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Analysis Documentation
Notice of Proposed Rulemaking
Numbering and Marking Undocumented Barges Greater
than 100 gross tons

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-Analysis Documentation-
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gross tons**

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EXECUTIVE SUMMARY

The Abandoned Barge Act of 1992 (the Act) states “The Secretary shall require an undocumented barge more than 100 gross tons operating on the navigable waters of the United States to be numbered”. This analysis supports the regulatory evaluation of the implementation of a numbering system for undocumented barges of more than 100 gross tons, per the Act. The numbering system would provide a means for identifying the parties responsible and liable for the illegal abandonment of a barge and enhance the Government’s recovery of costs associated with the removal of the barge. Currently, there is no formal process for linking an abandoned undocumented barge to a responsible party, and consequently, there is little chance of the government recovering costs incurred from the removal.

The work herein includes a population survey of affected barges, a cost/benefit analysis of implementing a numbering system, and an assessment of the impact of a numbering system on small business entities. Information was obtained from the U.S. Coast Guard, U.S. Army Corp of Engineers, U.S. Environmental Protection Agency, and the barge industry.

There are approximately 20,000 undocumented barges greater than 100 gross tons plying the nation’s navigable waters. A majority of these barges are dry cargo barges (86%) with the remainder being construction barges (10%) and tank barges (4%). It is estimated that 89% of undocumented barges operate within the Mississippi River System and Gulf Intracoastal Waterway.

The cost and benefit analysis reveals that both the barge industry and the Government would incur the costs of implementing and administrating the system. The cost to industry includes administration costs, transportation costs, and the costs to affix the number to the barge. The cost to government includes the cost to develop and implement a database for the system and cost to administer the system. The potential benefits would accrue to the Government through cost avoidance for removal and cleanup associated with the abandoned barge and from reimbursement of Government incurred costs from the responsible barge owner. No direct benefits were identified for the barge industry. It was assumed that the Coast Guard would have sole responsibility for implementing and administrating the numbering system for abandoned barges.

Two alternative conventional methods of numbering were posited: 1) welding the number to the barge and 2) painting the number on the barge. The assumption under Alternative 1, welding the numbers would necessitate towing 15% of the barges to an appropriate facility, and not towing the remaining 85% of the barges. For Alternative 2, it was assumed that painted numbers would not require towing to a facility and therefore no towing costs would be incurred. An estimated initial cost of \$18,000 would be incurred by the Coast Guard to develop and install a database for managing information from the barge numbering system. The unit costs for the 30-year study period for both alternatives are summarized in Table ES-1.

Table ES-1
Unit Cost Summary

	Alternative 1 Welding¹	Alternative 2 Painting
Government Costs:		
Administration Cost/Barge	\$62	\$62
Industry Cost/Barge:		
Existing Barges -Tow Req.	\$2,977	
Existing Barges – No Tow Req.	\$844	\$153
Future Barges	\$282	\$65
Total Cost/Barge:		
Existing Barges -Tow Req.	\$3,039	
Existing Barges-No Tow Req.	\$906	\$215
Future Barges	\$344	\$127

Three scenarios are used to develop the range of potential benefits: Scenario 1- barges greater than 100 tons are no longer abandoned (best case); Scenario 2- illegally abandoned barges are abandoned with the number intact; and Scenario 3- illegally abandoned barges are abandoned with the number removed or obliterated (worst case). The estimated annual benefits for each scenario are summarized in Table ES-2.

Table ES-2
Annual Benefits

	Scenario 1	Scenario 2	Scenario 3
Removal Cost Recovery	\$250,000	\$90,000	\$0
Clean Up Cost Recovery	\$429,890	\$154,760	\$0
Investigation Savings	\$1,500	\$1,090	\$0
Total Annual Savings	\$681,390	\$245,850	\$0

The net present values (present value of benefits – present value of costs) were calculated over a 30-year period (2001 – 2030) using a discount rate of 7% and were discounted to year 1999. The total present value cost was calculated by multiplying the unit cost by the number of affected barges for each year from 2001 through 2030. The cost/benefit analysis revealed no net benefit with Alternative 1 (welded numbers) for all 3 scenarios. A net benefit was identified for Alternative 2 (painted numbers) for scenario 1. There were no net benefits identified for scenario 2 or scenario 3. Table ES-3 summarizes the net present values for the 30-year period.

¹ Costs include Gas-freeing, chemist certificate.

Table ES-3

Net Present Values – 30 Year Period

Scenario	Alternative 1 – Welding			Alternative 2 – Painting		
	PV Benefit	PV Cost	Net PV	PV Benefit	PV Cost	Net PV
1	\$6,787,290	\$21,169,984	(\$14,382,694)	\$6,787,290	\$5,625,686	\$1,161,604
2	\$2,448,903	\$21,169,984	(\$18,721,081)	\$2,448,903	\$5,625,686	(\$3,176,783)
3	\$0	\$21,169,984	(\$21,169,984)	\$0	\$5,625,686	(\$5,625,686)

The costs associated with welding the number to the barge were found to be significantly higher than the cost of painting. However, welding the numbers to the barges is the recommended alternative considering that it will better prevent removal of the identification number on illegally abandoned barges. Therefore, it will help identify parties responsible for the illegal abandonment of barges and prevent future marine pollution from abandoned barges.

1.0 INTRODUCTION

This analysis supports the regulatory evaluation of implementing a numbering system for undocumented barges of more than 100 gross tons per the Abandoned Barge Act of 1992 (the Act). The intent of establishing a numbering system for undocumented barges is to provide a process for identifying the parties responsible for the illegal abandonment of a barge. Once identified, the responsible party would be held liable to the government for costs associated with the removal of the barge. Currently, there is no formal process for linking an abandoned undocumented barge to a responsible party, and consequently, there is little chance of the government recovering costs incurred from the removal.

A significant secondary benefit of numbering the abandoned barges is to identify the parties liable for removal and proper disposal of any hazardous substances stored or deposited on board. The Act itself does not specifically address this issue. However, if the materials in question constituted oil or hazardous substances and the owner refused to undertake their removal, the Government could carry out the work and recover the cost of mitigating or preventing a threatened or actual discharge to navigable waters from the owner, as a responsible party under the Oil Pollution Act. (Although if the barge were an inland oil barge, the amount of damages would be limited.) Similarly, if the materials constituted hazardous substances within the meaning of the Clean Water Act, CERCLA would impose liability for all costs of removal or remedial actions and also for any resulting damage to natural resources on the owner of the barge. To avoid liability, it would be necessary for the owner of the barge to prove not only that the materials were deposited by a third-party but also that there was no willful negligence on the owner's part which contributed to the problem. For purposes of this report, it is assumed that the barge owner will be liable for all the costs associated with removal and clean-up of all hazardous waste deposited on the barge.

2.0 LEGISLATIVE AND RULEMAKING BACKGROUND

The Abandoned Barge Act of 1992, 46 United States Code (USC) 4701, amended Title 46 USC, Section 12301, by adding paragraph (b) which states that “ The Secretary shall require an undocumented barge more than 100 gross tons operating on the navigable waters of the United States to be numbered.” Other provisions of the act establish civil penalties for abandonment of barges, provide for steps to be taken by the government to remove abandoned barges, and establish the liability of owners of abandoned barges for the costs of removal.

2.1 LEGISLATIVE HEARING

In preparation for this legislation, a hearing was held before the Subcommittee on Coast Guard and Navigation, of the House Committee on Merchant Marine and Fisheries on 10 June 1992 concerning “Draft Legislation to Prohibit Abandonment of Barges, and for other purposes” (Serial No. 102-83). During this hearing, statements were made by the following persons:

John Anderson, Assoc. Director for Transportation Issues, GAO
CDR William Chubb, USCG
CAPT Robert C. North, USCG
William Justice, Senior Evaluator, GAO
Hon. Howard Coble (NC)
Hon. Jack Fields (TX)
Hon. Greg Laughlin (TX)
Hon. Owen Pickett (VA)
Hon. Billy Tauzin (LA)
Cornell Martin, American Waterways Operators

The testimony of Mr. John Anderson, Associate Director for Transportation Issues, United States General Accounting Office (GAO) served as the introduction for the hearing as well as the basis of most discussion of the proposed legislation. The GAO had prepared a report on the pollution, vessel removal, and cost impacts of abandoned vessels².

The primary findings in the hearing report were:

1. Based upon a search conducted by the Coast Guard, nearly 1,300 vessels were abandoned in our nations waterways. This figure was the result of a survey sent out by GAO to 45 USCG Marine Safety Offices and Captain of the Port units, which requested they respond with the number of abandoned vessels within their respective zones.
2. From 1988 to 1992, 82 water pollution incidents occurred which originated from abandoned vessels, 37 of these incidents required cleanup operations. Over that same

² “COAST GUARD, Abandoned Vessels are Polluting the Waterways”, GAO/T-RCED-92-54, Jun 10, 1992

period of time the Coast Guard conducted oil recovery operations from 14 additional vessels that were not leaking in order to remove the potential for a future discharge/release of oil/hazardous materials. The combined costs for the operations in response to actual and potential spills was 4.4 million dollars, with 2.5 million dollars being spent for two separate removal operations from the same vessel, an abandoned barge located in Empire, LA.³ The total number of reported water pollution incidents over that same period (from all sources) was 54,386.⁴

3. There are no Federal laws to prohibit owners from abandoning vessels.⁵

4. It is often difficult to find the owner of an abandoned vessel. In many cases where ownership was determined, the owners were incapable of removing the abandoned vessel for a variety of reasons (e.g., deceased, bankrupt, etc.).

5. Barges that use inland waterways are exempt from vessel documentation.⁶

Ownership and disposition of vessels are subject to mandatory Coast Guard and Army Corps reporting. As part of the required annual report to the Army, vessel owners are required to strike through those vessels no longer operated and indicate the disposition of the vessel.

³ GAO Testimony "COAST GUARD, Abandoned Vessels are Polluting the Waterways, GAO/T-RCED-92-54, Jun 10, 1992

⁴ MSMS data query, 24 Jun 1998

⁵ As is the case with many terms used in a legal context, "Abandonment" has different meanings depending upon the definition of the law in which it appears. For the purposes of Admiralty and waterway protection statutes, abandonment is a traditional right by which an owner relinquishes all interest and property rights to a vessel. Historically abandonment has been, and in the case of all other vessels other than barges addressed by this act, a legal and legitimate means of disposal under U.S. Law. Until 1992, no laws specifically prohibited vessel abandonment, yet laws existed (and remain) which prohibit the obstruction of navigable waters by vessels and the wrongful deposit of refuse into navigable waters (33 USC 407, 408, and 409). All of these statutes are under the jurisdiction of the Army Corps of Engineers and are criminal in nature. Although it was limited to barges only, passage of the Abandoned Barge Act of 1992, also created the first civil prohibition to vessel abandonment.

⁶ With a few minor exceptions (i.e., lifeboats, tenders, etc.) all vessels of United States (ships, ferries, pleasure vessels, etc) are either "documented" under 46 CFR Part 67, or "numbered" under the regulations contained in 33 CFR Part 173. The only major exception exists in the case of "A non-self-propelled vessel, qualified to engage in the coastwise trade is exempt from documentation when used in that trade: Within a harbor, in whole or in part on the rivers or inland lakes of the United States, or in whole or in part on the internal waters or canals of any state." The exemption for non-self-propelled vessels extends back to as early as 1793 as a result of the limited utility and relatively short service life of such vessels. It is important to note that these historical exclusions predate the towing industry of today.

3.0 METHODOLOGY

3.1 OBJECTIVE

The objective of this analysis is to provide data and information to the Coast Guard in order to support a regulatory evaluation of a potential rulemaking implementing a numbering system for undocumented barges more than 100 gross tons.

3.2 DATA SOURCES

In order to support the regulatory evaluation, the acquired data represent the number and type of vessels affected by the regulation, the impacted agencies and industries, and the costs and benefits to society of implementing the regulation. Data was obtained from a number of sources including the U.S. Coast Guard, U.S. Army Corps of Engineers (USACE), National Response Center (NRC), and the barge and towing industry. Telephone interviews were also conducted with various government agencies and industry representatives.

3.2.1 Coast Guard

3.2.1.1 Abandoned Vessel Statistics

As outlined in Commandant instruction 16465.43 of 5 April 1996, Coast Guard units are required to identify abandoned vessels during the course of ongoing operations. Annually the Captains of the Ports (COTP) submit a summary report of abandoned vessels within their geographic areas of responsibility, from which a national summary is prepared. The 1997 summary report documents that 2,697 abandoned vessels exist along the navigable waterways of the United States. Of this total, 1,010 are barges. Analysis of the summary and discussions with Coast Guard COTP personnel reveals differences in the manner in which the surveys were performed from port to port. Some classify vessels by their use and others classify by vessel design. For example, a de-engined ship used as a barge to carry containers between ports could be counted as either a ship or a barge depending upon where the survey was conducted. In one case, a deck barge with a house trailer mounted on board was considered to be a recreational vessel.

Out of the 1,010 barges contained on the summary report, 15 of these barges are listed as posing a pollution threat. It is not clear if the determination of what constitutes a pollution threat is driven by the framework of the National Contingency Plan as contained in 40 CFR 300 (such as the presence of oil or hazardous substance on board) or the criterion under which some of the local summaries appear to have been prepared (the capacity as a receptacle for possible future dumping).

Again, the criterion for determining a pollution threat was left to local interpretation. For example, at one location abandoned vessels were deemed to be anything that is visible and that could be identified as being a vessel or part thereof, regardless of condition. This definition includes the skeletal remains of 19th century steam ships and wooden barges whose frames are visible at low water but clearly pose no threat for use as

depositories for oil and hazardous substances. In another port, anything that has an intact section of hull or portable tank on board that is capable of holding 1,000 gallons of oil or hazardous substance was counted as a pollution threat, regardless of the presence of oil or hazardous substances.

For the above reasons, the data in the Abandoned Vessel Summary are considered to be suspect and unreliable, and are not used herein.

3.2.1.2 National Pollution Funds Center

The U.S. Coast Guard's National Pollution Funds Center (NPFC) has fiduciary responsibility for the Oil Spill Liability Trust Fund (OSLTF) and the portion of Superfund used by the Coast Guard. The NPFC was queried in order to obtain actual spill frequency and cost data for spills from abandoned barges that resulted in federal cleanup costs. Data was also requested on the number of cases where Federal funds were expended in mitigation of spills originating from abandoned vessels, abandoned barges⁷, and the success rates of the NPFC in recovering costs expended for pollution response operations, from responsible parties.

3.2.1.3 Marine Safety Management System

The U.S. Coast Guard Marine Safety Management System was consulted in order to establish the size of the actively documented barge fleet of over 100 gross tons.

3.2.2 U.S. Army Corps of Engineers

Pursuant to the Rivers and Harbors Appropriations Act of 1922, the U.S. Army Corps of Engineers (USACE) collects statistical data concerning all vessels which ply the navigable waters of the United States in the pursuit of commerce. The requirements for submitting navigation statistics are in Title 33 CFR 207.800. These regulations, generally, require the owner of a vessel to submit navigation statistics to the Army for "all movements of domestic waterborne commercial vessels... including but not limited to dry cargo and tanker moves, loaded and empty barge moves, towboat moves, with or without barges in tow, fishing vessels, movements of crew boats and supply boats to offshore locations, tugboat moves, and movements of newly constructed vessels from the shipyard to the point of delivery." Owners must also report vessels which remained idle during the reporting period⁸. USACE does not collect data on recreational vessels and vessels used exclusively for construction.

USACE publishes this data as "Waterborne Transportation Lines of the United States", and is available from the Waterborne Commerce Statistics Center, in New Orleans, LA.

⁷ The National Pollution Funds Center does not track or maintain data regarding "abandoned vessels" or "abandoned barges". NPFC does however recognize if a responsible party for a pollution incident is known or unknown.

⁸ 33 CFR 207.800 (b) (2) (i) (B)

Data available includes physical description (type and dimensions), draft, service, cargo, ownership, area of operation, age, USCG number (Official Number or USCG assigned number), average age, and rates of new construction. 1995 and 1996 (latest year available) data are the basis of the analysis within this report.

3.2.3 National Response Center

The Emergency Response Notification System (ERNS) database contains data on initial reports to the National Response Center for spill reports within the Environmental Protection Agencies area of responsibility (inland Zone ⁹). ERNS was queried for spill reports which originated from barges, where the discharger was unknown. Data from ERNS and NPFC were the basis for estimating the number and cost of hazardous substance releases originating from abandoned barges.

3.2.4 Barge Industry

3.2.4.1. Barge Fleet Profile of Inland River Barges for the Mississippi River System and Connecting Waterways¹⁰

This publication contains statistical data on the Mississippi River line haul fleet, which makes up the majority of the undocumented barge fleet. These data are used for the purpose of comparison to USACE data regarding fleet size and barge operating locations.

3.2.4.2 Industry Interviews

Telephone interviews were held with a variety of barge and towing companies, as well as, the American Waterways Operators and the National Shipyard Association. The interviews were conducted in order to identify the impacts to industry from the implementation of a numbering system.

3.3 COST-BENEFIT ANALYSIS

The costs of implementing a numbering system were identified and quantified through discussions with the Coast Guard, USACE, US Environmental Protection Agency (EPA) and industry representatives. The benefits were identified through discussions with the Coast Guard, EPA and industry and quantified using databases from the Coast Guard, USACE, and the National Response Center. A more detailed discussion of the methodology used for the cost-benefit analysis is presented in section 5.

3.4 SMALL BUSINESS IMPACT

Data from the USACE's Waterborne Commerce Statistics Center, the "1998 Directorate of Corporate Affiliations"¹¹, "Standard and Poor's Register of Corporations, Directors,

⁹ Per 40 CFR 300, National Contingency Plan.

¹⁰ Lambert, Jack, Barge Fleet Profile of Inland River Barges for the Mississippi River System and Connecting Waterways, March 1998, Eleventh Annual Edition, Sparks Companies

and Executives”¹², and the Internet were used to identify the affected small business entities. This report qualified companies as small businesses according to the small business size standard SIC (Standard Industrial Code) and NAICS (North American Industry Classification System) Codes, when their number of employees or their revenues do not exceed the specified standard definition in the analyzed SIC and NAICS codes. The number and type of affected small entities, compliance requirements, are identified and discussed in the analysis.

¹¹ “1998 Directory of Corporate Affiliations”, Volumes 3 and 4, National Register Publishing, New Providence, NJ, 1998

¹² “Standard and Poor’s Register of Corporations, Directors, and Executives”, The McGraw-Hill Companies, New York, NY, 1998

4.0 AFFECTED BARGES

Information obtained from the population review includes: number of barges, service types/industries in which undocumented barges operate, maintenance intervals, construction rates, operating locations, and number of undocumented barges owned and operated by small entities (small entity information is presented in section 6.0). The resulting fleet description was found by comparison and analysis of Army Corps of Engineers, Coast Guard, and industry data sets.

4.1 DEFINITIONS

4.1.1 Barges

For the purposes of this study, barges were defined per the International Classification of Ships by Type (ICST) and the Vessel Type, Construction, and Characteristic (VTCC) codes used by the USACE. Both schemes classify vessels by construction characteristics of the marine structure without regard to particular vessel use or the type of cargo carried. Any vessel or barge reported as self-propelled is not included in the affected fleet. Barges listing propulsion horsepower were likewise excluded. Table 4.1 presents the types of vessels and their corresponding ICST and VTCC codes that were considered barges for this report.

Table 4.1
Barge Type and Codes

ICST Code	VTCC code	Description
141	70	Single Hull Tank Barge
142	71	Double Hull Tank Barge
143	72	Double Sided Tank Barge
144	73	Double Bottom Tank Barge
149	74	Other Tank Barge
341	40	Open Hopper Barge
341	47	Open Dry Cargo Barge
342	41	Covered Hopper Barge
342	48	Covered Dry Cargo Barge
343	43	Deck Barge
344	52	Lash/Seabee Barge
349	42	Carfloat
349	44	Pontoon Barge
349	49	RO-RO Barge
349	50	Lash/Seabee
349	90	Convertible Barge
349	99	Other

4.1.2 Other Barges

Construction Barge

Construction barges are used exclusively for construction and are exempt from Army Corps reporting requirements. Therefore these barges are not included in the USACE database, however since these barges will not be exempt from the requirement to register as undocumented barges, an estimated fleet population was included as part of this study. These barges are generally deck barges and spud barges that carry or position construction material (piling, stone, etc.) or equipment (cranes, dredge pipe, etc.).

Spar Barge

Refers to a barge that has passed its useful economic life as a means of marine transport and is used as a mooring platform for other vessels to tie up to. Due to the accountability problems that are inherent with this category of use, and the fact that barges in this category should fall under the jurisdiction of the Army Corps of Engineers' wetlands protection jurisdiction, these barges were considered outside of the definition of operating and were excluded from this study.

4.1.3 Miscellaneous Definitions

Documented/Undocumented Vessel

The definition and requirements of a documented vessel are given in 46 CFR 67. A documented vessel is a vessel that is the subject of a valid Certificate of Documentation. A Certificate of Documentation is required for the operation of a vessel in certain trades, serves as evidence of vessel nationality, and permits a vessel to be subject to preferred mortgages.

All vessels greater than 5 net tons which engage in the fisheries on the navigable waters of the United States or in the Exclusive Economic Zone, Great Lakes trade, or coastwise trade must have a Certificate of Documentation. However, the relevant exception to the requirement is any non-self-propelled vessel (i.e., barge) that is qualified to engage in the coastwise trade and is engaged:

Within a harbor;

On the rivers and lakes (except the Great Lakes) of the United States; or

On the internal waters or canals of any State.

A barge that is exempt from the requirement to be documented may be documented at the discretion of the owner. If a vessel does not have a Certificate of Documentation it is considered an undocumented vessel.

Numbered/Unnumbered Vessel

A numbered vessel is a vessel that is assigned an identification number from either the Coast Guard or a state agency. Documented vessels, undocumented vessels equipped with propulsion equipment, and undocumented barges greater than 100 gross tons (per Abandoned Barge Act of 1992) are required to be numbered. The Coast Guard issues number to documented vessels, which remains with the vessel for its entire service life, and state agencies issue numbers to undocumented vessel equipped with propulsion equipment. The numbering system to be implemented for undocumented barges has not been determined at the time of this report.

Inspected/Uninspected Barge

Barges that carry certain cargo or are engaged in oceangoing service (with the exception of Puget Sound) are required to be inspected by the Coast Guard. Barges are required to be inspected when carrying:

Flammable and combustible liquids in bulk

Passengers

Dangerous cargo defined by 46 CFR 98 and 49 CFR 171 – 179

Inspected barges receive a certificate of inspection, however they are not issued an official vessel identification number. The Coast Guard issues a certificate number that is used as an internal administration number for record keeping. Inspected barges do not have the certificate number marked on the vessel and the number does not remain with the barge for the life of the barge. Barges not requiring inspection are considered uninspected barges.

Gross Tonnage

The definition of gross tonnage is given in 46 CFR 69.9. The gross tonnage is the approximate volume of a vessel. There are three methods of calculating the gross tonnage:

Convention Measurement System: the total volume of all enclosed spaces modified by a coefficient.

Standard and Dual Measurement Systems: the total volume of all enclosed spaces less certain exempt spaces

Simplified Measurement System: the product of the vessel's length, depth, and breadth modified by a coefficient.

4.2 BARGE FLEET

The number of undocumented barges more than 100 gross tons was estimated based on data obtained from USACE's Waterborne Commerce Statistics Center and Coast Guard's Marine Safety Management System (MSMS). The USACE data was used to estimate the

total number of barges more than 100 gross tons. The MSMS database was used to identify the number of barges more than 100 gross tons that are currently documented. The difference in the number of barges between the USACE data and the MSMS data was used as the basis for the number of undocumented barges affected by the numbering requirement.

4.2.1. Data Issues and Methodology

The USACE data was queried for vessels with VTCC codes corresponding to barges (see section 4.1 for list of VTCC codes used) and with net tonnage greater than 100 tons. The USACE database did not include a field for gross tonnage therefore the net tonnage was used as an estimate of gross tonnage.¹³ This query resulted in 32,257 barges more than 100 gross tons.

The Coast Guard provided data from MSMS of all currently documented barges more than 100 gross tons. The total number of documented barges, per MSMS, was 15,676. In order to identify the number of undocumented barges, the vessel identification numbers were compared between the Coast Guard data of documented barges and the USACE data. The results of the comparison revealed 13,763 documented barges in both databases, 1,913 barges exclusively on the Coast Guard documented database (i.e., documented barges that should be in the USACE database but are not), and 18,494 barges exclusively on the USACE database. These 18,494 barges are considered existing undocumented barges more than 100 gross tons. To reach the final estimated number of undocumented barges, the 18,494 barges were reduced by 537 to account for the number of lash/seebee barges that were included as undocumented. Lash/seebee barges operate overseas and therefore are required to be documented. The 537 undocumented barges are most likely barges that have lapse documentation due to being out of operation. When these barges are brought back into operation they will be required to be documented. As stated in section 4.1, construction barges are not exempt from the numbering requirement and were not included in the USACE data. Discussions with various industry representatives, including the American Waterways Operators, resulted in an estimated 2,000 construction barges. Therefore, the estimated total number of undocumented barges more than 100 gross tones is 19,957.

4.2.2 Database Discrepancies

Several discrepancies were observed between the USACE and the MSMS databases: 1) there were 1,913 documented barges found in the MSMS database that were not included in the USACE database, 2) Coast Guard document numbers listed for many barges in the USACE database were not valid numbers, and 3) the USACE database may underestimate the total barge fleet. Details are found in the following paragraphs:

¹³ The USACE database determines net tonnage as the difference between gross tonnage and the volume used for accommodation of the vessel master, officers, crew, navigation and propelling equipment expressed in units of 100 cubic feet per ton. Since the affected barges will have minimum space dedicated to these purposes it was assumed the net tonnage would be similar to the gross tonnage.

Comparison of the USACE data with data from MSMS revealed 1,913 documented vessels were not included in the USACE database. There could be a number of reasons for the discrepancy, such as the documented barge being under construction, taken out of operation, or failure of the owner to report the barge to the USACE. This report considered the 1,913 documented barges as additional existing barges and added them to the USACE database total.

As a result of the database comparison, it became apparent that the documentation numbers listed for many of the barges in the USACE database were no longer active (approximately 14,000). One reason for the inactive numbers may be attributed to expired documentation numbers being reported to USACE. In many instances, barges are originally documented in order to obtain financing for construction. As documentation is not required for a large number of barges, owners will sometimes allow the documentation to lapse. As a result, the barge owner may have been issued a document number in the past, let the registration expire, and continued to report the number to USACE.

Although required to do so, owners do not uniformly report available, non-operating vessels to USACE. During the course of this study, carriers that were listed as having fleets of 100 or more barges were contacted. When questioned as to the actual size of the entire available fleet of hulls owned, many companies responded with a number that was 50% to 100% higher than what was reflected in the USACE database. In the interests of uniformity of data and to avoid the possibility of double counting, the higher estimates are not used as part of our analysis. Therefore, the total number of undocumented vessels used in this report should be considered a conservative estimate, since un-reported barges may come back into service.

4.2.3 Tree Top Fleet Description

Table 4.2 summarizes the affected barge fleet.

Table 4.2
Affected Barges

Description	Number of Barges
Barges more than 100 gross tons (USACE data)	32,257
Documented barges not in USACE database (MSMS)	1,913
Construction barges (estimated)	2,000
Total Estimated Barges More than 100 Gross Tons	36,170
Adjustment for Lash/Seebee barges	(537)
Documented barges more than 100 gross tons (MSMS)	(15,676)
Total Undocumented Barges More than 100 Gross Tons	19,957

4.3 BARGE FLEET BY SERVICE TYPE

The “Waterborne Transportation Lines of the United States” was used to obtain the service types of both the total barge fleet and the undocumented barge fleet. As stated in section 4.2.1.1, a number of documented barges (1,913) provided by MSMS were not included in the USACE database. The MSMS database did not provide a breakdown of the service type for the 1,913 documented barges and therefore these barges were not included in the service type breakdown. Table 4.3 presents the number of barges for each service type.

Table 4.3
Barge Population by Service Type

ICST	VTCC	Description	Total Barges	Un-Doc. Barges
141	70	Single Hull Tank Barge	757	178
142	71	Double Hull Tank Barge	2,378	493
143	72	Double Sided Tank Barge	148	34
144	73	Double Bottom Tank Barge	35	3
149	74	Other Tank Barge	588	1 52
341	40	Open Hopper Barge	8,415	5,717
341	47	Open Dry Cargo Barge	1,116	730
342	41	Covered Hopper Barge	9,387	5,429
342	48	Covered Dry Cargo Barge	3,120	1,808
343	43	Deck Barge	4,384	3,332
344	52	Lash/Seebee Barge	1,780	0
349	42	Other - Railroad Car Barge	29	19
349	44	Other - Pontoon Barge	2	2
349	49	Other – RO-RO Barge	20	2
349	50	Other - Container Barge	33	4
349	90	Other - Convertible Barge	26	22
349	99	Other	39	32
		Construction	2,000	2,000
<hr/>				
		Total	34,257	19,957

Table 4.4 presents the number of undocumented barges grouped by major service type: tank, dry cargo, and construction. Tank barges typically carry liquid cargo such as petroleum, petroleum products, and liquid chemicals. Dry cargo barges typically carry grain, coal, sand, steel and other solid bulk commodities. Construction barges are generally deck barges and spud barges that carry or position construction material (piling, stone, etc.) or equipment (cranes, dredge pipe. etc.).

Table 4.4
Undocumented Barges by Major Service Type

Barge Type	Number of Undoc. Barges	Percentage of Total Undoc. Barges
Tank	860	4%
Dry Cargo	17,097	86%
Construction	2,000	10%
Total	19,957	100%

4.4 FLEET BY AGE

The average age of barges by service type are presented in Table 4.5. Unless noted parenthetically, all barges listed below are of steel construction.

Table 4.5
Average Barge Age by Service Type

ICST	VTCC	Service Type	Fleet Size	Avg. Age	Oldest	Newest
141	70	Single Hull Tank Barge	178	20	1926	1996
142	71	Double Hull Tank Barge	493	21	1945	1997
143	72	Double Sided Tank Barge	34	14	1949	1995
144	73	Double Bottom Tank Barge	3	21	1950	1996
149	74	Other Tank Barge	152	28	1933	1997
341	40	Open Hopper Barge	5,709	17	1911	1997
341	40	“(wood)”	1	19		1979
341	40	“(unknown)”	7	35	1945	1982
341	47	Open Dry Cargo Barge	730	25	1922	1997
342	41	Covered Hopper Barge	5,363	18	1930	1997
342	41	“(fiberglass)”	63	19	1977	1980
342	41	“(unknown)”	3	20	1978	1978
342	48	Covered Dry Cargo Barge	1,805	18	1937	1997
342	48	“(fiberglass)”	3	18	1978	1981
343	43	Deck Barge	3,326	26	1906	1997
343	43	“(wood)”	5	68	1913	1943
343	43	“(unknown)”	1	55		1943
349	42	Other - Railroad car Barge	19	37	1940	1996
349	44	Other - Pontoon Barge	2	32	1965	1967
349	49	Other - Ro-Ro Barge	2	19	1970	1994
349	50	Other - Container Barge	4	19	1945	1995
349	90	Other - Convertible Barge	22	29	1926	1991
349	99	Other	32	30	1928	1984
		Construction	2,000		Unknow	Unknown
Total			19,957			

4.6 OPERATING LOCATIONS

The “Waterborne Transportation Lines of the United States” provides the number of barges (excluding construction barges) operating on the Atlantic, Gulf and Pacific Coasts, the Mississippi River System and the Gulf Intracoastal Waterway, and the Great Lakes System. Barges operating in the Great Lakes are required to be documented and therefore no undocumented barges operate in that area. In order to estimate the number of undocumented barges operating in each area, the percentage of total barges operating in each area was applied to the number of undocumented barges. The number of all barges and undocumented barges greater than 100 gross tons, by operating locations, are presented in Table 4.8 and Table 4.9, respectively. Data is not available regarding the operational locations of construction barges.

Table 4.8
All Barges by Operating Location

Barge Type	Atlantic, Gulf and Pacific Coasts		Mississippi River System and Gulf Intracoastal Waterway		Subtotal	Great Lakes System	Total
	Number	% ¹⁶	Number	%			
Tank	640	16	3,354	84	3,994	42	4,036
Dry Cargo	3,216	11	25,308	89	28,524	251	28,775
Total	3,856	12	28,662	88	32,518	293	32,811

Source: Waterborne Transportation Lines of the United States

Table 4.9
Undocumented Barges Greater Than 100 Gross Tons by Operating Location

Barge Type	Number of Undoc. Barges	Atlantic, Gulf and Pacific Coasts		Mississippi River System and Gulf Intracoastal Waterway	
		% ¹⁴	Number of Undoc. Barges	%	Number of Undoc. Barges
Tank	860	16	138	84	722
Dry Cargo	17,097	11	1,881	89	15,216
Total	17,957	11	2,019	89	15,938

¹⁴ percentages were calculated as the number of barges, by type (tank or dry cargo), divided by the total number of barges operating outside the Great Lakes System. For example, 16% of tank barges in Atlantic area was calculated as 640/3,994.

4.7 MAINTENANCE INTERVALS

Maintenance intervals vary widely across the barge fleet. The most frequent intervals coincide with the two-year Coast Guard inspection requirements for certain barges. Barges that require inspection include¹⁵: barges carrying flammable and combustible liquids in bulk, barges carrying passengers, barges carrying dangerous cargoes when required under 46 CFR 98, and 49 CFR 171-179, and barges in oceangoing service (with the exception of Puget Sound). The number of inspected/undocumented barges (577) makes up a small fraction of the total undocumented barge fleet.

No standard maintenance schedule exists for uninspected barges. Maintenance periods are very closely tied to the service and operating areas in which the barges trade. For example, dry cargo barges operating primarily in fresh water such as the western rivers (which make up the majority of the affected barge population) do not experience significant hull deterioration due to rust and therefore rarely if ever undergo preventative maintenance periods in a shipyard. In the case of this type of vessel, the barge is inspected when it is passed from tow to tow and damage is reported. When convenient (or in the case of serious damage, necessary), repairs are made. In the case of leased barges, repairs may not be conducted until the end of the lease period. It is not uncommon for barges to be under lease for several years. While dry cargo barges operating in fresh water do receive necessary repairs, they can also go through their entire service lives without ever undergoing periodic maintenance.

¹⁵ 46 CFR Subchapter "D" and "O"

5.0 COST/BENEFIT ANALYSIS

The annual costs and benefits of implementing the numbering system were estimated over a thirty-year duration. To calculate the present value of future costs and benefits, the annual cost and benefit streams were discounted using a rate of 7%, as specified in OMB Circular No. A-94 dated October 29, 1992.

The costs of implementing and administrating the numbering system will accrue to the barge industry and the government. The cost to industry includes added administrative costs, transportation costs, and the cost to affix the vessel identification number to the barge. The cost to the government includes costs for developing and installing a database for the numbering system and costs for administering the system. The potential benefits of implementing the numbering system will accrue to the Government through cost avoidance for removal and cleanup associated with the abandoned barge and from reimbursement of government incurred costs from the responsible party. Implementation of the numbering system would result in no direct benefits to industry.

5.1 AFFECTED AGENCIES

Two Federal agencies are affected by this rulemaking: the Coast Guard and the EPA. The Coast Guard has jurisdiction over vessel removal, while the Coast Guard and EPA have jurisdiction over cleanup of hazardous substance releases into the nation's waters.

5.1.1 Abandoned Barge Removal

The Coast Guard and USACE are the two governmental agencies responsible for responding to abandoned vessels. USACE is responsible for the removal of all vessels, including abandoned barges, that are obstructions to navigation. The Coast Guard is responsible for the removal of abandoned vessels that have released, or have the potential to release, hazardous substances into the environment.

USACE was contacted in order to obtain information regarding the impact of abandoned barges on USACE operations. The USACE reported that very seldom is a barge abandoned in a navigable waterway and therefore, USACE does not incur costs in removing them. Abandoned barges are almost always found along the banks of the waterway, away from the navigational channels. The barges that are obstructions to navigation are operational barges (not abandoned) and the responsible parties of the barges take responsibility for removing the barge. Therefore, USACE will not experience a benefit or cost from the barge numbering regulation, and for the purpose of this report, is not considered an impacted agency.

5.1.2 Cleanup of Hazardous Substance Releases

The Coast Guard and EPA are the responsible Federal agencies for overseeing the cleanup of hazardous substance released into the nation's water. The National

Contingency Plan gives jurisdiction over coastal areas to the Coast Guard and inland areas to EPA. The boundaries between coastal and inland waters are defined by regional agreement between the Coast Guard and EPA. Any affects this rulemaking will have on the quantity of hazardous substances being released from abandoned barges will impact both agencies; benefit calculations do not differentiate between the two agencies.

5.2 ASSUMPTIONS FOR COSTING OF NUMBERING SYSTEM

At the time of this analysis, a system for numbering undocumented barges more than 100 gross tons has not been established. In order to develop the costs of implementing a numbering system, it was necessary to make several assumptions regarding the type of numbering system that would be implemented by the Coast Guard. These assumptions are based on comments received from the Coast Guard request for comments (Federal Register, FR 52646), the hearing held before the Subcommittee on Coast Guard and Navigation, of the House Committee on Merchant Marine and Fisheries on 10 June 1992 concerning "Draft Legislation to Prohibit Abandonment of Barges, and for other purposes" (Serial No. 102-83), and from discussions with Coast Guard Headquarters and field units; they are:

There will be one national numbering system, administered by the Coast Guard, for undocumented barges over 100 gross tons.

The determination of a barge's tonnage relative to the numbering provisions of the Abandoned Barge Act would be based on the Simplified Measurement System¹⁶($gt=0.84 \times \text{length} \times \text{depth} \times \text{breadth}/100$). If the owner doesn't use the Simplified Measurement System, the gross tonnage is the tonnage assigned under any other applicable measurement system of 46 CFR part 69, as indicated on an appropriate tonnage certifying document. Under simplified measurement, no tonnage certifying document is issued. The number issued to a hull will remain for the life of the barge. The accompanying certificate of number will be valid until the barge changes ownership, or is taken out of service, at which time it will be the owner's responsibility to surrender the certificate of number to the Coast Guard.

Existing undocumented barges more than 100 gross tons will have five years from the effective date of the Final Rule to comply with its requirements.

The responsibility of numbering the affected barges will rest with the owners of the barges.

5.3 ALTERNATIVES

Two alternatives for numbering the affected barges were identified, based on discussions with the Coast Guard and comments received from the Coast Guard request for comments (Federal Register, FR 52646). The first alternative is to affix the number to the barge by welding the number to the hull. The second alternative is to paint or decal the number to the hull.

¹⁶ 46 CFR part 69/ Subpart E

5.3.1 Alternative 1 – Welded Number

The vessel identification number is to be affixed welded in three locations, once internally on the main beam and twice externally at the highest part of the vessel's hull or permanent structure so that the number can be seen from either side by qualified welders with the barge in a gas free state.

5.3.2 Alternative 2 – Paint or Decal Number

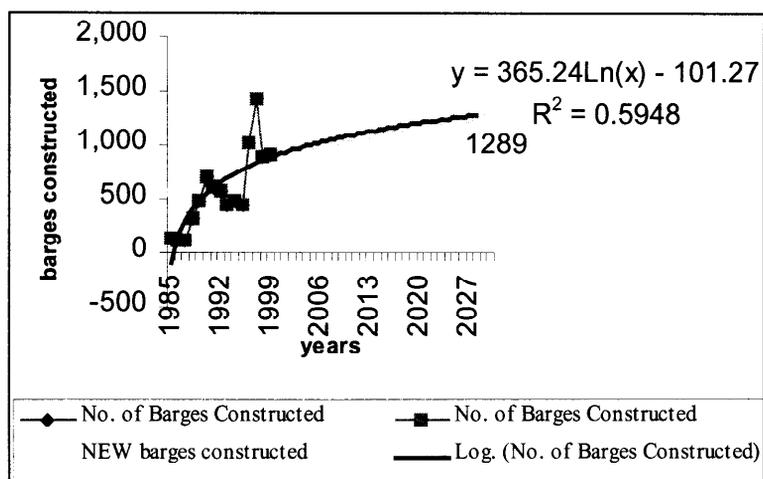
The vessel identification number is to be affixed in a manner similar to that required of state numbered vessels. The number is to be durably marked by paint or decal on the hull of the barge and will be repainted every 10 years. The numbering will be completed at the barges current location (i.e., the barge will not have to be towed to a ship repair facility).

Welding numbers into a hull offers a more durable marking than painting and will resist obliteration due to normal wear and tear. Nonetheless, it is important to point out that neither method will place a number onto the hull in such a manner that it can not be deliberately removed by one who is intent on illegally abandoning a barge, and concealing its ownership. Painted numbering is the least costly and time consuming option available, yet painted numbers can be easily painted over, defaced, or removed.

5.4 AFFECTED FLEET

As discussed in section 4.2, the estimated number of existing undocumented barges affected by the legislation is approximately 20,000. In order to estimate the number of affected barges in future years (i.e., barges to be constructed in the future that will require numbering), we used a regression analysis. We based our analysis on the Coast Guard's MSIS data series concerning the number of barges over 100 gross tones constructed in the period of time from 1985 up to 1999. We forecasted the number of new constructed undocumented barges over 100 gross tones to be constructed for the regulatory evaluation period of time, respectively from 2001 up to 2030, as shown in the graphic and Table 5.1 down the page. We assumed that the number of new constructed undocumented barges over 100 gross tones represents 55% of the total number of forecasted barges which includes documented and undocumeted barges more than 100 gross tones.

Graphic: Forecasted number of new constructed barges over 100 gross tones



The equation used for calculating the trendline is the following:

$$Y = 365.24 * \text{LN}(X) - 101.27, \text{ where:}$$

-X represents the independent variable, in our case is the period of time for which we forecast the number of new barges over 100 gross tones to be constructed each year from 2001 up to 2030.

-Y represents the dependent variable, in our case is the forecasted number of new barges over 100 gross tones to be constructed each year from 2001 up to 2030.

Table 5.1.a.
Number of new constructed barges over 100 gross tones, from 1985 up to 1999.

Year	No. of Barges Constructed (Docum. & Undoc.)	No. of Undocumented Barges
1985	132	73
1986	105	58
1987	115	63
1988	306	168
1989	486	267
1990	708	389
1991	613	337
1992	578	318
1993	447	246
1994	477	262
1995	446	245
1996	1,026	564
1997	1,432	788
1998	890	490
1999	910	501

Table 5.1.b.

Forecasted number of new constructed barges over 100 gross tons, from 2001 up to 2030.

Year	No. of Barges forecasted(Document ed & Undocumented)	No. of Undocumented Barges forecasted
2001	934	513
2002	954	525
2003	974	536
2004	993	546
2005	1011	556
2006	1028	565
2007	1044	574
2008	1059	583
2009	1074	591
2010	1089	599
2011	1103	606
2012	1116	614
2013	1129	621
2014	1141	628
2015	1153	634
2016	1165	641
2017	1176	647
2018	1187	653
2019	1197	659
2020	1208	664
2021	1218	670
2022	1227	675
2023	1237	680
2024	1246	685
2025	1255	690
2026	1264	695
2027	1272	700
2028	1281	704
2029	1289	709
2030	1297	713

We performed a "T-Test" (Appendix D) in order to verify the validity of the determined number of barges to be constructed when using a logarithmic trendline. The test result consists in rejecting or not rejecting an assumed hypothesis as follows: "there is a correlation between the barges previously constructed and the number of forecasted barges in a given period of time: 1985-1999". As a positive result of the "T-Test" we did not have to reject the hypothesis. This result allows us to say that the number of barges forecasted for the period of time from 2000-2030 is correctly estimated.

The projected number of new constructed undocumented barges more than 100 gross tons is also shown in table 5.2.

Table 5.2
Projected Number of New Constructed Undocumented Barges Over than 100 Gross Tons

Year	Currently undocumented barges	New constructed barges					
	2000	2005	2010	2015	2020	2025	2030
Affected barges	20,000	2,676	2,912	3,103	3,264	3,400	3,521

5.5 UNIT COSTS

The costs associated with implementing a vessel numbering system for barges more than 100 gross tons consists of industry costs and government costs. The cost to industry includes added administrative costs and the cost to affix the vessel identification number to the barge. The cost to the government includes costs for developing and installing a database for the numbering system and costs for administrating the system.

5.5.1 Government Costs

The relevant assumptions for this cost calculation are: 1) the Coast Guard will be the responsible agency for issuing vessel identification numbers for all undocumented barges more than 100 gross tons; and 2) the Coast Guard will incur the cost of developing and installing a database system for storing the numbering system data and the administrative cost of issuing numbers. The database development and installation costs and the numbering system administrative costs incurred by the government will be the same for Alternative 1 and Alternative 2.

The database development and installation costs include software development and installation, as well as training for Coast Guard personnel. Based on past experience with database development, it is assumed this will be a three week effort performed by a database professional including 1 week of training for 3 Coast Guard personnel.

The administrative costs include: distribution of the application form for Coast Guard vessel number, receipt and processing of the application, issuing the Certificate of Number, tracking barge ownership to assure the disposition of barges is recorded, and responding to information inquiries regarding the numbering of affected barges. The administrative costs estimate was based on information from discussions with the National Documentation Center.

There will be no additional financial costs to the government, as no additional personnel will be hired. However, there will be an opportunity cost, as existing personnel will perform additional tasks.

**Table 5.2
Government Costs**

Developing and Installing Database (one-time costs) (3 CG personnel x 40 hrs x \$38/hr) + (dbase prof. 120 hrs x \$110/hr)	\$18,000	
Administration Costs Numbering Barges		
	GS-07	GS-12
Hrly Rate*	\$ 24.00	\$ 38.00
Hrs./Barge	1	1
Labor Cost/Barge	\$ 24.00	\$ 38.00
Admin. Cost/Barge	\$ 62.00	

*Hourly rates are based on "Hourly Standard Rates for Personnel" COMDTINST 7310.1E/1999

5.5.2 Industry Costs

Industry would incur administrative costs and costs to affix the vessel identification number to the hull. It is assumed that owners of existing undocumented barges more than 100 gross tons will be required to apply for and affix a vessel identification number to all affected barges within 5 years, and that barges more than 100 gross tons that are to be constructed in the future (after June 2001) will have the required vessel number affixed during construction.

5.5.2.1 Alternative One: Welded Vessel Identification Number

The vessel identification number will be welded in block type Arabic numerals not less than four (4) inches in height. The number will be welded three times as follows: on the interior structural part of the vessel and at the highest part of the vessel's hull or permanent structure such that the number can be seen from either side. It is assumed that it will take 4 man-hours to weld on to the hull, including setup time. We assume the barges will be gas freed prior to welding.

We expect a five year phase-in period will allow companies enough lead time to schedule permanently marking their barges so additional costs due to down time can be avoided. However, for the purposes of this analysis we have included an estimate of down time to be conservative.

The Coast Guard assumes that 85% (17,000) of barges will be numbered during routine maintenance, Coast Guard inspections, or at their current on-site location. The remaining 15%, (3,000) of barges will require towing to a facility in order to be numbered.

Administrative Costs:

These are costs incurred for inventory of existing barges, request and completion of application forms, and scheduling of the numbering of the barge at an appropriate facility. We consider that different individuals perform each activity and we assume that the average salary is \$30 per hour. These costs are detailed as follows.

Inventory: The existing fleet must be inventoried in order to identify the number and locations of undocumented barges that will be affected by the numbering requirement. This activity also includes the admeasurement of barges in order to identify barges over 100 gross tons. For this analysis it was assumed the owners would use the simplified method of determining gross tonnage ($L \times B \times D \times 0.84 / 100 = GT$). If the owner doesn't use the Simplified Measurement System, the gross tonnage is the tonnage assigned under any other applicable measurement system of 46 CFR part 69, as indicated on an appropriate tonnage certifying document. Under simplified measurement, no tonnage certifying document is issued.

Application: Request for vessel numbering applications for each affected barge must be made to Coast Guard. Once the applications are received, an application for each affected barge must be completed and sent back to Coast Guard for issuance of the vessel identification.

Scheduling: Arrangements must be made to have the vessel identification number welded to each affected barge. Barges must be scheduled for down time in order to be available for welding of the vessel number. Arrangements must also be made to contract or schedule (if in-house) a welder to affix the number to each barge.

Cost to Affix Vessel Identification Number

These costs include towing the vessel to and from a welding facility, affixing the number, and down time of the barge.

Tow: The affected barges will need to be towed to and from the facility where the vessel identification number is to be welded. This cost will vary depending on the location of the barge, the distance of the barge from the welding facility, and the need go through any locks. The cost of towing is an average cost based on industry representatives and includes the cost to tow to and from the facility as well as the necessary insurance needed during tow. Future undocumented barges will have the number affixed during construction and towing will not be necessary.

Affixing It was estimated that it will take 4 man hours of a welder to setup for and affix

Number: the vessel number to the barge. The hourly rate of \$63 per hour is based on Means 1996 Heavy Construction Cost Data for a welder, adjusted for inflation and geographic location (Midwest).

Down Time: The 20,000 existing undocumented barges will be out of operation while the vessel identification number is being welded to the barge. The daily cost of downtime was based on a barge earning a monthly revenue of \$3,500. It was assumed that a barge that required towing would be out of operation for 3 days and a barge not requiring towing would be out of operation for 1 day. The estimated downtime cost was based on information obtained from interviews with industry representatives.

The unit cost to industry for numbering of undocumented barges is presented in Table 5.3, Table 5.4, and Table 5.5.

**Table 5.3
Unit Cost to Weld Number on Existing Barges (Tow Required)**

	Qty/Barge	Rate	Total
Administrative			
Inventory/File Application (hours)	1.5	\$ 30.00	\$ 45
Schedule Numbering (hours)	1	\$ 30.00	\$ 30
Subtotal			\$ 75
Affix Number			
Tow	1	\$ 1,900.00	\$ 1,900
Down Time (days)	3	\$ 116.67	\$ 350
Affix Number (hours)	4	\$ 63.00	\$ 252
Subtotal			\$ 2,502
Certified Engineer Fee	1	\$ 400.00	\$ 400
Total Cost Per Barge			\$ 2,977

**Table 5.4
Unit Cost to Weld Number on Existing Barges (Tow Not Required)**

	Qty/Barge	Rate	Total
Administrative			
Inventory/File Application (hours)	1.5	\$ 30.00	\$ 45
Schedule Numbering (hours)	1	\$ 30.00	\$ 30
Subtotal			\$ 75
Affix Number			
Tow	0	\$ 1,900.00	\$ 0
Down Time (days)	1	\$ 116.67	\$ 117
Affix Number (hours)	4	\$ 63.00	\$ 252

Subtotal			\$ 369
Certified Engineer Fee	1	\$ 400.00	\$ 400
Total Cost Per Barge			\$ 844

Table 5.5
Unit Cost to Weld Number on New buildings

	Qty/Barge	Rate	Total
Administrative			
File Application (hours)	1	\$ 30.00	\$ 30
Schedule Numbering (hours)	0	\$ 30.00	\$ -
Subtotal			\$ 30
Affix Number			
Tow	0	\$ 1,900.00	\$ -
Down Time (hours)	0	\$ 20.19	\$ -
Affix Number (hours)	4	\$ 63.00	\$ 252
Subtotal			\$ 252
Total Cost Per Barge			\$ 282

5.5.2.2 Alternative Two: Painted Vessel Identification Number

The vessel identification number will be affixed onto the hull three times by either paint or decals as follows: on the interior structural part of the vessel and at the highest part of the vessel's hull or permanent structure such that the number can be seen from either side. It is assumed that the vessel number will be painted in block type Arabic numerals not less than four (4) inches in height and that existing undocumented barges will not need towing to a facility for numbering. The vessel identification number will be painted on the barge while it remains at its operation site. For future newbuildings, the vessel identification will be affixed during construction.

Administrative Costs

These are costs incurred for inventory of existing barges, request and completion of application forms, and scheduling the barge numbering. The administration costs of Alternative 2 are similar to that of Alternative 1, with the exception that there is no need to schedule towing.

Cost to Affix Vessel Identification Number

These costs include the cost to paint or decal the vessel identification number to the hull. It was estimated that for existing barges the downtime would be 0.5 day. This downtime would be for locating the barge, preparing the hull, painting or decaling the number, and allowing the paint or decal to dry. The daily cost of downtime is the same as for Alternative 1.

The unit cost to industry for numbering of undocumented barges is presented in Table 5.6 and Table 5.7.

Table 5.6
Unit Cost to Paint or Decal Number on Existing Barges

	Qty/Barge	Rate	Total
Administrative			
Inventory/File Application (hours)	1.5	\$ 30.00	\$ 45
Schedule Numbering (hours)	0.5	\$ 30.00	\$ 15
Subtotal			\$ 60
Affix Number			
Down Time (days)	0.5	\$ 116.67	\$ 58
Affix Number (hours)	1	\$ 35.00	\$ 35
Subtotal			\$ 93
Total Cost Per Barge			\$ 153

Table 5.7
Unit Cost to Paint or Decal Number on Future Barges

	Qty/Barge	Rate	Total
Administrative			
File Application (hours)	1.0	\$ 30.00	\$ 30
Schedule Numbering (hours)	0	\$ 30.00	\$ -
Subtotal			\$ 30
Affix Number			
Down Time (days)	0	\$ 116.67	\$ -
Affix Number (hours)	1	\$ 35.00	\$ 35
Subtotal			\$ 35
Total Cost Per Barge			\$ 65

5.5.3 Summary of Unit Costs

Table 5.8 summarizes the unit costs for alternative 1 and alternative 2. The unit costs do not include the initial one-time cost (\$18,000) to develop and implement the numbering system database.

Table 5.8
Unit Costs Summary

	Alternative 1 Welding	Alternative 2 Painting
Government Costs:		
Administration Cost/Barge	\$62	\$62
Industry Cost/Barge:		
Existing Barges (Tow Req./No Tow Req.)	\$2,977/ \$844	\$153
Future Barges	\$282	\$65
Total Cost/Barge:		
Existing Barges (Tow Req./No Tow Req.)	\$3,039/ \$906	\$215
Future Barges	\$344	\$127

5.6 TOTAL COSTS

The total costs associated with implementing a vessel numbering system are presented in Tables 5.9 and 5.10 for Alternative 1 and Alternative 2, respectively. The total costs were calculated by multiplying the unit costs by the number of affected barges for each year from 2000 through 2030. The tables show the present values for the 10 year (Year 2010), 20 year (Year 2020), and 30 year (Year 2030) periods. Appendix B provides a breakdown of the annual present values of Alternatives 1 and 2.

Table 5.9
Cost summary for Alternative 1

Total Costs: Welded numbers						
Year	2001	2002	2003	2004	2005	2006
No. of Existing Affected Barges-Tow Req.	600	600	600	600	600	0
No. of Existing Affected Barges-No Tow Req.	3,400	3,400	3,400	3,400	3,400	0
No. of Future Barges	513	525	536	546	556	565
Initial Database Cost	\$ 18,000					
Cost/Barge Existing Affected Barges-Tow Req.	\$ 3,039	\$ 3,039	\$	\$	\$	\$
Cost/Barge Existing Affected Barges-No Tow Req.	\$ 906	\$ 906	\$	\$	\$	\$
Cost/Barge Future Barges	\$ 344	\$ 344	\$344	\$344	\$344	\$344
Total Cost(1999 \$)	\$ 5,080,424	\$ 5,084,374	\$5,088,110	\$5,091,655	\$5,095,027	\$194,441
Discounted Cost @ 7%	\$ 4,437,439	\$ 4,150,364	\$3,881,695	\$3,630,280	\$3,395,032	\$121,088
Present Value Costs through 2010	\$ 20,041,083					
Present Value Costs through 2020	\$ 20,767,618					
Present Value Costs through 2030	\$ 21,169,984					

Table 5.10
Cost summary for Alternative 2

Total Costs: Painted numbers						
Year	2001	2002	2003	2004	2005	2006
No. of Existing Affected Barges-Tow Req.	4,000	4,000	4,000	4,000	4,000	0
No. of Future Barges	513	525	536	546	556	565
Initial Database Cost	\$ 18,000					
Cost/Barge Existing Affected Barges	\$ 215	\$ 215	\$ 215	\$ 215	\$ 215	\$
Cost/Barge Future Barges	\$ 127	\$ 127	\$ 127	\$ 127	\$ 127	\$ 127
Total Cost(1999 \$)	\$ 925,207	\$ 926,665	\$ 928,045	\$ 929,353	\$ 930,598	\$ 71,785
Discounted Cost @ 7%	\$ 808,112	\$ 756,435	\$ 708,001	\$ 662,616	\$ 620,097	\$ 44,704
Present Value Costs through 2010	\$ 3,756,938					
Present Value Costs through 2020	\$ 4,921,590					
Present Value Costs through 2030	\$ 5,625,686					

5.7 BENEFITS

The potential benefits of a vessel numbering system for undocumented barges more than 100 gross tons will accrue to the government. No direct benefits to industry were identified. The potential benefit to the government will come from the government's cost avoidance of removal and cleanup costs associated with the barge and from reimbursement of government incurred costs from the responsible parties. The intent of the numbering system is to increase the responsible party's accountability for the barge, thereby deterring the illegal abandonment of the barge. Cost avoidance results from fewer undocumented barges being illegally abandoned, and therefore, fewer abandoned barges requiring government removal. Reimbursement of government incurred costs results from locating the responsible parties of an illegally abandoned barge and holding them liable for costs incurred from the removal.

The underlying intent and secondary benefit of the numbering system is that responsible parties can be held responsible for removal and disposal of any hazardous substances located on the abandoned barge and the clean up of any hazardous substances released from the barge into the environment. Without identifying the responsible party, the Coast Guard and EPA utilize funds from CERCLA and the Oil Spill Liability Trust Fund (OSLTF) for the cleanup, removal and disposal of the hazardous substance.

5.7.1 Annual Benefits

The calculation for avoidance of barge removal and hazardous waste cleanup costs are based on Coast Guard and EPA data since 1992. The annual benefits will depend on the actions of the responsible parties with regard to unlawful abandonment. Three scenarios based on possible actions of the responsible parties are identified, resulting in a range of possible values for the annual benefit.

5.7.1.1 Abandoned Barge Removal

The only case since 1992 where Coast Guard funds were used to remove abandoned barges under the authority of the Act is in the case of San Jacinto, Texas, where \$1.5 million was expended to remove 5 barges in 1997. All 5 barges were not numbered and the responsible parties were not identified. Due to the lack of historical data, it is difficult to estimate what the rate of abandoned barge removal will be for future years. Therefore, an annual cost of \$250,000 for barge removal is assumed for those cases where the responsible parties are not identified and held responsible for the removal. Table 5.11 presents the historical removals for the period FY 1992 (year Act was promulgated) through FY 1997.

Table 5.11
Coast Guard Abandoned Barge Removals

Fiscal Year	Number of Cases	Costs Incurred
FY92	0	\$0
FY93	0	\$0
FY94	0	\$0
FY95	0	\$0
FY96	0	\$0
FY97	5	\$1,500,000
TOTAL	5	\$1,500,000
AVG. ANNUAL	0.8	\$250,000

5.7.1.2 Hazardous Substance Cleanup and Removal

As stated in section 5.1, the Coast Guard and EPA are the two Federal agencies responsible for overseeing the cleanup of hazardous substance releases into the nation's waters. The NPFC provided data on the amount of OSLTF funds expended in response to spills from abandoned barges. Included in this data is the amount of CERCLA funds expended by the Coast Guard (Coast Guard requests for CERCLA funds are distributed through NPFC).

EPA was contacted in order to obtain data on the amount of CERCLA funds expended by EPA in response to releases from abandoned barges. EPA was not able to provide this data on a national basis, however EPA Headquarters deferred the request for data to EPA Region 6 where a majority of abandoned vessels are encountered. EPA Region 6 (consists of Arkansas, Louisiana, New Mexico, Oklahoma, and Texas) was contacted and their information was the basis for CERCLA funds used by EPA in response to abandoned barge cleanups.

Data were analyzed for the years 1992 through July, 1998 (includes 10 of the 12 months of FY98). NPFC provided data on the number of cases and costs incurred by fiscal year. The quantity of spilled material was not available. NPFC does not collect data regarding abandoned barges, therefore, data was queried for barges with unknown owners/operators. The number of cases and associated federal funds expended by fiscal year are provided in Table 5.12. A listing of the cases is provided in Appendix A.

Table 5.12
EPA and Coast Guard Abandoned Barge Cleanups

Fiscal Year	Number of Cases	Costs Incurred
FY92	2	\$2,190,163
FY93	1	\$467,789
FY94	0	\$0
FY95	1	\$4,844
FY96	1	\$4,785
FY97	3	\$270,000
TOTAL	8	\$2,937,581
AVG. ANNUAL		\$429,890

The average annual cost incurred by the Coast Guard and EPA for the period FY92 through July, 1998 was \$429,890. Neither the National Pollution Funds Center nor the Marine Safety Offices contacted could provide information regarding documentation history on any of these cases. Although it is possible that these cases could have been documented barges with numbers removed, it is assumed that the entire cost resulted from undocumented abandoned barges. This assumption is based on: 1) the majority of barges are undocumented, 2) documented barges are less likely to be abandoned due to the likelihood of documented barges having outstanding mortgages and protection and indemnity insurance (i.e., less likely an owner of a documented barge will benefit financially from abandonment), and 3) this assumption maximizes the potential benefits of the numbering system.

The available data do not indicate whether the funds were spent for cleanup of hazardous waste on board the barge prior to abandonment (either as clingage, cargo, or illegally dumped on board while the barge was operating¹⁷) or that illegally dumped into the barge after abandonment. This analysis assumes that all cleanup costs (\$2,937,581) are potential benefits.

Table 5.13 provides some perspective of the magnitude of the abandoned barge cleanup effort relative to total national expenditures, based on OSLTF data on the total number of oil spill and hazard substance incidents for FY93 through FY97. Incidents involving abandoned barges are a small percentage of oil and hazardous substance incidents.

¹⁷ During the course of our investigation we spoke to several barge operators. During these interviews we were advised by barge owners that although it is not a common or condoned practice, it sometimes occurs that a barge is returned to an owner with bilge slops from a towboat pumped on board.

Table 5.13

Oil and Hazardous Substance Incidents Reported by NPFC

Fiscal Year	Total Incidents		Abandoned Barge Incidents		
	# of Cases	Cost	# of Cases	Cost	% of Total Annual Cost
1993	490	\$14,000,000	1	\$467,789	3.34%
1994	538	\$30,200,000	0	\$0	0.00%
1995	567	\$39,500,000	1	\$4,844	0.01%
1996	599	\$48,600,000	1	\$4,785	0.01%
1997	552	\$49,600,000	3	\$270,000	0.54%

5.7.1.3 Reduced Investigation Effort

The time to investigate and identify the responsible party of an abandoned barge is reduced with a barge identification number system in place. The Coast Guard would use the database to identify the abandoned vessel and responsible party, rather than the laborious process of making phone calls to various state and local agencies and interviewing local people.

Cost estimates for both types of investigations follow and are based on Coast Guard field personnel experience. The investigation of a vessel with an identification number would typically require Coast Guard staff consisting of labor category E1-E4 and labor category E6-E9. The Coast Guard staff typically required to investigate a vessel without an identification number consists of labor categories E6-E9, and O1/O2. The estimated annual benefit to the Coast Guard in reduced investigation costs is \$1,090. The annual investigation costs are presented in Table 5.14.

5.7.2 Benefit Scenarios

The benefits of requiring undocumented barges to be numbered and registered will depend on the responsible party's method of disposal. There are three possible methods of barge disposal: 1) the barge is not abandoned and is properly disposed of, 2) the barge is illegally abandoned with the vessel number intact, and 3) the barge is illegally abandoned with the identification number removed or obliterated. Three scenarios are analyzed, one scenario for each of the possible disposal methods.

Scenario 1: The undocumented barge numbering requirement discourages responsible parties from illegally abandoning their barge. This scenario is the best case scenario.

Scenario 2: Undocumented barges are illegally abandoned with the vessel number intact. This scenario would allow the Coast Guard to track the responsible parties to the illegally abandoned barge.

Scenario 3: Undocumented barges are illegally abandoned with the vessel number removed or obliterated. This scenario defeats the purpose of a vessel numbering system and would result in no benefit. This is the worst case scenario.

Table 5.14
Annual Investigation Costs

<i>Barges with Vessel Identification Number</i>			
	E1-E4	E6-E9	O1/O2
Hrly Rate	\$ 17.00	\$ 24.00	\$ 27.00
Hrs./Barge	2	2	
Labor Cost/Barge	\$ 34.00	\$ 48.00	\$ -
Total Govt. Cost/Barge	\$ 82.00		
Est. Barge Investigations/year	5		
Annual Cost	\$ 410		
<i>Barges without Vessel Identification Number</i>			
	E1-E4	E6-E9	O1/O2
Hrly Rate	\$ 17.00	\$ 24.00	\$ 27.00
Hrs./Barge	0	8	4
Labor Cost/Barge	\$ -	\$ 92.00	\$108.00
Total Govt. Cost/Barge	\$ 300.00		
Est. Barge Investigations/year	5		
Annual Cost	\$ 1,500		
Annual Benefit (\$1,500-\$410)	\$ 1,090		

It is difficult to predict the percentage of barges that will fall into each of the three scenarios, for each of the two numbering schemes. Instead of trying to predict the distribution of barges that will fall within each scenario, the benefits for each scenario were calculated as if all the barges and associated costs fall within that scenario. The result is a range of potential benefits consisting of the maximum benefit (scenario 1), intermediate benefit (scenario 2), and minimum benefit (scenario 3). The likelihood of each scenario is discussed in section 5.8.3.

It is also assumed that the number of barges falling within each scenario is independent of whether the number is welded or painted to the hull. Discussions with the Coast Guard and comments from the docket reveal that there currently exists no permanent method of affixing an identification number to a vessel. Therefore, both welded numbers (alternative 1) and painted numbers (alternative 2) can be removed from a vessel. The difference between alternative 1 and alternative 2 is that the process to remove the welded number is more difficult than that for removing painted numbers.

5.7.2.1 Scenario 1 Benefit

This is the best case scenario. If barges more than 100 gross tons are no longer abandoned, the Coast Guard will benefit by not having to expend funds to remove these barges or clean up, remove and dispose of hazardous substances from the barge. The total potential benefit (cost avoidance) will consist of the annual removal costs (\$250,000), the annual hazardous substance cleanup costs (\$429,890), and Coast Guard time saved by not having to investigate and locate the responsible party of the abandoned barge. This scenario assumes that after the numbering system is established, the hazardous waste that would have been deposited into an abandoned barge is not deposited into one of the thousands of other legally abandoned vessels. Table 5.15 presents the estimated annual benefits for Scenario 1.

Table 5.15
Scenario 1 Annual Benefit

Annual Coast Guard Removal Costs	\$ 250,000
Annual Coast Guard Hazardous Substance Cleanup	\$ 429,890
Annual Investigation Savings	\$ 1,500
<i>Total Annual Benefit</i>	<i>\$ 681,390</i>

5.7.2.2 Scenario 2 Benefit

In this scenario, undocumented barges are abandoned with the vessel identification number intact. The Coast Guard would attempt to identify the responsible party and hold them liable for the removal of the barge and for any associated cleanup, removal and disposal of hazardous substances.

Based on estimates of cost recovery success for pollution mitigation operations from the NPFC, viable responsible parties are identified in 60% of all cases where federal funds are expended in pollution mitigation operations. Of those 60% of cases where viable responsible parties are identified, 60% of the funds expended are recovered by the government. This results in an average cost recovery of 36% of the total funds expended. Therefore, based on NPFC history, the government can expect to recover 36% of the cost incurred to remove and clean up illegally abandoned barges with their vessel identification number intact. Table 5.16 presents the estimated annual benefits for Scenario 2.

Table 5.16

Scenario 2 Annual Benefit

Annual Cost to Remove Barges	\$250,000
Annual Cost of Barge Clean Up	\$429,890
Subtotal	\$679,890
Expected Cost Recovery (36%)	\$244,760
Annual Investigation Savings	\$1,090
Total Annual Benefit	\$245,850

5.7.2.3 Scenario 3 Benefit

In this scenario the vessel identification numbers are removed or obliterated from the abandoned barges, and the numbering system is ineffective. Discussions with the Coast Guard and comments received in the docket reveal that the responsible party commonly removes or obliterates a vessel identification number prior to abandonment. Illegal abandonment would most likely mean removal or obliteration of the vessel identification number. If removal or obliteration of the number takes place in all cases, the annual benefit is clearly \$0.

5.7.3 Annual Benefits Summary

Table 5.17 summarizes the annual benefit for each scenario. The present values of the benefits for the 10 year (Year 2008), 20 year (Year 2018), and 30 year (Year 2028) periods are presented in Table 5.18. Appendix B provides a breakdown of the annual benefits and present values for each scenario.

**Table 5.17
Annual Benefit Summary**

	Scenario 1	Scenario 2	Scenario 3
Removal Cost Recovery	\$250,000	\$90,000	\$0
Clean Up Cost Recovery	\$429,890	\$154,760	\$0
Investigation Savings	\$1,500	\$1,090	\$0
Total Annual Savings	\$681,390	\$245,850	\$0

5.8 TOTAL COSTS AND BENEFITS COMPARISON

Table 5.19 presents the total costs and benefits associated with establishing a vessel numbering system for undocumented barges more than 100 gross tons. The table shows the total net present values (present value benefits – present value costs) for each of the cost alternatives and benefit scenarios for the 10 year (Year 2010, 20 year (Year 2020),

and 30 year (Year 2030) periods. Annual net present values for each alternative and scenario are provided in Appendix C.

Table 5.18
Benefit summary for Alternative 1

Total Benefits by Scenario						
Year	2001	2002	2003	2004	2005	2006
Scenario 1						
Total Benefits(1999 \$)*	\$ 136,278	\$ 272,556	\$408,834	\$545,112	\$681,390	\$681,390
Discounted Benefit @7%	\$ 119,030	\$ 222,487	\$311,897	\$388,657	\$454,039	\$424,335
Present Value Benefits through 2010	\$3,357,758					
Present Value Benefits through 2020	\$ 5,631,457					
Present Value Benefits through 2030	\$ 6,787,290					
Scenario 2						
Total Benefits(1999 \$)*	\$ 49,170	\$ 98,340	\$147,510	\$196,680	\$245,850	\$245,850
Discounted Benefit @7%	\$42,947	\$ 80,275	\$112,535	\$140,230	\$163,820	\$153,103
Present Value Benefits through 2010	\$1,211,504					
Present Value Benefits through 2020	\$2,031,870					
Present Value Benefits through 2030	\$2,448,903					
Scenario 3						
Total Benefits(1999 \$)*	\$0	\$ 0	\$0	\$0	\$0	\$0
Discounted Benefit @7%	\$0	\$ 0	\$0	\$0	\$0	\$0
Present Value Benefits through 2010	\$0					
Present Value Benefits through 2010	\$0					
Present Value Benefits through 2010	\$0					

Table 5.19: Total Cost and Benefit Summary

	Year 2010			Year 2020			Year 2030		
	Present Value Cost	Present Value Benefit	Present Value net Benefit	Present Value Cost	Present Value Benefit	Present Value net Benefit	Present Value Cost	Present Value Benefit	Present Value net Benefit
Scenario 1									
Welded Number	\$20,041,083	\$3,357,758	(\$16,683,325)	\$20,767,618	\$5,631,457	(\$15,136,161)	\$21,169,984	\$6,787,290	(\$14,382,694)
Painted Number	\$3,756,938	\$3,357,758	(\$399,180)	\$4,921,590	\$5,631,457	\$709,867	\$5,625,686	\$6,787,290	\$1,161,604
Scenario 2									
Welded Number	\$20,041,083	\$1,211,504	(\$18,829,579)	\$20,767,618	\$2,031,870	(\$18,735,748)	\$21,169,984	\$2,448,903	(\$18,721,081)
Painted Number	\$3,756,938	\$1,211,504	(\$2,545,434)	\$4,921,590	\$2,031,870	(\$2,889,720)	\$5,625,686	\$2,448,903	(\$3,176,783)
Scenario 3									
Welded Number	\$20,041,083	\$0.00	(\$20,041,083)	\$20,767,618	\$0.00	(\$20,767,618)	\$21,169,984	\$0.00	(\$21,169,984)
Painted Number	\$3,756,938	\$0.00	(\$3,756,938)	\$4,921,590	\$0.00	(\$4,921,590)	\$5,625,686	\$0.00	(\$5,625,686)

5.8.1 Alternative 1 – Welded Numbers

As can be seen in Table 5.19, the estimated net present value benefit associated with Alternative 1 (welding) is negative for all three scenarios and for all three analysis periods (2010, 2020, and 2030). This suggests that even for the best possible scenario (scenario 1), the estimated cost of Alternative 1 is greater than the estimated benefits. Consequently, there appears to be no net quantifiable economic benefit in requiring welded identification numbers for all undocumented barges more than 100 gross tons.

However, unquantifiable benefits, such as the reduction in risk to public safety and health do exist.

5.8.2 Alternative 2 – Painted Numbers

Table 5.19 shows the estimated net present value of alternative 2 is positive for two periods (2020, and 2030) for scenario 1 only. There is no net benefit to painted numbers with scenario 2 and scenario 3. Similar to alternative 1 (welded numbers), the cost associated with alternative 2 is highest in the first five years, at which time the existing 20,000 barges are required to be numbered. The estimated costs of this alternative will be greater than the estimated benefits for the first 15 years with scenario 1, after which the benefits will be greater than the costs (see Appendix C).

5.8.3 Likelihood of Abandonment Scenarios

5.8.3.1 Scenario 1

The likelihood of scenario 1, no barge owners illegally abandoning their barges, would be very small. Economic conditions will most likely be the major consideration of unethical owners when it comes to deciding whether to illegally abandoned their barge. Since both the welded and painted vessel identification numbers can be (and have been in the past) removed or obliterated from the barge, an unlawful owner would most likely remove the number prior to abandonment. Therefore, it appears the numbering of barges will have little affect in eliminating deliberate abandonment of barges. Scenario 1 was included in this analysis as a benchmark to identify the best case scenario (most possible benefit).

5.8.3.2 Scenario 2

As stated in section 5.6.3.1, an unethical owner would most likely remove or obliterate the barge number prior to illegally abandonment. In the case of intentional abandonment, the likelihood of abandonment with the numbers intact is also small. However, there have been cases where barges have been accidentally broken away and stranded (due to weather, etc.) and the owners have declared the barge a loss and abandoned it in order to escape salvage fees. In these cases, the barge number will most likely be intact and the owner identified. Therefore, there is the likelihood of some, but not all, abandoned barges having the number intact after abandonment.

5.8.3.3 Scenario 3

This is the most likely scenario for barges that are intentionally abandoned. Since intentional abandonment is illegal, the owner would most likely remove or obliterate the vessel number before abandonment.

There are no data available on the number of undocumented barges abandoned intentionally as opposed to unintentionally and, therefore, it is not possible to estimate the relative likelihood of scenario 2 and scenario 3. The number of barges illegally

abandoned will most likely be affected by scrap metal prices and the cost to properly dispose of barges. As the cost increases, the incentive for unethical owners to illegally abandon their barges will also increase. The same can be said for the illegal disposal of hazardous substances onto an abandoned barge. As the cost to dispose of hazardous substances increases, the incentive to illegally dump material into an abandoned barge (or any other abandoned vessel) will also increase. As a result, the actual net present value of numbering undocumented barges will most likely fluctuate between the net present value of scenario 2 and scenario 3.

Conclusion:

Two alternatives for affixing the number to the barge were analyzed: alternative 1-welded numbers and alternative 2-painted numbers. The estimated cost (1999 dollars) to government and industry to number the existing undocumented barges is approximately \$21,169,984 and \$5,625,686 for alternative 1 and alternative 2, respectively.

Three possible barge abandonment scenarios were identified for this analysis: 1) barges would no longer be illegally abandoned, 2) barges would be illegally abandoned with the barge number intact, and 3) the abandoned barge would be abandoned with the barge number removed or obliterated. The estimated annual benefits (1999 dollars) for scenarios 1, 2, and 3 are approximately \$6,787,290, \$2,448,903, and \$0 respectively.

The present values for the costs and benefits were calculated over a 30 year duration and are presented in Table 5.18 (Section 5.0). The costs of Alternative 1 significantly exceeded the benefits for all three scenarios. For Alternative 2, the benefits exceeded the costs for scenario 1 after year 2010, however the costs exceeded the benefits for scenario 2 and scenario 3. The results of the analysis indicate the following:

The benefits do not exceed the costs of Alternative 1 for all three scenarios. The benefits of Alternative 2 exceed the costs only for scenario 1 over a 30-year duration. The costs exceed the benefits for scenario 2 and scenario 3. If the barge numbers are removed or obliterated (scenario 3), there are no benefits to either alternative 1 or alternative 2. This results in costs being incurred by both government and industry, with no return of benefits.

This analysis suggests the only alternative that has a potential net benefit is Alternative 2-painted identification numbers (see Table 5.19). The most likely real life scenario is some combination of scenario 2 and scenario 3. However, if the barge numbers are removed or obliterated, which has happened in the past, the numbering fails its purpose and no benefits will accrue to the government. Therefore, the chosen alternative is Alternative 1: welding the numbers, due to the fact that welded numbers are much harder to be removed or obliterated when a barge is illegally abandoned. This will help the Government identify parties responsible for illegal abandonment of barges and prevent future marine pollution from abandoned barges.

6.0 SMALL ENTITIES

Under the Regulatory Flexibility Act (5 U.S.C. 601-612), we considered whether this proposed rule would have a significant economic impact on a substantial number of small entities. The term “small entities” comprises small businesses, not-for-profit organizations that are independently owned and operated and are not dominant in their fields, and governmental jurisdictions with populations of less than 50,000. This section addresses the analysis requirements of the act.

6.1 REASON FOR AGENCY ACTION

The Abandoned Barge Act of 1992, sections 5301 to 5305 of Public Law 102-587, of 4 November 1992, added a new chapter 47 to Title 46 United States Code (46 USC 4701 to 4705), which makes it illegal to abandon a barge of greater than 100 gross tons and established non-funded procedures for removal of barges illegally abandoned. The Act further amended 46 USC 12301 to require the numbering of undocumented barges of greater than 100 gross tons operating on the navigable waters of the United States.

6.2 REGULATORY OBJECTIVES

The direct objective of numbering undocumented barges is to provide a means of identification for abandoned barges, in order to facilitate the government’s recovery of costs expended removing abandoned barges. The underlying objective of this action is not addressed in the Act itself, yet is the primary justification for the Act discussed in all preliminary testimony, reports, and public notices, i.e., the recovery of costs expended in the removal of oil and hazardous wastes that might be on board or illegally deposited therein.

The Abandoned Barge Act clearly establishes liability for removal of an abandoned barge. The Act is silent with regard to additional liability such as hazardous waste removal costs for wastes that may have been deposited by another party following an owner’s abandonment.

6.3 LEGAL BASIS FOR THE ACTION

Title 46 USC Chapter 123, (Numbering of Undocumented Vessels) was amended by the Abandoned Barge Act of 1992. Section 12301 was amended by adding section (b) as indicated in Italics, below:

Section 12301 - Numbering Vessels

An undocumented vessel equipped with propulsion machinery of any kind shall have a number issued by the proper issuing authority in the State in which the vessel principally is operated.

The Secretary shall require an undocumented barge more than 100 gross tons operating on the navigable waters of the United States to be numbered.

6.4 AFFECTED SMALL ENTITIES

Companies that own and operate barges vary widely in size and operation. Some companies own, operate and maintain large fleets of barges (as well as lease considerable numbers of barges from others). Others merely own and lease out barges. Still others own and operate small fleets in local or regional trades.

The USACE’s “Waterborne Transportation Lines of the United States, Volume 2 - Vessel Company Summary” database was queried to identify owners of undocumented barges more than 100 gross tons. The query identified 660 owners with undocumented barge fleets ranging from 1 to 1,608 barges. The results of the query also revealed that 15% of the barge operators own over 85% of the affected barges. A majority (74%) of the affected owners have undocumented barge fleets of less than 10. Table 6.1 presents the number of affected owners by fleet size. No data was available on the ownership of construction barges and therefore these owners were not included in this analysis.

Table 6.1
Number of Affected Fleet Owners

Fleet Size Range	Number of Owners	Percentage of Owners	Number of Affected Barges*	Percentage of Affected Barges
Greater than 1000	3	0.5%	4,040	23%
100 to 999	34	5.2%	8,970	50%
20 to 99	59	8.9%	2,594	14%
10 to 19	75	11.4%	1,024	6%
Fewer than 10	489	74.0%	1,329	7%
Total	660	100.0%	17,957	100%

- Does not include construction barges

The Small Business Administration, in 13 CFR 121-201, defines small business by either the number of employees or the amount of receipts in dollars. Revenue or labor - force information for many of the companies can be obtained from sources such as: *Dun & Bradstreet, American Business and Lexis-Nexis*. We assumed that if a company was a subsidiary or branch of a parent company, then that subsidiary or branch was inseparable from the larger firm.

From those 660 companies we drew a random sample of 101 companies using a confidence level of 95% and a confidence interval of 9. From the random sample of 101 companies we found data for 66 (or 65%) of them. Furthermore, from the 66 firms we identified 20 owned/operated by large companies and the remaining 46 owned/operated by small businesses. According to the small business size standard of the SIC (Standard Industrial Classification) and NAICS (North American Industry Classification System) Codes, we determined that the 46 identified entities qualified as small businesses because

their revenues/number of employees do not exceed the specified standard in the corresponding SIC and NAICS codes definitions. This represents 69.7% of those 66 companies from which we have information. Therefore, we are 95% certain that 61.8% to 78.2% of the firms are small entities.

The determined small businesses cover several industry segments, therefore the corresponding SIC and NAICS codes analyzed for each company also cover a wide range. However, we determined that the most frequently identified SIC and NAICS codes when analyzing the small companies are as follows:

Table: The small businesses most frequently identified SIC and NAICS codes from the random sample

CLASSIFICATION SYSTEMS		DESCRIPTION		DEFINITION		Number of small businesses
SIC	NAICS	SIC	NAICS	SIC	NAICS	
1629	23493	Heavy Construction, N.E.C.	Industrial Nonbuilding Structure Construction	\$27,5Mil	\$27,5Mil	7
	23499		All Other Heavy Construction		\$27,5Mil	
3731	336611	Shipbuilding and Repair of Nuclear Propelled Ships	Ship Building and Repair	1,000E	1,000E	3
4449	483211	Water Transportation of Freight, N.E.C	Inland Water Transportation	500E	500E	8
4492	48833	Towing and Tug Boat	Navigational Services to Shipping	\$5Mil	\$5Mil	4
4499	532411	Water Transportation Services, N.E.C	Commercial Air, Rail and Water Transportation Equipment Rental and Leasing	\$5Mil	\$5Mil	3
5032	42132	Brick, Stone and Related Construction Materials	Brick, Stone and Related Construction Material Wholesalers	100E	100E	5

DESCRIPTION OF COMPLIANCE REQUIREMENTS

As the specific means of complying with the numbering provision of the Abandoned Barge Act have not yet been determined, the description of compliance requirements is based on the assumptions described in section 5.2.

For Alternative 1, the chosen alternative (welded numbers), the primary compliance requirements for a barge owner evident at this stage of the regulatory process are:

Inventory and scheduling of all barges - The first task will be to inventory and locate the barge fleet. If the numbers are to be welded, the fleet will be scheduled for delivery/arrival barge to the proper location for affixing the numbers (e.g., shipyard(s)). In the case of owner/operators of small fleets, this will not be a major task but will take some time. In the cases of large fleet owners, especially those who do not operate the barges, which they own, but lease to other companies, this may be quite time consuming.

Appreciation of the difficulty of locating a fleet of barges is best arrived at by comparison to railroad freight cars. Individual barges travel to a wide array of customer (or owner) locations, some as part of a large tow, others individually dropped along the way. These hulls usually remain at a designated point until loaded (or unloaded) and then are eventually joined with a tow (fleeting) for delivery to what might be a final or intermediate destination. The task of locating a barge in service is remarkably similar to attempting to locate a rail car, sitting idle at a loading point or identifying which train or railroad is moving the car at a given time.

In the case of an owner who leases barges to other operators, it is not uncommon that the owner only knows who pays him for the lease, while not seeing the barge for several years. Where barges are leased from owner to operator(s), coordination and scheduling problems should be anticipated, with the potential result of service interruptions and barge downtime.

Determination of Applicability: The determination of a barge's tonnage relative to the numbering provisions of the Abandoned Barge Act would be based on the Simplified Measurement System¹⁸ ($gt=0.84 \times \text{length} \times \text{depth} \times \text{breadth}/100$). If the owner doesn't use the Simplified Measurement System, the gross tonnage is the tonnage assigned under any other applicable measurement system of 46 CFR part 69, as indicated on an appropriate tonnage certifying document. Under simplified measurement, no tonnage certifying document is issued. The project team has noted that hundreds of barges in the Army database have reported tonnage well below 100 gross tons while their dimensions indicate that they are well over 100 gross tons. In many cases, these barges have been previously documented and may have been admeasured according to the cargo carrying capacity of the hull rather than the vessel's physical dimensions (as is the case with simplified measurement). This situation clearly shows examples where standard size barges, that are currently documented will measure below 100 gross tons while sisters of

¹⁸ 46 CFR part 69/ Subpart E

the same hulls that are not currently documented will increase in tonnage and be subject to the Act.

Contacting the Coast Guard National Vessel Documentation Center to Obtain the Application for a Certificate of Number, and completing the application:

Normally, this process would entail a visit to NVDC website to download the application form.

Movement of Hulls to Where the Number can be Attached (welded numbers only): This aspect of compliance is expected to be the most costly. Given the fact that an individual fleet can be scattered throughout the navigable waterways (especially in the western rivers), substantial charges will be incurred (e.g., towing charges) in the delivery of a hull to a point where the number can be attached, and its ultimate return to service.

Marking: If a barge is required to be towed to a shipyard where marking can be performed, the owner will likely incur yard towing fees, and mooring fees. If welded numbers are required, the barge will be “opened up” and gas freed, and the numbers, along with a receptacle for mounting the certificate of number on board the barge will be attached by the yard. During the period that the barge is out of service, lack of revenue due to loss of the barge from service will be experienced. We expect a five year phase-in period will allow companies enough lead time to schedule permanently marking their barges so additional costs due to down time can be avoided. However, for the purposes of this analysis we have included an estimate of down time to be conservative.

6.6 COST FOR SMALL ENTITIES

The costs to small business entities will depend only on the entity’s fleet size. Further down we have shown the impact on small businesses for welding only, our chosen alternative. Of the 660 owners of undocumented barges, we drew a random sample of 101 companies. According to the small business size standard of the SIC and NAICS Codes, we determined that the 46 entities qualified as small businesses because their revenues/number of employees do not exceed the specified standard in the corresponding SIC and NAICS codes definitions. We are 95% certain that 61.8% to 78.2% of the firms are small entities. For the chosen alternative, welding the numbers to barges, we estimate a 15% probability the vessel will need a tow, and an 85% probability that the vessel will not need a tow for welding. Therefore for the purpose of this analysis we estimate an expected cost of \$1,164/barge ($0.15 \times \$2,977/\text{barge} + 0.85 \times \$844/\text{barge} = \$1,164/\text{barge}$). The analyzed small business entities have relatively small fleets, with a median fleet size of 2. The median cost per company is \$2,328/company ($2 \text{ barges/company} \times \$1,164/\text{barge}$). The median revenue of a small business in our sample is \$3,750,000. Therefore, the annual median impact on a small business is 0.06% ($\$2,328/\$3,750,000 \times 100$) of annual revenue. For 45 of 46 small businesses the impact was less than 1% of the average revenues per year. For 46 of 46 small businesses the impact was less than 1.2% of the average revenue per year. In addition, the industry has a five year phase-in period to comply.

We do not consider this burden to be significant. Therefore, the Coast Guard certifies under 5 U.S.C. 605(b) that this proposed rule would not have a significant impact on a substantial number of small entities.

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APPENDICES

APPENDIX A: LISTING OF RELEASES

APPENDIX B: PRESENT VALUES: BENEFIT AND COSTS

APPENDIX C: NET PRESENT VALUE

APPENDIX D: T-TEST

APPENDIX A

OIL AND HAZARDOUS MATERIAL INCIDENTS FROM ABANDONED BARGES

YEAR	State	Description	Cost	Fund
1992	LA	Tank Barge(Bayou L'Eau Bleu)	\$ 890,163	OSLTF
	LA	Tank Barge, "Gail L"	\$ 1,300,000	CERCLA
		Total FY92	\$ 2,190,163	
1993	LA	Tank Barge, "Ken Adams # 3"	\$ 467,789	OSTLF
		Total FY93	\$ 467,789	
1994	N/A	None	N/A	
1995	WA	Tank Barge, (Name Unknown)	\$ 4,844	OSLTF
		Total FY95	\$ 4,844	
1996	MS	Tank Barge, (Name Unknown)	\$ 4,785	OSLTF
		Total FY96	\$ 4,785	
1997	LA	Abandoned Barge	\$ 10,000	OSLTF
	LA	Abandoned Barge	\$ 10,000	OSLTF
	LA	Abandoned Barge	\$ 250,000	OSLTF
		Total FY97	\$ 270,000	
		Total Costs	\$ 2,937,581	
		Average Annual Cost	\$ 429,890	

APPENDIX B

Cost 1 - Welding

	<u>No.</u>	<u>Cost per Barge</u>	<u>Total Cost</u>
Barges No Tow Required	17,000	\$ 506	\$ 8,602,000
Barge Tow Required	3,000	\$ 2,639	<u>\$ 7,917,000</u> +
			\$ 16,519,000 =
Certified Engineer Fee	20,000	\$ 400	<u>\$ 8,000,000</u> +
			Existing Barge Cost \$24,519,000 =

Time Period	Year	New Barges	Total Cost	Present Value	Cumulative Present Value
17	2001	513	5,080,424	4,437,439	4,437,439
18	2002	525	5,084,374	4,150,364	8,587,803
19	2003	536	5,088,110	3,881,695	12,469,498
20	2004	546	5,091,655	3,630,280	16,099,778
21	2005	556	5,095,027	3,395,032	19,494,810
22	2006	565	194,441	121,088	19,615,898
23	2007	574	197,513	114,954	19,730,852
24	2008	583	200,454	109,034	19,839,886
25	2009	591	203,275	103,335	19,943,221
26	2010	599	205,985	97,862	20,041,083
27	2011	606	208,593	92,618	20,133,701
28	2012	614	211,106	87,601	20,221,302
29	2013	621	213,531	82,811	20,304,113
30	2014	628	215,874	78,243	20,382,356
31	2015	634	218,140	73,892	20,456,248
32	2016	641	220,334	69,752	20,526,000
33	2017	647	222,460	65,818	20,591,818
34	2018	653	224,523	62,082	20,653,900
35	2019	659	226,526	58,539	20,712,439
36	2020	664	228,473	55,179	20,767,618
37	2021	670	230,366	51,997	20,819,615
38	2022	675	232,209	48,984	20,868,599
39	2023	680	234,004	46,133	20,914,732
40	2024	685	235,754	43,437	20,958,169
41	2025	690	237,460	40,890	20,999,059
42	2026	695	239,125	38,482	21,037,541
43	2027	700	240,751	36,209	21,073,750
44	2028	704	242,340	34,064	21,107,814
45	2029	709	243,893	32,040	21,139,854
46	2030	713	245,412	30,130	21,169,984

Discount Rate 7.0%
 Growth Rate 1.1%
 New Barge Cost \$ 344
 PV Total Cost \$ 21,169,984

APPENDIX B

Cost 2- Painting

No. Cost per Barge

Total Cost

20,000 \$ 215

4,300,000 +

Existing Barge Cost

4,300,000 =

Time Period	Year	New Barges	Repaint Barges	Total Cost	Present Value	Cumulative Present Value
17	2001	513		925,207	808,112	808,112
18	2002	525		926,665	756,435	1,564,547
19	2003	536		928,045	708,001	2,272,548
20	2004	546		929,353	662,616	2,935,164
21	2005	556		930,598	620,097	3,555,261
22	2006	565		71,785	44,704	3,599,965
23	2007	574		72,919	42,440	3,642,405
24	2008	583		74,005	40,254	3,682,659
25	2009	591		75,046	38,150	3,720,809
26	2010	599		76,047	36,129	3,756,938
27	2011	606	4,513	496,760	220,567	3,977,505
28	2012	614	4,525	498,756	206,966	4,184,471
29	2013	621	4,536	500,661	194,165	4,378,636
30	2014	628	4,546	502,484	182,123	4,560,759
31	2015	634	4,556	504,232	170,801	4,731,560
32	2016	641	565	133,911	42,393	4,773,953
33	2017	647	574	135,527	40,098	4,814,051
34	2018	653	583	137,083	37,905	4,851,956
35	2019	659	591	138,586	35,813	4,887,769
36	2020	664	599	140,037	33,821	4,921,590
37	2021	670	5,120	561,191	126,668	5,048,258
38	2022	675	5,139	563,619	118,894	5,167,152
39	2023	680	5,157	565,947	111,575	5,278,727
40	2024	685	5,174	568,185	104,688	5,383,415
41	2025	690	5,190	570,339	98,210	5,481,625
42	2026	695	1,206	200,416	32,253	5,513,878
43	2027	700	1,221	202,421	30,445	5,544,323
44	2028	704	1,235	204,361	28,726	5,573,049
45	2029	709	1,249	206,238	27,093	5,600,142
46	2030	713	1,263	208,058	25,544	5,625,686

Discount Rate 7.0%

Growth Rate 1.1%

New Barge Cost \$ 127

Repaint Cost \$ 93

PV Total Cost \$5,625,686

APPENDIX B

**Present Value Worksheet
Cost/Benefit-Scenario 1**

Discount Rate		7%
Yearly Removal Cost Recovery	\$	250,000
Yearly Cleanup Cost Recovery	\$	429,890
Benefit Subtotal	\$	679,890
Govt. Investigation Savings	\$	1,500
Total Yearly Benefit	\$	681,390
Total	\$	6,787,290

Year	Total Benefit	Present Value	Cumulative Present Value
2001	\$ 136,278	119,030	119,030
2002	\$ 272,556	222,487	341,517
2003	\$ 408,834	311,897	653,414
2004	\$ 545,112	388,657	1,042,071
2005	\$ 681,390	454,039	1,496,110
2006	\$ 681,390	424,335	1,920,445
2007	\$ 681,390	396,575	2,317,020
2008	\$ 681,390	370,631	2,687,651
2009	\$ 681,390	346,384	3,034,035
2010	\$ 681,390	323,723	3,357,758
2011	\$ 681,390	302,545	3,660,303
2012	\$ 681,390	282,753	3,943,056
2013	\$ 681,390	264,255	4,207,311
2014	\$ 681,390	246,967	4,454,278
2015	\$ 681,390	230,810	4,685,088
2016	\$ 681,390	215,711	4,900,799
2017	\$ 681,390	201,599	5,102,398
2018	\$ 681,390	188,410	5,290,808
2019	\$ 681,390	176,084	5,466,892
2020	\$ 681,390	164,565	5,631,457
2021	\$ 681,390	153,799	5,785,256
2022	\$ 681,390	143,737	5,928,993
2023	\$ 681,390	134,334	6,063,327
2024	\$ 681,390	125,546	6,188,873
2025	\$ 681,390	117,332	6,306,205
2026	\$ 681,390	109,656	6,415,861
2027	\$ 681,390	102,483	6,518,344
2028	\$ 681,390	95,778	6,614,122
2029	\$ 681,390	89,512	6,703,634
2030	\$ 681,390	83,656	6,787,290

APPENDIX B

**Present Value Worksheet
Cost/Benefit-Scenario 2**

Discount Rate		7%
Yearly Removal Cost Recovery	\$	250,000
Yearly Cleanup Cost Recovery	\$	429,890
Benefit Subtotal	\$	679,890
Expected Cost Recover (36%)	\$	244,760
Govt. Investigation Savings	\$	1,090
Total Yearly Benefit	\$	245,850
Total	\$	2,448,903

Year	Total Benefit	Present Value	Cumulative Present Value
2001	\$ 49,170	42,947	42,947
2002	\$ 98,340	80,275	123,222
2003	\$ 147,510	112,535	235,757
2004	\$ 196,680	140,230	375,987
2005	\$ 245,850	163,820	539,808
2006	\$ 245,850	153,103	692,911
2007	\$ 245,850	143,087	835,998
2008	\$ 245,850	133,726	969,724
2009	\$ 245,850	124,978	1,094,702
2010	\$ 245,850	116,802	1,211,504
2011	\$ 245,850	109,161	1,320,664
2012	\$ 245,850	102,019	1,422,684
2013	\$ 245,850	95,345	1,518,029
2014	\$ 245,850	89,107	1,607,136
2015	\$ 245,850	83,278	1,690,414
2016	\$ 245,850	77,830	1,768,244
2017	\$ 245,850	72,738	1,840,982
2018	\$ 245,850	67,980	1,908,962
2019	\$ 245,850	63,532	1,972,494
2020	\$ 245,850	59,376	2,031,870
2021	\$ 245,850	55,492	2,087,362
2022	\$ 245,850	51,861	2,139,223
2023	\$ 245,850	48,469	2,187,692
2024	\$ 245,850	45,298	2,232,990
2025	\$ 245,850	42,334	2,275,324
2026	\$ 245,850	39,565	2,314,889
2027	\$ 245,850	36,976	2,351,865
2028	\$ 245,850	34,557	2,386,423
2029	\$ 245,850	32,297	2,418,719
2030	\$ 245,850	30,184	2,448,903

APPENDIX C

Scenario 1 - Net Present Values

Year	Benefit Present Value	Alternative 1 Welding			Alternative 2 Painting		
		Cost Present Value	Net Present Value	Cumulative net Present Value	Cost Present Value	Net Present Value	Cumulative net Present Value
2001	119,030	4,437,439	\$ (4,318,409)	\$ (4,318,409)	\$ 808,112	\$ (689,082)	\$ (689,082)
2002	222,487	4,150,364	\$ (3,927,877)	\$ (8,246,286)	\$ 756,435	\$ (533,948)	\$ (1,223,030)
2003	311,897	3,881,695	\$ (3,569,798)	\$ (11,816,084)	\$ 708,001	\$ (396,104)	\$ (1,619,134)
2004	388,657	3,630,280	\$ (3,241,623)	\$ (15,057,707)	\$ 662,616	\$ (273,959)	\$ (1,893,093)
2005	454,039	3,395,032	\$ (2,940,993)	\$ (17,998,700)	\$ 620,097	\$ (166,058)	\$ (2,059,151)
2006	424,335	121,088	\$ 303,247	\$ (17,695,453)	\$ 44,704	\$ 379,631	\$ (1,679,520)
2007	396,575	114,954	\$ 281,621	\$ (17,413,832)	\$ 42,440	\$ 354,135	\$ (1,325,385)
2008	370,631	109,034	\$ 261,597	\$ (17,152,235)	\$ 40,254	\$ 330,377	\$ (995,008)
2009	346,384	103,335	\$ 243,049	\$ (16,909,186)	\$ 38,150	\$ 308,234	\$ (686,774)
2010	323,723	97,862	\$ 225,861	\$ (16,683,325)	\$ 36,129	\$ 287,594	\$ (399,180)
2011	302,545	92,618	\$ 209,927	\$ (16,473,398)	\$ 220,567	\$ 81,978	\$ (317,202)
2012	282,753	87,601	\$ 195,152	\$ (16,278,246)	\$ 206,966	\$ 75,787	\$ (241,415)
2013	264,255	82,811	\$ 181,444	\$ (16,096,802)	\$ 194,165	\$ 70,090	\$ (171,325)
2014	246,967	78,243	\$ 168,724	\$ (15,928,078)	\$ 182,123	\$ 64,844	\$ (106,481)
2015	230,810	73,892	\$ 156,918	\$ (15,771,160)	\$ 170,801	\$ 60,009	\$ (46,472)
2016	215,711	69,752	\$ 145,959	\$ (15,625,201)	\$ 42,393	\$ 173,318	\$ 126,846
2017	201,599	65,818	\$ 135,781	\$ (15,489,420)	\$ 40,098	\$ 161,501	\$ 288,347
2018	188,410	62,082	\$ 126,328	\$ (15,363,092)	\$ 37,905	\$ 150,505	\$ 438,852
2019	176,084	58,539	\$ 117,545	\$ (15,245,547)	\$ 35,813	\$ 140,271	\$ 579,123
2020	164,565	55,179	\$ 109,386	\$ (15,136,161)	\$ 33,821	\$ 130,744	\$ 709,867
2021	153,799	51,997	\$ 101,802	\$ (15,034,359)	\$ 126,668	\$ 27,131	\$ 736,998
2022	143,737	48,984	\$ 94,753	\$ (14,939,606)	\$ 118,894	\$ 24,843	\$ 761,841
2023	134,334	46,133	\$ 88,201	\$ (14,851,405)	\$ 111,575	\$ 22,759	\$ 784,600
2024	125,546	43,437	\$ 82,109	\$ (14,769,296)	\$ 104,688	\$ 20,858	\$ 805,458
2025	117,332	40,890	\$ 76,442	\$ (14,692,854)	\$ 98,210	\$ 19,122	\$ 824,580
2026	109,656	38,482	\$ 71,174	\$ (14,621,680)	\$ 32,253	\$ 77,403	\$ 901,983
2027	102,483	36,209	\$ 66,274	\$ (14,555,406)	\$ 30,445	\$ 72,038	\$ 974,021
2028	95,778	34,064	\$ 61,714	\$ (14,493,692)	\$ 28,726	\$ 67,052	\$ 1,041,073
2029	89,512	32,040	\$ 57,472	\$ (14,436,220)	\$ 27,093	\$ 62,419	\$ 1,103,492
2030	83,656	30,130	\$ 53,526	\$ (14,382,694)	\$ 25,544	\$ 58,112	\$ 1,161,604

APPENDIX C

Scenario 2 - Net Present Values

Year	Benefit Present Value	Alternative 1 Welding			Alternative 2 Painting		
		Cost Present Value	Net Present Value	Cumulative net Present Value	Cost Present Value	Net Present Value	Cumulative net Present Value
2001	\$ 42,947	\$ 4,437,439	\$ (4,394,492)	\$ (4,394,492)	\$ 808,112	\$ (765,165)	\$ (765,165)
2002	\$ 80,275	\$ 4,150,364	\$ (4,070,089)	\$ (8,464,581)	\$ 756,435	\$ (676,160)	\$ (1,441,325)
2003	\$ 112,535	\$ 3,881,695	\$ (3,769,160)	\$ (12,233,741)	\$ 708,001	\$ (595,466)	\$ (2,036,791)
2004	\$ 140,230	\$ 3,630,280	\$ (3,490,050)	\$ (15,723,791)	\$ 662,616	\$ (522,386)	\$ (2,559,177)
2005	\$ 163,820	\$ 3,395,032	\$ (3,231,212)	\$ (18,955,002)	\$ 620,097	\$ (456,277)	\$ (3,015,453)
2006	\$ 153,103	\$ 121,088	\$ 32,015	\$ (18,922,987)	\$ 44,704	\$ 108,399	\$ (2,907,054)
2007	\$ 143,087	\$ 114,954	\$ 28,133	\$ (18,894,854)	\$ 42,440	\$ 100,647	\$ (2,806,407)
2008	\$ 133,726	\$ 109,034	\$ 24,692	\$ (18,870,162)	\$ 40,254	\$ 93,472	\$ (2,712,935)
2009	\$ 124,978	\$ 103,335	\$ 21,643	\$ (18,848,519)	\$ 38,150	\$ 86,828	\$ (2,626,107)
2010	\$ 116,802	\$ 97,862	\$ 18,940	\$ (18,829,579)	\$ 36,129	\$ 80,673	\$ (2,545,434)
2011	\$ 109,161	\$ 92,618	\$ 16,543	\$ (18,813,037)	\$ 220,567	\$ (111,406)	\$ (2,656,841)
2012	\$ 102,019	\$ 87,601	\$ 14,418	\$ (18,798,618)	\$ 206,966	\$ (104,947)	\$ (2,761,787)
2013	\$ 95,345	\$ 82,811	\$ 12,534	\$ (18,786,084)	\$ 194,165	\$ (98,820)	\$ (2,860,607)
2014	\$ 89,107	\$ 78,243	\$ 10,864	\$ (18,775,220)	\$ 182,123	\$ (93,016)	\$ (2,953,623)
2015	\$ 83,278	\$ 73,892	\$ 9,386	\$ (18,765,834)	\$ 170,801	\$ (87,523)	\$ (3,041,146)
2016	\$ 77,830	\$ 69,752	\$ 8,078	\$ (18,757,756)	\$ 42,393	\$ 35,437	\$ (3,005,709)
2017	\$ 72,738	\$ 65,818	\$ 6,920	\$ (18,750,836)	\$ 40,098	\$ 32,640	\$ (2,973,069)
2018	\$ 67,980	\$ 62,082	\$ 5,898	\$ (18,744,938)	\$ 37,905	\$ 30,075	\$ (2,942,994)
2019	\$ 63,532	\$ 58,539	\$ 4,993	\$ (18,739,945)	\$ 35,813	\$ 27,719	\$ (2,915,275)
2020	\$ 59,376	\$ 55,179	\$ 4,197	\$ (18,735,748)	\$ 33,821	\$ 25,555	\$ (2,889,720)
2021	\$ 55,492	\$ 51,997	\$ 3,495	\$ (18,732,253)	\$ 126,668	\$ (71,176)	\$ (2,960,896)
2022	\$ 51,861	\$ 48,984	\$ 2,877	\$ (18,729,376)	\$ 118,894	\$ (67,033)	\$ (3,027,929)
2023	\$ 48,469	\$ 46,133	\$ 2,336	\$ (18,727,040)	\$ 111,575	\$ (63,106)	\$ (3,091,035)
2024	\$ 45,298	\$ 43,437	\$ 1,861	\$ (18,725,179)	\$ 104,688	\$ (59,390)	\$ (3,150,425)
2025	\$ 42,334	\$ 40,890	\$ 1,444	\$ (18,723,735)	\$ 98,210	\$ (55,876)	\$ (3,206,301)
2026	\$ 39,565	\$ 38,482	\$ 1,083	\$ (18,722,652)	\$ 32,253	\$ 7,312	\$ (3,198,989)
2027	\$ 36,976	\$ 36,209	\$ 767	\$ (18,721,885)	\$ 30,445	\$ 6,531	\$ (3,192,458)
2028	\$ 34,557	\$ 34,064	\$ 493	\$ (18,721,391)	\$ 28,726	\$ 5,831	\$ (3,186,626)
2029	\$ 32,297	\$ 32,040	\$ 257	\$ (18,721,135)	\$ 27,093	\$ 5,204	\$ (3,181,423)
2030	\$ 30,184	\$ 30,130	\$ 54	\$ (18,721,081)	\$25,544	\$ 4,640	\$ (3,176,783)

APPENDIX D

T-TEST

Year	Number of Barges Constructed	Number of observations	Number of barges forecasted
1985	132	1	-101.270000
1986	105	2	124.169189
1987	115	3	256.042661
1988	306	4	349.608378
1989	486	5	422.183587
1990	708	6	481.481850
1991	613	7	531.617817
1992	578	8	575.047567
1993	447	9	613.355322
1994	477	10	647.622776
1995	446	11	678.621459
1996	1,026	12	706.921039
1997	1,432	13	732.954129
1998	890	14	757.057006
1999	910	15	779.496247

t-Test: Two-Sample Assuming Unequal Variances

	<i>No. of Barges Constructed</i>	
Mean	578.0667	503.6606
Variance	137140.1	64683.17
Observations	15	15
Hypothesized Mean Difference	0	
df	25	
t Stat	0.641458	
P(T<=t) one-tail	0.263531	
t Critical one-tail	1.70814	
P(T<=t) two-tail	0.527063	
t Critical two-tail	2.059537	