Port of Texas City, Texas
Workshop Report

Introduction

A Port Risk Assessment Workshop was conducted for the Port of Texas City on August 21, 2000. This workshop report provides the following information:

- Brief description of the process used for the assessment;
- List of participants;
- Numerical results from the Analytic Hierarchy Process (AHP) [1];
- Summary of risks and mitigations discussion; and
- Port of Texas City Attributes Summaries.

Strategies for reducing unmitigated risks will be the subject of a separate report.

Assessment Process

The risk assessment process is a structured approach to obtaining expert judgments on the level of waterway risk. The process also addresses the relative merits of specific types of Vessel Traffic Management (VTM) improvements for reducing risk in the port. Based on the Analytic Hierarchy Process (AHP), the port risk assessment process uses a select group of waterway users/stakeholders in each port to evaluate waterway risk factors and the effectiveness of various VTM improvements. The process requires the participation of local Coast Guard officials before and throughout the workshops. Thus the process is a joint effort involving waterway users, stakeholders, and the agencies/entities responsible for implementing selected risk mitigation measures.

This methodology employs a generic model of port risk that was conceptually developed by a National Dialog Group on Port Risk and then translated into computer algorithms by the Volpe National Transportation Systems Center. In that model, risk is defined as the sum of the probability of a casualty and its consequences. Consequently, the model includes variables associated with both the causes and the effects of vessel casualties. The participants are asked to establish scales to measure each variable. Once the parameters have been established for each risk-inducing factor, port specific risk is estimated by putting into the computer risk model specific values for that port for each variable. The computer model allows comparison of relative risk and the potential efficacy of various VTM improvements between different ports.

- [1] Developed by Dr. Thomas L. Saaty, et al, to structure complex decision making, to provide scaled measurements, and to synthesize many factors having different dimensions.

Report Documentation Page

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Texas City Port Risk Assessment Background

Texas City was selected for a port risk assessment at the request of the Coast Guard Captain of the Port (COTP) because of a major port infrastructure expansion project that is in the planning stages. Texas City is on the West side of Galveston Bay about seven miles NW from Galveston. Texas City is a privately owned port of considerable and growing commercial importance. It has extensive foreign and coastwise trade in petroleum, chemicals, fertilizer, and tin ore. Studies are underway to expand Snake Island as a container port.[2]

- [2] United States Coast Pilot; Volume 5, Atlantic Coast: Gulf of Mexico, Puerto Rico, and Virgin Islands; 27th Edition, 1997.

Participants

The following is a list of waterway users and stakeholders who participated in the process:

Participant	Organization	Phone	Email
Joe Bridges	Americana Shipping	(813) 276-4670	jbridges@americanaships.com
Dean Cheramie	Kirby Marine	(713) 435-1663	dean.cheramie@kmtc.com
Jim Coonrod	Galveston-Texas City Pilots	(409) 740-1671	jimcrod@swbell.net
Richard Eames	BP Amoco	(409) 945-1349	eamesrd@bp.com
Joe Gilder	Port of Texas (Texas City Terminals)	(409) 945-4461 x15	jgilder37@aol.com
Phil Glenn	Clean Channel	(713) 534-6195	pglenn@pdq.net
Alisha Goldberg	Galveston Bay Foundation	(281) 332-3381	gbf@electrotex.com
Jeremy Goodson	Garner Environmental	(281) 930-1200	N/A
CAPT Wayne Gusman	USCG Marine Safety Office Houston/Galveston	(713) 671-5199	wgusman@msohouston.uscg.mil
Bing Hastings	USCG Auxiliary	(936) 321-5896	binghastings@worldnet.att.net
CWO Thomas Horan	USCG Group Base	(409) 766-4715	thoran@grugalveston.uscg.mil
Jim Indest	TNRCC	(713) 767-3561	jindest@tnrcc.state.tx.us
CDR Rick Kaser	USCG Marine Safety Unit Galveston	(409) 766-3609	rmkaser@msugalveston.uscg.mil
Tim Leitzell	Marine Exchange of West Gulf, Inc.	(281) 821-1208	tleitzell@butterworthsystems.com
Marvin Reed	Texas Waterways Operators Assoc.	(713) 943-5063	mreed@coastaltowing.com
Tom Rodino	Shiner Moseley & Associates, Inc.	(361) 857-2211	trodino@shinermoseley.com
John Rozsypal	USACE (Galveston Dist.)	(409) 766-3091	johnny.rozsypal@usace.army.mil
John Salvesen	Odfjell Tankers (USA) Inc.	(713) 844-2200	john.salvesen@houston.odfjell-tankers.com
John Savage	G&H Towing	(409) 744-6311	jsavage@wt.net
CDR Pete Simons	USCG Vessel Traffic Service	(713) 671-5164	psimons@vtshouston.uscg.mil
Kelly Teichman	T&T Marine Salvage, Inc.	(409) 744-1222	t2marine@aol.com

Facilitation Team Members	Organization	Phone	Email
Mike Sollosi	USCG Commandant (G-MWV)	(202) 267-1539	msollosi@comdt.uscg.mil
Doug Perkins	Potomac Management Group, Inc.	(703) 836-1037	dperkins@potomacmgmt.com
Fred Edwards	Soza & Company, Ltd.	(703) 560-9477	fredwards@soza.com
Kris Higman	Potomac Management Group, Inc.	(757) 838-5296	khigman@hotmail.com
Leanne Rebuck	Potomac Management Group, Inc.	(703) 836-1037	lrebuck@potomacmgmt.com

The PAWSA session in Texas City was abbreviated from a day and a half to just one day. In the longer session, participants contribute their input to weighting the national port risk model categories and factors. These stages (Books 1 and 2) were not done in Texas City. In the interest of time, the participants went straight to Book 3 after discussing the specific risks in Texas City. The purpose of Book 3 is for the participants to calibrate a risk assessment scale for each risk factor. For each risk factor there is a low (Port Heaven) and a high (Port Hell) severity limit, which are assigned values of 1.0 and 9.0 respectively. The participants determined numerical values for two intermediate qualitative descriptions between those two extreme limits. Results obtained are as follows:

Book 3 Factor Scales - Condition List *(Generic)*

	Scale Value
Wind Conditions	
a. Severe winds < 2 days / month	1.0
b. Severe winds occur in brief periods	2.5
c. Severe winds are frequent & anticipated	4.9
d. Severe winds occur without warning	9.0
Visibility Conditions	
a. Poor visibility < 2 days/month	1.0
b. Poor visibility occurs in brief periods	2.3
c. Poor visibility is frequent & anticipated	4.3
d. Poor visibility occurs without warning	9.0
Tide and River Currents	
a. Tides & currents are negligible	1.0
b. Currents run parallel to the channel	2.0
c. Transits are timed closely with tide	5.0
d. Currents cross channel/turns difficult	9.0
Ice Conditions	
a. Ice never forms	1.0
b. Some ice forms-icebreaking is rare	2.1
c. Icebreakers keep channel open	5.6
d. Vessels need icebreaker escorts	9.0
Visibility Obstructions	
a. No blind turns or intersections	1.0
b. Good geographic visibility-intersections	1.7
c. Visibility obscured, good communications	4.5
d. Distances & communications limited	9.0
Channel Width	
a. Meetings & overtakings are easy	1.0
b. Passing arrangements needed-ample room	2.3
c. Meetings & overtakings in specific areas	5.9
d. Movements restricted to one-way traffic	9.0

Bottom Type

a. Deep water or no channel necessary	1.0
b. Soft bottom, no obstructions	2.0
c. Mud, sand and rock outside channel	4.8
d. Hard or rocky bottom at channel edges	9.0

Waterway Complexity

a. Straight run with NO crossing traffic	1.0
b. Multiple turns > 15 degrees-NO crossing	2.6
c. Converging - NO crossing traffic	4.9
d. Converging WITH crossing traffic	9.0

Number of People on Waterway

a. Industrial, little recreational boating	1.0
b. Recreational boating and fishing	3.3
c. Cruise & excursion vessels-ferries	5.8
d. Extensive network of ferries, excursions	9.0

Petroleum Volume

a. Little or no petroleum cargoes	1.0
b. Petroleum for local heating & use	2.4
c. Petroleum for transshipment inland	5.1
d. High volume petroleum & LNG/LPG	9.0

Chemical Volume

a. Little or no hazardous chemicals	1.0
b. Some hazardous chemical cargo	2.4
c. Hazardous chemicals arrive daily	5.2
d. High volume of hazardous chemicals	9.0

Economic Impacts

a. Vulnerable population is small	1.0
b. Vulnerable population is large	2.9
c. Vulnerable, dependent & small	5.3
d. Vulnerable, dependent & large	9.0

Environmental Impacts

a. Minimal environmental sensitivity	1.0
b. Sensitive, wetlands, VULNERABLE	3.2
c. Sensitive, wetlands, ENDANGERED	5.9
d. ENDANGERED species, fisheries	9.0

Health and Safety Impacts

a. Small population around port	1.0
b. Medium - large population around port	2.3
c. Large population, bridges	5.1
d. Large DEPENDENT population	9.0

Analysis

On average, participants from this port evaluated the difference in risk between the lower limit (Port Heaven) and the first intermediate scale point as being equal to 2.0; the difference in risk between the first and second intermediate scale points was equal to 2.7; and the difference in risk between the second intermediate scale point and the upper risk limit (Port Hell) was 3.9.

Book 4 - Risk Factor Ratings *(Port of Texas City)*

Fleet Composition	Traffic Conditions	Navigational Conditions	Waterway Configuration	Immediate Consequences	Subsequent Consequences
9.3	21.5	8.5	20.6	19.8	14.4

% High Risk Deep Draft 4.3	Volume Deep Draft 5.5	Wind Conditions 3.1	Visibility Obstructions 3.4	Number of People on Waterway 2.2	Economic Impacts 5.9
% High Risk Shallow Draft 5.0	Volume Shallow Draft 6.5	Visibility Conditions 2.2	Channel Width 7.4	Volume of Petroleum 9.0	Environmental Impacts 6.1
	Vol. Fishing & Pleasure Craft 3.3	Tide & River Currents 2.2	Bottom Type 4.4	Volume of Chemicals 8.6	Health & Safety Impacts 2.4
	Traffic Density 6.2	Ice Conditions 1.0	Waterway Complexity 5.4		

Analysis

This is the point in the workshop when the process quantifies local port risks. The participants use the scales developed in Book 3 to assess the absolute level of risk in their port for each of the 20 risk factors. The values shown in the preceding table do NOT add up to 100. Based on the input from the participants, the following are the top risks to port safety in the Port of Texas City (in order of importance):

1. Volume of Petroleum (9.0)
2. Volume of Chemicals (8.6)
3. Channel Width (7.4)
4. Volume of Shallow Draft (6.5)
5. Traffic Density (6.2)
6. Environmental Impacts (6.1)
7. Economic Impacts (5.9)
8. Volume of Deep Draft (5.5)
9. Waterway Complexity (5.4)
10. % High Risk Shallow Draft (5.0)

Book 5 - VTM Tools *(Port of Texas City)*

Fleet Composition		**Traffic Conditions**		**Navigation Conditions**		**Waterway Configuration**		**Immediate Consequences**		**Subsequent Consequences**	
% High Risk Deep Draft		**Volume Deep Draft**		**Wind Conditions**		**Visibility Obstructions**		**Number of People on Waterway**		**Economic Impacts**	
9	0.4	**7**	0.8	**19**	0.0	**14**	0.1	**14**	0.1	**4**	1.2
RA		RA	ALERT	RA		RA	ALERT	RA		OTH	ALERT
% High Risk Shallow Draft		**Volume Shallow Draft**		**Visibility Conditions**		**Channel Width**		**Volume of Petroleum**		**Environmental Impacts**	
9	0.4	**4**	1.2	**14**	0.1	**14**	0.1	**1**	1.9	**2**	1.5
RA		RA	ALERT	RA		OTH	ALERT	OTH	ALERT	OTH	
		Vol. Fishing & Pleasure Craft		**Tide & River Currents**		**Bottom Type**		**Volume of Chemicals**		**Health & Safety Impacts**	
		9	0.4	**14**	0.1	**13**	0.3	**2**	1.5	**9**	0.4
		RA		RA		RA		OTH	ALERT	RA	ALERT
		Traffic Density		**Ice Conditions**		**Waterway Complexity**					
		6	1.0	**20**	-0.1	**8**	0.6				
		RA	ALERT	RA		RA					

<u>Legend</u>

See the **KEY** (below). Rank is the position of the Risk Gap for a particular factor relative to the Risk Gap for the other factors as determined by the participants. Risk Gap is the variance between the existing level of risk for each factor determined in Book 4 and the average acceptable risk level as determined by each participant team. Negative numbers imply that the risk level could INCREASE and still be acceptable. The teams were instructed as follows: *If the acceptable risk level is <u>equal to or higher than</u> to the existing risk level for a particular factor, circle RA (Risk Acceptable). If the mitigation needed does not fall under one of the VTM tools, circle OTH (Other) at the end of the line. Otherwise, circle the VTM tool that you feel would MOST APPROPRIATELY reduce the unmitigated risk to an acceptable level.*

The tool listed is the one determined by the majority of participant teams as the best to narrow the Risk Gap. An ALERT is given if no mathematical consensus is reached for the tool suggested. Below are the tool acronyms and tool definitions.

KEY	
Risk Factor	
Rank	Risk Gap
Tool	ALERT

RA	Risk Acceptable	DI	Improve Dynamic Navigation Info
AN	Improve Aids to Navigation	VTIS	Vessel Traffic Information System
CM	Improve Communications	VTS	Vessel Traffic System
RR	Improve Rules & Regulations	OTH	Other – not a VTM solution
SI	Improve Static Navigation Info		

<u>Analysis</u>

The results shown are consistent with the discussion that occurred about risks in the Port of Texas City area. For 10 out of the 11 risk factors for which there was good consensus, the participants judged the risk to be at an acceptable level already due to existing mitigation strategies.

No consensus alerts occurred because votes were split between several VTM tools, as indicated:

- Volume Deep Draft – RA (4), CM (2), RR (1), DI (1), VTS (2)
- Volume Shallow Draft – RA (3), CM (1), RR (2), VTS (2), OTH (2)
- Traffic Density – RA (4), DI (2), VTIS (1), VTS (2), OTH (1)
- Visibility Obstructions – RA (5), AN (1), CM (1), DI (2), VTS (1)
- Channel Width – RA (2), RR (1), VTIS (1), VTS (1), OTH (5)
- Volume of Petroleum – RA (3), CM (1), DI (2), OTH (4)
- Volume of Chemicals – RA (3), CM (1), DI (2), OTH (4)
- Economic Impacts – RA (4), DI (1), OTH (5)
- Health & Safety Impacts – RA (4), CM (2), OTH (4)

Summary of Risks

Scope of the port area under consideration: As the first step in the port risk assessment process, the participants defined the port area to be discussed. They decided that the port area of Texas City included Texas City Channel, Texas City Harbor and Turning Basin, and the Industrial Canal, plus Bolivar Roads and the junction of the junction of the Texas City Channel with the Houston Ship Channel.

<table>
<tr><th>FACTOR</th><th>RISKS</th><th>RISK MITIGATION STRATEGIES</th></tr>
<tr><td colspan="3">Fleet Composition</td></tr>
<tr><td>Percent High Risk Deep Draft Cargo & Passenger Vessels</td>
<td>Today:
5 to 6 ships per day. Very few high risk ships in Texas City today
Low value cargoes attract poor ships but very few in this port
Right now the container mega-vessels do not service Gulf ports. The ships that do call are in good condition
Summary: risk level for Texas City is low
Trends:
New container fleet ships being built and will replace older ones
Impact of increased container ship traffic if multi-modal terminal is built: 1 ship per day for 350 ship visits per year.
Volume through pass will not change short term because ships diverted from Houston to Texas City.
Over time with full build-out there will be 1500 ships per year, a doubling in the number of deep draft ships, as well as diversion from Houston to Texas City
Quality of ships is high and will remain high</td>
<td>Existing Mitigations:
For one container line, average age is 7 years now; next year average age will be under 5 (new ships in fleet)
Chemical carries well maintained in conformance to safety regulations. No history of accidents
New Ideas:
When container facility is active, there will not be a decrease in quality of ship, if anything, fleet will increase in quality</td></tr>
</table>

<table>
<tr><th>FACTOR</th><th>RISKS</th><th>RISK MITIGATION STRATEGIES</th></tr>
<tr><td colspan="3">Fleet Composition (continued)</td></tr>
<tr><td>Percent High Risk Shallow Draft Cargo & Passenger Vessels</td>
<td>Today:
• 25 barges per day
• Tug/tows also considered good quality. Age estimated ~20 years.
• Bunkering 3-4 vessels a day due to fuel price advantages
• By law tug operators can stand 12 hours watch a day and stand 12 on 12 off.
• Groundings resulting from cutting the corner where Texas City Channel crosses the ICW
• Fishing vessels. Local fleet works the Texas City Channel and is more professional in local knowledge and stay clear of the transiting ships
Trends:
• Other than increases in bunkering for container ships there are no changes anticipated
• Bunkering from tank barges for container ships. Bunkering a part of port call
• 800-900 x 105 PANAMAX size container ships anticipated
• Expect to get largest ships that the port can handle
• Bunkering will be done by Texas City tug and barge</td>
<td>Existing Mitigations:
• Low OSV traffic
• Low level of recreational boat activity, mostly on the north side of the Texas City Dike
• Tugs fleet in Pelican Cove awaiting access to harbor
• Tugs undergo major maintenance on 30-month cycle.
• Texas Waterway Operator Association certificates for high risk cargo carried in barges
• Harbor tug quality is good
• Licensing of tug operators
• Conformance to regulations
New Ideas:
• Simulator training for Houston and Texas City (Seaman’s Church Institute)
• Licensing/apprenticeship for steersman
• Address human factors concerns about operator fatigue</td></tr>
</table>

FACTOR	RISKS	RISK MITIGATION STRATEGIES
Traffic Conditions		
Volume of Deep Draft Vessels	**Today:** • 1750 deep draft ship visits per year (4 per day average) • Run out of tugs before they run out of pilots • Observation: 8 ships per day through 5 NM channel with run time of 45 minutes to 1 hour. Waterway can physically handle larger number of ships • Adequate dockside space today **Trends:** • An additional 4 ships per day once the container terminal is developed (5-6 years). That is a doubling of deep draft ship visits • Turn around cycles will change. Container ships are rapid turn around where as some other fleets are slower	**Existing Mitigations:** • Pilots self regulate Texas City Channel to one way traffic with large ships • Mandatory pilotage • Present VTS covers entire defined port area and Texas City Channel • Dedicated area tugs • Tug escort for all planned deep draft ship movements • If no movements scheduled, tugs may be as far away as Galveston **New Ideas:** • May have to introduce two-way traffic to satisfy traffic considerations • May need additional tugs • New turning basin 1500 feed wide NW of proposed container port in vicinity of front range • New turning basin will be outside of Texas City channel • Tractor tugs, especially for the volume of chemical ships. Note: even with a tractor tug made up to the ship, at seven knots it still takes ½ NM to get ship back under control • Continue working agreement with the harbor master

FACTOR	RISKS	RISK MITIGATION STRATEGIES
Traffic Conditions (continued)		
Volume of Shallow Draft Vessels	**Today:** • 3-5% annual growth rate • 25 tows per day. Tows may have to wait as much as 36-48 hours. Product has to go to specific docks. Tows will not wait in Texas City, will stay in Bolivar Roads area • Some congestion in turning basin when barges depart facilities. Have to hold traffic in Texas City Channel • Facilities are limited so barges enter queue system for a turn **Trends:** • Do not anticipate seagoing container barges	**Existing Mitigations:** • Harbormaster office controls movements. **New Ideas:** • Facilities issue for tows, not a waterway issue. • Establish fleeting area on east side of Texas City harbor rather than Bolivar Road. Problem, too, because creates congestion in harbor • Identify fleet area for barges. Require pilings or mooring to ensure integrity of tow • Refine scheduling so that barges arrive when dock is available • Identify scope of authority of private port authority of Texas City
Traffic Conditions (continued)		
Volume of Fishing & Pleasure Craft	**Today:** • Recreational traffic not using Texas City today • Problems are at Y and ICW junction • 4th largest recreational boating area in U.S. • Two boat ramps on south side of Texas City Dike **Trends:** • No plans for marinas or yacht clubs • Do not anticipate problem of boat ramps near dike	**Existing Mitigations:** • None discussed **New Ideas:** • None discussed

FACTOR	RISKS	RISK MITIGATION STRATEGIES
Traffic Conditions (continued)		
Traffic Density	**Today:** • Have to wait for opposing traffic to clear in Horn of the port • Y where ICW and Texas City Channel connect; a congestion spot • Two-way traffic when just one large ship meeting tugs and tows **Trends:** • Traffic increasing in channel • Expect more congestion at the Horn • Channel deepening to 45 feet is Texas City channel only. Will not include the port area past the Horn • Dredging might affect hydrodynamics along the Texas City Dike - sucking water off the flats along the dike as deep draft ships pass • Hydrodynamic problem in Industrial canal caused by deep draft movements	**Existing Mitigations:** • One way rule for large draft vessels in Texas City Channel to end of Industrial Canal • Harbormaster schedules and controls traffic movements • Former COTP moved fleeting traffic out of port • Pilots talk to each other, especially turning corner to harbor. • Use CH 16 for call-up and then shift to working frequency. Traffic on channels 12 and 13 is worse than on channel 16 • Very limited recreational boaters and commercial fishing fleet **New Ideas:** • Plans are to create turning basin and deepening channel for the container port facility • Trim NW corner at Shoal Point to widen channel and to open visibility at entrance to Harbor • Consider using specified frequency for bridge to bridge and harbor control

<table>
<tr><th>FACTOR</th><th>RISKS</th><th>RISK MITIGATION STRATEGIES</th></tr>
<tr><td colspan="3">Navigation Conditions</td></tr>
<tr><td>Wind Conditions</td><td>Today:
• Wind not a major concern for ships now
• Tows crab, taking up more of the channel
• Winds frequently 20-25 knots year round. When from SE not a problem, when from NW in winter, ships remain at dock until abates
• Winter predictions are not accurate- fronts stall. Creates traffic density problem and congestion in holding areas.
• Spring has strongest fronts and high winds last throughout March and April
• Tropical waves and depressions create big problem because they last for awhile
Trends:
• Pilots anticipate wind will be problem for large containerships</td><td>Existing Mitigations:
• None discussed
New Ideas:
• None discussed</td></tr>
<tr><td colspan="3">Navigation Conditions (continued)</td></tr>
<tr><td>Visibility Conditions</td><td>Today:
• Fog- 300 hours per year
• Fog distributed throughout the year
• Fog can blanket entire run up channel to port
Trends:
• None identified</td><td>Existing Mitigations:
• None discussed
New Ideas:
• None discussed</td></tr>
</table>

FACTOR	RISKS	RISK MITIGATION STRATEGIES
Navigation Conditions (continued)		
Tide & River Currents	**Today:** • Strong on ebb and flood with axis of channel • Strong cross channel current once clear of the dike **Trends:** • None discussed	**Existing Mitigations:** • Texas City Dike protects channel and port from cross currents **New Ideas:** • None discussed
Navigation Conditions (continued)		
Ice Conditions	**Today:** • None discussed **Trends:** • None discussed	**Existing Mitigations:** • None discussed **New Ideas:** • None discussed
Waterway Configuration		
Visibility Obstructions	**Today:** • Background lighting • Blind corner out of Industrial Canal-large mounds of coke • Horn deep draft ships can see each other over it but tows cannot see each other. **Trends:** • Potential back-lighting from night ops at proposed container port • Container ships will block view around the horn when berthed • Container ship terminal stacks may be high enough to obstruct view	**Existing Mitigations:** • Existing aids to navigation adequate but could be enhanced **New Ideas:** • None discussed

FACTOR	RISKS	RISK MITIGATION STRATEGIES
Waterway Configuration (continued)		
Channel Width	**Today:** • Texas City Channel 400 feet wide widens to 550 feet at turn approach to Horn. • Industrial Canal is 250 feet wide • Pipe line at Horn limits depth of inner harbor **Trends:** • If number of ships doubles, then all large ships will have to get in a queue for coordinated arrivals and departures	**Existing Mitigations:** • Dock space at existing facilities limits size of chemical carriers • Harbor depth restricts size of tankers • Harbormaster has video surveillance of Texas City Channel to head of navigation. Informs pilots and tows of traffic • Tugs and tows wait when they see large ships in the channel **New Ideas:** • Texas City Channel will be deepened to 45 feet, but not widened, for container terminals • New turning basin (1500 feet diameter) outside the channel at NW end of Texas City Channel • USACE dredge southeast corner of Texas City Y • Plans to trim off NW corner of Snake Island at the Horn
Waterway Configuration (continued)		
Bottom Type	**Today:** • Hardspots: Pipeline crossing at the Horn area • Mostly mud and silt bottom • Dike can be hit by shallow draft ships but not deep draft ships • Industrial Canal is rock **Trends:** • None identified	**Existing Mitigations:** • None discussed **New Ideas:** • Plans to relocate and deepen the pipeline

FACTOR	RISKS	RISK MITIGATION STRATEGIES
Waterway Configuration (continued)		
Waterway Complexity	**Today:** • Two 90 degree turns in harbor • Merge at Y • Crossing traffic with ICW • Rare but possible need for large ship to turn in Y from Texas City into Houston Ship channel northbound **Trends:** • New turning basin at Horn will cause crossing situation with every turn and docking by container ships • New passenger vessel berthed on north wall of dike between inner ranges but, will have to enter channel below dike somewhere (do not know where for sure yet)	**Existing Mitigations:** • Mandatory pilotage • Mandatory tug escorts for large ships **New Ideas:** • Open the Horn by removing point, increasing channel width and turning basin
Immediate Consequences		
Number of People on Waterway	**Today:** • No risk from cruise ships or ferry boats • Party boat activity where Texas City Channel meets Houston Ship Channel • Passenger barge (hotel barge) uses ICW • No gambling boats **Trends:** • No future development anticipated	**Existing Mitigations:** • None discussed **New Ideas:** • None discussed

FACTOR	RISKS	RISK MITIGATION STRATEGIES
Immediate Consequences (continued)		
Volume of Petroleum Cargoes	**Today:** • 50-60 million barrels of crude per year coming in • Refined product going out • 700 oil tankers per year (2 per day) • Considerable amount of product in barges too **Trends:** • Growing at 3-5 % per year and will continue to grow at that rate	**Existing Mitigations:** • Area contingency plan in place • Oil spill cleanup companies available • Port has installed anchor points for boom • Mutual aid society exists • Two national OSRO's with ships in Galveston • No fault pollution response SOP **New Ideas:** • Accessibility of personnel from spill source company to make decisions
Immediate Consequences (continued)		
Volume of Hazardous Chemical Cargoes	**Today:** • A lot of ship and barges traffic, amount not specified • Cargoes of particular hazard (e.g., benzene, ethylene): no concrete knowledge of specific cargoes by name • Containership manifests: element of doubt as to what is really in a container **Trends:** • None discussed	**Existing Mitigations:** • Oil spill companies also respond to chemical spills. New task area not fully tested or experienced yet **New Ideas:** • Area Contingency Plan in preparation stage • Proposed CG, International, Federal and LECP guidelines and regulations • Work more closely with local Office of Emergency Management • Communications: type and quantity of product in tanks available to concerned party • Improve Dynamic Navigation information on currents, sea state, approaching weather/winds

FACTOR	RISKS	RISK MITIGATION STRATEGIES
Subsequent Consequences		
Economic Impacts	**Today:** • Function of accident happens. Businesses are dependent on just-in-time shipments to satisfy operations • Texas City is small, depends on constant turnover so there is limited reserve storage capacity • Hurricane-not had a bad one since 1983 • Shut down by Tropical Storm Francis for two days-pilots could not board or move vessels. Created 72 vessel backlog throughout the entire system (Houston Ship Channel, too). Created high tides, flooding, high winds for three days **Trends:** • With containerships, 24-48 hours due to offload and redistribution. Customs and funds take 24 hours, beyond that, a problem • Damage from dockside containers washed adrift in storm	**Existing Mitigations:** • Hurricane plans in effect. All written since 1983; therefore, so not tested in action • Salvage equipment available for small ship or brown water vessel. Respond in 2 hours time • Large ship grounding-tugs of sufficient horsepower available to break suction and unstick ship • Port is prepared to respond to oil spill **New Ideas:** • Study impact of storm surge on various parts of port area particularly planned container terminal
Subsequent Consequences (continued)		
Environmental Impacts	**Today:** • Wetlands: Pelican Island, Swan Lake, and Virginia Lake. None in the defined port area but all affected by an uncontained spill • Easy to keep oil within port confines. Once released, quickly spreads beyond the port area to wetlands areas. • Roseate spoonbills south of the Industrial Canal **Trends:** • None identified	**Existing Mitigations:** • Area Contingency Plans • OSROs on site **New Ideas:** • Maps from Texas General Land Office identifies environmentally sensitive areas along the coast • Increase and improve marine firefighting capability

FACTOR	RISKS	RISK MITIGATION STRATEGIES
Subsequent Consequences (continued)		
Health & Safety Impacts	**Today:** • Health and safety consequences as a result of confined spill in Industrial Canal or Harbor itself • People on the Texas City Dike for recreation • Workers within Texas City port area • 46,000 population base within Texas City proper • Type of product involved: crude oil spill vs. toxic chemical plume **Trends:** • None discussed	**Existing Mitigations:** • Alert and evacuation plans • Vapor controls in loading and unloading product at facilities **New Ideas:** • Consider vapor controls in transferring product between ships