

# **AN INTRODUCTION TO BUNKERING**

**Nigel Driffin**

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# **AN INTRODUCTION TO BUNKERING**



## Dedication

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This book is dedicated to those people who have believed in me and supported me.

To the head of Marine Engineering at Riversdale College, Liverpool, who told all of his apprentices in 1966 that a marine engineer could do anything.

To my mother who always believed that I could write a book (even if my teachers did not agree).

To the many people who helped me acquire the knowledge that I needed throughout my career.

To my colleagues at LQM who have put up with a lot.

To my wife Chris who has put up with very much more.

**Nigel Draffin**



# **AN INTRODUCTION TO BUNKERING**

by

**Nigel Draffin**

M.I.Mar.E.S.T.

First Edition

Foreword by

**Capt M Segar**

**Director (Port) / Port Master**

**Maritime and Port Authority of Singapore**

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## Foreword

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Bunkering is an essential part of our lives. With around 90% of global trade transported by sea, the quality, price, availability and safe handling of the fuel that powers the engines of thousands of ships that sail around the world are all crucially important.

But, the bunker industry can be extraordinarily dynamic. It covers a wide range of activities and a long list of disciplines involving a large number of players in almost every port in the world. Add in the complexities of local, national, regional and global regulations, the vagaries of global financial and energy markets, the uncertainties of political developments and the inevitability of technical advances, and the picture becomes even more perplexing.

So, how does a newcomer to the industry have any chance to making sense of it all? Where does he or she go to get a basic understanding of what 'bunkering' is all about, how it works and who is involved? How can a bunker trader or laboratory chemist, chief engineer or banker, maritime lawyer or barge operator ever find out how and where they fit into this massive jigsaw? And how can they begin to learn, develop their skills and acquire the know-how?

To this end, I warmly welcome Nigel Draffin's work, *An Introduction to Bunkering*, which addresses all these issues simply and effectively. I am sure the wealth of information in this book will shed a great deal of light into this most labyrinthine of industries.

This book covers every aspect of bunkering, from its history and early development right through to the latest environmental legislation, newest delivery procedures and quality specifications, and – importantly – health and safety considerations.

It is written in a clear, easily understood style that addresses the issues and answers the questions that everyone – from the newest student to the most experienced practitioner – will want to understand. And, helpfully, it contains a wealth of diagrams, charts and photographs which will greatly assist anyone who has not yet had the chance to sail onboard a ship, set foot on a bunker barge, visit a testing laboratory or sit in an oil trader's office. Its extensive index allows the reader to quickly find explanations to technical words or phrases, while the appendices point readers towards other places they might look for help.

The Port of Singapore has long been at the forefront of developing standards for the benefit of the industry. Our pioneering standard, the Singapore Standard Code of Practice for Bunkering, has been recognised as an international benchmark, with the International Organization for Standardization (ISO) adopting this standard as the base document in the development of an international bunkering protocol. Playing a leading role, the Maritime and Port Authority of Singapore (MPA) has steered the Port of Singapore towards the peak in the industry. In 2007, the volume of bunkers sold in the port scaled a new high, crossing the 30 million tonnes mark for the first time, to reach 31.5 million tonnes and surpassing 2006's figures by 11.2%. This achievement

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once again maintained our position as the world's top bunkering port and reflects our customers' confidence in the quality of bunkering services in Singapore.

This book notes our contribution and meets a need in the industry which we have long recognised. I believe that *An Introduction to Bunkering* will leave every reader significantly better informed about how this truly global industry works.

Congratulations!

**Capt M Segar**  
**Director (Port) / Port Master**  
**Maritime and Port Authority of Singapore**

May 2008



## Preface

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In September 2007, after the *Oxford Bunker Course*, I was asked if I would consider writing a short book on the basics of bunkering. Some of you who know me will be aware that I have been writing, talking, even singing about the need for training and education in our industry. In a moment of weakness I agreed and went home to consider what sort of book it should be.

There are a few very good books on bunkering but they are learned works, covering the topics in great detail and requiring some previous knowledge about ships and bunkering. I decided I would try to produce a book that would sit comfortably on the desk of anyone who had to deal with the bunkering of ships, whatever their experience or training, where they could find simple answers to the majority of questions that I have been asked over the past 42 years.

The job took longer than I expected and made me return to my textbooks and research many things to make sure that what I wrote was reasonably accurate and not misleading. I was determined to provide a comprehensive index, but I am sure that it will never be perfect, such is life.

Sending the finished text with drawings and figures to the publisher was only the start of the journey as it was followed with weeks of questions, corrections and emails seeking permission to include figures, tables and drawings in the book whilst respecting the copyright of others. I only hope that we have managed to provide useful and relevant data, practical illustrations and enough pictures to help those who have never seen many of the 'bits' we talk about each day to understand exactly what bunkering is all about.

I believe that the information in this book is just as relevant to vessel charterers, ship operators, marine lawyers and port agents as it is to buyers and sellers of marine fuel.

Every book is the product of a team, not just the author and publisher. I sent chapters to colleagues and friends to ask for their comments, thoughts and corrections. The team at Petrosport worked really hard to knock it into shape and everyone I asked to help did so promptly, willingly and without making me feel inadequate.

The principal of my company sent me an email (after reading the book on a transatlantic flight) with about 20 suggestions of 'things junior brokers have asked me over the last 25 years'. Almost all were things I had not thought of. None had been picked up by the friends who had read each chapter but all are now part of the book. My only concern is how much else have I left out?

You, the reader, will determine if the book is worthwhile. I have enjoyed writing it and if it helps you to understand what we do a little better, then it will have all been worthwhile.

**Nigel Draffin**, May 2008

## About the author

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Nigel Draffin has been involved in shipping for over 42 years and with the commercial bunker market for over 22 years. After joining Shell Tankers as an apprentice engineer in 1966, he progressed through the ranks, serving on all classes of vessel including very large crude carriers (VLCCs) and liquefied natural gas (LNG) tankers.

He came ashore in 1979 to join the newbuilding department of Shell International Marine. After two years of new construction in Ireland, Korea and the Netherlands, he transferred to Shell's Research & Development unit, specialising in control systems, fuel combustion and safety systems.

In 1986, Nigel moved to the commercial department as a bunker buyer and economics analyst. In 1988, he was promoted to be Head of Operational Economics, responsible for all of the fuel purchased for the Shell fleet, the operation of the risk management policy and the speed / performance of the owned fleet. In March 1996, he joined the staff of E.A.Gibson Shipbrokers Ltd in the bunker department, and became the manager. In 2006, this department merged with US-based broking house LQM Petroleum Services, where Nigel is currently Senior Broker and Technical Manager.

Nigel is a founder member of the International Bunker Industry Association (IBIA) and has served twice on its council of management. He currently serves as co-ordinator of the Education Working Group and is the author of *IBIA's Basic Bunker Course*. He is a member of the Institute of Marine Engineering Science and Technology and Past Master of the Worshipful Company of Fuellers.

Nigel is a born communicator and dedicated teacher, whose simple style and vast knowledge of the subject mean that he is consistently voted one of the most effective lecturers on the courses he teaches. His contributions to the well-established *Oxford Bunker Course* over the past decade or so stand out for particular attention, as much for his teaching abilities as for his undeniable social skills.

**Llewellyn Bankes-Hughes**  
**Managing Director, Petrosport Limited**

May 2008



## Acknowledgements

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The author extends his thanks to everyone who has helped in the creation of *An Introduction to Bunkering*, particularly Angus Ogilvie, Chris Fisher, Capt Phil Julian and Gerry van Geysel, who have cast an eye over the text and suggested many additions and changes which hopefully make the book better. He also extends his thanks to Llewellyn Bankes-Hughes and his team at Petrosport for suggesting the idea in the first place then seeing it through, and, in particular, Alison Parsons, who has seamlessly designed and produced the finished article.

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## Chapter 1 - What are Bunkers?

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'Bunkers' is the generic name for fuel used by ships. The original usage came from the use of coal as a fuel for the boilers on the first steam ships. The coal was stored on board in compartments either side of the boiler room and these compartments were called coal bunkers. This was the same term as used for coal storage on land. Seafarers never use two words when one will do, so they started to refer to the storage space as just the bunker and the contents (coal) were called 'bunkers'.

By the end of the 19th century, a large number of merchant and naval vessels were propelled by steam. They took on coal at ports where they loaded and discharged cargo and also at intermediate ports en route where depots were established just for the supply of coal fuel. These depots were called either coaling stations or bunkering stations and for merchant vessels it became common practice to refer to the job of taking on fuel as 'bunkering'.

At the start of the 20th century, a British entrepreneur, Weetman Pearson, later Lord Cowdray, had a very large stake in oil fields and refineries in Mexico (Mexican Eagle) and in 1909 established a fleet of tankers to transport the oil to the USA. He had already started to use fuel oil in the railway locomotives transporting his cargo. He realised the potential advantage in terms of labour saving, extra cargo space and fuel efficiency of burning oil in his ships' boilers and these tankers were designed to burn both coal and oil. Because he could get enough oil at his load ports for the complete voyage, the ships rarely burned coal.

Burning fuel oil meant the end of teams of stokers shovelling the coal into the furnace. The fuel oil occupied a smaller space on board for the same steaming distance and the cost per mile was much lower.

Others watched what Pearson was doing and two characters saw possibilities of great benefit to them. Sir Marcus Samuel, the founder of Shell, was transporting and refining oil worldwide and was aware that whilst he was providing customers with the gasoline and kerosene that they wanted, he was left with large quantities of fuel oil in a number of locations for which he needed to create a demand.

Admiral John Fisher was Commander of the Mediterranean Fleet and later First Sea Lord of the British Royal Navy. He was instrumental in the adoption of the Dreadnaught and Super Dreadnaught warships of that time and he understood the benefits of oil fuel in manpower space and cost. They lobbied their friend Sir Winston Churchill, First Lord of the Admiralty, to facilitate the switch from coal to oil by the British Navy.

There was much political intrigue and considerable interference from the company which became BP. The revelation that Germany was also working on the switch broke the political opposition. The contract could not be awarded to Shell by the British Government because by that time it had become an Anglo Dutch company. So the contract was awarded to British Petroleum, now BP. However, as BP did not have the

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resources to supply the required volume, an additional contract for the majority of the supply went to Shell.

The contract required the establishment of fuel depots for British warships in the same locations as the navy's existing coaling stations. This switch, followed by the other major navies worldwide, established (with tax payers' money) a network of fuel oil 'bunkering' stations all round the world and the infrastructure needed to replenish the storage tanks at the stations and transfer the oil to the ships.

After the First World War, access to these bunkering stations made it possible for merchant ships to take advantage of oil fuel giving greater range, allowing for smaller crews and creating greater efficiency. The bunkering stations were largely owned and operated by what we now call the Oil Majors, in many cases leasing the facilities from the colonial administration (Gibraltar, Aden and Cape Town are all good examples). Merchant shipping began to switch to oil fuel very quickly and, by 1940, almost half of all ships were oil fired.

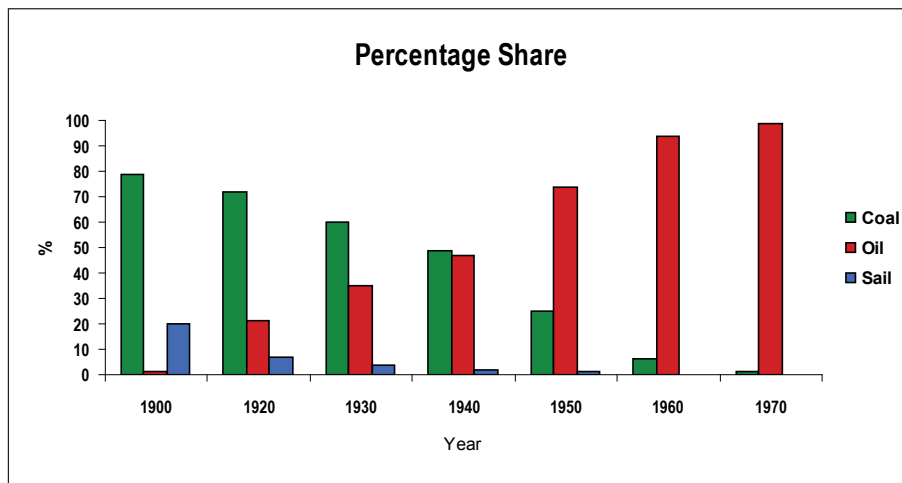


Figure 1. The change from coal to oil

By 2000, there were less than 12 commercial coal fired ships in service worldwide and these operated out of coal ports where their fuel was still always available (Australian coast and the North American Great Lakes).

The early steam ships had boilers where coal was burned on an open grate, the team of stokers firing the furnace and raking out the ash. The skill required in hot stokeholds was part of our training. Even in 1966, apprentices like myself were required to spend time learning how to fire a boiler. Modern coal-fired ships have automatic stokeholds, like modern power stations ashore.

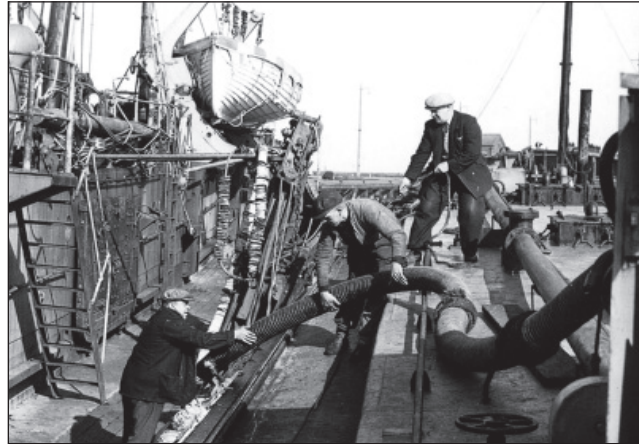


Figure 2. The early days of bunkering

Photograph courtesy of John W. Whitaker (Tankers) Ltd ([www.whitakertankers.com](http://www.whitakertankers.com))

## Types of fuel

The fuel we call bunkers can be described as two different types: residual fuel and distillate fuel.

### **Residual fuel**

This is the residue of the refinery process, or what is left after the refinery has extracted all of the 'good' products like gasoline, gasoil, propane, butane, naphtha, lubricating oils, etc. It is a dense, thick liquid which is difficult to handle – described as 'black, smelly and very difficult to clean up'. It is the most cost efficient means of storing and transporting energy that we have today. It cannot be used 'as is' but has to be blended with other components to meet an acceptable specification and still has to be treated on board ship before it can be used. Residual fuel prepared for use on ships is referred to as MFO (marine fuel oil), IFO (intermediate fuel oil), or sometimes by its viscosity, 380 centiStokes or 180 centiStokes. It is only suitable for larger engines and is primarily for the main engines of ocean going ships.

### **Distillate fuel**

This is called diesel or gasoil, is lighter, cleaner and easier to use. It costs almost twice as much as residual fuel. It is one of the products extracted from the crude oil in the refinery. Distillate fuel needs very little treatment before use, and is suitable for a much wider range of engines, being used on small ships, coasters and the auxiliary engines used on board for generating electrical or hydraulic power.

Distillate fuel has its own problems of contamination, operating difficulties and regulatory limits, but is generally easier to handle than residual fuels. Distillates will become more important as regulations on sulphur become stricter.

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### Daily consumption

Ocean going ships will consume from five to 350 tonnes per day of residual fuel, depending on vessel size and speed. They will normally have enough fuel capacity to steam for between 40 and 60 days, and usually take on bunkers every 20 to 30 days.

Small coasters consume between two and 10 tonnes per day of distillate fuel and usually have a capacity for 10 to 15 days steaming.

All ships need fuel for their auxiliary engines. In most ships this is distillate fuel and their consumption is between 0.5 and 6 tonnes per day, depending on the size and type of ship.

There are exceptions to the above. Some large container vessels and some cruise liners require much greater quantities of fuel for their auxiliaries, often burning residual fuel in auxiliary engines. Some specialised vessels can only burn distillates and may need 50 or more tonnes per day.

Almost all warships use only gasoil and can consume enormous quantities, which is why groups of warships often sail with their own tanker full of gasoil to replenish them en route.

### The size of the bunker market

The worldwide market for residual fuel is about 200 million tonnes per year and the distillate market is about 35 million tonnes per year. The three largest bunkering areas are Singapore, where over 30 million tonnes of bunker fuels a year are now delivered; Amsterdam / Rotterdam / Antwerp (ARA), where almost 20 million tonnes per year are delivered, and Fujairah, at the entrance to the Mideast Gulf, where about 15 million tonnes per year are delivered.

The residual fuel oil market has grown in line with the growth of world trade. The volumes in the major supply ports have been growing faster than average, almost exclusively due to the requirements of container shipping. The volumes in some bunker-only ports, such as Gibraltar, have also seen above-average growth and the impact of sulphur legislation has given a boost to ports just outside the sulphur control areas. Local supply conditions have had an adverse impact on some ports (Egypt, South of France and the Canary Islands) but we see from history that very few ports have a guaranteed market.

The major sources of fuel oil production are the world's major refining areas: the Mideast (Saudi Arabia, Kuwait and Iran); Northern Europe, especially Rotterdam; Singapore; Venezuela; and Russia (from both the Baltic and Black Sea ports). Because of the restricted sources of fuel oil, many bunker ports have to import their product, normally by sea. The largest selling areas actually sell more than they produce locally. This means that fuel purchased in Singapore, for example, may have come from Venezuela, Russia or the Mideast. The flow of product is linked to the relative economics of the selling price at the refinery and the cost of transportation.

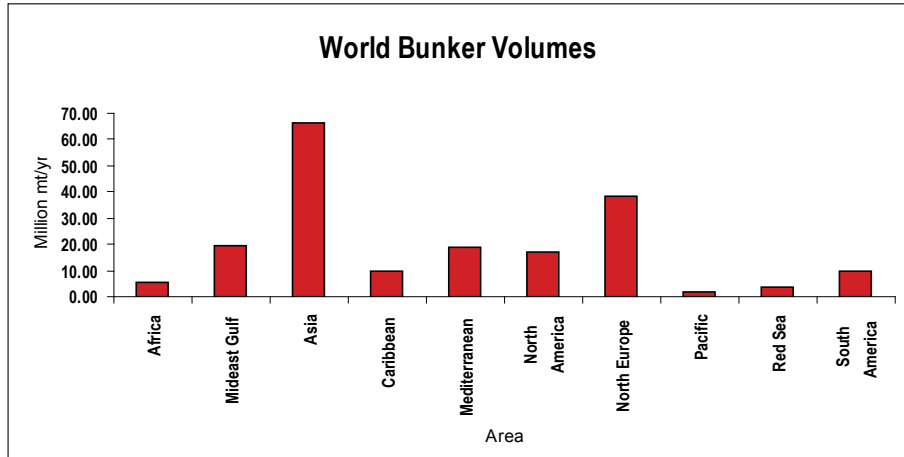


Figure 3. World bunker volumes