

No. 238  
September 1981

MARITIME TANKER SAFETY: SOME CONCLUSIONS  
AND RECOMMENDATIONS FOR IMPROVEMENT

by

Roger A. Peterson, D.B.A.  
Associate Professor  
Department of Marketing  
Eastern Michigan University

Presented at the October 22, 1981  
meeting of the Great Lakes Section of the Society of  
Naval Architects and Marine Engineers held in conjunction with the  
Centennial of naval architecture and marine engineering at  
The University of Michigan



Department of Naval Architecture  
and Marine Engineering  
College of Engineering  
The University of Michigan  
Ann Arbor, Michigan 48109

### Abstract

The author has recently completed a worldwide study of serious maritime oil tanker accidents occurring between 1964 and 1977.<sup>1</sup> In this paper he presents a summary of the research with emphasis on the conclusions regarding the causes of tanker accidents and recommendations for future action to reduce the occurrence of such events.

The paper begins by reviewing the role that the vessel owner, the Nation of Registry and the vessel itself play in accidents at sea. It then proceeds to review the state-of-the-art in marine casualty investigation and casualty data.

The work continues with the author's recommendations for improvements designed to improve the situation regarding tanker casualties as it now exists. These recommendations are presented in two parts. First, a series of short term actions designed to have an immediate effect on reducing the likelihood of serious tanker casualties. This is followed by long term recommendations showing the directions that future policy and research might take.

The author concludes with a statement about the future and what it holds if appropriate and timely action is not undertaken to minimize the present problems at sea.

---

<sup>1</sup>Roger A. Peterson, Maritime Oil Tanker Casualties (1964-1977): An Analysis of Safety and Policy Issues (Rotterdam: Maritime Research Institute Netherlands, 1981).

## CONTENTS

	<u>Page</u>
1. Introduction	1
2. Findings	2
3. Recommendations	5
Short Term Actions	5
Long Term Actions and Future Research	8
4. Implications of the Study	12
A Closing Note	13
Footnotes	14

## 1. Introduction

In a recent memorandum discussing maritime safety, The Nautical Institute of the United Kingdom stated that the present situation at sea involves:

". . . an unnecessary and excessive loss of life at sea, loss of ships and cargoes and an increasing potential danger to the marine environment. The effect of the rising level of gross tonnage lost resulting in higher costs of goods and services places an unacceptably high financial burden on the public."<sup>1</sup>

The situation regarding maritime oil tankers is no better. Between 1964 and 1977, total losses of such ships amounted to 220 vessels of 6,000 dead-weight tons or above becoming total losses and 1,115 persons losing their lives. Environmental damage can only be guessed at but 1,777,000 tons of oil spilled into the ocean as a result.<sup>2</sup>

Between 1978 and 1980, the author conducted a study of these casualties in an attempt to determine the causes of such accidents and to develop recommendations that will reduce the occurrence of these losses.<sup>3</sup> In the material to follow, the results of that study will be presented.

## 2. Findings

First and foremost, of all the factors relating to the frequency of oil tanker accidents, none turned out to be more critical than the attitude and nature of the management who ultimately control vessels and their operations. If any one factor can be considered to be of primary concern it is this one. The accident record of reputable owners (for example Exxon, Japan Lines and Peninsular and Orient to name a few) are excellent regardless of the age, size or flag of vessels involved.

Reputable owners insist upon and enforce rigid standards regarding qualification and licensing of their crews. In addition, such owners were also found to require that ship personnel receive thorough and ongoing training as well. As a further incentive to safety, some operators also insist that chartered vessels be required to meet high standards of safety and qualifications, treating chartered vessels as if they were part of their own fleet.<sup>4</sup>

The next major factor found was the character of the nation of registry. Principally, this relates to the manner in which the flag state administers and enforces safety measures, either its own national regulations or internationally accepted and ratified standards.

The evidence indicates that a number of nations, in particular Liberia, Panama and Greece, while accepting and ratifying international standards of licensing, safety and inspection, are not making any appreciable progress in improving their safety record.<sup>5</sup> This failure can be attributed to the fact that these nations lack the resources and the administrative machinery required to effectively control such matters. The process of vessel monitoring and vessel inspections have been almost exclusively left in the hands of the classification societies. While certain ship inspection personnel may receive designations as inspectors for these countries, there are no standards or exams for appointment. Recent years have seen a mounting barrage of criticism arising over these practices.<sup>6</sup> In particular, the critics have focused on the issues of secrecy and differences in standards between various classification societies.<sup>7</sup>

This can be a very dangerous procedure because unlike the United States, these countries lack an effective enforcement agency of a character similar in nature to the Coast Guard. Since these countries enroll tonnage far in excess

of their national requirements, many if not most of the vessels under their flag rarely visit the ports in which they are registered. Thus, even if the governments wish to monitor vessel condition, they must do so at ports in other countries. While such a system is possible, it is an expensive and difficult proposition to administer and operate effectively.

While criticism can and should be leveled at the licensing of ship's officers in almost every nation because they lack a requirement that applicants demonstrate practical shiphandling ability, the open registry nations are particularly deficient in this area. They have a history of adopting a careless approach to the issuance of licenses, issuing credentials on the basis of documents presented as proof and doing little in the way of checking for authenticity or in investigating the character and background of applicants.<sup>8</sup>

In fact, the very existence of open registries poses a serious problem in regard to the issue of safety. Even if one accepts that public pressures have caused Liberia and Panama to improve their systems and that Greece's accession to the European Community will result in an improvement in its system, a problem will remain. The owners of sub-standard tankers can merely transfer their ships to other emerging open registries (Bahamas, Bermuda, the Cayman Islands, the Maldiv Islands, Somalia, the Seychelle Islands). Even Vanatu (formerly the New Hebrides), an island nation of only 110,000 people has announced such a registry and opened a registration office in New York City.<sup>9</sup>

Age was the most prominent vessel-related factor encountered, with older tankers presenting the greatest opportunity for loss. The danger begins in the vicinity of 10 years of age and becomes particularly critical in the range of 16-20 years of age. Tankers in these older age brackets must be maintained to strict standards of upkeep if breakdowns and accidents are to be avoided. There is strong evidence to indicate that in many instances such is not the case. Certain owners are allowing these older ships to run down and gambling on safety to make money.

While the size of vessels did not turn out to be a major factor in the frequency of tanker accidents, there is evidence to indicate that it may well be a factor in the severity of an accident.<sup>10</sup> When VLCC's or ULCC's get into trouble, they require large, sophisticated and expensive salvage equipment to

save them. The evidence indicates that this equipment is becoming scarce because the owners of such equipment maintain that the increasing cost of suitable equipment and the increasingly complex environment in which they must operate prohibits further investment.<sup>11</sup> They say major changes are required.

The research also indicated that there are gaps in our knowledge as well. We lack much in the way of maritime casualty data coverage and dissemination. The human aspect of casualties is an unexplored and greatly neglected area. Little attention has been given to this factor and we know little about it. This is somewhat surprising for almost all studies and works in the area of marine casualties agree that human error is the cause of the majority of accidents. Further, the present systems of casualty reporting are diverse and non-uniform. In consequence it becomes difficult and expensive to reconcile these many systems. In this process much of the information is lost. In the study under review this was evidenced by an inability to determine the impact of location on tanker accident frequency.

### 3. Recommendations

If we wish to minimize tanker accidents and their consequences a two-pronged effort will be required; immediate short term actions designed to have a quick impact and based on what we do know; long term research oriented efforts designed to improve the current situation and a need for research into those areas where our knowledge is limited.

#### Short Term Actions

The first area of immediate action should be directed to the nature of ownership. Nations must recognize that this is the area offering the best opportunity to administer and enforce safety standards for tankers. However, to accomplish these goals they must be able to identify those who actually control the vessel. Therefore, it is necessary to correct the present situation where true ownership and control is hidden within a maze of interlocking companies.<sup>12</sup> If necessary, the ships of nations who refuse to require identification of owners should be barred from entering other nations's waters. Once identification of ownership has been accomplished, it should be coupled to a program of enforcement. Not only should crew members be subject to fines and imprisonment for violations of safety standards, owners and operators should also be liable. Vessels in sub-standard condition and their owners must be identified so that steps can be taken to remove the vessels from service and force the owners out of business.

Owners and/or operators who choose to disregard safety and operate dangerous vessels should be made liable for their actions in this regard. Evidence of deliberate disregard for safety and environmental concerns by managers, owners or crews should be grounds for fines, imprisonment or revocation of the right to operate.

Methods of communication between nations must be developed so that owners under investigation or conviction cannot simply transfer their vessels to a new flag. One proposal made recently appears to be an excellent one, that a record be kept of tankers and their safety record.<sup>13</sup> This would permit another recommendation to be put into effect, that of a common chartering policy, suggested by van Poelgeest.<sup>14</sup> Under his system there would be a worldwide common chartering policy for tankers. Before any tanker was chartered, its charterers would investigate the vessel's casualty record, crew competence,



vessel condition and inspection condition and the past record of her owners and/or management.

Actions should also be taken against nations who turn a blind eye to sub-standard tankers that operate under their flag and who freely allow the entry of such vessels into their registry. Barring such a nation's ships from trade and/or ports of other states is one such measure.

In regard to crew qualifications, the 1978 STW Convention is a step in the right direction but it must be followed through and improved upon. All nations should be striving for a set of uniform standards for crew examinations, physical fitness and including a requirement for a demonstration of practical competence by officers, perhaps by means of simulators.<sup>15</sup>

In addition, special endorsements and examinations should be required for various categories of ships and ship sizes. Licenses should be issued for a specified term and require a physical examination for renewal as well as some proof of current competency either by certified service or by examination.

Nations must recognize that while there is nothing inherently wrong with the use of reciprocity in the issuance and acceptance of licenses between nations, there must be some checks and safeguards employed if reciprocity is employed. First, before any nation issues a licence on the basis of another nation's licence presented by the applicant, they must establish the authenticity of the credentials and the character of the applicant. While such a background check may take time and cause inconvenience, such problems can be minimized by making the initial license issued a temporary one good for only a very short period. During this period the applicant is investigated and the license is either revoked, allowed to lapse or replaced by a permanent one.

When nations cancel licenses or take other major disciplinary action they should insure that information regarding such actions is made readily available to other nations. Such action will make it much more difficult for crew members to evade punishment by holding licenses from multiple nations.

In regard to vessel condition, a worldwide system of vessel standards and inspection procedures should be established. These standards and procedures should be developed and detailed at the government level.

The inspection of vessels can be left in the hands of classification societies but must be monitored and spot-checked by government employed inspectors. Any inspector, either government or privately employed, should be certificated and appointed only after careful screening and examination. Lapses of performance by such personnel should be dealt with by fines, suspensions or revocation of appointments as appropriate. Classification societies' operations must be carefully monitored and controlled. Any conflict of interests between their responsibilities as inspectors and as agents of shipowning firms must be prevented by regulatory action if need be.

The study showed that age is a significant factor in the frequency of serious tanker casualties. Therefore special programs of inspection and monitoring must be devised for older tankers involving more detailed and/or more frequent inspections of such vessels.

Whether or not such action is taken may prove to be crucial in the immediate future. The world tanker market is fragmented and tanker demand has been drastically altered.<sup>16</sup> Supertanker supply exceeds demand because of small cargoes moving. In consequence new supertankers are operating at a loss while older, smaller tankers are making profits.<sup>17</sup> If this situation continues, more older and smaller tankers will be kept in service.

To cope with this situation and its attendant problems, classification society inspections must be backed up by a program of government conducted inspections. Such inspections can and do have an effect. After 18 months of operation, the tanker boarding and inspection program of the U.S. Coast Guard showed a distinct improvement in the situation, in that the number of safety violations found decreased and that many tankers cited for numerous safety violations left the U.S. trade.<sup>18</sup>

Governments should also recognize that all states and particularly coastal nations have a vital interest in preventing tanker losses. Since economic and environmental concerns are often opposed when a tanker is in trouble, governments should be prepared to intervene as necessary. The actions in this regard taken by the French<sup>19</sup> and Somalian<sup>20</sup> governments in hiring salvage tugs to stand by dangerous traffic areas is one such step. It is far cheaper and easier to prevent a tanker accident than it is to clean up the pollution following a loss.

The author recommends a program in which governments agree to cooperate and to share the costs of salvage equipment and facilities. For example, it would be in the best interests of many nations to avoid accidents in the English Channel. Thus it would appear to be desirable for a number of countries to collectively agree to provide and fund the necessary equipment, ment and facilities to ensure adequate protection for this area. Another action, suggested by one salvage expert, is for certain areas and ports to be designated and equipped as havens and refuges for stricken tankers.<sup>21</sup> Such action would reduce confusion and facilitate the salvor's task.

IMCO's role also requires modification. IMCO should be given the power to monitor and enforce compliance. Member nations should no longer be allowed to make only a show of compliance. The Maritime Safety Corps should be expanded and their present passive and advisory role modified. They should also function as an inspecting and monitoring agency, reporting non-compliance and violations by member nations. IMCO should be given authority to use fines, suspension and expulsion of members for non-compliance with safety measures they have ratified.

The achievement of these goals is bound to be difficult because of the political aspects. IMCO is a political creation and politically motivated. But if the United States, Canada, France and other safety oriented nations use both their political power and their economic power, they can force changes to be made. The developed nations who regulate their fleets possess tremendous economic and political leverage which can be used to achieve safety measures. It is the attitude of the United States and France and their threats of severe unilateral action that has created an atmosphere where certain conventions and expensive retrofitting measures have been accepted in the name of safety.<sup>22</sup>

#### Long Term Actions and Future Research

Two areas of research worthy of future work and essentially long term in nature were found by the study.

First, there is a lack of detailed information regarding maritime tanker casualties. The situation in this regard has become serious enough to justify concern and discussion at a major conference of the tanker industry.<sup>23</sup> The

data that is available is all too often aggregated, incomplete or outdated, making analysis difficult. Further, there is a lack of standardization in terms of definitions and terminology. Foremost among these needs is a commonly accepted definition for a serious accident. Since it is impossible to cope with every possible contingency, we must have a system of priorities. Without an accepted measurement that can be used to distinguish between major and minor concerns, we cannot institute a system of priorities. While the United Kingdom's definition used in this study constitutes a distinct improvement over earlier efforts, it represents only a first step toward refinement.

We also need to develop common and accepted definitions for vessel class and size limits so that it will be easy to use data from differing sources in an efficient manner. Without such standardization it is difficult, at times impossible, to use data derived from different sources.

Finally, information is required in sufficient detail so that we can answer the following questions about any tanker accident.<sup>24</sup>

1. What caused the accident (human error, mechanical failure, etc.)?
2. What type of accident resulted (grounding, collision, etc.)?
3. What events followed the accident (oil spill, explosion, etc.)?
4. What damage and losses were involved (loss of life, structural damage, environmental damage, etc.)?
5. What secondary factors may have contributed to the accident (weather, navigation aids, etc.)?

If these questions are to be answered there is a need to arrange for an orderly and systematic method of collecting casualty information. While not intended to be exhaustive, Table 1 illustrates the essential information required to properly analyze a tanker casualty.

TABLE 1

ESSENTIAL INFORMATION REQUIRED TO ANALYZE A TANKER CASUALTY

A. General Factors

Type of accident  
Cause of accident  
Events following accident  
Damage and losses

B. Human Factors

Master on watch?  
If not, who was in charge of watch?  
    Their rank  
    Experience and training  
    Fatigue factor  
Was pilot aboard?  
    If so, did pilot have the conn?  
Proper procedures followed?  
Training and experience of crew  
Nationality

C. Vessel Factors

Design (clean tanker, dirty tanker, combo.)  
Size  
Product on board (crude, refined, etc.)  
Equipment status (navigation, cargo, machinery, etc.)  
Maintenance and repair status (age, overall condition)  
Flag of registry

D. Environmental Factors

Time of accident  
Weather conditions  
Location (at sea, costal, in-port)  
Other vessels invovled

---

Source: W. O. Gray, "Vessel Casualty Records: Better Information Systems Are Needed to Study the Causes of Accidents," Exxon Marine, Vol. 20, No. 4, December 1975, pp. 7-8, as modified by the author.

The second area of concern is our lack of knowledge regarding the human side of tanker casualties. While almost all authorities agree that human error is a major cause of tanker accidents, little has been done to identify why this is so and what can be done to improve the situation.

The author believes that we need to take action modeled on the aviation experience. The human factor has long been recognized as a crucial ingredient of any aviation safety program and large amounts of time and effort have been devoted to its study. A similar approach should be adopted in the maritime field and the concept of human factors be accepted as one of major importance. Steps should be taken to objectively investigate and evaluate the role of human factors in the design and operation of tankers. Further, it is absolutely essential that more work be done in the area of the master-pilot relationship, one that appears to be a particularly frequent factor in casualties.

#### 4. Implications Of The Study

The study has concluded that the major factors relating to the frequency of oil tanker accidents are the nature of vessel ownership, nation of registry and the age of the tankers in service.

These factors hold some threatening and pessimistic prospects if the present systems are not modified and strengthened. The first generation of VLCC's are already in the over-10-year-of-age category and in a few years will be reaching the 16-and-over age group. The first ULCC's are now entering the 10-years-and-over category and some are already being sold off or scraped.<sup>25</sup> The potential for disaster is great if these huge vessels are allowed to deteriorate in condition and to remain in service.

While the study's statistical data ended in 1977, events since then have been far from encouraging. Oil tanker accidents hit a new high in 1978 and then went even higher in 1979, the worst year ever for tankers. Major accidents alone accounted for the loss of 12 tankers totalling over 1.9 million deadweight tons.<sup>26</sup>

Unless things change, society faces a twofold threat. Many tankers entering the older age categories are of increasingly large size classes. Thus when they get into trouble they are harder to save or salvage and since they also contain more oil, they pose a bigger pollution threat.

### A Closing Note

The research indicates that oil tanker accidents can be minimized. While it is not reasonable to expect that there will never be an accident, preventive measure can reduce the risk of such operations. An example of such action lies in the operation of U.S. Flag Liquefied Natural Gas (LNG) carriers. Recognizing the potential for disaster in their cargo, the owners, insurers, operators, and crews of the LNG ships have cooperated together to develop a set of stringent standards for the design, construction and operation of these ships as well as equally strict standards of qualifications and training for their crews. Since 1959 these vessels, 10 in number, have made over 2,700 voyages with only one serious incident and without the loss of a single vessel.<sup>27</sup> In the one serious incident, that did happen, the grounding of the LNG carrier EL PASO PAUL KAYSER, experts agree that the extensive training and preparation that had gone before prevented a major disaster.<sup>28</sup>

Thus, the author believes that if the lessons from this study are taken seriously, future research carried out and corrective actions implemented there is no reason to doubt that equally impressive results can be accomplished with oil tankers. On the other hand, if the decision is made that no action needs to be taken and the "status quo" maintained, then the future holds an increasing amount of tanker accidents and their attendant problems.



## 6. Footnotes

1. Nautical Institute (United Kingdom), Memorandum on Marine Safety, London, 15 May 1981, unpagged.
2. Roger A. Peterson, Maritime Oil Tanker Casualties (1964-1977): An Analysis of Safety and Policy Issues, (Rotterdam: Maritime Research Institute Netherlands, 1981), pp. 5-7.
3. Ibid.
4. "Exxon Imposes Rigid Standards for Charter Vessels," Exxon Manhattan, 18 February 1977, p. 10.
5. "The Year of the Tanker, But Mostly for the Wrong Reasons," Fairplay International Shipping Weekly, 17 July 1980, pp. 59-60.
6. "Fitness For Sea," Editorial, Fairplay International Shipping Weekly, 11 September 1980, p. 3.
7. "Insurers Score Ship Grading," Journal of Commerce, 2 June 1981, p. 1A.
8. Peterson, pp. 44-98.
9. Alan F. Schoedel, "1st Ship Registered Under Vanatu Flag," The Journal of Commerce, 3 June 1981, p. 17A.
10. However, there has been some concern raised that the very large tankers (VLCC's and ULCC's) may be reaching the critical point earlier at 10 to 11 years of age. The Chairman of BP (United Kingdom) recently stated that the maximum age for such ships is likely to be 15 years of age. Reported by Arthur McKenzie of the Tanker Advisory Center in a telephone conversation with the author on 25 June 1981.
11. Brian P. Sullivan, "Ship-Salvage Efforts May Suffer From Lack of New Equipment," The Journal of Commerce, 4 May 1981, p. 9.
12. For an informative look at this subject see the film In The Wake of the ARGO MERCHANT, produced by the International Union of Marine Insurance, 1978.
13. "Tankers to Have Criminal Records?" Fairplay International Shipping Weekly, 4 May 1978, p. 1.
14. F.M. van Poelgeest, Sub-Standard Tankers, (Rotterdam: Netherlands Maritime Institute, 1978), p. 65.
15. These requirements are similar to those recommended by a U.S. government study. For more details, see U.S. Congress, General Accounting Office, Coast Guard Action Needed to Promote Safer Marine Transportation, Report CED-79-38, 21 May 1979, pp. 63-64.

16. Bruce Barnard, "UK Report: Oil Companies Shun Supertanker," Journal of Commerce, 3 September 1980, p. 4.
17. Ibid.
18. Maureen Robb, "Foreign Tankers Show Fewer Safety Violations," Journal of Commerce, 21 March 1979, p. 11.
19. "French Boost Pollution Salvage Fleet," Fairplay International Shipping Weekly, 16 August 1979, p. 10.
20. "Somali Measure for East African Salvage Protection," Fairplay International Shipping Weekly, 1 November 1979, p. 44.
21. Bruce Barnard, "Salvors See Need for Changes in International Salvage Laws," Journal of Commerce, 16 April 1979, p. 7.
22. "Of Politics and Pollution," Fairplay International Shipping Weekly, 22 May 1980, p. 31.
23. W.D. Ewart, "INTASAFCON 4: Thinking in the Right Direction", Fairplay International Shipping Weekly, 22 November 1979, p. 30.
24. A. Baisuck and W.Z. Wallace, "A Framework for Analyzing Marine Accidents," MTS Journal, Vol. 13, No. 5, n.d., p. 9, as adapted by the author.
25. "First Ever ULCC's Bought for Scrap," Journal of Commerce, 13 June 1980, p. 33.
26. Roger A. Peterson, "Oil Tanker Accidents: Cause for Concern," Outstanding Papers of the Fifth Student Conference on International Business (Chicago: Pullman, Inc., May 1980), p. 19.
27. "Safety Program Paying Off," Journal of Commerce, 24 September 1979, p. 9.
28. "Vessel Has Serious Accident Despite All The Precautions," Journal of Commerce, 18 September 1980, p. 8.

The University of Michigan, as an equal opportunity/affirmative action employer, complies with all applicable federal and state laws regarding nondiscrimination and affirmative action, including Title IX of the Education Amendments of 1972 and Section 504 of the Rehabilitation Act of 1973. The University of Michigan is committed to a policy of nondiscrimination and equal opportunity for all persons regardless of race, sex, color, religion, creed, national origin or ancestry, age, marital status, sexual orientation, gender identity, gender expression, disability, or Vietnam-era veteran status in employment, educational programs and activities, and admissions. Inquiries or complaints may be addressed to the Senior Director for Institutional Equity and Title IX/Section 504 Coordinator, Office of Institutional Equity, 2072 Administrative Services Building, Ann Arbor, Michigan 48109-1432, 734-763-0235, TTY 734-647-1388. For other University of Michigan information call 734-764-1817.