	Delivered Cost Per Ton Prior to Closure	Delivered Cost Per Ton During Closure
Examples:						
1	coke	8000	Louisville, KY	Weirton, WV	$95	$105
2	scrap iron	4000	Cincinnati, OH	Weirton, WV	$251	$271

4. If you checked "e" in question 1, please complete the following table:

Movement	Commodity	Affected Tonnage	Original Origin (City, State)	New Origin (City, State)	Destination (City, State)	Delivered Cost Per Ton Prior to Closure	Delivered Cost Per Ton During Closure
Examples:							
1	chemicals	5000	New Orleans, LA	Kenova, WV	Marietta, OH	$110	$115
2	steel	1500	Cincinnati, OH	Pittsburgh, PA	Wellsville, OH	$300	$335

5. If you checked response "a" or "b" under question 2, how were your total production costs affected during the period of closure (total increase in cost, if applicable)? Please explain.

_____

_____

_____

6. If you checked response "f" under question 2, what was the total estimated loss to your firm as a result of ceasing production during the closure period?

_____

_____

_____

7. If you checked response "g" under question 2, what was the total estimated loss to your firm as a result of altering production processes during the closure period?

_____

_____

_____

8. If you checked response "h" under question 2, what was the total increase in costs to your firm as a result of changing production locations during the closure period?

_____

_____

_____

9. If you checked "i" under question 2, to what extent did purchasing intermediate or final product increase your company's total costs during the period of closure?

_____

_____

_____

10. If you checked response "j" under question 2, to what extent did the other measures or combination of measures undertaken as a result of the closure increase your company's total production costs during the period of closure?

_____

_____

_____

11. Has the closure at the Greenup Locks caused your company to alter its long-term transportation strategy (e.g. switch to all-overland modes, increase stockpiles, etc.)? How will this impact your total commodity transportation or other costs (per year). Please explain.

_____

_____

_____

12. Has the closure at the Greenup Locks caused your company to take any other long-term permanent measures? Please explain. How will this affect your company's long-term operating costs (per year)?

_____

_____

_____

13. As you may be aware, the original closure period for the main chamber at Greenup was 3 weeks. This closure period was unexpectedly extended an additional 4 weeks. Did your company alter its plans in anticipation of the original closure? Did your company alter its plans in response to the additional delay? Please explain.

_____

_____

_____

_____

14. Has your company been impacted by other navigation system disruptions? Did they influence your response to the Greenup closure?

_____

_____

_____

15. If your company has experienced significant navigation disruptions (FN1) prior to the Greenup closure, please complete the following table:

Event	Date	Short-Term Response (FN2)	Long-Term Response (FN3)
Example:			
McAlpine closure	2 Sep 99-18-Sep-99	diverted to overland modes	none

FOOTNOTE 1. Significant navigation system disruptions are defined as disruptions that result in delays to your shipment of more than 48 hours (include scheduled and unscheduled lock outages, accidents, and low and high water events).

FOOTNOTE 2. Short term response refers to the response actions detailed in question 2.
___a. No change in procedures.
___b. Stockpiled product and waited for Greenup traffic to clear.
___c. Switched to all-overland mode for product delivery from existing sources.
___d. Switched to different waterway routing for product delivery from existing sources
___e. Switched product source to an entirely new source.
___f. Ceased operations during the period of closure.
___g. Altered production during the period of closure.
___h. Switched production to another facility.
___i. Purchased intermediate or final product, rather than produced.
___j. Other or combinations of the above. (Please explain.)

FOOTNOTE 3. Long term response refers to a modification of your long term business plan to include altering your long-term transportation strategy (e.g. switch to all-overland modes, increase stockpiles, etc.). Other long term responses might include sourcing commodities at alternate sites or moving production activities to a different location.

GREENUP LOCKS CLOSURE CARRIER SURVEY

Date: _____

Firm: _____

Address: _____

_____

Phone: _____ FAX: _____

Point of Contact: _____E-Mail_____

Title: _____

General Description of Firm/Commodities Handled: _____

_____

_____

NOTE: ALL RESPONSES WILL BE TREATED AS CONFIDENTIAL

As you are probably aware, the main lock chamber at Greenup Locks (Ohio River mile 341.0) was closed from 8 September until 31 October 2003. This closure was originally scheduled to last only 3 weeks, but in fact lasted about 7 weeks.

1. Did your company have sufficient notice of the scheduled Greenup closure to prepare a response plan? What, if anything, did your company do in preparation for the **scheduled** portion of the closure? For example, did you concentrate your equipment in the middle Ohio Valley to maximize throughput at the Greenup facility prior to the closure? (Please explain)

_____

_____

_____

_____

2. How did your company operate during the **scheduled** closure of the main chamber at Greenup? Check as many items as are applicable and explain any unusual procedures.

___a. Barges were tied up at fleeting areas; towboats operated elsewhere in the system.
___b. Towboats remained in queue with barges.
___c. Towboats (light) held positions in queue.
___d. Tows were dispatched ready-to-lock at Greenup.
___e. Tows were broken to lock through the auxiliary lock.
___f. Towboats (light) participated in industry self-help.
___g. Towboats tied off barges and participated in industry self-help.
___h. Company avoided the lock when possible.
___i. Other (Please explain). _____

_____

_____

_____

_____

3. How did your company operate during the **additional 4 weeks (unscheduled)** of main chamber outage at Greenup? Check as many items as are applicable and explain any unusual procedures.

___a. Barges were tied up at fleeting areas; towboats operated elsewhere in the system.
___b. Towboats remained in queue with barges.
___c. Towboats (light) held positions in queue.
___d. Tows were dispatched ready-to-lock at Greenup.
___e. Tows were broken to lock through the auxiliary lock.
___f. Towboats (light) participated in industry self-help.
___g. Towboats tied off barges and participated in industry self-help.
___h. Company avoided the lock when possible.
___i. Other (Please explain). _____

_____

_____

_____

_____

4. Did the experience with the outage at Greenup cause your company to adopt any new operating procedures to accommodate lock outages elsewhere in the system? (Please explain.)

_____

_____

_____

_____

5. Prior to the outage at the Greenup facility, towing industry representatives, in cooperation with the Corps of Engineers, developed some operating procedures that were put in place at the time of the closure. Do you believe this effort was effective, ineffective or only partially effective? (Please explain)

_____

_____

_____

_____

6. In what ways did your experiences with prior navigation system disruptions influence your preparations for this Greenup closure?

_____

_____

_____

_____

7. If a reasonable estimate can be made, what additional costs (over and above normal operations) did you incur as a result of the closure event at Greenup?

_____

_____

_____

navigation · economics · technologies

The NETS research program is developing a series of practical tools and techniques that can be used by Corps navigation planners across the country to develop consistent, accurate, useful and comparable information regarding the likely impact of proposed changes to navigation infrastructure or systems.

The centerpiece of these efforts will be a suite of simulation models. This suite will include:

- A model for forecasting **international and domestic traffic flows** and how they may be affected by project improvements.
- A **regional traffic routing model** that will identify the annual quantities of commodities coming from various origin points and the routes used to satisfy forecasted demand at each destination.
- A **microscopic event model** that will generate routes for individual shipments from commodity origin to destination in order to evaluate non-structural and reliability measures.

As these models and other tools are finalized they will be available on the NETS web site:

http://www.corpsnets.us/toolbox.cfm

The NETS bookshelf contains the NETS body of knowledge in the form of final reports, models, and policy guidance. Documents are posted as they become available and can be accessed here:

http://www.corpsnets.us/bookshelf.cfm

NETS

navigation · economics · technologies