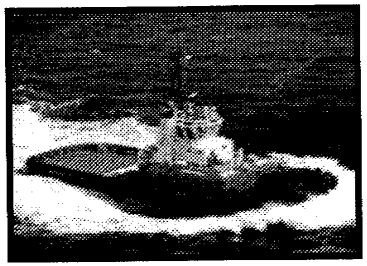
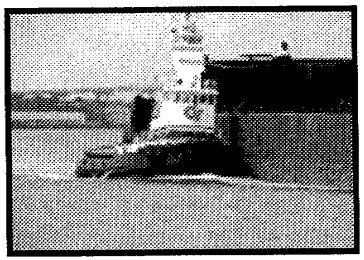
Atlantic Region Quality Steering Committee (ARQSC) Casualty & Fatality Data Analysis Quality Action Team

Towing Casualty Data Analysis

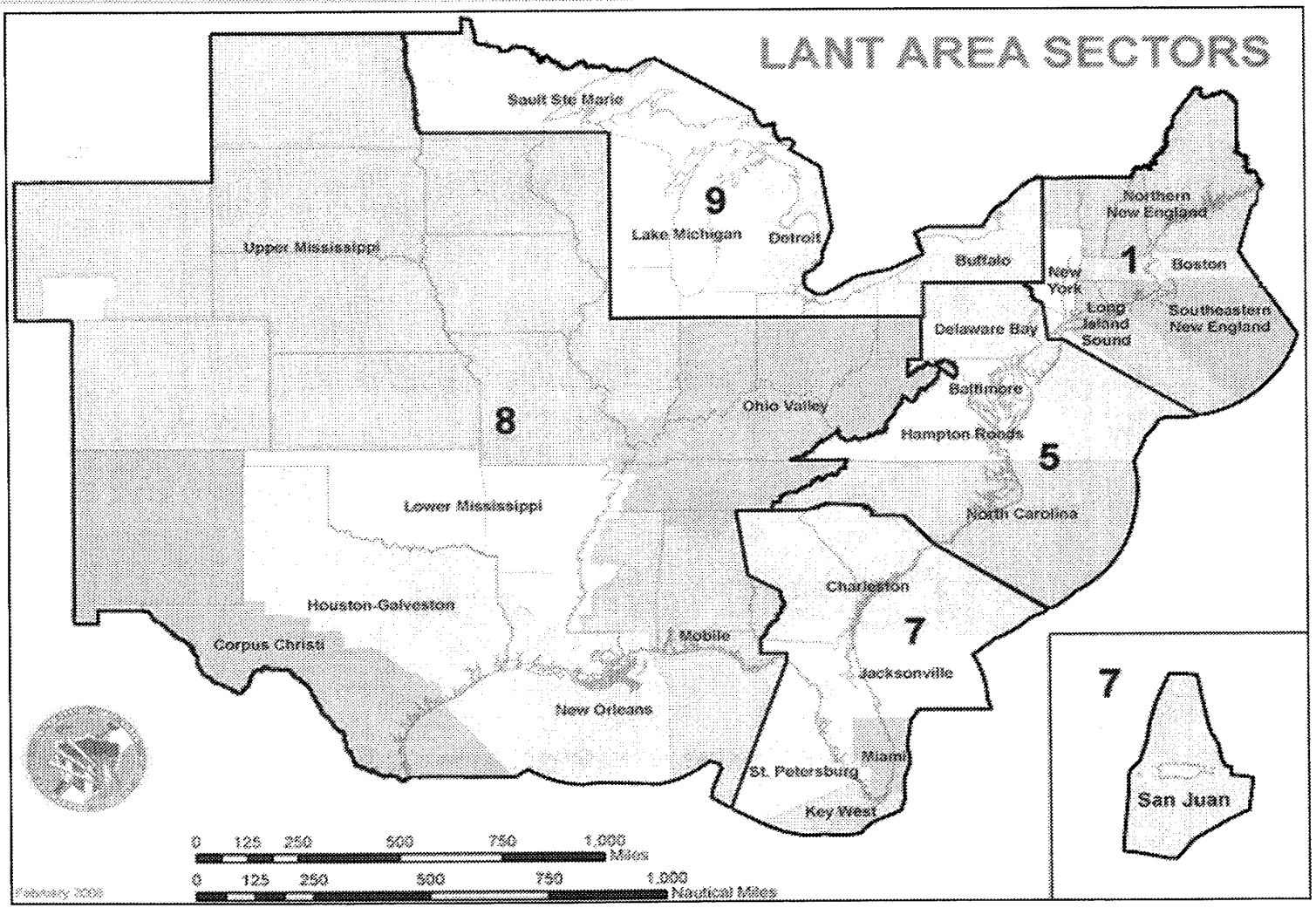




Atlantic Area Prevention Division
Investigations and Analysis Section
Portsmouth, Virginia
October 29, 2007

U. S. COAST GUARD

Coast Guard LANTAREA Map

Focus on CG Districts 1, 5, & 7



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Project Charter

Project Definition

Problem Statement

Serious accidents continue to occur in the Atlantic Region towing industry despite previous safety efforts. 77 serious accidents occurred in calendar years 2002-2006.

Project Scope

Atlantic Region Quality Steering Committee members want to improve safety in the towing vessel industry by revisiting marine casualty occurrences and conducting an in-depth analysis of serious accidents.

Project Deliverables

Project Goal

Produce actionable information for initiating effective measures to decrease occurrences of significant reportable marine casualties in the Atlantic towing industry based upon data driven analysis results.

Key Deliverables

Identify the appropriate causative or contributing factors associated with significant marine casualties for in-depth analysis.

Create a report or visual display of data to show any identify patterns of causative factors associated with vessel casualties and any actionable information for initiating effective measures to improve marine safety in the Atlantic Region

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Project Team

Roles & Responsibilities

Champion: CDR Elmer Emeric
Process Owner: USCG and AWO partnership

Project BB/GB: Gabriel Pall, William & Mary Mason School of Business

Team: LCDR Scott Higman
Mrs. Yukari Hughes

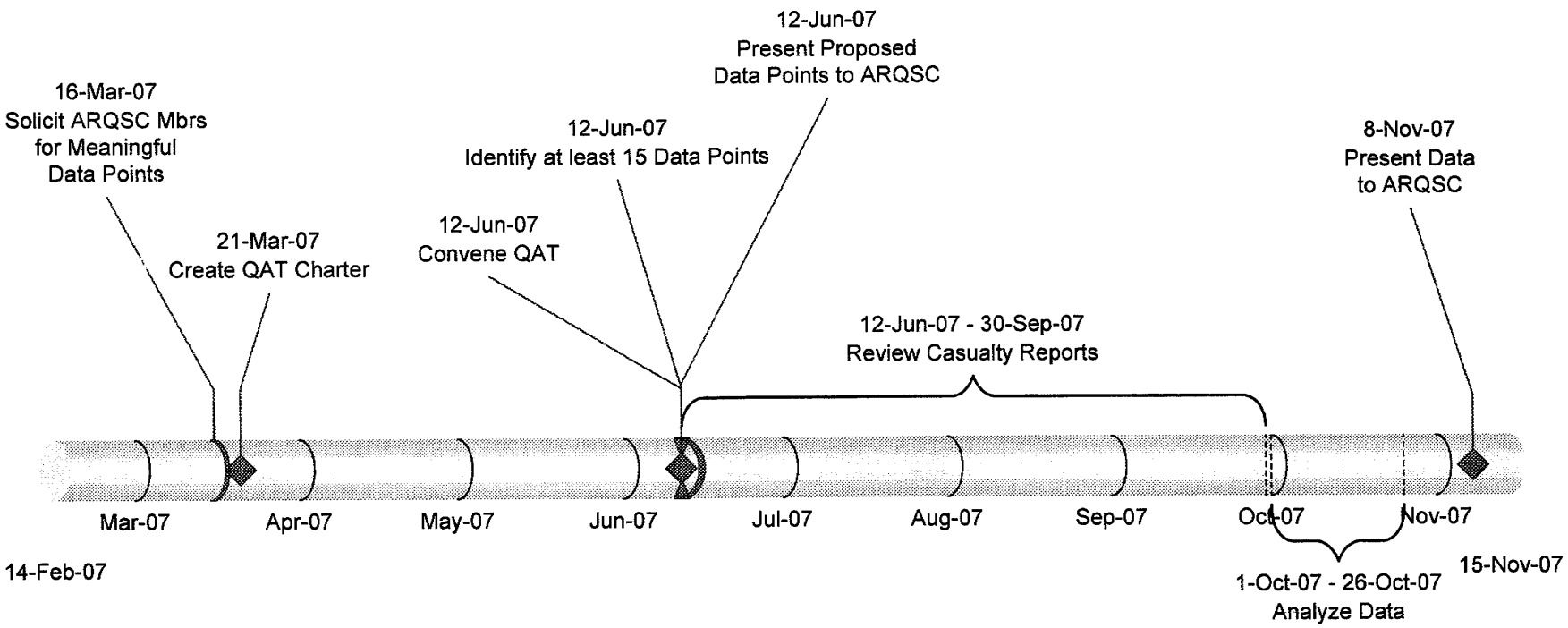
Potential Project Benefits

Financial and Operational Benefits

Financial Benefits	Operational Benefits
Reduced exposure to:	- Identify improved industry Best Practices & Standards of Care
- Regulatory fines	- Improve safety records
- Loss of revenue	- Improve quality of CG investigative reports
- Increased insurance costs	- Increase reputations/goodwill
- Settlement/compensation costs	- Lives saved
	- Injuries prevented or mitigated down

Project Plan

Casualty Data Analysis QAT Work Plan

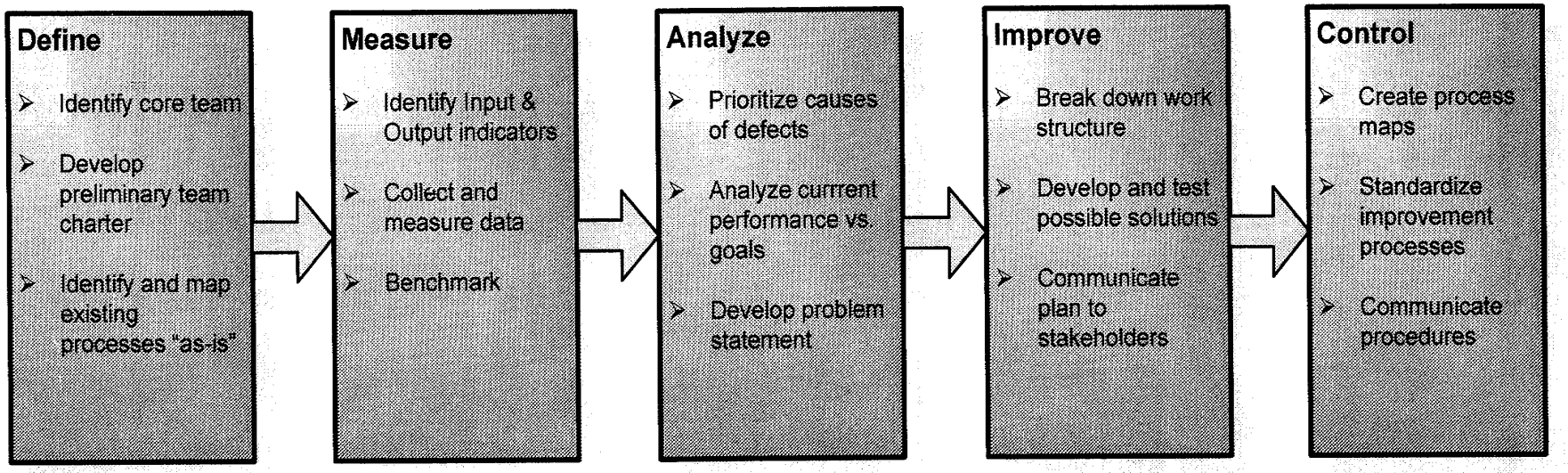


Action Plan

A detailed action plan with agreed upon deliverables was created and provided to QAT members

Clearing up the "fuzzy problem"

Systematic Phased Approach



Next Steps…

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DEFINE Phase

DEFINE Phase Deliverables

Project Charter
- ✓ Project Definition – Perceived Problem Statement
- ✓ Project Scope
- ✓ Project Team
- ✓ ARQSC Requirements (*critical to success*)

✓ Project Plan

✓ ARQSC QAT Process Map(s)
✓ CG Investigation Process Map(s)
❑ Industry Casualty Process Map(s)

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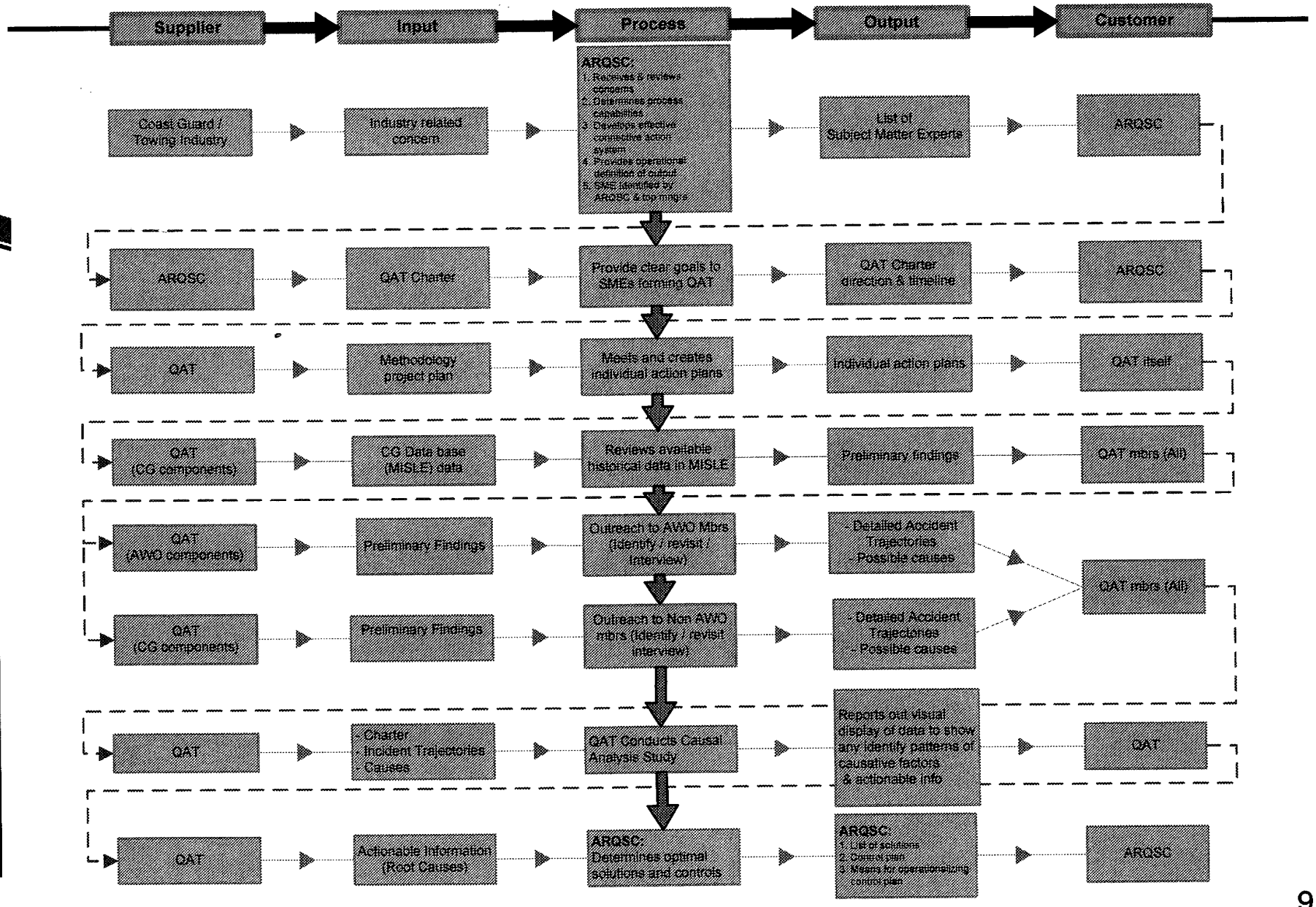
Existing ARQSC Process



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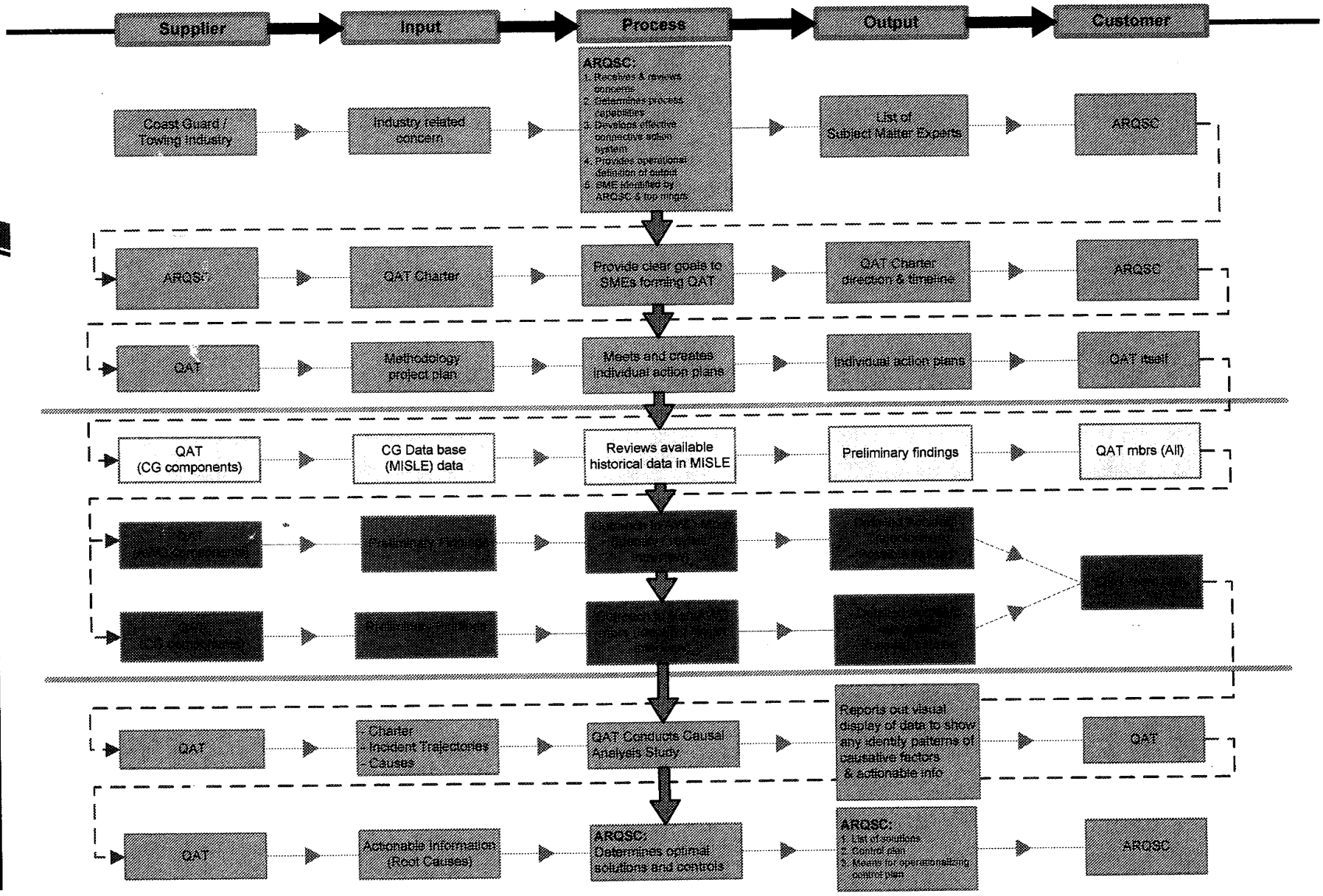
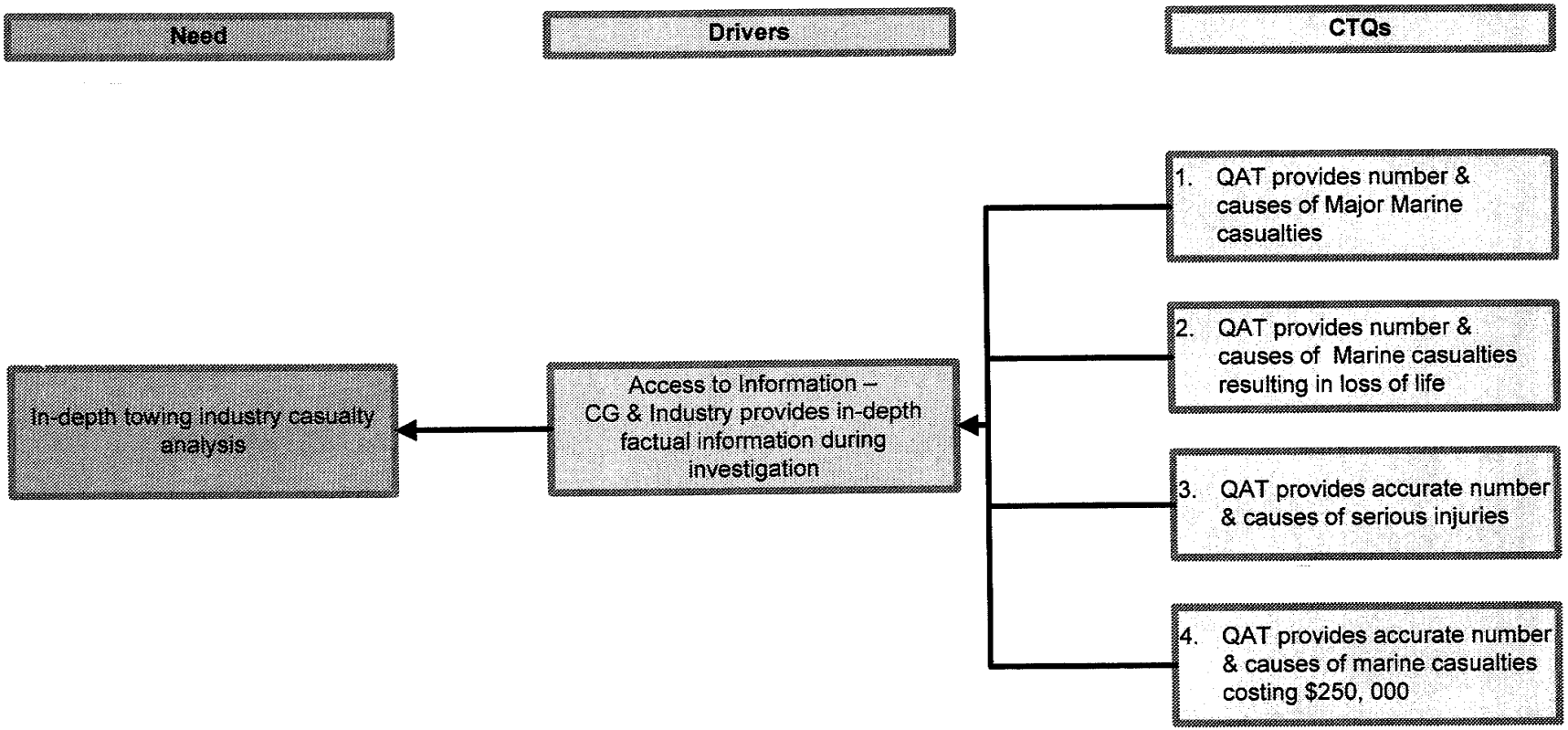
Existing ARQSC Process



Yellow depicts potential area for process improvement – Red depicts non-functional process

Critical to Quality Tree

ARQSC Requirements



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MEASURE Phase

MEASURE Phase Deliverables

- ✓ Measurement Plan

- ✓ CG investigative record baseline measurements for ARQSC identified outcomes
- ✓ Industry baseline measurements for ARQSC identified outcomes

- ❑ Business Case (*casualty cost analysis vs. preventative costs)*
  - ✓ Estimative CG costs
  - ❑ Estimative Industry costs

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Data Collection Plan

MEASUREMENT PLAN FOR: Outcomes (Y)

Purpose: Identify causative or contributing factors associated with medium and high severity towing vessel incidents as defined by the ARQSC. *(Severity level 4&5)*

Key Process ***Output*** variable (Y)	Operational Definition	Unit of Measure	How Measured: Potential Measurement Method/ Source	How Measured: Frequency/ Time Period	How Measured: Who/ Responsibility	Actual Measure of Y	Notes
Loss of Life in towing industry	Deaths on or missing persons from towing vessels or caused by towing vessels	Count	1. Reported to CG and recorded in CG MISLE database 2. Outreach to Involved Party	All instances reported in calendar years 2002-2006	S.T. Higman	17	Identified 17 deaths in 10 incidents causal information is not in-depth
Serious injuries in towing industry	Injuries on tow vsls & barges leading to incapacity to work 72hrs or greater	Count	1. Reported to CG and recorded in CG MISLE database 2. Outreach to Involved Party	All instances reported in calendar years 2002-2006	S.T. Higman	37	Identified 37 Significant injuries in 28 incidents causal information is not in-depth
Damages of $250 K or >	Damages greater than $250,000	Count	1. Reported to CG and recorded in CG MISLE database 2. Outreach to Involved Party	All instances reported in calendar years 2002-2006	S.T. Higman	40	40 incidents that resulted damages of $250K or more. Total Damage costs = **$ 64,625,629**
Major Marine Casualties	All non-pollution related Major Marine Casualties As defined by 46CFR part 4	Count	1. Reported to CG and recorded in CG MISLE database 2. Outreach to Involved Party	All instances reported in calendar years 2002-2006	S.T. Higman	21	Reported incidents met thresholds of MMC ($500K, loss of 100GT vsl or six or more deaths

Notes:
- **Outreach efforts to obtain more detailed causal information were unsuccessful.**
- Measurement data collection plan is recorded for all key process ***output*** variables.
- How does "Y" measure up to ARQSC requirements? *(How well is QAT meeting* ARQSC requirements*?)*

Data Collection

Going Beyond CG MISLE Data

Question:
How?

Answer:
Partnership Outreach to obtain more detailed information on causes of accidents

Software Factors		Hardware Factors	
Organization	Procedures(e.g. rigging changes not to spec)	Equipment error/ failure root cause	
Shore side mgnt	Experience	Maintenance	
Workload (division of duties)	Complexity of tasks	Design (latent condition)	
Composition of the crew	Documentation	Crew modifications	
Was tow vsl an AWO member & fully inducted into the responsible carrier program	Safety Management System existence / compliance	Material failure (wear, fatigue, etc)	
Environmental Factors		**Liveware Factors**	
Time of day	Weather conditions	Ability	Skills
Hour of the watch the casualty occurred	Wind and sea state	Knowledge	Training level
Day of Voyage (tour) when the casualty occurred		Personality	Emotional State
Visibility		Mental Condition	Activities prior to accident
		Physical Condition / health condition	Assigned duties at time of accident
		Work hours/Rest hour	Behavior at time of accident
		Service time with company	PPE
		Crew experience with: - Industry - Company - Situational (task)	Inter-crew relationships

ANALYZE Phase

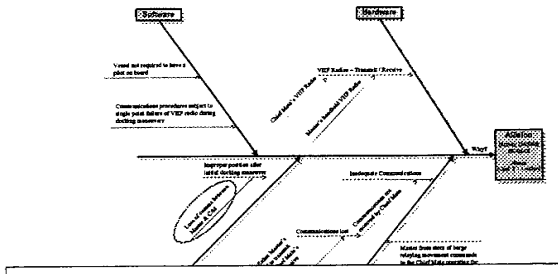
ANALYZE Phase Deliverables

Cause & Effect Diagrams for each incident
- ✓ Pareto Analysis with probable causes *(X's)*
- ✓ Measurement data collection plan for probable causes *(X's)*
- ❑ Value stream analysis probable causes *(X's)*
- ✓ Results of Graphical Analysis
- ❑ Process Map/Value Stream Map and Analysis
- ❑ List of root causes ("critical" or "vital few" causes *(X's)*)

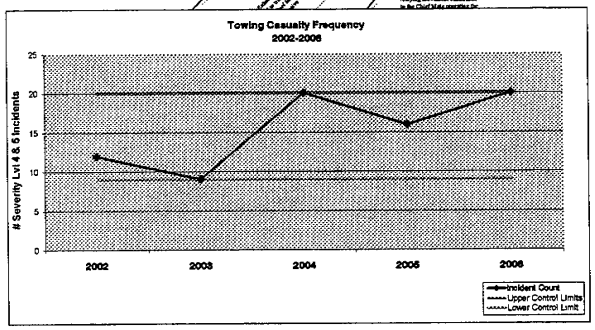
Baseline Process Performance

Graphical Tools Used:

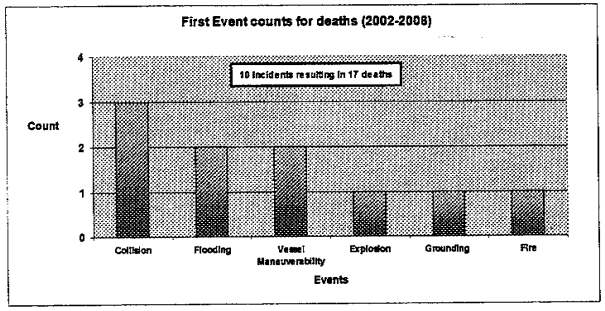
Cause & Effect Fishbone Diagrams
Cause & Effect Diagrams were completed as much as possible from the baseline data in CG investigation records as documented CG MISLE database.



Run Charts
Run charts were us display accident occurrence trend for calendar years 2002-2006 to determine baseline process improvement and to validate the ARQSC's statement that: "the industry's safety record is experiencing a plateau".



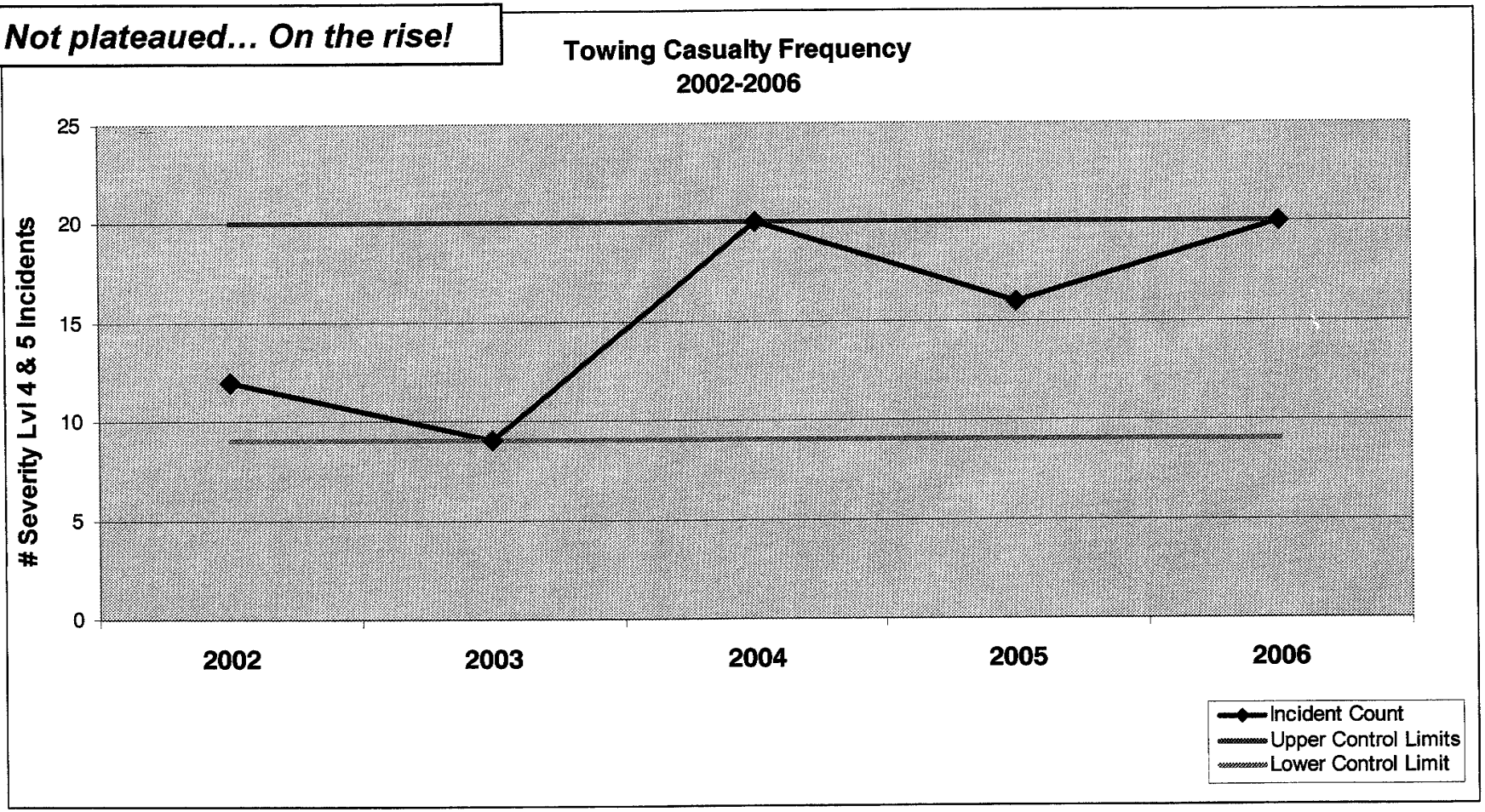
Pareto Bar Charts
Pareto Bar charts were used to display and analyze causative factors and identify trends in base-line data.



Baseline Process Performance

Annual Frequency

Not plateaued... On the rise!



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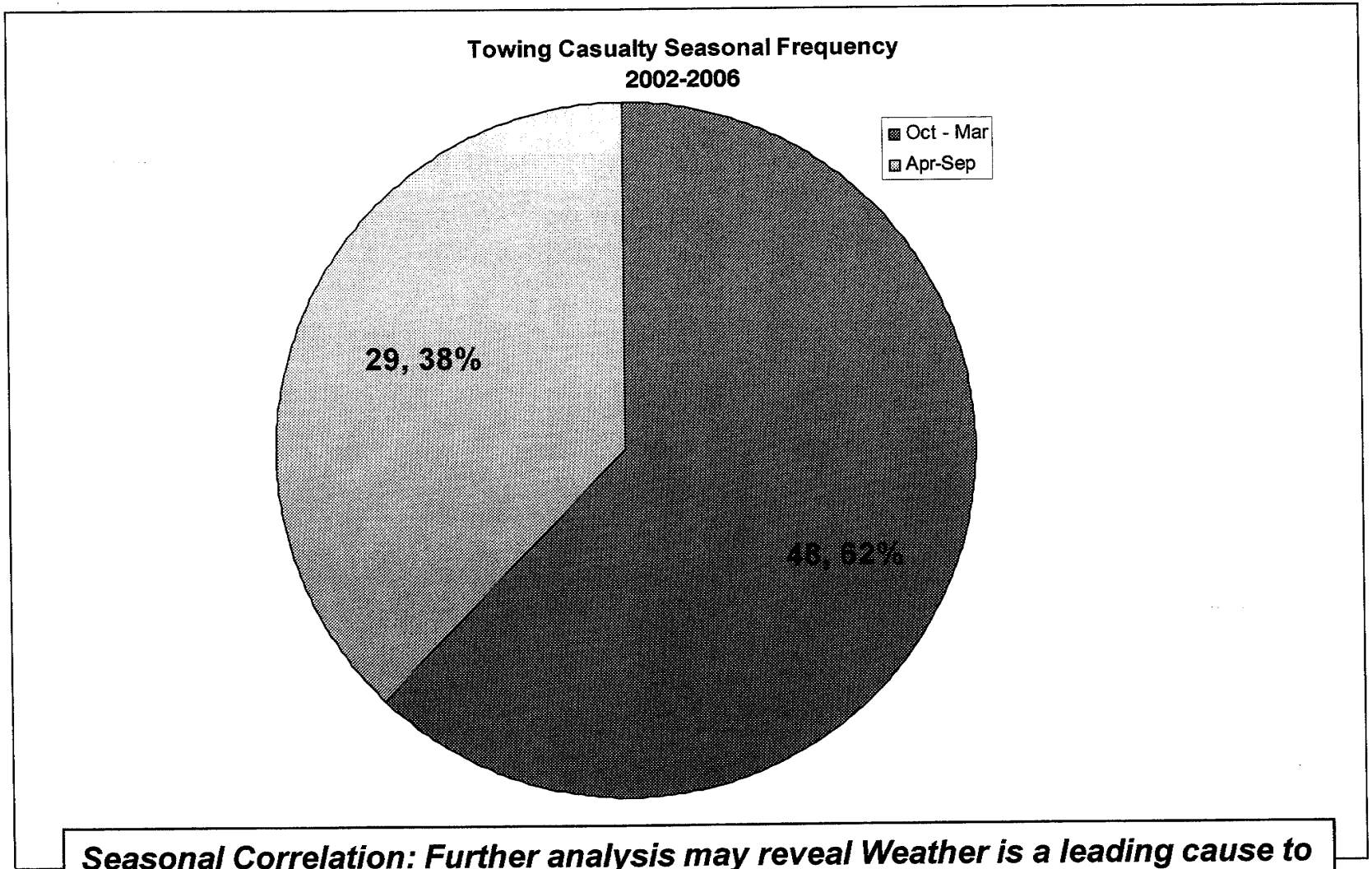
Baseline Process Performance

Seasonal Frequency



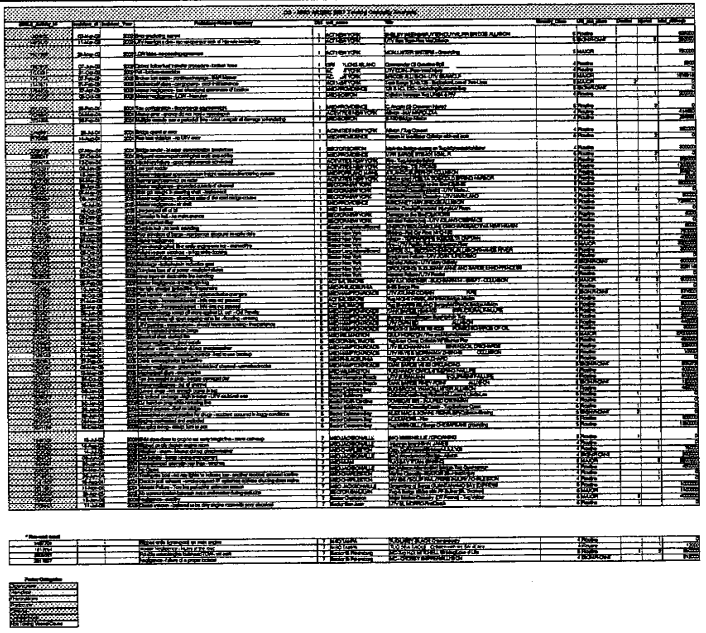
Seasonal Correlation: Further analysis may reveal Weather is a leading cause to accidents

Baseline Data

Data

CG MISLE Data:
CG Investigation records from the CG MISLE database served as project baseline data.

Amplifying Information & Data:
No amplifying data from external industry sources was available for consideration and validation of CG investigation records.



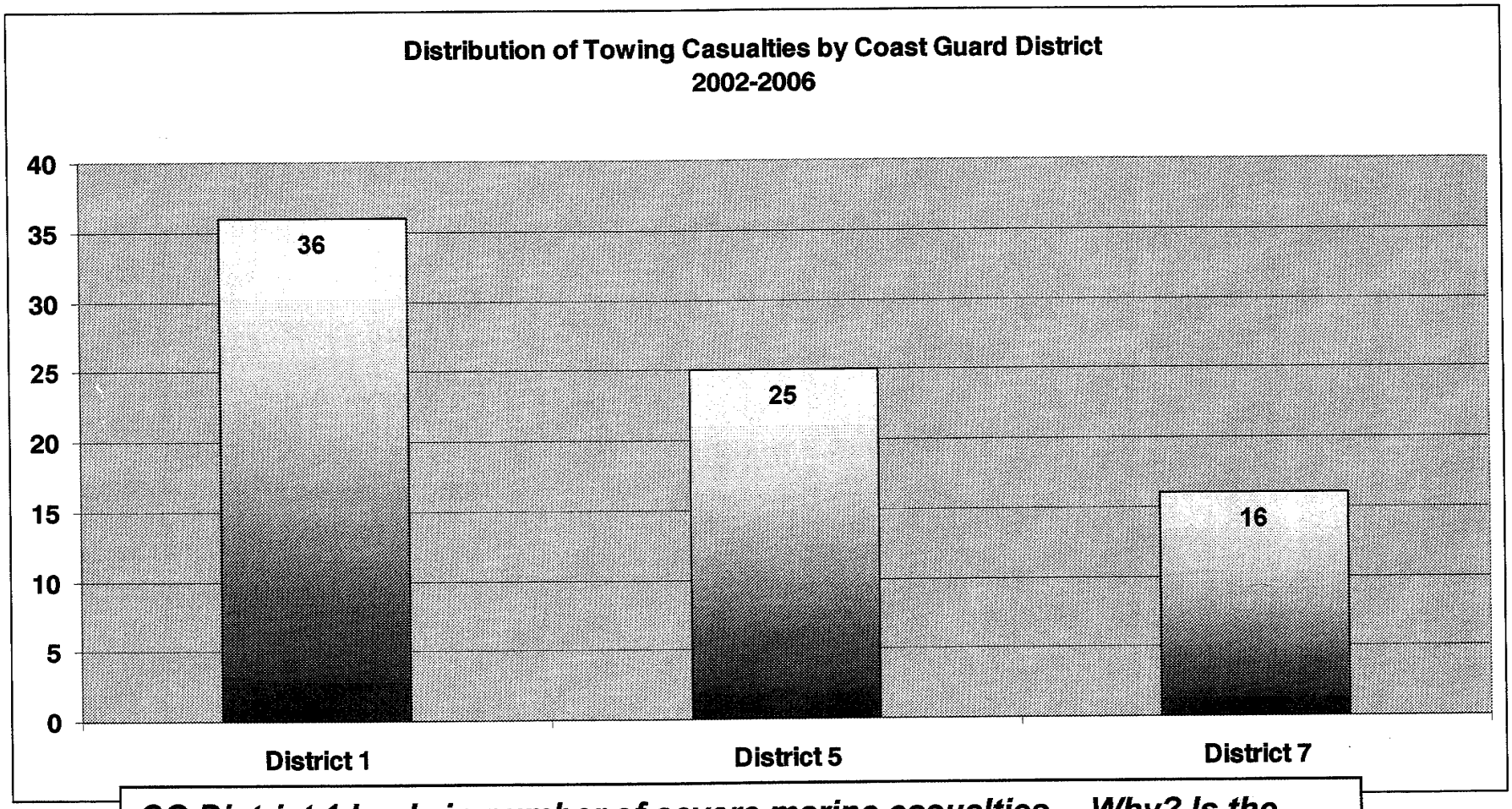
Summary Statement

CG MISLE Data:
CG Investigation records were deplete of adequate information to conduct in-depth analysis without re-opening investigations.

Amplifying Information & Data:
Amplifying, supplemental information from external industry sources was not available for consideration and validation of CG investigation records. Requests for information sharing were unanswered.

Baseline Data

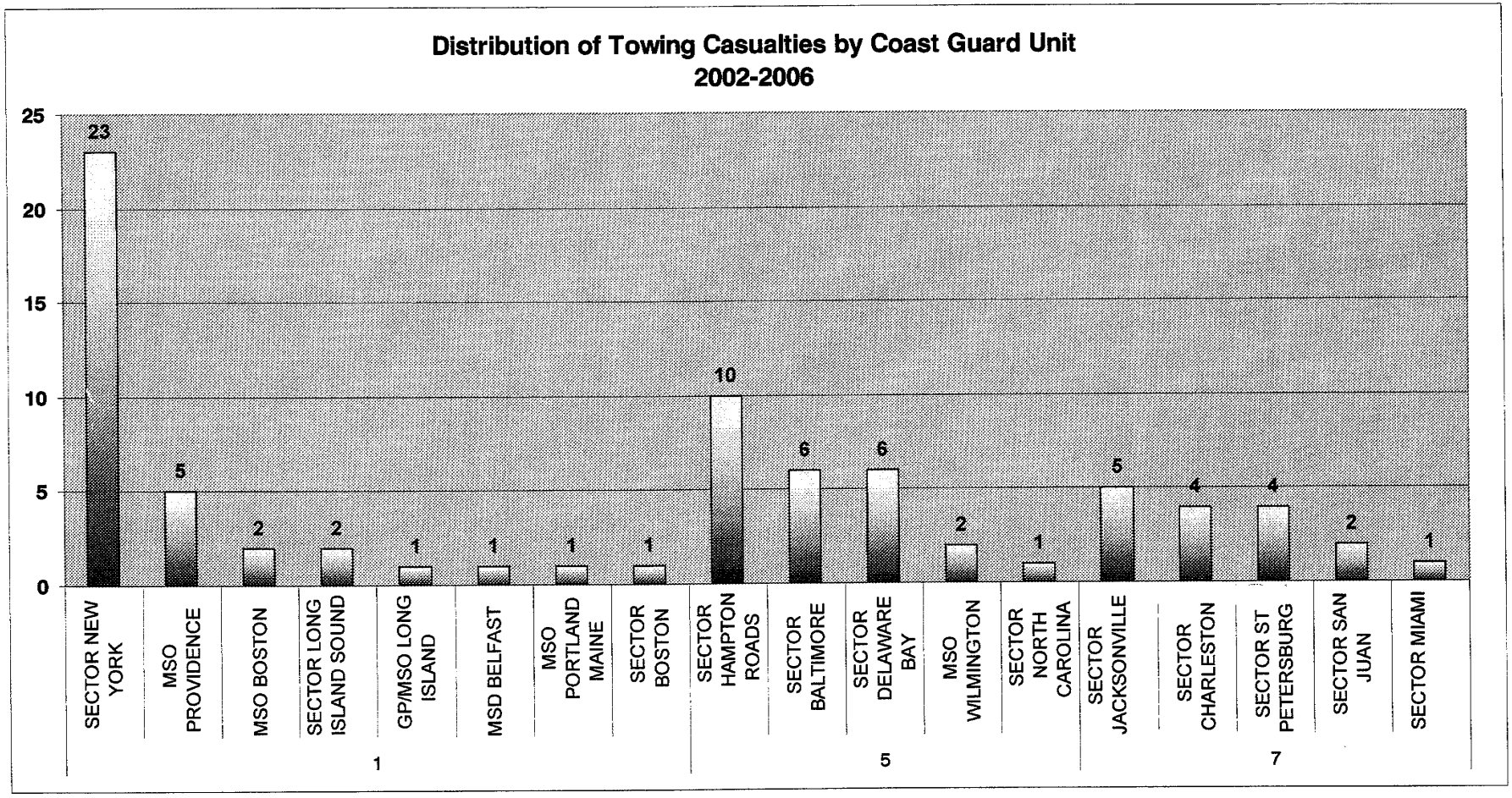
Coast Guard District Distribution



CG District 1 leads in number of severe marine casualties... Why? Is the highest concentration of towing work there? Or is there other reasons?

Baseline Data

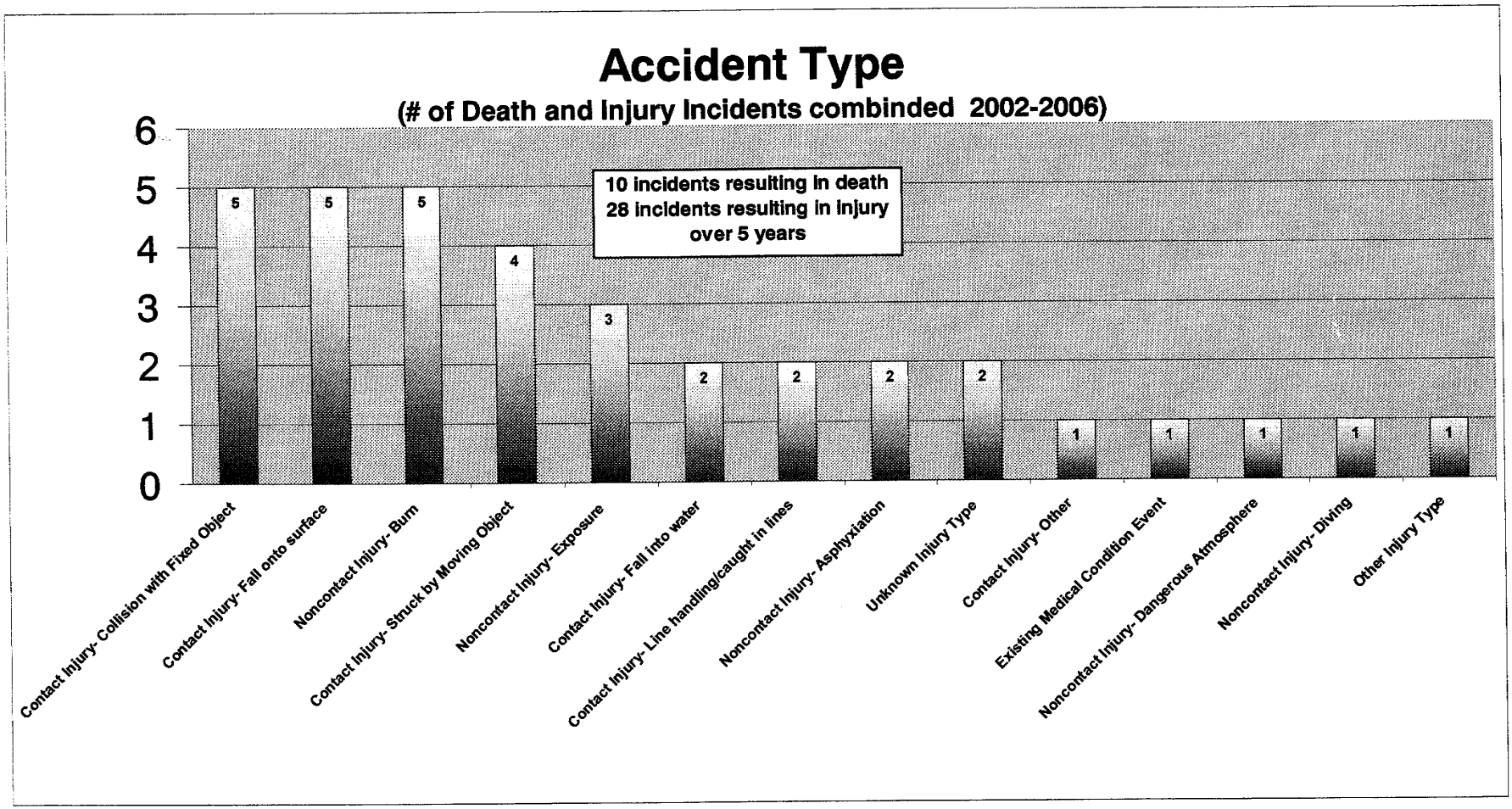
Coast Guard Unit Distribution



CG Sector New York is pulling CG District 1 numbers up. Why? Volume or greater hazards?

Baseline Data

Deaths & Injury Events



Cost Analysis

External: *Industry related*

Cost of Quality Worksheet / Cost of Casualty to Business Entity						
Problem Description: (Casualty)					Cost Type: External	
Average cost	**Hours for Task**	**Hourly Rate**	**Cost of Task**	**Material Costs**	**Failure Cost - Internal / External / Appraisal or Prevention**	**Total Cost of Nonconformance**
Document Casualty	2.0	$75	$150.00	$0.00	$150.00	$150.00
Internal Investigation	8.0	$75	$600.00	$0.00	$600.00	$600.00
Lost revenue	8.0	$1,000	$8,000.00	$0.00	$8,000.00	$8,000.00
Compensation	24.0	$75	$1,800.00	$0.00	$1,800.00	$1,800.00
Fine	NA			$0.00	$32,500.00	$32,500.00
Damage cost	NA			$0.00	$ 849,535.71	$849,535.71
Goodwill				$0.00		
Total Cost Per Failure						**$892,585.71**
Good Business						

Opportunity for process improvement.

This is a best guess and only takes into account estimated costs at the time an incident is reported to the CG on CG-2692 forms. If the project team or QAT could obtain industry real cost data, these figures would be much higher providing leveraging points for safety improvement buy-in

Causal Analysis - SHEL model

Grouping Categories

Software: The information and support systems guiding people (*Policies, procedures, laws, regulations etc...).*

Hardware: The vessels, facilities, machinery, cargo, equipment, & material people work with.

Environment: The internal and marine environment in which people work.

Liveware: The people themselves.

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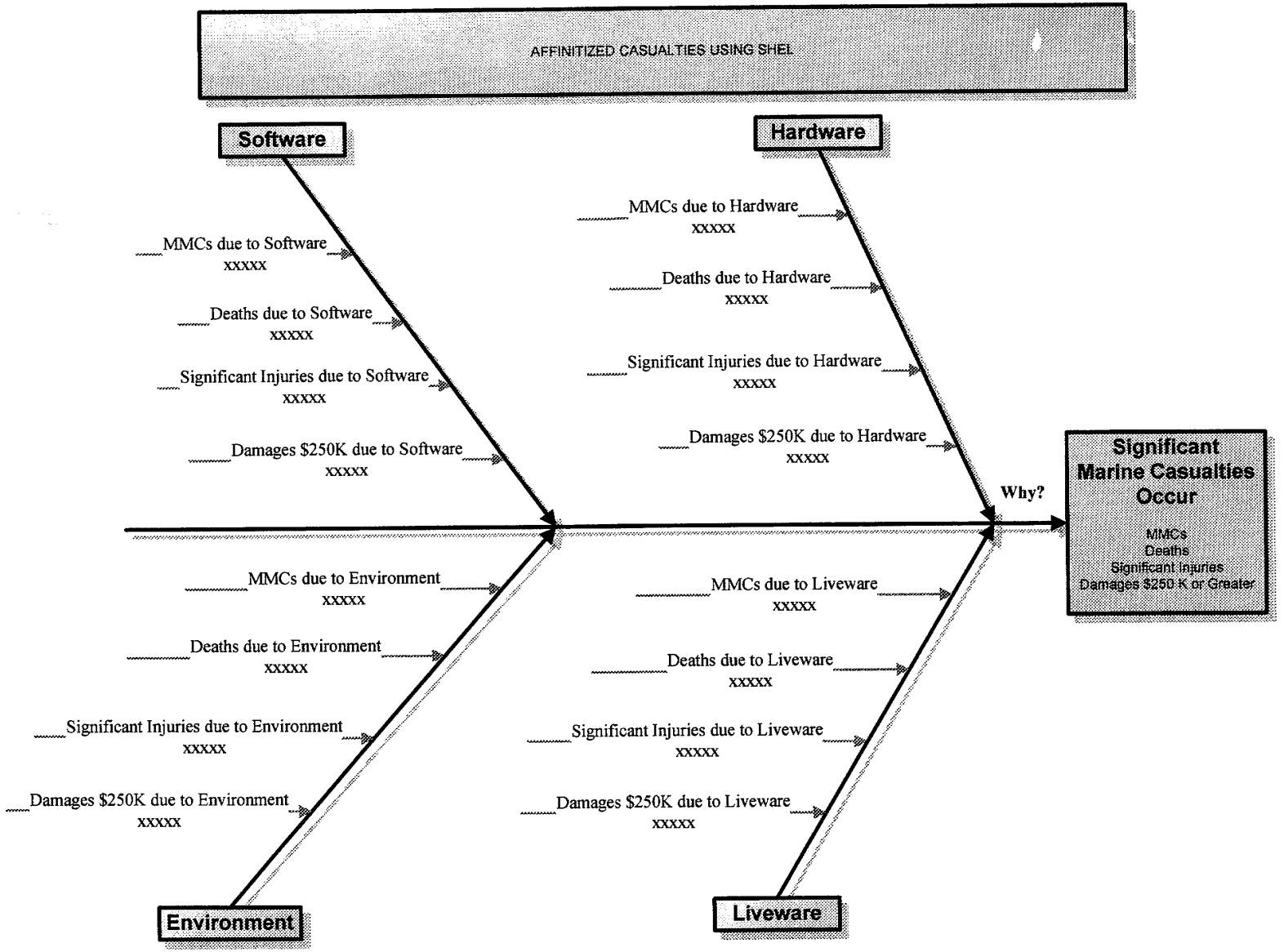
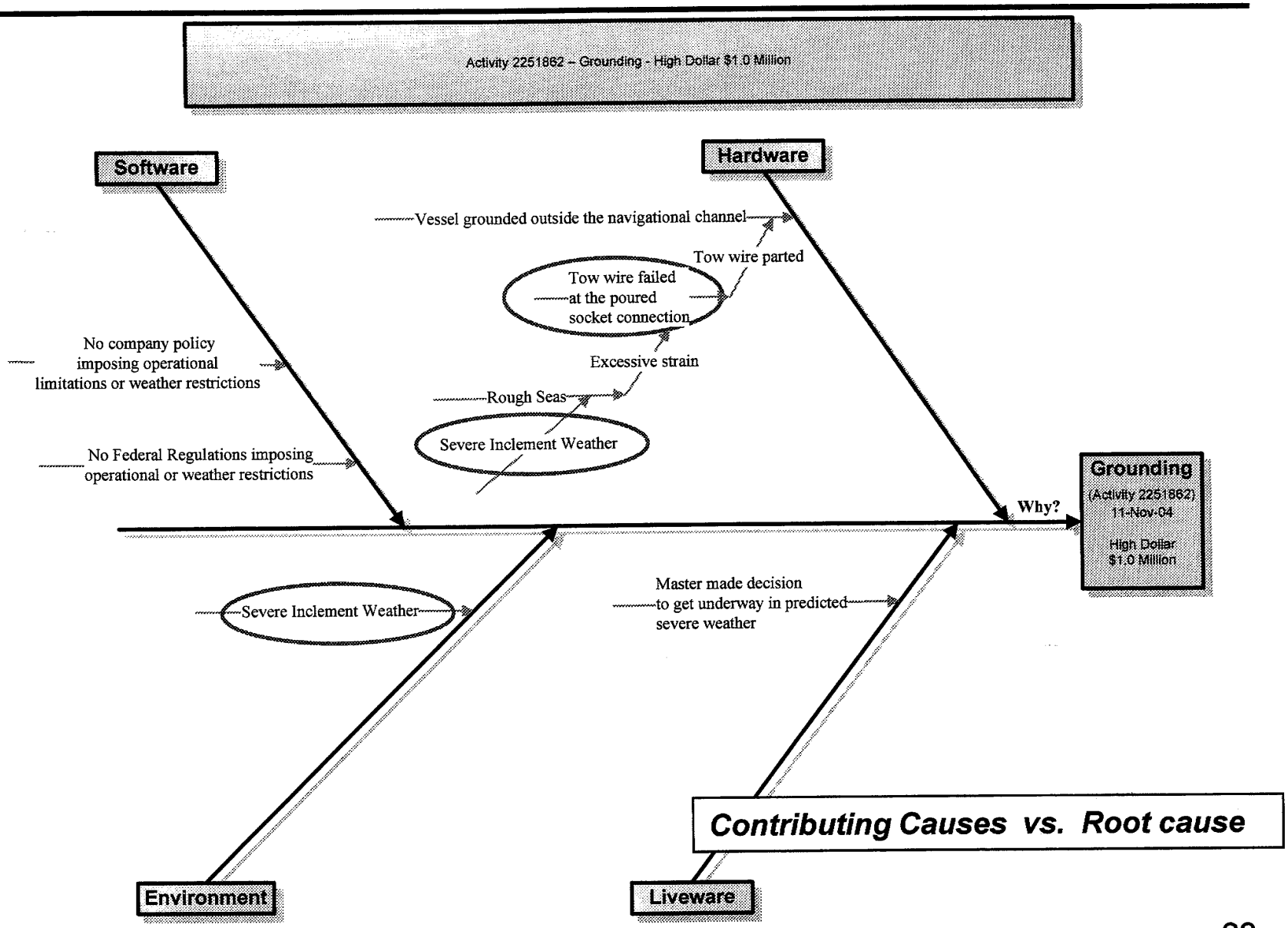
Causes of Marine Casualties

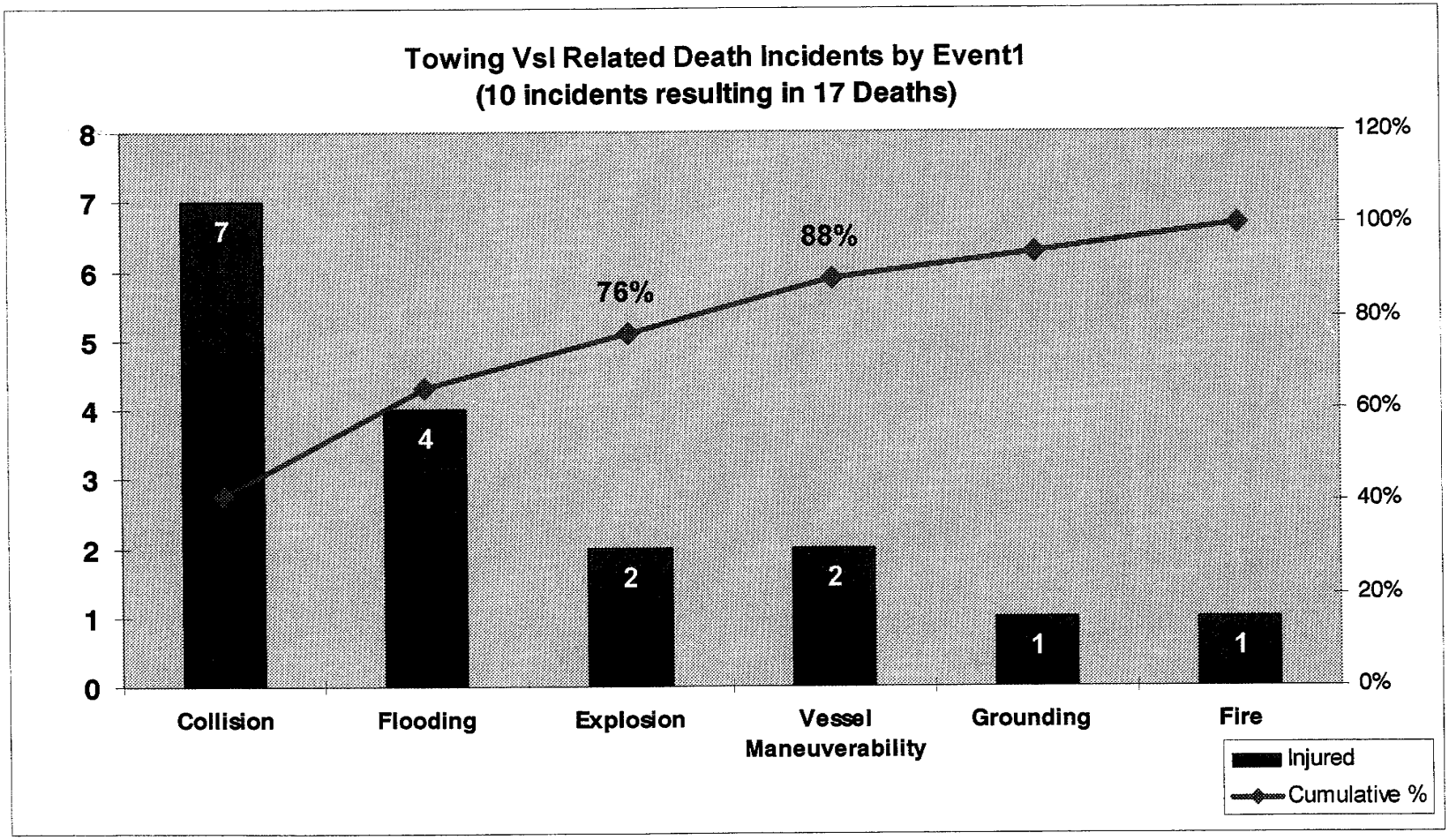


Cause and Effect Diagram



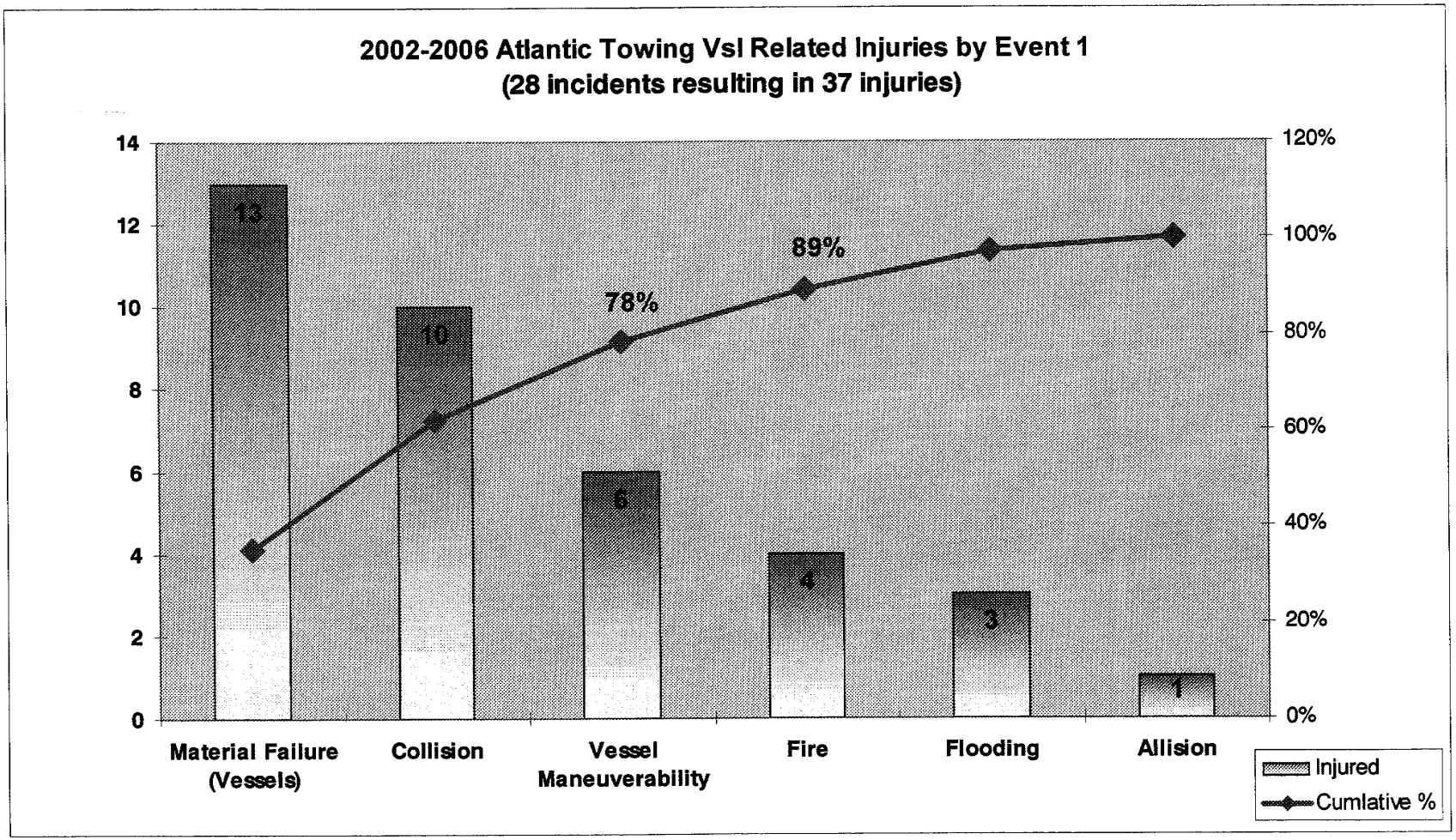
Deaths

Initiating Events Leading to Loss of Life



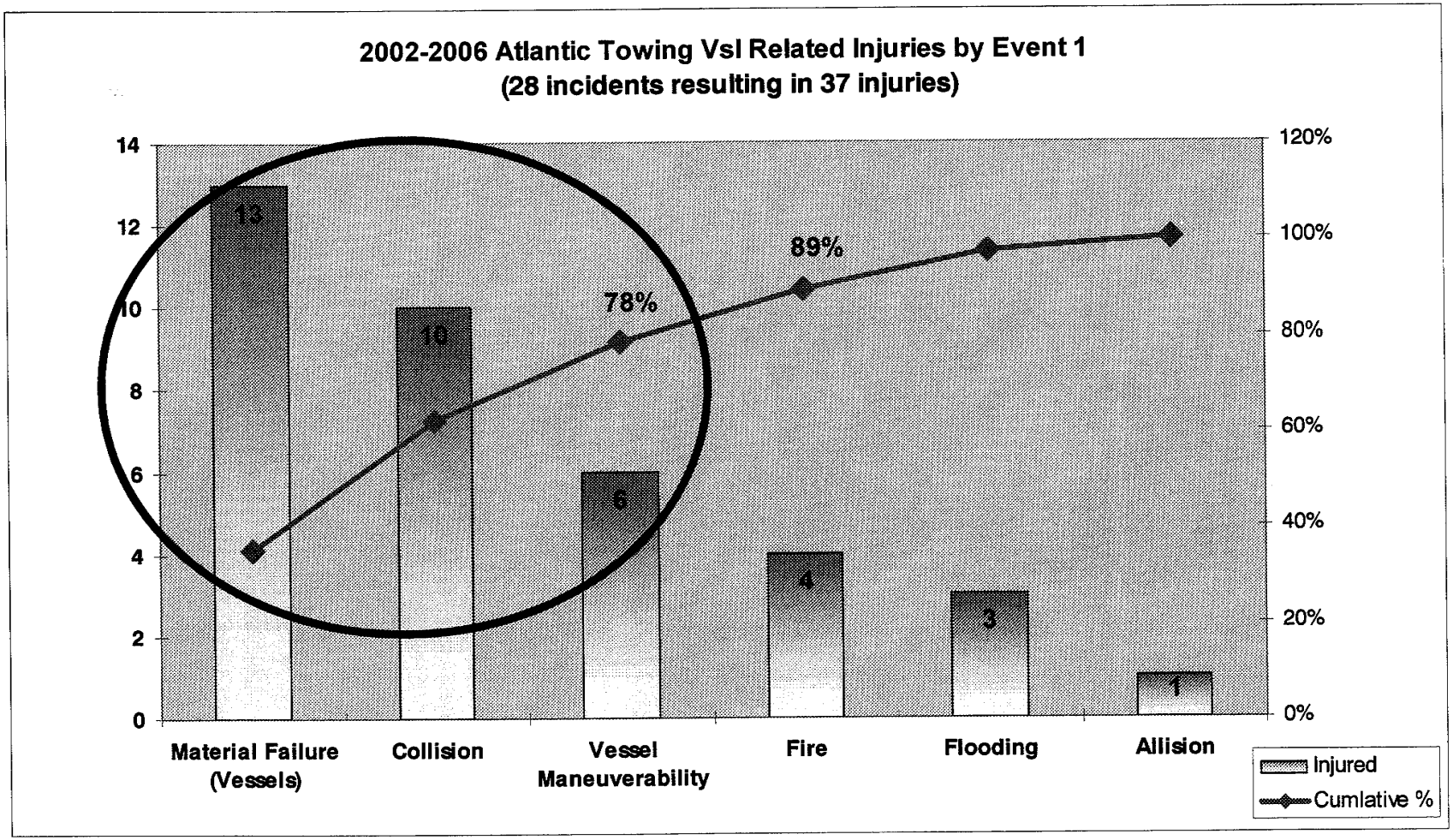
Significant Injuries

Initiating Events Leading Significant Injury



Significant Injuries

Initiating Events Leading Significant Injury



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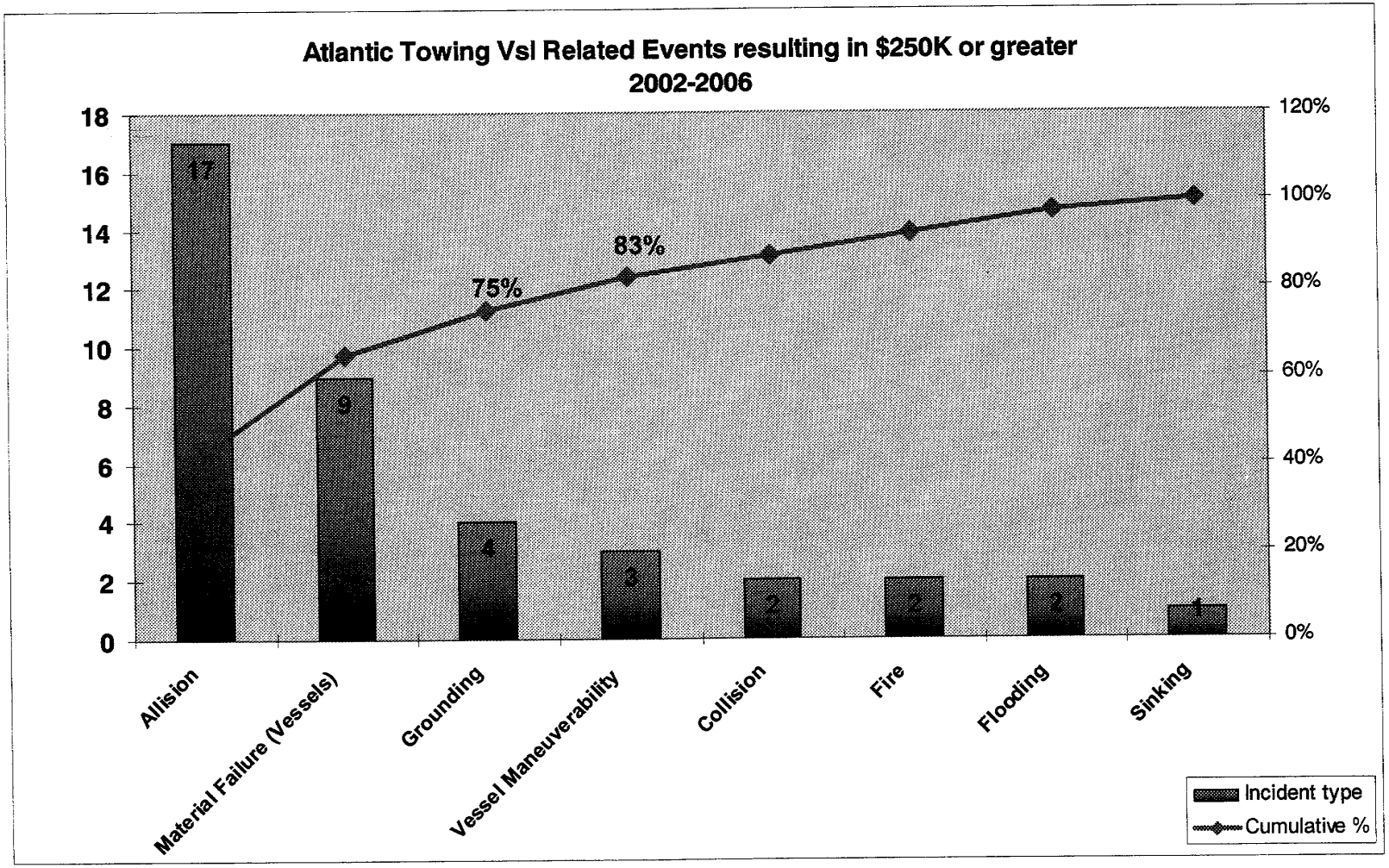
Damages

Initiating Events Leading to Damages $250K or greater



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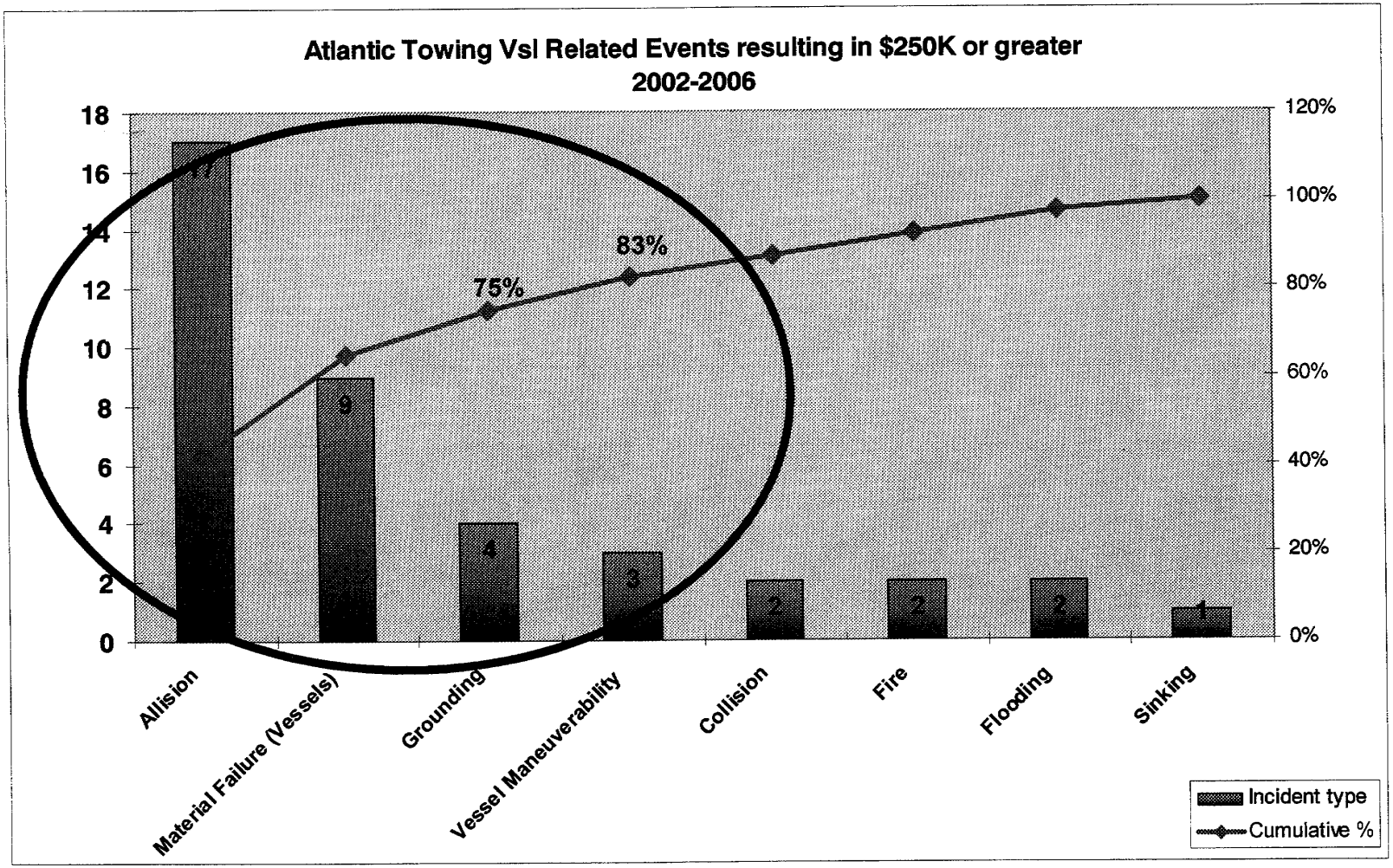
Damages

Initiating Events Leading to Damages $250K or greater



Measurement Plan for Causes

Example:

MEASUREMENT PLAN FOR: X Activity: 1493713 Loss of life (3) - collision, capsize, sinking

Purpose: Identify causative or contributing factors associated with medium and high severity towing vessel incidents as defined by the ARQSC. (Severity Level 4 & 5)

Key Process *Input* variable (X)	Operational Definition	Unit of Measure	How Measured			Actual Measure of X	Analysis			
			Measurement Method/ Source	Frequency/ Time Period	Who/ Responsibility		Subjective / Data	Is X Root Cause ?	5 Whys?	Root Cause
Weather – sudden fog	Visibility	Miles/feet	Witness estimate	Per Event	Witness & IO	0 - 100 ft	Subjective/ WX facts	Yes		
Cluttered RADAR	Target clarity	Visual	Witness statement	Per Event	Witness & IO	Not available	Subjective	No	WX	No
Watertight integrity of tug not maintained while underway	Number of non-watertight openings	Count	Evidential evidence	Per Event	Witness & IO	2 Watertight doors in open position 2 Wall mounted A/C units installed watertight bulkhead	Count	No	Policy Procedure People	No
NAVRULES	Safe Navigation	Count Violations of	Witness		Witness & IO	Failure to: - Post lookout - Avoid collision	Subjective	No	Failure to avoid collision	No

Notes: Measurement data collection plan is recorded for all key process ***input*** variables.

Causative or contributing factors associated with each outcome

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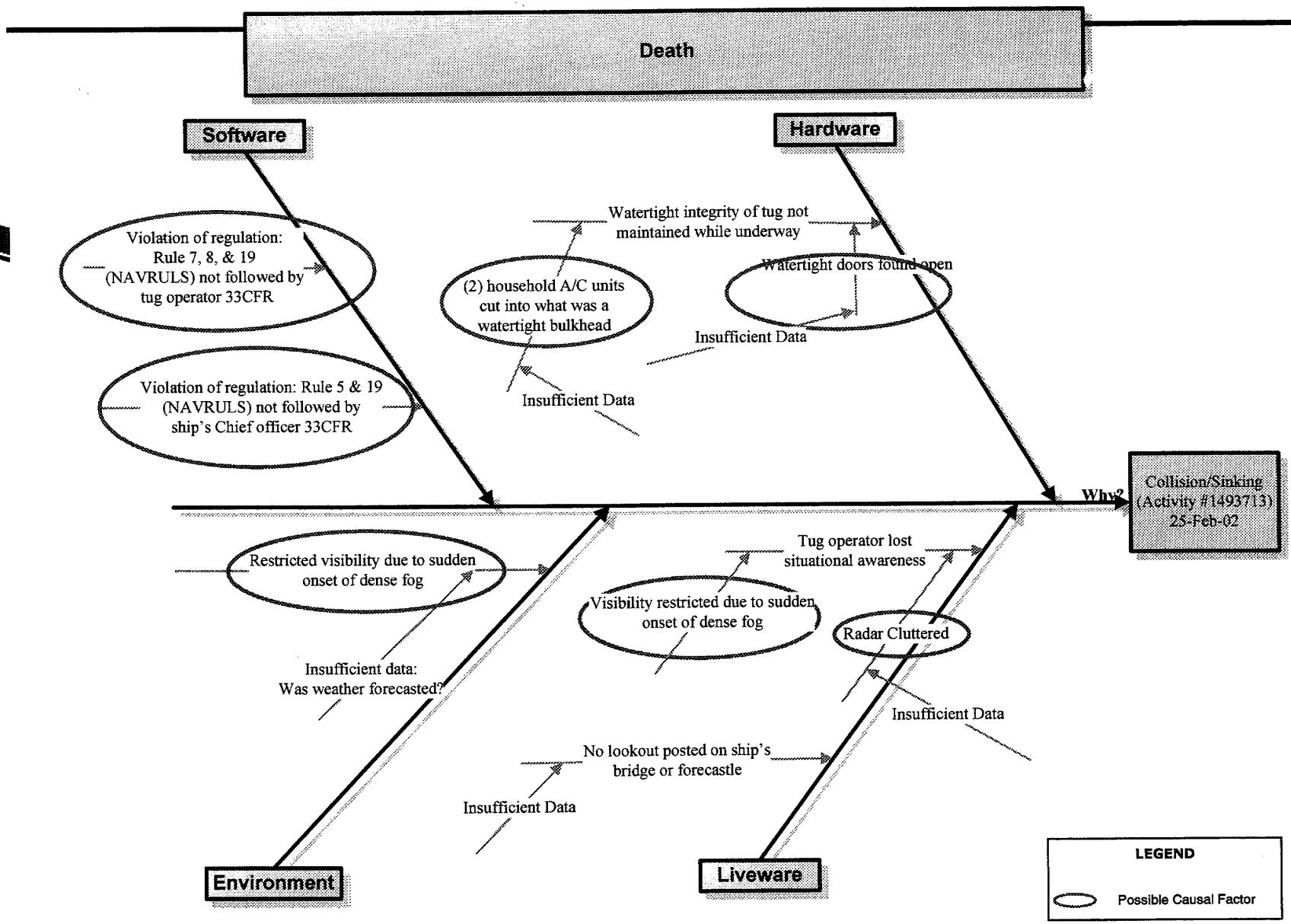
Cause & Effect Analysis



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Root Causes

Baseline Process Measures

MMCs

In calendar years 2002-2006 there were 21 incidents meeting the thresholds for a MMC

Deaths

In calendar years 2002-2006 there were 10 incidents that resulted in 17 deaths

Injuries

In calendar years 2002-2006 there were 28 incidents that resulted in 37 significant injuries

Money

In calendar years 2002-2006 there were 40 incidents that resulted damages of $250K or more. Total Damage costs = $ **64,625,629.00**

Progress: 06Nov07

- ✓ Baseline Data identified
- ✓ Initiating events leading to casualty Identified, affinitized
- ✓ Graphical displays
- ❑ Root causes: Still analyzing

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Project Soft Benefits

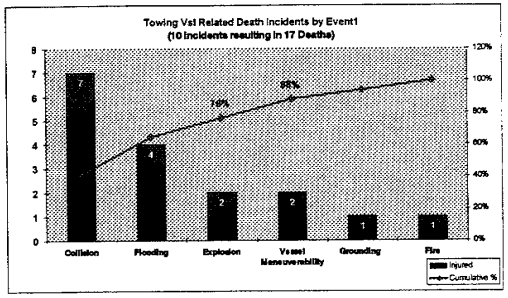
ARQSC:

If the AQRSC can DESIGN a process using DMAIC methodology for warehousing/ indexing and accessing in-depth casual data that can be directly or indirectly translated into actionable solutions to prevent or reduce the below outcomes from marine accidents...

Then hard and soft benefits may be realized in the future.

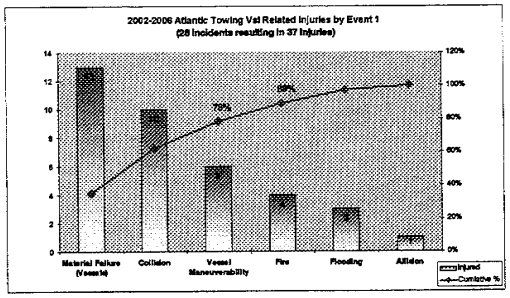
Deaths

In calendar years 2002-2006 there were 10 incidents that resulted in 17 deaths



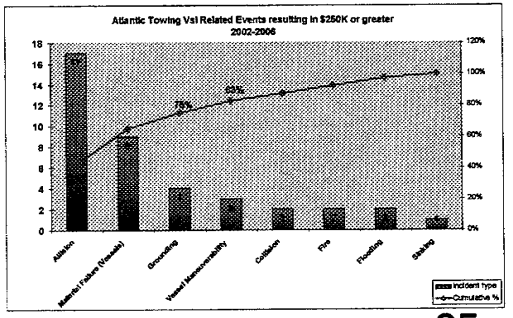
Injuries

In calendar years 2002-2006 there were 28 incidents that resulted in 37 significant injuries



Damages

In calendar years 2002-2006 there were 40 incidents that resulted damages of $250K or more. Total Damage costs = $ **64,625,629.00**



IMPROVE Phase

IMPROVE Phase

- ❑ Improvement Strategy *(include obvious Quick Hits)*
- ❑ Alternative Solutions for each Root Cause
- ❑ Evaluation of alternative solutions
- ❑ Improved/redesigned process
- ❑ Pilot test results *(if applicable)*
- ❑ Implementation Plan

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Potential Solutions

Constraints & Barriers

The current AQRSC Towing Casualty QAT effectiveness is limited by lack of access to quality information. The project team brought two existing challenges/constraints to light:

1. The first constraint is founded both in the lack of detailed information in MISLE investigation records and the framework of how information is stored and retrieved from MISLE

2. The second constraint stems from the perceived reluctance of industry to share amplifying information not brought out during the preliminary investigation by the CG Investigating Officer.

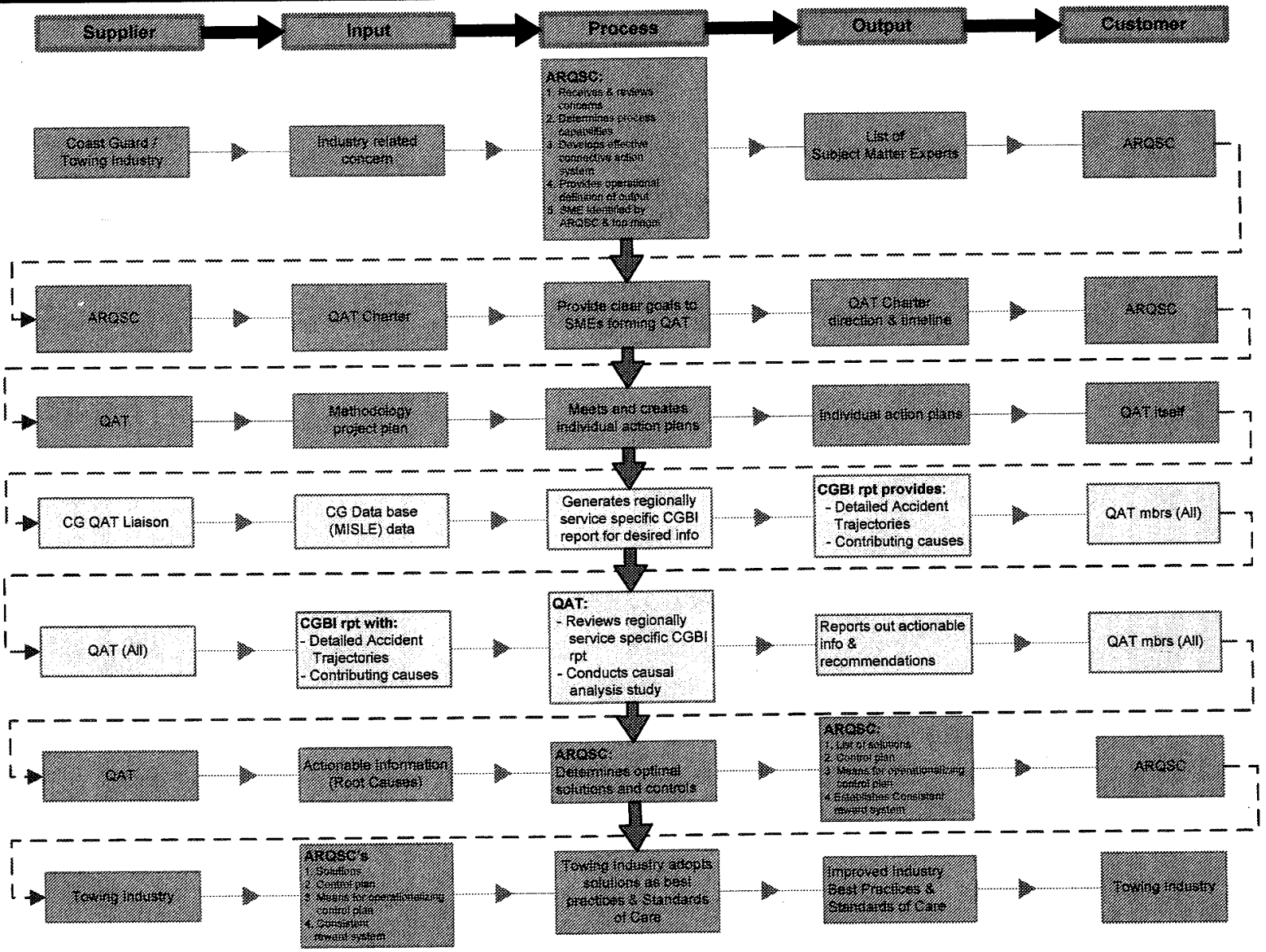
Solutions

1. Project team believes the ARQSC needs to DESIGN a methodology & process for conducting in-depth casualty analyses before further improvements can be realized.

2. Improve the quality of the CG Investigation process by ensuring all contributing causes are identified and documented in the investigation record including factors involving Software, Hardware, Environmental and Liveware. (to enhance future analysis)

3. Alter industry perception - Involved parties become true stakeholder in investigation process – Ask & answer 5 Whys to fullest extent possible before completing CG-2692 forms

Improved ARQSC SIPOC



Improved ARQSC Process

Opportunities for process improvement.

Opportunities for process improvement.

1. ARQSC formally adopts the DMAIC process for QATs
2. Improve QAT synergy by meeting more frequently.
3. Continue to attempt to obtain industry and Coast Guard real cost data to provide leveraging points for safety improvement buy-in and the value provided by in-depth investigations
4. Create a repeatable Towing Casualty report in CGBI to standardize
5. Improve the quality of the CG Investigation process by ensuring all contributing causes are identified and documented in the investigation record including factors involving Software, Hardware, Environmental and Liveware. *(to enhance future analysis)*
    a. Alter industry perception - Involved parties become true stakeholder in investigation process – *Ask & answer 5 Whys? Before completing CG-2692 forms.*
    b. Investigating Officers and Involved Parties adopt 5 Whys?

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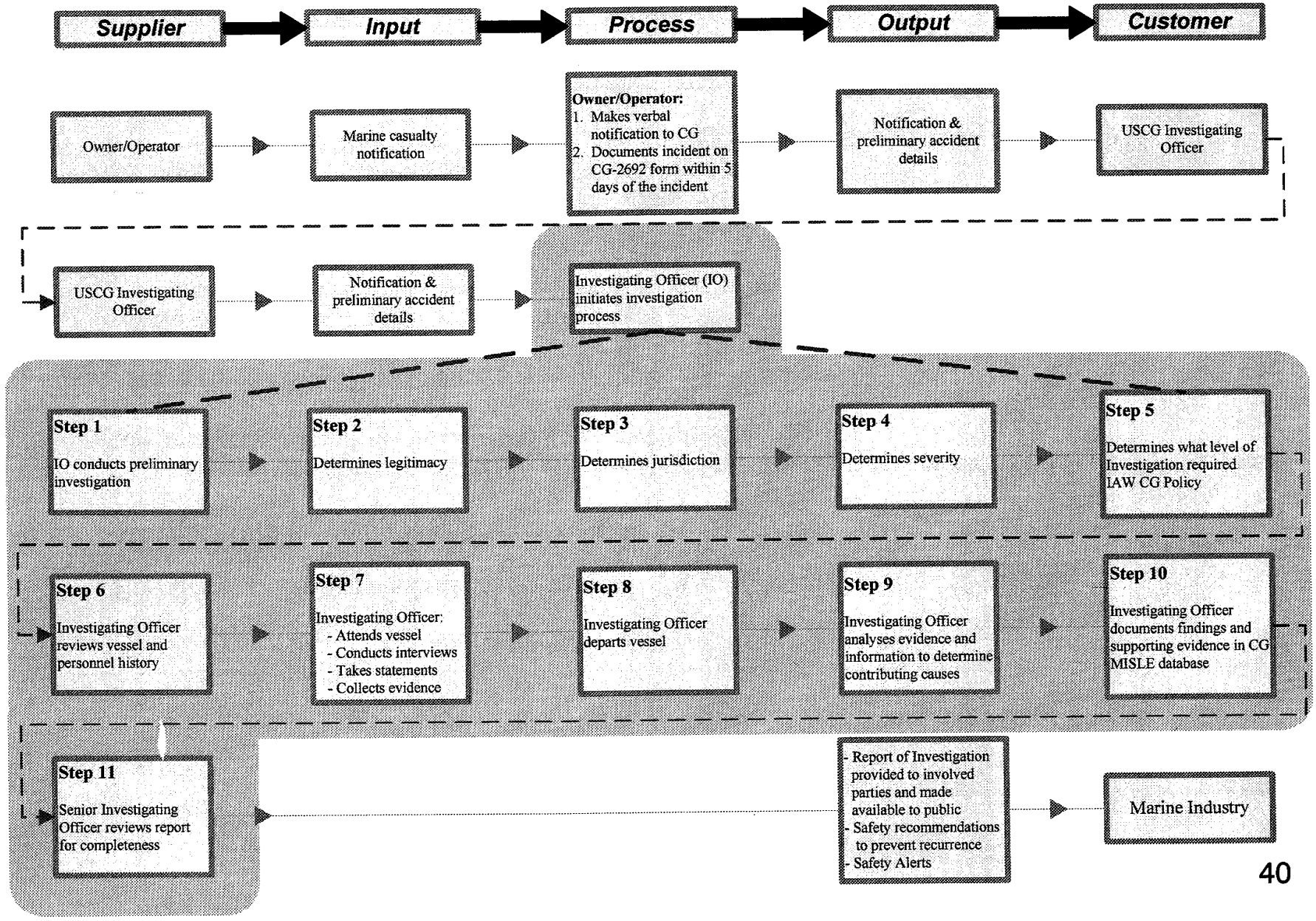
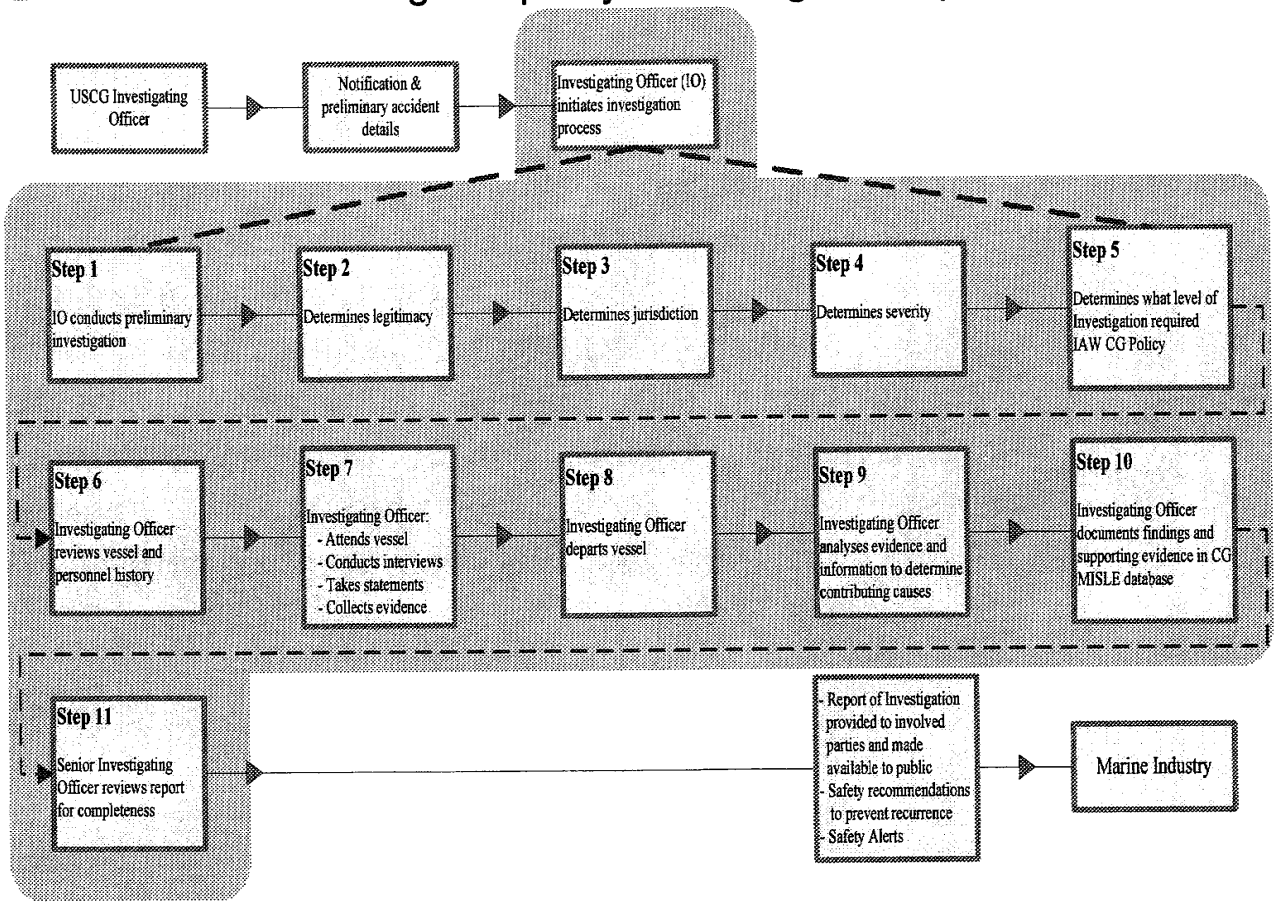
Marine Casualty SIPOC



Improving Investigation Results

Next Steps

- Determine CTQs for CG Investigation Program
- Process map existing processes
- Determine the causes hindering the quality of investigation reports



CONTROL Phase

CONTROL Phase Deliverables

- How to monitor progress of Implementation Plan
- Process Control Plan
- How to measure/monitor outcomes (Y's) and causes (X's)
- How to remedy future "out of control" situations
- Closeout results (project documentation)
  - What the team did
  - What the team accomplished (Y's)

Process Control Plan

Premature at this time.

Process Controls

Response Plan

Summarize the how defects should be addressed. Who? When? How?

A detailed control and response plan should be included in an appendix.

Training Plan

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Implement Optimal Solution

Implementation Schedule

Process Ownership

Verify Results

Project Wrap-Up

Celebrate!!!

Future Actions

Opportunities for process improvement.

1. Brief improvement findings to the AQRSC and communicate identified road blocks and constraints
2. Continue to increase industry cooperation in support of study
3. Improve quality of CG causal analysis data

Coast Guard Analysis Contacts

Project Team

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THANK YOU