Texas A&M Transportation Institute

Analysis of Effects on Port Operations from March 22 Incident in Houston Ship Channel

Final Report

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TRANSPORTATION
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Executive Summary

The Incident

At 12:35 p.m. on March 22, 2014, a collision occurred in the Houston Ship Channel just inside the junction known as the Texas City Y. Approximately 4,000 barrels (168,000 gallons) of bunker fuel were spilled into the bay. This incident had the potential for shutting down the Houston-Galveston port area for a lengthy period and causing serious economic harm, not just at the local level but nationally.

Due to a quick response from the barge company, the U.S. Coast Guard, and a host of federal and state agencies, the ship channel was reopened for normal traffic without restrictions by the Thursday following the incident—less than five days later. A key component in the process of responding to the incident and reopening the channel expeditiously was the Port Coordination Team, consisting of representatives from various user groups. Their input to the Coast Guard expedited a number of important decisions and reduced lost time considerably.

Effects on Marine Traffic

Even though the response was quick, the level of activity in the Houston-Galveston-Texas City port area is so high that there were still some costly consequences. Some can already be quantified; in some cases, it will take years to determine the extent and cost of the damage. Table 1 summarizes vessel-related effects.

Table 1. Vessel-Related Consequences of March 22 Incident.

Consequence of Incident	Number
Affected in-port oceangoing vessels (delayed departure)	43
Affected arriving oceangoing vessels (delayed entry)	17
Gulf Intracoastal Waterway (GIWW) tows delayed	37
Number of GIWW shipments postponed at origin	244
Number of vessels required to decontaminate	109
Cost of delays to oceangoing vessels	$7.3 million
Cost of delays to GIWW tows	$785,000

The costs in Table 1 do not include penalties for noncompliance with contract terms (late deliveries, barges held past the due date, etc.). These penalties are closely guarded by the businesses involved and are not available to third parties.

Non-traffic Effects

There were other costs incurred that cannot be quantified at this time—some because of pending litigation and some because of the time it takes to assess and determine the damage. However, some general information is already available.

Environmental/Ecosystem Effects

The last published report indicated that the Coast Guard recovered 329 oiled birds from Galveston Bay to North Padre Island, nearly all of them dead. Nearly 500 were observed with some traces of oil on Mustang Island. Air monitoring indicated that there were no deleterious effects from fumes.

Cost to Fishermen

Initially, there was a concern that fishermen would be trapped in port and not be able to go into the Gulf of Mexico and fish. However, the rapid response prevented this concern from materializing.

Effect on Recreation

The oil on Galveston beaches was in the form of tar balls, relatively easy to clean up, primarily on the east end of Galveston Island. As of Thursday (the day the channel reopened without restrictions), all recreational activities, including swimming, were open.

Effect on Refineries and Petrochemical Plants

Analysts did not reach a level of serious concern over the incident because of the prompt restoration of vessel traffic. The ExxonMobil Baytown refinery slowed production for several days but resumed full activity when the channel reopened. Two factors other than the prompt response also allayed fears:

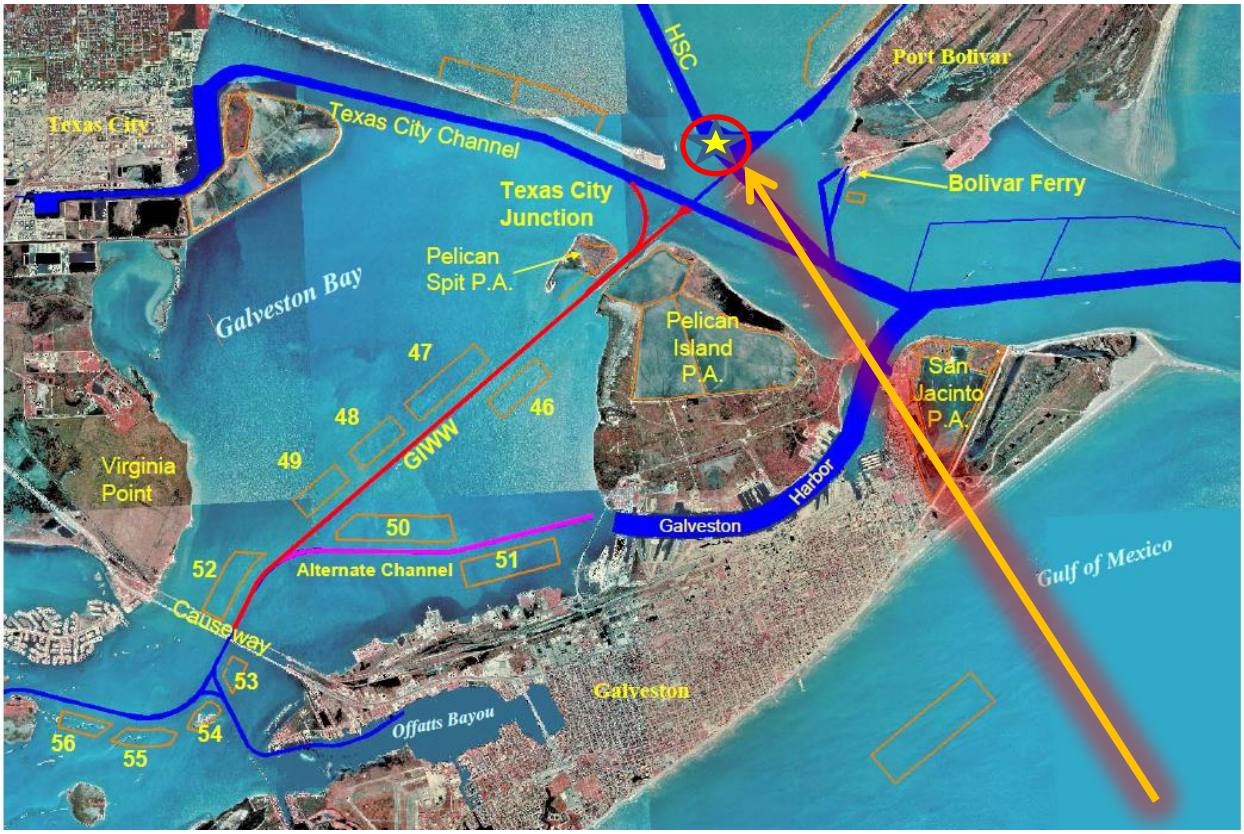
- Refiners are increasingly receiving crude from the Permian Basin and the Eagle Ford Shale play in Texas, as well as the Bakken Shale play in North Dakota. A disruption in vessel traffic does not completely cut them off from their feed stock.
- The time of year was ideal. Had it been summer, when refineries typically operate at or near capacity, the effects would have been more noticeable.

Conclusions

The quick and efficient response on the part of private interests and federal and state agencies limited the economic impact of the March 22 incident. Had the closure of the ship channel lasted several days more, the financial and economic impact would have been much more severe. It had the potential to affect the price of gasoline, products based on petrochemicals, and even consumer goods imported through the port. The damage to the environment and recreational interests could have also been much greater. The cooperation between users of the port and the Coast Guard kept an accident from turning into a catastrophe.

Background—The Incident

At 12:35 p.m. on March 22, 2014, a collision occurred in the Houston Ship Channel just inside the junction known as the Texas City Y. This is an extremely busy intersection of various shipping lanes—both deep sea and shallow draft. Figure 1 shows the location of the accident, as well as the routing for the various ship channels and the Gulf Intracoastal Waterway (GIWW) in that area.



Source: District Channel Maps, U.S. Army Corps of Engineers, Galveston District.

Figure 1. Map of Ship Channels in Vicinity of Oil Spill.

The M/V *Miss Susan*, a towboat, was pushing two barges carrying fuel oil (bunker fuel) en route to the Bolivar peninsula from Texas City. The *Summer Wind*, a 585-foot Liberian-flagged vessel operated by Cleopatra Shipping Agency, Ltd., was inbound on the Houston Ship Channel traveling at 12 knots. The *Miss Susan* was traveling at 4 knots. At 12:30 p.m., the crew members on both vessels realized that a collision was imminent, but they were unable to maneuver in such a manner as to avoid it. The barge that was struck was carrying about 22,000 barrels of fuel oil (bunker fuel) in four separate compartments. One of the compartments was ruptured, spilling approximately 4,000 barrels (168,000 gallons) of bunker fuel into the bay.

The Houston Ship Channel was closed, and response efforts began almost immediately. Initially, the oil began to move inland, but then the tide turned, and the oil began to flow out to the Gulf of Mexico past Galveston Island. At that point, all marine traffic in the area was halted.

The Coast Guard established a safety zone in which no vessels were allowed without prior clearance from the Coast Guard. Essentially, only response vessels were allowed to move in the area. Any vessel that was already in the area when the accident occurred was required to have an inspection and be decontaminated if oil was found on the hull. The same requirements applied to vessels allowed to pass through the safety zone while it was in effect. One example is inbound cruise ships that were allowed to come in and dock, but could not leave without being inspected. Figure 2 shows the safety zone.

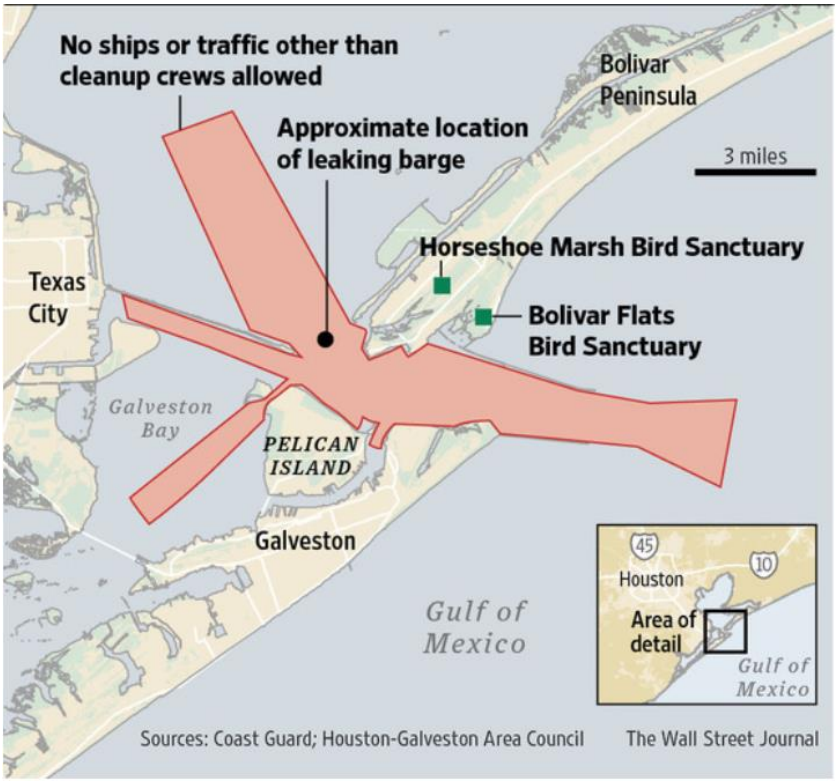


Figure 2. Safety Zone Established after March 22 Spill of Bunker Fuel.

What is bunker fuel?
Bunker fuel is primarily used as fuel for oceangoing vessels. After crude oil is extracted from the ground and brought to a refinery, it goes through a process called fractional distillation. Different types of oil within the crude separate during the process due to their different boiling points. Small molecules such as those in propane gas, naphtha, gasoline for cars, and jet fuel have relatively low boiling points, and they are removed at the start of the fractional distillation process. Heavier petroleum products such as diesel and lubricating oil precipitate out more slowly, and bunker oil is literally the bottom of the barrel; the only thing denser than bunker fuel is the residue (asphalt or bitumen), which is mixed with aggregate for paving roads or sealing roofs.

Table 2 provides a brief chronology of events as they relate to the management of marine traffic in the area. Although some in the press have characterized this event as similar to a fog day, it has some important differences. Even on fog days, there are periods during the day when vessel traffic can move. At a minimum, the critical shipments can be handled. During an event such as the March 22 incident, the channel is completely closed to all traffic until further notice. The inability to move anything at all and the uncertain duration of the closure make the management of the situation much more difficult.

Table 2. Chronology of Events after March 22 Incident.

Date	Status/Action
3/22 (Sat.)	The accident occurs. The Coast Guard begins shutting down traffic. Vessels in the area are required to have an inspection and, if oiled, be decontaminated. The Coast Guard establishes a safety zone. Because the oil appears to be flowing inward, the Coast Guard allows the ferries to continue operating. As the tide ebbs and the oil begins to reverse course, the Coast Guard shuts down the ferries.
3/23 (Sun.)	All marine traffic in the area is halted. The Port Coordination Team, a group of industry representatives and the Coast Guard, begins meeting to determine how to set priorities for vessel movements. The Coast Guard allows three cruise ships to come in and dock. All of them will have to be decontaminated.
3/24 (Mon.)	At 6 a.m., there are 43 outbound vessels in queue and 38 inbound. According to the West Gulf Maritime Association, the majority of private facilities are currently open and operating as though it was a fog day. Most landside operations are running as normal. The Coast Guard Unified Command sets up decontamination stations. At 9:48 a.m., the Houston Pilots organization reports 57 outbound and 50 inbound vessels waiting. The Galveston-Texas City Pilots reports 15 outbound and 15 inbound vessels that are waiting. Ferries are told they cannot operate until at least Tuesday, March 24. Several harbor tugs in the safety zone require decontamination. The safety zone established on Saturday to ensure the well-being of response workers and prevent the further spread of oil is extended from lighted buoy 40 to lighted buoy 3 on the Houston Ship Channel. This safety zone restricts the transit of vessels not involved in the response from entering the area. Coast Guard officials allow two cruise ships to travel through the incident area in the late afternoon to minimize inconvenience to the thousands of passengers aboard and limit economic impacts from the spill. However, neither vessel will be allowed to leave the port again until deemed safe to do so. ExxonMobil says production at its 560,000-barrels-per-day Baytown refinery has been cut due to the closure of the ship channel. It does not say how large the reduction is. It does say, however, that further production cuts could come by mid-week if the channel remains closed. An ExxonMobil spokesman emphasizes that the company expects to meet all its contractual commitments. The press reports that analysts are largely unconcerned, noting that ample inventories in the region provide a cushion for refiners.

Table 2. Chronology of Events after March 22 Incident (Continued).

Date	Event
3/25 (Tues.)	Ferries begin operating again in the morning and are allowed to run during daylight hours. The Coast Guard grants permission to run a test tow east-west through the GIWW to see if the channel really is clear. Based on the test run, a very limited movement of towing vessels through the safety zone is initiated. Tows are moved at a required spacing from each other with a helicopter and ground observers watching for signs of fuel oil being stirred up. A pilot vessel is also allowed to go out to anchorage. At 10 a.m., the Houston Pilots reports 53 inbound and 47 outbound vessels waiting. The Galveston-Texas City Pilots reports 7 waiting to go out from and 7 waiting to go into Texas City. There are 4 outbound and 7 inbound in the queue for Galveston. The Coast Guard begins accepting outbound deep-draft ships from Houston and Galveston. This is done in consultation with the Port Coordination Team. Inbound towing is allowed to move from Bolivar to Houston via the Bolivar Roads Alternate Inbound Route. The Texas City Channel remains closed because of its proximity to the Texas City dike and ongoing cleanup efforts. Deep-draft vessels start moving into and out of Galveston. At approximately 12:55 p.m., tow movements are allowed in both directions on the GIWW, as well as into and out of the Port of Houston. The Coast Guard establishes daylight-only restrictions for all movements of all oceangoing vessels into and out of safety zones. Hours of darkness are defined to begin at 7:30 p.m. As of 4 p.m., the Houston Pilots has made 14 sailings. It reports 29 outbound and 46 inbound vessels waiting. The Houston Pilots plans to bring 5–7 more vessels in before sunset. The Galveston-Texas City Pilots expects to clear Galveston of outbound vessels before daylight cutoff and begin work on inbounds.

Table 2. Chronology of Events after March 22 Incident (Continued).

Date	Event
3/26 (Wed.)	It is reported that GIWW tugs ran through the night. The first oceangoing vessel departs from Texas City at 8 a.m. At approximately 9:50 a.m., there are still daylight restrictions for deep-draft vessels. However, two-way traffic is open throughout the area. The Coast Guard expects to remove the daylight restriction today. At the same time, the Houston Pilots reports that it is moving 5 deep-sea vessels in and 10 vessels out, with 47 waiting to come in and 29 waiting to go out. The Galveston-Texas City Pilots reports that it is back to normal operations in Galveston. The Port Coordination Team gives priority to cargoes of crude oil, perishables, refrigerated goods, and cars. At approximately 12:30 p.m., it is reported that there are 51 deep-sea vessels waiting inbound to Houston and 36 waiting outbound. There are 2 ships waiting to leave Texas City. The Houston Ship Channel will remain open through safety zones until midnight. With high tide approaching just after midnight, deep-draft traffic through the safety zones will be suspended so that any refloated oil is not disturbed by pilot-driven vessels. Towboat operations will be allowed to continue throughout the night without restriction. The Coast Guard announces that safety zones will reopen for deep-draft traffic after sunrise. The Galveston Bolivar Ferry resumes 24-hour operations.
3/27 (Thurs.)	The Coast Guard announces that it has opened the bay to all traffic.

Affected Vessels

Oceangoing Vessels

This analysis of the effects on oceangoing vessels encompasses two specific objectives:

- Determine vessels that were in port at the time of the March 22 incident and were required to delay their departure.
- Determine vessels that arrived at the Houston/Galveston area shortly prior to or during the closure and were required to sit in an anchorage until they could transit the Houston Ship Channel.

Background

Several sources of data were used to analyze the effects of the closure. The primary sources were Automatic Identification Service (AIS)[1] data acquired from PortVision, the Houston Pilots activity log, the Port of Texas City activity log, conversations with the executive director of the Port of Galveston, and IHS Maritime Sea-web™ vessel movement history data. These data allowed researchers to identify vessels that were clearly outside the norm for dock or anchorage dwell time and quantify how much greater than average that time was.

A word of caution is in order regarding the estimates presented in this report. The data reported in the following sections give the impression of great accuracy. These are actually best educated guess figures. A large number of factors can cause a vessel to be delayed at any point in its journey, and it is quite possible that a factor other than the accident and oil spill caused or contributed to some of the calculated delay time. It is also possible that a vessel that exhibited an average delay time would have moved much quicker without the accident, resulting in a less-than-average dwell time. The only way to verify the cause of these delays would be to interview the vessel agents or terminal operators involved in each vessel's activity and acquire the details. However, this was outside the scope and budget of this specific research effort, and vessel agents are rarely willing to discuss such matters. That said, these data still provide a good order of magnitude understanding of the impacts.

PortVision AIS Data

AIS is an automatic tracking system used on ships and by vessel traffic services for identifying and locating vessels by electronically exchanging data with other nearby ships, AIS base stations, and satellites. AIS transponders automatically broadcast information, such as their vessel identification, position, speed, heading, and navigational status, at regular intervals via a very high frequency (VHF) transmitter built into the transponder. The default transmit rate is every few seconds. Service providers such as PortVision record these transmissions at certain

[1] AIS units are transceivers that, at a minimum, broadcast a vessel's name, number, location, course, and speed over ground. These transmissions can occur at intervals of 30 seconds up to several minutes. These devices can also exchange information with other vessels.

intervals and then use the data to locate vessels or determine vessel movements and tracks. Subscribers to such services can typically download historical information for their vessels or terminals.

Houston Pilots Activity Log

All oceangoing vessels navigating in channels in Texas are required to have a state-licensed pilot on board, with the exception of vessels documented as U.S. vessels and licensed for and engaged in coastwise trade.[2] Two pilot associations provide these services in the Houston-Galveston area: the Houston Pilots and the Galveston-Texas City Pilots. Researchers were unable to get information from the latter group, but the Houston Pilots provided a log for the second half of March that recorded all of the vessel movements for which it was responsible. The information the association provided included the name, type, and certain characteristics of the vessel; the docks or anchorages of origin and destination (the points at which the pilot boarded and left the vessel); and associated dates and times.

Port of Texas City Activity Log

The legal name of the Port of Texas City is the Texas City Terminal Railway Company. It is a privately owned port whose cargo is almost all liquid (petroleum, petroleum products, and petrochemical) in nature. The port office records all vessel and barge calls at facilities operated by its tenants. Staff provided a list of all vessels that arrived or sailed during March 2014. The listing included the arrival and departure times and the docks that were called.

IHS Maritime Sea-web™

IHS Maritime Sea-web™ is an online register of ships. One feature of this service is that it provides historical vessel movements for each vessel in its database by tapping into its AISLive services. Movements are typically reported at a port or sub-port region; individual terminals and docks are not identified.

Vessels Delayed at Dock

The analysis of delays at docks relied primarily on the PortVision AIS data and the activity logs from the Houston Pilots and the Port of Texas City. Vessels that were in port at the time of the incident were flagged for further analysis. AIS data were acquired for each terminal where these vessels were berthed. Researchers relied primarily on one month of AIS data to determine what an ordinary dwell time at each terminal would be. Activity logs and Sea-web™ data were used secondarily.

Each vessel's dwell time at the dock was compared to the average dwell time for vessels calling at that terminal. Initially, 65 vessel calls were flagged at the Port of Houston and 3 in Texas City for detailed examination. Conversations with the Port of Galveston's executive director revealed that only one freight vessel—a vessel carrying imported bananas—was scheduled to arrive at or

[2] Details can be found in the Texas Transportation Code, Chapter 61: Compulsory Pilotage.

depart Galveston during the period of the closure. Four cruise vessels were scheduled for activity during the period.

Detailed examination determined that 39 freight vessels and 4 cruise ships were affected by the closure. At the time, 36 vessels were in the Port of Houston, and 4 were in Texas City. Three of the cruise ships docked in Galveston. Table 3 shows the number by vessel type.

Table 3. Count of Affected In-Port Vessels.

Vessel Type	Count	Percent of Total
Articulated Tug/Barge (ATB)[3]	2	5%
Bulk Carrier	2	5%
Chemical/Products Tanker	15	35%
Container Ship	2	5%
Oil Tanker	5	12%
General Cargo[4]	7	16%
Liquefied Petroleum Gas (LPG) Tanker	3	7%
Open-Hatch Cargo Ship	1	2%
Passenger/Cruise Ship	4	9%
Vehicle Carrier	2	5%
Grand Total	**43**	**100%**[5]

Table 4 shows the hours of delay calculated and totaled by type of vessel.

Table 4. Hours of Delay for Affected In-Port Vessels.

Vessel Type	Hours of Delay	Percent of Total
ATB	154.3	6%
Bulk Carrier	81.4	3%
Chemical/Products Tanker	1076.82	40%
Container Ship	115.81	4%
Oil Tanker	278.25	10%
General Cargo	501.78	19%
LPG Tanker	118.75	4%
Open-Hatch Cargo Ship	82	3%
Passenger/Cruise Ship	169.03	6%
Vehicle Carrier	98.35	4%
Grand Total	**2676.49**	**100%**[6]

[3] An ATB consists of a tug permanently affixed to a tank barge. ATBs typically transport liquid products in coastwise shipping lanes.
[4] This category includes cargo that is not containerized and is neither liquid nor dry bulk cargo. Steel products, forest products, and project cargo fall into this category.
[5] Line items may not total 100 percent due to rounding.
[6] Line items may not total 100 percent due to rounding.

The statistics are clearly dominated by chemical/products tankers (35 percent of vessels and 40 percent of delays) and general cargo ships (16 percent of vessels and 19 percent of delays). Tanker vessels of all types account for 59 percent of the affected vessels and 60 percent of the delays.

Vessels Delayed at Anchorage

The analysis of delays at anchorage relied primarily on the IHS Maritime Sea-web™ database. Vessels that entered the port after March 22 but before March 29 were flagged for further examination.

One year of data was extracted for each vessel. The time at anchorage for the call during the week beginning March 22 was compared to the average time at anchorage for the last year. When there were insufficient data from calls to the Houston/Galveston area to make a determination of ordinary anchorage time, the area was expanded to include all gulf ports. In a high percentage of cases, there was enough information to clearly spot anomalies and quantify them.

Researchers flagged 55 vessel calls at the Port of Houston and 8 in Texas City for detailed examination. Conversations with the Port of Galveston's executive director revealed that only one freight vessel—a vessel carrying imported bananas—was scheduled to arrive or depart in Galveston during the period of the closure.

Detailed examination determined that 17 arriving freight vessels were affected by the closure. All 17 were bound for the Port of Houston. It is quite possible that some vessels were diverted to other ports to avoid the complications of an indefinite closure. It is not possible to identify those diversions without the assistance of vessel agents; therefore, diversions are not included in this analysis. Table 5 shows the count by vessel type.

Table 5. Count of Affected Arriving Vessels.

Vessel Type	Count	Percent of Total
ATB	1	6%
Chemical/Products Tanker	9	53%
Container Ship	5	29%
General Cargo	1	6%
Vehicle Carrier	1	6%
Grand Total	**17**	**100%**

Table 6 shows the hours of delay calculated and totaled by type of vessel.

Table 6. Hours of Delay for Affected Arriving Vessels.

Vessel Type	Hours of Delay	Percent of Total
ATB	114.0	10%
Chemical/Products Tanker	691.6	59%
Container Ship	225.0	19%
General Cargo	65.5	6%
Vehicle Carrier	72.0	6%
Grand Total	**1168.1**	**100%**

As in the case of the in-port vessels, the delays are dominated by the chemical/products tankers (53 percent of vessels and 59 percent of delays). However, the second-most dominant category in this case is container ships (29 percent of vessels and 19 percent of delays). Tanker vessels of all types account for 59 percent of the affected vessels and 69 percent of the delays.

Gulf Intracoastal Waterway Traffic

In order to extract data in a useable manner, the researchers established a number of zones along the GIWW. Data for movements within and through each zone were analyzed to determine normal traffic patterns and then delays due to the accident. These zones are shown in Figure 3 through Figure 6.

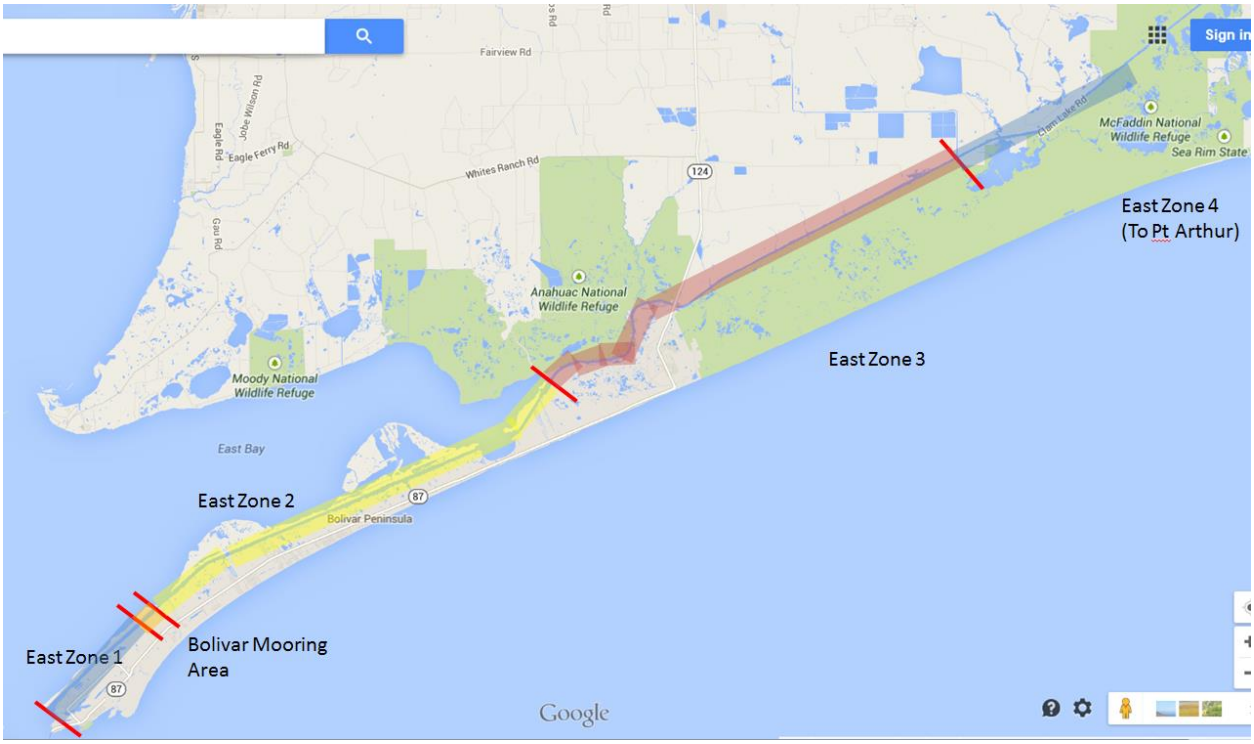


Figure 3. GIWW East Zones.

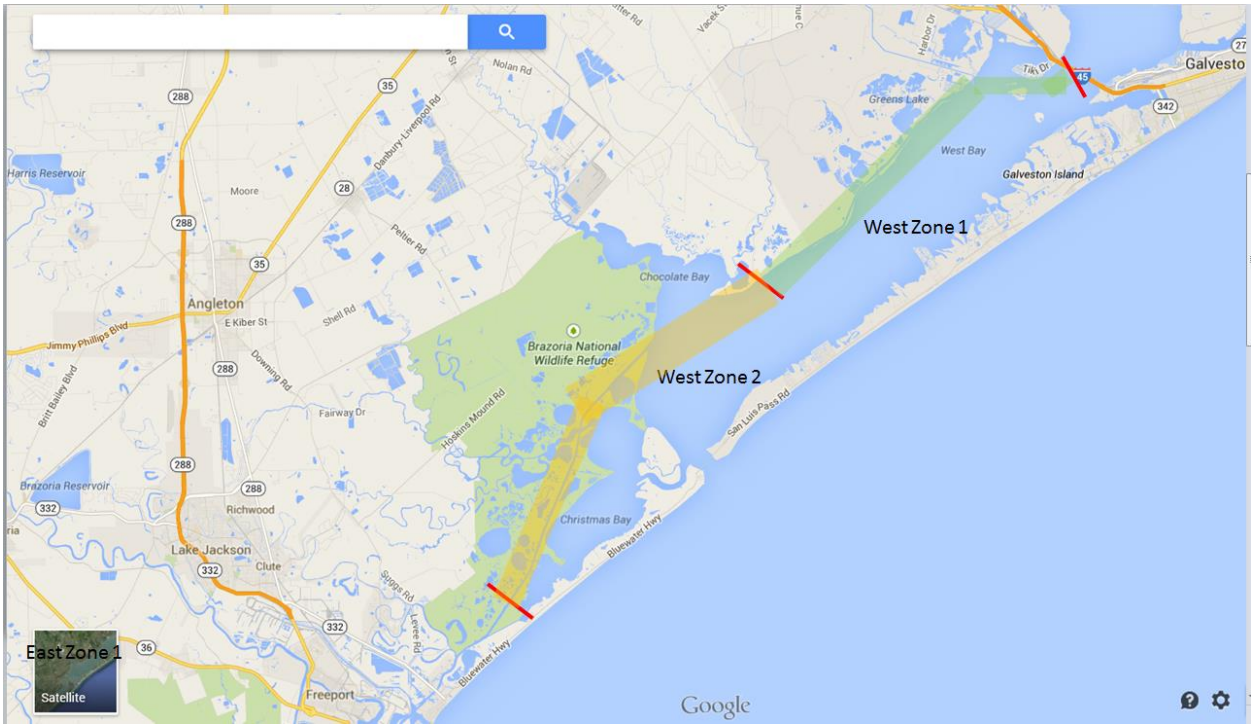


Figure 4. GIWW West Zones—Part 1.

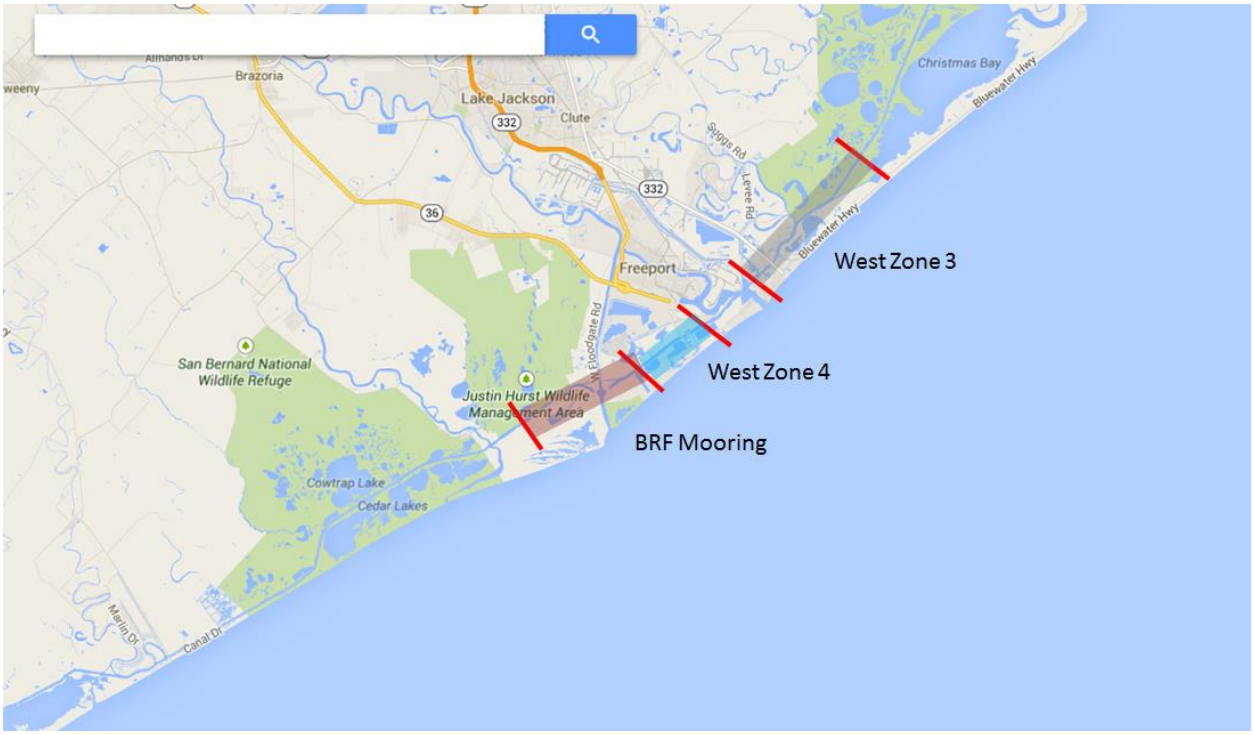


Figure 5. GIWW West Zones—Part 2.

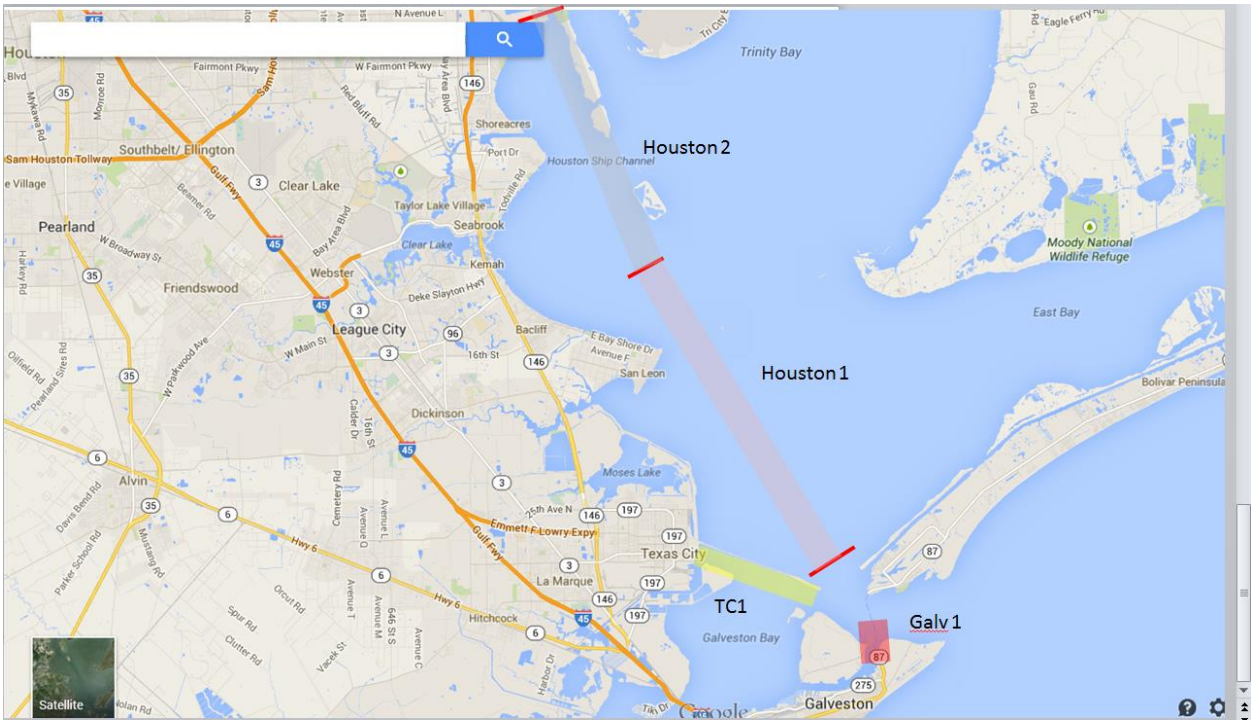


Figure 6. Port Zones.

Table 7 shows the transits that were identified as coming from, going to, or moving along the GIWW. A few additional transits were identified for GIWW-type traffic that moved between ports without actually entering a GIWW zone.

Table 7. GIWW Transits through Safety Zone Area.

Route	Transits by Date (All within March 2014)														
	16	17	18	19	20	21	22	23	24	25	26	27	28	29	Total
Houston–East GIWW	24	60	39	38	38	28	11			22	58	35	12	71	436
Houston–West GIWW	10	20	15	24	22	14	1			3	23	15	6	23	176
Galveston–East GIWW	1	4	6		4	5	2			2	2	5	6	5	42
Galveston–West GIWW	1	6					1				1				9
Texas City–East GIWW												1			1
Galveston–Houston	2	8	9	4	10	5	1			1	3	5	1	14	63
Houston–Texas City	2		2		2	1	2			1	1		3		14
Galveston–Texas City								2		1					3
Through Traffic	4	24	21	20	19	21	3			10	35	15	6	23	201
Total	44	122	92	86	95	74	21	2	0	40	123	76	34	136	945

GIWW Tow Delays

Researchers took a snapshot of marine traffic that was on the water at the time of the accident. All vessels that were in one of the defined GIWW zones, the Port of Galveston, the Port of Houston below the Fred Hartman Bridge, or the Port of Texas City, and were stationary or had a course that could lead to the accident site were noted and investigated. This did not include vessels that were in the Port of Houston above the Fred Hartman Bridge or oceangoing vessels

that were in anchorage areas waiting for clearance to enter the port. Table 8 lists the number of vessels by type.

Table 8. Vessel Types on the Water at Time of Accident.

Vessel Type	Number
Anti-pollution	3
Barge Cleaning	1
Coast Guard	1
Deep Sea—Container	1
Deep Sea—Non-container	14
Dredging Assist	3
Fishing Vessel	4
GIWW—Not Affected	64
GIWW—Potentially Affected	32
Harbor Tug	4
Ocean Tug	2
Offshore Supply/Service	13
Pleasure/Recreational	13
Research Survey Vessel	3
Undetermined	1
Total	159

The researchers then used the AIS data provided by PortVision to determine the movement of each GIWW vessel through each zone. This exercise revealed several instances where vessels were detained for extended periods during the time the port area was closed. Table 9 provides a summary of the detained GIWW vessels and the duration of their delay.

There is no readily available source of information regarding the number of barges that were in each tow. The Corps of Engineers, however, recently conducted a statistical analysis of GIWW traffic along the Texas coast using trip data from 2011. The Corps' analysis resulted in the statistics shown in Table 10.

These statistics were applied to the delayed tows based on the zone in which the delay occurred:

- All delays in zones east of Bolivar used the Sabine-to-Galveston statistics.
- All delays in zones west of Galveston used the Galveston-to-Corpus Christi statistics.

There were 37 instances of delay, 23 in the eastern portion and 14 in the western portion. Table 11 shows the calculated number of towboats and barges that were delayed.

Table 9. Towing Vessels Detained due to Closure.

End Date of Delay (March 2014)	Zone	Time in Zone (Hours)	Standard for Zone (Hours)	Delay (Hours)
24	Bolivar Mooring	45.22	2.39	42.83
24	Bolivar Mooring	24.85	2.39	22.46
25	Bolivar Mooring	69.23	2.39	66.84
26	Bolivar Mooring	6.73	2.39	4.34
26	Bolivar Mooring	19.82	2.39	17.43
26	Bolivar Mooring	15.88	2.39	13.49
26	Bolivar Mooring	19.57	2.39	17.18
22	West 1	7.07	3.58	3.49
25	West 1	86.62	3.58	83.04
25	West 1	90.85	3.58	87.27
25	West 1	71.98	3.58	68.40
25	West 1	74.28	3.58	70.70
26	West 1	27.42	3.58	23.84
26	West 1	9.72	3.58	6.14
26	West 1	9.73	3.58	6.15
26	West 1	10.90	3.58	7.32
25	West 2	17.81	3.29	14.52
25	West 2	29.25	3.29	25.96
25	West 2	47.75	3.29	44.46
26	West 2	70.83	3.29	67.54
26	West 2	7.68	3.29	4.39
23	East 1	16.92	3.07	13.85
25	East 1	23.85	3.07	20.78
25	East 1	49.10	3.07	46.03
25	East 1	89.40	3.07	86.33
26	East 1	143.05	3.07	139.98
26	East 1	9.18	3.07	6.11
23	East 2	27.47	4.29	23.18
23	East 2	17.25	4.29	12.96
25	East 2	88.62	4.29	84.33
25	East 2	76.08	4.29	71.79
25	East 2	9.36	4.29	5.07
25	East 2	75.80	4.29	71.51
25	East 2	72.70	4.29	68.41
26	East 2	84.93	4.29	80.64
23	East 3	16.33	3.93	12.40
24	East 3	43.12	3.93	39.19
Total				1,480.35

Table 10. Barge Statistics.

GIWW Reach	Barges per Tow	Liquid Barges Percentage
Sabine to Galveston	1.61	85%
Galveston to Corpus Christi	1.46	84%

Table 11. Towboat and Barge Totals for Delayed Tows.

GIWW Reach	Number of Towboats	Liquid Barges	Dry Barges
Sabine to Galveston	23	31	6
Galveston to Corpus Christi	14	17	3
Total	37	48	9

Postponed Activity

Traffic moving through the area that was designated as a safety zone could follow one of the seven basic routings listed earlier. In the week leading up to the accident, a daily average of 86 tow trips moved through the safety zone area. Following the accident, there were two-plus days when virtually no trips were allowed through the area. On March 25 (the third day after the incident), traffic resumed at a somewhat slow pace and then was allowed to move freely on March 26, resulting in a spike of activity. Table 12 shows how the traffic volume changed as a result of the accident.

Table 12. Daily Trip Counts through the Security Zone.

Date	Number of Tow Trips	Tows Postponed
Prior to Accident (Daily Average)	86	0
March 22 (Day of Accident)	21	65
March 23	2	84
March 24	0	86
March 25	40	46
March 26	123	0
March 27	76	0[7]
Total		**281**

Assuming that the daily average is a valid representation of expected activity, it would appear that there were 65 postponed shipments on March 22, 84 on March 23, 86 on March 24, and 46 on March 25. The spike in the number of tow trips on March 26 represents an attempt to catch up. Therefore, the figures indicate that a total of 281 shipments had to be postponed. To avoid double counting, it is necessary to remove the shipments already accounted for in the analysis of

[7] There were no identifiable delays from the accident at this point.

delays, i.e., 37 shipments. This means that a net of 244 shipments were actually postponed because of the accident.

These 244 shipments that were postponed represent a large amount of cargo. It is informative to equate this cargo to equivalent truck traffic. Publicly available data do not make it possible to determine the origins of the postponed shipments. Given the parameters specified in Table 10 for the Sabine to Galveston reach (by far the busiest and thus the most representative of actual traffic), approximately 392 barges were affected (244 × 1.61). Of this total, 85 percent, or 333 barges, were liquid barges; 15 percent, or 59 barges, were dry barges. The Corps statistics referenced earlier indicate that approximately 40 percent of the liquid barges, or 133, were fully loaded. For dry barges, 41 percent, or 24 barges, were fully loaded. A modal comparison study done by the Texas A&M Transportation Institute (*1*) determined that a liquid cargo barge carries the equivalent of 144 tank truckloads, and a dry cargo barge carries the equivalent of 70 truckloads. This means that the equivalent of almost 21,000 truckload shipments was potentially postponed.

Economic and Environmental Consequences

When discussing the economic and environmental consequences of the accident and oil spill, it is important to note that the agencies and companies involved in the accident and response effort are very reluctant to share information. A significant amount of litigation and possible fines could result from the incident, which causes the parties involved to guard their information and release only what is absolutely necessary. The researchers contacted almost every agency mentioned in this report. They provided very little information other than press releases and presentations they have made. Given this reluctance to share data, the researchers relied primarily on public information disseminated via the press and trade journals.

The cleanup effort for the March 22 oil spill was essentially complete at the end of April/beginning of May (*2*). This effort was organized by the U.S. Coast Guard and the Texas Parks and Wildlife Department. Almost all the parties involved have gone on record as saying that the response effort was excellent—it was quick and effective. In the words of Andy Kendrick, U.S. Coast Guard spokesman at the Texas City Command Post: "The most optimal thing would've been [the spill] never happening. But I've seen a number of oil spills from Port Arthur to San Francisco, and by far this has been one of the best responses" (*3*).

By Monday, the second day after the incident, 24 response vessels were actively working to skim the oil. Importantly, responders were able to complete transferring product inside the barge's damaged compartment to a second barge. The damaged barge was then moved to a safer location for responders until it could be removed to a local shipyard for further assessment and repair (*4*).

On Wednesday, March 26, the Coast Guard reported that 19 miles of nonconsecutive shoreline had been fouled by the spill (*5*). According to the National Oceanic and Atmospheric Administration (NOAA) on March 31, although scattered and trace amounts of oil were found as far west as Mustang and Padre Islands, almost all of the oil was still thought to be stranded on shorelines between Galveston and Matagorda. Some widely scattered floating tar balls and sheens were certainly possible, but no floating oil was observed on overflights.

Eventually, oil washed ashore along 24 miles of Mustang Island's beaches, leaving black stains in the sand and on some debris such as logs. Coast Guard spokesmen have reported that all but about 4 miles have since been cleaned by workers who removed more than 10 tons of contaminated soil and contaminated debris. As of April 8, none of the oil had appeared on the bay side of the island around the whooping crane habitat; however, wildlife experts expressed concern that all the activity surrounding the cleanup may have affected the migration of the rare birds, which are accustomed to spending their winters on a virtually deserted island (*6*).

The level of effort involved in the cleanup was impressive. The Unified Command published some statistics regarding its cleanup on March 25, three days after the incident (*7*):

- Total nonconsecutive shoreline impacted—18.9 miles.
- Recovered gallons of oily water—175,098 gallons.

- Recovered bags of solid waste—1,799 bags.
- Total gallons of oil evaporated—18,480 gallons.
- Natural dispersion rate of oil—2,100 gallons.
- Total containment boom deployed—69,268 feet.
- Total containment boom staged—253,300 feet.
- Additional containment boom ordered—5,400 feet.
- Response vessels assigned—70 vessels.
- Total personnel in the field—940 persons.
- Total personnel in the incident command post—324 persons.

On March 26, the effort refocused to protect and mitigate impacts on the Matagorda Bay area. The Unified Command reported that on that date approximately 150 response personnel, using 11 response vessels, were actively working to deploy over 50,000 feet of protective boom in Matagorda. In addition, responders had staged 40,000 feet of absorbent boom, with another 45,000 feet en route to Port O'Connor (*8*).

Overview of Importance of the Regional Port Complex

In order to place the environmental and economic consequences in perspective, it is important to understand the complexity and importance of the port complex where the incident occurred. There are three separately managed port complexes in the affected region—Houston, Texas City, and Galveston. Each one has separate management and operating parameters.

The Port of Houston is a 25-mile complex made up of 150 private companies, as well as the public facilities that the Port Authority operates. Houston ranks first in the United States for number of ship arrivals (*9*). It also ranks first in both import and export tonnage (*10*) and has the second-highest level of total tonnage (including intracoastal and inland waterways) (*11*). Almost 8,300 vessels arrive and 160,000 barge movements are registered annually (*12*). Most importantly, in 2012 roughly 21 percent of the oil imports for America flowed through Houston and Texas City—Houston registered 49,426,000 tons, and Texas City registered 26,493,000 tons (*13*). On a typical day, there are 38 tanker movements and 22 freighter transits in the Galveston Bay area (*14*). Houston handles over 66 percent of all containerized cargo shipped through Gulf of Mexico ports (*15*).

The Port of Texas City is actually the Texas City Terminal Railway Company. It is a privately owned port with two shareholders—Union Pacific Railroad and BNSF Railway. It is the largest privately owned port complex in the United States (*16*). As of 2012, it was the 12th largest port in the United State in terms of tonnage, with almost 57 million tons (*10*). The Texas City Terminal Railway Company provides an important land link to port industries, handling over

25,000 car loads per year (*17*). The economic benefits of the Port of Texas City complex are not limited to just the local refineries in Texas City—refineries in Houston and beyond are able to receive crude oil via pipeline from Texas City facilities.

The Port of Texas City is also home to a 70-year-old man-made breakwater called the Texas City Dike. Built with granite blocks, it was designed to prevent silting of the Houston Ship Channel. Stretching almost five miles toward the mouth of Galveston Bay, locals call it the world's longest man-made fishing pier.

The Galveston Wharves (Port of Galveston) was created as a separate utility of the City of Galveston to manage, maintain, operate, and control all existing port properties and all additions, improvements, or extensions to such properties. The Galveston Wharves is under the direction of a Board of Trustees appointed by the Galveston City Council. The port handles a variety of bulk, breakbulk, and roll-on/roll-off cargoes—led by grain, wind project and other oversized shipments, fresh fruit imports, and wheeled equipment (agriculture and construction). However, Galveston is most widely known for its cruise business. In 2013, Galveston ranked in the top 10 cruise ports worldwide. It is the number-one cruise port on the Gulf of Mexico and the number-four cruise port in the United States based on passenger embarkations (*18*).

Refineries in the Galveston Bay area, including the nation's largest refinery in Baytown, make up the largest refining center in the United States (*19*). As of January 1, 2014, there are 139 operating refineries in the United States (*20*). Twenty-seven are located in Texas. Nine of them are located in the Galveston Bay region, with eight of them currently producing. In terms of total operable capacity, two of these refineries are in the top 10 for the United States: (*20*), ExxonMobil Baytown (2) and Marathon Petroleum (5). Two more are in the next 10 rankings: Deer Park Refining (13) and Houston Refining (17). These four refineries have 9 percent of the nation's total operable capacity. The entire Galveston Bay bloc has almost 12 percent of the nation's total capacity.

With more than 100 petrochemical waterfront facilities, Houston is the second-largest such complex in the world. These petrochemical facilities have reported plans to invest at least another $35 billion in assets in the vicinity of the Houston Ship Channel. Major corporations such as ExxonMobil, Shell, Saudi ARAMCO, Stolt Nielson, Odfjell USA, Inc., Sea River, and Kirby Marine have national or international headquarters in Houston.

Direct Consequences

The direct costs of the March 22 accident and oil spill fall into several general categories:

- Additional towboat operating costs resulting from delays.
- Additional vessel operating costs resulting from delays.
- Effects on refineries and petrochemical plants.
- Decontamination costs for vessels and towboats.

- Environmental/ecosystem effects.
- Costs to fishermen.
- Loss of recreation.

It is not possible to estimate the costs resulting from damage to biological communities or the costs that will flow from the formal Natural Resource Damage Assessment to be conducted by federal agencies. These assessments typically take several years, involve the development of a plan to restore damaged areas, and require some negotiation with the responsible parties. The U.S. Fish and Wildlife Service is working on the environmental damage assessment with the National Park Service, NOAA, the Texas Parks and Wildlife Department, the Texas General Land Office, and the Texas Commission on Environmental Quality (*21*).

The oil that was spilled is classified as RMG 380 or IFO 380. Intermediate fuel oil (IFO) is a blend of heavy residual fuels with enough distillate to lower the viscosity to that required for large marine engines. RMG 380 is often described as similar to Bunker C, a bottom-of-the-barrel fuel used for oceangoing ships (*22*). Generally, the toxicity of RMG 380 is considered relatively low, but it is persistent—it can remain essentially unchanged in water or along a shoreline for months and even years. RMG 380 does not evaporate well and defies traditional chemical dispersants, which were used in the Deepwater Horizon oil spill. Canada's environmental agency has described it as "difficult to clean up," and research conducted for the U.S. Environmental Protection Agency concludes that "close to zero" of the heavy fuel can be chemically dispersed. According to material safety data sheets, the biggest concern about the fuel is its high hydrogen sulfide content, which in the March 22 incident weathered off quickly—a benefit to first responders aboard skimming vessels trying to suck up the oil.

Additional Vessel Operating Costs

Oceangoing

The analysis of the additional costs incurred by oceangoing vessels as a result of delays uses high-level cost structures provided by the U.S. Army Corps of Engineers Institute for Water Resources (IWR). These costs are valid for 2012. No index is available to convert these costs to 2013 levels. Additionally, because of contractual restrictions, IWR is not allowed to provide detailed cost breakdowns across the range of vessel types that the vendor who develops these costs each year provided. The data IWR provided for this report give a real-world estimate of costs but are not precise. Appendix A describes the methodology used to derive the hourly vessel operating costs.

Table 13 shows the hours of delay incurred by vessel type for vessels that were in port at the time of the incident or arrived in the next few days following the incident. When the hours are multiplied by the in-port hourly cost of operating vessels in each category, the total direct delay costs of the temporary closure come to approximately $7.3 million. Appendix B provides a listing of each affected vessel with its associated delay and cost.

Table 13. Cost of Delays for Oceangoing Vessels.

Vessel Type	Hours of Delay		Weighted Average Hourly Cost	Cost of Delay
	In Port	Anchorage		
ATB	154.3	114.0	$1,102	$295,638
Bulk Carrier	81.4		$1,005	$164,199
Chemical/Products/Oil Tanker	1355.07	691.6	$1,347	$2,756,679
Container Ship	115.81	225.0	$1,497	$510,361
General Cargo	583.78	65.5	$804	$455,814
LPG Tanker	118.75		$3,892	$462,175
Passenger/Cruise Ship	169.03		$14,699	$2,484,487
Vehicle Carrier	98.35	72.0	$878	$149,495
Grand Total	**2676.49**	**1168.1**		**$7,278,848**

GIWW Tows

A towboat and its barges must remain together as a unit, even when a tow is delayed in transit. The towboat crew must be on duty and make sure that the barges are not damaged or threatened. Therefore, it is reasonable to apply the normal hourly operating cost of towboats and barges to the hours of delay to arrive at an estimate of the increase in operating costs caused by the delays.

Table 9 shows a total of 1480.35 hours of delay. In a recent research project for the Texas Department of Transportation, Texas A&M Transportation Institute researchers calculated the average hourly cost of towboats and barges (*23*). Applying these hourly rates yields the calculated cost increase shown in Table 14.

Table 14. Estimated Increase in Operating Cost Caused by Delays Induced by March 22 Incident.

Asset Class	Number	Hourly Rate	Total Cost
Towboat	37	$490.08	$725,489
Liquid Barge	48	$34.32	$50,806
Dry Barge	9	$6.20	$9,178
Total			**$785,473**

This cost is strictly the increase in operating costs. Depending on the terms of individual contracts, a carrier could be penalized for late delivery or for holding a barge beyond a certain number of days (demurrage). These are confidential business arrangements that cannot be analyzed without insider knowledge, but they are real concerns for operators.

Because each individual barge shipment is governed by specific contract terms, it is not possible to estimate the economic effect of the postponed shipments. Depending on the terms, it is possible that operators could be liable for late delivery or for demurrage fees (holding the barge

over). There are other miscellaneous costs as well, not the least of which is the disruption to the schedule of towboat fleets and their crews.

Effect on Refineries and Petrochemical Plants

According to reports by the Reuters news service, on Monday (two days after the incident), analysts were largely unconcerned about the effects of the spill, noting that ample inventories in the region provided a cushion for refiners. ExxonMobil reported that same day that production at its 560,500-barrel-per-day Baytown, Texas, refinery had been cut due to the closure of the Houston Ship Channel. The company said it expected further production cuts by mid-week if the channel remained shut (*24*), but the additional cuts were not necessary—as of Wednesday, ExxonMobil was receiving crude shipments again. The refinery immediately adjusted its production volumes (*25*). Several other refineries that the media contacted declined to comment—among them were Marathon Petroleum Corporation's Galveston Bay refinery, Texas City refinery, and Royal Dutch Shell's joint-venture 327,000-barrels-per-day Deer Park refinery—noting only that they had contingency plans in place (*24*). Representatives for Valero Energy Corp., Marathon Petroleum Corp., and Royal Dutch Shell Plc, which own all or part of the refineries on the Houston Ship Channel, also declined to discuss operations at those plants. The combined capacity of refineries dependent on the ship channel is 2.1 million barrels a day, according to Andy Lipow, president of Lipow Oil Associates LLC in Houston (*25*).

Aaron Brady, senior director at IHS Cambridge Energy Research Associates, told reporters, "Gasoline inventories are high, but distillate inventories are low, so product storage levels are not a limiting factor at the moment for refinery run rates. Gulf refineries are exporting a lot of product, some of which comes through Galveston Bay. If access to the Channel remains limited they may eventually have to run at lower rates" (*26*). That eventuality did not materialize.

Chris McCloskey, director of aromatics at IHS Chemical, noted that two refineries in Texas City and several associated chemical plants could be affected owing to their close proximity to the cleanup effort: "After several days of restricted traffic south of the Texas City dike, the production of 800,000 m.t.[8]/year (2,200 m.t./day) of benzene and 1.1 million m.t./year (3,000 m.t./day) of xylenes may be impacted."[8]

Marc Laughlin, director of methanol and acetone at IHS Chemical, reported that acetic acid and formaldehyde producers could have trouble obtaining feedstock if the channel remained closed: "A lot of methanol is supplied via water to the seven area plants that are producing acetic acid and formaldehyde. In a case of extended closure of Galveston Bay, that is not expected at this time, production and shipment of 1.2 million m.t./year (3,300 m.t/day) of acetic acid and 800,000 m.t./year (2,200 m.t./day) of formaldehyde could be impacted."[8] Neither of the concerns expressed by the IHS Chemical analysts materialized.

[8] Metric tons.

Michael Green, a spokesman for the American Automobile Association, said the impact was softened, in part, by the domestic energy production boom. Refiners in the area are increasingly receiving crude from the Permian Basin and the Eagle Ford Shale in Texas and even the Bakken Shale play in North Dakota. In short, they do not rely on ships for crude oil as much as they used to. If the spill had occurred a few years ago, the effect probably would have been more pronounced (*27*).

Patrick DeHaan, senior petroleum analyst with GasBuddy.com, said a prolonged closure, or one later in the year, might well have caused a gasoline price spike: "If this was the summer, and all these refineries were on full tilt, it probably would have been more noticeable" (*27*).

Texas City Emergency Management Coordinator Bruce Clawson observed that the reopening of shipping lanes could not have come at a better time. "Many of our facilities were starting to hurt," Clawson said. "All of our oil refineries were at what they call in the margin zones. They were close to being in bad shape (to supply and send product out by ship). If this lasted another day, all of them would have been in bad shape." In particular, Marathon Petroleum's Galveston Bay Refinery in Texas City, the nation's fourth largest oil refinery, needed to get ships moving again, Clawson said (*28*).

In summary, because of the swift response and the relatively short closure period, the actual effect on the refineries and petrochemical plants was minimal. However, the impacts of a more prolonged closure could have had serious economic consequences. The speed of the response effort mitigated the concern over these possible impacts.

Decontamination of Towboats and Vessels

Six decontamination stations were set up for vessels that were contaminated. Decontamination took place at the vessels' berths as much as possible (*29*). The Coast Guard Sector Houston-Galveston office provided statistics regarding the decontamination of vessels due to the accident. Table 15 shows how many were required to undergo decontamination as of April 2, 2014.

Additionally, 105 recreational boats and 57 commercial fishing/shrimping vessels underwent examination and were not found to be oiled. The historic sailing vessel *Elissa* was also verified as not oiled. These examinations represent additional costs.

Vessels were not the only assets affected by the spill; there were also costs to decontaminate marine terminals. The Coast Guard reports that 10 marine terminals (which included multiple berths at the Port of Galveston) were decontaminated.

Because of pending litigation, it was not possible to obtain the cost of these decontamination procedures, even after repeated attempts to obtain a reasonable estimate. It is clear, however, that significant costs were incurred due to decontamination and to having vessels out of service for that period of time.

Table 15. Decontaminated Vessel Counts by Vessel Type.

Vessel Type	Number Decontaminated
Towing Vessel	32
Barge	4
Cruise Ship	4
Deep-Draft Freighter/Tanker	18
Offshore Supply Vessel	6
Oil Spill Response Vessel	10
Recreational Boat	6
Shrimping Vessel	18
Small Passenger Boat	3
U.S. Coast Guard Cutter	3
Pilot Boat	3
Army Corps of Engineers Survey Boat	1
NOAA Survey Boat	1
Total	**109**

Environmental/Ecosystem Effects

As noted earlier, it is not possible to put a dollar amount on the environmental/ecosystem effects of the spill at this time. There will be lingering impacts that may take some time to determine. However, this category of effects is one of the most far-reaching and may turn out to be the costliest.

Debbie Patton, division chief for emergency responses to oil and chemical spills for NOAA, said she believed the spill would have the greatest impact on birds and other species that have contact with the water's surface. This type of oil is not the kind that tends to have much dissolution into the water column. It is heavy and sticky and stays on the surface. This is a problem for birds or any species that comes up through the surfaces, like dolphins or turtles (*22*).

The Unified Command established a wildlife rehabilitation facility to treat any wildlife that was affected by the oil. The Unified Command worked in tandem with the Texas Parks and Wildlife Department, U.S. Fish and Wildlife Service, and Wildlife Response Services to respond to new reports as they arose. The Texas General Land Office also deployed a bird rehabilitation trailer in the area for quick response to impacted wildlife.

Initially, it was reported that not very many birds had been affected. On March 26, Audubon Texas sent out emails stating that the damage to bird habitats appeared to be contained to the immediate vicinity of the spill. The communique stated a concern for the hundreds of thousands of birds arriving in Galveston Bay for spring migration (*25*). It was eventually reported that the Coast Guard recovered 329 oiled birds from Galveston Bay to North Padre Island, nearly all dead, and had observed at least 500 birds with some traces of oil on Mustang Island. It appeared that many of the birds were coming into contact with the oil as it washed ashore (*3*,*30*).

Continuous air monitoring was done for several days throughout the general area, although readings consistently showed no reason for health concerns.

Cost to Fishermen

There did not appear to be any documented direct impact on fisheries, but there was some level of economic impact due to the fact that boats were not allowed out to fish for several days. On Tuesday, fishermen said they were already throwing back oil-covered catches (*22*).

The Texas Department of State Health Services stated that there is no indication that seafood in the marketplace was impacted by the oil spill. More information is provided at www.dshs.state.tx.us/news/updates.shtm (*31*).

Andrea Hance, the Brownsville-based executive director of the Texas Shrimp Association, said she reached out to multiple experts to try to get a handle on the consequences of the spill, if any, for Gulf shrimpers. Her conclusion was that there was not going to be a big impact. Carlton Reyes, a shrimp boat captain and president of the Brownsville-Port Isabel Shrimp Producers Association, said he did not think the shrimp migrating to the Gulf would be affected since the oil was on the surface and not settling (*32*).

Charter fishing enterprises could have suffered a big blow, but fortunately, the matter was resolved quickly enough that the effect was minimal. One such case illustrates the situation. Jeff Nielsen, owner of Galveston Fishing Charter Company, said he was looking at the possibility of losing about $10,000 a week if the waterways did not reopen immediately. His offshore boat was essentially trapped in the Galveston Yacht Basin. He expressed concern over charters that were supposed to depart on Wednesday, March 26. Fortunately, they were able to leave (*33*).

Effect on Recreation

The oil on Galveston beaches was in the form of tar balls, relatively easy to clean up, primarily on the east end of Galveston Island, according to Charlie Kelly, Galveston's emergency management coordinator (*22*). As of Thursday, all recreational activities, including swimming, were open, but the Texas Department of State Health Services advised people not to swim in areas where they could see oil (*31*).

Process for Reestablishing Vessel Traffic

The authority to restrict traffic in navigable waterways rests with the U.S. Coast Guard captain of the port (COTP), which in this case covers Houston, Galveston, Freeport, and Texas City. When vessel traffic must be restricted, the COTP consults with industry to determine how to reopen the channel. The COTP relies almost exclusive on industry in the determination of the order of vessels that will resume their activity after a closure.

The Houston, Galveston, Freeport, and Texas City industries have a very efficient and effective method for determining how to make recommendations to the Coast Guard. They coordinate and communicate with the Coast Guard via the Port Coordination Team (PCT). The PCT is comprised of members from the port communities of Houston, Galveston, Freeport, and Texas City. These members represent core constituents and are responsible for consolidating information from their respective groups. As a conduit through which information flows, the PCT permits the COTP to establish shipping priorities, implement port reopening protocols, and better manage the flow of vessel movements without compromising the safety and security of the impacted ports.

The following non-federal entities are typically represented on the PCT:

- Port of Houston Authority.
- Port of Texas City.
- Port of Galveston.
- Port of Freeport.
- Offshore Port (lightering interests).
- American Waterways Operators (e.g., tow companies).
- West Gulf Maritime Association (e.g., agents and labor).
- Houston Pilots Association.
- Galveston-Texas City Pilots Association.
- Oil refiners.
- Oil terminals.
- Chemical carriers.
- Non–vessel traffic service users (e.g., recreational vessels and fishing vessels).
- Harbor tugs.

These core stakeholders are responsible for developing outreach within their own group. The focus of the outreach is two-fold—first, to ensure the various users (e.g., impacted parties) are aware of the representative that they should contact in the event of a prolonged closure to the ports, and second, to ensure that the representative has a means of reaching out to the individuals that he or she is responsible for.

When the COTP deems it necessary to convene the PCT for purposes of passing information to and from the core user groups, the Coast Guard calls each representative and informs that person of the meeting specifics (e.g., telephonic conference, time, and venue). At the meetings, the COTP asks the PCT to focus on the most pressing needs of the port and take into consideration (not exclusively):

- The number of vessels within the offshore anchorage.
- The number of vessels within the inshore anchorage.
- The number of tows at Bolivar Roads.
- The number of tows at Pelican Cut.
- Feedstock levels within the refinery infrastructure.
- The number of vessels located at berths (i.e., current berth capacity).
- Weather conditions (e.g., currents, winds, and tides).
- Discrepant aids to navigation.
- Visibility.
- Critical manufacturing components destined to/from the port(s).
- Tug availability.
- Pilot availability.
- Fleeting area congestion.

Based on the interplay of these factors, the COTP establishes an operating protocol for restoring commerce to the impacted port(s). This process may consist of the following guidelines:

- Imposing traffic measures to minimize overtaking situations.
- Staggering the entry of vessels into the Houston Ship Channel.
- Identifying particular vessels/cargoes for priority entry into the port(s).
- Identifying critical berths that require vessel departures.

Once a vessel traffic management plan is devised, PCT members receive a follow-up email that can be distributed to interested port stakeholders. The purpose of this email is to ensure that impacted parties are aware of the measures in place to restore commerce to the port(s). This post-conference email also contains information on future conferences, the anticipated duration of the measures at hand, and any other information that will assist the PCT in managing the expectations of their respective constituents.

The PCT convened several times during the closure period for the March 22 incident. In these meetings, the PCT addressed questions such as:

- What is the availability of the pilots?
- Will weather affect the ability to navigate?
- What response efforts are under way?
- Who needs what critically? Is there anyone who is in critical need of inbound materials or who is rapidly depleting their available storage capacity? (These questions are most crucial for refineries.)
- Typically, it is advisable to begin by moving vessels out of the port and opening up berths. What about in this instance?
- Would it be best to allow only one-way traffic for a time?
- How do we handle towboats crossing the ship channel(s)?

In this case, the response effort was so rapid and effective that industry did not believe a crisis was at hand. The first vessel that was allowed to move was a vessel carrying imported bananas since this was a perishable cargo and needed to get to market. This vessel docked at Galveston. Additionally, several cruise ships were allowed to come into port even during the channel closure because of the severe logistical issues that would be encountered by passengers. A delayed ship would have affected thousands of flights and ground transportation arrangements. These vessels all required hull cleaning before they could leave the berth area.

The resumption of Texas City traffic was dependent on the cleanup effort. Texas City vessel traffic had to pass in close proximity to where the primary cleanup efforts occurred; therefore, resumption of traffic had to be delayed until there was no immediate danger to respondents and no serious threat that oil would be dispersed or transported to other areas of the port region. Once the dike was cleaned, vessel traffic resumed.

Once the Houston Ship Channel was reopened, it became a question of each vessel's readiness to proceed and the availability of the pilots. There was not a critical situation that demanded immediate action.

The Coast Guard, industry, and the Greater Houston Port Bureau all indicated in separate conversations that this response effort was quick and efficient and that the PCT did its job well. At the outset of the closure, there was concern that it would be a prolonged event, but the work performed by all parties involved enabled the resumption of traffic in a very short time.

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