

**International Association of Classification Societies  
(IACS)**

**FSA of Bulk Carriers  
Fore-end Watertight Integrity**

**Annex 1  
Basic Definitions and Abbreviations**

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## 1. BASIC DEFINITIONS

### 1.1 Ship Definition

This study is focused on Bulk Carriers, defined as ships constructed with topside tanks and hopper side tanks in cargo spaces, intended primarily to carry dry cargo in bulk.

### 1.2 Bulk Carrier Classification

INTERCARGO (1998), subdivides Bulk carriers in Handysize, Handymax, Panamax and Capesize according to their deadweight range.

The corresponding web site ([www.intercargo.org](http://www.intercargo.org)) further provides the corresponding approximate number of vessels in the fleet population and the percentage on the bulk carrier fleet population (5,365 vessels over 10,000 dwt). The results do not exactly sum to 100% due to some overlapping in the VL category.

Bulk carrier	Deadweight	n. vessels	%
Handysize	10,000-34,999 dwt	2,556	48
Handymax	35,000-49,999 dwt	1,283	24
Panamax	50,000-79,999 dwt	993	19
Capesize	80,000-199,000 dwt	494	9
VL Ore Carriers	180,000 + dwt	10	0.2

The PT decided to adopt the following bulk carrier classification, which includes the bulk carrier length, deemed an important parameter in a regulatory context.

**Table 1 – Classification of bulk carriers in size**

	L <sub>f</sub> (m)	DWT
(Mini)	100-130	10,000-23,000
Small-Handy	130-150	
Handy(max)	150-200	23,000-55,000
Panamax	200-230	55,000-80,000
Cape size	230-270	80,000+
(VL)	270-	

Annex 7 and 8 focus on the three upper typical bulk carrier sizes (Capesize, Panamax and Handymax). The Handysize bulk carriers were not considered, mainly because they exhibit a large variation of their size and characteristics.

### 1.3 Definition of Cost-Effectiveness Parameters (GCAF and NCAF)

In this study, the cost-effectiveness was expressed in terms of Gross Cost of Averting a Fatality (GCAF), defined as follows:

$$GCAF = \frac{\Delta \text{Cost}}{\Delta \text{Risk}}$$

$\Delta$ Cost is the marginal (additional) cost of the risk control option, whilst  $\Delta$ Risk is the reduced risk in terms of fatalities averted, i.e., the expected reduction in number of fatalities. This latter should be measured in terms of Potential Loss of Life (PLL). This term is misleading, since it really means the expected loss of life in rigorous statistical terminology. The unit of PLL is [Expected fatalities per ship-year]. GCAF evaluates the risk control options in terms of additional safety only.

An additional cost-effectiveness measure is given by Net Cost of Averting a Fatality (NCAF), where not only the increase in safety, but also the economic benefits of the investigated risk control options are accounted for. Economic benefits (or risk reduction) may also include the economic value of reduced pollution.

$$\text{NCAF} = \frac{\Delta\text{Cost} - \Delta\text{Economic Benefits}}{\Delta\text{Risk}} = \text{GCAF} - \frac{\Delta\text{Economic Benefits}}{\Delta\text{Risk}}$$

The study reports both measures for the risk control options.

The decision criterion referred to throughout the study was, as recommended in MSC72/16 US\$3 million per fatality averted.

#### 1.4 Casualty Statistics Definitions

Throughout the study, the terms below are frequently used.

**Serious casualty:** Accident resulting in at least one of the following consequences (LMIS, 1995):

- Total loss (see below for further description).
- Breakdown resulting in the ship being towed or requiring assistance from ashore.
- Flooding of any compartment.
- Structural, mechanical or electrical damage requiring repairs before the ship can continue trading.

**Total loss:** Ship having ceased to exist after a casualty, either due to it being irrecoverable (actual total loss) or due to it being subsequently broken up (constructive total loss) (LMIS, 1995). Constructive total loss occurs when the cost of repair exceeds the insured value of the ship.

The LMIS casualty database divides the accidents into the following 9 accident categories:

1. **Foundered** - includes ships which sank as a result of heavy weather, leaks, breaking in two, etc, and not as a consequence of other categories such as collision etc.
2. **Missing vessel** - includes ships that disappeared without any witnesses knowing exactly what happened in the accident.
3. **Fire/explosion** - includes ships where fire/explosion is the first event reported, or where fire/explosion results from hull/machinery damage, i.e. this category includes fires due to engine damage, but not fires due to collision etc.
4. **Collision** - includes ships striking or being struck by another ship, regardless of whether under way, anchored or moored. This category does not include ships striking underwater wrecks.
5. **Contact** - includes ships striking or being struck by an external object, but not another ship or the sea bottom. This category includes striking drilling rigs/platforms, regardless of whether in fixed position or in tow.
6. **Wrecked/stranded** - includes ships striking the sea bottom, shore or underwater wrecks.
7. **War loss/hostilities** - includes ships damaged from all hostile acts.

8. **Hull/machinery damage** - includes ships where the hull/machinery damage is not due to other categories such as collision etc.
9. **Miscellaneous** - includes lost or damaged ships which cannot be classified into any of the categories 1 through 8 due to not falling into any of the categories above or due to lack of information (e.g. an accident starting by the cargo shifting (not as a consequence of events of any of the categories 1 through 8) would typically be classified as miscellaneous).

In the casualty data analysis below, the category denoted as Hull/machinery damage in the LMIS casualty database has been split into “machinery”, “hull”, “mooring”, and “other” by separating the events according to the component category involved in the casualty.

## 1.5 Definition and Cost of Casualties

In this study, GCAF and NCAF of the risk control options were evaluated.

The consequences of an accident were classed as *Serious casualty*, or *Total loss* of the ship.

From Annex 2, Table 9, a generic serious casualty was estimated to cost US\$ 5,608,000, and a total loss US\$ 24,808,000, including cost elements like cargo and environmental damage. These figures were used in the calculation of the NCAF.

## 2. OTHER ABBREVIATIONS

The following abbreviations were used throughout the study.

BC = Bulk Carrier  
BHD = Bulkhead  
CEA = Cost-Effectiveness Analysis  
CTL = Constructive Total Loss  
CTLL = Constructive Total Loss with Loss of the crew  
DNV = Det Norske Veritas  
DSS = Double Side Skin  
ESP = Enhanced Survey Program  
ET = Event Tree  
FSA = Formal Safety Assessment  
FT = Fault Tree  
NKK = Nippon Kaiji Kyokai  
PLL = Potential Loss of Life  
RCM = Risk Control Measures  
RCO = Risk Control Options  
RINA = Registro Italiano Navale  
SC = Serious Casualty