Handbook

ITOPF

PROMOTING EFFECTIVE
SPILL RESPONSE

2019/20

Contents

Cover photo: Seaweed aquaculture, Japan

Emergency contact

To report a spill of oil, chemicals or other substance, please call us on the numbers below for advice and/or to mobilise us to site:

9 AM – 5 PM
(UK BUSINESS HOURS)
+44 (0) 20 7566 6999

This is our office number. Please ask to speak to a member of the technical team.

OUTSIDE UK BUSINESS HOURS
(spill emergencies only)
+44 (0) 20 7566 6998

Your call will be forwarded to the member of the technical team on duty.

We will require as much of the following information as possible:

ESSENTIAL INFORMATION

- Contact details of the person reporting the incident
- Name of vessel and owner
- Date and time of the incident (specifying local time or GMT/UTC)
- Position (e.g. latitude and longitude or distance and direction from the nearest port or landmark)
- Cause of the incident (e.g. collision, grounding, explosion, fire, etc) and nature of damage
- Description and quantity of cargo and bunker fuel on board
- Estimate of the quantity spilt or likelihood of spillage
- Name of the cargo owner
- Action, both taken and intended (and by whom), to combat pollution
- Status of the vessel and any planned salvage activities

ADDITIONAL USEFUL INFORMATION

- Weather and sea conditions, wind speed and direction
- Length, breadth and appearance of any slicks or plumes, including direction of movement
- Type of resources that may be at risk (e.g. fisheries or residential areas)
- Distribution of cargo and bunkers and location relative to damage

HNS Chemicals

- State – solid, liquid, gas, bulk, packaged
- UN or CAS number, MSDS, cargo manifest

Oil

- Density, viscosity, pour point, distillation characteristics, wax & asphaltene content (or bunkering certificate)

ITOPF in brief

ITOPF is maintained by the world's shipowners and their insurers on a not-for-profit basis to promote effective response to spills of oil, chemicals and other substances in the marine environment.

Our technical staff have attended on-site at over 800 shipping incidents in 100 countries to provide objective scientific advice on clean-up measures, the effects of pollutants on the environment and economic activities, and on compensation. These incidents can involve oil, chemicals and other bulk or packaged cargoes, as well as bunker fuel from all types of ship. We also provide advice in relation to oil spills from other potential sources of marine pollution, including pipelines and offshore installations; physical damage to coral reefs resulting from ship groundings; and environmental impacts associated with shipwrecks.

Our first-hand experience of pollution incidents is utilised during contingency planning and other advisory assignments for government and industry. We are an authoritative source of information on marine spills and share our knowledge at training courses and seminars throughout the world, encouraging best practice through outreach and education.

The majority of our income comes from dues from shipowners, paid on their behalf by Protection and Indemnity (P&I) insurers. Shipowners are enrolled in ITOPF either as Members (for tankers, barges, LPG/LNG carriers, FPSOs/FSUs or combination carriers) or Associates (for other types of ship). Our services are provided to Members, Associates and their P&I insurers, usually at no cost, apart from expenses. We are also available to assist at the request of governments and intergovernmental organisations such as the International Maritime Organization (IMO) and the International Oil Pollution Compensation Funds (IOPC Funds).

Benefits freely available to ITOPF Members and Associates

- emergency 24/7 technical advice and, where necessary, attendance on-site at incidents involving a spill (or potential spill) of oil, chemicals or other substances;
- highly qualified and experienced technical staff to answer queries related to the fate and effects of these substances in the marine environment;
- objective technical advice on the most appropriate response techniques to minimise pollution damage;
- objective technical assessment of claims for compensation in conjunction with those paying compensation and claimants;
- advice on realistic scenarios for testing during exercises and drills and participation in these, either remotely or in person;
- advice on the preparation or updating of contingency plans;
- advice concerning national, regional and international approaches to preparedness and response to spills of oil, chemicals and other substances;
- educational seminars and workshops;
- historic information and statistics relating to oil and chemical spills;
- technical publications and films;
- access to ITOPF's London based library;
- 24/7 access to the online Membership Database to retrieve copies of Membership Record Forms (applicable to Members only);
- Access to ITOPF's services is automatic and part of P&I cover.

We encourage our shipowners to make full use of the services available to them and to contact us directly if they would like further information.

ITOPF Directors

Chairman

Mr Paddy Rodgers	Euronav n.v., UK

Managing Director

Dr Karen Purnell	ITOPF Limited, UK

Directors

Mr Abdullah Aldubaikhi	Bahri, Saudi Arabia
Mr Billy Chiu	BW Maritime Pte Ltd, Singapore
Mr Clovis Garzia	Transpetro, Brazil
Mr Erik Hånell	Stena Bulk AB, Sweden
Mr Jonathan Hare	Assuranceforengen Skuld, Norway
Dr Grahaeme Henderson	Shell International Trading & Shipping Co Ltd, UK
Mr Christian Ingerslev	Maersk Tankers Singapore Pte/Maersk Tankers A/S, Denmark
Mr Jens Martin Jensen	Premuda spa, Italy
Capt Tomoyuki Koyama	NYK Line, Japan
Mr Donald Kurz	Keystone Shipping Co, USA
Mr Kevin MacKay	Teekay Shipping, Canada
Mr Mark Martecchini	Stolt Tankers B.V., Netherlands
Mr Guy Mason	BP Shipping Ltd, UK
Mr Tony Paulson	West of England P&I Club, UK
Mr Sergey Popravko	SCF – Unicom Management, Cyprus
Mr Cory Quarles	ExxonMobil, SeaRiver Maritime, Inc., USA
Mr Mark Ross	Chevron Shipping Company LLC, USA
Mr Hiroaki Sawabe	The Japan Ship Owners' Mutual P&I Association, Japan
Mr Kazuyoshi Takayama	JX Ocean Company Ltd, Japan
Mr Hannes Thiede	F. Laeisz Schiffahrtsgesellschaft, Germany
Dr Chao Wu	Thomas Miller P&I Club, UK
Capt Zhu Mai Jin	China Shipping Tanker Company Ltd, China

ITOPF Board of Directors 2018

Staffing

Managing Director

Dr Karen Purnell is a Fellow of the Royal Society of Chemistry, a member of the Institute of Directors and a Shipwright. Before joining ITOPF in 1994, she was a project manager involved in nuclear/toxic waste management and environmental remediation. Karen was appointed MD in 2009 and focuses on ensuring that ITOPF is recognised as the leading provider of objective technical advice on accidental ship-source pollution.

Technical Director

Richard Johnson is a marine biologist and holds a master's degree in radiation and environmental protection. Before joining ITOPF in 1994, he worked on investigating the fallout from the Chernobyl accident and assessing radioactive contamination of the marine environment. Richard became Technical Director in 2009 and is responsible for the strategic oversight and delivery of ITOPF's technical services.

PA

Jo Woodward joined ITOPF in 2016 to provide PA support to Karen Purnell and Richard Johnson. Jo has worked extensively as a Board level PA and has spent a large part of her career working for large hotel and retail organisations.

Technical Team Managers

Dr Franck Laruelle is a marine biologist and previously worked with the French research organisation Cedre, acting as a technical adviser on behalf of the French government at a number of spills, including ERIKA and PRESTIGE. Franck joined ITOPF in 2006 and currently leads ITOPF's Africa and Middle East team.

Alex Hunt is a marine biologist with a master's degree in tropical coastal management and a background in coral reef damage assessment work. Since joining ITOPF in 2004 he has attended on site for numerous shipping incidents throughout the world. Alex is Technical Manager for the Asia-Pacific Team at ITOPF and has a focus on spill preparedness projects in this region.

Dr Mark Whittington is a marine biologist with a background in fisheries, aquaculture and environmental monitoring. Prior to joining ITOPF in 2007, he worked in marine consultancy in the UK, Middle East and East Africa. Mark has attended pollution incidents worldwide, delivered national and regional training courses and supported national contingency planning projects. He currently leads ITOPF's Americas Team.

Technical Support Manager

Tim Wadsworth has degrees in engineering and law and joined ITOPF in 1991. He became Technical Support Manager in 2006 and is responsible for ITOPF's technical support functions, including the assessment of claims.

Finance and Pensions Manager

Amanda Howarth has an MBA and joined ITOPF in 2000. She has almost 25 years' experience of the tanker industry and has worked as Financial Controller for small entities for nearly 30 years. Her responsibilities at ITOPF include the management of its financial and tax affairs, as well as overseeing ITOPF's pension scheme accounts and administration procedures.

Information and Communications Manager

Lisa Stevens has a degree in physics with satellite technology. She joined ITOPF in 2006, bringing with her previous work experience of satellite programme and information mapping services. Lisa is responsible for the development and implementation of ITOPF's services and applications for 'Information, Knowledge, Education and Communications'.

HR Manager

Vanessa Holliday has a business studies degree, a post graduate diploma in people management and is a Chartered Member of the CIPD, the professional body for HR and people development. She joined ITOPF in 2017, bringing experience from a varied background in HR management, most recently in the not-for-profit and public sectors.

Senior Technical Advisers

Dr Annabelle Nicolas-Kopec is a chartered chemist and member of the Royal Society of Chemistry. She has a PhD in organic chemistry and postgraduate research experience in analytical and synthetic chemistry. Since joining ITOPF in 2011, Annabelle has attended numerous incidents worldwide. She leads ITOPF's HNS Working Group and coordinates the ITOPF R&D Award.

Miguel Patel has a degree in zoology and a master's degree in environmental management. He has research experience in ecotoxicology, population dynamics and habitat restoration and joined ITOPF in 2011. Miguel has attended numerous incidents worldwide and heads up ITOPF's Environmental Damage Working Group.

Technical Advisers

David Campion is a marine biologist with a master's degree in tropical coastal management. He previously worked as Group Director of Corporate Social Responsibility for an Asian based resort company focused upon environmental management and sustainability reporting. Since joining ITOPF in 2014, he has attended numerous incidents worldwide and is a member of ITOPF'S Cold Climate and Fisheries Working Groups.

Phil Ruck has a degree in physical geography and an MSc in environmental technology. Before joining ITOPF in 2016, he worked for IPIECA, the global oil and gas industry association for environmental and social issues, as Project Manager for the Oil Spill Working Group. Phil has attended several pollution incidents worldwide and is a member of ITOPF's Fisheries Working Group.

Dr Duarte Soares is a geologist with an MSc in petroleum geoscience and a PhD in seismic stratigraphy. He has attended spills in Asia, South America, Oceania and Europe, and is coordinator of the ITOPF R&D Award. Before joining ITOPF in 2017, Duarte worked for the hydrocarbon industry (UK), in mining (Angola), and on geoarchaeology and environmental impact studies (Portugal).

Julke Brandt holds a master mariner certificate of competency, a BSc in nautical science and an MSc in international marine environmental consultancy. Before joining ITOPF in 2017, she worked as a Navigation (Deck) Officer on board cargo ships and private yachts and as a visiting researcher for Newcastle University. She is a member of ITOPF's Cold Climate and HNS Working Groups.

Samuel Durrance is a marine biologist with an MSc in international marine environmental consultancy and a BSc in marine biology. Before joining ITOPF in 2018, he worked as a fisheries management consultant at an international marine resource management consultancy.

Lauren Fear is a biologist with an MSc by research in biology. Her project studied the effects of anthropogenic noise on coral reef fish communities. Before joining ITOPF in 2019, she was a consultant ecologist, involved in assessing the impacts of large infrastructure projects on protected species and habitats in the UK. Lauren is a member of the Chartered Institute of Ecology and Environmental Management.

Dr Angela Pinzón-Espinosa has a BSc in microbiology, MScs in chemistry and analytical chemistry and a PhD in environmental sciences. She is a member of the Royal Society of Chemistry and the Society of Environmental Toxicology and Chemistry. She has previously worked on projects related to the clean-up of oil refining waste, chemical diversity in marine organisms and the recovery of coral populations. Angela joined ITOPF in 2019.

Dr Conor Bolas has a degree in chemistry and holds a PhD in atmospheric and analytical chemistry. He has experience of environmental monitoring of tropical field sites in Southeast Asia and temperate ecosystems in the UK, as well as research in materials and organic chemistry in industrial laboratories. He joined ITOPF in 2019.

Senior Claims Coordinator

Pauline Marchand has master's degrees in maritime, international and business law. Prior to joining ITOPF in 2014, she worked for the International Group of P&I Clubs (IG). Her primary role at ITOPF is to coordinate the assessment of claims for compensation.

Technical Support Coordinator

Susannah Domaille joined ITOPF in 2016 after completing a BSc degree in mathematics and an MSc degree in atmosphere, ocean and climate science. Her main responsibilities are trajectory and fate modelling, and support for remote sensing and aerial surveillance. She is also responsible for assessing claims and assisting the wider technical team with queries regarding spill response equipment and resources.

IT Systems Manager

Alan Smith has worked in IT for over 20 years in a variety of companies from SME to enterprise. He joined ITOPF in 2019 and is responsible for developing and supporting its information systems.

Information Officer

Deborah McKendrick has an MA in librarianship and joined ITOPF in 1996 from the Institute of Petroleum Library. She is responsible for ITOPF's publications, its extensive library, the website and the Country Profiles.

Information Data Analyst

Naa Sackeyfio has a degree in natural resources management, a master's in GIS and previously worked for an environmental consultancy. She joined ITOPF in 2016 and her responsibilities include management of geodatabases and web applications, maintenance of the incidents and claims database, data analysis and GIS mapping.

Membership Secretary

Karen Young joined ITOPF in 2008, having previously worked in a membership role at the Institute of Marine Engineering, Science and Technology (IMarEST). She is responsible for all matters relating to Membership, including the issuance of Membership Record Forms and liaising with relevant parties.

Finance Officer

Jenny Maher has over 25 years' experience in preparing, managing and reporting financial information as well as implementing new accounting procedures, job costing systems and customised reports. She is responsible for ITOPF's financial management information systems and accounting transactions, which includes the collection of Membership and Associate dues.

Finance Assistant

Chee-Ming Chung has a higher national diploma in business and finance and over 15 years' accounts experience across a variety of sectors. He joined ITOPF in 2012 and provides administrative support for ITOPF's financial activities.

HR and Pensions Administrator

Claire Keogh is responsible for providing administrative support in the areas of HR, the pension scheme, health & safety and insurances. She had 8 years' experience working in HR departments for a number of large organisations prior to joining ITOPF in 2015. (Currently on maternity leave.)

Natalie Boyle joined ITOPF in 2018 to cover Claire Keogh's maternity leave. Natalie has a degree in business administration and previous experience working in HR.

Office Coordinator

Jayne Foster first joined ITOPF in 1998 as Team Secretary and, following a career break, re-joined in 2012 as Secretary to the Technical Director. Now Office Coordinator, Jayne manages the Office & Administration Team and has overall responsibility for administrative activities to facilitate the smooth and efficient running of the office.

Receptionist and Events Organiser

Terry Goodchild worked for a market research company prior to joining ITOPF in 2002. As well as acting as Receptionist, she organises ITOPF's internal and external events, undertakes a variety of secretarial and administration duties and is responsible for the distribution of ITOPF's publications.

Team Secretary

Afshan Prisaca joined ITOPF in 2018 and is responsible for organising travel itineraries and conducting travel risk assessments. Afshan also provides administrative and secretarial support to the team, including management of the central diary system of staff movements and commitments.

Technical services

ITOPF promotes effective response to marine spills of oil, chemicals and other substances by providing five core services. These are usually provided at no cost to our Members, Associates and their P&I insurers, apart from expenses. Our technical services are also available to other groups around the world involved with marine spills.

RESPONSE

Spill Response

We are available 24 hours a day, 365 days of the year to attend spills of oil, chemicals and other substances in the marine environment worldwide.

Claims Analysis & Damage Assessment

We give advice on pollution damage caused by spills and assess the technical merits of claims for compensation.

PREPAREDNESS

Contingency Planning & Advisory Work

We regularly advise governments and industry on the preparation of contingency plans and other matters related to accidental pollution from ships.

Training & Education

We run training courses and seminars worldwide where we share our technical knowledge and first-hand experiences.

Information Services

We are a primary and trusted source of information on accidental ship-source pollution.

Spill Response

Responding to marine spills of oil, chemicals and other cargoes is our priority service.

Notification

We can be notified of an incident in a number of ways. Most often we will be contacted by the vessel's P&I insurer via our emergency contact numbers (see page 1). We can also be notified by our extensive network of contacts, which include correspondents, surveyors, spill response organisations, government agencies and port authorities.

Mobilisation

If the incident requires our immediate attendance, we will determine the quickest and most effective way of getting on site.

We will also identify any potential health or personal risk concerns as one of our Technical Advisers prepares to travel.

As we provide assistance throughout the world from our office in London, we pride ourselves on our ability to mobilise rapidly when needed.

ITOPF office

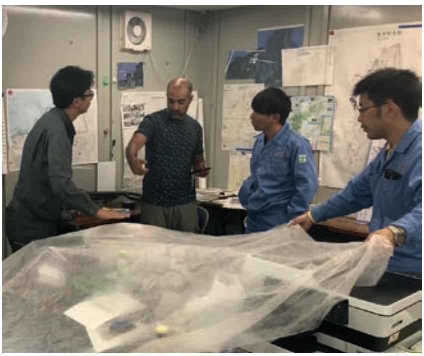
ITOPF discussing clean-up issues, France

Evaluation

At this stage, we will gather information and contact key parties so that the Technical Adviser arriving on scene can 'hit the ground running'. We will carry out a preliminary evaluation of the likely extent of the pollution, its probable behaviour, fate and potential impact on resources, and the local capability to respond.

We employ a variety of in-house resources, such as our Membership database, spills attended database, global mapping applications, and models to predict the fate and behaviour of the oil and/or other substances involved.

Sensitive resources at risk are identified



Providing technical advice to contractors, Japan

Taking samples, Japan

and mapped using our in-house GIS. Information on meteorological and oceanographic conditions and local preparedness, such as the availability of contingency plans and equipment stockpiles, are also collated. This gives us a better basis for understanding how the incident might develop.

On-site

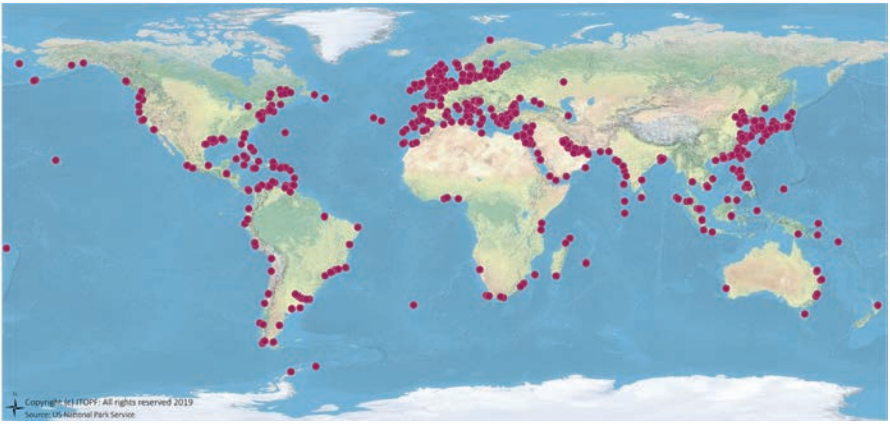
Upon arrival, we are usually met by the P&I insurer's local correspondent or appointed surveyor, who will brief us on any recent developments and act as an initial guide to the area.

Our role on site will vary according to the circumstances of the incident, but it is always advisory. Decisions on the response are made by the relevant authorities. The advice we provide is based on scientific principles and our past experiences attending spills in a large range of habitats and economies.

Our role normally includes one or more of the following activities:

- advising all parties on the potential fate and effects of the pollutant;
- assisting and advising all parties on the most appropriate clean-up techniques, with the aim of mitigating any damage;
- helping to source equipment and, in cases where the shipowner is required to mount the response operation, helping to organise the clean-up;
- undertaking surveys, monitoring the clean-up and advising all parties on the technical merits of the actions;
- investigating the damage to the marine environment and to coastal resources, such as fisheries and aquaculture;
- advising on methods to mitigate environmental and economic losses, including restoration options.

Inspecting waste, Greece



Spills attended by ITOPF since 1970

Command and control is vital in spill response, and early decisions may have a lasting benefit. For this reason, we usually try to integrate ourselves into the command centre as quickly as possible.

In all cases, our aim is to cooperate and work closely with the government agencies, contractors and other parties involved in an incident, and to reach agreement on measures that are technically justified in the particular circumstances. This not only helps to ensure that the clean-up is as efficient and effective as possible and that damage is minimised, but that subsequent claims for compensation can be dealt with promptly and amicably.

Remote advice

We are also available to provide generic advice remotely from the office for cases that may not require full mobilisation. Common requests include advice on the fate and effects of a pollutant, the resources at risk or the location of response equipment.

Attends on average 20 cases per year

Provides remote advice for an average of 25 incidents per year

Marine biologists, chemists, environmental scientists, engineers, geologists

Fluent in English, French, German, Portuguese, Spanish

>800 incidents in 100 countries over the last 50 years

Claims Analysis & Damage Assessment

We provide advice on the technical merit of claims for compensation arising from spills. In many cases this is a natural extension of our attendance on-site at the time of an incident. Claims assessment usually involves evaluating the reasonableness of clean-up costs and the merit of claims for damage to economic resources, such as property or businesses, according to internationally established criteria. The assessment of damage to fisheries, especially mariculture facilities, is a specialist area, which often requires detailed analysis of complex claims. We may work in conjunction with experts who have in-depth knowledge of the affected area and the economics of its particular fisheries.

Our advice is also regularly sought in relation to environmental damage caused by spills, and on the feasibility and technical justification of the restoration measures proposed.

Our role is to encourage a cooperative approach to the assessment of pollution damage with a view to facilitating the prompt and amicable settlement of claims. In this regard, we provide support both to claimants and to those who actually pay the compensation, usually the P&I insurer and/or the IOPC Funds.

These bodies – not ITOPF – ultimately decide whether or not a particular claim should be paid as factors, other than purely technical considerations, may influence the final decision.

Mussel farm, Croatia

Cleaning fenders, Germany

Contingency Planning & Advisory Work

Running a training course with the Korea Coast Guard (photo courtesy of Korea Coast Guard)

We use our extensive practical experience to advise governments, industry, international agencies and other organisations on contingency planning and other matters related to preparedness in case of marine pollution.

These activities give us the opportunity to communicate best practice outside the pressurised environment of a spill. This also enables us to build and maintain contacts within governments and organisations with whom we might work in the future.

Attending meetings at IMO, London (photo courtesy of IMO)

Training & Education

Lecturing to students at the World Maritime University, Sweden

We organise and participate in training courses and seminars for government and industry around the world. These are often undertaken with key inter-governmental partners, such as IMO and the IOPC Funds, or industry bodies like IPIECA.

Training courses provide an excellent opportunity for us to share our technical knowledge and first-hand experience with those likely to be involved with an incident.

We also regularly assist with spill drills and exercises conducted by shipowners, oil companies, governments and other groups.

ITOPF R&D Award

We fund an annual award for research and development (R&D). Each year, up to £50,000 is made available for R&D projects that have the potential to lead to improvements in spill preparation and response, as well as new techniques for monitoring and restoring environmental resources.

The Award is open to any reputable R&D establishment or other organisation worldwide intending to fund a candidate or project team to undertake research related to accidental marine pollution.

Proposals are evaluated by the ITOPF R&D Award Committee, comprised of external and internal evaluators with a wealth of experience in maritime and environmental issues and a keen focus on developing young talent in these areas.

£50k

Awards up to £50,000 each year for R&D activities

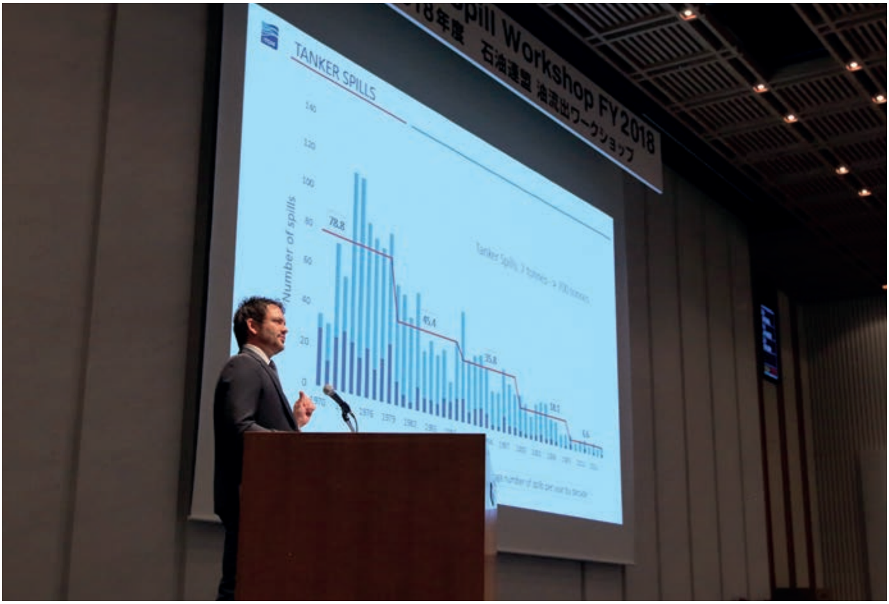
Information Services

We are a primary source of information on ship-source pollution. Unless otherwise stated, the following resources are available free of charge via our website:

Technical Information Papers (TIPs), providing practical guidance on oil and chemical spill response and effects in the marine environment, available in multiple languages.

1 Aerial observation of marine oil spills
2 Fate of marine oil spills
3 Use of booms in oil pollution response
4 Use of dispersants to treat oil spills
5 Use of skimmers in oil pollution response
6 Recognition of oil on shorelines
7 Clean-up of oil from shorelines
8 Use of sorbent materials in oil spill response
9 Disposal of oil and debris
10 Leadership, command & management of oil spills
11 Effects of oil pollution on fisheries and mariculture
12 Effects of oil pollution on social and economic activities
13 Effects of oil pollution on the marine environment
14 Sampling and monitoring of marine oil spills
15 Preparation and submission of claims from oil pollution
16 Contingency planning for marine oil spills
17 Response to marine chemical incidents

ITOPF team at INTERSPILL 2018, London, UK



Presenting ITOPF's statistics in Japan (Photo courtesy of the Petroleum Association of Japan)

Response to Marine Oil Spills Films, an award winning series of eight films tackling key issues related to oil spills and how to deliver a well-planned and executed response, subtitled in multiple languages. The first seven films are available to buy as a DVD priced £10.

1 Introduction to oil spills
2 Aerial surveillance
3 At-sea response
4 Shoreline clean-up
5 Waste management
6 Environmental impacts
7 Oil spill compensation
8 Oil spills in cold climates

Response to Marine Oil Spills book (2012), a comprehensive review of the problems posed by marine oil spills and appropriate response measures, available for sale priced £95 from Witherbys (www.witherbys.com).

Oil Tanker Spill Statistics, annual data on accidental oil spills from tankers, combined carriers and barges since the 1970s, derived from ITOPF's database.

Country & Territory Profiles, short reports summarising the spill response arrangements and clean-up resources within individual maritime states.

GIS, displaying historic spills, international conventions and tanker traffic data.

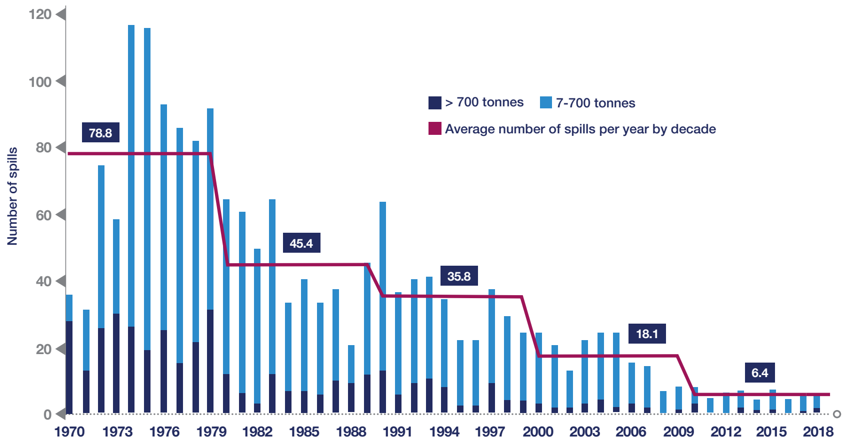
We also have a comprehensive library containing a unique collection of publications on marine spills, clean-up techniques, environmental effects and other related issues. This is open to students and other visitors for reference purposes by appointment.

Oil tanker spill statistics

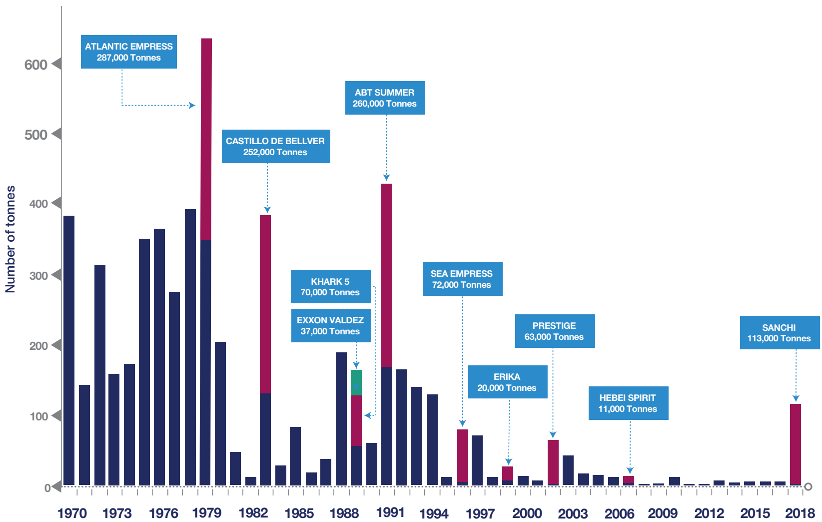
ITOPF's database contains information on approximately 10,000 oil spills from tank vessels, including combined carriers, FPSOs and barges, some 81% of which are less than seven tonnes.

Numbers and amounts

For close to five decades, the frequency of oil spills from tankers has shown a progressive downward trend. The



Numbers of large (over 700 tonnes) and medium (7–700 tonnes) spills, 1970–2018



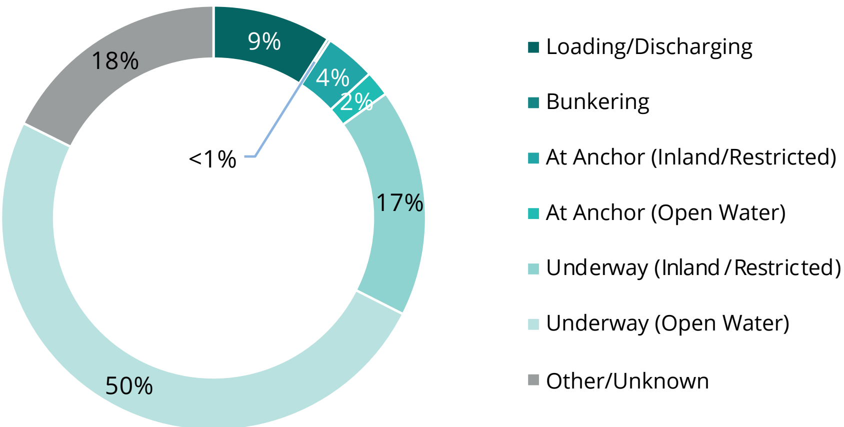
Quantities of oil spilt, 1970–2018

average number of spills of 7 tonnes or more is now about six per year, from a high of 79 in the 1970s. This dramatic reduction has been due to the combined efforts of the oil/shipping industry and governments (largely through IMO) to improve safety and pollution prevention.

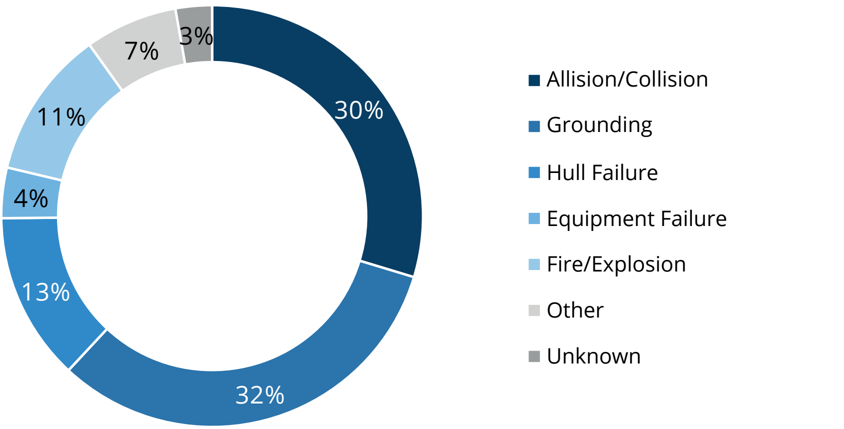
Statistics for the quantity of oil spilled through the decades show a similar trend. However, this trend can be distorted by a single large spill.

Causes of spills

Spills of different sizes have been evaluated in terms of the operation taking place at the time and the primary event leading to the spill. During the period 1970-2018, 50% of large spills (>700 tonnes) occurred while the vessels were underway in open water and 17% while underway in inland or restricted waters. The main causes of large spills were allisions/collisions (30%) and groundings (32%).



Operation at time of incident for large spills (>700 tonnes), 1970–2018



Causes of large spills (>700 tonnes), 1970–2018

Different types of marine spills

Spills of hydrocarbon-based oils from ships have been the focus of ITOPF's work from the outset, initially from tankers and later from a wide range of ships. Over time, our activities have expanded to include other types of pollution at sea – including spills of vegetable oils, a wide range of hazardous chemicals and dry-bulk cargoes including coal and wood. The contents of containers also present a multitude of pollution risks. Here we provide an overview of some of the pollutants that ITOPF is called to deal with.

Hydrocarbon oils

Spills of hydrocarbon oils carried as cargo or bunker fuel remain our core activity. Further information on their fate and effects and appropriate clean-up activities are provided on pages 27–35.

Vegetable oils

The carriage of vegetable oils, such as palm, canola and soybean oil, has increased in recent years. Although less toxic than hydrocarbon oils, spills of vegetable oils in the marine environment can prove problematic, nonetheless.

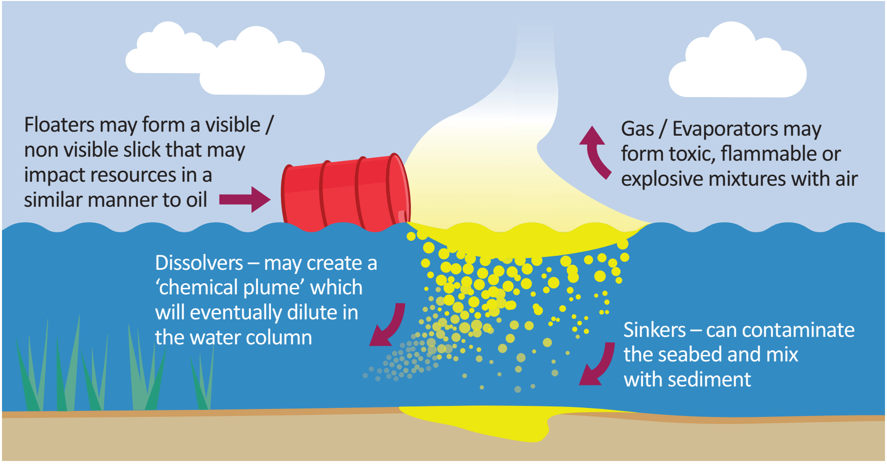
In general, vegetable oils will behave similarly to hydrocarbon oils in the initial stage of a spill, in that they tend to float and spread on the surface of the water. However, vegetable oils are not very soluble in water; they do not undergo dispersion in the water column nor will they evaporate to any extent. Depending on their particular characteristics, they may form solid lumps or polymerise into floating rubbery strings.

Vegetable oils are comprised primarily of triacylglycerols or fatty acids and in their fresh state may be broken down by marine micro-organisms. This decomposition contributes to the rancid odours typical of these spills.

The primary environmental consequences of spills of vegetable oils are seen in relation to surface dwelling organisms where oil can lead to smothering, suffocation and starvation. Examples include oiling of bird plumage and animal fur, or oxygen depletion and asphyxiation.

The most appropriate response technique is containment and recovery, such as using conventional booms combined with scoops, nets or grabs. Ideally, the floating lumps should be removed before they have chance

Lumps of palm stearin washed up on rocks, Hong Kong



Behaviour of spilled chemicals

to fragment, incorporate sediment and sink to the seabed or reach the shoreline. Dispersants formulated for use on hydrocarbon oils have been shown to have little or no effect on vegetable oils.

Chemicals

Spills of chemicals are less frequent than spills of oil, but, due to the wide variety of chemicals transported, their differing properties and fate in the marine environment, as well as potential effects on human health and safety, they can often prove to be a more complex challenge.

Chemicals can be categorised in a number of ways, for example whether they are a solid, liquid or gas when transported or spilled; whether they exhibit one or more of five hazards: flammable, explosive, toxic, corrosive or reactive; and whether they sink, dissolve, float or evaporate in water (or a combination of these processes), as illustrated above.

The effects of a spilled chemical will depend on a number of factors such as its toxicity, the quantities involved and the resulting concentrations in the environment. Even sub-lethal concentrations of hazardous chemicals can lead to long term impacts within the marine environment. For example, chemically-induced stress can reduce the overall ability of an organism to reproduce, grow, feed or otherwise function normally.

Some substances can persist for long periods in the marine environment once lost to sea, including heavy metals and some organic compounds. This can result in bio-accumulation, whereby the chemical builds up in tissue at a faster rate than it can be broken down. Sessile marine species that filter seawater for food, such as bivalve molluscs, are particularly vulnerable to this problem. Subsequent bio-magnification may also occur if the chemicals travel up the food chain and ultimately to humans.

The potential consequences of spills


Coal carrier aground, Indonesia


Manual removal of coal from a shoreline, Indonesia

of hazardous chemicals mean that effective response planning is crucial. A response should be mounted only once a thorough safety assessment of the situation has been completed. A number of different models are available to predict how a substance will behave and its likely trajectory, as well as assessing fire, explosion and toxicity risks.

Response options for many chemicals are limited and monitoring, without necessarily undertaking an active response, must always be considered. If a response is required, responders should wear appropriate personal protective equipment (PPE). For gases and evaporators, techniques available include "knocking down" the vapour cloud or trying to stop or deflect it using water sprays. For dissolvers, acceleration of the natural processes of dispersion and dilution may be possible. Containment and recovery may be an option for some floating chemicals, depending on their flammability, whilst mechanical dredgers and pump/vacuum systems might be used to recover chemicals that have sunk to the seabed.

For all types of chemical spill, maintaining adequate health and safety for vessel crew, responders and the public is key. In a major casualty, the presence of spilled hazardous chemicals can affect the clean-up of spilled oil, requiring detailed risk assessments for all involved.

Dry bulk – coal

Although fairly infrequent, coal spills recently attended by ITOPF have typically occurred in sensitive tropical regions where reefs and fisheries are present.

Common problems with large spills of coal include smothering and abrasion. The coal may sink, blocking light to sea bed flora and fauna and restricting water circulation. Any fixed or slow moving benthic organisms, including corals, may be crushed or trapped and have limited access to food sources, potentially causing mortality. Negative impacts are exacerbated by high wave energy which can throw coal repeatedly against shoreline substrates causing physical damage through abrasion.

Small particles of coal (or fines) may remain suspended in the water column for some time and in calm waters coal 'clouds' can block light and reduce the photosynthetic ability of organisms. Mobile organisms will move to better light sources, but fixed organisms are vulnerable to starvation, with corals particularly at risk. Fines released close to mariculture facilities or water intakes can clog pumping equipment or affect stock.

The removal of large amounts of stranded coal can present logistical challenges in remote environments; manual recovery is usually required rather than reliance on mechanical resources due to access or availability issues. Furthermore, coal may become buried by subsequent tides and become difficult to remove, particularly in dynamic environments.

Storage of recovered coal should be managed with care. An awareness of the potential for self-combustion of stored coal is important. In areas of high rainfall, leachate should be managed to prevent contamination through runoff.

The above issues, particularly smothering, can apply equally to spills of other types of dry bulk cargoes, for example, iron and nickel ores, fertilisers, sulphur and cement.

Other cargoes

The loss of other cargoes, such as wood, foodstuffs (bulk and packaged) and livestock or the myriad other products carried in containerships bring their own set of variables and challenges. Rotting or decomposing organic materials, for example, grain, thawing fish or rotting carcasses, can result in the generation of hydrogen sulphide gas which is particularly hazardous when allowed to accumulate in confined spaces as it is highly toxic and flammable.

For container ship incidents, an understanding of the integrity of the container and the packaged contents inside may provide an indication of whether the containers are likely to remain intact, float or sink if lost overboard. The response actions, as with oil, will depend on the specific properties and characteristics of the

Timber washed ashore from a grounded cargo ship, UK

Nurdles collected from the shoreline, South Africa

Oil soaked plastic and debris in mangroves, India

materials in question. Floating solids can be corralled from boats using nets and then recovered using grabs or shovels. Sunken materials may require dive surveys, dredges or crane grabs, where recovery is considered necessary.

In addition to packaged hazardous chemicals carried in containers, seemingly inert and innocuous container contents can be problematic, if spread over a shoreline or the seabed. Nurdles, small plastic pellets, present a particular problem if released to sea as they can spread over vast distances and are difficult to detect on shore.

Incidents can become particularly complex when non-oil cargoes mix with spilled oil, most commonly from the casualty's fuel tanks.

For example, large quantities of stranded oil-soaked plastic will need to be removed manually. Oiling also makes the identification of hazardous materials amongst other cargoes more difficult and the classification of recovered material for waste disposal more complex.

Fate of oil spills

The fate of oil spilled in the marine environment is dependent upon factors such as the initial physical and chemical properties of the oil, the quantity spilled, the prevailing climatic and sea conditions and whether the oil remains at sea or is washed ashore.

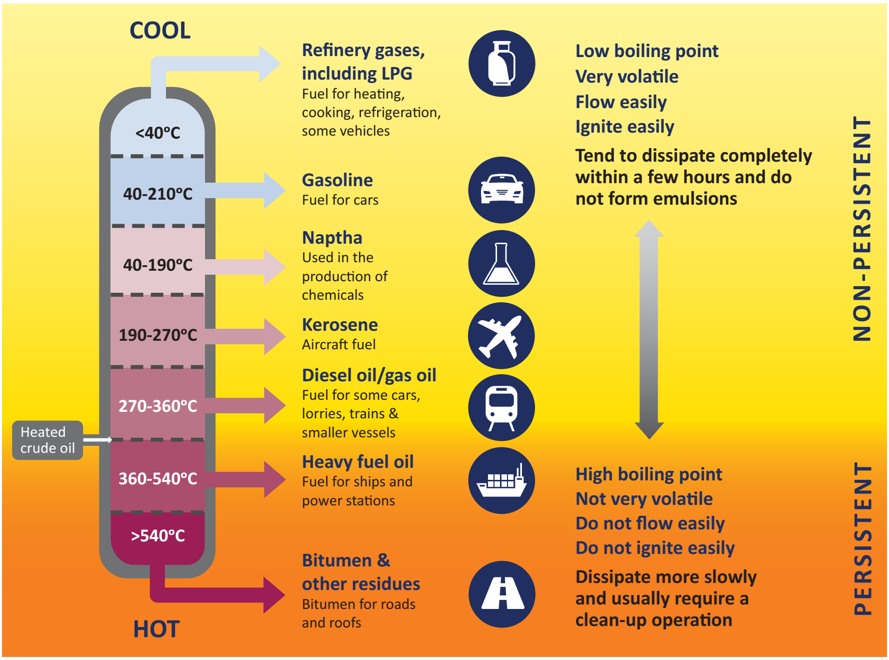
Oil properties

Crude oil is made up of a complex mixture of compounds. These range from very volatile, light materials such as propane and benzene, through medium-weight liquids, which include kerosene and diesel, to more complex heavy compounds such as bitumens, asphaltenes, resins and waxes.

Different fractions have different boiling points and can be separated during the refining process by distillation. The schematic below summarises the main fractions obtained from crude oil, as well as their uses, properties and fate when spilled.

The main properties of oil which affect its behaviour when spilled oil at sea are:

- specific gravity (its density relative to pure water - often expressed as °API or API gravity); (Oil can be classified into four groups according to API. The table on page 29 shows example oils



Crude oil and its distillation fractions

from the four groups.)
- distillation characteristics (its volatility);
- viscosity (its resistance to flow);
- pour point (the temperature below which it will not flow).

In addition, wax and asphaltene content influence the degree to which the oil will mix with water to form a water-in-oil emulsion.

Weathering

When oil is spilled at sea it normally spreads out and moves on the sea surface with wind and currents while undergoing a number of chemical and physical changes. These processes are collectively termed weathering.

Weathering processes acting on oil at sea

Spreading – the speed at which this occurs depends greatly upon the viscosity of the oil and the volume spilled.

Evaporation – the more volatile components of an oil will evaporate to the atmosphere at a rate dependent upon the ambient temperature and wind speed.

Sinking – oils of sufficiently high density may sink. This may occur more readily in brackish or fresh water.

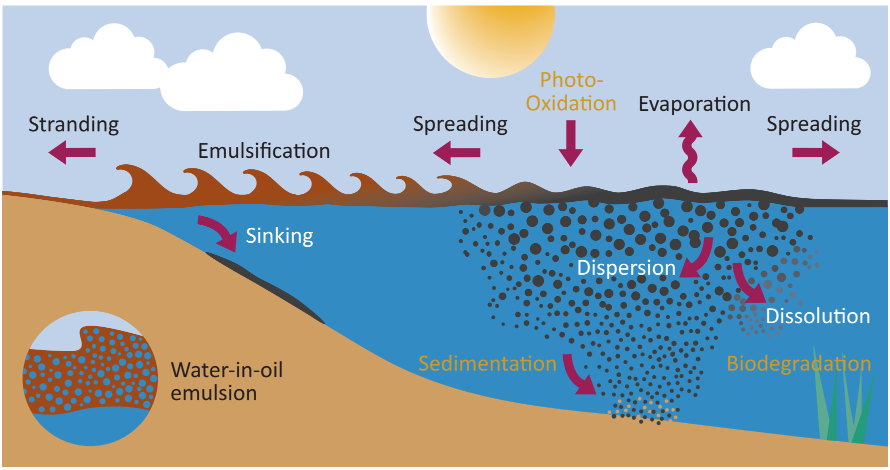
Dispersion – proceeds most rapidly with low viscosity oils in the presence of breaking waves.

Emulsification – can increase the volume of pollutant up to five times.

Stranding – the type of shoreline substrate can affect the fate of stranded oil.

Dissolution – makes only a minor contribution to the removal of oil from the sea surface.

Oxidation – the reaction with oxygen, promoted by sunlight, means oil can form persistent tars most commonly seen as tarballs.



Weathering processes acting on oil at sea

Classification of oils according to their specific gravity

Group 1 oils

A: °API > 45 (Specific gravity < 0.8)
B: Pour point °C
C: Viscosity @ 10–20°C: less than 3 CSt
D: % boiling below 200°C: greater than 50%
E: % boiling above 370°C: between 20 and 0%

	A	B	C	D	E
Aasgard	49	-28	2 @ 10°C	58	14
Arabian Super Light	51	-39	2 @ 20°C		
Cossack	48	-18	2 @ 20°C	51	18
Curlew	47	-13	2 @ 20°C	57	17
F3 Condensate	54	<-63	1 @ 10°C	81	0
Gippsland	52	-13	1.5 @ 20°C	63	8
Hidra	52	-62	2.5 @ 10°C	60	11
Terengganu condensate	73	-36	0.5 @ 20°C	>95	0
Wollybutt	49	-53	2@ 20°C	55	4
Gasoline	58		0.5 @ 15°C	100	0
Kerosene	45	-55	2 @ 15°C	50	0
Naptha	55		0.5 @ 15°C	100	0

Group 2 oils

A: °API 35–45 (Specific gravity 0.8–0.85)
B: Pour point °C
C: Viscosity @ 10–20°C: between 4 Cst and semi-solid
D: % boiling below 200°C: between 20 and 50%
E: % boiling above 370°C: between 15 and 50%

Low pour point <6°C

	A	B	C	D	E
Arabian Extra Light	38	-30	3 @ 15°C	26	39
Azeri	37	-3	8 @ 20°C	29	46
Brent	38	-3	7 @ 10°C	37	33
Draugen	40	-15	4 @ 20°C	37	32
Dukhan	41	-49	9 @ 15°C	36	33
Liverpool Bay	45	-21	4 @ 20°C	42	28
Sokol (Sakhalin)	37	-27	4 @ 20°C	45	21
Rio Negro	35	-5	23 @ 10°C	29	41
Umm Shaif	37	-24	10 @ 10°C	34	31
Zakum	40	-24	6@ 10°C	36	33
Marine Gas oil (MGO)	37	-3	5 @ 15°C		
High pour point >5°C					
Amna	36	19	Semi-solid	25	30
Beatrice	38	18	32 @ 15°C	25	35
Bintulu	37	19	Semi-solid	24	34
Escravos	34	10	9 @ 15°C	35	15
Sarir	38	24	Semi-solid	24	39
Statfjord	40	6	7 @ 10°C	38	32

Note: High pour point oils only behave as Group 2 at ambient temperatures above their pour point. Below this treat as Group 4 oils.

Group 3 oils

A: °API 17.5–35 (Specific gravity 0.85–0.95)
B: Pour point °C
C: Viscosity @ 10–20°C: between 8 CSt and semi solid
D: % boiling below 200°C: between 10 and 35%
E: % boiling above 370°C: between 30 and 65%

Low pour point <6°C

	A	B	C	D	E
Alaska North Slope	28	-18	32 @ 15°C	32	41
Arabian Heavy	28	-40	55 @ 15°C	21	56
Arabian Medium	30	-21	25 @ 15°C	22	51
Arabian Light	33	-40	14 @ 15°C	25	45
Bonny Light	35	-11	25 @ 15°C	26	30
Iranian Heavy	31	-36	25 @ 15°C	24	48
Iranian Light	34	-32	15 @ 15°C	26	43
Khafji	28	-57	80 @ 15°C	21	55
Sirri	33	-12	18 @ 10°C	32	38
Thunder Horse	35	-27	10 @ 10°C	32	39
Tia Juana Light	32	-42	500 @ 15°C	24	45
Troll	33	-9	14 @ 10°C	24	35
IFO 180	18–20	10–30	1,500–3,000 @ 15°C		–
High pour point >5°C					
Cabinda	33	12	Semi-solid	18	56
Coco	32	21	Semi-solid	21	46
Gamba	31	23	Semi-solid	11	54
Mandji	30	9	70 @ 15°C	21	53
Minas	35	18	Semi-solid	15	58

Note: High pour point oils only behave as Group 3 at ambient temperatures above their pour point. Below this treat as Group 4 oils.

Group 4 oils

A: °API <17.5 (Specific gravity >0.95) or
B: Pour point >30°C
C: Viscosity @ 10–20°C: between 1500 CSt and semi-solid
D: % boiling below 200°C: less than 25%
E: % boiling above 370°C: greater than 30%

	A	B	C	D	E
Bachaquero 17	16	-29	5,000 @ 15°C	10	60
Boscan	10	15	Semi -solid	4	80
Cinta	33	43	Semi -solid	10	54
Handil	33	35	Semi -solid	23	33
Merey	17	-21	7,000 @ 15°C	7	70
Nile Blend	34	33	Semi-solid	13	59
Pilon	14	-3	Semi-solid	2	92
Shengli	24	21	Semi-solid	9	70
Taching	31	35	Semi-solid	12	49
Tia Juana Pesado	12	-1	Semi-solid	3	78
Widuri	33	46	Semi-solid	7	70
IFO 380	11–15	10–30	5,000–30,000 @ 15°C		

Example oils classified according to their °API (American Petroleum Institute gravity). Indicative ranges of expected viscosities and distillation characteristics are provided for each group. Generally, when spilt, persistence increases with group number. However, if an oil cools to below its pour point temperature, it will change from a liquid to a semi-solid. This can occur for certain oils irrespective of whether they are classed as Group 2, 3 or 4. The pour points of oils classed as Group 1 are sufficiently low so as not to be a concern in the marine environment.

Sedimentation – dispersed oil can interact with sediment particles and organic matter to sink to the seabed.

Biodegradation – metabolisation of oil by micro-organisms, dependent on temperature and upon the availability of oxygen and nutrients.

As a general rule, each process can be put into one of two chronological categories in terms of when their effect is most significant:

Early stage of a spill: spreading, evaporation, sinking, dispersion, emulsification, dissolution, and stranding

Later stage of a spill: oxidation, sedimentation and biodegradation. These are longer term processes that will determine the ultimate fate of the oil spilled.

Some of these processes, like natural dispersion of the oil into the water, lead to the removal of the oil from the sea surface, and facilitate its natural breakdown in the marine environment. Others, particularly the formation of water-in-oil emulsions, cause the oil to become more persistent, and remain at sea or on the shoreline for prolonged periods of time.

The speed and relative importance of the processes depend on factors such as the quantity and type of oil spilled, weather and sea conditions. Once washed ashore, the fate of an oil depends on factors such as the type of substrate and wave energy. Ultimately, spilled oil is usually dealt with in the marine environment through the long-term process of biodegradation.

A number of models are available for predicting the trajectory and weathering of oil spills at sea. These can serve as a useful guide to understanding how a particular oil is likely to behave and help when assessing the scale of impact.

Persistence

When considering the fate of spilled oil at sea, a distinction is frequently made between persistent oils and non-persistent oils.

As a rule, persistent oils break up and dissipate more slowly in the marine environment and usually require an active clean-up response. Persistent oils typically include crude oils, fuel oils, lubricating oils and heavier grades of marine diesel oil. These oils pose a potential threat to natural resources when released, for example, through impacts to wildlife, smothering of habitats or oiling of amenity beaches and mariculture facilities.

In contrast, non-persistent oils will dissipate rapidly, primarily through evaporation. As a result, spills of these lighter oils rarely require an active response beyond monitoring. Non-persistent oils include gasoline, light diesel oil and kerosene.

Impacts from non-persistent oils may include effects on paint coatings in marinas and harbours and, at high concentrations, acute toxicity to marine organisms.

Persistence is also important when it comes to the international compensation regimes. The IOPC Funds have developed guidelines which define persistence according to the distillation characteristics of the oil. Under these guidelines an oil is considered non- persistent if at the time of shipment at least 50% of the hydrocarbon fractions, by volume, distil at a temperature of 340°C (645°F) and at least 95% of the hydrocarbon fractions, by volume, distil at a temperature of 370°C (700°F) when tested in accordance with the American Society for Testing and Materials (ASTM) Method D86/78 or any subsequent revision thereof.

Oil spill response techniques

The selection of the most appropriate response strategy will depend on many factors, including the resources available; the national and local regulations on oil spill response; the spill scenario; and the physical and ecological characteristics of the area affected by the spill.

Sometimes oil will dissipate and eventually degrade naturally without impacting the coast or wildlife. In these cases, monitoring the movement and fate of the floating slicks may be a sufficient response. For spills in coastal waters, the oil will often drift towards the shore and become stranded due to the action of waves and tides and an active clean-up response will be required.

Containment and recovery at sea, France

At-Sea Response

Containment & recovery

Containing floating oil within booms for recovery by specialised skimmers is often seen as the ideal solution to a spill at sea as, if successful, this will physically remove the oil from the marine environment. As a result, it is the primary at-sea response strategy adopted by many governments around the world.

For a containment and recovery operation to be successful, there are some key challenges that must be overcome. The floating oil needs to be located and the equipment deployed in an effective arrangement. The sea state and weather conditions should be sufficiently calm for the selected equipment to function as designed and to be operated safely by response personnel. The oil must also be in a state that is amenable for recovering with the skimmers that are available. Importantly, sufficient storage should be available to meet the pumping capability of the skimmers. These interrelated challenges commonly combine to limit the proportion of spilled oil that can be recovered at sea.

Nonetheless, where environmental conditions and equipment availability allow, containment and recovery is an important response strategy.

In-situ burning

The controlled burning of oil slicks at sea often at, or near, the spill source has the potential to rapidly remove relatively large amounts of oil from the sea surface. However, there are a number of operational constraints that limit the feasibility of this response method, including the difficulty of collecting and maintaining a sufficient thickness of oil to burn. The condition of the oil is also important; as it weathers the oil may lose lighter fractions through evaporation and start to form an emulsion making ignition difficult. Residues from burning may sink, with potential effects on sea bed ecology and fisheries and there may also be human health concerns from the fire or smoke plume. Given the many factors to consider, the decision-making process for in-situ burning should be addressed during the contingency planning process.

Dispersants

Dispersants are not the same as detergents; dispersants are specially formulated for oil spills at sea and, when used appropriately, are an effective oil spill response strategy. Dispersants work by enhancing the natural dispersion of the oil into the sea. They do this by facilitating the formation of numerous small droplets which rapidly dilute into the water column and are subsequently degraded by naturally occurring micro-organisms. Significant environmental and economic benefits can be achieved with dispersants, particularly when other at-sea response techniques are limited by weather conditions or the availability of resources.

Dispersants can be applied by a variety of methods. In general, spraying dispersant from vessels and small aircraft or helicopters is more suitable for treating smaller spills and nearshore areas; large multi-engine planes are better for handling large offshore spills. The key to successful chemical dispersion is the ability to target the thickest part of the oil slick in a timely manner, before it becomes viscous through evaporation or has formed an emulsion. Some types of oil, such as heavy fuel oil and viscous crude, are less amenable to dispersion from the outset.

Dispersant use can be controversial, at times generating widespread debate in the media and public forums. Whilst its use can be viewed as a way of minimising the potential impacts of oil on sensitive resources, it is also sometimes seen as adding another unwanted pollutant into the environment.

The decision on whether or not to use dispersants is seldom clear-cut and a balance has to be struck between the advantages and limitations of the different available response options, conflicting priorities for protecting sensitive resources from pollution damage and cost-effectiveness.

As with all clean-up options, detailed contingency planning will aid in the decision process. In particular, dispersant use is usually regulated by

Oil arriving onshore, Greece

government agencies and planning for its use may allow the necessary licenses and permissions to be expedited.

Shoreline clean-up and response

Once oil has reached the shoreline, the selection of the most appropriate clean-up techniques requires a rapid evaluation of the degree and type of contamination, together with the length, nature and accessibility of the affected coastline. Where possible, it is important to start removing oil from affected shorelines as quickly as possible to minimise its remobilisation and potential to affect other areas. As time passes and the oil weathers, it may adhere to rocks and sea walls or become mixed or buried in sediments.

Shoreline clean-up operations are often considered in three stages; Stage 1 – removal of bulk oil; Stage 2 - removal or treatment in-situ of oiled shoreline substrate, for example oiled sand or gravel (often the most protracted part of shoreline clean-up) and; Stage 3 – final clean-up of light contamination and removal of stains, if required. Consideration needs to be given to the environmental sensitivity of the shoreline to ensure that the planned level of cleaning will not cause more harm than allowing the oil to degrade naturally.

During Stage 1 clean-up, the use of vacuum trucks, pumps and skimmers may be useful on pooled liquid bulk oil. For very viscous or emulsified bulk oil or oiled-soaked sediment, mechanical collection using a variety of non-specialised civil engineering or agricultural machinery may be used to collect and remove stranded oil and contaminated material. In many parts of the world, manual collection is an important strategy and can be particularly useful on sensitive shores and areas inaccessible to vehicles.

Importantly, with Stage 2 clean-up, collection of unoiled material should be kept to a minimum to prevent shoreline erosion and avoid excessive waste. Preferably, oiled material should be treated in-situ, for example by flushing (a technique using high volumes of low-pressure water to wash stranded or buried oil from shorelines) or surf washing (whereby the natural cleaning

Flushing oiled rocks, Japan

action of shoreline waves are used to release oil from shore sediment).

During the latter stages of a shoreline clean-up, other techniques may be deployed to complete the work. These include high pressure washing (using either hot or cold water), particularly on man-made structures; drum washing of pebbles and cobbles in concrete mixers or purpose built facilities; and ploughing or harrowing using tractor-towed implements or sand sieving/ beach cleaning machines for high amenity use beaches.

In situations where restricted access to rocky or cobble shorelines prevents the use of pressure washing or other equipment, manual cleaning may be the only option for the active removal of oil.

The use of bioremediation products, which accelerate the natural degradation of oil, is not normally recommended on open shorelines as biodegradation is rarely limited by nutrients and/or biodegrading organisms. Furthermore, the time required for complex oil compounds to degrade is longer than the timescales

Mechanically-assisted pebble washing, South Korea

Pressure washing hard surfaces, Turkey

usually desired to return an area to its normal use.

In time, most shorelines will clean naturally as the oil weathers and degrades. On high-energy sites, natural cleaning can be very effective, and the majority of oil is likely to be removed within a seasonal cycle. However, along sheltered shorelines, particularly with fine sediment, such as saltmarshes, or in cold climates, natural degradation can proceed very slowly and oil may persist for many years.

Disposal

Cleaning up oil spills can generate significant amounts of waste. This includes not just the recovered oil itself, but oiled cargo, debris, shoreline sediment, fauna and flora, mariculture infrastructure, response equipment and materials, and protective clothing (PPE). The waste generated may amount to over ten times the volume of oil originally spilled, particularly if non-selective shoreline clean-up techniques are employed. As a consequence, waste can cause major logistical problems and delays for the clean-up operation and even bring the response to a standstill,

Manually cleaning rocky shoreline, Japan

unless adequate arrangements are in place, including temporary storage and transportation, as well as final disposal.

The best and most obvious option for waste is to minimise the recovery of unoiled material and treat as much oiled substrate in-situ as possible.

Different types of waste are often disposed of differently, so it helps to separate the waste and keep it segregated from the outset. This is not always easy, but it saves time and money and makes it much easier to direct the waste towards the appropriate treatment or disposal method.

In many countries, the most practical and cost-effective disposal options still take precedence over more sustainable waste management choices. This means that much oily waste goes for incineration or into landfill. However, some waste streams can be treated to facilitate re-use. For example, recovered liquid oil can be blended into feedstock for use in oil refineries or with fuel oils for burning in power stations. This is an option that works best with oil collected from the sea rather than the shoreline, as the former typically contains less debris. Oily sand that does not contain too much debris can also be minimised by stabilising it using quicklime for use in land reclamation and road construction.

Temporary storage of oily waste, Greece

Waste reception facility, Greece

Contingency planning & response management

The effectiveness of the response to an oil spill depends largely on the quality of the contingency plan and the organisation and control of the clean-up operation. Once oil has spilled, events can move rapidly and having the necessary infrastructure, logistical support and leadership in place makes for a more effective response.

Pre-planning

Careful planning before an incident occurs allows key decisions to be made outside the pressurised environment of a real incident. The process of producing a plan provides the opportunity to define the roles and responsibilities of the different parties likely to be involved in a spill and the organisational structure for effective command and control. It also allows for the assessment of the particular risks of a spill and its expected consequences, and identifies sensitive environmental and economic resources, priorities for protection and clean-up, effective response strategies and operational procedures.

It is crucial that plans are living documents, prepared by those agencies, organisations and stakeholders that might be involved in a response, and incorporate a high degree of local knowledge. Thorough testing of the plan through regular exercises will help ensure that all participants are familiar with their roles.

Oil spill exercise, Australia

In line with best practice, contingency planning often follows the concept of 'tiered' response. This is a widely accepted and convenient way to categorise response levels and provides a practical basis for planning. Spills that are small can often be dealt with locally (Tier 1). Should an incident prove beyond the local capability or affect a larger area, an enhanced but compatible response will be required, drawing upon resources based further afield (Tier 2). The foundation of this tiered response is the local plan for a specific facility, such as a port or oil terminal, or for a specific length of coastline at risk from a spill. These local plans may form part of a larger district or national plan (Tier 3). National plans may in turn be integrated into regional response arrangements covering two or more countries. In general, contingency plans should follow a similar format. This will enable the plans to be easily understood, assist compatibility and ensure a smooth transition from one tier level to the next.

As events unfold

Aerial surveillance is an important element of planning during a response, and can establish the scale and nature of an incident at an early stage, verifying predictions of the movement and fate of oil. Once operations are underway, it provides information that facilitates the appropriate deployment of resources at sea, the timely protection of sites along threatened coastlines and the prioritisation of resources for shoreline clean-up. Advances in remote sensing – using satellites or unmanned aerial vehicles (UAVs) – offer huge potential for monitoring and responding to oil spills safely and efficiently.

The efficient management of resources engaged in shoreline clean-up is vital to the success of the operation. In deciding which clean-up techniques are to be used, the management team have to consider the interests of all concerned with the various local uses of the marine environment, for example, recreation, tourism, fisheries, industry and marine conservation. Proper organisation of the workforce and activities on the shoreline is also crucial so that the clean-up is undertaken in the safest and most effective way possible, and that unnecessary impacts on the environment are avoided.

All clean-up activities should be monitored regularly and re-evaluated constantly using information gained from aerial surveillance and personnel on site. Strategic decisions can be reassessed to determine whether the scale of the response remains appropriate to the size and severity of the spill.

Joint surveys, undertaken by representatives of the various interested parties, are commonly undertaken in order to bring operations to a successful close.

Aerial surveillance, Morocco

Joint shoreline inspection, Japan

Effects of marine oil spills

Environmental

Oil spills can have serious and wide-ranging impacts on wildlife, fisheries and coastal and marine habitats, but long-term damage at an ecosystem level is rare.

Oil spills are often portrayed as "environmental disasters" in the media and such perceptions, fuelled by distressing images of oiled birds and contaminated shorelines, are understandable. A science-based appraisal of typical oil spill effects, however, reveals that while damage occurs and may be severe at the level of individual organisms, populations are more resilient. With time, ecosystems can re-establish, even after severe disruptions and/or extensive mortality. Recovery can be assisted by the removal of oil through well-conducted clean-up operations and may sometimes be accelerated with carefully planned restoration measures.

Type of effects

The effects of oil on marine organisms is caused either by its physical nature or by its chemical components.

Physical smothering will affect an organism's ability to continue critical functions, such as respiration, feeding and thermoregulation. This is most common with heavier oils and weathered residues.

Chemical toxicity may arise as a result of chemical components being absorbed into organs, tissues and cells. This does not always cause mortality, but may induce temporary effects like narcosis and tainting of tissues, which usually subside over time. This is more common with light oils and refined products.


Oil spill, Maldives

Marine life may also be affected by clean-up operations, indirectly through physical damage to the habitats in which they live, or through the loss of key organisms that alter the ecosystem dynamics.

The effects of an oil spill will depend on a variety of factors. These include the quantity and type of oil spilled, and how it interacts with the marine environment; the season and prevailing weather conditions; the biological and ecological attributes of the area and its sensitivity to oil pollution; and the type and effectiveness of the clean-up response.

Effects on specific marine organisms and habitats

Plankton

The upper layers of the sea support a myriad of planktonic organisms, including bacteria, eggs and larvae, and a variety of animal and plant species. It is well established that plankton is sensitive to oil exposure and consequently short-term impacts would be expected in the immediate vicinity of the oil. However, plankton is abundant and will naturally suffer very high levels of mortality. As a result, a large proportion of a given species will remain unaffected by the oil and it is rare for plankton mortalities following a spill to have lasting consequences.

Fish

Although the eggs and larvae of fish may be susceptible to the effects of oil, adult fish tend to be more resilient. Reductions in wild fish stocks in offshore and coastal waters following oil spills have rarely been detected, as fish can detect unfavourable water conditions and actively swim away to avoid them. Where mass mortalities have arisen, it has been because of very high, localised concentrations of dispersed oil in shallow or confined waters. Fish mortalities can occur with caged fish stocks where individuals are unable to actively avoid the oil.

Rehabilitating oiled swans, Netherlands

Seabirds

In open water, seabirds are some of the most vulnerable of all animals, and in some incidents large numbers may perish. Fouling of plumage (which is essential for thermoregulation and buoyancy control) is the most visible effect. Although cleaning and rehabilitation of birds may be attempted, success is often linked to the species of bird, and in many cases only a small fraction of those treated will survive or breed successfully after release. However, it is encouraging that with experience and research, best practices for bird cleaning are emerging and rehabilitation success is improving. Increasingly, oil contingency plans define policies on how to deal with oiled seabirds and wildlife.

Sea mammals and reptiles

Oil can potentially cause harm to the nasal tissues and eyes of marine mammals and reptiles as they come to the surface to breathe. Mammals that rely on fur to regulate body temperature may also be harmed or die from hypothermia or overheating if their fur becomes matted with oil. For species that breed on shorelines, the greatest impact is likely to be on their breeding sites if they become contaminated with oil.

Coastal waters and shorelines

The impacts of a spill in nearshore waters are most often related to exposure to high concentrations of naturally or chemically dispersed oil. Where tidal flushing is insufficient to


Oiled mangrove, Singapore

dilute the dispersed oil below harmful levels, high mortalities of benthic organisms can occur.

Shorelines, more than any other part of the marine environment, are exposed to the effects of oil as this is where it naturally tends to accumulate. Shorelines can be impacted both by the toxic effects of high concentrations of dispersed oil at high tide or suffer the smothering effect of oil stranded at low tide. Many species and individual organisms found here are inherently tough and resilient, however, because they have evolved to survive in a highly dynamic environment with periodic fluctuations in temperature and salinity, storms or other severe stresses. This tolerance also gives many shoreline organisms the ability to withstand and recover from oil spill effects.

Within shallow inshore waters and the shoreline zone, three habitats are particularly sensitive to oil pollution; coral reefs, saltmarshes and mangroves. These ecologically rich and diverse habitats are important for providing coastal protection and as nursery grounds for many invertebrate and fish species. They tend to be found at, or close to, the border between sea and land, and are, therefore, at high risk of contamination during oil spills. Because of the turbulence and wave action associated with reefs, corals may be exposed to naturally dispersed oil droplets. This may cause interference with reproductive processes and lead to abnormal behaviour and reduced, or suspended, growth. The communities that reef habitats support are also sensitive to oil. Saltmarshes and mangroves are typically found on sheltered shores and natural recovery of these complex ecosystems may take a long time. It is in these marsh and mangrove areas where reinstatement measures, such as planting mangrove seedlings, may have potential to accelerate recovery.

Recovery

The natural variability of animal and plant populations, which are subject to ever-changing environmental phenomena such as hurricanes, tsunamis and anthropogenic pressures, makes it difficult to determine the point of recovery following an oil spill, and the time that this will take.

A return to exact pre-spill conditions is unlikely, but it is generally accepted that recovery is reached when a community of plants and animals characteristic of that habitat is established and functioning normally.

Long-term damage has been recorded in a few instances. However, in most cases, even after the largest oil spills, the affected habitats and associated marine life can be expected to have broadly recovered within a few seasons.

Economic

Significant economic losses can be experienced by industries and businesses dependent on coastal resources. Usually, the tourist and fisheries sectors are where the greatest impacts are felt.

Tourism

Contamination of coastal amenity areas is a common feature of many oil spills, but disruption to recreational activities is usually relatively short-lived. Once shorelines are clean, normal activities and tourist-related trade would be expected to resume. However, longer-term economic impacts can occur when public perception of prolonged and widescale pollution remains long after the oil has gone. In some cases, promotional campaigns may help to counteract negative publicity generated by the spill.

Fisheries and mariculture

Oil spills can cause serious damage to fisheries and mariculture resources. Physical contamination can affect stocks and disrupt business activities by fouling gear or impeding access to fishing sites. In order to preserve market confidence and to protect fishing gear, fishing or harvesting bans may be imposed or voluntarily implemented. In some cases, bans are imposed if contamination in seafood exceeds acceptable limits.

All fishery damage needs to be documented and, where possible, supported by evidence in order to facilitate the compensation process. This often requires rigorous scientific sampling and analysis. It is often difficult to separate the effects of an oil spill from other factors, such as over-fishing and industrial pollution. In order to make the best assessment of spill-related damages, it is necessary to compare post-spill recovery with pre-spill conditions.

Other industries/businesses

Heavy industry that relies on seawater for normal operations can be at high risk from oil spills, particularly if water intakes are close to the surface. If such plants are responsible for meeting needs on a national scale, disruptions can be far reaching. Other types of coastal industry, such as shipyards, ports and harbours, can also be disrupted both by oil spills and subsequent clean-up operations.

Clean-up activities near a tourist resort, Ibiza

Pollution liability and compensation

A spill of oil may result in expenditure and financial loss for a variety of affected organisations and individuals. Despite the best efforts of those concerned, the response and clean-up can be protracted and costly. Oil may arrive on a shoreline resulting in damage to property and the environment, with economic loss to fishing, tourism and other commercial activity. Those placed at a financial disadvantage as a result of a spill of oil may be eligible for compensation.

Liability for the costs of a pollution incident will generally be set out in civil law, as opposed to criminal law, in relevant national legislation. Many countries have signed a number of international conventions relating to compensation for a release of oil from a ship. These conventions provide uniform rules and criteria relating to compensation claims for the owners of ships, and for those affected by an oil spill in countries that have signed the appropriate convention and in which the spill occurred.

While the regime of international compensation conventions aims to provide global uniformity for all scenarios of ship-source marine oil pollution, these conventions have not been ratified universally or are not yet in force. In incidents where an international convention does not apply, liability and the availability of compensation for those affected by pollution will be dependent upon legislation established nationally. This legislation can be highly specific, such as the Oil Pollution Act of 1990 (OPA '90) in the USA (described on page 46) or be based on broader laws developed originally for other purposes. As a result, liability and the availability of compensation varies widely from country to country.

The sources of compensation for shipping incidents

The insurer of a vessel's third-party liabilities, typically a P&I insurer, is usually the primary source of compensation for an incident involving oil pollution from a ship. The 13 largest P&I Clubs provide cover for approximately 90% of the world's ocean-going tonnage and are members of the International Group of P&I Clubs (the International Group). These P&I Clubs provide cover on behalf of their shipowner and charterer members for a wide range of liabilities, including pollution by oil and other hazardous substances. A further number of commercial vessels are insured for third-party liabilities by smaller P&I insurers that operate in a similar way to providers of domestic insurance.

Government and publicly operated vessels, including warships and other vessels on military duty or charter, usually operate outside established P&I and other commercial insurance. Such vessels may be self-insured by government agencies.

Convention	Applicability	Source of compensation	Financial limit[1]	Signatory States[2]
1992 Civil Liability Convention	Tankers carrying persistent oil cargo & bunker fuel oil	Shipowner	Dependent on GT up to ~$125.5 million	138
1992 Fund Convention		1992 Fund	~$203 million	116
2003 Supplementary Fund Protocol		Supplementary Fund	~$1,050 million	32
2001 Bunkers Convention	Bunker fuel oil from all ships	Shipowner	Dependent on GT	92
2010 HNS Convention	Ships carrying cargoes of HNS, including non-persistent oils	Shipowner	Dependent on GT up to ~$160 million	4
		Fund	~$350 million	

Summary of international conventions applicable to ship-source marine pollution

For oil pollution incidents from commercially operated ships, the shipowner, via a P&I Club or other insurer, is normally liable up to an amount set by national legislation, where relevant, through incorporation of the appropriate international convention. Historical developments with legislation mean that the availability of compensation for releases of oil from ships is dependent to a large extent upon:

- the type of ship: in a broad sense, either a commercially operated tanker or a non-tanker;
- the type of oil involved: either persistent or non-persistent oil; and
- whether the country or countries affected has/have signed one or more applicable international compensation conventions or operate(s) a national compensation scheme.

Claims for compensation should be made in the first instance to the shipowner, often via the insurer of the vessel's third-party liabilities. Compensation to supplement money available from a vessel's insurer may be available from other sources, including international and domestic funds.

The applicable primary international conventions can be compared in the table above.

The availability of compensation for oil spills from tankers has developed over recent decades, prompted by the TORREY CANYON spill in 1967. In this case the UK and French governments encountered difficulties in recovering costs incurred as a result of cleaning oil from beaches and other activities. In response, governments, through the International Maritime Consultative Organization (IMCO)[3], developed two

[1] Limits converted to US $ from SDR (Special Drawing Rights) as defined by the International Monetary Fund.
[2] As at 18th March 2019. An up-to-date list of Contracting States is available at www.imo.org/en/About/Conventions/StatusOfConventions/Pages/Default.aspx.
[3] Now the International Maritime Organization www.imo.org.

international conventions for the same purpose: the Civil Liability and Fund Conventions. The Civil Liability and Fund Conventions provide a mechanism for compensation for a release, or the threat of a release, of persistent[4] hydrocarbon mineral oil carried in tankers[5]. A tanker is defined under the two conventions as a seagoing vessel or seaborne craft constructed or adapted to carry oil in bulk as cargo.

Further international conventions have been developed subsequently to cover other pollution scenarios.

The international conventions follow a defined process of signature, ratification, acceptance, approval and accession through IMO, before coming into force in a country and becoming binding upon that government and on activities in the waters of that country. To be applicable, an international convention must be implemented into national law. Many countries are signatories to one or more of the conventions described.

Although different in their application, the international compensation conventions have many principles in common. For example, they apply primarily to releases of oil in the waters of countries that have signed that convention. The HNS Convention applies also to incidents involving pollutants other than oil. For claimants, a primary advantage is that a claim for reimbursement of costs/losses can be made under the conventions without the need to prove that the owner of the ship causing the pollution was at fault, and without a need, in most instances, to engage lawyers or to go to court. However, each convention has a time limit during which claims can be submitted, and restricts the types of claims that can be made. Nonetheless, there are crucial differences between the individual conventions and between their iterations and an understanding of their applicability to each incident is important.

Civil Liability Convention

The International Convention on Civil Liability for Oil Pollution Damage (Civil Liability Convention or CLC) provides a first level of compensation paid by the owner, or insurer, of the tanker which causes pollution damage as a result of a release, or the grave and imminent threat of a release, of persistent oil. The CLC places strict liability on the tanker owner, meaning that compensation may be available even if the pollution was not due to any fault of the owner and in most instances without the need for a claimant to involve the courts. The tanker owner is exempt from this strict liability only in exceptional circumstances. At the same time, the CLC allows the tanker owner's liability to be limited to an amount of money dependent upon the size (gross tonnage) of the tanker. The limitation amount varies according to the version of the CLC in force in the affected country.

Fund Convention

The International Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage (Fund Convention) provides a second level of compensation for a release, or the threat of a release,

[4] A definition of persistence is provided on page 30.
[5] In some instances, persistent oil onboard a tanker may be covered alternatively by the 2001 Bunkers Convention.

of persistent oil from a tanker up to a fixed limit. The Fund Convention established the International Oil Pollution Compensation Funds (IOPC Funds), financed by a levy on receivers of persistent oil in countries that have signed the convention. The IOPC Funds are an intergovernmental organisation, administered by a Secretariat, based in the headquarters of IMO in London, and governed by two bodies: an Assembly and an Executive Committee.

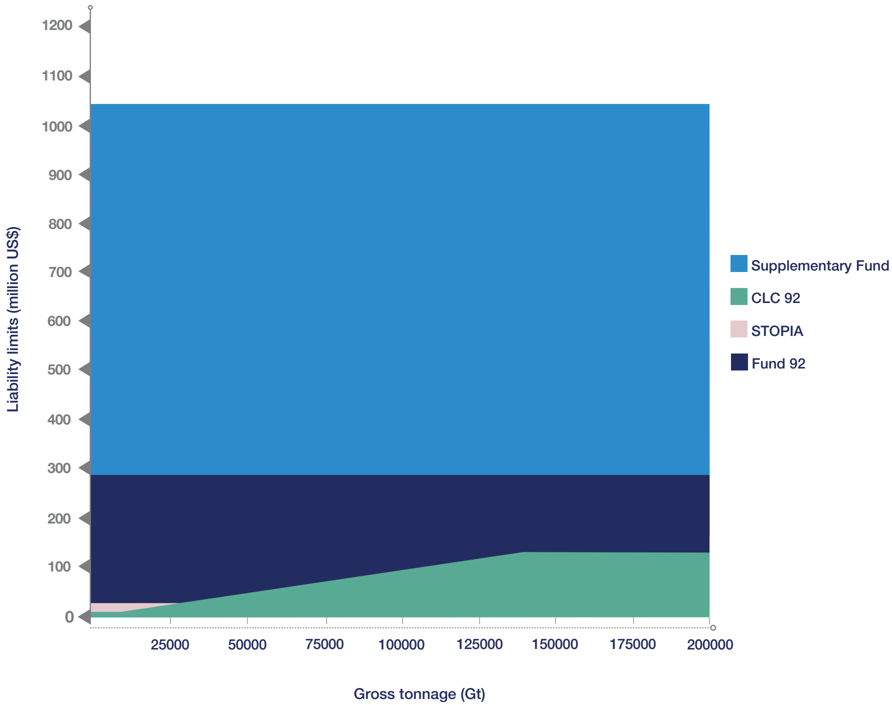
In 2003, a protocol was agreed to the 1992 Fund, to establish the Supplementary Fund, providing a third level of compensation.

STOPIA and TOPIA

The Small Tanker Oil Pollution Indemnification Agreement (STOPIA 2006) applies to small tankers, insured by a P&I Club in the International Group, that cause pollution damage in a country in which the 1992 Fund Convention is in force. Under STOPIA 2006, the liability under the 1992 CLC for owners of tankers up to 29,548 gross tonnes (GT) is increased to ~US$27.7 million.

Bunkers Convention

The International Convention on Civil Liability for Bunker Oil Pollution Damage 2001 (Bunkers Convention)



Compensation limits under the 1992 Civil Liability and Fund Conventions (including 2003 Supplementary Fund Protocol and Small Tanker Oil Pollution Indemnification Agreement–STOPIA) is applicable to pollution damage caused by any hydrocarbon mineral oil used for the operation or propulsion of any type of sea-going vessel in the territory of a signatory country, as well as to response activities undertaken anywhere to protect a signatory country.

The Bunkers Convention is a single-tier compensation regime modelled on the CLC, but has no provision for additional compensation above the shipowner's limit. As with the CLC, a key requirement of the Bunkers Convention is the need for the registered owner of a vessel (over 1,000 GT for the Bunkers Convention) to maintain compulsory insurance to cover liability, evidenced by a Blue Card and a Convention certificate. The limit of liability of the shipowner is determined by separate applicable national legislation or an international limitation regime, such as the Convention on Limitation of Liability for Maritime Claims.

Claims

Claims arising under the four primary conventions will usually be handled by the shipowner's insurer in the first instance. Where a loss is anticipated, notification should be made at the earliest opportunity, supported by information on the quantum of the loss. It is the responsibility of the claimant to provide adequate evidence of the loss, and further information and evidence may be requested during the claims assessment process. The assessment may therefore take the form of iterative exchanges between the claimant and those responsible for settling the claim, until the process has been completed. In most cases, agreement on the amount of compensation to be paid is reached on an amicable basis, without the need for legal action and associated costs.

USA – Oil Pollution Act of 1990 and Oil Spill Liability Trust Fund

Following the release of oil from EXXON VALDEZ, in March 1989 in Alaska, the US Congress passed the Oil Pollution Act of 1990 (OPA '90), which amended the existing Clean Water Act. OPA '90 includes provisions for liability and compensation of releases of persistent and non-persistent oils from onshore and offshore facilities, ships and other watercraft. OPA '90 does not prevent individual US States from implementing more stringent laws for releases of oil and many have done so.

The first level of liability is placed on the Responsible Party (the owner, operator or bareboat charterer of the vessel) and varies according to the type and size of the ship.

In certain circumstances claims may be submitted to the US Oil Spill Liability Trust Fund (OSLTF), for example when the Responsible Party is unknown or refuses to pay a claim, or when the first level of liability is insufficient to satisfy all admissible claims for compensation. The Fund is administered by the US Coast Guard's National Pollution Funds Center and can provide up to $1 billion for any one pollution incident.

Hazardous and Noxious Substances (HNS) Convention

Damage caused by many hazardous substances, including non-persistent hydrocarbon mineral oils, and vegetable oils, carried as cargo, will be covered by the International Convention on

Source tank vessel (US$)	Liability limits for five ship sizes (US$ rounded)
For an oil cargo tank vessel less than or equal to 3,000GT with a single hull, including a single-hull tank vessel fitted with double sides only or a double bottom only. The greater of $3,500 per GT or $7,048,800	2,000 GT = $7.05 million
For a tank vessel less than or equal to 3,000 GT, other than a vessel referred to above. The greater of $2,200 per GT or $4,699,200	2,000 GT = $4.7 million
For an oil cargo tank vessel greater than 3,000 GT with a single-hull, including a single-hull tank vessel fitted with double sides only or a double bottom only. The greater of $3,500 per GT or $25,845,600	10,000 GT = $35 million 50,000 GT = $175 million 100,000 GT = $350 million 200,000 GT = $700 million
For a tank vessel greater than 3,000 GT, other than a vessel referred to above. The greater of $2,200 per GT or $18,796,800	10,000 GT = $22 million 50,000 GT = $110 million 100,000 GT = $220 million 200,000 GT = $440 million

Tank vessel liability limits under OPA '90

Liability and Compensation for Damage in Connection with the Carriage of Hazardous and Noxious Substances by Sea, known as the HNS Convention. The 2010 HNS Convention is not yet in force.

The convention will apply to the carriage of HNS by sea by any sea-going craft, including tankers and bulk carriers carrying bulk cargoes, as well as container ships carrying packaged goods. A large number of substances are included under the HNS Convention, as referenced in various IMO conventions and codes; for example, the International Maritime Dangerous Goods (IMDG) Code lists hundreds of materials which can be dangerous when shipped in packaged form. Some bulk solids, such as coal and iron ore are excluded from the convention.

The availability of compensation under the HNS Convention will be modelled largely on the existing Civil Liability and Fund Conventions. However, the HNS Convention combines shipowner and cargo receiver liability in a single convention. For the first level, the shipowner will be liable strictly for the loss or damage, up to an amount dependent upon the size of the ship, and whether the HNS is in bulk or packaged form, paid by the shipowner or insurer of the vessel. An HNS Fund will provide a second level of additional compensation when full compensation is not available from the shipowner.

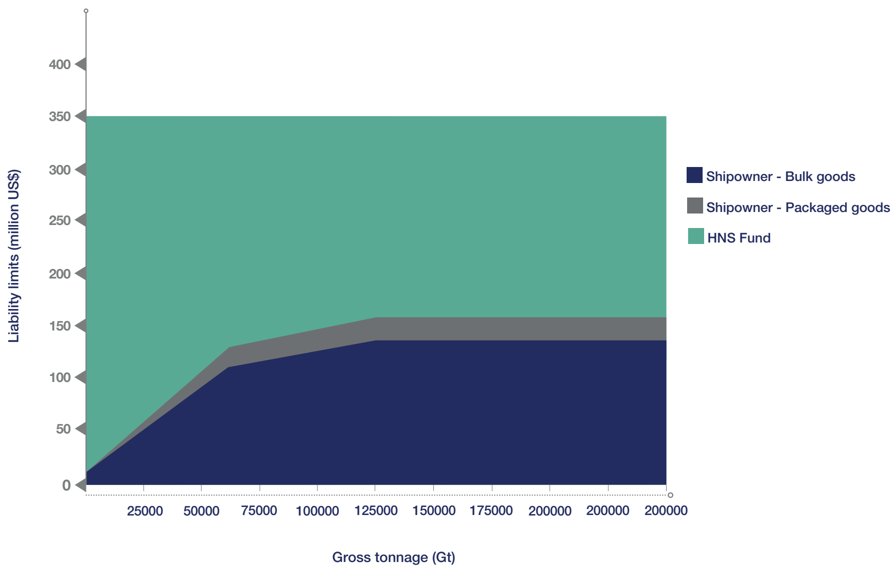
Other relevant conventions

Oil Pollution Preparedness, Response and Co-operation (OPRC) Convention

The primary objective of OPRC 1990, which entered into force in 1995, is to facilitate international co-operation and mutual assistance between States and regions when preparing for, and responding to, major oil pollution incidents, and to encourage States to develop and maintain an adequate capability to deal with such emergencies. OPRC 1990 covers oil spills from offshore oil exploration and production (E&P) platforms, ports, oil handling facilities and ships. In 2000, a Protocol was introduced extending the provisions of OPRC 1990 to encompass Hazardous and Noxious Substances (OPRC-HNS Protocol) which entered into force in 2007.

Wreck Removal Convention

The Nairobi International Convention on the Removal of Wrecks 2007 provides the legal basis for States to remove, or have removed, shipwrecks which pose a hazard to the safety of navigation or to the marine and coastal environments, or both. This convention entered into force in 2015.



Compensation limits under the 2010 HNS Convention showing the limits in US$ for vessels of Gross Tonnage up to 200,000GT.

Status of international conventions

This table shows which countries were parties to the 1969 CLC, 1992 CLC, 1992 Fund Convention, 2003 Supplementary Fund, 1990 OPRC, OPRC-HNS, Bunkers and Wreck Removal Conventions as at 18th March, 2019. x denotes that the convention is in force in that country, whereas + denotes that it has been ratified but is not yet in force. o denotes that the country has denounced that convention but that it has not yet taken effect. For a current list see the IMO or IOPC Funds websites (www.imo.org; www.iopcfunds.org).

Country	CLC 69	CLC 92	FUND 92	Supp Fund 03	OPRC 90	OPRC-HNS 00	BUNKERS 01	WRECK
Albania		x	x		x	x	x	x
Algeria		x	x		x			
Angola		x	x		x			
Antigua & Barbuda		x	x		x		x	x
Argentina		x	x		x			
Australia		x	x	x	x	x	x	
Austria							x	
Azerbaijan	x	x			x		x	
Bahamas		x	x		x		x	x
Bahrain		x	x		x		x	
Bangladesh					x			
Barbados		x	x	x			x	
Belarus								
Belgium		x	x	x	x	x	x	x
Belize		x	x				x	x
Benin	x	x	x		x			
Bosnia & Herzegovina								
Brazil	x				x			
Brunei Darussalam		x	x					
Bulgaria		x	x		x		x	x
Cabo Verde		x	x		x			
Cambodia	x	x	x					
Cameroon		x	x		x			
Canada		x	x	x	x		x	
Chile	x	x			x	x		
China		x			x	x	x	x
China (Hong Kong spec.admin.region)		x	x		x	x	x	
Colombia		x	x		x	x		
Comoros		x	x		x		x	x
Congo		x	x	x	x	x	x	x
Cook Islands		x	x				x	x
Costa Rica	x							
Cote d'Ivoire	x	x	x		x	x	x	
Croatia		x	x	x	x		x	x
Cuba					x			
Cyprus		x	x				x	x
Czechia							x	
Dem. Rep. of the Congo								
Denmark		x	x	x	x	x	x	x
Djibouti		x	x		x	x	x	
Dominica		x	x		x			
Dominican Republic	x	x	x					
Ecuador	x	x	x		x	x		
Egypt	x	x			x	x	x	
El Salvador	x	x			x			
Equatorial Guinea	x							
Eritrea								
Estonia		x	x	x	x	x	x	
Ethiopia							x	
Fiji		x	x				x	
Finland		x	x	x	x	x	x	x
France		x	x	x	x	x	x	x
Gabon		x	x		x			
Gambia	x							
Georgia	x	x	x		x		x	
Germany		x	x	x	x	x	x	x
Ghana	x	x	x		x			
Greece		x	x	x	x	x	x	
Grenada		x	x				x	
Guatemala	x	x						
Guinea		x	x		x			
Guinea-Bissau								
Guyana	x	+	+			+	+	+
Haiti								
Honduras	x				x			
Hungary		x	x	x			x	
Iceland		x	x		x			
India		x	x		x			x
Indonesia	x	x					x	
Iran		x	x		x	x	x	x
Iraq								
Ireland		x	x	x	x		x	
Israel		x	x		x			
Italy		x	x	x	x		x	
Jamaica		x	x		x		x	
Japan		x	x	x	x	x		
Jordan	o	x			x		x	x
Kazakhstan	x							
Kenya		x	x		x		x	x
Kiribati		x	x				x	
Kuwait	x	x						
Latvia		x	x	x	x		x	
Lebanon	x	x			x		x	
Lesotho								
Liberia		x	x		x	x	x	x
Libya	x				x			
Lithuania		x	x	x	x		x	
Luxembourg		x	x				x	
Madagascar		x	x		x	x	x	
Malaysia		x	x		x	x	x	x
Maldives	x	x	x					
Mali								
Malta		x	x		x	x	x	x
Marshall Islands		x	x		x		x	x
Mauritania		x	x		x			
Mauritius		x	x		x	x	x	
Mexico		x	x		x			
Micronesia								
Moldova		x						
Monaco		x	x		x			
Mongolia	x	x					x	
Montenegro		x	x	x			x	
Morocco		x	x	x	x		x	x
Mozambique		x	x		x			
Myanmar		x			x		x	
Namibia		x	x		x			
Nauru								
Netherlands		x	x	x	x	x	x	x
New Zealand		x	x	x	x		x	
Nicaragua		x	x				x	
Nigeria		x	x		x		x	x
Niue		x	x				x	x
North Korea							x	x
Norway		x	x	x	x	x	x	
Oman		x	x		x			
Pakistan		x			x			
Palau		x	x		x	x	x	x
Panama		x	x				x	x
Papua New Guinea		x	x					
Peru	x	x			x			
Philippines		x	x		x			
Poland		x	x	x	x	x	x	
Portugal		x	x	x	x	x	x	x
Qatar		x	x		x			
Romania		x			x		x	x
Russian Federation		x	x		x		x	
Saint Kitts and Nevis	x	x	x		x		x	x
Saint Lucia		x	x		x		x	
St. Vincent & Grenadines		x	x				x	
Samoa		x	x		x		x	
Sao Tome & Principe	x							
Saudi Arabia	x	x			x		x	
Senegal	x	x	x		x			
Serbia		x	x				x	
Seychelles		x	x		x			
Sierra Leone		x	x		x		x	
Singapore		x	x		x	x	x	x
Slovakia		x	x	x			x	
Slovenia		x	x	x	x	x	x	
Solomon Islands		x						
Somalia								
South Africa		x	x		x			x
South Korea		x	x	x	x	x	x	
Spain		x	x	x	x	x	x	
Sri Lanka		x	x					
Sudan					x			
Suriname								
Sweden		x	x	x	x	x	x	x
Switzerland		x	x		x		x	x
Syria	x	x	x		x	x	x	
Tanzania		x	x		x			
Thailand		x	x		x			
Togo		x			x		x	
Tonga		x	x		x		x	x
Trinidad & Tobago		x	x		x			
Tunisia		x	x		x		x	
Turkey		x	x	x	x	x	x	
Turkmenistan	x	x						
Tuvalu		x	x				x	x
Ukraine		x						
United Arab Emirates	x	x	x					
United Kingdom		x	x	x	x		x	x
United States					x			
Uruguay		x	x		x	x		
Uzbekistan								
Vanuatu		x	x		x	x	x	
Venezuela		x	x		x			
Viet Nam		x					x	
Yemen		x			x	x		

Terms and Conditions of Membership

(effective 12th July, 2018)

1. Membership of ITOPF is subject to ITOPF's Memorandum and Articles of Association and to these Terms and Conditions, which apply to all Owners who are Members of ITOPF as at 12th July 2018, and to all Owners who thereafter are accepted for Membership. The Directors of ITOPF have the right from time to time to add to or modify these Terms and Conditions. Any such additions or modifications and their effective date will be notified to Members.

2. Membership of ITOPF is available only to an owner or demise charterer ("Owner") of a tanker, being any ship (whether or not self-propelled) designed, constructed or adapted for the carriage by water in bulk of crude petroleum, hydrocarbon products and any other liquid substance ("Tanker").

3. A Member is required to notify ITOPF (or ensure that ITOPF is notified) in writing from time to time of the name and tonnage of Tankers of which it is or becomes Owner and in respect of which it wishes to be entitled to the services of ITOPF. A Member who is no longer the Owner of any Tanker whose name and tonnage have been so notified shall automatically cease to be a Member of ITOPF.

4. Subject to these Terms and Conditions, a Member has the right to request ITOPF to provide technical and other services, advice and information ("Services") in relation to:

a) a spill (or the threat thereof) of oil, or of HNS, whether as cargo or bunkers, or of any other cargo from a Tanker, including on-site attendance to give technical advice with the aim of effecting an efficient response operation and mitigating any damage;

b) the technical assessment of damage caused by a spill of oil, or of HNS, whether as cargo or bunkers, or of any other cargo from a Tanker;

c) the technical assessment of claims for compensation resulting from a spill (or the threat thereof) of oil, or of HNS, whether as cargo or bunkers, or of any other cargo from a Tanker;

d) Contingency planning, response techniques, fate and effects, and compensation resulting from a spill (or threat thereof) of oil, or of HNS, whether as cargo or bunkers, and of any other cargo;

e) training courses, drills, exercises and similar events in respect of oil, or of HNS, whether as cargo or bunkers, or of any other cargo;

f) the provision of such of ITOPF's publications as are for circulation to Members and such other general information and advice as is within the scope of ITOPF's Services.

5. It is a condition of entitlement to Services that the Member's ITOPF subscription has been paid in respect of the current year commencing 20th February and for all prior periods of Membership, either directly or by another body on the Member's behalf, and in respect of all Tankers notified pursuant to paragraph 3 of which the Member is the Owner.

6. Although under no obligation to solicit or obtain such information, ITOPF reserves the right from time to time to request any Member or its insurer to provide information satisfactory to ITOPF concerning the Member's pollution liability insurance cover. It is a condition of entitlement to Services that any Member or its insurer of which such a request is made will duly comply.

7. ITOPF reserves the right to recover costs incurred in respect of the provision of any Services from a Member, on whose behalf such costs are incurred. ITOPF will not normally charge a fee for providing Services to a Member but may do so from time to time when circumstances warrant at ITOPF's discretion. It is a condition of entitlement to Services that a Member will agree to, and arrange for, the payment of such costs and fees when so requested by ITOPF.

8. ITOPF reserves the right in its absolute discretion:

a) (i) to terminate the Membership of any Member; and/or

(ii) to decline to respond or cease responding either in whole or in part to any request by or on behalf of a Member for the provision of Services where the continuation of such Membership and/or where such response or its continuation may in any way howsoever expose ITOPF to the risk of being or becoming subject to any sanction, prohibition or adverse action in any form whatsoever by any state or international organisation;

b) not to respond to a request by or on behalf of a Member for the provision of Services where in its absolute discretion ITOPF has determined that the spill (or the threat thereof) of oil, or of HNS or any other cargo from a Tanker has arisen other than directly in connection with the operation of the Tanker including, but not limited to, as a result of a blow-out, cratering, seepage or any other uncontrolled flow from a well or reservoir or any equipment not contained within the Tanker; and/or

c) not to respond either in whole or in part to any request by or on behalf of a Member for the provision of Services whether because of a failure on the part of the Member to meet a condition set by ITOPF, or because of a lack of available ITOPF staff capacity, or for any reason which in ITOPF's absolute discretion might adversely affect ITOPF, the safety of its staff, or the provision of the Services requested. In the case of competing demands for its Services, ITOPF will normally give priority to its Members.

9. To the extent permitted by law, ITOPF shall have no liability to any Member or other person for any direct, indirect, special or consequential loss, expenses and/or costs arising out of or in connection with the provision of, or failure to provide, any Services.

Note: Membership of ITOPF and payment of the relevant subscription referred to in paragraph 5 of these Terms and Conditions of Membership is normally arranged by a tanker owner's P&I insurer. The subscription is currently calculated on the basis of 0.42 of a UK penny per gross ton plus £20 Administration fee per tanker.

Terms and Conditions of Associate Status

(effective 12th July, 2018)

1. Associate status of ITOPF is subject to these Terms and Conditions, which apply to all Associates of ITOPF as at 12th July 2018, and to all persons who thereafter become Associates. The Directors of ITOPF have the right from time to time to add to or modify these Terms and Conditions.

2. Associate status of ITOPF is available only to such persons as the Directors of ITOPF may determine being an owner or demise charterer ("Owner") of any ship other than a tanker ("Ship"). For these purposes "tanker" means any ship (whether or not self-propelled) designed, constructed or adapted for the carriage by water in bulk of crude petroleum, hydrocarbon products and any other liquid substance.

3. An Associate may be required to notify ITOPF (or ensure that ITOPF is notified) in writing from time to time of the name and tonnage of Ships of which it is or becomes Owner and in respect of which it wishes to be entitled to the services of ITOPF. An Associate who is no longer the Owner of any Ship shall automatically cease to be an Associate of ITOPF.

4. Subject to these Terms and Conditions, an Associate has the right to request ITOPF to provide technical and other services, advice and information ("Services") in relation to:

a) a spill (or the threat thereof) of oil, or of HNS, whether as cargo or bunkers, or of any other cargo from a Ship, including on-site attendance to give technical advice with the aim of effecting an efficient response operation and mitigating any damage;

b) the technical assessment of damage caused by a spill of oil, or of HNS, whether as cargo or bunkers, or of any other cargo from a Ship;

c) the technical assessment of claims for compensation resulting from a spill (or the threat thereof) of oil, or of HNS, whether as cargo or bunkers, or of any other cargo from a Ship;

d) Contingency planning, response techniques, fate and effects, and compensation resulting from a spill (or threat thereof) of oil, or of HNS, whether as cargo or bunkers, and of any other cargo;

e) training courses, drills, exercises and similar events in respect of oil, or of HNS, whether as cargo or bunkers, or of any other cargo;

f) the provision of such of ITOPF's publications as are for general circulation and such other general information and advice as is within the scope of ITOPF's Services.

5. ITOPF will charge each Associate an annual subscription to assist in meeting its general expenses. It is a condition of entitlement to Services that the Associate's ITOPF subscription has been paid in respect of the current year commencing 20th February and for all prior periods of Associate status, either directly or by another body on the Associate's behalf and in respect of all Ships notified pursuant to paragraph 3 of which the Associate is the Owner. If in a winding-up of ITOPF there remains any surplus which is attributable to Associates' subscriptions, that surplus shall be distributed among Associates in proportion to the amounts subscribed by them.

6. Although under no obligation to solicit or obtain such information, ITOPF reserves the right from time to time to request any Associate or its insurer to provide information satisfactory to ITOPF concerning the Associate's pollution liability insurance cover. It is a condition of entitlement to Services that any Associate or its insurer of which such a request is made will duly comply.

7. ITOPF reserves the right to recover costs incurred in respect of the provision of any Services from an Associate on whose behalf such costs are incurred. ITOPF will not normally charge a fee for providing Services to an Associate but may do so from time to time when circumstances warrant at ITOPF's discretion. It is a condition of entitlement to Services that an Associate will agree to, and arrange for, the payment of such costs and fees when so requested by ITOPF.

8. ITOPF reserves the right in its absolute discretion:

a) (i) to terminate the Associate status of any Associate; and/or

(ii) to decline to respond or cease responding either in whole or in part to any request by or on behalf of an Associate for the provision of Services where the continuation of such Membership and/or where such response or its continuation may in any way howsoever expose ITOPF to the risk of being or becoming subject to any sanction, prohibition or adverse action in any form whatsoever by any state or international organisation;

b) not to respond to a request by or on behalf of an Associate for the provision of Services where in its absolute discretion ITOPF has determined that the spill (or the threat thereof) of oil, or of HNS or any other cargo from a Ship has arisen other than directly in connection with the operation of the Ship including, but not limited to, as a result of a blow-out, cratering, seepage or any other uncontrolled flow from a well or reservoir or any equipment not contained within the Ship; and/or

c) not to respond either in whole or in part to any request by or on behalf of an Associate for the provision of Services whether because of a failure on the part of the Associate to meet a condition set by ITOPF, or because of a lack of available ITOPF staff capacity, or for any reason which in ITOPF's absolute discretion might adversely affect ITOPF, the safety of its staff, or the provision of the Services requested. In the case of competing demands for its Services, ITOPF will normally give priority to its Members.

9. To the extent permitted by law, ITOPF shall have no liability to any Associate or other person for any direct, indirect, special or consequential loss, expenses and/or costs arising out of or in connection with the provision of, or failure to provide, any Services.

10. Notices to Associates may be given in such manner as ITOPF may determine and shall be deemed given if given to an Associate's insurer or by way of press advertisement.

Note: ITOPF Associate status and payment of the relevant subscription referred to in paragraph 5 of these Terms and Conditions of Associate Status is normally arranged by a shipowner's P&I insurer. The subscription is currently calculated on the basis of 0.38 of a UK penny per gross ton of entered ships.

Emergency contact

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