Insight & Opinion

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Issues a court must decide

THERE is a certain risk attached to the action by a coalition of interested parties led by Intertanko who have begun a challenge in London's High Court to the legality of the European Union's directive on ship source pollution.

Those who invariably impute the worst possible motives to industry, and generally hate anything to do with oil, or tankers, or come to think of it any form of ship propelled by oil, will be given free rein to air once again their prejudices.

"This is just the potential pollutors attempting to overturn laws designed to punish them for pollution," this 'alternative' coalition will shout. But, even though there is this risk, it is important that this case goes ahead, and that it is cleared to go forward to the European Court of Justice. More than shipowners' reputations are at stake here, for the EU directive, without a doubt, goes against international treaty obligations of contracting parties to the Marine Pollution Convention, and also to the Law of the Sea Convention.

This is no dramatic revelation that lawyers with enormous brains have deduced from close study of the directive. When this ill-judged legislation was first proposed as one of the "knee-jerk reactions" to the regrettable *Prestige* sinking, the clear contradictions between international conventions and the proposed hard line directive that sought to criminalise those who have been responsible for accidental pollution was immediately raised. Since then the European Commission and various European Parliamentary luminaries have sought to gloss over these contradictions, hinting darkly that EU law is obviously superior to anything else on earth. Indeed, certain Eurocrats have even suggested that the proposals will do much to free people like shipmasters and shipowners from the fear of prosecution. Few have been reassured.

For its part, the marine industry has attempted to illustrate what it regards as the likely effects of the directive becoming enshrined in national law, with the threat of prosecution, criminal records, huge fines and imprisonment sapping the morale of seafarers and responsible people ashore alike, and acting as a huge deterrent to recruitment. The legal challenge, we hope, will be rather more effective in preventing something that almost certainly will result in a very negative net result. One only has to see the sort of behaviour being indulged in by the French justice system, which has been fiercely penalising those whose ships have been accused of leaving trails of pollution within that country's exclusive economic zone.

The evidence upon which these prosecutions have been launched has been scanty, based solely on airborne photography unsupported mostly by any other evidence. The penalties have been disproportionate and the notion of separately penalising the master of a ship (as if he has gone down and swung open a valve) has been unjust, to say the least.

This is the sort of behaviour we can expect to see institutionalised across Europe if the EU has its way.

An unsafe port

THERE will be some relief that the US Coast Guard has, after a full inquiry, absolved Tsakos Shipping and Trading for any responsibility for the puncture of its ship on the flukes of an abandoned anchor in Delaware Bay. The $175m clean-up costs are just the most immediately visible costs from this debacle, as the Coast Guard investigators have been unable to trace the chain of responsibility that needs to be followed to detect who might have been ultimately responsible for the accident involving a well-found, albeit single-hulled ship.

But somebody must surely be responsible for the provision of a 'safe' port in the US? Port authorities in many countries operate, at their own expense, a modest or even more elaborate hydrographic service, which, with the aid of a readily obtainable sidescan sonar, ensures that channels are not obstructed by shoals, or even enormous anchors. Or have shipowners, before entering a US port, got to undertake their own surveys?

Safety, risk, probability: or playing with lives?

Formal Safety Assessment forces us to ask how much we are willing to pay to increase marine safety, write **Harilaos N Psaraftis** and **Christos A Kontovas**

MUCH has been said about the method of Formal Safety Assessment and how it is applied for maritime safety policy formulation. The example of bulk carrier double hulls is perhaps the most relevant, in which FSA was used by both sides of the argument.

It is well known that the May 2004 decision of the International Maritime Organization not to impose mandatory double hulls on bulk carriers was based on a study that used FSA, even though the IMO's prior opposite view on this subject was essentially based on other studies that used the same method.

Before commenting further on FSA, let us see a related issue. A classic problem in decision analysis is the so-called black pill problem. A man is asked to swallow a black pill which with a known probability P will cause him a painless and instantaneous death, otherwise he walks away alive with no side-effects. The question is, what is the minimum sum of money S that the man in question is willing to receive to take the pill?

Obviously, if probability P is small enough, say one in a million or even one in 100,000, our friend may be willing to risk his life to take the pill in return for the amount of money S he will receive. The higher the value of P, the higher the amount S he would demand.

For those who think that no sum of money is enough for them to be subjected to this experiment, things are not quite that way. In many everyday occasions a person, either willingly or unwillingly, is exposed to risks that are non-trivial and maybe actually higher than that of the black pill.

Examples abound. A compulsive smoker. An alcoholic. A motorcycle rider without a helmet. A drunken driver speeding down the motorway. A yachtsman who deliberately sails his boat under adverse weather conditions.

In these and many other situations, a person assumes a non-zero risk that can ultimately lead to death, even without demanding money in return for being exposed to that risk.

If, in some situations, the person is not aware of the extent of the risk (e.g. in cigarette smoking), this does not mean that the risk does not exist. In other situations (e.g. somebody who has to travel by plane) somebody deliberately chooses to be exposed to risk, knowing that he probably has no alternative.

The alternative for a European who is afraid of flying but has to go to America is to go by ship or not go at all. But with a ship he will lose much time and statistically he is more likely to die than in an aircraft — and cancelling the trip will deprive him of the anticipated benefits from the trip.

The fact that he travels by plane knowing there is a risk of death means he is willing to accept that risk. Anyway, in air transport the probability of being involved in a fatal accident is about one in nine million on a bona fide airline.

To grasp what this number means, if you take one flight per day for the rest of your life, the expected time before you will be involved in a fatal accident is about 25,000 years.

All this essentially means that the black pill problem is not too distant from everyday reality, which involves a multitude of risks that we are constantly exposed to, whether we realise it or not, and whether we like it or not.

The black pill problem is a theoretical tool that can help to estimate, among other things, the economic value of human life, a concept that is very real, even though it may seem odd to some. Even for those who may challenge this from an ethical standpoint, somebody might be able to argue that such an economic value is generally different for two different people, being dependent on the expected income of the person in question for the rest of his or her life.

Is all this somehow related to maritime safety? Of course it is. The question of how much we are willing to pay to reduce maritime transport risk is the inverse of the black pill problem. It assumes that somebody is willing to pay an amount of money, so that the probability of loss of life at sea is reduced or, more generally, maritime safety is increased.

In that spirit, we pay to have double hull tankers because legislation such as OPA 90 and the Erika I package tells us (rightly or wrongly, it does not matter) that this measure would increase maritime safety.

We pay to build ro-ro ferries with Stockholm agreement specifications because someone calculated that this would reduce the risk of sinkage if water enters the vessel. We pay to build double hull bulk carriers because somebody told us they are safer, even though later on somebody else told us that this is not necessarily the case. And so on.

The central question in maritime safety is: "what price safety?" — that is, how much are we willing to pay to increase maritime safety? This is a difficult and, to date, by and large an unanswered question. One of the reasons for this is the difficulty of determining economic quantities such as the value of human life, let alone that of the seagull or the seal that may die because of oil pollution.

In FSA applications the IMO has adopted the average of $3m for the value of human life and there has been a lot of scientific work in this area recently. But many issues are still open. As bad as this may seem, a death in a developed country does not seem to be the same as a death in a less developed country. Who can remember the name of the ferry that sank in Senegal in 2002, causing more than 950 fatalities?

Another, perhaps more fundamental, reason for the difficulty in addressing the "what price safety?" question relates to how the concept of risk is defined and perceived.

The IMO has developed specific guidelines for the application of FSA to its rule-making process. Among those, risk is defined as the product of the probability of an undesirable event — in our case a marine accident — multiplied by the consequence of that event, appropriately quantified. To that effect, two indices are defined (see Tables 1 and 2 below) — the frequency index and the severity index.

Then the so-called risk index (see Table 3) is defined on a logarithmic scale as the sum of the two indices (FI+SI), implying that higher risk indices correspond to scenarios that warrant higher attention, at least as far as measures to avoid them or measures to mitigate their consequences are concerned.

Such an approach to risk has inherent problems. In addition to relying on expert judgment, which is subjective, the risk index method collapses the two main determinants of an inherently two-dimensional concept such as risk (probability and consequence) into a single number.

Doing so loses much of the relevant information and may lead to some nonsensical results. For instance, suppose that once a month (FI=7) there is a risk that leads to a single injury (SI=1). This means that RI=8. Suppose also there is another risk where once a year (FI=5) a death occurs (SI=3). Here RI=8 as well.

Are these two scenarios equivalent in terms of risk? One would assume that the latter would be more serious. Also, if within a year in a 1,000-ship fleet an accident occurs that produces more than 10 deaths, then FI=3, SI=4, and RI=7. Why is this scenario less serious than the previous ones?

In addition, and according to this scheme, 50 fatalities are equivalent to 100, 500 or more fatalities, even though the IMO acknowledges this scale can change for passenger ships. As it stands, this method over-emphasises frequent, low-consequence events over extremely rare accidents that are catastrophic.

Attempts to extend the risk index approach to environmental protection issues are also under way by various research groups. The obligatory question is if this is worth pursuing before the shortcomings of the method are fixed first. Until this is done, we feel that extreme caution is necessary in applying the method, particularly if it targets the formulation of maritime safety policy or, soon, policy for the protection of the marine environment.

One would hope that rules, legislation or policies that concern maritime safety are proactive; that is, based on advance identification of risks and sound scientific justification before the policies are adopted.

The story thus far is quite the opposite, as much of the relevant policy has been reactive; that is, adopted ad hoc as a result of political pressures after a catastrophic accident (e.g. after *Exxon Valdez, Estonia, Erika, Prestige* and so on).

Shortcomings like those of the risk index approach make FSA prone to manipulation to produce whatever result is desired by the stakeholders who use it. This does little justice to the status of FSA as a solid scientific tool and, more importantly, to the quest for increased maritime safety.

We feel that an improved scientific framework for risk and safety assessment is warranted, one that is void of such deficiencies. IMO's goal-based standards approach aspires to have such a property, although in our opinion it is still too early to tell what exactly this framework will entail and how it will be applied.

Whatever its name, the improved framework has to retain the correct elements of the current state of the art and replace the elements that exhibit problems.

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Pancakes of oil on Biscarosse Beach in southwestern France six weeks after the Prestige sank off northwest Spain in 2002. Laboratory tests traced the oil back to the sunken tanker, which deposited thousands of tonnes of oil. AP

Table 1: Frequency Index

FI	Frequency	Definition	F (per ship year)
7	Frequent	Likely to occur once per month on one ship	10
5	Reasonably probable	Likely to occur once per year in a fleet of 10 ships i.e. likely to occur a few times during ship's life	0.1
3	Remote	Likely to occur once per year in a fleet of 1000 ships, i.e. likely to occur in the total life of several similar ships	10^{-3}
1	Extremely remote	Likely to occur once in the lifetime (20 years) of a world fleet of 5000 ships	10^{-5}

Table 2: Severity Index

SI	Severity	Effects on Human Safety	Effects on Ships	S (Equivalent fatalities)
1	Minor	Single or minor injuries	Local equipment damage	0.01
2	Significant	Multiple or severe injuries	Non-severe ship damage	0.1
3	Severe	Single fatality or multiple severe injuries	Severe damage	1
4	Catastrophic	Multiple fatalities	Total loss	10

Table 3: Risk Index (RI)

		Severity (SI)			
		1	2	3	4
FI	Frequency	Minor	Significant	Severe	Catastrophic
7	Frequent	8	9	10	11
6		7	8	9	10
5	Reasonably probable	6	7	8	9
4		5	6	7	8
3	Remote	4	5	6	7
2		3	4	5	6
1	Extremely remote	2	3	4	5