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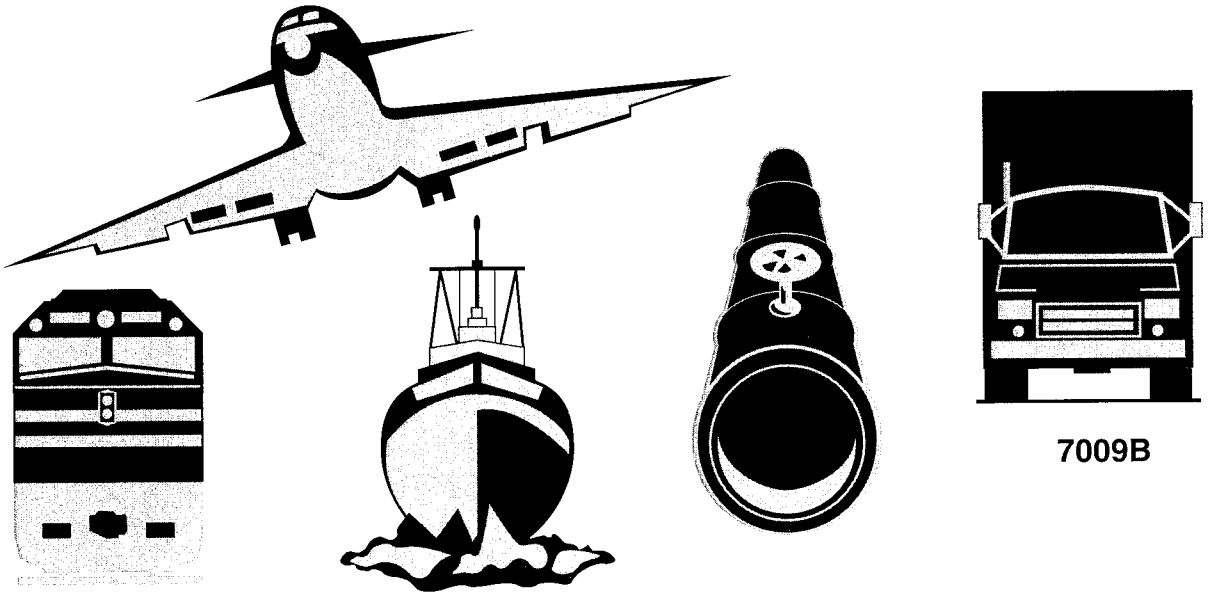
NTSB/MAR-00/01

NATIONAL TRANSPORTATION SAFETY BOARD

WASHINGTON, D.C. 20594

MARINE ACCIDENT REPORT

Ramming of the Eads Bridge by Barges In Tow of the M/V *Anne Holly* With Subsequent Ramming and Near Breakaway of the *President Casino on the Admiral*
St. Louis Harbor, Missouri
April 4, 1998



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Adopted September 8, 2000

National Transportation Safety Board
490 L'Enfant Plaza, S.W.
Washington, D.C. 20594

National Transportation Safety Board. 2000. *Ramming of the Eads Bridge by Barges in Tow of the M/V* Anne Holly *With Subsequent Ramming and Near Breakaway of the* President Casino on the Admiral, *St. Louis Harbor, Missouri, April 4, 1998.* Marine Accident Report NTSB/MAR-00/01. Washington, DC.

Abstract: On April 4, 1998, a tow of the M/V *Anne Holly*, which was traveling northbound on the Mississippi River through the St. Louis Harbor, struck the Missouri-side pier of the center span of the Eads Bridge. Eight barges broke away and drifted back through the Missouri span. Three of these barges drifted toward the *President Casino on the Admiral* (*Admiral*), a permanently moored gaming vessel below the bridge on the Missouri side of the river. The drifting barges struck the moored *Admiral*, causing most of its mooring lines to break. The *Admiral* then rotated away from the Missouri riverbank. The captain of the *Anne Holly* disengaged his vessel from the remaining barges in the tow and placed the *Anne Holly*'s bow against the *Admiral*'s bow to hold it against the bank. No deaths resulted from the accident; 50 people were examined for minor injuries. Of those examined, 16 were sent to local hospitals for further treatment.

The safety issues discussed in the report are: the advisability of the *Anne Holly* captain's decision to make the upriver transit and the effectiveness of safety management oversight on the part of American Milling, L.P.; the effectiveness of safety measures provided for the permanently moored vessel *President Casino on the Admiral*; and the adequacy of public safety for permanently moored vessels.

As a result of this investigation, the National Transportation Safety Board made safety recommendations to the U.S. Coast Guard, the Research and Special Programs Administration, the States of Missouri and Illinois, the cities of St. Louis and East St. Louis, the National League of Cities, the American Association of Port Authorities, the American Gas Association, the American Public Gas Association, President Casinos, Inc., Laclede Gas Company, and American Milling, L.P.

Contents

Acronyms and Abbreviations

ABS	American Bureau of Shipping
Admiral	*President Casino on the Admiral*
AM	American Milling
AWO	American Waterways Operators
BOCA Code	Building Officials and Code Administrators Basic Fire Prevention Code
CFR	*Code of Federal Regulations*
COTP	Coast Guard Captain of the Port
ERT	Emergency Response Team
hp	horsepower
LMR	Lower Mississippi River
MLK	Martin Luther King
MSM	*U.S. Coast Guard Marine Safety Manual*
MSO	Coast Guard Marine Safety Office
NFESC	Naval Facilities Engineering Service Center
NFPA	National Fire Protection Association
OCMI	Officer in Charge of Marine Inspection
PARI	Port Activity Risk Index
PMV	permanently moored vessel
PVA	Passenger Vessel Association
RCP	Responsible Carrier Program
RSPA	Research and Special Programs Administration
SLFD	St. Louis Fire Department
U.S.C.	*United States Code*
UMR	Upper Mississippi River
USACE	U.S. Army Corps of Engineers

Executive Summary

About 1950 on April 4, 1998, a tow of the M/V *Anne Holly*, comprising 12 loaded and 2 empty barges, which was traveling northbound on the Mississippi River through the St. Louis Harbor, struck the Missouri-side pier of the center span of the Eads Bridge. Eight barges broke away from the tow and drifted back through the Missouri span. Three of these barges drifted toward the *President Casino on the Admiral* (*Admiral*), a permanently moored gaming vessel below the bridge on the Missouri side of the river. The drifting barges struck the moored *Admiral*, causing 8 of its 10 mooring lines to break. The *Admiral* then rotated clockwise downriver, away from the Missouri riverbank. The captain of the *Anne Holly* disengaged his vessel from the six remaining barges in the tow and placed the *Anne Holly*'s bow against the *Admiral*'s bow to hold it against the bank. About the time the *Anne Holly* began pushing against the *Admiral*, the *Admiral*'s next-to-last mooring line parted. The *Anne Holly* and the single mooring wire that remained attached to the *Admiral*'s stern anchor held the *Admiral* near the Missouri bank. No deaths resulted from the accident; 50 people were examined for minor injuries. Of those examined, 16 were sent to local hospitals for further treatment. Damages were estimated at $11 million.

The National Transportation Safety Board determines that the probable cause of the ramming of the Eads Bridge in St. Louis Harbor by barges in tow of the *Anne Holly* and the subsequent breakup of the tow was the poor decision-making of the captain of the *Anne Holly* in attempting to transit St. Louis Harbor with a large tow, in darkness, under high current and flood conditions, and the failure of the management of American Milling, L.P., to provide adequate policy and direction to ensure the safe operation of its towboats.

The National Transportation Safety Board also determines that the probable cause of the near breakaway of the *President Casino on the Admiral* was the failure of the owner, the local and State authorities, and the U.S. Coast Guard to adequately protect the permanently moored vessel from waterborne and current-related risks.

The Safety Board's investigation identified the following major safety issues:

- the advisability of the *Anne Holly* captain's decision to make the upriver transit and the effectiveness of safety management oversight on the part of American Milling, L.P.,
- the effectiveness of safety measures provided for the permanently moored vessel *President Casino on the Admiral*, and
- the adequacy of public safety for permanently moored vessels.

As a result of this investigation, the Safety Board made safety recommendations to the U.S. Coast Guard, the Research and Special Programs Administration, the States of Missouri and Illinois, the cities of St. Louis and East St. Louis, the National League of

Cities, the American Association of Port Authorities, the American Gas Association, the American Public Gas Association, President Casinos, Inc., Laclede Gas Company, and American Milling, L.P.

Factual Information

The Accident

The towboat *Anne Holly*, owned by American Milling, L.P., (AM) began its 1998 operating season on the Upper Mississippi River (UMR)[1] on March 9, 1998. According to its log, the *Anne Holly* transited southbound through St. Louis Harbor about 0850[2] on April 4 and arrived at the Eagle fleeting area[3] at mile 177.6 UMR at 0930. (See figure 1.)

About 1710 on April 4, the *Anne Holly*'s captain[4] relieved the pilot on watch. At this time, the tow was being made up and the barges were being secured to each other with extra rigging because of the prevailing river conditions. About 1830, the *Anne Holly* got underway from the fleeting area, heading upstream for St. Paul, Minnesota, (mile 839.0) pushing 12 loaded and 2 empty barges.

The tow was five barges long in the port side or string, five barges long in the center string, and four barges long in the starboard string.[5] Except for the two empty barges on the forward end of the starboard string, all the barges contained dry cargo (mostly fertilizer) and carried 981 to 1,696 tons of cargo each. All 14 barges were 35 feet wide; 11 barges were 200 feet long, and the remaining 3 barges were 195 feet long. The complete tow, including the 154-foot-long towboat (secured at the after-center of the tow), was 1,149 feet long and 105 feet wide. (See figure 2.)

The river current at St. Louis was running about 6 mph at a river gage of 31.6 feet.

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[1] For navigation purposes, the Mississippi River is divided into the Lower Mississippi River (LMR) and the UMR. The LMR extends from the Gulf of Mexico to the confluence of the Ohio and Mississippi Rivers, near Cairo, Illinois. The UMR extends north from the Ohio River to the head of navigation at Minneapolis, Minnesota. All river miles along the UMR are measured in statute miles northbound from mile 0 near Cairo to mile 857.6 at Minneapolis.

[2] Unless otherwise noted, all times are central standard and are based on the 24-hour clock. Daylight savings time began at 0200 on April 5, 1998.

[3] A *fleeting area* is where barges are kept until picked up by tows. Barges are dropped off and picked up by line-haul towboats at these locations. The areas consist of an anchor barge to which the other barges are moored. Small towboats, also known as harbor or fleet boats, shift the barges around to make them accessible for making up tows.

[4] The terms *captain* and *pilot* are routinely used on river towboats, and here they are used to differentiate between the *Anne Holly*'s two operators. The captain was the senior licensed operator and was in charge of the vessel. Each operator had, and was required to have, a Coast Guard license as an operator of uninspected towing vessels.

[5] Due to the size of locks (110 feet wide by 600 feet long) on the UMR, the sizes of dry cargo tows tend to be limited to a maximum of about 15 barges (5 barges long and 3 barges wide). Because barges are about 35 feet wide and 195 or 200 feet long, such a tow would measure about 1,000 feet long and 105 feet wide. Such a tow would have to make a double lockage to pass a lock. In this procedure, the tow is split at nine barges and locked through; then the remainder of the tow goes through the lock. After both segments lock through, the tow is reconnected to continue its trip.

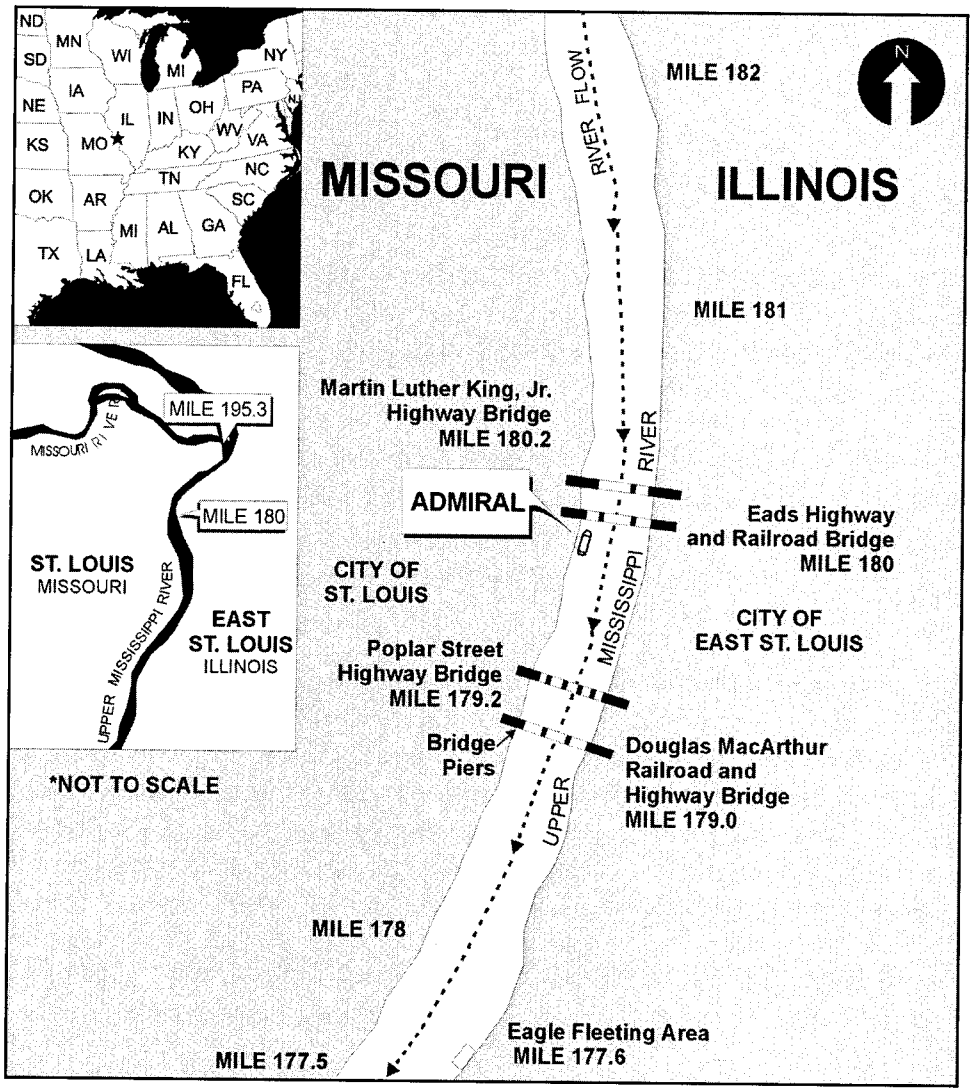

Figure 1. Map showing accident area

The captain said that, after leaving the Eagle fleeting area, he radioed the fleet to request a helper boat[6] to assist the *Anne Holly* through the four upcoming bridges. The only Eagle fleet boat working that evening was carrying out other activities, and the *Anne Holly* captain was told that a fleet helper boat was not available. Around 1900, the tow passed under the Douglas MacArthur and Poplar Street Bridges, miles 179.0 and 179.2 UMR, respectively. The captain said the passings were uneventful and the equipment on the vessel was operating satisfactorily.

With respect to the transit of St. Louis Harbor, the captain told investigators, "Once I cleared Poplar Street [Bridge], I didn't think I'd have no problem at all." He also said, "If you can shove up these two bridges [MacArthur and Poplar] in high water like we

[6] A *helper boat* is a harbor or fleeting towboat that can either be secured to the forward or aft part of the tow, wait ahead of the tow, or follow alongside the tow to assist, if needed, in controlling the tow.

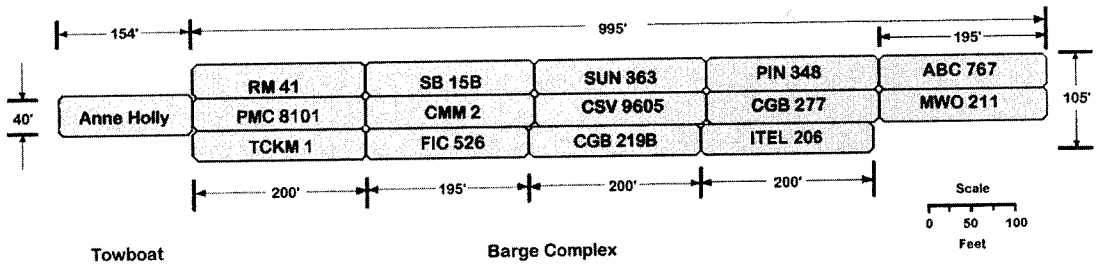

Figure 2. Schematic of the *Anne Holly* tow barges

have now, the rest of the bridges are simple." When investigators asked the captain whether he had thought he needed a helper boat in making this passage, he stated that he might have needed one for the MacArthur and Poplar Street Bridge transits but not after he had cleared the Poplar Street Bridge.

The captain told investigators that he had maneuvered the tow northbound through St. Louis Harbor at full engine throttle (about 900 rpm on both engines), making about 3 mph against the river current. According to the chief engineer, the captain asked him to set the fuel rack to provide the maximum engine power before the *Anne Holly* got near the bridges. The engineer complied with the request, and the captain made no comments about inadequate engine power.

The *Anne Holly*'s chief engineer testified that he was in the engineroom during the transit through St. Louis Harbor (including the passage under the Eads Bridge), and that the two propulsion engines, the electrical generators, the steering gear, and other engineroom equipment experienced no problems. The chief engineer testified that the readings shown on the engineroom log for April 4, 1998, which recorded engine rpms, fuel rack settings, and temperatures and pressures for engine cooling water and lubricating oil, were normal. He also stated that since he had come aboard the vessel on March 8, 1998, he had not experienced any problems with the propulsion engines; he had performed only routine maintenance.

A little before 1950 on April 4, 1998, the tow approached the Eads Bridge, mile 180.0 UMR. The captain later recalled, "Everything was looking good. Everything was under control. The boat was doing well." The captain said that he did not have any trouble seeing the dayboards[7] and the fixed green light at the center of the Eads Bridge. He said he illuminated the dayboards with his searchlight.

The captain told investigators that he directed the tow to the right of the center of the Eads Bridge center span.[8] According to the *Anne Holly*'s first mate (non-navigating

[7] A *dayboard* is an unlighted aid to navigation designed primarily for daytime use; dayboards are coated with retroreflective material for nighttime use (with searchlights).

[8] The bridge's three spans, facing north, are the Missouri (left side, 498 feet wide), the center (517 feet wide), and the Illinois (right side, 498 feet wide).

person in charge of the deck), the vessel's steering light[9] was not lit. The captain said that by using visual "marks" (the Eads and Martin Luther King Memorial Bridge lights and other visual points), he maneuvered the *Anne Holly* close to the middle of the arched center span because the arch apex could best accommodate the towboat's height. He said he thought the vessel had about 8 feet of vertical clearance. The captain testified that when 300 to 400 feet of the tow had passed under the Eads Bridge, he could feel the tow begin to slow. He said he continued to use the vessel's full power to move the tow through the bridge.

The captain said that as the eight forward barges (three port, three center, and two starboard), which comprised about 600 feet of the tow, passed under the center span, the *Anne Holly* "stalled" (the tow's forward movement was halted by the river current). When asked by investigators about the reason for the halt, the captain said that he believed a "pop rise"[10] had occurred, which impeded the vessel's forward progress. The captain said that the towboat was using its maximum engine power of 900 rpm, but it could not overcome the current in the bridge span. He said that, with the headway stopped, a current then caused the tow to drift sideways toward the Missouri shore. Within 30 seconds, the tow's port side (between the third and fourth barge from the tow's head) struck the Missouri-side pier of the Eads Bridge center span.

About 1950, just after the tow struck the bridge, the forward eight barges broke away from the tow and drifted back down through the Missouri span. Three of these barges began drifting toward the 380-foot-long *President Casino on the Admiral (Admiral)*, which is a gaming vessel and attached entry barge[11] permanently moored by 10 mooring wires below the Eads Bridge on the Missouri side of the river.[12] (See figure 3. See figure 4 for a schematic of the *Admiral* complex.) The captain of the *Anne Holly* immediately notified the Coast Guard Group UMR in Keokuk, Iowa, on VHF-FM radio of the accident. He also attempted to call the *Admiral* on VHF-FM radio to warn it of the loose barges, but he received no response.

Across the river, the master on watch on the M/V *Casino Queen* (a passenger vessel that periodically gets underway for gaming) overheard the *Anne Holly*'s radio

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[9] A *steering light* is a small blue light installed on a pole placed on the centerline at the head of the tow facing aft. The operator may use the light to detect heading changes and to align the tow with respect to a bridge or other restricted navigation area during periods of darkness.

[10] The *Anne Holly* captain said, "there are two types of rises, the slow rise [in river stage or level], you don't have as much current. You have a more steady current. A pop rise is a rise [in river stage or level] that comes up a lot swifter...it brings gushes of water at time." A pamphlet on the "Language of the Western Rivers," published by the U.S. Coast Guard in the early 1970s, defines a pop rise as "a fast rise (usually not a great one) in the river generally caused by flash flood."

[11] The *Admiral*'s owner told the Safety Board that the entry barge was actually two custom-built barges connected end to end. For the purposes of this report, we refer to this unit as the entry barge.

[12] The floating entry barge has three gangways to shore; the center gangway is for passengers, while the forward and aft ones are for services. The passengers move from shore over the gangways onto the entry barge and then onto the *Admiral*. The *Admiral* and the entry barge are physically secured to each other. For the purposes of this report, the whole complex, including entry barge and vessel, will be generally considered the *Admiral*.

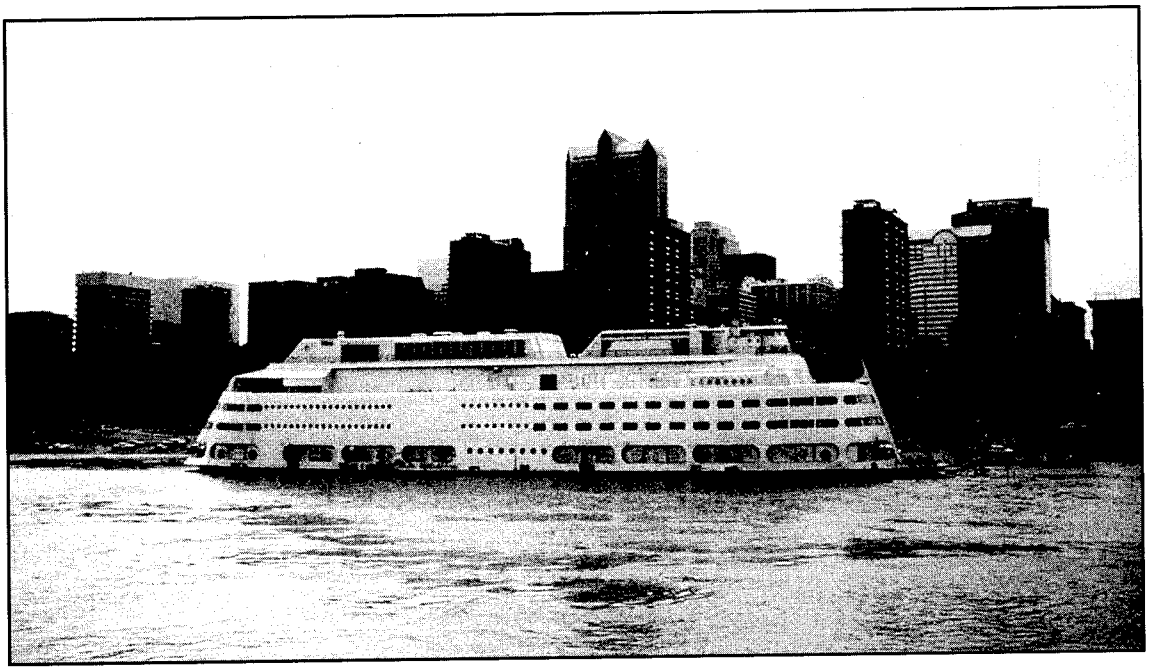

Figure 3. Photo of the *Admiral*

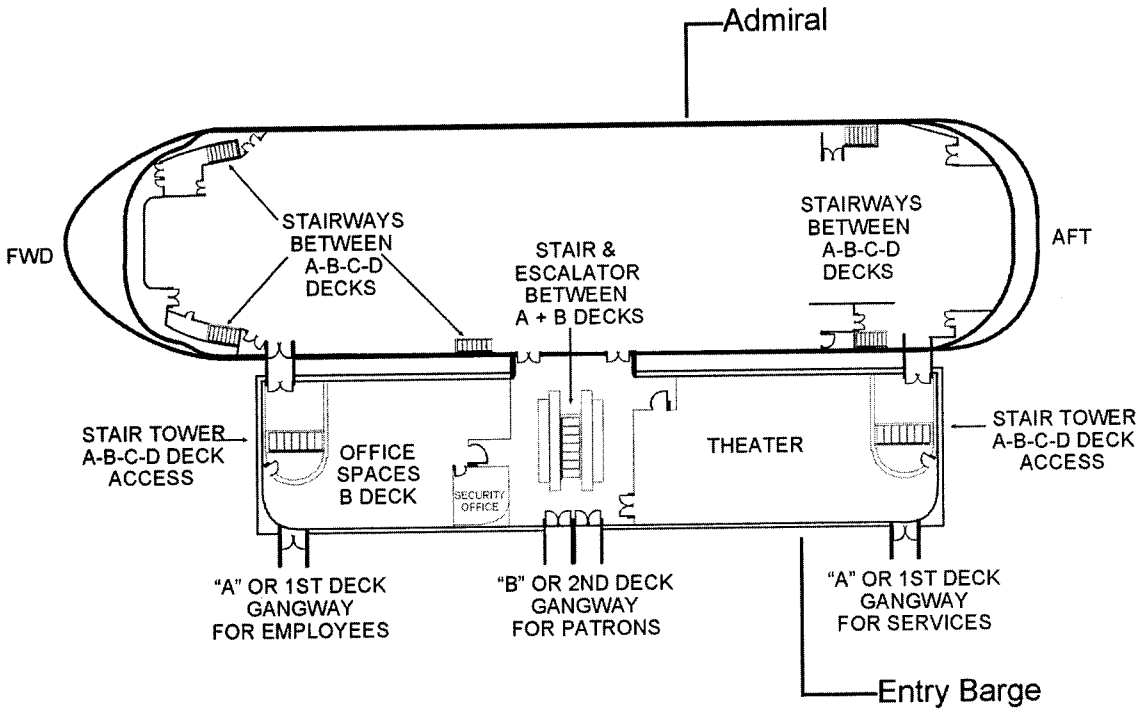

Figure 4. Schematic of the *Admiral* complex

attempts to contact the *Admiral*. He called the captain of the *Anne Holly* and advised him that the *Admiral* did not have a radio and that people were on the vessel.

Shortly thereafter, the three barges from the *Anne Holly* drifted toward the *Admiral* and severed or severely damaged mooring line numbers 8, 9, and 10 at the *Admiral*'s bow, before colliding with the *Admiral*. At least two of the three barges struck the *Admiral*, and two barges drifted downriver. The third barge drifted toward shore and struck the sidewalk protection guards and the north gangway between the shore and the entry barge. The impact to the *Admiral* caused wire rope numbers 1, 2, 3, 4, and 5 to break. (Figure 5 details the mooring arrangement. Figure 6 shows two views of the complex.)

Almost immediately, the *Admiral* began moving offshore and slowly rotated with the current clockwise downriver, away from the Missouri shoreline. The three gangways (which remained attached to the entry barge) were damaged, and the *Admiral*'s electrical, natural gas, telephone, and water service lines parted about 1954.[13]

The *Casino Queen* master on watch radioed the *Anne Holly* captain and told him that the *Admiral* was drifting. After receiving the radio call, the captain of the *Anne Holly* disengaged his vessel from the six remaining barges in the tow. He then moved his vessel downriver to the *Admiral* and, about 1959, placed the *Anne Holly*'s bow against the *Admiral*'s bow to keep it near the bank. According to the chief engineer on the *Admiral*, wire rope number 6 broke about the time the *Anne Holly* began pushing against the *Admiral*.

After being notified of the emergency by President Casinos[14] personnel, about 1957, a St. Louis Fire Department (SLFD) team arrived at the scene at 2005. The SLFD deputy chief assumed responsibility as the incident commander and found that the *Admiral* appeared to be "stable." He ordered *Admiral* engineering personnel to inspect the hull; they subsequently told him that the *Admiral* was not taking on water.

Once the *Admiral* was stabilized against the bank, patrons from the *Admiral* were evacuated to the *Anne Holly*. At first, the evacuation took place over a foot-wide plank between the two vessels. Later, the people evacuated to the towboat using a ramp provided by the SLFD. From the *Anne Holly*, the patrons transferred to two excursion vessels, the *Becky Thatcher* and the *Tom Sawyer*, and subsequently to shore. The evacuation process took about 3 1/2 hours.

Upon hearing the radio transmissions from the *Anne Holly*, at least seven towboats from various fleeting areas south of the MacArthur Bridge responded to the scene to capture the loose barges drifting down the river. By 2050, all 14 barges had been retrieved and secured to fleeting areas.

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[13] Times for events occurring after the *Admiral* was struck were derived by investigators using President Casinos, Inc.'s onboard security videos and electric company records. Electrical power was partially restored within 5 seconds, when the *Admiral*'s emergency generators activated.

[14] The *Admiral* is owned by President Riverboat Casino-Missouri, Inc., which is a subsidiary of President Casinos, Inc. For the purposes of this report, we will generally use the term "President Casinos" to refer to the ownership of the *Admiral*, unless a distinction between the two firms seems necessary.

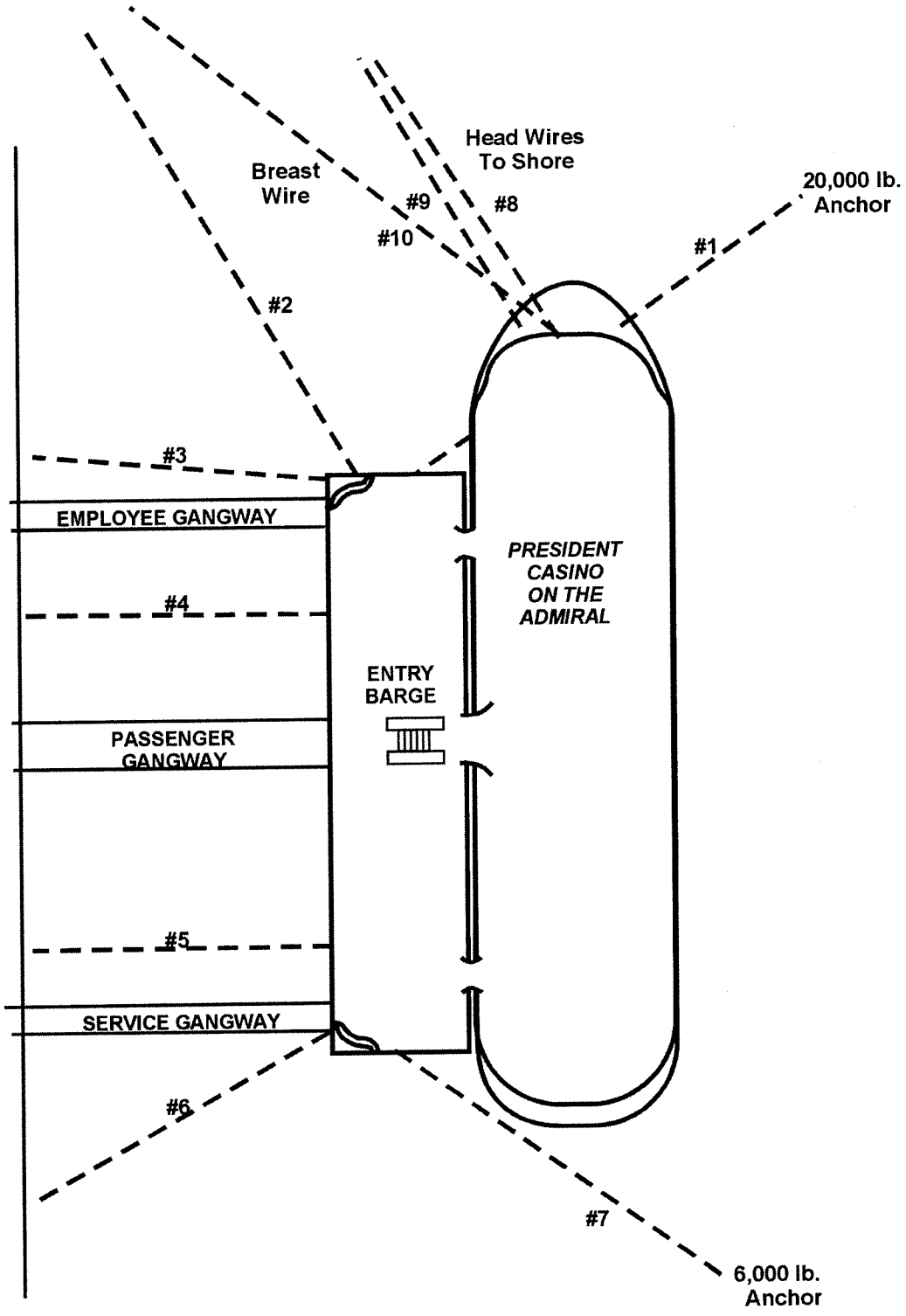

Figure 5. Schematic of the *Admiral* mooring arrangement

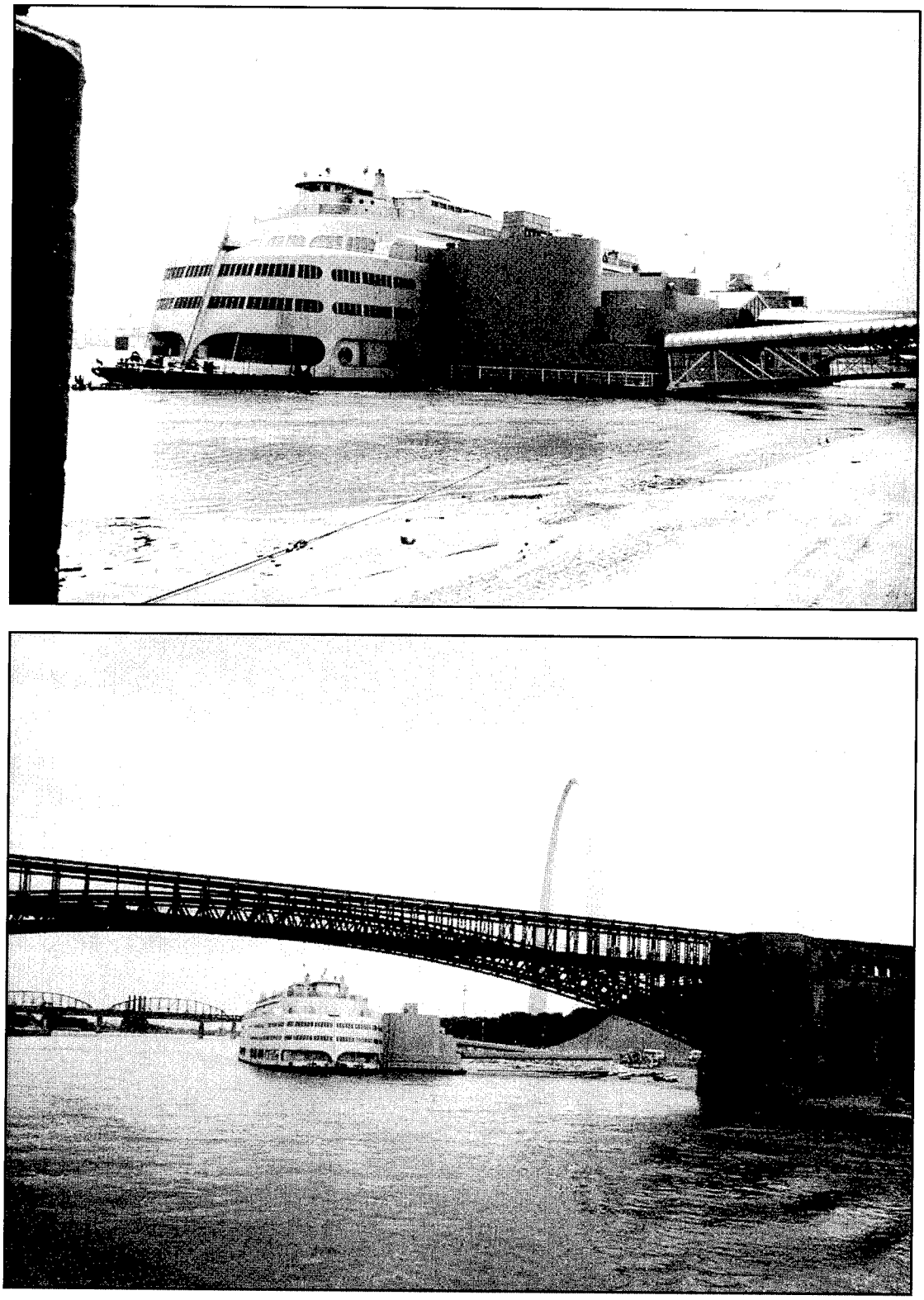

Figure 6. Two views of the *Admiral* complex

Emergency Response

President Casinos

About 1951 on April 4, 1998, a night security officer assigned to President Casino, Inc.'s, main office on North 1st Street (a few blocks upriver of the *Admiral*) heard a towboat blowing its whistle. He went to a nearby office with a view of the harbor, from which he observed sparks caused by the *Anne Holly*'s barges striking against the concrete pier of the Eads Bridge. He immediately telephoned the *Admiral*'s security office.

The *Admiral*'s senior shift manager received the warning telephone call from shore. He left the security office on the entry barge and went down one deck to the north (employee) gangway. Looking northward, he saw three barges about 50 yards upstream heading downriver and directly toward the *Admiral.* Realizing that impact was imminent, he sent a warning message by walkie-talkie to all *Admiral* security personnel, who were equipped with walkie-talkies, that loose barges were heading toward the *Admiral* and to prepare for impact. The senior shift manager stated that, after giving the warning, he ran down the north gangway onto some nearby scaffolding (which had been used during the high water as a temporary means of access to the entry barge gangway) and began ushering people toward shore.[15]

As soon as they were aware of the approach of the breakaway barges, center gangway security personnel[16] began ushering patrons back down the gangway and up the temporary scaffolding along L.K. Sullivan Boulevard. Testimony indicated that at least two elderly individuals among the patrons near the center gangway were using walkers and required security officer assistance to get them off the gangway.

At some time during this activity, the barges struck the *Admiral.* About 1957, the President Casinos shoreside office took action to notify the SLFD and the St. Louis City Police Department of the accident.

As he ushered patrons up the scaffolding, the senior shift manager used his walkie-talkie to tell the *Admiral*'s security dispatch office (on the north gangway) to call 911. The dispatcher told the senior shift manager that the vessel's telephone lines were dead.

Following the barge strikes, vessel engineering personnel closed all watertight doors below deck, inspected all compartments below deck for leaks, and ensured that the emergency generators were operating properly. When the *Anne Holly* arrived and pushed against the *Admiral* to hold it in place near the riverbank about 1959, security personnel began moving patrons from the "B," "C," and "D" decks down to the "A" deck and toward the starboard forward doors.

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[15] *Admiral* security personnel estimated that about 100 people had been on the center gangway and nearby scaffolding before the initial impact.

[16] Five security personnel were assigned to the center gangway. Their primary responsibilities were to check patron ages, prevent unruly people from boarding, and control the crowd.

When the *Admiral* began to break away from shore, the senior shift manager was on shore. He returned to the *Admiral* about 2145, transferring from the *Becky Thatcher.*

Admiral security personnel told investigators that they carried out at least five deck-by-deck security sweeps of the *Admiral* in the hours following the accident, looking for stray, lost, or injured patrons.

Police

City. St. Louis police personnel arrived on the scene about 2000 and saw the *Anne Holly* holding the *Admiral* in place. About 30 additional St. Louis police officers were dispatched to the scene.

State. When he saw the accident sequence begin, a Missouri State police gaming officer assigned to the *Admiral*,[17] who was ashore at the time of the accident, ran to a parking garage about 1/4 mile away and asked the attendant to call 911. (The attendant was unable to complete the call.) The gaming officer then ran to the State Gaming Commission's patrol car, which was parked on the upper level of the garage, to use his department's cellular phone. He was unable to do so because he did not have the cellular phone password. He then drove another patrol car out of the garage (for better radio reception) and, at 2002, used the car's radio to notify the Missouri State police dispatcher of the accident and of possible people in the water. The Missouri State police dispatcher notified the State Water Patrol, the Coast Guard, the SLFD, the St. Louis City Police Department, and local State police units. Shortly thereafter, the Missouri State police dispatched a police helicopter and six crowd management personnel to the scene.

Fire Department

An SLFD deputy chief and SLFD personnel and equipment (a marine task force, five quint firefighting apparatuses,[18] one heavy rescue squad, and two battalion chiefs) arrived on the scene at 2005 and established an incident command post and a medical triage area. Rescue squads and 12 ambulances arrived shortly thereafter. More than 48 units (including 15 ambulances) and 65 people (including 35 medics and technicians and 1 medical physician) ultimately responded to the emergency.

The fire department also provided a 32-foot-long fire and rescue boat. This boat was later used to transport SLFD personnel to the *Admiral* and to move patrons with medical complaints and injuries ashore. According to SLFD logs, responders examined 50 people who had medical complaints and transported 16 to area hospitals for further treatment of disorders including chest pains, dizziness, lumbar strain, and abdominal pain. Most were released shortly thereafter. (One person remained in the hospital because of a pre-existing heart condition.)

[17] A *State gaming officer* is a Missouri State trooper on board the vessel to ensure that the State receives its proper tax revenues. The trooper can arrest patrons if they become unruly or a public nuisance.

[18] A fire truck with multiple-feature firefighting capabilities.

SLFD personnel were told that people were trapped in elevators on the *Admiral*. They checked this report and found that no one was in the *Admiral* elevators. The SLFD also responded to two incidents involving people trapped in elevators at a nearby National Park Service parking garage.[19] Regarding the first incident, one person had been released from an elevator before the SLFD arrived at the garage. At the second incident, the SLFD removed one person who had been trapped in an elevator.

The safety coordinator for the National Park Service Gateway Arch facility reported that the elevator power failure at the parking lot was related to the *Admiral* accident. He said that when the *Admiral* broke its moorings, electrical power was lost to the Arch parking garage and caused the Arch garage elevators to shut down and the doors to remain closed. The elevators had no emergency power backup. (The safety coordinator told Safety Board investigators that a fail-safe system has since been installed and that if power is lost now, battery power will activate, the elevator cars will go to the lowest garage level, and the doors will open. The system was tested and found satisfactory on February 15, 2000.)

Coast Guard

At 2000, Group UMR notified the duty officer at the Coast Guard Marine Safety Office (MSO) St. Louis that the *Anne Holly* had lost power and collided with the Eads Bridge. At 2004, Group UMR issued an urgent marine information broadcast about the drifting barges.[20]

At 2014, the Coast Guard (at the request of the SLFD) closed the river between miles 178 and 180 UMR to all vessel traffic. The Eads, Poplar Street, and MacArthur Bridges were also closed until all barges could be recovered and the bridges inspected for damage. At 2030, a team of MSO St. Louis personnel, consisting of the Captain of the Port (COTP),[21] the executive officer, a public affairs officer, an inspector, and an investigating officer, arrived at the scene to assist fire and police services. The COTP joined the SLFD deputy chief at the incident command post. State bridge inspectors reopened the Eads, Poplar Street, and MacArthur Bridges at 2216.

At 2228, the Coast Guard buoy tender *Cheyenne* received reports that a person may have fallen into the water. The Coast Guard began a search using the *Cheyenne*, three Missouri water patrol boats, and a St. Louis police helicopter. They searched 8 miles downstream for anyone in the water. The Coast Guard issued an urgent marine information broadcast requesting all vessels in the vicinity of the *Admiral* to report any

[19] The garage provides parking for the St. Louis Gateway Arch.

[20] The broadcast was "PAN PAN, PAN PAN, PAN PAN. This is the United States Coast Guard Upper Mississippi River, Keokuk, Iowa. The Coast Guard has received a report of 14 barges adrift in vicinity of mile 180 Upper Mississippi River. All vessels in vicinity are requested to transit with caution and assist if possible. Signed, Commander Coast Guard Group, Upper Mississippi River."

[21] In St. Louis, the person in charge of the MSO has three titles; commanding officer (for carrying out military duties), officer-in-charge (for regulating the commercial marine industry by conducting inspections and investigations), and COTP (for conducting pollution control and port safety duties). In this report, we will refer to the highest official in the St. Louis MSO as the COTP.

sightings of people in the water and to assist, if possible. At 2310, the search ended, and no one had been found. A vessel in the area, the M/V *Janie Charlie*, continued to watch for anyone in the water. No reports of a missing person were received in the aftermath of the accident, and authorities received no other evidence indicating that anyone had fallen into the water.

At 0148 on April 5, the Coast Guard reopened the river to light boat traffic (vessels with no tows). About 0930 on April 5, the river was reopened to all traffic. (See table 1 for notification sequence of initial emergency responders.)

Table 1. Approximate initial notification and response sequence

Times (some estimated)	Actions
1950	Barges break loose from the *Anne Holly.* *Anne Holly* captain makes emergency call to Coast Guard Group UMR.
1951	President Casinos, Inc., watchman notifies the *Admiral* senior shift manager of problem at Eads Bridge.
1952 to 1954	Barges strike the *Admiral;* moorings begin to break; the *Admiral* begins to swing away from shore; power fails and emergency power activates.
1957 to 1958	The SLFD and the St. Louis City Police are notified.
1959	The *Anne Holly* pushes against the *Admiral's* bow.
2000 to 2001	Coast Guard Group UMR notifies MSO St. Louis that the *Anne Holly* has collided with Eads Bridge and lost tows. St. Louis City police personnel arrive on scene.
2002	Gaming officer notifies Missouri State police of accident.
2003	Missouri State police dispatcher notifies the State Water Patrol, the Coast Guard, the SLFD, the St. Louis City Police, and local State police units.
2004	Coast Guard Group UMR issues urgent marine information broadcast about breakaway barges. The Missouri State police dispatch a helicopter and personnel to the scene.
2005	SLFD team arrives on scene.
2014	Coast Guard closes river between miles 178 and 180 UMR to all vessel traffic.
2030	MSO St. Louis personnel arrive on scene.

Other Responders

Gateway Riverboat Cruises. Two nearby Gateway Riverboat Cruises excursion vessels, the *Becky Thatcher* and the *Tom Sawyer*, both of which had moorings at the Gateway barge, south of the *Admiral*, assisted in the emergency response. The master of the *Becky Thatcher*, hearing the danger signal from the *Anne Holly* and seeing the *Admiral* swing around, disembarked his vessel's passengers and got underway to assist. According to the *Becky Thatcher*'s logbooks, the vessel got underway at 2040, arrived along the port side of the *Anne Holly* at 2045, and began boarding *Admiral* patrons from the *Anne Holly.* The first load of 302 patrons evacuated from the *Anne Holly* to the *Becky Thatcher* about

2100. By 2355, the *Becky Thatcher* had offloaded 927 people from the *Admiral* to the Gateway barge.

Gateway Riverboat Cruises called in a crew for the *Tom Sawyer*, which had been moored at the Gateway barge. The vessel came alongside the *Anne Holly* and began offloading patrons at 2105. The first load of 288 patrons left the *Anne Holly* for the *Tom Sawyer* at 2130. The *Tom Sawyer* had offloaded 787 people from the *Admiral* by 0030 on April 5, 1998.

Utilities. The electrical power and natural gas lines attached to the *Admiral* from shore parted when the vessel rotated after being struck by the barges. Shoreside electric power to the *Admiral* was lost when the power supply line shorted as it parted. Emergency generators on the *Admiral* restored emergency electrical power on the vessel within 5 seconds.

When the *Admiral* lost power, the Arch parking garage and three other buildings in the area served by the same power line that served the *Admiral* also lost electric power. At 1954, the electric company received an alarm in its distribution dispatch office indicating that the power line was open to the waterfront area. The company sent personnel to the substation[22] responsible for the power line and began checking circuits at 2037. The problem circuit was isolated at 2107. The technicians then had to go to each building to isolate the affected circuit and activate reserve circuits to carry the electric power. Between 2145 and 2200 on April 4, power was restored to the parking lot garage and downtown buildings. The line to the *Admiral* had to be repaired. Full power was restored to the *Admiral* at 1430 on April 30, 1998.

After the lines parted following the accident, natural gas continued to leak from the natural gas line at 5 psi. Because natural gas is lighter than air, the natural gas rose and dispersed into the atmosphere. The wind hastened this process. Soon after arriving on scene, the SLFD incident commander had water sprayed on the escaping natural gas. No fire or explosion occurred.

At 2028, the SLFD dispatcher requested assistance from the Laclede Gas Company, and a seven-person emergency repair team was on the scene by 2105. Laclede Gas responders located the regulator pit in the flooded sidewalk near the *Admiral*. The pit was under temporary scaffolding that had been erected for passengers to use when boarding the *Admiral*, so that they would not have to walk through the flood water in the street leading to the boarding ramp. The Laclede team removed the scaffolding so they could access the steel coverplate of the pit. Once they had removed the plate, the Laclede team could not locate the shut-off valves within the pit, which was filled with muddy river water. When they could not turn off the natural gas from the pit, the Laclede personnel made two unsuccessful attempts to close off the natural gas hose with clamps supplied by a fire truck. About 2300, the team put a heavy-duty Laclede clamp on the ruptured hose and tightened it until the natural gas flow stopped.

[22] The substation, which supplied the electrical power to the *Admiral*, reduced the incoming voltage from 138 to 13.8 kilovolts.

Federal regulations (49 *Code of Federal Regulations* [CFR] 192.365 [b] and [c]) make the following requirements regarding the location of valves for service lines:

> (b) *Outside valves.* Each service line must have a shut-off valve in a readily accessible location that, if feasible, is outside of the building.
>
> (c) *Underground valves.* Each underground service-line valve must be located in a covered durable curb box or standpipe that allows ready operation of the valve and is supported independently of the service lines.

Injuries

Table 2. Injuries sustained in the *Admiral* accident*

Injuries	*Anne Holly*	*Admiral*	Total
Fatal	0	0	0
Serious	0	1	1
Minor	0	15	15
None	10	2,084	2,094
Total	10	2,100**	2,110

* Table is based on the injury criteria of the International Civil Aviation Organization (49 CFR 830.2), which the Safety Board uses in accident reports for all transportation modes. The table contains injuries sustained by those persons involved in this accident who were treated at local hospitals within 24 hours of the accident.

** President Casinos estimated through ticket counts that the *Admiral* had about 2,100 people, including 250 staff members, on board at this time.

Damage

Anne Holly and barges	$485,000
Admiral	$10 to 11 million
Total	Approximately $11 million

The *Anne Holly* and 9 of its 14 barges were undamaged. See appendix B for the details about the towing company's damage estimate for the remaining five barges and the cargo.

The *Admiral*'s bow received damage above the waterline. Also, two of the four universal-type joint connection devices (upriver and downriver ends) that connected the vessel and its entrance barge were damaged. The *Admiral*'s entrance barge was damaged when it was dragged from its shoreside position. All three gangways had to be replaced. Electrical, natural gas, and water lines that parted during the accident had to be replaced or repaired. The *Admiral* and its entry barge were repaired and back in full operation on April 30, 1998.

Except for some scraping on the Missouri-side pier of its center navigation span, the Eads Bridge did not sustain any damage.

Crew and Staff Information

Anne Holly

Crew. The *Anne Holly* had a crew of 10, including the captain, the pilot, two engineers, a mate, four deckhands, and a cook. Both the captain and pilot held valid Coast Guard licenses as operators of uninspected towing vessels. No other people on board were required to have Coast Guard licenses.

Chief engineer. The chief engineer of the *Anne Holly* said that he had 23 years of experience on the river as a towboat engineer, had been employed with the company as chief engineer for 7 1/2 years, and had served as the chief engineer of the *Anne Holly* for about 4 1/2 years.

Captain. The captain, 54, said that he had begun working on vessels as a deckhand when he was 15. He had obtained his first license as an operator of uninspected towing vessels upon the Great Lakes and inland waters in 1973. Since 1985, most of his experience had been operating towing vessels on the UMR through St. Louis Harbor. He said that he had made numerous trips through St. Louis Harbor at various river stages. He told investigators that he had had one other accident in 1986 or 1987, when he was pushing a tow downstream near Huntington Point, Mississippi; his towboat's starboard engine failed, and the tow struck a dock.

The Coast Guard told the Safety Board that it had no record of any actions taken against the captain before the April 4, 1998, accident at the Eads Bridge. Following the accident, the captain was charged with negligence; he entered a "no contest" plea. All the valid licenses and documents issued to the captain by the Coast Guard were suspended for 2 months, remitted on 6 months probation, effective July 27, 1998.

Winterville Marine, of Greenville, Mississippi, a personnel agency that provides crews to operate towboats, employed the captain. He worked sporadically for Winterville Marine during the 1980s. The captain had worked the *Anne Holly* for Winterville Marine since March 1993. Winterville Marine paid his health care benefits and salary. AM paid Winterville Marine a monthly fee for towboat personnel services. Although the captain was paid by Winterville Marine, AM was responsible for all operational matters on the tow.

The captain's physical exam for renewal of his operator of uninspected towing vessels license took place in November 1993. His hearing, vision, and color acuity were normal, and his visual acuity was uncorrected 20/20. His blood pressure was 150/90. The physician certified the captain physically competent to perform duties aboard a U.S. merchant vessel.

The captain had a physical examination, including referral for an exercise stress test, administered by his private physician in February 1998. No problems were noted. In August 1998, the captain underwent a physical exam for renewal of his operator's license, conducted by his private physician. The physician certified the captain physically competent to perform duties aboard a U.S. merchant vessel.

The captain had been prescribed three medications at the time of the accident: nifedipine for high blood pressure; glyburide for noninsulin-dependent diabetes; and sertraline, an antidepressant (beginning in December 1997). The captain told Safety Board investigators that he had been taking the nifedipine and glyburide for years (the Board was able to document use since December 1996) and was not suffering from any side effects. The captain's blood pressure in February 1998 was 150/90, and his estimated average blood glucose in August 1998 (after the accident) was 227. The captain did not mention use of sertraline, which was discovered by Safety Board investigators upon review of subpoenaed personal medical records.

During postaccident interviews, the captain told Safety Board investigators that he was not a drinker. He told Coast Guard investigators under oath that he did not drink alcohol.

As of April 4, 1998, the captain and the pilot had worked about 26 days of a 30-days-on, 30-days-off rotation that began on March 9, 1998. The captain and pilot shared navigation responsibilities for the *Anne Holly* on a 6-hour alternating watch schedule, which is commonly used in the UMR towboat industry. The captain's watch times, by agreement with the pilot, were about 0500 to 1100 and 1700 to 2300.

The captain said he generally slept 4 to 5 hours per off-duty period, when not in the pilothouse, and he felt that this sleep schedule was adequate for him. He chose to use some of his off-watch time to eat, see to his personal hygiene, and relax.

The captain testified that on April 4 he was relieved at 1115 from his morning watch (which began that day at 0500). He then went below, ate lunch, and went to bed. He said that he slept 3 1/2 to 3 3/4 hours, got up, and took a shower. After showering, he went down to the galley, visited, drank coffee, and ate supper. The captain said that he relieved the watch in the pilothouse about 1705.

When Safety Board investigators asked him what he thought would make transiting St. Louis Harbor safer under high-water conditions, the captain replied, "I'd like for them to put a restriction on these bridges northbound as well as southbound.... It would be a lot safer if everybody could run in the daylight." He also stated:

> Daytime you can see up above. You can tell about how your set is. At nighttime, you can't tell that. You go by feel, you go by experience, you know. You know what this stage of river was last year, 30 foot on the gage, you know. You held up this much from the bridge.
>
> But daytime, you can see all this as well as your experience, and that's the same reason they have it, you know, southbound at night for 25 foot.

The captain testified:

> The biggest difference in daytime you can see your current, you can see your setting. At nighttime the only thing you have to rely on is your radar and your searchlight. Which the radar doesn't pick up current. It doesn't pick it up, and your searchlight you can't see it... . But on the Eads Bridge in particular you have no way of, you know, other than common knowledge, of what the current is going to do.

President Casino on the Admiral

At the time of the accident, the *Admiral* had a staff of about 250 people on board, serving in the security, casino or gaming, food service, and maintenance departments. About 15 people were on the security staff. None of the *Admiral* staff members were required to have Coast Guard marine licenses. The *Admiral* normally employed about 900 people (three daily 8-hour shifts of about 250 to 300 people per shift). The *Admiral* was open to patrons 22 hours a day.

The facility had a 10- to 20-percent turnover in personnel each month. Company management told the Safety Board that more than 250 of the *Admiral*'s staff members were original employees who had been with the casino since it began gaming operations in 1994.

Vessel Information

Anne Holly *Tow and Barges*

The *Anne Holly,* O.N. 553021, was an uninspected, diesel-driven, push-type river towboat built on January 1, 1973, at the Mississippi Marine Corporation, Greenville, Mississippi. For the next 20 years, the vessel had various owners and was used as a towing vessel on the Mississippi River. On October 6, 1989, AM's parent company (the American Milling Company) purchased the vessel from River Carriers, Inc.

The *Anne Holly* was equipped with two 645 EMD–E7 propulsion diesel engines at 2,800 horsepower (hp) each, driving two propellers through reduction gear drives. The *Anne Holly* was equipped with navigation and communication devices, including radar, radiotelephone equipment, and searchlights. The vessel had pilothouse control of engines and rudders, and was equipped with twin propellers, twin rudders, and flanking or backing rudders.[23]

The *Anne Holly*'s operator directed the towboat by manipulating two parallel, horizontally arranged, 3-foot-long metal rudder control handles that were in the control console in the forward center of the pilothouse. The operator stood between the two handles and shifted them from side to side as needed to control the rudders. The radar

[23] A set of rudders forward of the propellers, designed to assist in controlling the towboat's movement at very low speeds, particularly when backing down.

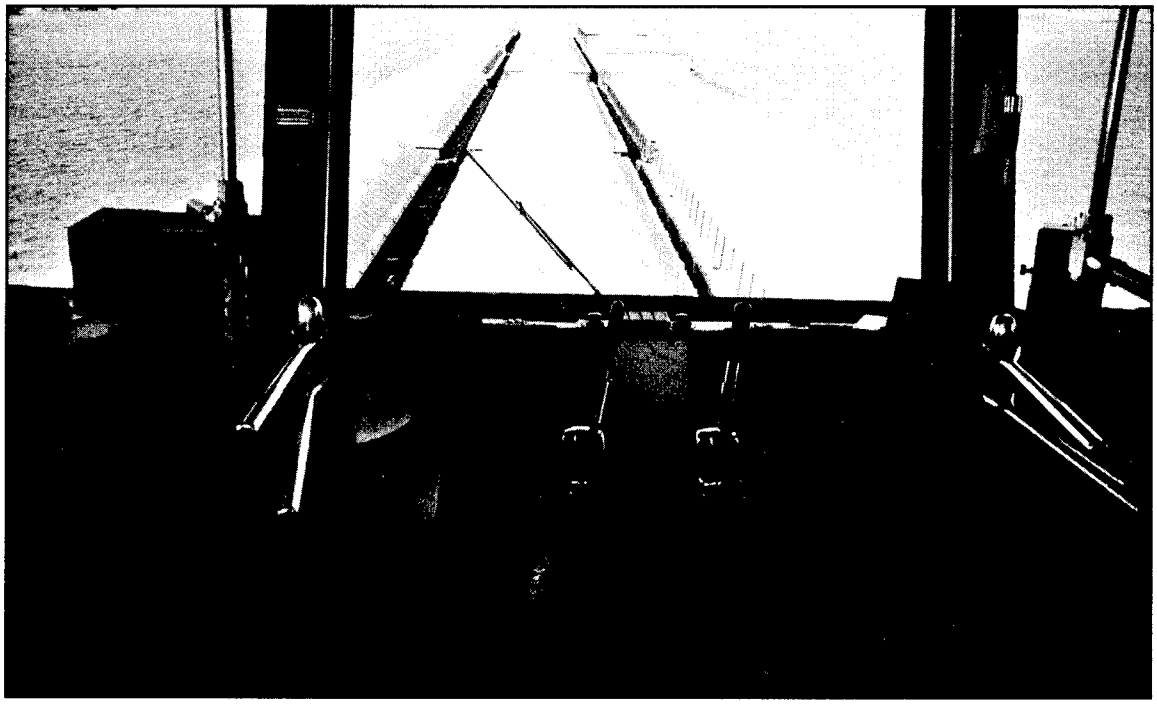

Figure 7. *Anne Holly* pilothouse interior

console was to the operator's right as he stood his watch at the control console. (See figure 7 for the *Anne Holly* pilothouse interior.)

The *Anne Holly*'s principal characteristics were:

Length	154 feet
Beam	40 feet
Depth	9.3 feet
Draft	8.8 feet
Gross tonnage	1,099
Hp	5,600
Air draft[24]	46 feet (approximate)

The 14 barges in the *Anne Holly*'s tow were of double-hull construction. Their cargo areas were surrounded on both sides, on the bottom, and at each end by void spaces to protect the cargo and limit flooding in case of outer hull damage. Because these were dry cargo barges and operated solely on U.S. inland waters, they were not required to be inspected by the Coast Guard. (Appendix C shows the characteristics of each barge.)

[24] Distance from the vessel's waterline to the highest point on the vessel.

President Casino on the Admiral

History. The *Admiral* was built in 1907 as a side-paddlewheeled steam-driven railroad transfer and passenger ferry. At that time, it was called the *Albatross*. In 1926, the vessel was lengthened by 50 feet. About 1939, it was bought by Streckfus Steamers, Inc., which converted it into an excursion passenger vessel in St. Louis Harbor and renamed it the *Admiral*. About 1973, the steam-powered paddlewheels were replaced by three diesel engines with outboard propellers, one in place of each paddlewheel and one on the stern. The *Admiral* continued to operate as an excursion passenger vessel in St. Louis Harbor until 1978, when it was taken out of excursion passenger service and sold.

Between 1978 and 1983, the vessel was moved from St. Louis and its engines were removed. The *Admiral*'s entry barge, however, remained permanently moored at mile 179.9 UMR throughout this period.[25] In 1983, the *Admiral* returned to mile 179.9 UMR in St. Louis Harbor and became a permanently moored vessel (PMV) with its barge at that location.

The Coast Guard classifies the *Admiral* as a permanently moored shoreside structure or floating building, not an inspected passenger vessel. As a building, it must meet the regulatory requirements of the local authority, in this case, the city of St. Louis. The Coast Guard no longer inspects the *Admiral*, issues it certificates of inspection, or requires drills of any kind to be conducted on it.

A city of St. Louis occupancy permit allowed the *Admiral* to carry 5,625 people.

Structure. At the time of the accident, the *Admiral* was secured[26] to a boarding or entry barge that was also a permanently moored facility. The entry barge had three gangways that led to shore. The north and south gangways, each of which was 12 feet wide and 125 feet long, were used to embark and disembark casino employees and to load supplies. The center gangway, 20 feet wide and 135 feet long, was covered by an awning 9 feet, 6 inches, high. The center gangway was designed for two-way patron traffic on and off the vessel via the entry barge. Due to changing river levels, the center gangway sometimes became so steep that wheelchairs were kept at hand to assist elderly and disabled patrons on and off the vessel.[27] (See figure 8 for a photograph of the center gangway of the *Admiral*.)

At the time of the accident, the vessel and the entry barge were secured by 10 mooring wires (or combinations of wires and chains). The 10 lines comprised the bow and stern anchor wires (attached to the entry barge) and 8 lines secured to the shore. The

[25] This was not the entry barge in place at the time of the April 4, 1998, accident. The barge had been replaced in the mid-1980s.

[26] The *Admiral* was secured to the entry barge by four universal couplings in addition to wires that held the vessels together. Each coupling was welded to the hulls of both vessels and allowed for limited movement to accommodate differences in vessel drafts as patrons moved from the entry barge to the *Admiral* and vice versa, as well as other small differences in vessel movements.

[27] According to *Admiral* management, many of the vessel's patrons are elderly, rely on walkers, have breathing problems, have had recent surgery, or have some other physical condition hampering their ability to move up and down the gangway.

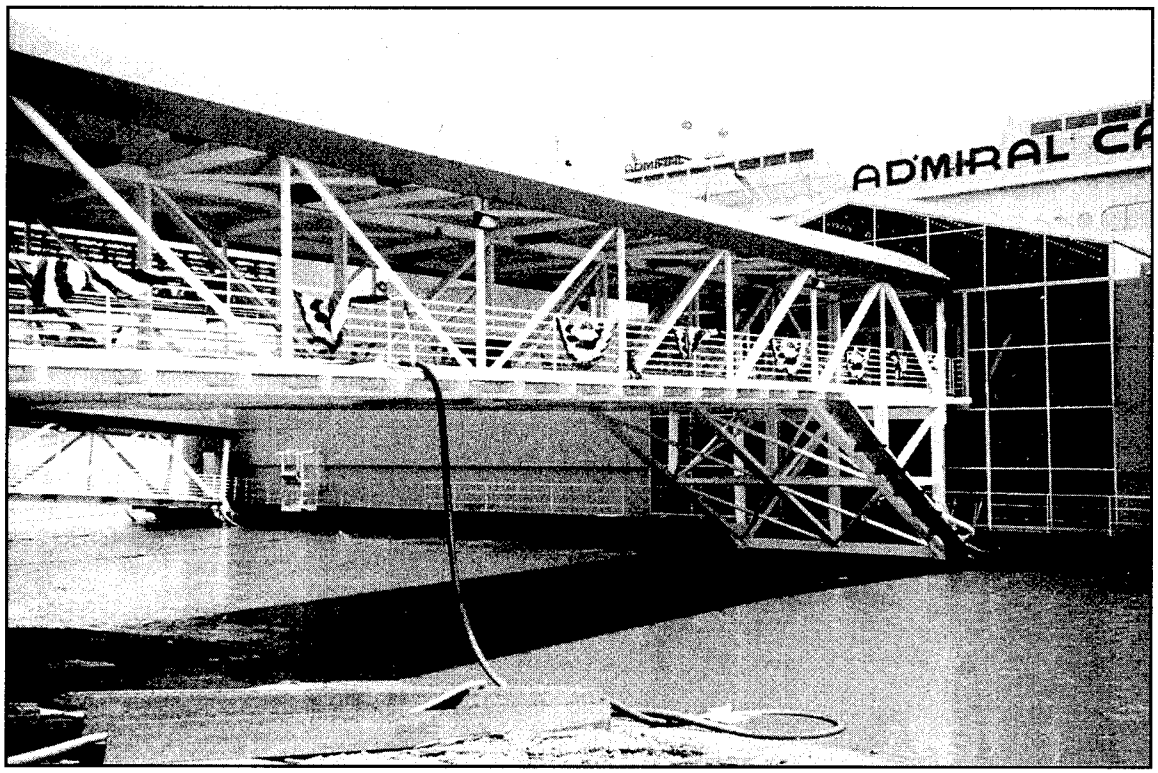

Figure 8. Center (passenger) gangway to the *Admiral*

mooring wires for the *Admiral* and the entry barge were routinely adjusted as the facility was moved toward (during high water) and away from (during low water) shore. President Casinos informed the Safety Board through a January 25, 1999, letter that:

> The authorized mooring arrangement, including location and size of mooring wires, was designed by P.H. Weis and Associates, Professional Engineers. The moorings are designed using conventional design and analysis methods with loads determined using recognized codes, such as the Uniform Building Code and the American Association of State Highway and Transportation Officials. The mooring lines are sized for various combinations for all forces acting on the *Admiral* and Support Barges, such as wind and stream flow.

(See appendix D for additional information about the mooring wires.)

The Ameren-Union Electric Company and the Laclede Gas Company supplied electricity and natural gas, respectively, to the vessel through individual lines that came from shore along the gangways. The natural gas was transported from the 12-inch main line beneath L.K. Sullivan Boulevard to the *Admiral* via a 4-inch line leading to a concrete regulator pit on the boulevard's eastern sidewalk. The opening to the pit, covered by steel plates, was at sidewalk level. A 2-inch service line that extended from the regulator pit to the *Admiral* was installed in April 1986. The service line, which ran from the regulator pit and emerged into a shallow concrete trough (about 12 inches wide and 6 inches deep) led to a quick-disconnect fitting. The quick-disconnect fitting was 35 to 50 feet from the

street. A steel grating also protected that portion of the concrete trough housing the service line in the street before the line emerged and was attached to the *Admiral*'s gangway.

The *Admiral*'s principal characteristics were:

Length	380.0 feet
Beam	89.5 feet
Depth	7.6 feet
Draft	6.0 feet (estimated)
Gross tonnage	1,599
Hp	N/A
Air draft	62.5 feet (estimated)

The entry barge's principal characteristics were:

Length	265.0 feet
Beam	60.5 feet
Depth	6.6 feet (estimated)
Draft	5.0 feet (estimated)
Gross tonnage	N/A
Hp	N/A

Waterway Information

Conditions, Traffic, and Accident History

Conditions. According to the U.S. Army Corps of Engineers (USACE), St. Louis District, the river stage at mile 179.6 UMR on the Missouri side of the river was 31.6 feet on the St. Louis gage at 2000 on April 4, 1998. Flood stage is 30.0 feet in St. Louis. USACE does not designate an official "high-water" level for St. Louis Harbor, but the region's operators generally consider high water to be about 20 feet or more on the St. Louis gage. From 1987 through 1997, St. Louis averaged 22.8 days per year (6.2 percent) with the river stage at 30 feet or more and 69 days (18.9 percent) at 20 feet or more. USACE estimated the current at the time of the *Anne Holly*'s allision[28] with the Eads Bridge to be about 6 mph.

USACE obtained river stage information from an automatic stage gage on the Eads Bridge (which records river stage every hour) and a flow gage on Poplar Street Bridge. The chief of the potamology[29] section of the St. Louis District USACE indicated

[28] An *allision* is the striking of an object that is stationary (such as a bridge or moored vessel) by a moving vessel.

[29] *Potamology* is the study of rivers.

that from 0100 through 2400 on April 4, 1998, the river was rising and the river stage increased from 30.7 to 31.6 feet, while the flow increased from 515,000 to 538,000 cubic feet per second. Between 1900 and 2000, the river stage rose from 31.4 to 31.6 feet. During this same period, the flow increased from 533,000 to 536,000 cubic feet per second. During his testimony, the USACE chief of potamology stated that the river's rise in St. Louis Harbor on April 4, 1998, could be characterized as "gradual."

When he was asked if there had been "any unusual precipitation or additions to the base flow rate upstream of the St. Louis Harbor that could have resulted in an unexpected 'wall of water' between the Martin Luther King, Jr., and the Eads Bridges," the USACE representative's reply was negative. He said that if there had been a "wall of water" coming down the river, it would have appeared in the data, and the data did not reveal such a phenomenon.

According to records kept by USACE, from 1970 to mid-1997, minimum water temperatures in St. Louis Harbor occurred from December to February and ranged from 32° to 36° F. The average annual water temperature was about 56° F. On April 4, 1998, the water temperature was about 53° F.

Traffic. According to an estimate made by the lock keeper at lock 27, mile 185.5 UMR, which is the first lock northbound above St. Louis, about 8,000 tows pass through the harbor each year, transporting 80,000 to 85,000 barges. The USACE records from lock 27 show that from April 6 to April 30, 1998, 27 tows of a size or tonnage similar to that of the *Anne Holly* successfully made upbound trips in darkness through St. Louis Harbor. Of the 27 upbound tow transits:

- 9 were made at river stages between 32.0 and 30.8 feet;
- 5 were made at river stages between 29.9 and 28.5 feet; and
- 13 were made at river stages between 27.8 and 25.5 feet.

On the morning of April 4, 1998, one tow of comparable size to the *Anne Holly* transited upbound through the harbor. (The tow had 16 barges, 16,500 short tons[30] of cargo, and 4,300 hp.) No problems were reported with the transit. No other upbound transits of similar tows were recorded that day by USACE. After the *Anne Holly* accident, no other upbound tows transited the harbor in darkness on the night of April 4 through 5, 1998. The river was closed to traffic from about 2014 on April 4 until 0930 on April 5, 1998.

According to USACE "Waterborne Commerce of the United States" statistics for 1998, the metropolitan St. Louis area (mile 138 to 208 UMR) had a 21.9 percent increase in total tonnage from 1989 through 1998. In 1998, the total tonnage was 31.758 million short tons, of which about 5.710 million short tons (18 percent) were petroleum or hazardous materials.

[30] A *short ton* is 2,000 pounds.

Accident History. According to Coast Guard data, from January 1, 1989, through June 30, 1999, a total of 18 accidents (1.6 per year) classified as casualties[31] took place in St. Louis Harbor. Twelve accidents occurred when the river was in high-water stage (20 feet or higher on the St. Louis gage). Of the 18 accidents, 12 were allisions and occurred in high water, 2 were collisions, 2 were of unknown cause, and 2 were groundings in low water when the gage read 2 feet.

During this 11-year period, 29 breakaway accidents occurred (2.6 per year). Of the 29 breakaways, 4 took place above the location of the *Admiral.* Three of these four breakaways occurred at river stages between 10.2 and 13 feet on the gage. The fourth took place when a moored tow was dragged in ice at a river stage of -5 feet.[32]

The 25 breakaways occurring below the location of the *Admiral* affected fleeting areas but no publicly accessed PMVs. Of the 25 breakaways, 10 occurred in high-water river stages. Of the 10 high-water breakaways, 1 was considered a case of sabotage, and 1 was caused by vandalism. In 1993, four breakaways took place, three of which occurred during river stages of 35, 43, and 49 feet on the gage (respectively, 5, 8, and 19 feet above flood level in St. Louis Harbor). The breakaway that occurred at 49 feet on the gage occurred at mile 179.8, or 0.1 mile below the *Admiral.*

Bridges

Four fixed-span bridges are within the recreational and tourist area of the St. Louis waterfront. They are:

Douglas MacArthur Highway and Railroad Bridge	mile 179.0 UMR
Poplar Street Highway Bridge	mile 179.2 UMR
Eads Highway and Railroad Bridge	mile 180.0 UMR
Martin Luther King, Jr., Memorial (MLK) Highway Bridge	mile 180.2 UMR

The Poplar Street Bridge is on the interstate highway system and is a principal vehicular roadway between St. Louis, Missouri, and East St. Louis, Illinois.

On its lower level, the Eads Bridge supports a tramway that operates between St. Louis, Missouri, and East St. Louis, Illinois. The upper-level highway portion of the bridge is in disrepair and is not used for vehicular traffic. The Eads Bridge bears fixed markers that indicate to mariners the center of the arched span (a green square dayboard for daylight and a green light for darkness) and the two low points on either side of the span (red triangular dayboards) to be cleared.

Between the Poplar Street and Eads Bridges on the Missouri side of the river are, in addition to the *Admiral*, the Gateway Riverboat Cruises permanent floating barge, the

[31] The Coast Guard considers a marine *casualty* to be an accident that results in damage in excess of $25,000. (46 CFR 4.05-1)

[32] According to the USACE in St. Louis, zero gage means that the river channel has about 12.5 feet of water in it. At -5 feet on the gage, St. Louis Harbor would have a water depth of about 7.5 feet.

permanently moored *Robert E. Lee* restaurant (not operating), and a permanently moored *McDonald's* restaurant (permitted to hold 400 people). On the Illinois side between the two bridges are a permanent floating mooring for the *Casino Queen* (a casino vessel that gets underway periodically and is certified to carry 3,000 people) and, south of this vessel, fixed mooring cells for grain and coal facilities.

Below the Poplar Street Bridge, on both sides of the river, are barge terminals, fleeting areas, and other industrial facilities. (See figure 9.)

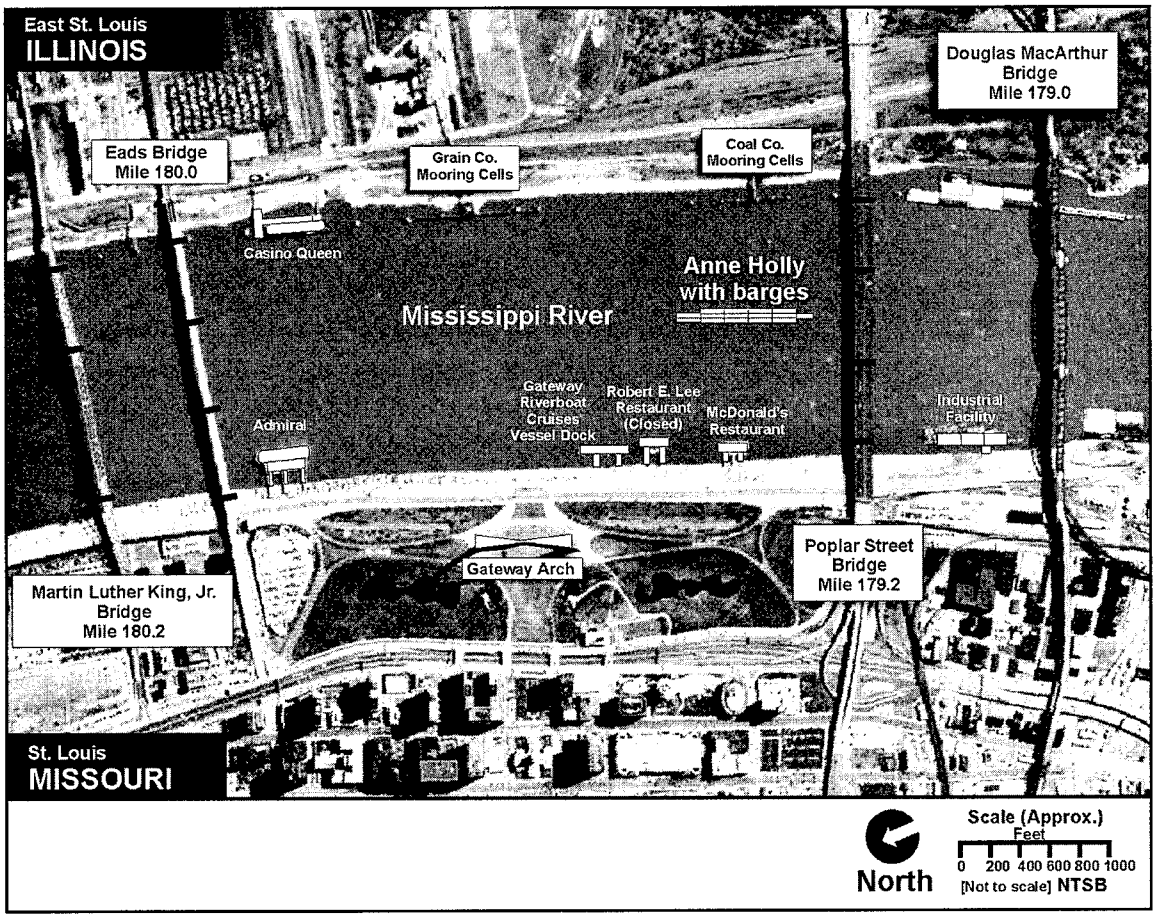

Figure 9. Schematic view of the accident area

Except for the MLK Bridge, the main navigation spans for all four bridges are centered at mid-river.[33] Information on the widths and vertical clearances of the various bridges appears in table 3.

All the bridges except the Eads Bridge provided a vertical clearance under all spans of at least 61.1 feet at the time of the accident. The Eads Bridge's symmetrical main navigation arch provided 57 feet of vertical clearance at the center; this clearance tapered

[33] The left descending pier of the MLK Bridge center span is almost in line with the left descending pier of the Eads Bridge's center span. The right descending pier of the MLK Bridge center span is near the Missouri shore, almost in line with the right descending pier of the Eads Bridge's Missouri span.

Table 3. Bridge widths (by span) and vertical clearances, in feet

Bridge	Missouri Span	Center Span	Illinois Span	Vertical Clearance*
MacArthur	645	647	645	71.9
Poplar Street	480	580	480**	61.1
Eads	498	517	498	57.0
MLK	450***	940	450	64.8

* At 31.6 feet gage in St. Louis.
** Mooring cells riverside of the Illinois pier reduce this navigable width to about 420 feet. These cells were in place before the bridge was constructed.
*** Not navigable.

down proportionately on each side of the arch. The bridge's red day markers were each 150 feet from the center of the bridge, leaving a horizontal space of 300 feet between them. At the time of the accident, 42.2 feet was between each marker and the river surface. Given its air draft, the *Anne Holly* required a minimum of 46 feet of vertical clearance. The flood conditions reduced the vertical clearance under the side portions of the Eads Bridge main arch so that a center navigation area of about 270 feet had 46 feet or more of vertical clearance. (See figure 10.)

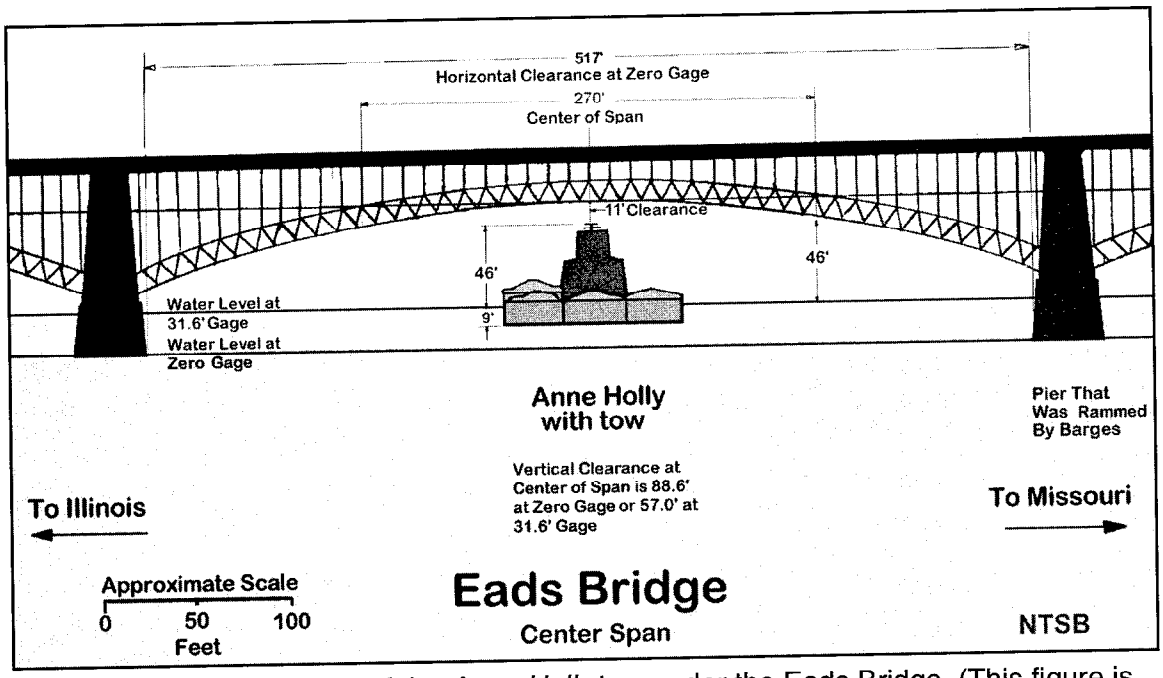

Figure 10. Schematic view of the *Anne Holly* tow under the Eads Bridge. (This figure is not representative of the actual path taken by the *Anne Holly.* The figure is used for illustrative purposes only, to show the heights of the bridge and the *Anne Holly.*)

Upbound Transit of the Eads Bridge

For an operator conducting an upbound transit of the Eads Bridge, lighting sources in the area immediately preceding the bridge included rotating colored lights from the

Casino Queen (moored on the Illinois shore opposite the *Admiral*), street lighting, and traffic headlights from cars on the St. Louis side of the river. The *Admiral* had a string of lights around its top deck and lighted letters spelling "Admiral" on the top deck. During the Safety Board's public hearing on the *Admiral* accident, a towboat captain who testified as an expert in towing operations in St. Louis Harbor stated:

> Let's take St. Louis Harbor here, for instance, at nighttime, when you are coming southbound through the bridges and the *Casino Queen* is lit up with all its high-intensity lights and different colors, it really distracts—first of all, it impedes your night vision... .

North of the MLK Bridge, the current flows approximately parallel to the riverbanks. Between the MLK and Eads Bridges, the current flows toward the Illinois side at various angles.

According to one experienced towboat operator, to complete a transit of the Eads Bridge, the operator of an upbound tow follows the procedure outlined below:

- The operator may use radar to identify riverbanks and other objects in or near the waterway, such as bridges, other vessels, piers, etc., in darkness and in restricted visibility. Use of the radar can help the operator to orient the tow with respect to fixed objects and, if need be, to compare the radar image to river charts.
- To begin the transit, the operator approaches the bridge with the tow to the left (Missouri side) of the river centerline and with the tow's head aimed at the Illinois (right side) bridge pier of the center span. During the approach, the tow is held at a slight angle to the axis of the river, so that the stern of the tow is angled slightly toward the Missouri side of the river. In this position, the tow presents its port side to the current.
- On nearing the Eads Bridge opening, the operator applies left rudder to turn the tow to the left so that it will head directly into the current and line up for passage through the center bridge opening.
- Once the tow is aligned for passage and heading directly into the current, the operator pushes the tow into the bridge opening.
- When the tow and towboat are almost through the Eads Bridge center span, the operator turns the tow slightly to the right for passage through the MLK Bridge.

St. Louis Harbor Tow Restrictions

The MSO St. Louis tow restrictions for the high-water river stage of 25 feet or more are based on a power and tonnage formula. The local marine industry, the Coast Guard, and USACE cooperatively developed the formula, using their experience in this area. Upbound (against the current) and downbound (with the current) towboats are

required to have a minimum of 250 hp per 1,500 tons of cargo. During high water of 25 feet or more, downbound tows longer than 600 feet are restricted to daylight operation.

MSO St. Louis advised the Safety Board in June 2000 that, since late 1998, during flood stages of 30 feet or more, "All line boat traffic [is] limited to daylight transit only with the exception of northbound tows with helper boats." (A *line boat* is a relatively large towboat that pushes large tows over long distances, as opposed to a harbor or fleet boat that moves one or two barges at a time in a local area.)

Operations Information

American Milling, L.P.

AM is a small towboat business that operates nine towboats on the inland waterways. The company contracts for additional boats and operators as its workload requires. AM is not a member of the American Waterways Operators (AWO), the inland towing industry's primary trade association. (The AWO is a national trade association for the inland and coastal barge and towing industry. About 375 companies are AWO members; of these, about 200 are tug/towboat companies. AWO members account for about 85 percent of the tonnage that moves on U.S. waterways.)

AM policy is that the captain is responsible for crew welfare and all operational obligations associated with running the towboat. In addition, the captain is responsible for the tow configuration and the security and fastness of the tow's barges. At fleet operations, the captain determines the arrangement of the barges in the tow and whether he can safely move the tow as configured. The captain is responsible for ensuring that logbooks are properly maintained and that associated paperwork is completed. (The captain can perform some or all of these duties while on watch.)

The company provides no safety guidance to its operators concerning high-water operations, night operations, use of helper boats, required equipment, or halting operations when safety concerns may warrant such action. AM does not have written procedures on how to identify or respond to potential emergency shipboard situations, such as an allision and loss of tow. AM does not have written policies or procedures to ensure that its towboats and equipment are adequately maintained and appropriate for their assigned tasks. AM does not designate anyone on shore to assist the captain to make decisions concerning the safety of navigation.

The company relies on its towboat operators to use their own skill and experience and maintains that the captain is responsible for all aspects of the towing operation. When investigators asked the *Anne Holly* captain whether the company responded unfavorably to a captain's decision to make changes to the company-assigned schedule or load for safety reasons, the *Anne Holly* captain replied, "Only if you do it all the time... ."

AM provides no training to its crewmembers, nor does Winterville Marine.

The following is a brief description of the duties of the captain and pilot during a routine day while working the *Anne Holly* for AM. The captain and pilot would each stand two watches a day. The watch times might be varied by the captain (with agreement by the pilot), but the schedule followed would be 6 hours off watch succeeded by 6 hours on watch. During the watch, any navigation or maneuvering of the vessel or tow would be the responsibility of the person on watch (the captain or the pilot). On watch, the pilot would handle all operational and administrative matters arising, in the same manner that the captain would. If a problem that the pilot could not or desired not to handle arose, he could call the captain.

Generally, the captain would fulfill his administrative duties, such as ordering food, fuel, or other supplies, while on watch. The captain would typically take care of personnel administration or engineering matters while on-watch, but, if necessary, he could deal with them while off-watch. Such off-watch work, however, would not occur on a routine basis.

The captain, after being relieved by the pilot about 2330, would go to bed and sleep for about 5 hours before being awakened to have breakfast before going on watch at about 0530. After being relieved about 6 hours later, the captain would, about 1130, eat lunch, watch TV, talk, read, do laundry, or carry out other personal tasks. He might also make a round of the boat or check the tow before going to bed. He generally would get 3 to 4 hours sleep before being called to prepare for the evening watch. He might take a shower and eat dinner before going on watch about 1730. The pilot would usually follow a similar routine on his off-watch periods.

President Casinos

The *Admiral* is owned by President Riverboat Casino-Missouri, Inc., which also owns and operates the *Becky Thatcher* and the *Tom Sawyer* excursion vessels, through Gateway Riverboat Cruises. President Riverboat Casino-Missouri, Inc., is owned by President Casinos, Inc., which is a Passenger Vessel Association (PVA)[34] member.

Admiral engineering personnel were responsible for vessel operations, including managing the mooring and utility lines between the vessel and shore and ensuring the hull's integrity. Security personnel were responsible for safety on the vessel. They were not trained in crowd management techniques. None of the security or engineering personnel were required to be licensed or to have any other formal certification of competency.

[34] The PVA is a trade organization that focuses on the U.S. domestic passenger vessel industry. PVA membership represents about 65 percent of the industry owner-operators nationwide, comprising more than 1,100 vessels, which carry approximately 85 million passengers annually.

Meteorological Information

At the time of the accident, the weather was clear, with visibility of at least 2 miles in darkness. The wind was from the southwest at 5 mph. The air temperature was 42° F.

Toxicological Information

About 3 1/2 hours after the accident, when the evacuation of the *Admiral* was almost complete, the St. Louis Police Department, at the request of the Coast Guard, administered a breathalyzer alcohol test to the *Anne Holly* captain. (The *Anne Holly* captain was engaged in the emergency response for the *Admiral* until this time.) Test results were negative. Immediately following the breathalyzer test, the captain gave a videotaped sworn interview to the Coast Guard in which he stated that he did not drink alcohol. Safety Board investigators reviewed the videotape and found no apparent evidence of impairment, such as slurred speech, in the captain's behavior.

According to 46 CFR 4.06–1, "Responsibilities of the marine employer," a marine employer must establish and maintain procedures to conduct drug and alcohol testing in the event that one of its crews is involved in an accident. According to 46 CFR 4.06–20, "Specimen collection requirements," a marine employer must ensure that specimens required are collected "as soon as practicable" following the occurrence of a serious marine incident. AM defers all personnel matters to Winterville Marine. After being notified of the accident by AM, Winterville Marine arranged for medical technicians from West Kentucky Drug and Alcohol Screen Specialists of Paducah, Kentucky, to board the *Anne Holly* in St. Louis Harbor at 1620 on April 5, 1998, to conduct crew breath tests for alcohol. They also collected urine for drug testing. The specimens were tested at Lab One in Overland Park, Kansas. Negative results were reported by Medical Review Services, Inc., of Belle Chase, Louisiana, serving as the medical review officer for Winterville Marine.

Emergency Preparedness

President Casinos

The company provided the Safety Board with a copy of its *Emergency Evacuation Procedures* for the *Admiral*, dated February 21, 1997. The procedures specified that *Admiral* security personnel are responsible for ensuring that patrons leave the facility in an emergency. The document essentially stated that staff should conduct the evacuation by directing patrons and employees to the nearest exit and assembling them at a prearranged staging area on shore. The procedures did not include specific duties for managing patrons and employees. Most of the staff members were instructed to assist patrons as they themselves were exiting the vessel. The procedures did not indicate how assistance was to be provided. All evacuation procedures presupposed that those on the vessel would

proceed to shore via the standard entry barge gangways. The *Admiral* staff members had not received crowd management training before the accident, and they were not required to take such training.

The *Admiral* management considered its security force to have primary responsibility for patron safety during an emergency. President Casinos, Inc., had developed a *St. Louis Emergency Plan*, dated January 1994. The stated purpose of the plan was to:

> Minimize the effects of a major emergency or disaster by prompt treatment of injuries, prevention of additional injuries, reduction in property damage, and provision for continuity and expeditious resumption of operations.

President Casinos, Inc., designed the plan to activate whenever a situation occurred that "threatens the well-being of more than a few people at any of the [company's] St. Louis-based facilities." (The plan's scope included the corporate headquarters building, the *Admiral*, the two Gateway Riverboat Cruises vessels, and the *Robert E. Lee* floating restaurant.) The emergencies specifically cited in the plan were air or water pollution incident, civil disorder or riot, earthquake, explosion, fire, flood, tornado, and utility failure.

Each company facility had a designated Emergency Response Team (ERT). The chain of command and responsibilities for the *Admiral*'s ERT were dependent on the time the event occurred and the availability of personnel. According to President Casinos, the assigned duties and responsibilities of the *Admiral* personnel were as follows:

> **General manager**: Responsible for directing emergency operations on site. Is also in charge of the ERT and other duties and responsibilities that include: contacting members of senior management and outside authorities as necessary, overseeing rescue operations, and directing the return of facilities to normal operations.
>
> **Director of security**: Responsible for alerting Federal, State, and local agencies for assistance; controlling the flow of foot and vehicle traffic to and from the *Admiral*; securing and policing the damaged areas and facilities; and controlling the evacuation and movement of patrons and employees to a safe area. When the director of security is not on board, the senior security supervisor assumes these duties.
>
> **Director of casino operations**: Responsible for coordinating casino operations and activities, including securing all gaming equipment, rendering aid to the injured, and assisting all other departments in dealing with patrons and employees on an as-needed basis.
>
> **Director of surveillance**: Responsible for monitoring and videotaping all areas of the casino.
>
> **Director of marine operations**: Responsible for all marine operations for the company's vessels (*Admiral*, *Robert E. Lee*, *Becky Thatcher*, and *Tom Sawyer*).

MSO St. Louis

According to its 1997 annual report, MSO St. Louis has a complement of about 30 people attached to it. The office has one small harbor patrol boat that can be used to assist in local search and rescue activities in St. Louis Harbor. The geographic area of responsibility for this office includes all or parts of 12 States and more than 2,000 miles of navigable waterways. In covering this area, MSO St. Louis is assisted by its Marine Safety Detachments in St. Paul, Minnesota, and Quad Cities, Illinois. Together, these two detachments have about 40 employees.

St. Louis Harbor Emergency Response Plan

MSO St. Louis had a St. Louis Harbor Emergency Response Plan, most recently issued in October 1996. The plan covered the area between miles 160.7 and 195.0 UMR. The St. Louis COTP developed the plan with the cooperation of St. Louis Harbor area fire departments, river industry representatives, and local law enforcement agencies. The plan stated that it was intended to facilitate:

> Effective marine emergency response operations through the establishment of mutually agreed upon operating guidelines and the compilation of pertinent reference materials needed during response operations.

The St. Louis Harbor Emergency Response Plan specifically stated "**the COTP does not have firefighting or search and rescue capabilities**... ." [Emphasis appears in original.]

The plan also stated that the St. Louis COTP would monitor all emergencies and dispatch a Coast Guard representative to the incident's command post to coordinate Federal and local response activities. It made Coast Guard Group UMR, in Keokuk, Iowa, responsible for notifying the appropriate COTP and local fire department of a marine or shoreside emergency.

The St. Louis Harbor Emergency Response Plan specified that firefighting and search and rescue operations fell under the jurisdiction of local and State fire and rescue services. The plan called for the senior fire department official on scene to become incident commander for riverfront emergencies within the department's jurisdiction. A unified command system, consisting of the fire chief (incident commander), the owner of the facility involved, and the COTP representative, was to be established at the incident command post.

The St. Louis Harbor Emergency Response Plan also identified the agencies that would participate in the response to marine emergencies in St. Louis Harbor and listed the names and telephone numbers of critical responders. The plan identified the interagency command and control responsibilities of the various agencies and designated the radio frequencies to be used during the response.

Survival Aspects

Admiral patrons indicated that they experienced some panic and confusion during the emergency. Some stated that the initial impact of the barges caused them to fall against slot machines and to the floor. No patrons entered the water due to the barge strikes. Several patrons commented on minor injuries they had sustained because of the press of other patrons attempting to exit. They also recalled concerns about the smell of natural gas and the fact that patrons were allowed to continue smoking. They indicated that the large numbers of people attempting to push through the single exit leading to the *Anne Holly* caused some discomfort. Several also stated that some patrons were disorderly.

Drills

The Fire Prevention Code of the city of St. Louis required fire drills to be held at least every 90 days in accordance with evacuation plans. Fire drills were not required to be documented on the *Admiral*. According to an SLFD official, fire department personnel visited the *Admiral* annually to conduct fire code inspections and to familiarize firefighters with the *Admiral*'s layout.

President Casinos made conducting fire drills aboard the *Admiral* the responsibility of the facility's security staff. Security personnel were also responsible for securing cash and chips in the casino in an emergency. Fire drills on the *Admiral* were conducted similarly to fire drills from a building and included the sounding of on-board alarms and exiting of occupants. The *Admiral* had last conducted an on-board fire drill at 0700 on June 9, 1997. The fire drill involved those employees normally on the vessel at that time.

According to the *Admiral*'s chief security supervisor, two power outages had taken place on the vessel between January 1994 and the day of the allision. The last outage had occurred in December 1996. To deal with these power problems, the *Admiral* established a power outage procedures review program. The purpose of the reviews was to establish means to stop casino operations and evacuate patrons from the vessel in an expeditious and organized manner. Vessel personnel conducted reviews (question and answer sessions) to ensure that employees understood their individual duties in a power outage. The *Admiral*'s security manual detailed the procedures and each employee's duties and responsibilities. Each *Admiral* employee had to sign a statement verifying that he or she had read the security manual.

Communications

With Emergency Responders. *Admiral* security personnel had walkie-talkies by which they could communicate with each other. On the accident night, when the shore lines' breaking interrupted the hard-wire telephone service, the *Admiral* staff did not establish direct communications with shoreside responders until SLFD personnel came on board.

With Patrons. Before the accident, no *Admiral* staff member issued any statement or warning to patrons of the impending allision. After the impact, some *Admiral* staff members gave patrons oral instructions. The instructions were not consistent or coordinated.

The *Admiral* had a public address system capable of transmitting messages throughout the vessel. The company had no formal policies governing the use of the public address system in an emergency. Three telephones on the vessel could operate the public address system. One telephone was on either side of the center gangway. The third telephone was at the Captain's Club, on the vessel's "B" deck (port side) near the top of the escalators. Captain's Club personnel carried out various administrative tasks (selling tickets, voiding passes, stamping parking vouchers, and handling food and beverage charges). They also made announcements concerning lost and found items.

On the night of the accident, *Admiral* staff did not initially use the public address system because they believed it was inoperable. According to the *Admiral*'s senior shift manager, he used the public address system to make several announcements to patrons and staff after he had returned to the vessel via the *Becky Thatcher* (around 2145). He recalled that he told patrons that "the vessel was not taking on water... [it] was being held in place by a tugboat." He said he also told them that everything was fine and that, because of the size of the *Becky Thatcher* and the *Tom Sawyer*, only 300 patrons could be disembarked at a time. He said he told them that fire and rescue personnel had arrived and that patrons with medical problems should go to the gift shop (on the "A" deck) for treatment.

Patron Questionnaires

Following the accident, the Safety Board sent 251 questionnaires to *Admiral* patrons.[35] Among other inquiries, the questionnaires asked patrons to characterize the amount, type, and usefulness of information they received from the *Admiral*'s staff during the emergency. The Board received 74 responses. Asked whether they had received information about the nature of the emergency, 38 respondents stated that they received no useful information from the *Admiral*'s staff about the emergency's nature. Four of the 74 respondents said that they first learned of the nature of the emergency more than an hour after the accident occurred. Forty-five respondents reported that the oral instructions they received from the staff about the need to evacuate and the procedures for doing so were either nonexistent or of little use.

One respondent stated that the vessel staff made no effort to calm the crowd, and she observed that some staff members rushed to get off the vessel before patrons. Another stated that the staff "appeared to be just as confused as we were." One respondent stated

[35] President Casinos does not maintain patron lists. To obtain names and addresses of patrons on board the *Admiral* on the night of the accident, the Safety Board requested assistance from President Casinos. President Casinos provided the Safety Board with a list of patrons who had made claims concerning the accident against President Riverboat Casino-Missouri, Inc. The Safety Board sent its questionnaires to these patrons. The information from the questionnaires used in this report is not intended to represent a statistical sample of passengers' experiences; instead, it served as a preliminary indicator of areas to be pursued in the investigation.

that, during the emergency, one of the vessel cashiers ran by yelling, "Get off this boat, it's sinking."

Safety Equipment

Coast Guard regulations at 46 CFR Parts 70 through 78 require inspected passenger vessels to carry life preservers and survival craft (lifeboats, life rafts, buoyant apparatus, life floats, etc.). The Coast Guard does not extend lifesaving equipment requirements to permanently moored public structures like the *Admiral*, and the *Admiral* carries no life preservers or survival craft.

At the July 23, 1998, Safety Board hearing session on this accident, the former MSO St. Louis COTP stated that, during his 3 years in St. Louis, people who entered the river at St. Louis rarely survived, even if they were wearing lifejackets. He stated, "I would not do anything to encourage people to think that they could jump in the river with a lifejacket on and have a very good chance of surviving."

The *Casino Queen*, an inspected casino vessel that may carry 2,775 passengers and 225 crewmembers, is moored across from the *Admiral* along the Illinois bank. The vessel gets underway periodically for gaming and is required to have a life preserver for every person on board. The Coast Guard also requires the vessel to carry life floats or buoyant apparatus or both (for 10 percent of the people carried), ring buoys, and two rescue vessels (one forward and one aft).

Inspections and Tests

On April 8, 1998, Safety Board investigators rode the *Anne Holly* northbound from the Eagle fleeting area through St. Louis Harbor and past the Eads Bridge; the vessel had a 15-barge tow (5 barges comprising the port string, 5 the center string, 4 the starboard string, and 1 empty barge on the starboard side by the towboat). During the trip, the river stage was 30.2 feet on the St. Louis gage. The trip was uneventful, and no problems were noted.

A Safety Board investigator examined the operation of the *Anne Holly*'s steering gear, its propulsion engines, and its other engineroom equipment during the test trip. He found no problems. According to the company, no repairs had been made to the steering gear or propulsion engines since the accident.

Other Information

Permanently Moored Vessels and Structures

General. PMVs are used for a wide variety of purposes, including serving as casinos, museums (or other tourist attractions), entertainment facilities, restaurants, or

mooring barges. Because they frequently involve significant public use, PMVs often have relatively high patron occupancy levels. According to the Coast Guard, 162 PMVs were on U.S. waterways as of November 20, 1998. (See appendix E.) The Coast Guard estimated that about 30 of them were permanently moored gaming vessels in Mississippi and Missouri. In all, these 30 vessels had a carrying capacity of more than 50,000 people. St. Louis Harbor contained five PMVs, the *Admiral* vessel, the *Admiral* support barge, the *McDonald's* restaurant barge, the *Robert E. Lee* restaurant barge (not operating), and the Gateway Riverboat Cruises support barge.

Coast Guard Authority. The Coast Guard's authority to regulate the design, construction, equipment, staffing, and inspection of vessels derives from its enabling statute, 46 *United States Code* (U.S.C.), Subtitle II. With respect to the definition of the term *vessel*, Section 2101[45] of Subtitle II refers to 1 U.S.C., Chapter 1, Section 3, which states that *vessel* "includes every description of watercraft or other artificial contrivance used, or capable of being used, as a means of transportation on water." Section 3301(4) of 46 U.S.C., Subtitle II, states that *passenger vessels* are among the categories of craft that are subject to Coast Guard inspection.

The *U.S. Coast Guard Marine Safety Manual* (MSM),[36] Volume 2, Chapter 10, Section I, states that:

> a. Introduction. A floating fuel dock, showboat, theater, hotel, restaurant, museum, etc., is not a 'vessel' for inspection purposes if it is permanently moored and thus taken out of navigation. In this manner, the entity is 'substantially a land structure' and not subject to the [Coast Guard] inspection laws. However, it may be subject to other regulations, such as those promulgated under the Ports and Waterways Safety Act of 1972. The following criteria should be used in determining whether an entity is 'substantially a land structure.'
>
> (1) It must be securely and substantially moored as approved by the Officer in Charge of Marine Inspection [OCMI].
>
> (2) The mooring must be so rigged that its lines cannot be inadvertently or accidentally cast off, it is unlikely to break away from its mooring, and it cannot be moved away from the mooring without special effort (i.e., the use of tools).
>
> (3) Permanent connection to shoreside facilities is evidence of being a 'land structure.' The nature and use of the entity may also be considered.

The Coast Guard has other responsibilities concerning waterway safety that are not necessarily related to vessel inspection. The Coast Guard has extensive authority under the Ports and Waterways Safety Act of 1972 (PWSA) to act to safeguard navigation and protect waterfront facilities and the marine environment. Under the PWSA, as amended, the Coast Guard:

[36] The MSM sets forth Coast Guard policy and guidelines for use by Coast Guard personnel and the marine industry. It explains the Coast Guard's authority and rationale for various marine safety activities.

> May take such action as is necessary to–(1) prevent damage to, or the destruction of, any bridge or other structure on or in the navigable waters of the United States, or any land structure or shore area immediately adjacent to such waters; and (2) protect the navigable waters and the resources therein from harm resulting from vessel or structure damage, destruction, or loss. Such action may include, but need not be limited to– (A) establishing procedures, measures, and standards for the handling, loading, unloading, storage, stowage, and movement on the structure (including the emergency removal, control, and disposition) of explosives or other dangerous articles and substances, including oil or hazardous material as those terms are defined in section 2101 of title 46; (B) prescribing minimum safety equipment requirements for the structure to assure adequate protection from fire, explosion, natural disaster, and other serious accidents or casualties; (C) establishing water or waterfront safety zones, or other measures for limited, controlled, or conditional access and activity when necessary for the protection of any vessel, structure, waters, or shore area; and (D) establishing procedures for examination to assure compliance with the requirements prescribed under this section. [33 U.S.C. 1225]

With respect to the application of the PWSA as it may concern PMVs, the Coast Guard stated, in a February 17, 2000, letter to the Safety Board:

> The PWSA has generally not been interpreted and applied to expand the Coast Guard's regulatory authority over construction, manning, equipment or operations on vessels other than tank vessels.... If the issue is how ingress and egress from the PMV is provided in an emergency, the authority is more likely the vessel inspection laws and regulations, as opposed to the PWSA, at least as it has been traditionally applied.

This letter further stated that:

> [T]he broad language of the PWSA can provide additional regulatory authority to address new risks to port safety presented by vessels other than tank vessels, or to facilities in U.S. ports, or protection of the marine environment on the navigable waters of the United States. In fact, the language of the PWSA, authorizing the Secretary to regulate with respect to facilities and vessels in the ports of the U.S., is very broad.

(See appendix F for the full text of the Coast Guard's February 17, 2000, letter.)

USACE Authority. USACE is authorized to regulate activities on the Nation's waters according to 33 CFR Parts 320 through 330, which establish the Department of the Army permit process. USACE permits are required for dams or dikes in U.S. navigable waters and other structures or work, including excavation and dredging or disposal activities (or both), in U.S. navigable waters (33 CFR 320.1[b]). PMVs are considered structures under this definition and are required to have USACE permits. The USACE permit program is not concerned solely with safety; it involves "consideration of the full public interest by balancing the favorable impacts against the detrimental impacts" (33 CFR 320.1[a][1]). Permit review processes do not require that USACE assess the effect on vessel traffic or the risks to public safety posed by the structure. USACE often

consults with Federal (particularly Coast Guard), State, and local government agencies before issuing a permit; but USACE is not required to conduct such a consultation before it issues a permit.

Federal Oversight of the *Admiral*. In July 1983, the S.S. *Admiral* Ltd. company applied for a USACE permit to permanently moor a floating showplace family entertainment and dining center at mile 179.9 UMR. In conjunction with the permit application, the company installed "deadmen"[37] to secure the floating showplace structures to shore.

USACE asked the Coast Guard to review the permit request. In an advisory capacity, the St. Louis COTP conducted the review. In a letter dated September 22, 1983, he stated that "I have no objection to this proposal; however, I would be interested in reviewing any major changes to the plan." USACE issued the requested permit on October 5, 1983. The showplace operated from March 1987 until summer 1988, when it closed. In 1992, President Casinos purchased the floating showplace structures at mile 179.9 UMR.

In 1992, President Casinos applied for a modification to the USACE permit for the *Admiral* because the entry barge facility was 25 feet wider than the barge cited in the 1983 permit. (The unit extended 25 feet further into the river.)[38]

USACE requested that the Coast Guard review the permit revision request. After reviewing the public notice of permit, the St. Louis COTP wrote a letter to USACE dated June 22, 1994. The letter included the following statements:

> A recent towboat casualty in St. Louis Harbor involving the 'permanently moored' gaming boat *Admiral* [39] indicates the vulnerability of that vessel to possible future casualties. The presence of large numbers of patrons raises similar considerations to those discussed during the review of the *Casino Queen*'s application. In that case, a protection cell was required to deflect and slow down a barge which might otherwise strike the vessel with high and destructive energy.
>
> Accordingly, I request a review of the *Admiral*'s permit to determine if additional conditions are necessary to assure public safety. I have verbally discussed this with [a named individual], the director of marine operations for the parent company, President Casinos. [40] I request that he be included in the review effort.

On November 23, 1994, USACE advised President Casinos that it had modified the *Admiral*'s October 1983 permit to accommodate the existing mooring configuration.

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[37] *Deadmen* are mooring anchoring devices sunk into the riverbank from which anchor chains or mooring wires may be attached to a floating structure.

[38] The wider entry barge was necessary to comply with shore-to-entry gangway slope boarding requirements in the Americans With Disabilities Act of 1990.

[39] Coast Guard St. Louis case MC95005051, allision of the *Admiral* by the two-barge (empty) tow of the harbor towboat M/V *Robert Y. Love* on May 5, 1994.

[40] The President Casinos representative to whom the Coast Guard officer spoke was actually the director of the subsidiary, President Riverboat Casino-Missouri, Inc., not the parent company, President Casinos, Inc.

USACE also stated that a USACE district engineer "deemed it necessary that the S.S. *Admiral* must emplace a protection cell to provide protection from ice flow, debris, and breakaway tows."

President Casinos hired a professional engineering consulting firm to conduct a risk assessment (completed March 9, 1995) concerning drifting vessels affecting the *Admiral* and the possible location of a protection cell. The consultant reported that breakaway upbound tows had struck the vessel three times while it had been moored in this location.[41] The consultant's report stated that placing a protection cell upstream and to the starboard of the *Admiral* could redirect loose barges toward the *Admiral* and was not in the best interests of public safety. President Casinos did not install a protection cell.

On July 10, 1995, the St. Louis COTP[42] sent a letter to the St. Louis District USACE. A portion of the letter read:

> This addresses a previous request filed by this office for consideration of a protection/deflection cell upstream of the *Admiral* Casino on the St. Louis waterfront. Since that request was filed I have had several meetings with representatives of the lease holder, your office, the River Industry Action Committee, and the St. Louis Harbor Association. Casualty scenarios were examined and assessed; protection cells and other measures were discussed; and future move from the site now under review by the port authority is considered likely. [43]
>
> I believe the allision risks associated with continued operations at the site are such that a deflection cell would not significantly improve the public's safety. This conclusion is particularly valid given the probability of a change in the vessel's location in the near future.

Local Requirements. The city of St. Louis owns the waterfront area in St. Louis Harbor where the *Admiral* is moored; the city leases the area to President Casinos. The city of St. Louis has procedures that its Port Commission and the Board of Public Service must follow when the owners of a structure, like the *Admiral*, request a lease to moor the structure along city-owned land within the port district. These procedures involve review

[41] Coast Guard records provided one instance of the *Admiral* being struck, by tows from the towboat *Robert Y. Love* in May 1994. On June 5, 2000, AM representatives provided the Safety Board evidence of other occasions on which the *Admiral* was struck by tows/barges. AM provided a copy of a February 13, 1995, memo from the *Admiral*'s (then) director of marine operations to the President Casinos, Inc., engineering consultant. The 1995 memo stated that the *Admiral* had been struck three times since 1988. The three incidents to which the memo referred were an April 23, 1991, incident involving the towboat *Wendy Ann,* during which the operator lost tow control while passing through the MLK Bridge and the tow struck the *Admiral*, a second for which no details were provided, and the *Robert Y. Love* accident. AM also gave Board staff a copy of a Coast Guard accident investigation report of the "M/V *Crescent City* allision with the Eads Bridge, Mile 180, Upper Mississippi River on 23 February 1985, with no personnel injuries or loss of life." The report indicated that breakaway barges from the tow struck the *Robert E. Lee*, the *Admiral*, the *Golden Rod Showboat*, and the St. Louis Visitors Center.

[42] The COTP in this case was the same individual who had sent the June 22, 1994, letter.

[43] In 1995, interested parties had discussed the possibility of moving the *Admiral* upstream when it obtained the new permit. No action was taken until after the accident.

and approval by the Board of Public Service, the port administrator,[44] the Department of Public Safety, and other city agencies. If the Board of Public Service ultimately approves the application, it recommends a lease ordinance to the Board of Aldermen. If the Board of Aldermen and the mayor approve the lease ordinance, they make it a lease agreement. President Casinos went through this approval procedure to obtain a lease for the *Admiral* on the St. Louis waterfront.

As substantially land structures or floating buildings, PMVs are subject to local ordinances and building codes. The codes require that the "building" have adequate electrical, mechanical, and plumbing arrangements, as well as appropriate exits, lighting, emergency lighting, power ratings, sprinkler systems, etc., for a facility of its size. The city of St. Louis has adopted the Building Officials and Code Administrators Basic Fire Prevention Code (BOCA Code)[45] for its buildings. Through a December 6, 1999, letter, the SLFD deputy chief informed the Safety Board that pertinent provisions of the code had been applied to the *Admiral.*

The Department of Public Safety for the city of St. Louis reviewed the *Admiral*'s design plans to ensure that the PMV met the applicable building codes for fire safety (according to the BOCA Code), electrical, mechanical, and plumbing requirements. The department also approved the *Admiral*'s design and evacuation plan for compliance with requirements for emergency exits, emergency lighting, and fire sprinklers, as they would apply to buildings. According to a Department of Public Safety representative, the agency was not required to review the *Admiral* for marine safety aspects, nor did the city consider the need for lifesaving equipment because such factors are not considered during the approval processes for buildings.

Missouri Gaming Commission Requirements. Permanently moored casinos in Missouri must have a license from the Missouri Gaming Commission. In a July 9, 1998, letter to the Safety Board, the Missouri Gaming Commission stated:

> The Commission's rules mandate that the licensee meet the minimum standards for safety and environment established by the U.S. Coast Guard, the Army Corps of Engineers, and the Environmental Protection Agency.
>
> The Commission's safety rules require that permanently moored vessels meet: (1) The fire safety standards of the Missouri Law and Rules; (2) The fire safety standards contained in the National Fire Protection Association (NFPA), *NFPA Standard 307 Standard for the Construction and Fire Protection of Marine Terminals, Piers, and Wharfs*; and (3) The NFPA Life Safety Code.

[44] The port administrator is responsible for monitoring any lease and for requesting the assistance of appropriate city agencies when it is necessary to fulfill city ordinances or State or Federal regulations that might apply to the transaction or that might be needed to protect the life, health, or property of citizens or to further the city's economic development.

[45] The BOCA is one of three major national model building code groups that publish a building code. Each code group is a consensus body. There is some uniformity among the model codes, although the groups meet different regional and geographical needs.

The acting executive director of the Missouri Gaming Commission also informed the Safety Board in the July 1998 letter that:

> The Commission does not employ safety experts but instead relies on other government agencies with expertise in safety standards and inspections.

The Commission required that, before it would license the *Admiral*, the vessel be inspected by American Bureau of Shipping (ABS) Marine Services, Inc.,[46] for stability and integrity. Before it would relicense the *Admiral* in 1995 and 1997, the Commission required that ABS Marine Services reinspect the vessel to ensure that it continued to be fit to serve as a permanently moored casino in Missouri.

Boats in a Moat

"Boat in a moat" is a term used to describe a vessel that is restricted from leaving a waterway (lake, pond, or basin) by natural or man-made obstructions. Such a vessel cannot float into a river or be subject to collision or ramming by other vessels. If a boat in a moat breaks away from its mooring for any reason (such as weather), it will not be subject to the dangers of vessel traffic. The moat is generally shallow, so if the vessel should sink, people on board will not be endangered.

The Eighth (Gulf Coast and Central Western Rivers District) and Ninth (Great Lakes District) Coast Guard Districts contain 9 and 11 boats in a moat, respectively. Thirteen of these vessels are inspected by the Coast Guard and issued certificates of inspection. State and local authorities regulate the other seven. Four of the 11 boats in a moat in the Ninth District are attempting to give up their Coast Guard certificate status and be regulated by State and local governments.

Passenger Vessels in St. Louis Area

The St. Louis Harbor area contains four vessels that are inspected by the Coast Guard for compliance with passenger vessel safety requirements. They are the *Casino Queen* (capacity 3,000), the *Tom Sawyer* (capacity 375), the *Becky Thatcher* (capacity 350), and the *Alton Belle II* (capacity 1,500).

Risk Assessment

General. "Risk" may be defined as a combination of the probability of an accident occurring together with its consequences.[47] "Risk assessment" is an organized and systematic search for high-risk conditions in a system; through this process, the hazards in a system are identified and prioritized. Through risk assessment, risk management

[46] ABS Marine Services, Inc., is a for-profit corporation that provides consulting, survey, engineering and training services. It is separate from ABS, Inc., a non-profit vessel classification society.

[47] National Transportation Safety Board. *Fire Aboard the Tug* Scandia *and the Subsequent Grounding of the Tug and the Tank Barge* North Cape *on Moonstone Beach, South Kingston, Rhode Island, January 19, 1996*. Marine Accident Report NTSB/MAR-98/03. (Washington, DC: National Transportation Safety Board, 1998).

strategies can be developed. System stakeholders can then select certain risk management strategies over others, based on the level of risk they are willing to accept.[48]

The MSM defines the waterway elements to be considered during the risk assessment process as vessel properties, waterway properties, cargo properties, and environmental conditions. Port risk management is the responsibility of the Coast Guard's Office of Marine Safety and Environmental Protection, which is charged with protecting the public, the environment, and U.S. economic interests by preventing or mitigating the effects of marine accidents and incidents. According to the "Program Principles" section of the Office of Marine Safety and Environmental Protection's *1996 Performance Report*,[49] risk management is the "business" of the office. The report states:

> Preventing low probability-high consequence events, such as major loss of life on passenger vessels, and medium and major oil spills, is a cornerstone of our risk management approach. To improve our decision making, we need to strike a balance, allowing field commanders to employ existing risk analysis tools for routine risk management decisions, while establishing a formal program policy for high level risk analysis projects, such as comprehensive port risk models.

According to the operations manager of the St. Louis City Port Authority, neither Federal, State, nor local authorities conducted a formal risk assessment of waterfront operations in St. Louis Harbor.

The PVA maintains a *Risk Management Manual for Passenger Vessels*. The document addresses such topics as providing safety audits, meetings, and announcements; reducing various types of accidents; managing hazardous waste; maintaining logbooks; and conducting fire drills and contingency planning. In 1995, a President Casinos employee drafted the chapter "Emergency Drills and Contingency Planning" that appears in the PVA manual. Using St. Louis Harbor as its model, the chapter discusses developing passenger vessel marine risk contingency plans to address various types of emergencies involving collisions, taking on water, losing propulsion and requiring harbor tug assistance, moving injured people ashore, and transferring firefighters from shore to vessel.

Risk Assessment Methods Used by the Coast Guard. Pursuant to the Coast Guard's *1996 Performance Report* objectives of employing risk-based tools for routine field use and port risk management, the Coast Guard contracted with George Washington University to develop a *Port and Waterways Risk Assessment Guide*.[50] The guide was

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[48] For more information on risk assessment as it applies to marine vessel operations, see National Transportation Safety Board, *Allision of the Liberian Freighter* Bright Field *with the Poydras Street Wharf, Riverwalk Marketplace, and New Orleans Hilton Hotel in New Orleans, Louisiana, December 14, 1996*. Marine Accident Report NTSB/MAR-98/01. (Washington, DC: National Transportation Safety Board, 1998).

[49] The Coast Guard's 1996 report on the office's progress toward goals listed in Commandant Instruction 16000.2 (series), *Business Plan for Marine Safety and Environmental Protection*.

[50] George Washington University. *Port and Waterways Risk Assessment Guide*. (Washington, DC: George Washington University, 1996).

published for Coast Guard field personnel to use in evaluating and managing risk in U.S. ports and waterways. Appendix A of the guide contains a 12-step program that provides "a structured format for gathering and analyzing the necessary information and professional knowledge required to evaluate and manage risk in U.S. ports and waterways." The Coast Guard *Proceedings of the Marine Safety Council, July–September 1999*, contains several articles about how the Coast Guard is applying risk management approaches similar to those described in the guide.

The *Proceedings* outline how MSO Jacksonville, Florida, has developed vessel risk measures for the different types of vessels (deep-draft, fishing, towing, and passenger) operating in its port. MSO Jacksonville has also developed facility risk measures to manage the risk of oil spills at cargo oil transfer facilities in its port, as well as a port activity risk measure that gauges the relative risk levels for waterway segments according to each segment's traffic density, geographic features, importance, other unique factors, and high-risk activities such as dredging, bridgework, etc. The risk profile for the port is updated and monitored weekly, allowing the COTP to target risk management resources optimally.

The MSO at Los Angeles/Long Beach, California, refined and expanded MSO Jacksonville's risk model by including as many as 16 parametric measures of risk to develop an overall Port Activity Risk Index (PARI). Examples of risk parameters include cruise ship activity, vessel movements, status of aids to navigation, weather, and special operations in the port. The PARI is updated daily and provides the COTP with an overall indicator of the relative port risk for that day, so the COTP can implement appropriate risk reduction measures.

Following the December 1996 collision of the M/V *Bright Field* with a pier in the Port of New Orleans,[51] the February 1998 breakaway of the casino barge *Jubilee* near Greenville, Mississippi,[52] and the April 1998 near breakaway of the *Admiral*, the Coast Guard established a Quality Action Team (QAT) in April 1998 to identify risks to PMVs that carry passengers. The goals of the team were to establish Coast Guard involvement in the siting and mooring of PMVs and to develop measures for reducing the risk of accidents affecting PMVs.

On December 7, 1999, the Coast Guard issued the final report of its QAT for PMVs.[53] The report provided a simplified methodology by which Coast Guard field units might assess risks to PMVs. The risk assessment methodology is based on six parameters: PMV location, vessel traffic, adequacy of emergency maritime assistance to disabled vessels, anticipated environmental factors, unpredictable environmental factors, and exposure (presence) of PMV passengers. (See appendix G for the Coast Guard's PMV

[51] NTSB/MAR-98/01.

[52] On February 10, 1998, the PMV *Jubilee Casino*, carrying nearly 1,000 people, broke loose from its moorings on an inlet of the Mississippi River near Greenville, Mississippi, during a severe thunderstorm with high winds. No injuries or damage resulted, and river vessels pushed the PMV back into place.

[53] U.S. Coast Guard. *Permanently Moored Vessel QAT: A Site Selection and Risk Mitigation Model: Final Report, December 7, 1999*. (Washington, DC: U.S. Coast Guard, 1999).

initial risk assessment form.) The QAT developed the methodology using expert opinion, experience, and local knowledge from Coast Guard field units. The team developed the method by assigning risk scores between 1 and 5 to each risk parameter (1 being the greatest risk and 5 being the least risk).

Next, the QAT examined accident data comprising 295 accidents (including groundings, collisions, allisions, and breakaways) that occurred between 1992 and 1997 within 1/2 mile upstream of PMVs. The QAT included data on 162 PMVs in the study. The QAT found that the accident data generally validated the methodology[54] developed through field experience and expert opinions. The accident statistics were used to establish acceptable risk scores to be used with the method. (The published QAT report did not disclose the actual risk scores and rankings for individual PMVs, or determinations of whether the PMVs met acceptable risk criteria as defined by the report.)

The QAT found that barge breakaways, collisions, and high water were the main causes of PMVs breaking their moorings.[55] The team also found that accident statistics showed that most (68 percent) of the accidents occurred at high-risk locations, making location the single most important parameter in predicting risk to a PMV. The QAT report concluded that site selection was the most effective way of managing PMV risk. The report stated that, where site selection options are limited, the next option could be to modify the site by adopting measures such as the installation of protective cells.

In addition, the QAT report stated that, although the methodology that the QAT constructed for assessing PMV risks was developed using only PMV data, this risk assessment system is applicable to other vessel types and mooring sites.[56]

The Coast Guard adopted the QAT report's recommendations and used them as the bases for changes in Coast Guard policies applicable to PMVs. (See appendix H for a full list of the report's conclusions and recommendations.) The policy changes are explained in the Coast Guard's 1999 update to its MSM, which the Coast Guard issued for field use. (See appendix I, Draft *U.S. Coast Guard Marine Safety Manual* Change, MSM Vol. II: Material Inspection, Chapter 10.)

The revised MSM makes a number of new requirements regarding PMVs. For example, before the Coast Guard will formally acknowledge a vessel as a PMV, the vessel must undergo a risk assessment based on the methodology described in the QAT report. If a PMV fails to meet the risk criteria, the COTP has "articulable grounds" for calling safety into question. In such a case, the COTP can require the vessel owner or operator to develop a formal risk assessment and mitigation plan.

With respect to the USACE permit process, the new Coast Guard policy requires that the simplified risk assessment be an integral part of USACE permit reviews. The Safety Board understands that, as part of the Coast Guard's involvement in the site

[54] *Permanently Moored Vessel QAT: Final Report, December 7, 1999*, appendix C.

[55] *Permanently Moored Vessel QAT: Final Report, December 7, 1999*, appendix F, p. 2.

[56] *Permanently Moored Vessel QAT: Final Report, December 7, 1999*, p. 13, conclusion 6.

approval process, the COTP will advise USACE whether the PMV under consideration meets the acceptable risk criteria.

On June 2, 2000, USACE and the Coast Guard signed a Memorandum of Agreement regarding the new process for evaluating risks to PMVs. According to the Coast Guard's media advisory concerning this action, the agreement establishes "a formal process whereby the Coast Guard will provide input into [USACE's] evaluation process for issuing permits related to these types of fixed or floating structures." The release further stated:

> The new process elevates the attention given to port and waterway safety issues associated with a structure's location during [USACE's] public interest review process, and provides for periodic review of existing permits as a result of waterway changes.

The Coast Guard continues to require that PMVs be immobilized and removed from navigation but, under the revised MSM, the local COTP must now require that a professional engineer evaluate each PMV's mooring arrangements. Further, the standard to which the mooring is evaluated must be developed during the initial risk assessment process and take local conditions into account.

Under the new procedures, once the COTP determines that the PMV meets the risk criteria and the USACE provides a site permit, the Coast Guard will transfer the responsibility for future safety regulation of the PMV to local authorities. The transfer will be designated in writing. Because some local authorities may not be well versed in marine issues, the COTP will meet with the local authorities to ensure that they have satisfactorily addressed hull integrity, mooring arrangements, emergency egress, lifesaving appliances, and navigation-related operational issues.

The Coast Guard will continue to be involved in the PMV's safety after its jurisdiction is transferred to local authorities. The COTP must re-evaluate the risks to the PMV at least every 2 years (and when pertinent local conditions change), using the QAT report's risk method. (The Memorandum of Agreement being developed between the Coast Guard and USACE is to include a provision for periodic permit reassessments.) Further, if the PMV is moved to a site that already has a USACE permit, the Coast Guard is responsible for determining whether that vessel qualifies as a PMV at that location.

The Coast Guard has initiated a review of all PMVs based on the new policy and expects to complete the assessment of risk for all 162 PMVs in 2000. (The results of this review are not yet available.)

Responsible Carrier Program

Through the AWO, the inland towing industry has developed and adopted a safety management system called the Responsible Carrier Program (RCP). The RCP is modeled after the International Maritime Organization's International Safety Management Code.[57] The RCP provides member companies with recommended policies and practices

concerning the management, administration, maintenance, inspection, and use of equipment and human factors affecting the safe and efficient operation of towing vessels under varying conditions (such as high water, low water, restricted visibility, and so forth).

All AWO members are required to develop and implement the vessel operating policies and procedures outlined in the RCP to retain their AWO membership. The RCP system is intended to document and define the responsibilities of shoreside management and tow crews, to enhance safety and environmental protection for vessel operations. All AWO members were required to develop and implement the vessel operating policies and procedures outlined in the RCP by 2000 to retain their AWO membership. AWO has reported that 11 companies have been removed from AWO membership because they did not fully comply with the RCP requirements.

1994 New Orleans Search and Rescue Exercises

On January 30, 1994, Coast Guard Group New Orleans, Louisiana, conducted a series of search and rescue exercises with local emergency groups on the LMR, between the Crescent City connection bridges and Algiers Point. The purpose of the exercises was to determine the capability of the Coast Guard, city, and commercial interests to locate and rescue large numbers of people in the river. The exercise simulated a collision between a passenger vessel with 1,400 people on board and a 700-foot freighter. In the staged incident, the passenger vessel sank quickly, causing 1,400 "people" to go in the water. Wooden blocks represented people in the water.

In the response to the scenario, responders recovered less than 20 percent of the 1,400 wooden blocks. The Coast Guard found that the conditions of the Mississippi River in the vicinity of New Orleans severely limited the survivability of people in the water. These conditions included cold water temperatures (34° F) and swift and treacherous currents, eddies, and undertows. The Coast Guard determined that, under prevailing conditions, a large percentage of people entering the water would have soon succumbed to hypothermia. The Coast Guard on-scene commander concluded that, should such an accident actually occur, he could not guarantee the rescue of passengers forced into the Mississippi River.

Developments Since the Accident

President Casino on the Admiral

The *Admiral*'s 10 mooring wires have been replaced with new wires. The stern anchor weight has been increased from 6,000 to 12,000 pounds. President Casinos has

[57] The International Safety Management Code recognizes and codifies the responsibilities of shipping company management in ensuring adherence to marine safety guidelines and environmental protection standards. The Code provides member companies with recommended policies and practices concerning the management, administration, maintenance, inspection, and use of equipment and human factors affecting the safe and efficient operation of vessels under varying operating conditions.

added an auxiliary anchor and chain to the *Admiral*'s bow; they can be released should the other two anchors (bow and stern) or anchor mooring wires break or become dislodged.

Since the accident, the company has purchased two cellular phones for the *Admiral*; one is kept in the security shift office and the other in the general manager's office. President Casinos has also installed a marine radio scanner and a marine radio in the *Admiral*'s security shift office. The radio can be used to communicate with the *Casino Queen* and other navigating vessels in the area. The company has made provision for an *Admiral* employee to monitor the marine radio 24 hours a day, 7 days a week.

On March 16, 1999, three *Admiral* security staffers participated in a 6-hour "Crowd Management for Passenger/Casino Vessels" training session conducted by a commercial training center. The course was designed to help participants develop the knowledge and skills to control and direct passengers in emergency situations.

On May 24, 1999, at the request of President Casinos, USACE issued a permit to move the *Admiral* complex to mile 180.3 UMR, above the MLK Bridge, and to place four protection cells around it. President Casinos has until December 31, 2003, to complete the action and is expected to move the vessel by fall 2000.

Laclede

According to a December 9, 1999, letter from the Laclede Gas Company to the Safety Board, when the *Admiral* is moved to mile 180.3 UMR, Laclede will install a new service line and meter station to serve the vessel. The company stated that:

> The new meter station, with accessible shutoff valves, will be located at 802 N. First Street. This location was chosen by Laclede because it is remote from areas affected by flooding. This new service line will be approximately 750 feet in length and will terminate in a custody transfer vault located on the riverfront. Considering the *Admiral*'s new location, and its readily accessible valving which would be available in the event of an emergency, Laclede feels that an automatic shutoff device is not necessary for this installation.

When the Safety Board expressed its concern about the other PMVs on the St. Louis waterfront to which Laclede supplies natural gas, the company stated, in a December 28, 1999, reply, that:

> Laclede has tested and found the Fisher 299H w/VSX module regulator to be an acceptable automatic shutoff device for the service to the St. Louis Concessions [58] and *McDonald's* riverboats. Installation of a Fisher 299H w/VSX module regulator and necessary service line modifications for both of these customers is planned by Laclede [ ]... .

Laclede subsequently informed the Safety Board that it will install these low-pressure shutoff devices in fall 2000.

[58] Gateway Riverboat Cruises support barge.

In a January 7, 2000, letter to the Safety Board, Laclede stated that, with respect to "providing ready access, in the event of flooding, to the natural gas service shutoff valves for floating customers on the St. Louis riverfront," the company was continuing its actions. Specifically, Laclede stated that:

> A [ ] guide is being designed for these service valves so that a valve key can be easily placed on a service valve from over head in the event of high water on the St. Louis riverfront. These guides will be installed on the remaining active customers [St. Louis Concessions, *McDonald's*, and *Robert E. Lee*] during the Spring of 2000 when additional work is planned.

Laclede has since informed the Safety Board that valve key guides have been installed on the St. Louis Concessions, *McDonald's*, and *Robert E. Lee* PMVs, as well as the *Admiral*, in its current location.

NFESC Mooring Study

After the accident, the Safety Board contracted with the Naval Facilities Engineering Service Center (NFESC), East Coast Detachment, to conduct an engineering analysis of the mooring of the *Admiral* and its entry barge as it was at the time of April 1998 accident. The purpose of the analysis was to help determine what factors may have contributed to the mooring failure.

The NFESC evaluated the effect on the mooring caused by impact on the *Admiral*'s bow from one and three loose barges, loaded as they were at the time of the accident. The mooring wire strengths, diameters, and arrangements used in the NFESC's calculations were based on those used to moor the *Admiral.*

In summary, the NFESC found that:

- the *Anne Holly*'s runaway barges probably badly damaged or severed mooring wires 8, 9, and 10 by drifting into them before the barges struck the *Admiral* itself;
- the impact of the runaway barges on the *Admiral* caused peak acceleration of the *Admiral* of approximately 0.1 g or less;
- more than one runaway barge probably struck the *Admiral* and/or the wire ropes may not have had their full new-break strength at the time of the accident;
- a runaway group of three barges would have broken the mooring wire rope numbers 1 through 6 at a speed as low as 4 feet per second (2.7 miles per hour);
- the mooring wire rope numbers 1, 2, 3, 4, 5, and 6 likely failed because wire ropes are stiff (do not stretch much), and the wire rope winches were locked tight, so the wire rope could not "pay out" in case of overloading;

- after wire rope numbers 1 through 6 and 8 through 10 broke, the river current acted on the *Admiral* and the entry barge to make them swing slowly in a clockwise direction and end up near the riverbank downstream; and
- the final remaining mooring wire, number 7, would likely have held even without the *Anne Holly*'s assistance.

Analysis

Exclusions

Based on the statements of the *Anne Holly*'s chief engineer, the Safety Board's examination of the towboat's machinery and steering, and the trial trip taken on the *Anne Holly* on April 8, 1998, the Safety Board found no evidence of loss of engine power, loss of steering, or of any other mechanical or electrical malfunction that could have caused or contributed to this accident. The *Anne Holly* had nearly twice the minimum horsepower required by the Coast Guard for upbound towboats during high-water conditions, and the vessel successfully navigated the area a few days after the accident with a similar tow under similar conditions. The Safety Board therefore concludes that the *Anne Holly* had sufficient horsepower to successfully navigate upbound through St. Louis Harbor on the night of the accident, and the vessel did not experience any propulsion or steering system failure.

Nifedipine and glyburide do not typically impair performance, although some individuals may experience side effects, including dizziness and nausea. The *Anne Holly* captain had used both of these medications on a regular and continuing basis at least since December 1996, and he testified that he did not experience any side effects. In controlled medical studies, sertraline did not cause sedation and did not interfere with psychomotor performance,[59] and may actually improve performance in patients with depression.[60]

The Safety Board reviewed the report of a medical examination of the captain performed several weeks before the accident (in late February 1998) and a medical examination for Coast Guard licensing done in August 1998, after the accident. The review of the two examinations indicated that the captain's physician had found the captain physically fit for duty on board the *Anne Holly.* He was receiving appropriate treatment for his diabetes and elevated blood pressure, and no side effects were reported for any of his medications.[61]

The *Anne Holly* captain had more than 25 years of experience as a towing vessel operator, was properly licensed, and had routinely transited the river through St. Louis Harbor many times both upbound and downbound under many different circumstances, including high-water conditions. Moreover, he had operated tows through the St. Louis Harbor area without an accident for the previous 4 years. He was thus qualified and

[59] See, for example, Doogan, D.P., and Caillard V. "Sertraline, A New Antidepressant." *J Clin Psychiatry.* Aug: 49. Suppl: 46-51. 1988.

[60] See, for example, Finkelstein, S.N., Berndt, E.R., Greenberg, P.E., Parsley, R.A., Russell, J.M., and Keller, M.B. "Improvement in Subjective Work Performance After Treatment of Chronic Depression: Some Preliminary Results." *Psychopharmacol Bull.* 32(1): 33-40. 1996.

[61] Postaccident drug and alcohol testing and fatigue, as they relate to the *Anne Holly* captain, will be addressed in a later section of the analysis.

adequately experienced and skillful to serve as captain of the *Anne Holly* in St. Louis Harbor. Therefore, the Safety Board concludes that the captain of the *Anne Holly* was sufficiently qualified, experienced, and skillful to serve as captain on the night of the accident, and his prescription medication did not negatively affect his performance.

Although it was dark when the *Anne Holly*'s transit began, the weather was clear, with good visibility (of at least 2 miles) in darkness. The wind was from the southwest at 5 miles per hour. The Safety Board therefore concludes that weather was not a factor in this accident.

After the accident, the *Anne Holly* captain said that his tow's forward movement was affected by a river phenomenon that he described as a "pop rise" between the MLK and Eads Bridges. A review of the USACE hourly river stage data, however, indicated a gradual rise of about 0.9 foot in 24 hours in the river stage in St. Louis Harbor. USACE data showed about 0.2-foot rise between 1900 and 2000 on April 4, 1998.

Testimony from the chief of the potamology section of the St. Louis District USACE indicated that the rise in river level that day had been gradual. When he was asked if a condition "that could have resulted in an unexpected 'wall of water' between the MLK and the Eads Bridges" had been present on the day of the accident, the USACE official replied that it had not. The USACE findings suggest that the *Anne Holly* tow experienced no anomalous river conditions as it moved between the MLK and Eads Bridges. Consequently, the Safety Board concludes that no sudden rise in river level interfered with the forward movement of the *Anne Holly* tow.

The major safety issues identified in this investigation and discussed below are:

- the advisability of the *Anne Holly* captain's decision to make the upriver transit and the effectiveness of safety management oversight on the part of AM,
- the effectiveness of safety measures provided for the PMV *Admiral*, and
- the adequacy of public safety for permanently moored vessels.

This accident comprises two separate accident sequences: 1) the striking of the Eads Bridge, with the break up of the *Anne Holly* tow, and 2) the subsequent striking of the PMV *Admiral* by barges from the *Anne Holly* tow and the PMV's near breakaway. The analysis that follows considers each sequence separately.

Striking of the Eads Bridge by the *Anne Holly* Tow

Captain's Decision-making

On the night of the accident, the principal task of the *Anne Holly* captain was to navigate the 14-barge tow upriver from the Eagle fleeting area past four bridges. Under normal river stage (less than 20 feet on the St. Louis gage) and in daylight, someone with

experience and skills similar to the captain's could routinely accomplish this task. Conditions, however, were unfavorable in that the river was in flood and it was dark.

The captain's decision to proceed with the transit under the prevailing conditions of darkness and flood (which resulted in minimal vertical clearance at the Eads Bridge and a swift current of 6 mph) is critical to understanding the probable cause of this accident. On the night of the accident, the *Anne Holly* captain was aware of the difficult navigation task that he was undertaking; once he left the fleeting area, he requested a helper boat to assist him in taking his tow through the St. Louis Harbor bridges. When he learned that no helper boat was immediately available, he chose to attempt the transit without one. Other options, however, were open to him. He could have:

- returned to the fleet to await the availability of a helper boat;
- returned to the fleet, dropped off part of his tow, and then proceeded with a partial tow through St. Louis Harbor[62] (he would then have had to return to the fleet to retrieve the remainder of the tow and make a second trip through the harbor or had another towboat bring the remaining barges upriver for him); or
- returned to the fleet and remained there until daylight so that he could make the transit through St. Louis Harbor in daytime.

Despite these options, the captain decided to continue with the transit without a helper boat.

The transit of this tow under the prevailing conditions was a difficult task and presented risks that increased the likelihood of an accident. The captain, although experienced and familiar with the navigational demands of the area, decided on the evening of April 4, 1998, to move the *Anne Holly* tow through the area under recognizably adverse conditions. The Safety Board concludes that, given the difficult navigation task, the darkness, the flood conditions (which resulted in a swift current and minimal vertical clearance at the Eads Bridge), and the lack of a helper boat, the captain should have chosen to pursue another option on the evening of April 4, 1998.

Role of Company. Although the immediate cause of the accident was the *Anne Holly* captain's operational error or errors (to be discussed in the next section), the underlying cause was the owner's lack of effective safety management of its towing operations. The absence of corporate management input into the captain's strategic decision-making process about whether to proceed with the transit of St. Louis Harbor that night placed an unreasonable burden on the captain and forced him to make unilateral safety-critical decisions from the narrow perspective of the pilothouse.

As a small business, AM often contracts for boats and operators as its workload requires and does not maintain an extensive shoreside operations infrastructure.

[62] By making the transit with a shorter tow, the captain would have made the navigation task less challenging because it would have reduced the tow's tonnage, increased the *Anne Holly*'s control over the barges in the tow and the tow's maneuverability, and lessened the effect that the current had on the tow by reducing the surface area of the tow that was exposed to the current.

According to AM management, the company relies on the captain to make all decisions regarding the tow's operation. The company does not have written policies that its captains should follow to consistently ensure safe towing operations or procedures to assist the captains in choosing the proper course of action in safety-critical situations. The company has not established policies that address high water, nighttime transit, and other conditions that might affect the safety of towing operations. In addition, AM has provided no written guidance to its captains describing situations in which they may be justified in recessing operations for safety reasons. Nor does the company provide basic guidance concerning the proper way to make up a tow or use the tow's equipment when underway. Company officials told the Safety Board that they rely exclusively on the knowledge, experience, and discretion of the individual captain to decide what is safe and proper under the prevailing circumstances.

In the Safety Board's view, the company's comparatively small size does not justify AM's attempt to place sole responsibility for safe operation of its vessels on the captain. Regardless of corporate size, management retains responsibility and accountability for its vessels' operations and accidents. The Safety Board realizes that the captain is on board the vessel and is making decisions and taking actions for which he, and only he, can be responsible. Nevertheless, shoreside management shares or owns the responsibility for many of the operational decisions and actions affecting vessel safety.

AM, which is not an AWO member, did not participate in the RCP and did not have a similar safety management system. The absence of such a system meant that AM had no comprehensive method to provide effective management oversight of safety operations, a responsibility that the company should have proactively pursued. This responsibility is not one that can be delegated to the towboat captain. The lack of an effective safety management system that provided procedures governing the safe operation of the *Anne Holly* was substantially responsible for creating an environment that increased the likelihood that this accident would occur.

Night operation increases the risk of accidents, and AM should have developed night operations procedures for its captains. Operations during high water also pose greater risks, and AM should have addressed them through management instruction and policy. Certain areas of operation, such as the transit through St. Louis Harbor, present unique risks that likewise should have been the subject of management policy and oversight. The procedures should have anticipated the need for a helper boat and should have delineated alternative actions that the captain might take under various foreseeable circumstances. Moreover, the risk of collision with other river traffic is always present. Had the *Anne Holly*'s tow struck and ruptured other barges loaded with petroleum products or hazardous materials, the resulting spill could have seriously harmed the environment. The captain should have been provided guidance concerning such an eventuality.

By not providing guidance through a comprehensive safety management system, AM left the captain of the *Anne Holly* to his own devices to make safety-critical decisions, increasing the likelihood that the captain would make an inappropriate decision. Consequently, the Safety Board concludes that the captain of the *Anne Holly* would have

been better able to make prudent decisions concerning the operation of his tow, and this accident might thereby have been prevented, had AM developed and implemented an effective safety management system. The Safety Board therefore believes that AM should develop and implement a safety management system similar to the RCP used by the AWO; the system should establish effective policies and procedures to enhance the safety of vessel operations.

The Safety Board has previously addressed the need for safety management systems in the U.S. towing industry and has recommended that the Coast Guard require such systems. As a result of its investigation of the 1996 accident involving fire aboard the tug *Scandia* and the subsequent grounding of the tug and the tank barge *North Cape*,[63] the Safety Board issued the following safety recommendation to the Coast Guard:

> M-98-104
>
> In conjunction with the towing vessel industry, develop and implement an effective safety management code to ensure adequate management oversight of the maintenance and operation of vessels involved in oil transportation by barges.

In its November 5, 1998, reply to the Safety Board, the Coast Guard stated that it concurred with the intent of the recommendation, that it believed use of safety management systems would result in significant benefits, and that it supported the development of such programs. However, the Coast Guard's letter also stated that 46 U.S.C. 3202, which affirms that U.S. domestic vessels may *voluntarily* meet the requirements of the chapter, does not provide the Coast Guard with statutory authority to require safety management systems on domestic vessels. The Coast Guard further stated that it had issued *Navigation and Vessel Inspection Circular 2–94*, providing "Guidance Regarding Voluntary Compliance with the International Management Code for the Safe Operation of Ships and for Pollution Prevention," and that it had worked with the AWO in developing the RCP. The Coast Guard considered that these actions fulfilled the intent of Safety Recommendation M-98-104 and requested that it be closed.

In a September 22, 1999, reply, the Safety Board stated that because not all U.S. towing companies are AWO members, some may not use the RCP, so a safety management system remains necessary for the industry. Further, the Safety Board found the Coast Guard's efforts insufficient to fulfill the recommended action. Consequently, the Safety Board classified the recommendation "Open–Unacceptable Response."

This accident demonstrated that the Safety Board's concern regarding the lack of safety management systems for towing industry companies that are not AWO members was well founded. AM was not an AWO member and had no safety management system. Approximately 15 percent of the tonnage that is moved on U.S. waterways is transported by towing companies that are, like AM, not AWO members. These non-AWO members are not required to follow a safety management system similar to the RCP and therefore may not benefit from the organized safety procedures that such systems provide. The Safety Board concludes that the lack of a safety management system requirement for all

[63] NTSB/MAR-98/03.

U.S. towing industry companies represents a threat to waterway safety. Consequently, the Safety Board reclassifies Safety Recommendation M-98-104 "Closed–Unacceptable Action/Superseded" and believes that the Coast Guard should seek authority to require domestic towing companies to develop and implement an effective safety management system to ensure adequate management oversight of the maintenance and operation of all towing vessels.

Navigation Task

Once he was committed to transiting St. Louis Harbor on the evening of April 4, 1998, the captain faced the challenging task of navigating past the MacArthur, Poplar Street, Eads, and MLK Bridges. The captain successfully brought the *Anne Holly* tow through the MacArthur and Poplar Street Bridges. Then he faced the Eads Bridge transit.

The passage of a tow through the Eads Bridge required the operator to approach the bridge with the tow positioned to the left of the river centerline and with the tow's head aimed at the Illinois (right side) bridge pier of the center span. Operators of multi-barge tows must head their tows directly into the current to navigate the Eads Bridge successfully during high water. On nearing the Eads Bridge opening, the operator turns the tow to the left so that it will be aligned with the current for passage through the navigation span. Upon exiting the span, the operator moves the tow back to the right to align it for passage through the MLK Bridge.

This steering task cannot be completed by the operator establishing the tow's course while he is still some distance from the bridge and driving the tow straight through the opening. The maneuver requires that the operator begin the turns at the proper locations, at the proper times, and with the proper amounts of rudder. The operator also has to complete the turns appropriately by reducing the rudder angle or applying counter rudder in the opposite direction, at the correct locations and times. According to the testimony of the *Anne Holly* captain, which the Safety Board verified through discussions with other Mississippi River towing vessel operators, these types of maneuvers are made by sight and "feel," based on years of experience in handling tows in a particular area.

The center of the navigation span for the Eads Bridge was marked by a fixed green dayboard for daytime use and a fixed green light for nighttime use. The horizontal limits of the recommended 300-foot-wide navigable channel under the bridge were marked by two red dayboards. The *Anne Holly*'s captain stated that he clearly saw the center green light and that he illuminated the red dayboards on the bridge arch with his searchlights so that he could use them as visual cues. He also indicated that he used these visual aids, the lights on the MLK Bridge, and his radar to align the tow for passage under the Eads Bridge.

The value of the radar information, however, would have diminished as the tow approached the bridge, especially once the radar return from the bridge began to degrade the radar screen picture. Despite the captain's initial use of the radar, the execution of the transit under the bridge remained essentially a visual task.

The *Anne Holly* captain was attempting to perform a critical visual task under less than ideal circumstances. To complete the task successfully, he had to be in peak physiological and mental condition. The task required that the captain remain attentive to the headway (speed and distance traveled), feel, and handling of the tow, as well as be ready to react quickly if he perceived that the tow was not in alignment to pass the Eads Bridge safely. Lacking daylight visual cues, the captain would have had to rely on his piloting skills, knowledge, experience, and memory of the currents around the Eads Bridge to make the transit successfully. His ability to predict headway, distances, current speed and direction, and other conditions, as well as his ability to make the most of degraded visual cues, would factor into the task.

A momentary lapse in attention, a slight error in estimating speed or distance, or a minor misjudgment of the current speed or direction on the part of the captain could have caused the accident. The path available under the bridge with sufficient vertical clearance (of 46 feet or more) to accommodate the 105-foot-wide *Anne Holly* tow was only 270 feet wide. Thus, the captain had little margin for error. Most probably, he misjudged the alignment of his tow during the approach to the bridge and did not detect the misalignment in time to correct it before his tow struck the bridge. The Safety Board therefore concludes that the tow struck the Eads Bridge because of an error in judgment or a lapse of attention on the part of the *Anne Holly* captain, which resulted in the tow's misalignment.

Factors That Could Have Affected the Captain's Performance

Visibility. The maneuvering of inland river towboats relies heavily on the operator's visual acuity and ability to make accurate visual estimates of speed and distance. The operator not only needs to judge the speed of the tow correctly, but also to assess the speed and effect of the currents that the tow encounters. Much of this proficiency is developed through experience and practice. However, the towboat operator's ability to make accurate velocity and spatial estimations also depends on his ability to see visual cues, in particular, changes in the current direction and tow movement.

Naturally, this ability is diminished when visibility is limited. The operator's task on the night of the accident was made unusually difficult by the darkness, particularly given the high current speed and the tow's length.

To provide a reference point for nighttime operations, many inland towboat operators rig a steering light at the heads of their tows. According to the *Anne Holly*'s mate, a steering light had not been lit for the tow on the night of the accident. The Coast Guard or AM did not require use of a steering light, and use of such a light would not necessarily have prevented this accident. Nevertheless, a steering light would have provided an additional visual cue to help the captain judge the alignment and angular movement of the tow.

The length of the *Anne Holly* tow also limited the visible cues available to the captain. On the night of the accident, the captain's vantage point was more than 1,000 feet

aft of the tow's head, and the physical presence of the tow blocked his view of the water ahead of the tow.

Such visibility-limiting factors also would have made it more difficult for the captain to determine the direction of the river's current and negatively affected his ability to perceive the tow's headway and to estimate distances. Although darkness alone did not cause the *Anne Holly* captain to strike the Eads Bridge, limited visibility of navigational cues due to darkness made the transit through St. Louis Harbor more difficult than it would have been in daylight.

In maneuvering the tow through St. Louis Harbor, the captain would have experienced background illumination from shoreside lighting and shadows near bridge structures and a general lack of visual cues due to darkness. The Safety Board previously investigated an accident in St. Louis Harbor in which the glare from lighting was a safety issue.[64] In that instance, the accident occurred in high water while the tow was downbound in St. Louis Harbor at night because the operator failed to identify the navigation span of Poplar Street Bridge in time to align the tow for safe transit. Through its investigation, the Safety Board surmised that the background lighting in St. Louis Harbor hampered the operator's ability to distinguish the navigation lights on the bridge and resulted in the operator's misaligning the tow. In its report on this accident, the Safety Board recommended that the Coast Guard:

> M-85-23
>
> Conduct a comprehensive review of shore lighting in St. Louis Harbor to determine which lights adversely affect identification of bridge span navigation lights and take action to minimize the effect of the shore lights that interfere with bridge light identification.

The Coast Guard concurred with Safety Recommendation M-85-23. It conducted a harbor survey and met with towboat operators to identify troublesome shore lighting so that these lights might be altered or screened to limit their interference with safe navigation. The Coast Guard made changes to the bridge navigation lights in St. Louis Harbor to make them easier to distinguish from the background lights. On December 23, 1993, the Safety Board classified Safety Recommendation M-85-23 "Closed–Acceptable Action."

In the years since the Coast Guard conducted its survey, both the *Admiral* and the *Casino Queen*, which are brightly lit at night, began operating in St. Louis Harbor. Given the combined effect of the city lights along the waterfront, the lights from area marine facilities, and the lights on the bridges, the ambient light level may be high enough to impair the night vision of towboat operators. During the Safety Board's public hearing on the *Admiral* accident, a towboat captain who testified as an expert in St. Louis Harbor

[64] National Transportation Safety Board. *Ramming of the Poplar Street Bridge by the Towboat* M/V Erin Marie *and Its Twelve-Barge Tow, St. Louis, Missouri, April 26, 1984.* Marine Accident Report NTSB/MAR-85/02. (Washington, DC: National Transportation Safety Board, 1985).

towing operations stated that he thought the high-intensity lights in the harbor could be distracting and could impede night vision.

The *Anne Holly* captain testified that he had no trouble seeing the navigation markers on the Eads Bridge. Nevertheless, the fact that the captain could see the navigation markers on the bridge does not necessarily mean that he had no night vision problems. The Safety Board, therefore, concludes that glare from shoreside lighting may have impaired the *Anne Holly* captain's night vision and may have been a factor in his failure to align the tow properly for transit through the Eads Bridge. Consequently, the Safety Board believes that the Coast Guard should conduct a study of the lighting in St. Louis Harbor to determine whether the light level impairs nighttime navigation and take corrective action as necessary.

Postaccident Drug and Alcohol Testing. Although the results of postaccident alcohol and drug testing for the *Anne Holly* captain were negative, the Safety Board is concerned about the timeliness of the postaccident collection of testing samples. Blood or breath and urine samples for postaccident testing must be collected before any impairing or suspected substances are metabolized and eliminated from the body. Alcohol metabolizes much faster than the drugs listed for postaccident testing in 46 CFR 16.350, "Specimen analysis"; thus, a lower time limit is required for alcohol testing. Failure to collect specimens promptly for testing will likely yield inconclusive results.

In this instance, postaccident alcohol testing was not done sooner because the *Anne Holly* captain was engaged in the emergency response for the *Admiral*. Over a period of hours, the *Anne Holly* served as a platform to hold the *Admiral* against the shore and to off-load the *Admiral*'s patrons. Federal regulations (46 CFR 4.06–20) stipulate that postaccident testing is to be done as "soon as practicable." Once all the *Admiral*'s patrons had been off-loaded, the *Anne Holly* captain was breath-tested for alcohol. Therefore, the Safety Board concludes that, because alcohol testing could not be accomplished until rescue operations were complete, the Safety Board is not able to eliminate the possibility that alcohol use may have contributed to the accident. Nevertheless, the *Anne Holly* captain stated under oath that he did not drink alcohol, and his videotaped interview with the Coast Guard, taken just after the breathalyzer test, showed no evidence of impairment.

As a marine employer, Winterville Marine is responsible for having procedures in place for conducting drug and alcohol testing in the event that its marine employees are involved in an accident (46 CFR 4.06–1). Following the accident, AM contacted Winterville Marine. Winterville Marine, in turn, arranged for the dispatch of medical technicians to St. Louis Harbor on the day after the accident.

In its May 1998 Special Investigation Report, *Postaccident Testing for Alcohol and Other Drugs in the Marine Industry and the Ramming of the Portland-South Portland (Million Dollar) Bridge at Portland, Maine, by the Liberian Tankship* Julie N *on September 27, 1996*, the Safety Board issued the following safety recommendation to the Coast Guard:

M-98-79

Establish a requirement that postaccident testing for drugs begin within 4 hours of a serious marine incident and postaccident testing for alcohol begin within 2 hours of a serious marine incident, with attempts to test for alcohol ceasing after 8 hours, and establish a requirement that the marine employer document any testing delays or failures.

The Coast Guard responded to this recommendation on November 4, 1998, and stated "the Coast Guard intends to initiate a regulatory project to review, and revise as necessary, the drug and alcohol testing regulations and will include this issue in that review." In its July 28, 1999, reply to the Coast Guard, the Safety Board classified the recommendation "Open–Acceptable Response." Safety Board staff has been informed that the Coast Guard is contemplating issuance of a notice of proposed rulemaking on this matter sometime in fall 2000.

The *Anne Holly* captain's urine sample for drug testing was collected the day after the accident, well beyond the 4-hour limit recommended by the Safety Board in the *Julie N* report. Therefore, the Safety Board concludes that, because postaccident testing for illicit drugs did not take place until the day following the accident, the Safety Board is not able to eliminate the possibility that illicit drug use may have contributed to the accident.

Nonetheless, the captain's medical records indicated no history of alcohol or illicit drug abuse, and his behavior following the accident did not indicate impairment. Therefore, the Safety Board concludes that, given the results of postaccident testing, together with the review of the captain's videotaped interview, and the review of his medical records, the Safety Board found no evidence that the *Anne Holly* captain was impaired by drugs or alcohol at the time of the accident.

Fatigue. Sleep loss can result in performance degradation or variability (or both), affecting decision-making ability, vigilance, reaction time, memory, psychomotor coordination, and information processing.[65] If the *Anne Holly* captain was sleep-deprived at the time of the accident, he may have been less alert than he would have been had he fulfilled his normal sleep requirement. Reduced vigilance could have caused him to miss normal landmarks or other cues to navigation that he may have needed. The Safety Board considered whether sleep loss as a consequence of the captain's watch schedule affected his performance. In particular, the Safety Board considered whether the captain had adequate opportunity to obtain about 8 hours of sleep in every 24-hour period.

During interviews with both Coast Guard and Safety Board investigators, the captain stated that he had been operating on a standard watch schedule of 6 hours on,

[65] A general description of classic research and findings on sleep deprivation and loss and human performance can be found in sections 10.801-806 and 10.809-811 of the *Engineering Data Compendium, Human Perception and Performance,* Volume III, edited by Kenneth R. Boff, Human Engineering Division, Armstrong Aerospace Medical Research Laboratory, and Janet E. Lincoln, University of Dayton Research Institute. Published by the Armstrong Aerospace Medical Research Laboratory, Wright-Patterson Air Force Base, Ohio, 1988.

6 hours off in the *Anne Holly* pilothouse. The captain's watch schedule shows that before beginning the 0500 watch on April 4, 1998, he would have been off watch for 6 hours after completing his 2300 watch on April 3.

On April 4, the captain was relieved from his 0500 morning watch at 1115. He then went below, ate lunch, and went to bed. He said that he slept 3 ½ to 3 ¾ hours. He got up, took a shower, went down to the galley, visited, drank coffee, ate supper, and relieved the pilothouse watch about 1705. While at the Eagle fleeting area, the captain had no collateral duties during his off-watch period.

According to this schedule, in the best of circumstances, absent any emergencies or collateral activities when off watch, the captain had about 2 ¼ to 2 ½ hours in which to eat two meals, shower, dress, and so forth. This time allotment is reasonable if we allow 45 minutes for each meal (including socializing with crewmembers), 30 minutes for getting undressed and dressed, and 15 to 30 minutes for ancillary activities. Therefore, he had about 4 hours available per off-watch period for sleep. Consequently, in the 24 hours preceding the accident, the captain had the opportunity to obtain about 8 hours of sleep.

Given that the captain had the opportunity to obtain about 8 hours of sleep each day of the 26 days that he had been aboard the *Anne Holly*, the Safety Board could find no clear evidence of sleep loss. However, because of the 6-on, 6-off watch schedule, the captain's sleep would have been split into two periods. That is, the captain could not possibly have gotten 8 hours of continuous sleep, given the demands of his work schedule. Therefore, the Safety Board concludes that, although the *Anne Holly* captain had the opportunity to obtain about 8 hours of sleep in a 24-hour period, the sleep would necessarily have been obtained on a split schedule.

In 1995, the Safety Board conducted a study on factors that affect fatigue in heavy truck accidents,[66] which considered the effects of split-sleep patterns on the accident rates for truckdrivers. The study stated:

> The findings of this study show that truckdrivers with split sleep patterns were obtaining about 8 hours of sleep in a 24-hour time period; however, they obtained it in segments, on average of 4 hours at a time. While the research is not clear whether split sleep constitutes or contributes to sleep loss, research has shown that sleep accumulated in short time blocks is less refreshing than sleep accumulated in one long time period.[67] [68]

[66] National Transportation Safety Board. *Factors That Affect Fatigue in Heavy Truck Accidents, Volume 1.* Safety Study NTSB/SS-95/01. (Washington, DC: National Transportation Safety Board, 1995).

[67] Dinges, D.F. "The Nature of Sleepiness: Cases, Contexts, and Consequences." In: Stunkard, A.J.; Baum, A. *Perspectives in Behavioral Medicine: Eating, Sleeping, and Sex.* (Hillsdale, NJ: Lawrence Erblaum Associates, 1989) p. 147-179.

[68] NTSB/SS-95/01. p. 46.

The Safety Board's 1995 study drew upon research[69] that indicated "decrements in performance occur earlier for drivers using sleeper berths (or drivers with split-sleep patterns) than for other drivers."[70] The Safety Board's truckdriver fatigue study showed a correlation between split-sleep schedules and fatigue-related accidents. The Safety Board is not aware of any similar studies correlating split-sleep schedules for towing vessel operators and the towing vessel accidents in which fatigue caused or contributed to the accident.

Relatively little research exists to establish the physiological and performance implications of the 6-on, 6-off watch schedule widely used in the towing industry. Although the Safety Board's 1995 study on factors affecting fatigue among drivers of heavy trucks correlated split-sleep schedules with accident occurrences, the precise nature of split sleep and its specific effects on performance need further research. Therefore, the Safety Board concludes that insufficient research is available on the effects of split-sleep schedules on the performance of inland towing industry operators for the Safety Board to determine whether the *Anne Holly* captain was appropriately rested.

As a result of its 1999 evaluation of U.S. Department of Transportation efforts to address operator fatigue, the Safety Board made the following recommendation to the Coast Guard:

> M-99-1
>
> Establish within 2 years scientifically based hours-of-service regulations that set limits on hours of service, provide predictable work and rest schedules, and consider circadian rhythms and human sleep and rest requirements.[71]

The Coast Guard replied to the recommendation on October 8, 1999, stating that:

> While the complexities of the maritime transportation system preclude the Coast Guard from establishing scientifically based hours of service at this time, progress is being made on multiple levels, internationally as well as domestically, to rationally frame and address the fatigue issue on commercial vessels. The Coast Guard intends to continue sponsoring research domestically, and leading efforts internationally, with the aim of identifying and promoting the best practices and most effective countermeasures to control fatigue.

The Safety Board classified Safety Recommendation M-99-1 "Open–Acceptable Response" on December 9, 1999. This classification anticipates that the Coast Guard will establish, in the course of completing compliance with Safety Recommendation M-99-1, the physiological and performance implications of various marine watchstanding schedules currently in use, including the 6-on, 6-off watch schedule, and examine the precise nature of split sleep and its specific effects on performance.

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[69] Hertz, R.P. "Tractor-Trailer Driver Fatality: The Role of Nonconsecutive Rest in a Sleeper Berth." *Accident Analysis and Prevention*. 20(6): 431-439. 1988.

[70] NTSB/SS-95/01. p. 46.

[71] National Transportation Safety Board. *Evaluation of U.S. Department of Transportation Efforts in the 1990s to Address Operator Fatigue*. Safety Report NTSB/SR-99/01. (Washington, DC: National Transportation Safety Board, 1999).

Striking and Near Breakaway of the *President Casino on the Admiral*

When the *Anne Holly* struck the Eads Bridge, its eight lead barges broke free from the rest of the tow and were cast adrift in the river. When three of these barges drifted near the *Admiral*, they severed or severely damaged the three mooring lines at the *Admiral*'s bow. The force of the impact of the barges on the *Admiral* resulted in the rest of the remaining lines breaking, except for line number 7, which held. Two of the three barges continued downriver. The third barge headed toward shore and struck, in succession, the levee wall, the access walkway from shore, and the north (employee) gangway to the *Admiral*.

The 1999 NFESC study of the *Admiral*'s mooring indicates that the final mooring line (number 7) probably would have kept the PMV from breaking away even if the *Anne Holly* had not assisted the *Admiral*. Given the range of conditions present when the accident occurred and the number of unknown factors that could have influenced the outcome of the event, however, the validity of the NFESC's supposition cannot be guaranteed. The fact remains that only 1 of the 10 lines that moored the *Admiral* held when the PMV was struck by a few relatively small vessels. Had the allision been more severe, or had the drifting vessels been heavier or larger, a less favorable outcome could have occurred.

The *Admiral* had more than 2,000 people on board and was unpowered and without a marine crew or emergency equipment. Had the *Admiral* broken free from its moorings without intervention, it would have entered a flood current and been forced downbound on the Mississippi. The swift current would have carried the *Admiral* downstream where it might have collided with the Poplar Street Bridge, which did not have sufficient vertical clearance for the *Admiral* to pass underneath it in the existing flood conditions. The Safety Board concludes that, had the *Admiral* broken free as a result of the allision, the consequences could have been catastrophic, because it could have resulted in the sinking or capsizing of the vessel, which would have placed more than 2,000 lives in jeopardy.

Survival Aspects

Drills. Although the *Admiral* security personnel were responsible for ensuring the safety of patrons in an emergency, they had no training in crowd management techniques. During the emergency response, the security personnel did not keep vessel patrons from becoming agitated and disorderly. Respondents to the Safety Board's postaccident questionnaire reported that some minor injuries and considerable anxiety resulted from people shoving them and crowds attempting to push through the single exit leading to the *Anne Holly*. Had the accident been more severe, this unruly conduct might have increased to the point of causing serious injuries or even deaths.

The fire drills held on the *Admiral* essentially addressed the procedures for securing the casino and evacuating a building-type structure, rather than for assembling and managing crowds to make an orderly evacuation. The drills did not provide alternative actions for personnel to take if the main avenues of egress were blocked or not available.

Further, although the local fire prevention code required that fire drills be held every 90 days on the *Admiral*, the last such drill before the April 1998 accident was held in June 1997.

Clearly, local authorities did not provide adequate oversight of the company's responsibility to conduct periodic fire drills. Because the city of St. Louis did not require owners to keep records of drills that had been conducted, the city was unaware that the *Admiral* had gone almost 9 months between the last fire drill and the accident. In the Safety Board's opinion, frequent drills would have helped prepare the *Admiral*'s staff to deal with a real emergency. The Safety Board concludes that President Casino's failure to conduct fire drills and the city of St. Louis's failure to enforce fire drill requirements for the *Admiral* contributed to a lack of casino staff preparedness to deal with emergency situations. Therefore, the Safety Board believes that the city of St. Louis should establish and implement oversight procedures to ensure that owners of operational PMVs accessible to the public in St. Louis Harbor conduct and document fire drills.

Communication. Once the *Admiral*'s ship-to-shore telephone lines parted during the near breakaway, vessel personnel could not communicate with on-shore emergency personnel. None of the emergency rescue organizations were notified from the *Admiral* because the vessel had no means of communicating externally after it was struck and its phone lines parted. Since the accident, the *Admiral* has installed a marine radio scanner and a marine radio in the security office, and personnel now have access to cellular phones that are kept in the security shift and general managers' offices. The Safety Board is pleased that President Casinos has installed this important communication equipment.

Another element of a successful on-board emergency response is authoritative and helpful communication to vessel patrons and staff about the nature, scope, and status of the emergency. During the *Admiral*'s near breakaway, internal communication deficiencies were evident. President Casinos had no formal policies governing the use of the public address system in an emergency. On the night of the accident, use of the public address system was delayed because the staff mistakenly thought the system was inoperable until about 2145, when the security shift manager returned to the PMV from the shore. Thus, no use was made of the public address system until the emergency on the *Admiral* had gone on for about 1 hour and 45 minutes.

In their responses to postaccident questionnaires, a significant proportion of the *Admiral* patrons who responded stated that, despite some public address announcements and instructions from staff, patrons generally found the staff's communication of information not useful. They also reported that many people on board did not know what had happened or what they should do in the accident aftermath. Respondents said that panic and confusion may have been encouraged by the scarcity of information. Some respondents further claimed that they incurred minor injuries caused by other patrons' panicked attempts to evacuate the *Admiral* following the barge strikes. Therefore, the Safety Board concludes that patrons on board the *Admiral* did not receive sufficient safety information in the aftermath of the barge allisions to help prevent panic and confusion. To resolve this problem, the Safety Board believes that President Casinos should develop

guidelines for making periodic public address announcements during emergencies to provide direction and ensure patron safety.

Crowd Management. The *Admiral* often accommodates thousands of patrons and hundreds of staff members at a time. All would have to be evacuated safely in an emergency. Such evacuations are best conducted by trained personnel who are assigned, and trained in carrying out, specific responsibilities during an evacuation. As a result of its investigation of a 1994 fire aboard the *Argo Commodore*,[72] the Safety Board issued the following recommendation to the PVA:

> M-95-43
>
> Develop and provide to your members crew drills for on-board crew emergency procedures/standards that include pre-incident planning for a variety of shipboard emergencies, including fires, and the deployment of crew resources for proper response to the emergency without compromising passenger safety.

The PVA developed a section for its *Training Manual for Passenger Vessel Safety* entitled "Non-marine Crew Training" that outlines a comprehensive training program for nonoperating crewmembers. The introduction to this section states that specialized safety training for nonoperating employees "makes sense when management realizes that, more often than not, [these employees] will be the first person[s] on the scene in any kind of emergency." Based on the PVA's support for comprehensive training for nonoperating employees and the organization's development of the training manual, the Safety Board classified Safety Recommendation M-95-43 "Closed–Acceptable Action" on July 21, 1997.

As an operator of several passenger vessels on the Mississippi River, President Casinos, Inc., is a PVA member. Personnel on the PMV *Admiral* face many of the same emergency response challenges as crewmembers of other types of large passenger vessels.

The Safety Board understands that, since the accident, President Casinos has had three *Admiral* security employees trained in crowd management techniques. The Board considers that this effort, if continued, will improve the vessel's on-board emergency response capability. To ensure the development of crowd management capabilities throughout the organization, the training should include all *Admiral* personnel. Such broad provision of training is prudent because even those vessel employees who do not have safety-related duties in an emergency can affect the response either positively or negatively. The Safety Board noted as a result of the *Bright Field* investigation[73] that nonoperating crewmembers on both the *Queen of New Orleans* and the *Creole Queen* had not received training covering the full range of emergency scenarios and were unprepared to properly carry out their responsibilities.

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[72] National Transportation Safety Board, *Fire Aboard U.S. Small Passenger Vessel* Argo Commodore *in San Francisco Bay, California, December 3, 1994*, Marine Accident Report NTSB/MAR-95/03. (Washington, DC: National Transportation Safety Board, 1995).

[73] NTSB/MAR-98/01.

According to a comment made by a patron after the *Admiral* allision and near breakaway, some *Admiral* staff members "appeared to be just as confused as we were." One cashier even shouted that the vessel was sinking. Staff confusion and inflammatory remarks can only increase the level of panic on board a vessel or a permanently moored casino during an emergency. Training in crowd management would help staff understand the importance of maintaining calm and order. The Safety Board concludes that *Admiral* security personnel and other staff members were not adequately trained and drilled in crowd management techniques and therefore were not successful in ensuring that the vessel's patrons and staff behaved in a calm and orderly fashion in the aftermath of the April 4, 1998, accident. Therefore, the Safety Board believes that President Casinos should require and document that all *Admiral* personnel receive formal training in crowd management techniques and conduct periodic drills to reinforce this training so that vessel staff can perform effectively in an emergency. Also, President Casinos should amend the *Admiral*'s *Emergency Evacuation Procedures* to reflect crowd management techniques.

St. Louis Harbor contains three PMVs in addition to the *Admiral* and its support barge—the *McDonald's* restaurant barge, the *Robert E. Lee* restaurant barge, and the Gateway Riverboat Cruises support barge. The *Robert E. Lee* is not operating, but the other two PMVs face some of the same safety challenges as the *Admiral.* Both are accessible to the public, so the personnel that staff them need the same type of crowd management training as *Admiral* personnel. The Safety Board concludes that formal training in crowd management techniques for staff on all operating PMVs that are accessible to the public would enhance safety on board PMVs. The city of St. Louis does not require crowd management training for the staff members of any PMVs within its jurisdiction. Because the city of St. Louis has primary enforcement responsibility for PMVs in St. Louis, it should ensure that all operating PMVs accessible to the public have staff trained in crowd management techniques. Therefore, the Safety Board believes that the city of St. Louis should take the following three actions: a) require that the owners of all operating PMVs that are accessible to the public in St. Louis Harbor provide and document formal training in crowd management techniques for all personnel on such vessels; b) require that periodic drills be conducted to reinforce the crowd management training; and c) require that the vessel owners amend their emergency plans to reflect crowd management techniques. In view of the need to ensure that such measures are applied to all PMVs and the fact that the Coast Guard is best positioned to establish uniform crowd control requirements, the Safety Board believes that the Coast Guard should take the following three actions under its PWSA authority: a) require that the owners of all operating PMVs that are accessible to the public provide and document formal training in crowd management techniques for all personnel on such vessels; b) require that periodic drills be conducted to reinforce the crowd management training; and c) require that the vessel owners amend their emergency plans to reflect crowd management techniques.

Means of Egress. When the *Anne Holly* barges struck the *Admiral*, the standard gangways almost immediately dropped into the water. Together, the *Admiral* staff, the *Anne Holly* crew, and the Gateway Riverboat Cruises personnel improvised means to evacuate patrons and staff, but they were following no directions from President Casinos

about how to do so. Also, the makeshift evacuation was a slow process, taking more than 3 hours to complete. Had the *Admiral* caught fire or begun to sink, such a lengthy evacuation would have placed patrons and staff at considerable risk.

In addition to strikes by barges or vessels, other emergency situations, such as fires, floods, severe winds, etc., that might make the *Admiral*'s standard gangways dangerous or unavailable can easily be envisioned. Nevertheless, President Casinos did not have contingency plans for such events, and the company did not train or instruct its personnel in how to conduct an evacuation that would not involve use of the standard gangways. Therefore, the Safety Board concludes that the evacuation of the *Admiral* was jeopardized by the lack of contingency plans for an emergency egress when the standard gangways were not available. The Safety Board believes that President Casinos should develop and exercise contingency plans for emergency egress from the *Admiral* to ensure that occupants can exit the vessel in a timely and orderly manner when the standard means of egress become unusable and amend the *Admiral*'s *Emergency Evacuation Procedures* to reflect the new procedures.

Emergency Response

After the accident, the SLFD had personnel on the scene within 15 minutes. Coast Guard MSO St. Louis and other resources arrived shortly thereafter. The SLFD incident commander worked effectively with the Coast Guard to halt river traffic and close bridges during the emergency. The SLFD provided a rescue boat and medical personnel who examined patrons with medical complaints and transported some patrons to local hospitals.

When the *Admiral*'s gangways collapsed, however, SLFD rescue personnel could not immediately board the *Admiral*. The lack of available means of boarding and leaving the vessel delayed the evacuation of the *Admiral*, which ultimately took more than 3 hours to complete. Therefore, the Safety Board concludes that, although local emergency response agencies arrived on the scene in a timely manner, they were not prepared to rescue patrons and staff from the *Admiral* after the standard gangways to the vessel became unusable, which delayed the evacuation and could have put patrons and staff in jeopardy. Consequently, the Safety Board believes that the city of St. Louis should ensure that harbor emergency responders develop, in conjunction with local PMV owners, including President Casinos and the McDonald's Corporation, contingency plans for boarding and exiting the vessels when the standard means of egress become unusable and amend the St. Louis Harbor Emergency Response Plan to reflect the new procedures.

Emergency Preparedness

The Coast Guard coordinated the development of the St. Louis Harbor Emergency Response Plan in cooperation with State and local fire and rescue services and the local marine industry. The intent of the plan was to allow the emergency response agencies, the industry, and the Coast Guard to achieve coordinated and effective use of public and private response resources during an emergency. Although the Coast Guard has Federal responsibility for the overall safety of the port during an emergency, the responsibility for

emergency response rests with local fire and rescue services and State response services. While, as a policy matter, the Coast Guard responds to emergencies to the extent that its resources allow, it does not have primary search and rescue responsibility in inland areas, such as St. Louis Harbor. The Coast Guard does not have firefighting or search and rescue capabilities in St. Louis Harbor, yet its personnel helped coordinate the plan, participated in drills, and provided information about marine risk mitigation measures to the incident commander. The COTP also assisted in crises by restricting vessel movements on the Mississippi River.

The Safety Board evaluated the St. Louis Harbor Emergency Response Plan and found that it adequately identified the agencies that would participate in marine emergency responses in St. Louis Harbor and provided a comprehensive contact listing for critical responders. The plan further identified the interagency command and control responsibilities of the various agencies and designated the radio frequencies to be used during responses.

The response plan, however, did not take into account the various types of accidents that might occur in the harbor. For instance, the plan did not anticipate an accident similar to that involving the *Admiral* on April 4, 1998—the breakaway or near breakaway of a high-capacity PMV. The possibility of such an accident, especially during a period of high water, was reasonably foreseeable. The St. Louis Harbor Emergency Response Plan did not identify all foreseeable emergencies or create strategies to deal with them. Without identifying the types and magnitudes of the possible emergencies for which St. Louis Harbor authorities would have to be prepared, response planners could not determine the amounts, types, and sources of emergency equipment and other resources that would be needed to conduct a successful response.

The 1994 exercise sponsored by the Coast Guard in New Orleans, Louisiana, revealed that local contingency plans and responses for the New Orleans area were inadequate for rescuing large numbers of people from the Mississippi River. The exercise illustrated that responding to emergencies requiring the rescue of large numbers of people from the Mississippi River can overwhelm local resources, even in municipalities that may have greater marine resources than St. Louis.

It is conceivable that, had the *Anne Holly* not held the *Admiral* against the riverbank on April 4, 1998, the *Admiral* might have broken free of its last mooring wire and floated downriver, possibly causing collisions and sinking or capsizing under one of the lower bridges. The risk to the *Admiral* and its more than 2,000 occupants would have been high in such a scenario because the *Admiral* did not have means of propulsion or navigational control, marine lifesaving equipment (such as life floats or personal flotation devices), or an experienced marine crew.

Therefore, the Safety Board concludes that the St. Louis Harbor Emergency Response Plan did not sufficiently prepare emergency response agencies to deal with an emergency involving the rescue of a large number of people on or in the Mississippi River. Consequently, the Safety Board believes that the Coast Guard should take the lead, in cooperation with appropriate port and waterways stakeholders, to develop contingency

plans to assist in marine-related incidents, such as search and rescue operations, fires, capsizings, or sinkings involving passenger vessels or permanently moored public facilities within St. Louis Harbor. Also, the Coast Guard should amend the St. Louis Harbor Emergency Response Plan to reflect these changes.

The Safety Board also believes that the Coast Guard should conduct, in cooperation with the States of Missouri and Illinois and the cities of St. Louis and East St. Louis, regular drills to exercise the contingency plans for a variety of different marine scenarios, such as stopping breakaway vessels or rescuing large numbers of people from the Mississippi River.

Laclede Gas Company. The severing of the natural gas supply line to the *Admiral* resulted in a natural gas leak. When the line broke, natural gas began escaping. Although the escaping gas did not ignite, one of the first priorities in any situation during which natural gas is released should be to curtail the escape of product.

An emergency repair team was summoned from the Laclede Gas Company to deal with the situation. The Laclede team could not shut off the natural gas from the regulator pit because, due to high water, the pit had filled with muddy water that prevented them from reaching the shutoff valves. The team was able to clamp off the ruptured natural gas hose, but by then, the leak had continued for about 3 hours.

High water is not particularly unusual in this area; on the average, the river stage at St. Louis is 30 feet or higher more than 20 days a year. The river stage is 20 feet or higher nearly 70 days a year, on the average. Given this environment, the designers of this system should have considered that a facility set so close to the river might be difficult to access, depending on the river level. Laclede should have been aware of this design weakness and of the need to prepare its personnel to respond to emergencies affecting this regulator pit (and others on the waterfront) under all river conditions. But the Laclede response team had received no special preparation for responding to an emergency during high water and had to take a trial-and-error approach to shutting off the broken line. Therefore, the Safety Board concludes that Laclede Gas Company's emergency responders had not been adequately prepared to stop the uncontrolled flow of natural gas resulting from this accident. To enable Laclede personnel to become more familiar with the special challenges associated with riverside emergency responses, the Safety Board believes that Laclede Gas Company should require that its emergency response teams participate in port contingency plan drill exercises involving PMVs that are supplied with natural gas. Because inadequate emergency response preparation may be a concern for natural gas providers to PMVs in other jurisdictions, the Safety Board believes that the American Gas Association and the American Public Gas Association should advise their members of the natural gas leak that resulted from the April 4, 1998, accident affecting the *Admiral* in St. Louis Harbor, and recommend that they participate in port contingency plan drill exercises involving PMVs that are supplied with natural gas.

Federal regulations (49 CFR 192.365) require that natural gas service line valves be placed in "a readily accessible location." Based on the Laclede responders' inability to

reach the valve, the Safety Board concludes that, at the time of the accident, the *Admiral*'s natural gas shutoff service valve was not readily accessible.

Laclede has taken actions to provide the *Admiral* and its other floating facility customers in St. Louis Harbor with improved means of stopping the flow of gas in emergencies. In the case of the *Admiral*, Laclede intends to provide a new service line and meter station with accessible shutoff valves when the *Admiral* relocates to a position north of the MLK Bridge in 2000. Laclede informed the Safety Board that it selected the new meter station location specifically because it is removed from areas affected by flooding. Laclede has also informed the Safety Board that it has installed valve key guides that allow service valves to be readily accessed and operated, even during periods of high-water conditions, for the *Admiral* (in its current location) and the other floating facilities in St. Louis Harbor.

Natural gas lines serve other PMVs in U.S. ports, so inaccessible shutoff valves may be a safety hazard common to pipelines that supply natural gas to PMVs during high-water conditions. In the case of the *Admiral*, it took about 3 hours to stop the escape of gas from the service line. The delay in this instance did not have serious consequences, but a future incident involving release of gas could have far more unfortunate results. The Safety Board concludes that the flow from the *Admiral*'s ruptured natural gas supply line was not secured in a timely manner, and such a delay could be hazardous should such an incident recur. The Research and Special Programs Administration (RSPA) is the Federal agency with the responsibility for ensuring that local gas companies comply with the requirements of 49 CFR 192.365. The Safety Board believes that RSPA should require corrective action as appropriate to ensure that pipeline operators have the means to shut off the flow of natural gas to PMVs in a timely manner, even during periods of high-water conditions. In the interim, the Safety Board believes that the American Gas Association and the American Public Gas Association should urge their members to take corrective action as appropriate to ensure that they can shut off the flow of natural gas to PMVs in a timely manner, even during periods of high-water conditions.

Public Safety of Permanently Moored Vessels

PMV safety falls under the purview of many entities, from the owner and local jurisdictions, such as the fire department and the city building commissioner, to State and Federal authorities, including the Coast Guard and USACE. The overlapping of these authorities' responsibilities can result in confusion or worse. In some instances, gaps in safety have resulted because authorities have assumed that another entity is administering PMV safety oversight. Under this assumption, these authorities have then allocated their own limited resources to other priorities rather than using them to provide PMV oversight.

The Coast Guard has traditionally described the system for providing marine safety as a series of "safety nets." The primary safety net is provided by the owner as the entity responsible for ensuring that a safe environment is provided to its customer, the public. The next two in the series of safety nets are provided by the owner's flag State

(or its representative when the vessel is foreign) and by the public safety representative(s), such as the Coast Guard. In the case of the *Admiral*, the Safety Board reviewed the safety net system in a similar fashion, considering that the primary safety responsibility lies with the owner, that the next levels of safety are provided by the local jurisdiction and the State, and that the remaining safety assurances are provided by the Federal authorities (the Coast Guard and USACE). This investigation looked at the safety of these vessels in a hierarchical format, starting with the responsibilities of the owner and ending with an assessment of the Coast Guard's policy on PMVs from a national perspective.

Owner's Safety Management of the President Casino on the Admiral

President Casinos, as the owner of the *Admiral,* had the fundamental responsibility to ensure the safety of the PMV and all people on board it. President Casinos also had the corporate control, knowledge, and resources to provide an effective safety management system but failed to do so, unnecessarily exposing the *Admiral* and people on board to waterborne and current-related risks that none of the stakeholders were prepared to meet.

President Casinos was the entity most knowledgeable about its business and the unique aspects of operating a casino on a floating platform in the Mississippi River and was, therefore, best placed to provide the primary safety net for the PMV and its occupants. President Casinos, Inc., operated other passenger vessels in St. Louis under the same environment and river conditions and was knowledgeable about and experienced with Coast Guard inspection and certification requirements for passenger vessels, including the provisions concerning such safety features as lifesaving equipment, staffing requirements, marine crew qualifications, and vessel operational requirements. President Casinos was more knowledgeable than any other organization about the operation of the *Admiral*, including its history of accidents and near misses while located in St. Louis Harbor. President Casinos was also familiar with the local and State jurisdictional authorities and the local codes and standards with which the *Admiral* had to comply.

President Casinos, Inc., had the corporate responsibility to establish risk reduction measures to provide a safe operation. President Casinos, Inc., was in the best position to understand the risks associated with marine operations because the company operated several passenger vessels and was involved with the daily operation of the *Admiral.* President Casinos, Inc., also had access to the appropriate resources (such as capital, personnel, PVA membership, and so forth) to help mitigate the risks, and the company controlled the corporate decision-making process. President Casinos, Inc., however, did not take any safety action beyond complying with the regulatory requirements.

An effective safety management system is essential for the safe operation of a high-capacity passenger vessel (regardless of whether it is in permanently moored status). Such a system should, at a minimum:

- Describe the functions of the staff during an emergency,
- Require staff training in their respective emergency functions,
- Provide adequate fire and lifesaving equipment for passengers and staff,

- Provide appropriate shore notification,
- Provide internal communication with staff and passengers,
- Provide the capacity for communication with emergency responders,
- Provide for the safe evacuation of occupants or an adequate area of safe refuge aboard the vessel,
- Include regular drills, and
- Provide management oversight of the process to ensure compliance and system viability.

President Casinos did not have a safety management system to ensure that company responsibilities and authority were defined, risks were identified, contingency plans were prepared, staff emergency training was provided, proper safety and response equipment was available, and local responders were involved. A safety management system would have also provided for a designated individual to oversee and coordinate emergency training drills and for an audit to be conducted to ensure compliance with company safety policies and procedures. The company did not have an effective safety management system in place before it put the *Admiral* in service, nor did it implement one once the PMV was in operation.

Risk assessment is an essential part of any effective safety management system. President Casinos, however, did not conduct a comprehensive risk assessment before placing the vessel in service. The owner conducted only a limited risk assessment to evaluate the possibility of locating a protective cell upstream of the *Admiral.* USACE, urged by the Coast Guard, had required during the site permit review process that such a protective cell be installed because of concern that the *Admiral* had previously been struck by tows while at that location.

The professional engineering firm hired by President Casinos determined that a protective cell placed at the bow of the *Admiral* on the outboard side would present a safety problem; that is, the firm's report stated that, under such a cell arrangement, loose barges would be directed into the vessel rather than away from it. Neither the owner nor the engineering firm (which had cited three previous allisions of the *Admiral* by upbound tows) then considered what type of protection would be necessary to keep loose barges from striking the *Admiral.* Instead, President Casinos simply decided that because the engineer's report found that the proposed solution of using a single protective cell had negative safety implications, the requirement should be rescinded.

Therefore, despite its knowledge of previous allisions, President Casinos made no effort to mitigate the risk to the *Admiral* from breakaway tows or even from debris or ice flows. Had President Casinos employed risk reduction measures, the *Admiral*'s ability to survive waterborne and current-related risks would have increased. Possible risk reduction methods included:

- Relocating the vessel to an area that eliminates the chance of collisions,
- Installing barriers, such as fendering or crush zones, to absorb the dynamic loading from collisions with other vessels or floating debris,
- Restricting vessel operations during high-risk conditions,
- Developing alternate escape routes for use in emergencies, and
- Training the staff in crowd management, as is done on large cruise liners.

The operation of a high-capacity floating casino like the *Admiral* shares many operational elements and safety concerns with high-capacity passenger vessels that operate in the same area. President Casinos, Inc., was a member of the PVA and had access to the PVA's experience and support in the safe operation of high-capacity passenger vessels. A President Casinos employee, in fact, drafted the chapter on "Emergency Drills and Contingency Planning" for the PVA's *Risk Management Manual for Passenger Vessels*. The chapter cites specific examples of conditions in St. Louis Harbor for use in developing passenger vessel marine risk contingency plans covering events such as collisions, taking on water, losing propulsion and requiring harbor tug assistance, moving injured people ashore, and transferring firefighters from shore to a vessel. The *Admiral* is subject to the same types of risks. President Casinos developed a contingency plan for the PMV (the *Admiral*'s *Emergency Evacuation Procedures).* However, the risks identified in the plan did not include all the waterborne and current-related risks and factors cited in the PVA *Risk Management Manual for Passenger Vessels.*

The Safety Board concludes that President Casinos had the responsibility, knowledge, and experience with passenger vessel operations, previous accident history, and contingency planning, as well as the necessary management control and opportunity, to provide an effective safety management system for the *Admiral* but failed to do so. Therefore, the Safety Board believes that President Casinos should develop and implement a safety management system for the *Admiral* that anticipates and provides appropriate means of responding to all foreseeable emergencies.

The Safety Board also believes that President Casinos should site the *Admiral* in a location in which it is protected from waterborne and current-related risk events, including breakaways, allisions, sinking, capsizing, etc.

Local and State Oversight of Permanently Moored Vessels in St. Louis Harbor

The local and State jurisdictional authorities for St. Louis Harbor did not provide adequate marine safety oversight of the owners' responsibility to assess and mitigate waterborne and current-related risks to the local PMVs and all people on board them.

At the time of the *Admiral* accident, local jurisdictional authorities, such as the city's public safety and fire departments, had immediate oversight responsibility for the PMVs in St. Louis Harbor. The local authorities provided the first level of regulatory oversight for PMV owners and the first safety net under PMV operations. The St. Louis

Department of Public Safety believed that it had met its obligation to ensure public safety by reviewing the *Admiral*'s design plans to ensure that the PMV met the applicable building codes for certain aspects of building structures, such as fire safety (according to the requirements of the BOCA Code), electrical, mechanical, and plumbing requirements.

The St. Louis Department of Public Safety also approved the *Admiral*'s design and evacuation plan for compliance with requirements for emergency exits, emergency lighting, and fire sprinklers, as they would apply to buildings. However, the department did not require the equivalent of below-ground structural elements, such as would be required of a land-based structure, or any additional structural elements to protect the *Admiral* from the risk of collision. Buildings, when they are designed for public occupancy, are required to have fixed fire exits with clear access to areas of safety. The city required no added features to ensure the long-term integrity of the *Admiral*'s fire exits. According to its representative, the St. Louis Department of Public Safety was not required to address the siting of the *Admiral* or marine safety aspects, such as the possibility of the PMV's breaking away or sinking or whether it might require flooding alarms or emergency pumps and generators. Nor did the city consider the need for lifesaving equipment, because such aspects are not considered during the approval processes for buildings.

After the Coast Guard designated the *Admiral* as a PMV, the city of St. Louis assumed responsibility for its safety. In the absence of Coast Guard involvement, the city had general oversight responsibility for public safety for the entire operation. Yet city authorities did not have a mechanism for regulating the marine safety aspects of the operation of PMVs located in St. Louis Harbor. Local building and safety codes did not address the waterborne and current-related risks and risk reduction measures associated with PMVs in the harbor. The Safety Board therefore concludes that the city of St. Louis did not exercise effective marine safety oversight for the *Admiral* because the city treated the *Admiral* as a commercial building on land.

The State of Missouri Gaming Commission also placed safety requirements on the operation of the *Admiral*. In a July 9, 1998, letter to the Safety Board, the Commission stated that it requires its licensees to meet the minimum standards for safety and environment established by the Coast Guard, the USACE, and the Environmental Protection Agency. It also requires that licensed casino PMVs meet Missouri's fire safety standards, the NFPA's fire safety standards for the construction and fire protection of marine structures, and the NFPA Life Safety Code.

In addition, the Commission requires that the vessel comply with all local fire and safety codes. However, because the Coast Guard did not impose any safety requirements beyond "secure and substantial mooring" of the vessel and because none of the other authorities or standards addressed all the waterborne and current-related risks to which the *Admiral* was exposed, the Commission's actions fell short of its intended purpose.

The Commission also said in the July 1998 letter that it does not employ safety experts but relies on government agencies with safety standard and inspection expertise.

The Commission recognized that it does not possess the requisite expertise to establish safety standards or to provide safety oversight of the *Admiral*'s operations.

Although the State Gaming Commission required the owner to contract with ABS Marine Services to assess the stability of the *Admiral* and to periodically inspect its hull and watertight closures to ensure their integrity, ABS Marine Services did not, nor was it requested to, assess the adequacy of the mooring design, fire safety, lifesaving, or any other marine safety systems related to the *Admiral*'s operation. The Safety Board therefore concludes that the oversight provided by the State of Missouri, as represented by the State Gaming Commission, did not address marine safety systems, such as the PMV's mooring design, fire safety, and lifesaving capabilities, and did not protect the safety of people on board the *Admiral.*

In the Safety Board's opinion, city and State authorities should recognize their limitations in marine safety expertise. The Coast Guard is the primary recognized marine safety regulatory authority and should regulate the operation of floating casinos exposed to waterborne and current-related risks. The Safety Board therefore believes that the Coast Guard, the city of St. Louis, and the State of Missouri should either require owners of PMVs to protect their vessels from waterborne and current-related risks so that their PMVs are, in fact, equivalent to buildings or require that the owners obtain Coast Guard certificates of inspection for their PMVs.

Also, to ensure that other jurisdictions benefit from information gained during this investigation, the Safety Board believes that the National League of Cities and the American Association of Port Authorities should inform their members of the April 4, 1998, near breakaway of the permanently moored *Admiral* in St. Louis Harbor and of the waterborne and current-related risks associated with similarly located PMVs.

Role of the Coast Guard

Tows regularly pass the *Admiral*'s site on the Mississippi River. In an average year, about 8,000 tows pass through St. Louis Harbor, transporting 80,000 to 85,000 barges. Between January 1989 and April 1999, about 30 barge breakaways took place in St. Louis Harbor. The *Admiral*, sited below the Eads Bridge, had been struck three times by upriver tows before it was struck by barges from the *Anne Holly* tow. Thus, based on experience, a future strike was a predictable event. In fact, during the USACE site permit process, the Coast Guard correctly predicted that the *Admiral* would be struck again. As previously stated, however, when President Casinos subsequently argued that a protective cell was unnecessary, the Coast Guard agreed. Neither the Coast Guard nor President Casinos took any further action to assess and mitigate the risk to the *Admiral* from a future allision.

The fact that the *Admiral* was hit on April 4, 1998, by barges from the *Anne Holly* was merely a function of circumstance; any number of breakaway or wayward vessels or objects traveling with the river current could have struck it. The overriding consideration is that the *Admiral,* as it is currently sited below the Eads Bridge, is vulnerable to allision from breakaway tows and other vessels or objects due to its location.

At the time of the April 1998 accident, Coast Guard policy did not provide local Coast Guard representatives with adequate practical guidance for determining whether a PMV was safely sited. Guidance on PMV siting could provide information on the relative risks of various types of site locations. Such risks might include those associated with the outside and inside bends of rivers, obstructions such as bridge piers, the water depth, and the natural and artificial protective barriers in the vicinity. At its location directly below the Eads Bridge in the busy Mississippi River, the *Admiral* was at risk from an allision and the potential consequences of that event. Therefore, the Safety Board concludes that the *Admiral* should not have been sited in a location where it was subject to waterborne and current-related risk events, including breakaways, which could have put more than 2,000 lives in jeopardy.

PMVs, as they are treated in existing Coast Guard policy, are unique in that they possess certain characteristics of both vessels and buildings, so their risks do not fall entirely into either category. A *vessel*, as the term is used in the Coast Guard's enabling statute, 46 U.S.C. Subtitle II, is defined as a craft "used or capable of being used as a means of transportation on the water" (46 U.S.C. 2101[45], citing 1 U.S.C. 3). The Coast Guard's authority to regulate design, construction, equipment, staffing, and inspection of vessels derives from Subtitle II. Most vessels, because they are subject to waterborne and current-related risks, require Coast Guard inspection and certification under 46 U.S.C. Subtitle II. Thus, according to the Coast Guard, if a craft is no longer "used or capable of being used as a means of transportation on the water," it is not subject to this Coast Guard inspection authority.

Under such a flexible, fact-bound test, and given the wide disparity of judicial precedent on the subject, the Coast Guard had considerable discretion in its categorization of PMVs. The Coast Guard chose to treat all PMVs, including the *Admiral*, as "substantially land structures," which, once sited, were the regulatory responsibility of the land jurisdiction to which they were moored. And, although the Coast Guard has extensive and broad authority under the PWSA to act to safeguard navigation and protect waterfront facilities and the marine environment, the Coast Guard did not exercise its authority to protect PMV occupants. Therefore, the Safety Board concludes that the Coast Guard has extensive discretionary authority over PMVs in navigable waters, such as the *Admiral*, but has chosen not to fully exercise it.

It is noteworthy that several large casino boats have been placed in moats in shallow water, where they are in no danger of sinking or capsizing, and are surrounded by enclosures so that other vessels could never allide with them. These "vessels" are not used in transportation but are nonetheless considered "vessels" under the Coast Guard's inspection authority and are required to meet Coast Guard safety standards, including the carriage of life preservers for all people on board. It is completely incongruous that these PMVs, which are not vulnerable to waterborne and current-related risks, are under Coast Guard safety oversight while the *Admiral*, which is vulnerable to such risks, is not.

The policy issued by Coast Guard headquarters regarding PMVs—the Coast Guard's PMV safety net—not only failed to recognize the risk to the *Admiral* from breakaways, it failed to recognize that the *Admiral* and similar vessels would be exposed

to other serious waterborne and current-related risks. Because the *Admiral* was exposed to many of the same risks as vessels in navigation, it was also vulnerable to being struck by passing marine traffic, to sinking, and to capsizing. The *Admiral*, in effect, fell through the safety nets on April 4, 1998. A major disaster may have been narrowly averted by the *Admiral*'s last mooring line holding and the *Anne Holly* captain acting to help stabilize the *Admiral* against the riverbank.

The Safety Board considers that the Coast Guard PMV policies, and the decisions that were made based on those policies, failed to adequately protect the *Admiral* from the risk of a marine accident. In essence, the Coast Guard PMV policy stated that removing the vessel from active navigation and attaching it to land by mooring lines changed the basic character of the *Admiral* so that it was no longer a vessel and ceased to be subject to Coast Guard inspection jurisdiction. The Safety Board questions the wisdom of this policy and of its application to the *Admiral* in particular. The Coast Guard was the only public safety organization in St. Louis Harbor with the knowledge and experience to regulate the public safety of PMVs at risk from waterborne and current-related events.

Although the *Admiral* was moored in a stationary position, it was still exposed to many of the same hazards to which it would have been exposed were it a vessel in active navigation. Hundreds of towboats and thousands of barges passed close by the *Admiral* every year. These passings were made in all weathers and at all times of the day and night. Further, when changing conditions made navigation riskier, as when the river reached flood stage, the risks to the *Admiral* likewise increased. The *Admiral* was vulnerable to being struck by a passing vessel, and, if holed as a result, it could have flooded, sunk, capsized, or broken away.

An accident involving the *Admiral* caused by a waterborne or current-related risk could easily endanger 2,000 or more lives. Yet the Coast Guard PMV policy at the time of the *Admiral* accident did not consider anything other than the mooring system in determining whether the vessel would be granted PMV status.

Instead of protecting PMVs from waterborne and current-related risk events, the Coast Guard's policy focused on the adequacy of the mooring arrangement. However, a mooring system, no matter how well engineered, cannot compensate for the consequences of locating a PMV at a risky site. As the accident demonstrated and the NFESC mooring study confirmed, the *Admiral*'s mooring system, which was designed by a professional engineer, was, as a consequence of the allision with the *Anne Holly*'s barges, unable to keep the *Admiral* and its entry barge secure in position against the riverbank. After the allision, without the gangways in place, emergency egress from the PMV was jeopardized. Had the circumstances of this accident been different and had the *Admiral* been set adrift in the river during flood stage, the risk to the *Admiral* and the people on board could have been extreme.

As the Coast Guard determined in its review of PMV safety, 68 percent of waterway accidents occurred at high-risk locations, making location the single most important factor in PMV waterborne and current-related risk. Nevertheless, the Coast Guard PMV policy failed to account for and remedy the *Admiral*'s risky location through

site selection or other means. The Safety Board therefore concludes that the Coast Guard PMV policy, as it existed at the time of the accident, did not adequately provide for the safety of the *Admiral* or its patrons.

As a result of the *Bright Field*, *Admiral*, and less prominent accidents involving PMVs, the Coast Guard reviewed its PMV policy. In 1999, the Coast Guard revised the policy to improve and standardize the way the Coast Guard treats PMVs. The new policy requires all local Coast Guard OCMIs to re-evaluate the safety of all existing PMV designations within their zones, using the risk assessment and reduction methodology developed by the Coast Guard's QAT for PMVs.

The Safety Board reviewed the new Coast Guard policy on PMVs and found it to be an improvement over the policy used at the time of the *Admiral* accident. The Safety Board is pleased with this Coast Guard action but considers it does not go far enough to ensure the safety of PMV operations in U.S. navigable waters. The new policy does not change the basic premise of the Coast Guard's treatment of PMVs at risk from waterborne and current-related events—that local and State authorities will eventually have safety and enforcement responsibility over these vessels. Expecting local and State authorities to adequately oversee and regulate PMV safety regarding waterborne and current-related risks is unrealistic because building safety considerations do not address issues such as collision potential, mooring requirements, or waterway safety factors. Therefore, the Safety Board concludes that the Coast Guard's new policy on PMVs is inadequate because it still fails to provide for the safety of people on PMVs subject to waterborne and current-related risk events, including breakaways, allisions, sinking, and capsizing. Consequently, the Safety Board believes that the Coast Guard should not allow PMVs to be sited in locations in which they are not protected from waterborne and current-related risk events, including breakaways, allisions, sinking, capsizing, etc.

Conclusions

Findings

1. The *Anne Holly* had sufficient horsepower to successfully navigate upbound through St. Louis Harbor on the night of the accident, and the vessel did not experience any propulsion or steering system failure.

2. The captain of the *Anne Holly* was sufficiently qualified, experienced, and skillful to serve as captain on the night of the accident, and his prescription medication did not negatively affect his performance.

3. Weather was not a factor in this accident.

4. No sudden rise in river level interfered with the forward movement of the *Anne Holly* tow.

5. Given the difficult navigation task, the darkness, the flood conditions (which resulted in a swift current and minimal vertical clearance at the Eads Bridge), and the lack of a helper boat, the captain should have chosen to pursue another option on the evening of April 4, 1998.

6. The captain of the *Anne Holly* would have been better able to make prudent decisions concerning the operation of his tow, and this accident might thereby have been prevented, had American Milling, L.P., developed and implemented an effective safety management system.

7. The lack of a safety management system requirement for all U.S. towing industry companies represents a threat to waterway safety.

8. The tow struck the Eads Bridge because of an error in judgment or a lapse of attention on the part of the *Anne Holly* captain, which resulted in the tow's misalignment.

9. Glare from shoreside lighting may have impaired the *Anne Holly* captain's night vision and may have been a factor in his failure to align the tow properly for transit through the Eads Bridge.

10. Because alcohol testing could not be accomplished until rescue operations were complete, the Safety Board is not able to eliminate the possibility that alcohol use may have contributed to the accident.

11. Because postaccident testing for illicit drugs did not take place until the day following the accident, the Safety Board is not able to eliminate the possibility that illicit drug use may have contributed to the accident.

12. Given the results of postaccident testing, together with the review of the captain's videotaped interview, and the review of his medical records, the Safety Board found no evidence that the *Anne Holly* captain was impaired by drugs or alcohol at the time of the accident.

13. Although the *Anne Holly* captain had the opportunity to obtain about 8 hours of sleep in a 24-hour period, the sleep would necessarily have been obtained on a split schedule.

14. Insufficient research is available on the effects of split-sleep schedules on the performance of inland towing industry operators for the National Transportation Safety Board to determine whether the *Anne Holly* captain was appropriately rested.

15. Had the *President Casino on the Admiral* broken free as a result of the allision, the consequences could have been catastrophic, because it could have resulted in the sinking or capsizing of the vessel, which would have placed more than 2,000 lives in jeopardy.

16. President Casinos's failure to conduct fire drills and the city of St. Louis's failure to enforce fire drill requirements for the *President Casino on the Admiral* contributed to a lack of casino staff preparedness to deal with emergency situations.

17. Patrons on board the *President Casino on the Admiral* did not receive sufficient safety information in the aftermath of the barge allisions to help prevent panic and confusion.

18. *President Casino on the Admiral* security personnel and other staff members were not adequately trained and drilled in crowd management techniques and therefore were not successful in ensuring that the vessel's patrons and staff behaved in a calm and orderly fashion in the aftermath of the April 4, 1998, accident.

19. Formal training in crowd management techniques for staff on all operating permanently moored vessels that are accessible to the public would enhance safety on board permanently moored vessels.

20. The evacuation of the *President Casino on the Admiral* was jeopardized by the lack of contingency plans for an emergency egress when the standard gangways were not available.

21. Although local emergency response agencies arrived on the scene in a timely manner, they were not prepared to rescue patrons and staff from the *President Casino on the Admiral* after the standard gangways to the vessel became unusable, which delayed the evacuation and could have put patrons and staff in jeopardy.

22. The St. Louis Harbor Emergency Response Plan did not sufficiently prepare emergency response agencies to deal with an emergency involving the rescue of a large number of people on or in the Mississippi River.

23. Laclede Gas Company's emergency responders had not been adequately prepared to stop the uncontrolled flow of natural gas resulting from this accident.

24. At the time of the accident, the *President on the Admiral*'s natural gas shutoff service valve was not readily accessible.

25. The flow from the *President Casino on the Admiral*'s ruptured natural gas supply line was not secured in a timely manner, and such a delay could be hazardous should such an incident recur.

26. The *President Casino on the Admiral* should not have been sited in a location where it was subject to waterborne and current-related risks, including breakaways, which could have put more than 2,000 lives in jeopardy.

27. President Casinos had the responsibility, knowledge, and experience with passenger vessel operations, previous accident history, and contingency planning, as well as the necessary management control and opportunity, to provide an effective safety management system for the *President Casino on the Admiral* but failed to do so.

28. The city of St. Louis did not exercise effective marine safety oversight for the *President Casino on the Admiral* because the city treated the *President Casino on the Admiral* as a commercial building on land.

29. The oversight provided by the State of Missouri, as represented by the State Gaming Commission, did not address marine safety systems, such as the permanently moored vessel's mooring design, fire safety, and lifesaving capabilities, and did not protect the safety of people on board the *President Casino on the Admiral.*

30. The U.S. Coast Guard has extensive discretionary authority over permanently moored vessels in navigable waters, such as the *President Casino on the Admiral*, but has chosen not to fully exercise it.

31. The U.S. Coast Guard permanently moored vessel policy, as it existed at the time of the accident, did not adequately provide for the safety of the *President Casino on the Admiral* or its patrons.

32. The U.S. Coast Guard's new policy on permanently moored vessels is inadequate because it still fails to provide for the safety of people on permanently moored vessels subject to waterborne and current-related risk events, including breakaways, allisions, sinking, and capsizing.

Probable Cause

The National Transportation Safety Board determines that the probable cause of the ramming of the Eads Bridge in St. Louis Harbor by barges in tow of the *Anne Holly* and the subsequent breakup of the tow was the poor decision-making of the captain of the

Anne Holly in attempting to transit St. Louis Harbor with a large tow, in darkness, under high current and flood conditions, and the failure of the management of American Milling, L.P., to provide adequate policy and direction to ensure the safe operation of its towboats.

The National Transportation Safety Board also determines that the probable cause of the near breakaway of the *President Casino on the Admiral* was the failure of the owner, the local and State authorities, and the U.S. Coast Guard to adequately protect the permanently moored vessel from waterborne and current-related risks.

Recommendations

New Recommendations

As a result of its investigation, the National Transportation Safety Board makes the following safety recommendations:

To the U.S. Coast Guard:

Seek authority to require domestic towing companies to develop and implement an effective safety management system to ensure adequate management oversight of the maintenance and operation of all towing vessels. (M-00-10)

Conduct a study of the lighting in St. Louis Harbor to determine whether the light level impairs nighttime navigation and take corrective action as necessary. (M-00-11)

Take the following three actions under your Ports and Waterways Safety Act authority: a) require that the owners of all operating permanently moored vessels that are accessible to the public provide and document formal training in crowd management techniques for all personnel on such vessels; b) require that periodic drills be conducted to reinforce the crowd management training; and c) require that the vessel owners amend their emergency plans to reflect crowd management techniques. (M-00-12)

Take the lead, in cooperation with appropriate port and waterways stakeholders, to develop contingency plans to assist in marine-related incidents, such as search and rescue operations, fires, capsizings, or sinkings involving passenger vessels or permanently moored public facilities within St. Louis Harbor. Also, amend the St. Louis Harbor Emergency Response Plan to reflect these changes. (M-00-13)

Conduct, in cooperation with the States of Missouri and Illinois and the cities of St. Louis and East St. Louis, regular drills to exercise the contingency plans for a variety of different marine scenarios, such as stopping breakaway vessels or rescuing large numbers of people from the Mississippi River. (M-00-14)

Either require owners of permanently moored vessels to protect their vessels from waterborne and current-related risks so that their permanently moored vessels are, in fact, equivalent to buildings or require that the owners obtain U.S. Coast Guard certificates of inspection for their permanently moored vessels. (M-00-15)

Do not allow permanently moored vessels to be sited in locations in which they are not protected from waterborne and current-related risk events, including breakaways, allisions, sinking, capsizing, etc. (M-00-16)

To the Research and Special Programs Administration:

Require corrective action as appropriate to ensure that pipeline operators have the means to shut off the flow of natural gas to permanently moored vessels in a timely manner, even during periods of high-water conditions. (P-00-14)

To the State of Missouri:

Conduct, in cooperation with the U.S. Coast Guard, the State of Illinois, and the cities of St. Louis and East St. Louis, regular drills to exercise the contingency plans for a variety of different marine scenarios, such as stopping breakaway vessels or rescuing large numbers of people from the Mississippi River. (M-00-17)

Either require owners of permanently moored vessels to protect their vessels from waterborne and current-related risks so that their permanently moored vessels are, in fact, equivalent to buildings or require that the owners obtain U.S. Coast Guard certificates of inspection for their permanently moored vessels. (M-00-18)

To the State of Illinois:

Conduct, in cooperation with the U.S. Coast Guard, the State of Missouri, and the cities of St. Louis and East St. Louis, regular drills to exercise the contingency plans for a variety of different marine scenarios, such as stopping breakaway vessels or rescuing large numbers of people from the Mississippi River. (M-00-19)

To the City of St. Louis:

Establish and implement oversight procedures to ensure that owners of operational permanently moored vessels that are accessible to the public in St. Louis Harbor conduct and document fire drills. (M-00-20)

Take the following three actions: a) require that the owners of all operating permanently moored vessels that are accessible to the public in St. Louis Harbor provide and document formal training in crowd management techniques for all personnel on such vessels; b) require that periodic drills be conducted to reinforce the crowd management training; and c) require that the vessel owners amend their emergency plans to reflect crowd management techniques. (M-00-21)

Ensure that harbor emergency responders develop, in conjunction with local permanently moored vessel owners, including President Casinos, Inc., and the McDonald's Corporation, contingency plans for boarding and exiting the vessels when the standard means of egress become unusable and amend the St. Louis Harbor Emergency Response Plan to reflect the new procedures. (M-00-22)

Conduct, in cooperation with the U.S. Coast Guard, the States of Missouri and Illinois, and the city of East St. Louis, regular drills to exercise the contingency plans for a variety of different marine scenarios, such as stopping breakaway vessels or rescuing large numbers of people from the Mississippi River. (M-00-23)

Either require owners of permanently moored vessels to protect their vessels from waterborne and current-related risks so that their permanently moored vessels are, in fact, equivalent to buildings or require that the owners obtain U.S. Coast Guard certificates of inspection for their permanently moored vessels. (M-00-24)

To the City of East St. Louis:

Conduct, in cooperation with the U.S. Coast Guard, the States of Missouri and Illinois, and the city of St. Louis, regular drills to exercise the contingency plans for a variety of different marine scenarios, such as stopping breakaway vessels or rescuing large numbers of people from the Mississippi River. (M-00-25)

To the National League of Cities (M-00-26):
To the American Association of Port Authorities (M-00-27):

Inform your members of the April 4, 1998, near breakaway of the permanently moored *President Casino on the Admiral* in St. Louis Harbor and of the waterborne and current-related risks associated with similarly located permanently moored vessels.

To the American Gas Association (P-00-15 and P-00-16):
To the American Public Gas Association (P-00-17 and P-00-18):

Advise your members of the natural gas leak that resulted from the April 4, 1998, accident affecting the *President Casino on the Admiral* in St. Louis Harbor and recommend that they participate in port contingency plan drill exercises involving permanently moored vessels that are supplied with natural gas.

Urge your members to take corrective action as appropriate to ensure that they can shut off the flow of natural gas to permanently moored vessels in a timely manner, even during periods of high-water conditions.

To President Casinos, Inc.:

Develop guidelines for making periodic public address announcements during emergencies to provide direction and ensure patron safety. (M-00-28)

Require and document that all *President Casino on the Admiral* personnel receive formal training in crowd management techniques, and conduct periodic drills to reinforce this training so that vessel staff can perform effectively in an emergency. Also, amend the *President Casino on the Admiral*'s *Emergency Evacuation Procedures* to reflect crowd management techniques. (M-00-29)

Develop and exercise contingency plans for emergency egress from the *President Casino on the Admiral* to ensure that occupants can exit the vessel in a timely and orderly manner when the standard means of egress become unusable and amend the *President Casino on the Admiral*'s *Emergency Evacuation Procedures* to reflect the new procedures. (M-00-30)

Develop and implement a safety management system for the *President Casino on the Admiral* that anticipates and provides appropriate means of responding to all foreseeable emergencies. (M-00-31)

Site the *President Casino on the Admiral* in a location in which it is protected from waterborne and current-related risk events, including breakaways, allisions, sinking, capsizing, etc. (M-00-32)

To the Laclede Gas Company:

Require that your emergency response teams participate in port contingency plan drill exercises involving permanently moored vessels that are supplied with natural gas. (P-00-19)

To American Milling, L.P.:

Develop and implement a safety management system similar to the Responsible Carrier Program used by the American Waterways Operators; the system should establish effective policies and procedures to enhance the safety of vessel operations. (M-00-33)

Previously Issued Recommendations Classified in This Report

To the U.S. Coast Guard:

In conjunction with the towing vessel industry, develop and implement an effective safety management code to ensure adequate management oversight of the maintenance and operation of vessels involved in oil transportation by barges. (M-98-104)

Safety Recommendation M-98-104 (previously classified "Open–Unacceptable Response") is classified "Closed–Unacceptable Action/Superseded" in the "Captain's Decision-making" section of this report. It is superseded by Safety Recommendation M-00-10, issued in this report.

BY THE NATIONAL TRANSPORTATION SAFETY BOARD

James E. Hall
Chairman

John A. Hammerschmidt
Member

John J. Goglia
Member

George W. Black, Jr.
Member

Carol J. Carmody
Member

Adopted: September 8, 2000

Appendix A

Investigation and Hearing

The National Transportation Safety Board was notified of this accident early in the morning of April 5, 1998, and launched a four-person investigative team that arrived in St. Louis, Missouri, in late afternoon. The team consisted of an investigator-in-charge and survival factors, human performance, and engineering factors investigators. That evening, the Captain of the Port of the U.S. Coast Guard Marine Safety Office in St. Louis briefed the team. A Board Member arrived on scene on April 7.

The Safety Board investigated the accident under the authority of the Independent Safety Board Act of 1997, according to Safety Board rules. Team members conducted interviews from April 7 through 10, and on April 15. The team viewed the damage on the *President Casino on the Admiral* and interviewed crewmembers of the towing vessel *Anne Holly*, including the captain, pilot, mate, deckhands, and chief engineer. The team interviewed representatives from the U.S. Army Corps of Engineers and the Coast Guard, the master on watch of the *Casino Queen*, St. Louis emergency response personnel, and an American Bureau of Shipping surveyor. Safety Board investigators also spoke with personnel from the *President Casino on the Admiral*, including the Missouri State gaming officer, the senior shift manager who had been on duty when the accident took place, the vessel's former marine manager, and the casino manager.

The designated parties to the Safety Board's on-scene investigation were the Coast Guard; President Casinos, owner of the *Admiral*; and American Milling, L.P., owner of the *Anne Holly*. A public hearing on this accident was held in St. Louis, Missouri, on July 23 and 24, 1998. The parties to the public hearing were the Coast Guard; President Casinos; the city of St. Louis, Missouri; and the U.S. Army Corps of Engineers.

Appendix B

Damage to *Anne Holly* Barges

Barge	Hull Damage	Cargo Damage
SB 15B	$35,000	$30,000
CGB 219B	$20,000	-0-
PIN 348	$100,000	$125,000
ABC 767	$150,000	$15,000
MWO 211	$10,000	-0-
Total	$315,000	$170,000

Appendix C

Characteristics of Barges in *Anne Holly* Tow

NAME	LENGTH (feet)	BEAM (feet)	DRAFT (estimated)	CARGO TONNAGE	CARGO TYPE
Port Position*					
ABC 767	195	35	6 ft., 6 1/2 in.	981	Cottonseed
PIN 348	200	35	9 ft., 5 in.	1,638	Fertilizer
SUN 363	200	35	9 ft., 3 in.	1,638	Fertilizer
SB 15B	200	35	9 ft., 5 in.	1,643	Clay
RM 41	200	35	9 ft., 8 1/2 in.	1,696	Fertilizer
Center Position					
MWO 211	195	35	6 ft., 9 1/2 in.	1,037	Cottonseed
CGB 277	200	35	9 ft.	1,553	Fertilizer
CSV 9605	200	35	9 ft., 1 1/2 in.	1,575	Fertilizer
CMM 2	200	35	9 ft., 4 in.	1,626	Fertilizer
PMC 8101	200	35	9 ft., 7 1/2 in.	1,682	Fertilizer
Starboard Position					
ITEL 206	200	35	1 ft., 9 in.	empty	N/A
CGB 219B	200	35	1 ft., 9 in.	empty	N/A
FIC 526	195	35	8 ft., 11 in.	1,476	Fertilizer
TCKM 1	200	35	9 ft., 1/2 in.	1,563	Fertilizer
Total					
Total Cargo				18,108	

*In order, forward to aft.

Appendix D

Mooring Wires for the *President Casino on the Admiral*

The *President Casino on the Admiral* (*Admiral*) was moored with 10 mooring wires:

- **Number 1 wire**: (1½ inch diameter) Attached to the facility's entry barge and to the anchor upstream of the structure. This wire was put into service 23 months before the accident.
- **Number 2 wire**: (1¼ inch diameter) Attached to a deadman upstream from the entry barge. This wire was put into service 55 months before the accident.
- **Number 3 wire**: (1 1/8 inch diameter) Attached to a deadman at the forward end of the entry barge, forward of the employee gangway. This wire was put into service 22 months before the accident.
- **Numbers 4 and 5 wires**: (1 1/8 inch diameter) Attached to a deadman on the levee parallel to the center gangway with one wire on each side. These wires were put into service 26 and 2 months, respectively, before the accident.
- **Number 6 wire**: (1 1/8 inch diameter) Attached to the entry barge and a deadman downstream of the entry barge. This wire was put into service 55 months before the accident.
- **Number 7 wire**: (1½ inch diameter) Attached to the entry barge and the anchor downstream of the structure. This wire was put into service 14 months before the accident.
- **Numbers 8 and 9 wires**: (1 1/8 inch diameter) Attached to the *Admiral* bow and deadmen upstream of the Eads Bridge. These wires were put into service 12 and 24 months, respectively, before the accident.
- **Number 10 wire**: (1 1/8 inch diameter) This was a breast wire attached to the *Admiral*'s bow and to a deadman upstream of the Eads Bridge. This wire was put into service 48 months before the accident.

Before the "Great Flood of 1993," the *Admiral* had eight mooring wires. During the first rise of the 1993 flood waters, the chief engineer on the *Admiral* and the Chief of Marine Operations decided to add the head and bow wires to the *Admiral* mooring. The St. Louis gage reached 49.5 feet on August 1, 1993. From the beginning of April through early October 1993, St. Louis experienced flood waters (over 30 feet on the gage) except for a period from the end of May to the end of June when the river stage was at high water. A permanently moored heliport, the permanently moored *Burger King* barge, and a minesweeper were damaged and broke away from their moorings in 1993. The *Admiral*, the Gateway Riverboat Cruises barge (and the two small passenger vessels moored to it), the *Robert E. Lee*, and the *McDonald's* riverboat remained secure to their moorings.

Appendix E

Coast Guard List of PMVs in the United States

List of Permanently Moored Vessels as of November 20, 1998

	PORT	VNAME	MAX PAS	LATITUDE	LONGITUDE	RIVER	MILE
1	BALTIMORE	EX USCGC TANEY	NA			PATAPSCO RIVER	
2	BALTIMORE	TORSK	NA			PATAPSCO RIVER	
3	BALTIMORE	CHESAPEAKE	NA			PATAPSCO RIVER	
4	BALTIMORE	CONSTELLATION	NA			PATAPSCO RIVER	
5	BOSTON	MAYFLOWER II (FRAZIER PIER)	75			PLYMOUTH, MA	
6	BOSTON	DISCOVERY (LONG WHARF)	1500			BOSTON, MA	
7	BOSTON	MERRIMAC QUEEN (BURROUGH'S)	150			BOSTON, MA	
8	BOSTON	FORT WARREN (LONG WHARF)	342			BOSTON, MA	
9	BUFFALO	USS CROAKER	40			BUFFALO RIVER	0.9
10	BUFFALO	USS SULLIVANS	150			BUFFALO RIVER	0.9
11	BUFFALO	USS LITTLE ROCK	600			BUFFALO RIVER	0.9
12	CHICAGO	COLUMBIA YACHT CLUB	500	N415303	W0873635		
13	CHICAGO	USS SILVERSIDES	40	N431348	W0862000		
14	CHICAGO	IDLER	150	N422418	W0861626		
15	CLEVELAND	USS COD	72	N413038	W814130		
16	CLEVELAND	S/S/WILLIAM G MATHER	125	N413040	W814147		
17	CLEVELAND	HORNBLOWERS	225	N413038	W814129		
18	CORPUS CHRISTI	LANDRY'S RESTAURANT	200	N27477	W097235		
19	DULUTH	S/S WILLIAM A IRVING	100				
20	DULUTH	M/V LAKE SUPERIOR	40				
21	DULUTH	S/S EDNA G	40				
22	GUAM	ASHORE RESTAURANT				SAIPAN	
23	GUAM	REEF WALKER				GUAM	
24	HAMPTON ROADS	DISCOVERY	25	N37125	W76468	JAMESTOWN ISLAND	
25	HAMPTON ROADS	JAMES RIVER RESERVE FLEET	UNK	N3768	W76389	JAMES RIVER	
26	HAMPTON ROADS	HUNTINGTON	10	N36506	W76176	ELIZABETH RIVER	
27	HONOLULU	FALLS OF CLYDE	300	HONOLULU, HI			
28	HONOLULU	USS BOWFIN	70	PEARL HARBOR			
29	HONOLULU	BRIG CARTHAGINIAN	50	LAHAINA, MAUI, HI			
30	HUNTINGTON	W.P. SNYDER	<50			MUSKINGUM RIVER	0.5
31	HUNTINGTON	BECKY THATCHER	<350			MUSKINGUM RIVER	0.3
32	HUNTINGTON	SHOWBOAT MARINA	<100	N38241	W082333	OHIO RIVER	305
33	JACKSONVILLE	LLOYD'S RESTAURANT	30	CAPE CANAVERAL			
34	JACKSONVILLE	PROFESSIONAL OFFICE COMPLEX	50	TAVARES, FL			
35	LA/LB	NAUTICAL HERITAGE MUSEUM	150	NEWPORT HARBOR			
36	LA/LB	SCORPION (RUSSIAN SUB)	100				
37	LA/LB	QUEEN MARY	1000	SAN PEDRO BAY			
38	LONG ISLAND	REGINA MARS	50			GREENPORT, NY	
39	LONG ISLAND	NANTUCKET	40			BRIDGEPORT, CT	
40	LONG ISLAND	CHARLES MORGAN	100			MYSTIC, CT	
41	LONG ISLAND	JOSEPH CONRAD	50			MYSTIC, CT	
42	LONG ISLAND	L.A. DUNTON	50			MYSTIC, CT	
43	LONG ISLAND	GOV BRYANT (INACTIVE)	30	N4139	W070165		
44	LOUISVILLE	SHOWBOAT MAJESTIC	233			OHIO RIVER	470
45	LOUISVILLE	TOW BOAT ANNIES	400			OHIO RIVER	603.8
46	LOUISVILLE	HARVEY'S ON THE RIVER	150			OHIO RIVER	589.9
47	LOUISVILLE	FORE & AFT RESTAURANT	300			OHIO RIVER	484
48	LOUISVILLE	STAR OF LOUISVILLE LANDING	350			OHIO RIVER	603.7
49	LOUISVILLE	THE WHARF	130			OHIO RIVER	558
50	LOUISVILLE	MIKE FINK'S	450			OHIO RIVER	470.5
51	LOUISVILLE	SLOPPY JOES	233			OHIO RIVER	470
52	LOUISVILLE	HOOTER'S	354			OHIO RIVER	470
53	LOUISVILLE	REMINGTON'S	350			OHIO RIVER	469.5
54	LOUISVILLE	RIVERSIDE 4	60			OHIO RIVER	469
55	LOUISVILLE	FOUR SEASONS	250			OHIO RIVER	464
56	LOUISVILLE	ANCHOR INN	250			OHIO RIVER	465.5
57	LOUISVILLE	BARLEYCORN'S	784			OHIO RIVER	470
60	LOUISVILLE	WATERFRONT RESTAURANT	1700			OHIO RIVER	471
61	LOUISVILLE	COVINGTON'S LANDING (CLOSED)				OHIO RIVER	
62	MEMPHIS	LAS VEGAS CASINO	1132	N33250	W091040	UMR	
63	MEMPHIS	JUBILLEE CASINO	1500	N33251	W091040	UMR	
64	MEMPHIS	LIGHTHOUSE POINT CASINO	1800	N33252	W091040	UMR	
65	MIAMI	WATERWAY CLIPPER	53	N26500	W080044		
66	MIAMI	LOBSTER WALK (INACTIVE)	40	N24517	W0804365		
67	MIAMI	CAPTAIN RUNAGROUND	50	N24335	W0814715		
68	MILWAUKEE	USS COBIA	35			MANITOWOC RIVER	0.2

List of Permanently Moored Vessels as of November 20, 1998 (cont.)

	PORT	VNAME	MAX PAS	LATITUDE	LONGITUDE	RIVER	MILE
69	NEW ORLEANS	CASINO MAGIC BAY	5000	N30170	W089260	BAY ST LOUIS	
70	NEW ORLEANS	SHREVE STAR	1925			RED RIVER	277
71	NEW ORLEANS	LADY OF THE ISLE	1925			RED RIVER	276
72	NEW ORLEANS	QUEEN OF THE RED (INACTIVE)	1850			RED RIVER	276
73	NEW ORLEANS	LADY LUCK CASINO	2000	N41322	W090310	UMR	485.5
74	NEW ORLEANS	ISLE OF CAPRI	2000	N32200	W090550	LMR	436
75	NEW ORLEANS	KING OF THE RED	2930			RED RIVER	276
76	NEW ORLEANS	MARY'S PRIZE	1925			RED RIVER	275
77	NEW ORLEANS	AMERISTAR CASINO	2000	N32200	W090550	LMR	436
78	NEW ORLEANS	RAINBOW CASINO	2000	N32150	W090533	YAZOO RIVER	1
79	NEW ORLEANS	HARRAH'S CASINO	2000	N32300	W090124		
80	NEW YORK	LEHIGH VALLEY RR BRGE79	100	N40403	W074011		
81	NEW YORK	USS SLATER	0	N42383	W073450		
82	NEW YORK	BARGE MUSIC	140	N40421	W0730595		
83	NEW YORK	USS GROWLER	15	N40456	W074001		
84	NEW YORK	USS INTREPID	3500	N40456	W074001		
85	NEW YORK	USS EDSON	250	N40456	W074001		
86	NEW YORK	3 UNNAMED BARGES	150	N40456	W074001		
87	NEW YORK	PEKING	200	N40222	W074001		
88	NEW YORK	AMBROSE LIGHT SHIP	125	N40222	W074001		
89	PADUCAH	QUEEN OF CLARKSVILLE BRD BRG				CUMBERLAND RIVER	125.5
90	PADUCAH	CHATTANOOGA STAR BRD PLAT				TENNESSEE RIVER	464.5
91	PADUCAH	THE STAR BRD PLAT				TENNESSEE RIVER	648.3
92	PADUCAH	SOUTHERN BELLE BRD BRG				TENNESSEE RIVER	464
93	PADUCAH	PLAYER'S ISLAND CASINO				OHIO RIVER	943.7
94	PADUCAH	OPRYLAND RIVER TAXIS BRD BRGE				CUMBERLAND RIVER	191
95	PHILADELPHIA	OLYMPIA	350	N39565	W075085	DELAWARE RIVER	
96	PHILADELPHIA	BECUNA	100	N39565	W075085	DELAWARE RIVER	
97	PHILADELPHIA	HOOTER'S	500	N39575	W075082	DELAWARE RIVER	
98	PHILADELPHIA	MOSHULU	490	N39564	W075085	DELAWARE RIVER	
99	PHILADELPHIA	AMERICANA	110	N38570	W074546	CAPE MAY	
100	PITTSBURGH	REGATTA BEER BARGE	400			OHIO RIVER	0
101	PITTSBURGH	SCIENCE CENTER SUB	300			OHIO RIVER	0.5
102	PITTSBURGH	GATEWAY CLIPPER	810			MONONGHELA RIVER	0.5
103	PITTSBURGH	CAPT ED'S DOCK	650			OHIO RIVER	0.93
104	PITTSBURGH	CREWSER'S DOCK	3000			ALLEGHENY RIVER	1.5
105	PORTLAND	USS BLUEBACK	100			WILLIAMETT RIVER	13.5
106	PORTLAND	DIMILLO'S FLOATING RESTAURANT	700			PORTLAND, ME	
107	PORTLAND	JOHN WANNAMAKER	200			PORTSMOUTH HARBOR, NH	
108	PORTLAND	PORTLAND	100			WILLIAMETT RIVER	12.5
109	PORTLAND	COLUMBIA	25			WILLIAMETTE RIVER	15
110	PROVIDENCE	BIG BOB'S BARGE					
111	PROVIDENCE	NEW BEDFORD					
112	PROVIDENCE	LION FISH					
113	PROVIDENCE	JOE KENNEDY					
114	PROVIDENCE	HIDDEN SEA					
115	PROVIDENCE	GOV BRANT (INACTIVE)		N4139	W070165		
116	PROVIDENCE	USS MASSACHUSETTS (INACTIVE)	30	N4139	W070165		
117	PUGET SOUND	WAWONA	100	N47376	W122202		
118	PUGET SOUND	COEUR D'ALENE FLOATING GREEN	15	N4741	W11645		
119	PUGET SOUND	CHALLENGER	12	N47389	W122198		
120	PUGET SOUND	SKANSONIA	150	N47389	W122198		
121	PUGET SOUND	USS TURNER JOY	300	N4733	W12239		
122	PUGET SOUND	EMERALD QUEEN	400	N47158	W122233		
123	SAN FRANCISCO	CGC RELIEF				PORT OF OAKLAND	
124	SAN FRANCISCO	TELCO				HYDE ST PIER	
125	SAN DIEGO	STAR OF INDIA	450	N32432	W117105		
126	SAN DIEGO	BERKLEY	1400	N32433	W117105		
127	SAN DIEGO	CHARLEY BROWN'S	640	N32435	W117113		
128	SAN FRANCISCO	USS HORNET				ALEMADA	
129	SAN FRANCISCO	ALAMAR				SACRAMENTO RIVER	
130	SAN FRANCISCO	FRESNO				PORT OF RICHMOND	
131	SAN FRANCISCO	RED OAK VICTORY				PORT OF RICHMOND	
132	SAN FRANCISCO	VIRGIN TURGEON				SACRAMENTO RIVER	
133	SAN FRANCISCO	SAN JOAQUIN YACHT CLUB	184	N380100	W1213850		
134	SAN FRANCISCO	S/V BALCLUTHA	100	N374836	W1222523		
135	SAN FRANCISCO	M/V EPPLETON HALL	5	N374845	W1222520		
136	SAN FRANCISCO	S/V C.A. THAYER	50	N374834	W1222518		
137	SAN FRANCISCO	S/V ALMA	40	N374838	W1222524		
138	SAN FRANCISCO	M/V HERCULES	20	N374836	W1222522		
139	SAN FRANCISCO	M/V EUREKA	100	N374833	W1222519		
140	SAN FRANCISCO	USS PAMPANITO (SS383)	70	N374830	W1222506		
141	SAN FRANCISCO	M/V DELTA KING	1250	N383430	W1213030		
142	SLT ST MARIE	MAPLE	23	N45 52	W084 43		
143	ST LOUIS	RIVERPORT PLAYER'S ISLAND				MISSOURI RIVER	32

List of Permanently Moored Vessels as of November 20, 1998 (cont.)

	PORT	VNAME	MAX PAS	LATITUDE	LONGITUDE	RIVER	MILE
144	ST LOUIS	GOLDENROD THEATRE BOAT				MISSOURI RIVER	29
145	ST LOUIS	ST CHARLES CASINO SPT BRGE		N37032	W089231	UMR	29.5
146	ST LOUIS	PRESIDENT CASINO SPT BRGE		N41308	W090332	UMR	482.5
147	ST LOUIS	LACROSSE QUEEN PASS BRGE				UMR	888
148	ST LOUIS	LONGNECKER RESTAURANT		N40235	W091225	UMR	364
149	ST LOUIS	CADIE HOOPER RESTAURANT		N40380	W089400	ILR	162.5
150	ST LOUIS	MISSISSIPPI BELLE SPT BRGE		N41501	W090110	UMR	518
151	ST LOUIS	ARGOSY V SPT BRGE				MISSOURI RIVER	731.8
152	ST LOUIS	CATFISH BEND SPT BRGE		N40363	W091161	UMR	383
153	ST LOUIS	PADDLEFORD OFFICE		N44560	W093050	UMR	840
154	ST LOUIS	NO WAKE CAFE		N44560	W093050	UMR	839.8
155	ST LOUIS	ROBERT E LEE RESTAURANT		N38374	W090106	UMR	179.6
156	ST LOUIS	CASINO VESSEL ADMIRAL		N38366	W090110	UMR	179.9
157	ST LOUIS	ADMIRAL SUPPORT BARGE		N38366	W090110	UMR	179.9
158	ST LOUIS	GATEWAY SUPPORT BARGE		N38374	W090106	UMR	179.6
159	ST LOUIS	MACDONALD'S RESTAURANT		N38366	W090110	UMR	179.3
160	ST LOUIS	CASINO ROCK ISL SPT BRGE		N41308	W090332	UMR	482.5
161	TAMPA BAY	"SUBMARINE"	60	ST PETE PIER, ST PETE			
162	TOLEDO	SS WILLIS BOYER	1000			MAUMEE RIVER	5.16

Appendix F

Coast Guard February 17, 2000, Letter to the Safety Board on PMVs

U.S. Department of Transportation
United States Coast Guard

Commandant
United States Coast Guard

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Washington, D.C. 20593-0001
Staff Symbol: G-MOA
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16732

FEB 17 2000

Mr. Leon Z. Katcharian
490 L'Enfant Plaza East, SW
National Transportation Safety Board
Washington, D.C. 20594

Dear Mr. Katcharian:

This responds to your letter of January 19, 2000, regarding the U.S. Coast Guard's authority with respect to permanently moored vessels.

First, it should be noted that at the meeting on January 12, the NTSB staff stated that they did not want the Coast Guard to draft a legal opinion or conduct any new legal research on this issue. They merely wanted to be provided with what legal analysis had been given previously to their questions, (presumably in the context of permanently moored passenger craft, such as the ADMIRAL). Despite a search of the files, aside from a file dealing with jurisdiction over PMVs and facilities that store or transfer oil, no file on PMVs, in general, or high capacity passenger PMVs, in particular, was found. Accordingly, these questions are being answered without reference to a previous "file on PMVs." The analysis and answers necessarily include historical treatment and interpretation of the relevant statutes and regulatory authority. Second, it is noted that the NTSB is investigating a casualty involving a specific type of permanently moored vessel – a permanently moored floating casino. Therefore, this analysis will focus on that type of craft. Third, the NTSB wanted answers to these questions as they would have been provided at the time of the *Anne Holley/Admiral* casualty, (4 April. 1998), i.e. prior to the 1998 QAT on permanently moored passenger vessels.

Your questions are repeated below, and our answers follow.

1. What is the CG's jurisdiction over PMVs?

At the outset, it should be understood that there never has been any specific statutory mandate for the CG to regulate PMVs, as such. The Coast Guard's statutory authority is with respect to vessels on the navigable waters of the United States which are, by virtue of their size, occupation and other relevant considerations, subject to regulation and inspection. Therefore, any question about the jurisdiction of the CG over PMVs must be understood to be in a specific context relevant to the existing CG statutory and regulatory framework.

The statutory framework and authority to issue regulations for design, construction, equipment, manning and inspection of vessels of a given size and engaged in certain activities derives from Title 46 US Code, Subtitle II, specifically 46 USC 3301. 46 USC 3301(4) [passenger vessels] provides the Coast Guard's authority to prescribe regulations in respect of design, construction, equipment, manning, and operations aboard, and inspection of passenger vessels, including casino vessels on the navigable waters of the United States. However, the Coast Guard's inspection authority over passenger vessels, including casino vessels, whether moored or not, is dependent on the craft in question being a "vessel" for purposes of the inspection statute in question. Thus, the first step in determining whether the Coast Guard has jurisdiction over a particular craft is to determine whether that craft is a "vessel" at the point in time of the inquiry.

46 USC 2101 (45) states that, "vessel" [for purposes of the vessel inspection laws] "has the same meaning given that term in 1 USC 3." 1 USC 3 states, " 'vessel' includes every description of watercraft used or capable of being used as a means of transportation on the water."

It should be noted at the outset that determining whether a particular craft has "vessel" status under the law is dependent on the statute in question, and more specifically, on the purpose for which the inquiry is being made. Compare *The Showboat*, 47 F2d 286 (D. Mass. 1930) with *Hayford v. Doussony*, 32 F2d 605 (5th Cir. 1929), in which the courts reached opposite results on the question of vessel status when considering similar floating structures. Further, a particular craft may be a vessel for purposes of one law, and not be a vessel for purposes of another. For example, the court in *Pavone, infra*, concluded that the floating gaming craft at issue was not a vessel for Jones Act seaman purposes, notwithstanding that it was conceded to be a vessel for purposes of the Mississisippi Gaming Statute and the Coast Guard vessel documentation law. *Pavone v. Miss. Riverboat Amusement Ltd.*, 52 F3d 560, at 569-70 (5th Cir. 1995). Additionally, vessel status of a particular craft may change over time, depending on the use to which it is put, and the surrounding facts and circumstances. A reading of the cases applying the statutory definition of vessel in 1 USC 3 makes clear that the determination of whether a structure is a vessel at a given time is dependent principally on two things – the statute or law being applied and the facts of the particular case.

The Coast Guard has interpreted and applied the definition of vessel in 1 USC 3 broadly to effectuate the purposes of the laws it administers to promote marine safety and protection of the marine environment. But, it has not distorted that definition or applied it in such a way as to find jurisdiction over structures which are not, in fact, vessels.

Additionally, and before the proliferation of high capacity passenger vessels, such as the casino boat ADMIRAL, the CG position on its jurisdiction over PMVs was as stated in the Vol. II of the Marine Safety Manual. It was based almost exclusively on whether the particular craft involved was so securely moored or otherwise prevented from getting underway as not to be "capable of being used as a means of transportation on the water" without taking extraordinary means. Determination of whether a craft that is "permanently moored" is a vessel subject to inspection or other regulation, has always involved considerations of whether it was exposed to the same marine risks characteristic of those risks to which vessels, in general, are exposed. The more "vessel related" risk is presented to (or by) the craft in question, the more that traditional

maritime activity is involved in its operation; the more risk to navigation or the marine environment, and the less that needs to be done to render the craft "capable of being used as a means of transportation on water", the more likely a particular "permanently moored vessel" is to be subject to regulation and inspection. On the other hand, where the risks to the environment and the personnel on the craft are no different than those posed by traditional land structures located on the banks of a navigable waterway, and where the craft can not be used as a means of transportation on the water without extraordinary steps being taken, the less likely it is to be subject to regulation or inspection as a "vessel." The analysis does not lend itself to simplistic "one size fits all" criteria. Each case stands on its own, and the rule of reason applies. But, once a particular floating craft was determined not to be a "vessel," it ceased being subject to inspection (CG jurisdiction), and became subject to inspection and regulation by other regulatory bodies, viz OSHA, state and local authorities.

Vol. II, Paragraph 10.I.1 of the Marine Safety Manual, which discusses the status of "permanently moored vessels," incorporates this philosophy, and correctly states that courts have adopted a similar analysis (albeit in the context of issues unrelated to the Coast Guard's marine safety statutes). See, e.g. *Pavone supra,* (USCG documented barge described as a floating dockside casino was not a "vessel" for Jones Act seaman purposes because of the permanency of its mooring), and *Matter of Treasure Bay Corp.*, 208 B.R. 490, 1997 AMC 2878 (Bankr. SD Miss) (Floating dockside casino on barge permanently secured to a land side structure not a "vessel" for purposes of conferring preferred mortgage status on mortgage filed by USCG Vessel Documentation Center on barge, a documented vessel). The Marine Safety Manual statement of policy on PMVs, while brief, correctly states the historical application of the marine inspection statutes, including 46 USC 3301 (4), to permanently moored casino vessels. As stated, the inquiry tended to be focused on the nature and permanency of the mooring as the predominant consideration. Some courts faced with determining "vessel status" have looked to the rules that apply to vessels that have been "withdrawn from navigation" for guidance. See, e.g. *Desper v. Starved Rock Ferry Co.*, 342 U.S. 187, 191, 72 S.Ct. 216, 218 (1952)(quoting *Hawn v. American S.S. Co.*, 107 F2d 999, 1000 (2d Cir. 1939). The Coast Guard has taken the same approach in the Marine Safety Manual.

Although NTSB wanted answers to their questions as of the time of the *Anne Holley/Admiral* casualty, it is worth noting that as a result of the rapid proliferation of casino vessels since 1990, and several recent casualties involving permanently moored casino vessels, the Coast Guard reevaluated its policy concerning such vessels in 1998. A Quality Action Team (QAT) was formed to address safety issues on these craft. The QAT issued a report which was approved in December 1999. Among other things, the Commandant approved a more rigorous approach to evaluating whether a casino vessel, which had been or would be subject to inspection as a passenger vessel under 46 USC 3301 (4), could achieve the status of permanently moored vessel and be regulated and inspected by the state and local authorities. Several additional changes in policy toward permanently moored vessels were also initiated at that time as well, and will be incorporated into revisions to the regulations and Marine Safety Manual.

2. If the CG's jurisdiction over PMVs stems from the PWSA, specifically what part or section of the PWSA does the CG believe provides this authority?

The Ports and Waterways Safety Act of 1972, 33 USC 1221 et seq. (PWSA), was passed in 1972, amended in 1978 (Port and Tanker Safety Act), and again in 1990 (OPA 90), to fill specific voids in the Coast Guard's regulatory authorities over tank vessels and port safety after a series of oil tanker accidents and oil spills in the 1970s, and the Exxon Valdez spill in 1989. The PWSA has been interpreted as providing principally for protection of the marine environment, safeguarding waterfront facilities from fire, explosives, flammable and combustible materials and safeguarding navigation by means of regulating vessel movement and providing for vessel traffic services. The PWSA has generally not been interpreted and applied to expand the Coast Guard's regulatory authority over construction, manning, equipment or operations on vessels other than tank vessels. But, the broad language of the PWSA can provide additional regulatory authority to address new risks to port safety presented by vessels other than tank vessels, or to facilities in U.S. ports, or protection of the marine environment on the navigable waters of the United States. In fact, the language of the PWSA, authorizing the Secretary to regulate with respect to facilities and vessels in the ports of the U.S., is very broad. And the legislative history of the PWSA suggests that a broad reading to effectuate its purposes would be consistent with the Act. To date, however, the PWSA has only been applied to high capacity passenger PMVs in the ports of the U.S. by the CG to control vessel traffic in the port, and to restrict movement or placement of vessels in the ports to protect life or property and the marine environment. The specific sections of the PWSA which apply to these issues are 33 USC 1223 and 1225.

3. If CG authority emanates from some other statute, please advise and explain.

See # 1 above.

4. Is there separate authority covering the port and waterway as opposed to the safety of the PMV itself and its occupants?

Generally, the authority over ports and waterways is found in the PWSA; and the authority over vessels and the safety of their occupants is found in the vessel inspection laws. See # 1 and #2 above.

5. At what point, if any, does the CG believe its authority over PMVs ceases?

As explained above, CG authority over a PMV depends on the facts and circumstances of each individual case. It also depends on what is sought to be accomplished by exercising authority. For example, if the issue is where the PMV can be located in the waterway, or what steps must be taken to protect it from other vessel traffic in the area, the authority is likely to be the PWSA. If the issue is how ingress and egress from the PMV is provided in an emergency, the authority is more likely the vessel inspection laws and regulations, as opposed to the PWSA, at least as it has been traditionally applied. Because the status of a PMV at any given time and under different factual circumstances (as well as the nature of the regulation in question) can change depending on the context, it is impossible for one answer to be given to such a broad question. It is believed that the discussion above, primarily in response to questions # 1 and #2, answers this question in

the context of a permanently moored passenger casino boat on the Mississippi River, such as the ADMIRAL.

6. What are the differences between the way the CG addresses the safety issues for PMVs and laid-up vessels? Provide the rationale(s) for differences, if any.

Again, the context of this question is assumed to be contrasting a permanently moored casino vessel, such as the ADMIRAL on the Mississippi River, with a laid-up vessel that is subject to inspection because of its employment. The historical treatment given the two different situations has been to examine whether the PMV is, in fact, withdrawn from navigation on a permanent basis, as opposed to the temporary withdrawal envisioned with a laid up vessel. The primary distinction between treatment of the two is in the permanency of the mooring arrangement and what steps are necessary to "undo" the mooring and return the craft to service. Objective indications of capability to be used in navigation as evidenced by all the facts and circumstances play a role in the determination of "vessel status." Here again, no one set of criteria will apply indiscriminately, and the rule of reason applies so as to further the twin aims of protecting marine safety and the marine environment.

7. What advice or requirements for passenger safety can or does the CG give to State/local authorities who assume safety responsibilities for the structure? If so, would the requirements be made part of the letter of designation for a permanently moored status?

Please see paragraphs I.1.k and I.1.l in appendix I to the report of the Permanently Moored Vessel QAT dated December 7, 1999, which has previously been provided to you . A sample "Designation Letter for a Vessel in Permanently Moored Status" is also included in the report as appendix H.

Sincerely,

J. L. GRENIER
Captain, U.S. Coast Guard
Chief, Office of Investigation and Analysis
By direction of the Commandant

Appendix G

Coast Guard PMV Initial Risk Assesment Form

Permanently Moored Passenger Vessel Initial Risk Assessment

Name of Vessel: _____

Location: _____

Passenger Capacity: _____

The risk model use uses six parameters to quantify the risk to the vessel. The parameters are designed to capture the key risk elements associated with permanently moored vessels. Each of the six parameters is scored on a scale of one to five. A low score indicates an undesirable condition and conversely, a high score indicates a desirable situation. **Therefore, based on the six parameters, a vessel could receive a maximum total score of 30 and a minimum total score of 6.**

Rate the vessel on the six parameters as described in the "discussion column" using the following values as a rough guide: 1 – Poor; 2- Fair; 3 – Good; 4 – Excellent; 5 - Outstanding

CATEGORY	VALUE	DISCUSSION
Location		Value based on the vessel's site location in terms of the risk the vessel is exposed to from a collision or allision. E.g., 1 = vessel sited on the outside bend of a river; 5 = boat in a moat. **Other considerations / mitigating factors:** **If total score is 2 or less:** Involve vessel owner /operator and review further risk mitigation actions. If score is still 2 or less, require owner to present a formal risk assessment.
Traffic		Value based on the amount/type/activities of vessel traffic adjacent to the PMV. Factors to consider - amount, size and frequency of traffic; speed of traffic/current; maneuvering constraints/limitations; vessel service. **Other considerations/ mitigating factors:**
Response		Value based on the ability of local maritime response community (including Federal, State and local governments) to provide timely, adequate assistance to disabled/damaged vessels. **Other considerations/ mitigating factors:**
Anticipated environmental factors		Value based on the duration a vessel may be exposed to high risk due to anticipated environmental factors that occur annually, such as fog, river flood stage, storms, etc. E.g. 1 = 4+ weeks/yr.; 5 = 0-1 week/yr. **Other considerations/ mitigating factors:**
Severe and sudden environmental factors		Value based on how often vessel could be at risk due to unpredictable sudden and severe environmental factors such as hurricane, flash flood, tornado. E.g. 1 = anticipated annual occurrence; 3 = occasional (every 5 - 10 yr.); 5 = unlikely (never occurred but possible). **Other considerations / mitigating factors:**
Passenger exposure		Value based on the amount of time and the number of passengers to which a vessel is accessible per week. E.g. 1 = 100,000 passenger-hours/wk.; 5 = 2000 passenger-hours/wk. **Other considerations/ mitigating factors:**
TOTAL		**If total score is 13 or less:** Involve vessel owner/operator and review risk mitigation actions. If score is still 13 or less, require owner to present a formal risk assessment.

Appendix H

Conclusions and Recommendations of the QAT for PMVs

Conclusions

The QAT concluded the concept of a permanently moored vessel is necessary. However, additional safety measures are needed to achieve and maintain an acceptable level of safety in a consistent manner. Other conclusions include:

1. The physical location of the vessel on the waterway most clearly predicts the risk of casualty.
2. Even though USACE has the final authority to issue siting permits, USCG should work with USACE and be more actively involved in the approval process.
3. Risk management modeling can be used to improve site approvals and standards.
4. Existing definition for a permanently moored passenger vessel is inadequate and needs to be modified to include a risk analysis and an engineering assessment of a vessel's mooring arrangements.
5. Additional review and risk reduction measures may be needed on some existing sites.
6. The risk matrix developed for permanently moored passenger vessels may be useful for other vessels types and mooring sites.
7. Adequate authority exists in the Ports and Waterways Safety Act (33USC1223) to implement safety improvements without additional regulations or statue.

Recommendations

1. **G-MOC should change the definition of a PMV from what currently exists in the Marine Safety Manual to:**

   A vessel in permanently moored status is one that:

   a) is immobilized and removed from navigation;

   b) cannot be moved except on emergency or deliberate basis where extensive effort and equipment would be required; and

   c) has met an acceptable risk assessment.

   Discussion. The current definition is too loosely structured and provides inadequate guidance to field units on what should be required prior to a vessel being considered a PMV. Additionally, two recent casualties demonstrate that the "permanency" of the mooring arrangements is in question. While one can argue that the casualties that caused the vessels to break away from their moorings may be at the extreme end of the spectrum of foreseeable events, and therefore beyond the scope of normal risk mitigation, the fact remains that there is no standard to which a vessel must adhere when it wishes to be considered a PMV.

2. **USCG (G-M) should enter into a MOU with USACE and become more involved in the USACE process for awarding siting permits to vessels and facilities on the navigable waters of the United States.**

   Discussion. The data clearly indicates that the location of the vessel on the waterway is the dominant variable in reducing the risk to the passengers aboard these vessels. The best time and place to impact that variable is during the siting process. A consistent, national standard for formal USCG involvement in the USACE siting process can be accomplished through a formalized MOU between the two agencies.

3. **USCG should involve other interested stakeholders during the entire process, i.e., from site selection to risk assessment to designating a vessel to be in a permanently moored status.**

   Discussion: This report should be provided to all interested stakeholders such as the vessel owners and operators, local authorities and the local maritime response community.

4. **Before designating a vessel a PMV, COTPs should:**
   a. **conduct a risk assessment using the Risk Assessment Matrix in Appendix D and ensure it meets an appropriate total risk and location risk score.**
   b. **ensure that local safety codes are adequate and properly enforced.**

   Discussion. The data analysis indicates the risk scores (total risk ≥14 and location risk ≥3) need to be achieved. Secondly, these vessels will become the equivalent of an immobile floating restaurant and therefore the USCG should review the safety criteria required by the local or State agency for their acceptability prior to making a PMV determination. Risk mitigation measures should be added if necessary in order to achieve an appropriate level of safety. With a proper risk assessment and ensuring that appropriate safety measures/requirements are enforced, an equivalent level of safety to USCG regulations can be achieved when a vessel is "turned over" to local or State regulatory and safety agencies. This will eliminate our need to certificate these vessels. Additionally, the practice of conserving USCG resources for higher risk activities, by utilizing the concept of permanently moored vessels, is fully supported by DOT/IG (see ref. 7 of Appendix E).

5. **COTPs should require formal risk assessments from vessel owners for vessels which exceed the criteria for total risk or location risk score.**

   Discussion. The applicability of the PWSA in addressing the risk presented by these vessels is articulated by G-LMI in reference 14 of Appendix E. A synopsis of G-LMI's opinion is that there is currently no statutory authority to require submission of a risk analysis on a general basis. Accordingly, the COTP could not make a risk analysis a general requirement for a vessel wishing to receive permanently moored status. However, under the authority in 33 CFR 160, the COTP can require a risk analysis based on articulable reasons that the area in which the vessel would be operating is hazardous. See also "Risk Based Decision Making Guidelines" in Appendix E, Reference 10.

6. **COTPs should require a licensed Professional Engineer (P.E.) registered by one of the 50 States of the United States or the District of Columbia, to evaluate the mooring arrangements of a vessel that is allowed to enter permanently moored status. A performance standard for the mooring arrangement should be that a permanently moored vessel must not break away from its moorings under all envisioned conditions for that particular location. It is the responsibility of the P.E. to ensure that he or she does not exceed the scope of their P.E. license.**

Discussion. An integral part of this evaluation is the location of the vessel, i.e., the engineering standards for the mooring arrangements of a boat in a moat will be decidedly different than for a vessel secured to pier in a waterway. The QAT deliberated at length regarding the standard to which the P.E. should ensure the mooring arrangements are designed. In the end, this standard cannot be made except at the local level. It is a function of local environmental conditions and the location in which the vessel is to be moored. The determination of the standard to be used should be made during the risk assessment that is conducted prior to the vessel being placed in permanently moored status. However, a performance outcome should be that a permanently moored vessel must not break away from its moorings under all envisioned conditions. Examples to take into consideration are local 100 year storm winds, 100 year flood waters, range of high and low water, etc. Mooring arrangements should also consider allision and breakaway risks and the possible establishment of risk mitigation measures such as protective piling.

7. **The COTP/OCMI should re-evaluate risks to permanently moored passenger vessels whenever there is a change of traffic, local conditions, etc., or at least every two years.**

Discussion. The USCG should conduct a biennial re-evaluation of the conditions that allow a vessel to be placed in permanently moored status. Any decrease in the total risk score below 14 or a location score below 3 would necessitate a further risk analysis. However, any downward trend in the vessel's risk scores should prompt re-evaluation of the risk to passengers and risk mitigation measures should be considered. This re-evaluation should, if unresolved by risk mitigation measures, require a review of the vessel's USACE siting permit. This could be accomplished through our MOU with the. USACE Specific guidance will be found in the Marine Safety Manual change to Permanently Moored Vessels.

8. **USCG (G-MOC) should maintain an accurate listing of all PMVs, until PMV information is routinely captured in MSN.**

9. **Vessels that are placed in a permanently moored status should be formally designated in writing, along with the conditions required to maintain it in that status, by the COTP / OCMI.**

Discussion. Appendix H is an example from MSO St. Louis of this designation. A copy of the designation should be sent to G-MOC. A current listing is contained in appendix A.

10. **USCG should capture PMV information in its database in a user-friendly data field.**

Discussion: Necessary fields must be created in MSN to easily capture vessels placed in a permanently moored status.

11. G-MOC should provide policy guidance to the field as soon as possible by updating the Marine Safety Manual (Chapter 10) and incorporate appropriate recommendations of this QAT.

*Discussion: The conclusion and recommendation of this QAT are included in a draft policy change to the Marine Safety Manual as **Appendix I**.*

12. G-M should designate G-M-2 as the lead Directorate at CGHQ as the owners of issues of this nature.

Discussion. Vessel inspection is a G-MOC responsibility. However, determining if a vessel should be allowed to attain permanently moored vessel status is a COTP function that involves risk assessment and mitigation for a specific waterway. It also involves the resolution of competing interests on a navigable waterway. Long term policy regarding vessels being placed in permanently moored status should be a Ports and Waterways Management function.

J. M. GARRETT
Chairman

Appendices

A. List of Permanently Moored Passenger Vessels as of November 20, 1998

B. Quality Action Team (QAT) Charter

C. Data Call Message

D. Permanently Moored Passenger Vessel Initial Risk Assessment

E. List of References

F. Sample Case

G. October 1998 G-MO Letter to USCG field offices to validate risk model

H. Designation Letter for a Vessel in Permanently Moored Status

I. USCG Marine Safety Manual, Vol. II: Material Inspection;
Chapter 10: Inspection Procedures applicable to vessel types, classes and categories;
Vessels in Immobile Status; PMV carrying Passengers.

Appendix I

Draft *Coast Guard Marine Safety Manual* Change

USCG Marine Safety Manual, Vol. II: Materiel Inspection

CHAPTER 10: INSPECTION PROCEDURES APPLICABLE TO VESSEL TYPES, CLASSES, AND CATEGORIES

I. VESSELS IN IMMOBILE STATUS.

1. Permanently Moored Vessels (PMV) carrying passengers.

Introduction and Coast Guard responsibility

a. The intent of this section is to give the COTP / OCMI overall guidance and philosophy on how to best address safety and risk management for permanently moored passenger vessels. Some examples of such PMVs are showboats, theaters, hotels, gaming sites, restaurants, museums, and business offices on a barge. The primary concerns for the Coast Guard COTP and OCMI are assessing the suitability of the site, and deciding if risks are best handled as a certificated vessel or through appropriate standards enforced by local building codes, fire marshal and other jurisdictions. In any case, it is the Coast Guard's obligation to ensure safety for all on or near the water.

Definitions

b. **Vessel:** A vessel is defined in 46 USC 2101(45) as "any watercraft or other artificial contrivance, used or capable of being used as a means of transportation on the water". A vessel taken out of transportation and permanently moored (or a PMV) falls somewhere between a statutory definition of a vessel and a building or land structure and is deemed to be "substantially a land structure."

Determination and designation process for a passenger PMV

c. PMVs are vessels that are removed from navigation and are not inspected by the Coast Guard. They are vessels that would have received a COI had they stayed in navigation but instead have become "substantially a land structure". However, prior to receiving this designation they must satisfy the Coast Guard that appropriate safeguards are in place and must meet the following criteria:

(1) immobilized (cannot be moved except on a deliberate basis where extensive effort and equipment would be required) and removed from navigation;

(3) meet an acceptable risk assessment;

(4) permitted or otherwise authorized by the United States Army Corps of Engineers (USACE) for the site, and;

(5) appropriate safety standards and local oversight jurisdiction clearly established and designated in writing.

Immobilized and removed from navigation

d. A series of incidents in the spring of '98, where PMVs broke free from their moorings, highlighted the need to critically assess a PMVs mooring arrangements. COTPs should require a professional engineer or equivalent to evaluate the mooring arrangements of any PMV. The determination of the standard to which the mooring arrangements must be evaluated should be made during the risk assessment that is conducted prior to the vessel being placed in PMV status (see 10.I.1.e). Consideration should be given to local 100 year storm winds, 100 year flood waters, range of high and low water, etc. Mooring arrangements should consider allision and breakaway risks, and may take into account risk mitigation measures such as protective pilings.

Initial Risk Assessment

e. An initial risk assessment is an integral part of all new USACE site permit reviews done by the CG (see USCG/USACE MOA in MSM Vol. X), or any decisions to allow a vessel to become a PMV. This initial risk assessment should consist of using the simplified risk model described in the next paragraph. Depending on the results of this initial risk assessment a more formal, technical risk analysis may be required by the COTP.

Risk Model

f. The risk model uses six parameters to quantify the risk to the vessel. The model is shown as appendix to this chapter. Rate the vessel on the six parameters as described in the "discussion column" on the risk model.

Formal Risk Assessment

g. If the results of the initial risk assessment result in a location score of 2 or below, or a total score of 13 or below(high risk), then the COTP has articulable grounds for calling the safety of the site location into question. At

this point the COTP should exercise COTP authority under the Ports and Waterways Safety Act and require the vessel owner/operator to present a formal risk assessment if they wish to continue to pursue PMV status. Concurrently, the COTP must work with USACE to provide input into the site permit award process as described in the next paragraph.

New Site Permit

h. The USACE has the sole authority to issue vessel or facility siting permits. Per the USCG/USACE MOA in MSM Vol. X, the USACE will seek COTP input on new site permit applications and approvals at the earliest opportunity. The COTP should actively engage with the USACE in siting risk management. If the initial risk assessment indicates a safety problem then the COTP should require the vessel owner to present a formal risk assessment prior to the Coast Guard "signing off" on the USACE site permit process. The COTP should advise the USACE of this determination and recommend that a formal risk assessment be completed prior to granting the site permit.

Existing Site

i. If a vessel is being moved to an existing site that already has a USACE permit, the determination of whether or not to allow the vessel to become a PMV at that site is a Coast Guard decision. If the initial risk assessment indicates a safety problem then the COTP should require a formal risk assessment be conducted.

Risk Mitigation

j. A formal risk assessment should address the safety concerns identified in the initial risk assessment and include risk mitigation measures to reduce the level of risk to which the vessel is exposed. The COTP should remain open to options as risk mitigation measures can cover a broad spectrum of options, such as:

1) Location: the first and most effective option is to alter the location to reduce or eliminate the risk of allision. However, in many cases site selection options are limited and other risk mitigation tools must be used such as the installation of protective bumpers or "icebreaker" type cells.

2) Operational Controls: emergency options such as closing businesses in high water, radio watches for timely warning and evacuation in case of runaway vessels etc. may be use to reduce risk

3) Response Preparedness: emergency exercises and drills on a frequent basis.

Turnover to local or state authorities

k. Once the decision has been made that the site is safe and if necessary, appropriate risk mitigation measures are in place, then there must be a transition between the Coast Guard and the local entity that will be taking over responsibility for the regulation of safety issues on the PMV. The COTP should meet with the local or state authority and ensure that appropriate safety standards and local jurisdiction are clearly established. Most local authorities are not well-versed in vessel safety issues and the COTP/OCMI should ensure that, at a minimum, the following issues are addressed in the hand-over to the local entity:

1) Hull Integrity. The hull structure should be periodically evaluated. This can be accomplished by contracting services from a local surveyor if the local entity does not have the expertise to conduct the evaluation itself.

2) Integrity of mooring arrangements.

3) Emergency egress.

4) Any lifesaving appliances that are part of risk mitigation measures.

5) Any navigation related operational issues such as maintaining a radio watch.

Designation in writing

l. After the hand over of the PMV to local authorities the transition should be documented in writing by a letter to the local authority with copy to the vessel owner/ operator. This letter should state that the safety issues relating to the PMV have been turned over to the local entity and that the PMV is no longer under Coast Guard inspection.

Record PMV in database

m. The PMV should be loaded in the marine safety database under the vessel type "PMV". A good deal of information about a PMV such as: location, the local authority responsible for the PMV, process issues like risk mitigation measures, etc. are not data fields normally associated with a vessel. This information should be recorded in the narrative supplement of the activity report that establishes the vessel as a PMV. If the PMV is an existing PMV, then an activity report should be created to capture this information.

Periodically review PMV site and condition.

n. The COTP/OCMI should re-evaluate risks to permanently moored passenger vessels whenever there is a change of traffic, local conditions, etc., or at least every two years. The risk model described herein should be used for this purpose. In addition, the COTP/OCMI should also periodically visit the site and satisfy himself/herself that the vessel is being maintained in satisfactory condition particularly with those aspects of the PMV that are identified herein.

Change of Status

o. A vessel may be placed in navigation periodically, yet keep its status as "substantially a land structure" when moored. When returned to navigation, it becomes subject to inspection under the regulations applicable to its particular operation. The vessel owner/operator must notify the OCMI prior to placing the vessel in navigation. When the vessel is again immobilized, the COTP must again approve the site before the vessel can be considered "permanently moored." Once these conditions are met, the vessel would again be considered out of navigation. This procedure is intended to allow a permanently moored vessel to make infrequent trips for purposes of overhaul, drydocking, location changes, etc. This procedure is not intended to allow the "permanent" mooring of a vessel that is placed in navigation on a regular basis (e.g., on weekly or monthly trips between ports). When intended operations are tantamount to use as a vessel normally requiring inspection, claims of status as substantially a land structure are voided and the structure must be inspected and certificated.

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