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DEVELOPMENT OF A SAFETY REGULATORY FRAMEWORK TO SUPPORT THE REDUCTION OF GHG EMISSIONS FROM SHIPS USING NEW TECHNOLOGIES AND ALTERNATIVE FUELS

Analysis of the structure of the Nuclear Code and comparison against other IMO instruments

Submitted by WNTI

SUMMARY

Executive summary:	This document contains observations from analysis of the structure of the *Code of Safety for Nuclear Merchant Ships* (resolution A.491(XII)) and a comparative assessment of the Nuclear Code against other IMO instruments. Particular attention has been given to whether the Nuclear Code and other IMO instruments are prescriptive, or follow a goal-based approach, and whether prescriptive elements in the Nuclear Code are technology-specific.
Strategic direction, if applicable:	3
Output:	3.8
Action to be taken:	Paragraph 15
Related document:	SDC 12/9

Introduction

1 A project group in the Nuclear Energy Maritime Organization (NEMO) has carried out an analysis of the structure of the *Code of Safety for Nuclear Merchant Ships* (resolution A.491(XII)) (Nuclear Code), to assess the extent to which it has prescriptive requirements, whether the prescriptive elements are technology-specific or agnostic, and whether it contains elements that follow a goal-based approach. This analysis is presented in annex 1.

2 The NEMO project group has also undertaken a comparative analysis of the structure of the Nuclear Code against other IMO instruments. This analysis also looks at the evolution of the content and structure of other IMO instruments that have undergone updates in recent years. Results of this analysis is presented in annex 2.

3 The aim of this document and its annexes is to provide background information to the SDC Sub-Committee to facilitate a consideration of the structure of the Nuclear Code, in line with the draft work plan for updating SOLAS chapter VIII and the Nuclear Code in document SDC 12/9 (WNTI et al.).

Background

4 IMO regulatory framework has evolved significantly since the Nuclear Code was adopted through resolution A.491(XII) in 1981.

5 The SOLAS Convention, as amended, is considered by NEMO and WNTI as fundamental for updating the Nuclear Code, as SOLAS is applicable to all merchant ships engaged in international voyages, as defined in chapter 1, part A, regulations 1 to 5, and chapter VIII for Nuclear Ships.

6 Since 2010, new SOLAS regulations, and updates to existing IMO instruments, have increasingly used a goal-based approach, relying on overarching goals and functional requirements as opposed to prescriptive requirements.

7 As stated in paragraph 24 of document SDC 12/9, given the age of the Nuclear Code, it would be beneficial to consider whether its current structure should be maintained, or whether a new structure similar to that of more recent Codes under SOLAS would be more appropriate.

8 Paragraph 25 of document SDC 12/9 suggests that restructuring the Nuclear Code may allow more flexibility in adding new elements or reorganizing the content and aligning it with a more goal-based approach to regulation, in line with current IMO practice. International Atomic Energy Agency (IAEA) standards also adopt a goal-based approach.

Analysis to support consideration of the structure of the Nuclear Code

9 In order to facilitate a consideration of the structure of the Nuclear Code, and its possible restructuring, NEMO has carried out two sets of analyses.

10 The first, found in annex 1, examines which sections of the Nuclear Code contain prescriptive requirements, and assesses whether the prescriptive elements are technology-specific or could allow for a technology-agnostic approach. It also provides guidance on sections that can be considered as following a goal-based or functional requirements approach. Furthermore, it identifies parts of the Nuclear Code that require further analysis and contains suggestions for how the Nuclear Code could be revised.

11 Annex 2 contains a comparative analysis of the structure of Nuclear Code and other IMO instruments. It also identifies whether they follow a prescriptive or goal-based approach. Moreover, the analysis looks at the evolution of the content structure in other instruments that have undergone updates in recent years.

12 The methodology used in the analysis and assessment in annex 2 followed the steps outlined below:

.1 identification of IMO instruments of interest;

.2 drafting of contents list and summary tables for each instrument of interest (see annex 2 for contents lists of the Nuclear Code and other selected IMO instruments); and

.3 ascertaining of year of adoption by resolution, whether the nature of the code is prescriptive or goal-based and drafting of observations for the instrument under consideration.

13 The following list of IMO instruments was considered as guidance for the structure of the updated Nuclear Code:

.1 International Code of Safety for Ships using Gases or other Low-flashpoint Fuels (IGF Code);

.2 International Code for Ships Operating in Polar Waters (Polar Code);

.3 International Maritime Solid Bulk Cargos Code (IMSBC Code);

.4 International Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk (IBC Code);

.5 2014 International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk (2014 IGC Code);

.6 1979 Code for the Construction and Equipment of Mobile Offshore Drilling Units (1979 MODU Code);

.7 2009 Code for the Construction and Equipment of Mobile Offshore Drilling Units (2009 MODU Code);

.8 Code of Safe Practice for the Carriage of Cargoes and Persons by Offshore Supply Vessels (OSV Code);

.9 Code for the Transport and Handling of Hazardous and Noxious Liquid Substances in Bulk on Offshore Support Vessels (OSV Chemical Code);

.10 Code of Safety for Special Purpose Ships (SPS Code);

.11 2008 Code of Safety for Special Purpose Ships (2008 SPS Code);

.12 Code of Safety for Dynamically Supported Craft (DSC Code);

.13 1994 International Code of Safety for High-Speed Craft (1994 HSC Code); and

.14 2000 International Code of Safety for High-Speed Craft (2000 HSC Code).

14 The following key takeaways were observed:

.1 The Nuclear Code refers in its preamble to the following:

"While development of the Code has been based upon established and accepted shipbuilding, marine and nuclear engineering principles, it is recognized that review will be necessary as technology progresses. Initial application of the Code is restricted to conventional types of ships propelled by nuclear propulsion plants with pressurized light water type reactors."

.2 The Nuclear Code contents list is generic in its top level (e.g. chapter title); however, the content list within chapters may contain specifics that need to be revised should the intent of the update be to generate a code that is technology agnostic and goal-based (see, for example, chapter 4 of the Nuclear Code).

.3 Chapters such as chapter 4 of the Nuclear Code (titled Nuclear Steam Supply System) appear to only apply to those specific arrangements. Chapters such as this, and the requirements within, do not appear to be aligned with a technology-agnostic approach.

.4 Some IMO instruments, such as the IGC Code, originally adopted by resolution MSC.5(48) in 1983, have been updated in recent years acknowledging similar statements as the one transcribed under in paragraph 14.1 above. In the case of the IGC Code, the following statements are made (taken from IMO website, accessible here).

.1 "The requirements in the codes are intended to minimize these risks as far as is practicable, based upon present knowledge and technology."

.2 "Throughout the development of the Code it was recognized that it must be based upon sound naval architectural and engineering principles and the best understanding available as to the hazards of the various products covered; furthermore, that gas carrier design technology is not only a complex technology but is rapidly evolving and that the Code should not remain static. Therefore, the IGC Code is kept under review, taking into account experience and technological development."

.5 Some IMO instruments show progression from a prescriptive approach to using goal-based standards. In the case of goal-based standards, the following statements are made (taken from IMO website, accessible here).

.1 "Going back to the 1990s, the Maritime Safety Committee recognized that the prescriptive-based regulations were unable to cope with the new ship design challenges and took action to incorporate the goal-based philosophy into the technical regulations of the Safety of Life at Sea Convention (SOLAS)."

.2 "Goal-based standards (GBS) are high-level standards and procedures that are to be met through regulations, rules and standards for ships. GBS are comprised of at least one goal, functional requirement(s) associated with that goal, and verification of conformity that rules/regulations meet the functional requirements including goals."

.3 "The latest IMO instruments using the GBS approach are the Polar Code, IGF Code and Goal-based ship construction standards for bulk carriers and oil tankers."

.4 "The Maritime Safety Committee, at its eighty-seventh session in May 2010, adopted a new SOLAS regulation II-1/3-10 on goal-based ship construction standards for bulk carriers and oil tankers (resolution MSC.290(87)). This regulation, which entered into force on 1 January 2012, requires that all oil tankers and bulk carriers of 150 m in length and above, for which the building contract is placed on or after 1 July 2016, satisfy applicable structural requirements conforming to the functional requirements of the *International Goal-based Ship Construction Standards for Bulk Carriers and Oil Tankers* (GBS Standards) (resolution MSC.287(87))."

.6 Following the adoption of the GBS Standards (resolution MSC.287(87)) in 2010, updates to a number of IMO instruments have increasingly used this approach.

.7 The IGC Code was updated to its 2014 version following a very similar structure as its 1984 predecessor; however, in the 2014 version, the contents in each Chapter include a Goals section rather than all goals being collated in one section.

.8 The IGF Code and the Polar Code (2017) are both recently developed IMO instruments that follow a goal-based approach.

.9 The IGF Code follows the *Generic guidelines for developing IMO goal-based standards* (MSC.1/Circ.1394), most recently updated in its Revision 2 in 2019 (MSC.1/Circ.1394/Rev.2). The structure of the IGF Code follows the structure suggested in Appendix 2 of MSC.1/Circ.1394.

.10 Other IMO instruments that have been updated "prior to 2010", such as the MODU Code, display a similar contents structure throughout the different updates and have remained generally prescriptive.

Action requested of the Sub-Committee

15 The Sub-Committee is invited to note the information in this document, including the annexes.

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ANNEX 1

ANALYSIS OF THE STRUCTURE OF THE CODE OF SAFETY FOR NUCLEAR MERCHANT SHIPS (RESOLUTION A.491(XII))

Introduction

1 Each chapter of the *Code of Safety for Nuclear Merchant Ship*s (resolution A.491(XII)) has been analysed to determine if the sections contain:

.1 a prescriptive requirement, or;

.2 a goal based/ functional requirement.

2 Following the tabulated method below, this annex provides guidance on which chapters and sections of the Nuclear Code that can be considered as containing prescriptive requirements, either agnostic (2nd column) or technology-specific (3rd column), and those that can be considered as containing a goal-based or functional requirements approach (3rd column), identifying the chapters in the Nuclear Code which require further analysis, as well as suggestions for how the Nuclear Code could be revised.

CODE OF SAFETY FOR NUCLEAR MERCHANT SHIPS - Resolution A.491(XII)	**Contains Prescriptive Requirement – Agnostic**	**Contains Prescriptive Requirement Specific to technology or arrangement**	**Contains or could imply Goal or Functional Requirement**	**General Note**
Section number and title	Y(es) - some content can be considered prescriptive but may be applied agnostically to any reactor technology or specific arrangement. Quoted example provided. N(o) - no content was found that could be considered a prescriptive requirement, hence may be applied agnostically to any reactor technology or specific arrangement.	Y(es) - some prescriptive content can be considered specific to a PWR and steam propulsion arrangement. Quoted example provided. N(o) - no prescriptive content was found that can be considered specific to a PWR or steam propulsion arrangement.	Y(es) - some content can be considered as (or used to derive) goals and functional requirements for an updated Nuclear Code (that is agnostic and uses GBS approach). Quoted example provided. N(o) - no content was found that could be considered (or used to derive) goals and functional requirements for an updated Nuclear Code.	Comments on: Does this section contain prescriptive requirements that are nevertheless technology agnostic? Does this section contain prescriptive requirements that are specific to PWRs or steam propulsion arrangements? Does the section appear to be written under the assumption of specific technologies or arrangements?

Chapter 1 General

CODE OF SAFETY FOR NUCLEAR MERCHANT SHIPS - Resolution A.491(XII)	**Contains Prescriptive Requirement - Agnostic**	**Contains Prescriptive Requirement Specific to technology or arrangement**	**Contains or could imply Goal or Functional Requirement**	**General Note**
1.1 Purpose	N	N	N	*Notes on scope*
1.2 Application	N	N	N	*Notes on application*
1.3 General Safety Principles	N	Y - “the primary pressure boundary, which is the second barrier… “the containment structure, which is the third barrier… “the safety enclosure, which is the fourth barrier…”	Y - "Overall safety of the nuclear ship is the primary objective"	*1.3.5 list of successive physical barriers as defined may be considered prescriptive.*
1.4 Principles of risk acceptance	N	N	Y - "It is therefore appropriate to rank situations qualitatively according to their frequency and consequences."	*Non-prescriptive guidance on principles for risk management. Methodology of plant process condition (PPC) classifications may be considered prescriptive.*
1.5 First commissioning of a nuclear ship and further surveys	N	N	N	*Discussion of responsibilities*
1.6 Review of the Code	N	N	N	*Administrative note*
1.7 Equivalents	N	N	N	*Administrative note*
1.8 Decommissioning or loss	N	N	Y - "Operations directly or indirectly concerned with the intentional or planned decommissioning of a nuclear ship should satisfy the requirement to protect man and his environment from unacceptable hazards that may be caused by the ship after its NPP has finally been shut down."	*Non-prescriptive requirements. Not specific to technology or arrangement. General provisions and arrangements in the case of decommissioning or loss.*
1.9 Recovery following loss	N	N	Y - "Consideration of the feasibility of recovering the wreck or part of it should be reflected in the design where this proves technically possible."	*Non-prescriptive requirements. Not specific to technology or arrangement. General provisions and arrangements in the case of decommissioning or loss.*

Chapter 2 Design Criteria and Conditions

CODE OF SAFETY FOR NUCLEAR MERCHANT SHIPS - Resolution A.491(XII)	Contains Prescriptive Requirement - Agnostic	Contains Prescriptive Requirement Specific to technology or arrangement	Contains or could imply Goal or Functional Requirement	General Note
2.1 Basic criteria and safety functions	N	N	Y - "Means should be provided to remove residual heat safely from the reactor core."	*Non-prescriptive requirements. Not specific to technology or arrangement.*
2.2 Safety classes and design classes	Y - "Safety class 1 (SC-1) applies to […] .1 reactor protection system and the scram system."	Y - "Safety class 1 (SC-1) applies to […] .3 the steam generator shell and main piping including the isolating valves on the steam line."	Y - "Systems should be assigned a safety class."	*List of Safety Class examples includes both technology-agnostic systems (independent from the type of reactor) and PWR-specific requirements related to steam arrangements, water as the primary coolant, and control rod arrangement.*
2.3 Environmental conditions	Y - "…the inertial forces acting on the ship in a seaway may be based upon North Atlantic seaway data, assuming that the ship encounters that seaway with equal frequency from all directions, over the number of days shown in table 2.1, for any required safety class.	N	Y - "SC-1 components and structures should be capable of withstanding the maximum inertial forces calculated."	*2.3.5 & Table 2.1 may be considered prescriptive 2.3.10 Dynamic and static angles of inclination may be considered prescriptive.*
2.4 Nuclear propulsion plant design criteria	N	N	Y - "The NPP should be designed to operate satisfactorily under seagoing conditions, having regard to the environmental conditions given in 2.3"	*2.4.2 contains functional requirements for PPCs.*
2.5 Plant process conditions	N	N	N	*Instructions and examples on identifying PPCs associated with Safety classes; some may be considered PWR-specific.*
2.6 General conditions governing accident analysis	N	N	Y - " Accident analyses should be carried out for the PPCs given below and any other postulated accident scenarios required by the Administration."	*Non-prescriptive guidance on principles for accident analyses, some considerations may be deemed PWR-specific.*

2.7 Evaluation of ship accident situations	N	N	Y - " …the following principles should be adopted for analysing certain ship accidents…"	*Instructions and examples given on assessing accidents/incidents.*
2.8 Evaluation of NPP accidents	N	N	Y - "Reactor and machinery or equipment failures that may cause a PPC 2 to 4 situation should be analysed in accordance with the provisions of 2.6."	*Instructions and examples provided, including technology-specific examples.*

Chapter 3 Ship Design, Construction and Equipment

CODE OF SAFETY FOR NUCLEAR MERCHANT SHIPS - Resolution A.491(XII)	Contains Prescriptive Requirement - Agnostic	Contains Prescriptive Requirement Specific to technology or arrangement	Contains or could imply Goal or Functional Requirement	General Note
3.1 Ship arrangements	Y - "The reactor compartment should […] be bounded fore and aft by cofferdams or suitable bulkheads, extending from the double bottom to the bulkhead deck…"	Y - "…the primary pressure boundary should be located within the containment structure."	Y - "The ship should be divided into areas classified in accordance with Chapter 6 on the basis of radiation hazards actually or potentially present."	*Definitions and terminology used may be considered technology-specific.*
3.2 Ventilation - general provisions	Y - "Ventilation systems serving spaces which contain or may contain radioactive material should be segregated from other ventilation systems."	N	Y - "The location of exhaust outlets should be carefully selected to avoid accidental contamination of any area of the vessel."	*General ventilation requirements related to radiation protection may apply to any reactor technology or arrangement.*
3.3 Structure	Y - "The section modulus in the area of the collision protective structures should not radically change at the end of the structures. This structure should be smoothly integrated into the rest of the ship"	N	Y - "Ship's structure in way of the reactor compartment should be designed and constructed to give adequate protection to the NSSS from external forces as detailed in Chapter 2."	*Definitions and terminology used may be considered technology-specific.* *General structural requirements may be interpreted as applicable to any reactor technology or arrangement.*
3.4 Subdivision and damage stability	Y - "At least a two-compartment standard of subdivision should be obtained."	N	N	*Instructions on subdivision and damaged stability assessments must be updated to reflect modern SOLAS requirements. Generally, not prescriptive and are technology-agnostic.*
3.5 Collision protection	N	N	Y - "Collision protective structure should be provided […] such that protection is provided to prevent penetration of the longitudinal watertight, gastight boundaries of the safety enclosure by the striking ship or struck object."	*Instructions for assessing and deciding on appropriate collision protection are generally not prescriptive (although does offer specific examples) and are technology-agnostic.* *Definitions and terminology used may be considered technology or arrangement specific.*
3.6 Grounding and stranding	Y - "The depth of the double bottom under the reactor compartment should provide protection against the bottom damage of the extent given in 3.4.3, but in no case should the bottom of the safety enclosure be less than the greater of B/15 or 2	N	Y - "A double bottom is to be provided under the reactor compartment, sufficient for the protection of the reactor and safety related systems, including high level radioactive material storage areas."	*Definitions and terminology used may be considered technology or arrangement specific.*

Chapter 3 Ship Design, Construction and Equipment

CODE OF SAFETY FOR NUCLEAR MERCHANT SHIPS - Resolution A.491(XII)	Contains Prescriptive Requirement - Agnostic	Contains Prescriptive Requirement Specific to technology or arrangement	Contains or could imply Goal or Functional Requirement	General Note
	metres above the bottom of the ship or be below the inner bottom plating."			
3.7 Navigational aids and manoeuvrability	Y - "A nuclear ship should be fitted with an anti-collision aid and at least two radars, each capable of being operated independently."	N	Y- "Manoeuvrability of a nuclear ship should be at least equivalent to that of a ship of like size and power using conventional steam turbine propulsion."	*Manoeuvring requirements are technology-agnostic; should refer to existing standards for ship manoeuvrability and navigational aids.*
3.8 Lifesaving appliances	Y- 3.8.1 Portable radiation monitoring devices should be provided for use in survival craft. Y- 3.8.2 The primary survival craft should be fitted with an external drenching system for decontamination. Y- functional requirements discussed, no specific requirements of equipment type, location, or performance.	N	Y - "Portable radiation monitoring devices should be provided for use in survival craft."	*Additional requirements from existing SOLAS Code Regulations are specific to radiation hazards in the case of evacuation. Technology agnostic.*
3.9 Fire safety	Y - "At least two means of escape should be provided from the main reactor control room and from the compartment in which the reactor control position is located."	N	Y - "…safety systems should be so designed and located as to minimize the probability and effect of fires and explosions."	*Definitions and terminology used may be considered technology or arrangement-specific, however, requirements provided do not include technology-specific prescription.* *Fire safety requirements should be aligned with modern FFS Code.*
3.10 **Security** of the ship and physical protection of the fissile material	N	N	Y - " Security measures against malevolence should be taken into account […] in order to achieve protection of the ship and fissile material on board."	*Security requirements are technology and arrangement agnostic and are not prescriptive. ISPS code is mandatory and prescriptive – onboard implementation is Class approved.*
3.11 Access openings	N - only functional requirements discussed, no specific requirements of equipment type, location, or performance.	N	Y - "Where necessary for security or safety purposes, closures should be provided with appropriate arrangements for local and remote operation."	*Technology agnostic, not prescriptive.*

Chapter 3 Ship Design, Construction and Equipment

CODE OF SAFETY FOR NUCLEAR MERCHANT SHIPS - Resolution A.491(XII)	**Contains Prescriptive Requirement - Agnostic**	**Contains Prescriptive Requirement Specific to technology or arrangement**	**Contains or could imply Goal or Functional Requirement**	**General Note**
3.12 Non propulsive steam systems	N	Y	Y - "Steam supply for domestic or other non-propulsive purposes should not directly employ steam generated in the NSSS".	*Specific to arrangement of steam supply system for direct propulsion. i.e., not technology-agnostic. Definition of NSSS is inherently specific to steam propulsion arrangement and therefore needs review and modification to be made technology and arrangement-agnostic.*

Chapter 4 Nuclear Steam Supply System

CODE OF SAFETY FOR NUCLEAR MERCHANT SHIPS - Resolution A.491(XII)	Contains Prescriptive Requirement - Agnostic	Contains Prescriptive Requirement Specific to technology or arrangement	Contains or could imply Goal or Functional Requirement	General Note
4.1 General design criteria	N	N	Y - "System design should permit periodic in-service inspection and testing without loss of safety protection."	*Definitions and terminology used are arrangement-specific, but generally non-prescriptive.*
4.2 Reactor core	N	N	Y - "Calculation of thermal conditions should allow for uncertainties in calculations and should take into consideration the effects of thermal performance of ship motions."	*General requirements give technology-specific examples but are generally non-prescriptive.*
4.3 Reactivity control	Y - "To provide for the reactivity control system and reactor safety and protection systems, at least two independent sources of power should be available during reactor startup and until the power level is reached."	N - but should be checked by PWR subject matter expert.	Y - "The likelihood of events resulting in unplanned reactivity increases […] should not lead to situations which pose a hazard to the public, crew or environment greater than that defined in Chapters 1 and 6."	*Requirements for reactor control are generally high-level and not prescriptive, although terms such as 'control element' may refer to control rod arrangements (technology-specific).*
4.4 Reactor control	N	N	Y - "Taking into account the inherent stability of the reactor system itself, the control system should be designed to control reactor power, in response to operational demand, under all anticipated ship manoeuvres and sea states during normal and emergency situations."	*Control requirements include control position and are not technology-specific or obviously prescriptive.*
4.5 Mechanical engineering considerations	N	N	Y - "The effects of [structural] loads should neither prevent the reactor from being shut down nor affect the ability to maintain a coolable geometry."	*General requirements are not technology-specific or prescriptive.*
4.6 Primary pressure boundary	Y - but should be checked by PWR subject matter expert that language is technology-agnostic and generally applicable to any reactor or arrangement.	Y - but should be checked. See Notes.	Y - "Means should be provided to detect reactor coolant leakage."	*Assumption of this section is that primary pressure boundary may contain radiation or radioactive materials. Terminology needs to be checked or modified slightly to ensure technology and arrangement-agnostic approach. However, it is not overly prescriptive.*

Chapter 4 Nuclear Steam Supply System

CODE OF SAFETY FOR NUCLEAR MERCHANT SHIPS - Resolution A.491(XII)	Contains Prescriptive Requirement - Agnostic	Contains Prescriptive Requirement Specific to technology or arrangement	Contains or could imply Goal or Functional Requirement	General Note
4.7 Secondary coolant system	Y - "Each steam generator, or group of steam generating devices interconnected in such a way that they cannot be isolated from each other, should be protected against overpressure by at least two safety valves installed upstream of the first isolation valve."	Y - "Secondary steam lines and feedwater pipes penetrating the containment structure should be protected by an isolation valve at the containment structure boundary, to provide isolation of the system."	Y - "Means should be provided to detect and limit leakage into the secondary cooling system from the primary cooling system."	*Similar to Primary Pressure Boundary, Assumption of this section is that secondary pressure boundary may contain radiation or radioactive materials. Terminology needs to be checked or modified slightly to ensure technology and arrangement-agnostic approach (not steam-specific).*
4.8 Residual heat removal	N	N	Y - "The residual heat removal system should be designed to permit unattended operation during and following all ship accident conditions."	*General requirements may have originally assumed a specific arrangement or technology, so need to be checked for agnostic language. Not prescriptive.*
4.9 Instrumentation	Y - "Limit values and normal working ranges should be indicated on all instruments."	N	Y - "The design of instrumentation should ensure continuity of its function under any anticipated service environment."	*General instrumentation requirements are not technology-specific or overly prescriptive. Can easily be interpreted to apply in general to any arrangement or technology.*
4.10 Reactor protection system	Y - "at least two diverse process variables should be measured to detect any malfunction or accident by the reactor system…"	N	Y - "The reactor protection system should have suitable redundancy and capability to ensure that its safety functions can be accomplished assuming a single failure."	*Requirements do not appear to be technology or arrangement-specific. Should be checked by PWR subject matter expert that agnostic language and terminology is used. Not overly prescriptive.*
4.11 Engineered safety features	Y - the following contain prescriptive arrangements: 4.11.1.1 The containment structure and related systems should establish an essentially leak tight barrier... 4.11.1.2 Only the reactor and NSSS reactor related systems should be within the containment structure and safety enclosure;	N	Y - "ECCSs should, as far as is reasonably achievable, maintain the integrity of the fuel elements following LOCA with consequent reactor shutdown."	*Definitions and terminology used are arrangement-specific, but generally non-prescriptive. Should be reviewed by reactor technology subject matter expert to confirm agnostic language is used.*
4.12 Interface of nuclear and ship systems	Y - "Where piping systems are over 15mm in internal diameter, one of the isolation valves should be remotely controlled and operate	Y - "Where piping systems are over 15mm in internal diameter, one of the isolation valves should be remotely controlled and operate	Y - "Interconnections between normal ship's piping and that which contains or may contain radioactive material, should be minimized."	*Definitions and terminology used are specific to steam propulsion. Should be checked for agnostic language.*

Chapter 4 Nuclear Steam Supply System

CODE OF SAFETY FOR NUCLEAR MERCHANT SHIPS - Resolution A.491(XII)	Contains Prescriptive Requirement - Agnostic	Contains Prescriptive Requirement Specific to technology or arrangement	Contains or could imply Goal or Functional Requirement	General Note
	automatically as the piping system demands."	automatically as the piping system demands."		
4.13 Cyclic loading design considerations	N	N	N	*Advice on how to consider design of cycling loadings. Not necessarily technology or arrangement specific, not prescriptive.*
4.14 General criteria on fuel behaviour in the reactor	N	Y - "Monitoring of the primary circuit water for failed fuel should be carried out."	Y - "The design, manufacture, inspection and modes of fuel operation should be such that releases of radioactive material from the fuel, during its use in the reactor, are kept as low as required by radiation protection and safety criteria."	*Goal/Functional Requirement written with intention specific to PWRs, but not necessarily prescriptive. Reactor technology subject matter expert should review for agnostic language.*

Chapter 5 Machinery and Electrical Installations

CODE OF SAFETY FOR NUCLEAR MERCHANT SHIPS - Resolution A.491(XII)	Contains Prescriptive Requirement - Agnostic	Contains Prescriptive Requirement Specific to technology or arrangement	Contains or could imply Goal or Functional Requirement	General Note
5.1 Scope	N	N	N	*Notes on scope*

PART A- MAIN AND AUXILIARY MACHINERY

5.2 General	Y - "The inclination angles at which main and auxiliary machinery should be capable of operation are […] A.325(IX);"	N - but goals and FRs provided under assumption of steam propulsion arrangements.	Y - "Adequate provision should be made to facilitate cleaning, inspection and maintenance of main propulsion and auxiliary machinery, including arrangements for radioactive decontamination, where required."	*General requirements written under the assumption of specific steam-propulsion arrangement. Should be reviewed for technology and arrangement-agnostic approach. 5.2.2 is specific to PWR technology where it is possible to generate superheated steam.*
5.3 Communications	Y - "Where applicable, this provision may be met by the requirements of Regulation 15 of resolution A.325(IX)." Locations provided.	N	Y - Functional Requirement: "At least one system of communication, which should be available in the event of complete loss of electrical power, should be provided between each of the locations listed in this subsection."	*General requirements for communication equipment not specific to reactor technology but were written under the assumption of specific arrangements. Should be checked to see whether they are technology and arrangement specific.*
5.4 Bilge pumping and ballast arrangements	N	N	Y - "Bilge, ballast and drainage systems should be arranged to prevent the spread of radioactive liquids."	*General requirements are not technology-specific or prescriptive.*
5.5 Cooling water systems	Y - the following contain prescriptive arrangements: 5.5.2 “To supply cooling water to essential auxiliaries and the main engines, systems having separate high and low sea suctions should be provided on both the port and starboard sides”	N	Y - "Liquids used for cooling components connected to the primary circuit, should be compatible with all materials normally in contact with the primary coolant."	*General requirements may be considered prescriptive but are missing specificity in compliance. Not technology specific.*
5.6 Hydraulic and pneumatic systems	Y - "Compressed air systems, serving essential auxiliary equipment or used for control purposes, should be supplied from two compressors independent of each other and each capable of operating the systems."	N	Y - "Single failure of any active component of the compressed air system should be considered."	*May have been written under the assumption of specific arrangement, so should be reviewed for arrangement-agnostic language.*
5.7 Emergency propulsion	Y - Functional Requirement: "A ship equipped with a single reactor of a	N	Y - "The NPP should be designed to have a reliability at least equal to	*Short section - emergency power arrangements should be same as*

	type of the reliability of which has not been demonstrated should be provided with an emergency source of propulsive power for the main propulsion plant"		the reliability of a conventional propulsion plant."	*SOLAS requirements. Not prescriptive or technology/arrangement specific.*

Chapter 5 Machinery and Electrical Installations

CODE OF SAFETY FOR NUCLEAR MERCHANT SHIPS - Resolution A.491(XII)	Contains Prescriptive Requirement - Agnostic	Contains Prescriptive Requirement Specific to technology or arrangement	Contains or could imply Goal or Functional Requirement	General Note
PART B- ELECTRICAL SYSTEMS				
5.8 General	Y - "Emergency generators may be used for the purpose of startup if their capacity is sufficient to provide, at the same time, those services essential for ship safety."	Y - "…the electrical system as a whole, excluding the generating sets dependent on the NSSS, should be capable of shutting down the reactor and holding it in a safe state for at least 30 days assuming a single failure of the electrical system in addition to the initiating event which caused the PPC."	Y - "The design of the electrical power system should permit appropriate periodic inspection and testing of equipment important to nuclear safety and ship safety."	*Additional requirements from existing SOLAS Code Regulations provided specifically for provisions of continuous power when primary energy source is shut down. Not overly prescriptive, only one feature (30 days) specific to technology safety measures at the time of the writing of this code, may need to be reconsidered according to technology advancements.*
5.9 Main electrical system	Y - "The main electrical system should be divided into at least two sections, each section having its own main switchboard, and each section being supplied by at least one service generator."	N - but goals and FRs provided under assumption of steam propulsion and electrical generation arrangements.	Y - "The service generating capacity should be sufficient to supply the full electrical power necessary for maintaining the ship in normal operational and habitable conditions."	*Not overly prescriptive but written under the assumption of steam generators for onboard electricity from reactor. Should be reviewed to have technology/arrangement-agnostic language.*
5.10 Emergency electrical system	Y - "Each emergency switchboard should be capable of receiving electrical power from either section of the main electrical system."	N - but goals and FRs provided under assumption of steam propulsion and electrical generation arrangements.	Y - "The emergency electrical system […] should have sufficient independence, redundancy and testability to perform their safety functions, assuming a single failure in any condition up to and including PPC 4a…"	*Not overly prescriptive but written under the assumption of steam generators for onboard electricity from reactor. Should be reviewed to have technology/arrangement-agnostic language.* *Requirements for sufficient emergency fuel for 30 days may be specific to nuclear technology safety measures during the 70's, may need to be considered according to technology advancements and be technology agnostic.*

Chapter 5 Machinery and Electrical Installations

CODE OF SAFETY FOR NUCLEAR MERCHANT SHIPS - Resolution A.491(XII)	Contains Prescriptive Requirement - Agnostic	Contains Prescriptive Requirement Specific to technology or arrangement	Contains or could imply Goal or Functional Requirement	General Note
PART B- ELECTRICAL SYSTEMS				
5.11 Transitional power sources	N	N	Y - "The transitional power sources should be segregated so that a PPC 1 to 4a does not disable more than one redundance power source."	*Requirements for transitional power should be updated to meet modern SOLAS requirements for transitional power and uninterruptible power onboard. Not technology-specific, not prescriptive.*
5.12 Shore power connections	N	N	Y - "Shore power connections should be provided, through which power may be supplied to any section of the main electrical system.	*Not prescriptive, not technology-specific or arrangement-specific*
5.13 Electrical wiring and component insulation	N	N	Y - "Electrical wiring and components which are to fulfil their safety function after a postulated accident should withstand the environmental conditions […] associated with that accident."	*Not prescriptive, not technology-specific or arrangement-specific*
5.14 Penetration of physical barriers by electrical cabling	N	N	Y - "Electrical cabling penetrations of the containment structure, safety enclosure and reactor compartment boundaries, should be kept to a minimum consistent with safety considerations."	*Not prescriptive, not technology-specific or arrangement-specific*

Chapter 6 Radiation Safety

CODE OF SAFETY FOR NUCLEAR MERCHANT SHIPS - Resolution A.491(XII)	Contains Prescriptive Requirement - Agnostic	Contains Prescriptive Requirement Specific to technology or arrangement	Contains or could imply Goal or Functional Requirement	General Note
6.1 General	N	N	N	*Notes on scope, topic, and terminology. Refer to ICRP for Radiation protection guidance.*
6.2 Radiological protection design	N	N	Y - "…when the reactor is operating normally or is shut down, no persons on board or in the vicinity of the ship may as a result of the ship's operation be subjected to radiation or contamination levels in excess of limits laid down in accordance with 6.3.1."	*Design considerations are non-prescriptive, not technology or arrangement specific.*
6.3 Protection of persons	N	N	Y - "Unless designated as occupationally exposed persons, member of the crew or any other person on board or in the vicinity of the ship should be exposed, as a result of the ship's operation, to radiation doses which exceed the relevant dose-equivalent limit for members of the public."	*Examples given of "filter respirators and air-supplied sets" of PPE may need to be considered technology or arrangement-specific. Consider reviewing for agnostic language.*
6.4 Dosimetry and monitoring	Y - "the radioactive monitoring and recording systems should include […] fixed and portable equipment for assessing the concentrations and amounts of gaseous and airborne particulate material which may be released to the environment."	Y - "the radioactive monitoring and recording systems should include […] Equipment to detect releases of radioactive material from the fuel elements and to detect the presence of radioactive gasses within the primary coolant." … "equipment to determine the levels of specified radioactivity isotopes in liquid wastes prior to their discharge to the marine environment."	Y - "Monitoring facilities […] should be provided on the ship to indicate and record, where necessary, radiation levels, airborne and surface contamination levels, radioactive concentrations and flows."	*Some examples of radiation protection are specific to certain types of exposure, reactor arrangements and coolants, or releases. Review needed to ensure agnostic language is used.*
6.5 Radioactive waste management - general requirements	N	N	Y - "The design […] should provide for the safe management of radioactive wastes by storage and eventual disposal, or by controlled release to the environment within the limitations imposed by 6.6.1."	*General requirements are non-prescriptive, not technology or arrangement specific.*

Chapter 6 Radiation Safety

CODE OF SAFETY FOR NUCLEAR MERCHANT SHIPS - Resolution A.491(XII)	Contains Prescriptive Requirement - Agnostic	Contains Prescriptive Requirement Specific to technology or arrangement	Contains or could imply Goal or Functional Requirement	General Note
6.6 Criteria for discharge of radioactive waste	Y - "Radioactive levels of wastes arising from the ship's operations discharged from the ship to the environment in PPC 1 and 2 should be as low as is reasonably achievable and in any case within the following limits" (limits provided by waste activity levels)	N	Y - "The design should be such as to prevent where practicable discharges of gaseous radioactive effluents when in port or harbor."	*General requirements provide limits of radioactive waste levels for discharge. Otherwise, requirements are non-prescriptive, not technology or arrangement-specific.* *Sections on waste generation, assumed to be generated from PWRs, should be reviewed for agnostic application and language.*
6.7 Management of solid radioactive waste	N	N	Y - "Solid radioactive waste should only be discharged to properly equipped dockside facilities and not to the sea."	*General requirements are non-prescriptive, not technology or arrangement specific.*
6.8 Management of liquid radioactive waste	Y - "The facilities should provide for the transfer of liquid radioactive wastes from the ship to shore, or to special floating facilities, by two separate systems, one intended for higher activity wastes and the other for lower activity wastes."	N	Y - "The on-board waste collection, treatment (if any) and storage facilities should be designed to cope with the volume of liquid waste arising from NSSS operation."	*General requirements are non-prescriptive, not technology or arrangement specific.*
6.9 Management of gaseous radioactive waste	N	N	Y - "Means should be provided to control all discharge routes through which gaseous radioactive waste could reach the environment."	*Examples given of gaseous radioactive waste appear specific to PWR technology, but are not prescriptive. Not technology or arrangement specific.*
6.10 Ventilation filtration	N	N	Y - "A combination of efficient ventilation and filtration arrangements should be provided to […] prevent the uncontrolled spread of airborne contamination."	*Sections on ventilation and filtration are assumed to be related to PWRs, should be reviewed for agnostic application and language. Should also be reviewed for modern technical approaches to ventilation and filtration of potentially radioactive containment spaces. Definitions and terminology of spaces may be arrangement-specific and need to be checked. Not prescriptive.*

Chapter 7 Operation

CODE OF SAFETY FOR NUCLEAR MERCHANT SHIPS - Resolution A.491(XII)	Contains Prescriptive Requirement - Agnostic	Contains Prescriptive Requirement Specific to technology or arrangement	Contains or could imply Goal or Functional Requirement	General Note
7.1 General operating principles and competent bodies	Y - "At all times, when there is fuel in the reactor, the NPP should be supervised by qualified personnel keeping continuous watch in the main reactor control room."	Y - "No fissile materials, other than fuel in the reactor or cargo carried in accordance with the International Maritime Dangerous Goods Code, should be carried on the ship."	Y - "All work required on board ship involving the handling and disposal of gaseous, liquid or solid radioactive materials, or the possibility of spreading contamination, should be carried out only in properly arranged and equipped locations."	*Not overly prescriptive but may be specific to PWR reactors, as opposed to types of reactors that have online refuelling. Not arrangement specific.*
7.2 Operating documentation	N	N	Y - "The ship's Safety Assessment should contain detailed information that will permit qualified personnel to assess the safety of the ship and its NPP."	*Onboard documentation requirements available for crew use and audit review. Examples may be technology or arrangement specific and should be reviewed for agnostic language.* *NSSS is technology specific.*
7.3 Normal operation procedures	N	N	Y - "Regular in-service inspections and maintenance of equipment should not prejudice the ability of systems to perform their safety-related functions by producing levels of redundancy below minimum requirements.	*Requirements for contents of operating procedures. Examples may be technology or arrangement specific and should be reviewed for agnostic language.*
7.4 Emergency operation procedures	N	N	Y - "Where there is danger of exposure of the crew and passengers to radiation doses exceeding the annual dose-equivalent limits or occupational exposure recommended by ICRP, the master should take appropriate steps to minimize the radiation exposure received by persons onboard."	*Administrative steps to take during emergency. Not prescriptive.*
7.5 Maintenance and repair	N	N	Y - "Arrangements should be provided to ensure that maintenance and repair can be carried out safely without unacceptable exposure of personnel to radiation and without hazardous release of fission products to the environment."	*Guidance for conducting safe maintenance and repair activities. Not technology or arrangement specific, not prescriptive.*

7.6 Manning, training, qualification, updating of knowledge, drills and musters	N	N	N	*Training requirements are to be updated to meet SOLAS and other IMO Codes. Naturally training requirements are to be appropriate for the specific technology and arrangement type. Language should be checked to be agnostic to technology and arrangement.*

Chapter 8 Surveys

CODE OF SAFETY FOR NUCLEAR MERCHANT SHIPS - Resolution A.491(XII)	**Contains Prescriptive Requirement - Agnostic**	**Contains Prescriptive Requirement Specific to technology or arrangement**	**Contains or could imply Goal or Functional Requirement**	**General Note**
8.1 General	N	N	Y - "Where necessary for radiation safety, additional biological shielding, special test procedures and appropriate decontamination measures should be employed during surveys and tests."	*Administrative requirements for surveys, responsibilities, and expected outcomes of surveys. Not prescriptive, not specific to technology or arrangements. Requiring plans and documentation to be derived from risk assessments and examples of information to be presented/reviewed.*
8.2 Survey during construction	N	N	Y - "…the containment structure should be tested for leak tightness." "The safety enclosure should be tested for leak tightness."	*Definitions and terminology used are specific to steam propulsion. Should be checked for agnostic language.* *Test procedures should be verified to be modern.*
8.3 Survey during trials	Y - "Reactor and ship systems should be checked for safe and satisfactory operation under normal seagoing conditions, [including] accuracy and proper operation of instruments measuring reactor power."	Y - "Reactor and ship systems should be checked for safe and satisfactory operation under normal seagoing conditions, [including] effectiveness of xenon poison override provisions."	Y - "The overall trials programme should […] be scheduled progressively, in a methodical manner, to ensure that all safety requirements are met."	*Definitions, terminology and activities described are specific to PWRs and steam propulsion. Should be checked for agnostic language.* *Test procedures should be verified to be modern.*
8.4 Survey during operational phase	Y - "Hull structure in way of the reactor and the collision protective structure should be surveyed annually."	Y - "An examination should be made of the primary pressure boundary structure, secondary system pressure vessels and pressure piping, and associated machinery and equipment" (specific to PWR terminology, PWR arrangements and water coolant loops)	Y - "periodical or continuous surveys should not be unduly restricted by radiation and pressure vessels, and piping systems should, whenever practicable, be accessible for survey."	*Definitions, terminology and activities described are specific to PWRs and steam propulsion. Should be checked for agnostic language.* *Test procedures should be verified to be modern.*

8.5 Special surveys, repairs, renewals and modifications	N	N	Y - "… The survey should be such as to ensure that the necessary repairs or renewals have been effectively made, that the material and workmanship of such repairs conform in all respects to all applicable quality requirements, and that the renewed or repaired parts comply in all respects with this Code."	*Definitions, terminology and activities described are specific to PWRs and steam propulsion. Should be checked for agnostic language.* *Test procedures should be verified to be modern.* *Prescriptive requirements for periodic surveys for NSSS and supporting hull structure. The interval is now 60 months (5 years) based on IMO's Harmonized System of Survey and Certification System.*

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Appendix 2 Seaway loads depending on service periods				
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3 Statistical properties of the seaway function				
4 Application				
Appendix 3 Safety Assessment				
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2 Practical aspects				
3 General information and summary				
4 Environmental design bases				
5 Safety rules				
6 Technical description and design evaluation				
7 NPP performance				
8 Radiation protection				
9 Accident and failure analysis				
10 Conditions for authorized operation				
11 Ship and NPP security				
12 Decommissioning				
13 Suggested list of contents				
Appendix 4 Limiting dose equivalent rates for different areas and spaces				
Appendix 5 Quality assurance programme				
1 General				
2 Organisational structures				
3 Documentation and records				
4 Control procedures				
5 Testing				
Appendix 6 Application of single failure criterion				

NOTE: The Appendixes of resolution A.491 (XII) have not been reviewed at this time.

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ANNEX 2

COMPARATIVE ANALYSIS OF THE STRUCTURE OF THE NUCLEAR CODE AND OTHER IMO INSTRUMENTS

Introduction

1 The tables on the following pages contain a comparative analysis of the structure of the Nuclear Code and other IMO instruments, including notes on when the instrument was adopted and/or updated. The tables also contain analysis of the methodology used in each instrument. This information may be of assistance when considering the revision of the *Code of Safety for Nuclear Merchant Ships* (resolution A.491(XII)).

2 The tables serve as a quick reference guide

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Resolution A491(XII) -CODE OF SAFETY FOR NUCLEAR MERCHANT SHIPS
GENERALLY PRESCRIPTIVE & TECHNOLOGY SPECIFIC
ADOPTED IN 1981

IGF Code - International Code of Safety for Ships Using Gases or Other Low-Flashpoint Fuels
GOAL-BASED
The IGF Code was adopted in June 2015 by Resolution MSC.391(95) and entered into force on 1 January 2017. The purpose of the IGF Code is to provide an international standard for ships, other than vessels covered by the IGC Code, operating with gas or low-flashpoint liquids as fuel. The basic philosophy of the Code is to provide mandatory criteria for the arrangement and installation of machinery, equipment and systems for vessels operating with gas or low-flashpoint liquids as fuel to minimize the risk to the ship, its crew and the environment, having regard to the nature of the fuels involved. Throughout the development of the Code it was recognized that it must be based upon sound naval architectural and engineering principles and the best understanding available of current operational experience, field data and research and development. Due to the rapidly evolving new fuels technology, the Organization will periodically review the Code, taking into account both experience and technical developments. The Code addresses all areas that need special consideration for the usage of the gas or low-flashpoint liquids as fuel. The basic philosophy of the IGF Code considers the goal-based approach (MSC.1/Circ.1394/Rev.2). Therefore, goals and functional requirements were specified for each section forming the basis for the design, construction and operation. In this respect the goal of the Code is to provide criteria for the arrangement and installation of machinery for propulsion and auxiliary purposes, using natural gas as fuel, which will have an equivalent level of integrity in terms of safety, reliability and dependability as that which can be achieved with a new and comparable conventional oil fuelled main and auxiliary machinery.

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IGF Code - International Code of Safety for Ships Using Gases or Other Low-Flashpoint Fuels		
	1	Preamble
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	3	Goal and functional requirements
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Part A-1 Specific Requirements for Ships Using Natural Gas as Fuel	5	Ship Design and Arrangement
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	7	Material and general pipe design
	8	Bunkering
	9	Fuel supply to consumers
	10	Power generation including propulsion and other gas consumers
	11	Fire safety
	12	Explosion prevention
	13	Ventilation
	14	Electrical installations
	15	Control, monitoring and safety systems
	Annex	Annex- Standard for the use of limit state methodologies in the design of fuel containment systems of novel configuration
Part B-1	16	Manufacture, workmanship and testing

Part C-1	17	Drills and emergency exercises
	18	Operation
	Annex	Annex - bunker delivery note
Part D	19	Training

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IMSBC Code – International Maritime Solid Bulk Cargoes Code	
GENERALLY PRESCRIPTIVE	
The IMSBC Code was adopted on 4 December 2008 by resolution MSC.268(85), and entered into force on 1 January 2011, from which date it was made mandatory under the provisions of the SOLAS Convention. Since then, the Code has been amended.	
IMSBC Code – International Maritime Solid Bulk Cargoes Code	
	Foreword
Section 1	General Provisions
Section 2	General loading, carriage and unloading precautions
Section 3	Safety of personnel and ship
Section 4	Assessment of acceptability of consignments for safe shipment
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Section 8	Test procedures for cargoes which may liquefy
Section 9	Materials possessing chemical hazards
Section 10	Carriage of solid wastes in bulk
Section 11	Security provisions
Section 12	Stowage factor conversion tables
Section 13	References to related information and recommendations
Appendix 1	Individual Schedules of Solid Bulk Cargoes
Appendix 2	Laboratory Test Procedures, Associated Apparatus and Standards
Appendix 3	Properties of Solid Bulk Cargoes
Appendix 4	Index
Appendix 5	Bulk Cargo Shipping Names in three languages (English, Spanish and French)

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IBC Code- International Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk	
GENERALLY PRESCRIPTIVE	
SHIPS BEFORE 1986 - BHC CODE, SHIPS AFTER 1986 - IBC CODE	
IBC Code- International Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk	
	Introduction
Chapter 1	General
Chapter 2	Ship survival capability and location of cargo tanks
Chapter 3	Ship arrangements
Chapter 4	Cargo containment
Chapter 5	Cargo transfer
Chapter 6	Materials of Construction, protective linings and coatings
Chapter 7	Cargo temperature control
Chapter 8	Cargo tank venting and gas freeing arrangements
Chapter 9	Environmental control
Chapter 10	Electrical installations
Chapter 11	Fire protection and fire extinction
Chapter 12	Mechanical ventilation in the cargo area
Chapter 13	Instrumentation
Chapter 14	Personnel protection
Chapter 15	Special requirements
Chapter 16	Operational requirements
Chapter 17	Summary of minimum requirements
Chapter 18	List of products to which the Code does not Apply
Chapter 19	Index of Products Carried in Bulk
Chapter 20	Transport of liquid chemical wastes
Chapter 21	Criteria for assigning carriage requirements for products subject to the IBC Code
Appendix	Model Form of International Certificate of Fitness for the Carriage of Dangerous Chemicals in Bulk

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1983 IGC Code - International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk	
GENERALLY PRESCRIPTIVE	
SHIPS BEFORE 1986 - GC AND EGC CODES, SHIPS AFTER 1986 - IGC CODE. ONGOING AMENDMENTS TILL NEW CODE -> SEE 2014 IGC CODE The International Code of the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk (IGC Code), was adopted by resolution MSC.5(48) in 1983, and has been mandatory under SOLAS chapter VII since 1 July 1986. The IGC Code applies to ships regardless of their size, including those of less than 500 gross tonnage, engaged in carriage of liquefied gases having a vapour pressure exceeding 2.8 bar absolute at a temperature of 37.8°C, and certain other substances listed in chapter 19 of the Code. The aim of the Code is to provide an international standard for the safe carriage by sea in bulk of liquefied gases and the substances listed in chapter 19, by prescribing the design and construction standards of ships involved in such carriage and the equipment they should carry so as to minimize the risk to the ship, to its crew and to the environment, having regard to the nature of the products involved.	
1983 IGC Code - International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk	
	Introduction
Chapter 1	General
Chapter 2	Ship survival capability and location of Cargo Tanks
Chapter 3	Ship arrangements
Chapter 4	Cargo containment
Chapter 5	Process Pressure Vessels and Liquid, Vapour and Pressure Piping Systems
Chapter 6	Materials of Construction
Chapter 7	Cargo Pressure/Temperature Control
Chapter 8	Cargo Tank Vent Systems
Chapter 9	Environmental Control
Chapter 10	Electrical Installations
Chapter 11	Fire Protection and Fire Extinction
Chapter 12	Mechanical Ventilation in the Cargo Area
Chapter 13	Instrumentation (Gauging, Gas Detection)
Chapter 14	Personnel Protection
Chapter 15	Filling Limits for Cargo Tanks
Chapter 16	Use of Cargo as Fuel
Chapter 17	Special Requirements
Chapter 18	Operating Requirements
Chapter 19	Summary of Minimum Requirements
Appendix	Model Form of International Certificate of Fitness for the Carriage of Liquefied Gases in Bulk [Harmonised Requirements of Resolution MSC.17(58)]

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2014 IGC Code - International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk
INTRODUCES GOALS AT THE BEGINNING OF EACH CHAPTER, IT ALSO PROVIDES REQUIREMENTS AND SPECIFICATIONS OR OTHERS BASED ON EXISTING TECHNOLOGIES
The basic philosophy is one of ship types related to the hazards of the gaseous bulk products covered by these codes, each of which may have one or more hazardous properties. A further possible hazard may arise owing to the cryogenic (refrigerated) or pressurized conditions required to hold and transport the products. Severe collisions or strandings could lead to cargo tank damage and uncontrolled release of the product. Such release could result in evaporation and dispersion of the product and, in some cases, could cause brittle fracture of the ship's hull. The requirements in the codes are intended to minimize these risks as far as is practicable, based upon present knowledge and technology. Throughout the development of the Code it was recognized that it must be based upon sound naval architectural and engineering principles and the best understanding available as to the hazards of the various products covered; furthermore that gas carrier design technology is not only a complex technology but is rapidly evolving and that the Code should not remain static. Therefore, IGC Code is kept under review, taking into account experience and technological development. The latest comprehensive amendments of the IGC Code were adopted by resolution MSC.370(93) in 2014, expected to enter into force on 1 July 2016.

2014 IGC Code - International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk	
	Preamble
Chapter 1	General
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Chapter 3	Ship Arrangements
Chapter 4	Cargo Containment
Chapter 5	Process Pressure Vessels and Liquid, Vapour and Pressure Piping Systems
Chapter 6	Materials of Construction and Quality Control
Chapter 7	Cargo Pressure/Temperature Control
Chapter 8	Vent Systems for Cargo Containment
Chapter 9	Cargo Containment System Atmosphere Control
Chapter 10	Electrical Installations
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Appendix 5	Standard for the Use of Limit State Methodologies in the Design of Cargo Containment Systems of Novel Configuration

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INF Code - International Code for the Safe Carriage of Packaged Irradiated Nuclear Fuel, Plutonium and High-Level Radioactive Wastes on Board Ships
GENERALLY PRESCRIPTIVE
1993 - VOLUNTARY CODE; 2001 MANDATORY CODE (AMENDED SINCE 2001 VIA MSC RESOLUTIONS) The principal regulations for radioactive transport are the International Atomic Energy Agency (IAEA) Regulations for the Safe Transport of Radioactive Material, which were first published in 1961. These regulations have been reviewed regularly since then to keep pace with scientific and technological developments. The IAEA regulations are aimed at ensuring safety primarily by the package, no matter the mode of transport, and cover both normal and potential accident conditions of transport to protect people, property and the environment against the effects of radiation. In 1993, the International Maritime Organization (IMO) introduced the voluntary Code for the Safe Carriage of Irradiated Nuclear Fuel, Plutonium and High-Level Radioactive Wastes on Board Ships (INF Code), complementing the IAEA regulations. This voluntary Code introduced recommendations for the design of ships transporting radioactive material and addressed such issues as stability after damage, fire protection, and structural resistance. In January 2001, the INF Code was made mandatory and renamed the International Code for the Safe Carriage of Packaged Irradiated Nuclear Fuel, Plutonium and High-Level Radioactive Waste on Board Ships. Since coming into force, the Code has been amended by resolutions MSC.118(74), MSC.135(76), MSC.178(79) and MSC.241(83).

INF Code - International Code for the Safe Carriage of Packaged Irradiated Nuclear Fuel, Plutonium and High-Level Radioactive Wastes on Board Ships	
Chapter 1	General
Chapter 2	Damage stability
Chapter 3	Fire safety measures
Chapter 4	Temperature control of cargo spaces
Chapter 5	Structural consideration
Chapter 6	Cargo securing arrangements
Chapter 7	Electrical power supplies
Chapter 8	Radiological protection
Chapter 9	Management and training
Chapter 10	Shipboard emergency plan
Chapter 11	Notification in the event of an incident involving INF cargo
Appendix	Form of International Certificate of Fitness for the Carriage of INF Cargo

Resolution A491(XII) -CODE OF SAFETY FOR NUCLEAR MERCHANT SHIPS	**1979 MODU Code – Code for the Construction and Equipment of Mobile Offshore Drilling Units**	**1989 MODU Code – Code for the Construction and Equipment of Mobile Offshore Drilling Units**	**2009 MODU Code - Code for the Construction and Equipment of Mobile Offshore Drilling Units**
GENERALLY PRESCRIPTIVE & TECHNOLOGY SPECIFIC	GENERALLY PRESCRIPTIVE	GENERALLY PRESCRIPTIVE	**GENERALLY PRESCRIPTIVE**
ADOPTED IN 1981	SUPERSEDED BUT APPLICABLE TO UNITS BUILT BEFORE A CERTAIN DATE IF STILL ACTIVE	SUPERSEDED BUT APPLICABLE TO UNITS BUILT BEFORE 1 JAN 2012 IF STILL ACTIVE	The MODU Code is a set of International Maritime Organization (IMO) guidelines that establish safety standards for new mobile offshore drilling units, ensuring their safety and that of their personnel. It provides rules for construction, equipment, and operation for these units to facilitate their international movement. The code is periodically reviewed and updated to reflect evolving technology. The Assembly, at its twenty-sixth session (23 November to 2 December 2009), adopted by resolution A.1023(26) the Code for the Construction and Equipment of Mobile Offshore Drilling Units, 2009 (2009 MODU Code), which had been developed following a thorough revision of the 1989 MODU Code adopted by resolution A.649(16). In adopting the 2009 MODU Code, the Assembly recalled in particular that, since the adoption of the 1989 MODU Code, the Organization had adopted a significant number of amendments to many of the regulations of the International Convention for the Safety of Life at Sea, 1974 (SOLAS) referenced in the Code, and also that the International Civil Aviation Organization (ICAO) had adopted amendments to the Convention on international Civil Aviation which impacted on the provisions for helicopter facilities as contained in the Code. The 2009 MODU Code provides an international standard for MODUs of new construction which will facilitate their international movement and operation and ensure a level of safety for such units and for personnel on board, equivalent to that required by the 1974 SOLAS Convention and the Protocol of 1988 relating to the International Convention on Load Lines, 1966, for conventional ships engaged on

							international voyages. The 2009 MODU Code supersedes the 1989 MODU Code, adopted by resolution A.649(16), for mobile offshore drilling units the keels of which are laid or which are at a similar stage of construction on or after 1 January 2012.
Resolution A491(XII) -CODE OF SAFETY FOR NUCLEAR MERCHANT SHIPS		**1979 MODU Code – Code for the Construction and Equipment of Mobile Offshore Drilling Units**		**1989 MODU Code – Code for the Construction and Equipment of Mobile Offshore Drilling Units, 1989**		**2009 MODU Code - Code for the Construction and Equipment of Mobile Offshore Drilling Units**	
			Preamble		Preamble		Preamble
Chapter 1	General	Chapter 1	General	Chapter 1	General	Chapter 1	General
Chapter 2	Design Criteria and Conditions	Chapter 2	Construction, Strength and Materials	Chapter 2	Construction, Strength and Materials	Chapter 2	Construction, Strength and Materials
Chapter 3	Ship Design, Construction and Equipment	Chapter 3	Subdivision, Stability and Freeboard	Chapter 3	Subdivision, Stability and Freeboard	Chapter 3	Subdivision, Stability and Freeboard
Chapter 4	Nuclear Steam Supply System	Chapter 4	Machinery Installations for all Types of Units	Chapter 4	Machinery Installations for all Types of Units	Chapter 4	Machinery Installations for all Types of Units
Chapter 5	Machinery and Electrical Installations	Chapter 5	Electrical Installations for all Types of Units	Chapter 5	Electrical Installations for all Types of Units	Chapter 5	Electrical Installations for all Types of Units
Chapter 6	Radiation Safety	Chapter 6	Machinery and Electrical Installations in Hazardous Areas for all Types of Units	Chapter 6	Machinery and Electrical Installations in Hazardous Areas for all Types of Units	Chapter 6	Machinery and Electrical Installations in Hazardous Areas for all Types of Units
Chapter 7	Operation	Chapter 7	Machinery and Electrical Installations for Self-propelled Units	Chapter 7	Machinery and Electrical Installations for Self-propelled Units	Chapter 7	Machinery and Electrical Installations for Self-propelled Units
Chapter 8	Surveys	Chapter 8	Periodically Unattended Machinery Spaces for all Types of Units	Chapter 8	Periodically Unattended Machinery Spaces for all Types of Units	Chapter 8	Periodically Unattended Machinery Spaces for all Types of Units
Appendix 1	Sinking velocity calculations	Chapter 9	Fire Safety	Chapter 9	Fire Safety	Chapter 9	Fire Safety
Appendix 2	Seaway loads depending on service periods	Chapter 10	Life-saving Appliances and Equipment	Chapter 10	Life-saving Appliances and Equipment	Chapter 10	Life-saving Appliances and Equipment
Appendix 3	Safety Assessment	Chapter 11	Radiocommunication Installations	Chapter 11	Radiocommunication Installations	Chapter 11	Radiocommunication Installations
Appendix 4	Limiting dose equivalent rates for different areas and spaces	Chapter 12	Lifting Devices	Chapter 12	Lifting Devices	Chapter 12	Lifting Devices
Appendix 5	Quality assurance programme	Chapter 13	Helicopter Facilities	Chapter 13	Helicopter Facilities	Chapter 13	Helicopter Facilities
Appendix 6	Application of single failure criterion	Chapter 14	Operating Requirements	Chapter 14	Operating Requirements	Chapter 14	Operating Requirements

Chapter 15	Special Measures to Enhance Safety
Appendix	Model form of Mobile Offshore Drilling Unit Safety Certificate

Chapter 15	Special Measures to Enhance Safety
Appendix	Model form of Mobile Offshore Drilling Unit Safety Certificate

Chapter 15	Special Measures to Enhance Safety
Appendix	Model form of Mobile Offshore Drilling Unit Safety Certificate

Resolution A491(XII) -CODE OF SAFETY FOR NUCLEAR MERCHANT SHIPS	
GENERALLY PRESCRIPTIVE & TECHNOLOGY SPECIFIC	
ADOPTED IN 1981	
Resolution A491(XII) -CODE OF SAFETY FOR NUCLEAR MERCHANT SHIPS	
Chapter 1	General
Chapter 2	Design Criteria and Conditions
Chapter 3	Ship Design, Construction and Equipment
Chapter 4	Nuclear Steam Supply System
Chapter 5	Machinery and Electrical Installations
Chapter 6	Radiation Safety
Chapter 7	Operation
Chapter 8	Surveys
Appendix 1	Sinking velocity calculations
Appendix 2	Seaway loads depending on service periods
Appendix 3	Safety Assessment
Appendix 4	Limiting dose equivalent rates for different areas and spaces
Appendix 5	Quality assurance programme
Appendix 6	Application of single failure criterion

OSV Code - Code of Safe Practice for the Carriage of Cargoes and Persons by Offshore Supply Vessels	
GENERALLY PRESCRIPTIVE	
Resolution A.863(20), 2000 The purpose of this Code of Safe Practice is to provide, for both operator and contractor, an international standard to avoid or reduce to a minimum the hazards which affect offshore supply vessels in their daily operation of carrying cargoes and persons to, from and between offshore installations. It is not intended to address contractual matters or the financial implications that occur in the operator/contractor relationship. This standard should be considered when implementing a Safety Management System (SMS) within the meaning of 1.4 of the IMO International Safety Management (ISM) Code.	
OSV Code - Code of Safe Practice for the Carriage of Cargoes and Persons by Offshore Supply Vessels	
	The Assembly
Annex - Code of Safe Practice for the Carriage of Cargoes and Persons by Offshore Supply Vessels (OSV Code)	
	Foreword
1	General
2	Port Operations
3	Sea Transport
4	Operations at the Offshore Installation
Appendix 1	Examples and Types of Offshore Installations
Appendix 2	Colour Code for Hoses Transferring Bulk Substances
Appendix 3	Interfacing Activities of Operators and Contractors

OSV Chemical Code - Code for the Transport and Handling of Hazardous and Noxious Liquid Substances in Bulk on Offshore Support Vessels (OSV Chemical Code)	
GENERALLY PRESCRIPTIVE	
Resolution A.1122(30) Adopted on 6 December 2017 To provide an international standard for the safe carriage, by sea in bulk, of chemicals by setting the design and construction standards of vessels involved in such carriage and the equipment, so as to minimize the risks to the vessel, its crew and the environment, having regard to the nature of the products, including flammability, toxicity, asphyxiation, corrosivity and reactivity. The OSV Chemical Code replaces the previous Resolution A.673(16), "Guidelines for Transport and handling of limited amounts of hazards and Noxious Liquid Substances in Bulk on offshore support vessels" (LHNS Guidelines).	
OSV Chemical Code - Code for the Transport and Handling of Hazardous and Noxious Liquid Substances in Bulk on Offshore Support Vessels	
	Preamble
Chapter 1	General
Chapter 2	Vessel Survival Capability and Location of Cargo Tanks
Chapter 3	Vessel Design
Chapter 4	Special Requirements for Products with a Flashpoint Not Exceeding 60°C, Toxic Products and Acids
Chapter 5	Cargo Containment
Chapter 6	Cargo Transfer
Chapter 7	Cargo Tank Venting
Chapter 8	Electrical Installations
Chapter 9	Fire-Fighting Requirements
Chapter 10	Mechanical Ventilation in the Cargo Area
Chapter 11	Instrumentation and Automation Systems
Chapter 12	Pollution Prevention Requirements
Chapter 13	Life-Saving Appliances and Arrangements
Chapter 14	Personnel Protection
Chapter 15	Operational Requirements
Chapter 16	Backloading of Contaminated Bulk Liquids
Chapter 17	Discharging and Loading of Portable Tanks on Board
Chapter 18	Carriage of Liquefied Gases

Appendix 1	Model Form of Certificate of Fitness
Appendix 2	Guidelines for Testing Prior to Backloading
Appendix 3	Model Format for the Procedure for Discharging and Loading Portable Tanks Containing Dangerous Goods Carried as Deck Tanks on Offshore Support Vessels

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GENERALLY PRESCRIPTIVE & TECHNOLOGY SPECIFIC	
ADOPTED IN 1981	
Resolution A491(XII) -CODE OF SAFETY FOR NUCLEAR MERCHANT SHIPS	
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Chapter 2	Design Criteria and Conditions
Chapter 3	Ship Design, Construction and Equipment
Chapter 4	Nuclear Steam Supply System
Chapter 5	Machinery and Electrical Installations
Chapter 6	Radiation Safety
Chapter 7	Operation
Chapter 8	Surveys
Appendix 1	Sinking velocity calculations
Appendix 2	Seaway loads depending on service periods
Appendix 3	Safety Assessment
Appendix 4	Limiting dose equivalent rates for different areas and spaces
Appendix 5	Quality assurance programme
Appendix 6	Application of single failure criterion

Polar Code - International Code for Ships Operating in Polar Waters		
GOALS & FUNCTIONAL REQUIREMENTS		
IMO's International Code for Ships Operating in Polar Waters (Polar Code) is mandatory under both the International Convention for the Safety of Life at Sea (SOLAS) and the International Convention for the Prevention of Pollution from Ships (MARPOL). The Polar Code covers the full range of design, construction, equipment, operational, training, search and rescue and environmental protection matters relevant to ships operating in the inhospitable waters surrounding the two poles. The Polar Code entered into force on 1 January 2017. The Polar Code and SOLAS amendments were adopted during the 94th session of IMO's Maritime Safety Committee (MSC), in November 2014; the environmental provisions and MARPOL amendments were adopted during the 68th session of the Marine Environment Protection Committee (MEPC) in May 2015.		
Polar Code - International Code for Ships Operating In Polar Waters		
		Preamble
Part I-A Safety Measures		
	Chapter 1	General
	Chapter 2	POLAR WATER OPERATIONAL MANUAL (PWOM)
	Chapter 3	SHIP STRUCTURE
	Chapter 4	SUBDIVISION AND STABILITY
	Chapter 5	WATERTIGHT AND WEATHERTIGHT INTEGRITY
	Chapter 6	MACHINERY INSTALLATIONS
	Chapter 7	FIRE SAFETY/PROTECTION
	Chapter 8	LIFE-SAVING APPLIANCES AND ARRANGEMENTS
	Chapter 9	SAFETY OF NAVIGATION
	Chapter 10	COMMUNICATION
	Chapter 11	VOYAGE PLANNING
	Chapter 12	MANNING AND TRAINING
Part I-B - Additional Guidance regarding the Provisions of the Introduction and Part I-A		
PART II-A - Pollution Prevention Measures		
	Chapter 1	PREVENTION OF POLLUTION BY OIL
	Chapter 2	CONTROL OF POLLUTION BY NOXIOUS LIQUID SUBSTANCES IN BULK
	Chapter 3	PREVENTION OF POLLUTION BY HARMFUL SUBSTANCES CARRIED BY SEA IN PACKAGED FORM (intentionally blank)

	Chapter 4	PREVENTION OF POLLUTION BY SEWAGE FROM SHIPS
	Chapter 5	PREVENTION OF POLLUTION BY GARBAGE FROM SHIPS
PART II-B - Additional Guidance regarding the Provisions of the Introduction and Part II-A		
	Appendix 1	Form of Certificate for Ships operating in Polar Waters
	Appendix 2	Model table of contents for the Polar Water Operational Manual (PWOM)

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ADOPTED IN 1981	
Resolution A491(XII) -CODE OF SAFETY FOR NUCLEAR MERCHANT SHIPS	
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Chapter 3	Ship Design, Construction and Equipment
Chapter 4	Nuclear Steam Supply System
Chapter 5	Machinery and Electrical Installations
Chapter 6	Radiation Safety
Chapter 7	Operation
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Appendix 1	Sinking velocity calculations
Appendix 2	Seaway loads depending on service periods
Appendix 3	Safety Assessment

SPS Code - Code of Safety for Special Purpose Ships	
GENERALLY PRESCRIPTIVE	
IMO Resolution A.534(13) of 17 November 1983 - Code of Safety for Special Purpose Ships, 1983, (for ships built before 1 July 2009)	
SPS Code - Code of Safety for Special Purpose Ships	
	A & B The Assembly
Annex - Code of Safety for Special Purpose Ships	
	Preamble
Chapter 1	General
Chapter 2	Stability and Subdivision
Chapter 3	Machinery Installations
Chapter 4	Electrical Installations
Chapter 5	Periodically Unattended Machinery Spaces
Chapter 6	Fire Protection
Chapter 7	Explosives Stowage
Chapter 8	Life Saving Appliances
Chapter 9	Radiocommunications

2008 SPS Code – Code of Safety for Special Purpose Ships, 2008	
GENERALLY PRESCRIPTIVE	
The SPS Code (Code of Safety for Special Purpose Ships), established by IMO, sets safety standards for vessels carrying special personnel, such as scientists and technicians. The 2008 SPS Code ensures appropriate safety levels for cargo ships carrying more than 12 persons, including crew and special personnel. It outlines regulations to enhance safety for operations involving special activities onboard. The SPS Code is voluntary. A new mandatory safety code for ships carrying industrial personnel – aimed at ensuring the safety of people transported to work on offshore facilities including windfarms – was adopted by IMO's Maritime Safety Committee (MSC 106) in November 2022. The Code entered into force in 2024. Ships carrying more than 12 persons, not engaged on board, would have been considered passenger ships under the SOLAS Convention. The non-mandatory SPS Code has, however, frequently been accepted by flag administrations for such vessels, instead of full passenger ship compliance, although the SPS Code is explicitly not intended to enable carrying persons not working on board. Furthermore, the SPS Code is not accepted by all flag Administrations. These regulatory gaps have resulted in inconsistent application of requirements by the various flag administrations, and a confusing compliance regime for shipowners and operators. IMO has developed a new SOLAS Chapter XV and a related mandatory new IP Code for the carriage of more than 12 industrial personnel on cargo ships and high-speed cargo craft. The IP Code intentionally fills and clarifies the regulatory gap between SOLAS cargo ships and SOLAS passenger ships.	
2008 SPS Code – Code of Safety for Special Purpose Ships, 2008	
	Preamble
	Preamble
Chapter 1	General
Chapter 2	Stability and Subdivision
Chapter 3	Machinery Installations
Chapter 4	Electrical Installations
Chapter 5	Periodically Unattended Machinery Spaces
Chapter 6	Fire Protection
Chapter 7	Dangerous Goods
Chapter 8	Life Saving Appliances
Chapter 9	Radiocommunications

Appendix 4	Limiting dose equivalent rates for different areas and spaces
Appendix 5	Quality assurance programme
Appendix 6	Application of single failure criterion

Chapter 10	Safety of Navigation
Appendix	Form of Safety Certificate for Special Purpose Ships
Annex	Record of Equipment for the Special Purpose Ship Safety Certificate (Form SPS)

Chapter 10	Safety of Navigation
Chapter 11	Security
Annex	Form of Safety Certificate for Special Purpose Ships

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GENERALLY PRESCRIPTIVE & TECHNOLOGY SPECIFIC	
ADOPTED IN 1981	
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Appendix 3	Safety Assessment
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Appendix 5	Quality assurance programme
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DSC Code - Code of Safety for Dynamically Supported Craft	
GENERALLY PRESCRIPTIVE	
The DSC Code was adopted by the IMO Assembly on 14 November 1977 by resolution A.373(X), recognizing that the design criteria for dynamically supported craft are often quite different from those of conventional ships, making the application of international conventions such as the SOLAS Convention inappropriate in respect to those types of ships. The provisions of the Code superseded a number of earlier IMO recommendations concerning hydrofoil boats and air-cushion vehicles. The Code applies to craft engaged in international voyages constructed before 1 January 1996 and sets out minimum requirements for craft carrying up to a maximum of 450 passengers and operating within a distance of 100 nautical miles from a place of refuge.	
DSC - Code of Safety for Dynamically Supported Craft	
	Preamble
Chapter 1	General
Chapter 2	Buoyancy, Stability and Subdivision
Chapter 3	Structures
Chapter 4	Accommodation and Escape Measures
Chapter 5	Directional Control Systems
Chapter 6	Anchoring, Towing and Berthing
Chapter 7	Fire Safety
Chapter 8	Life Saving Appliances
Chapter 9	Machinery
Chapter 10	Auxiliary Systems
Chapter 11	Remote Control and Warning Systems
Chapter 12	Electrical Equipment
Chapter 13	Radiocommunications and Navigational Equipment
Chapter 14	Operating Compartment Layout
Chapter 15	Stabilization Systems
Chapter 16	Handling, Controllability and Performance
Chapter 17	Operational Requirements

Chapter 18	Maintenance Requirements
Annex I	Sample of the Dynamically Supported Craft Construction and Equipment Certificate.
Annex II	Use of Probability Concept
Annex III	Interpretation of the Convention on the International Regulations for Preventing Collisions at Sea, 1972, Concerning Dynamically Supported Craft
Appendix I	Ice Accretion Applicable to all Types of Craft
Appendix II	Methods Relating to the Intact Stability Investigation of Hydrofoil Boats Passenger Loading

Resolution A491(XII) -CODE OF SAFETY FOR NUCLEAR MERCHANT SHIPS	
GENERALLY PRESCRIPTIVE & TECHNOLOGY SPECIFIC	
ADOPTED IN 1981	
Resolution A491(XII) -CODE OF SAFETY FOR NUCLEAR MERCHANT SHIPS	
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Chapter 2	Design Criteria and Conditions
Chapter 3	Ship Design, Construction and Equipment
Chapter 4	Nuclear Steam Supply System
Chapter 5	Machinery and Electrical Installations
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Chapter 7	Operation
Chapter 8	Surveys
Appendix 1	Sinking velocity calculations
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Appendix 3	Safety Assessment
Appendix 4	Limiting dose equivalent rates for different areas and spaces

HSC Code - International Code of Safety for High Speed Craft, 1994	
GENERALLY PRESCRIPTIVE	
In 1994, IMO adopted the International Code of Safety for High-Speed Craft (HSC Code) (resolution MSC.36 (63), which was developed following a revision of the Code of Safety of Dynamically Supported Craft (resolution A.373(X)). Also in 1994, IMO adopted a new SOLAS chapter X - Safety measures for high-speed craft, which makes the HSC Code mandatory high-speed craft built on or after 1 January 1996. The Chapter was adopted in May 1994 and entered into force on 1 January 1996.	
HSC Code - International Code of Safety for High Speed Craft, 1994	
	The Maritime Safety Committee
Annex - International Code of Safety for High Speed Craft, 1994	
	Preamble
Chapter 1	General Comment and Requirements
Chapter 2	Buoyancy, Stability and Subdivision
Chapter 3	Structures
Chapter 4	Accommodation and Escape Measures
Chapter 5	Directional Control Systems
Chapter 6	Anchoring, Towing and Berthing
Chapter 7	Fire Safety
Chapter 8	Life-saving Appliances and Arrangements
Chapter 9	Machinery
Chapter 10	Auxiliary Systems

HSC 2000 Code - International Code of Safety for High-Speed Craft, 2000	
GENERALLY PRESCRIPTIVE. EACH CHAPTER IS DIVIDED IN THREE PARTS: GENERAL, PAX SHIP AND CARGO SHIP	
The 2000 HSC Code updates the 1994 HSC Code and applies to all HSC built after the date of entry into force, 1 July 2002. The original Code will continue to apply to high-speed craft built before that date.	
HSC 2000 Code - International Code of Safety for High-Speed Craft, 2000	
	Preamble
Chapter 1	General Comment and Requirements
Chapter 2	Buoyancy, Stability and Subdivision
Chapter 3	Structures
Chapter 4	Accommodation and Escape Measures
Chapter 5	Directional Control Systems
Chapter 6	Anchoring, Towing and Berthing
Chapter 7	Fire Safety
Chapter 8	Life-saving Appliances and Arrangements
Chapter 9	Machinery
Chapter 10	Auxiliary Systems

Appendix 5	Quality assurance programme
Appendix 6	Application of single failure criterion

Chapter 11	Remote Control, Alarm and Safety Systems
Chapter 12	Electrical Installations
Chapter 13	Shipborne Navigational Systems and Equipment and Voyage Data Recorder
Chapter 14	Radiocommunications
Chapter 15	Operating Compartment Layout
Chapter 16	Stabilization Systems
Chapter 17	Handling, Controllability and Performance
Chapter 18	Operational Requirements
Chapter 19	Inspection and Maintenance Requirements
Annex 1	Form of Safety Certificate for High Speed Craft
Annex 2	For of Permit to Operate High Speed Craft
Annex 3	Use of Probability Concept
Annex 4	Procedures for Failure Mode and Effects Analysis
Annex 5	Ice Accretion Applicable to all Types of Craft
Annex 6	Methods Relating to the Intact Stability Investigation of Hydrofoil Craft
Annex 7	Stability of Multihull Craft
Annex 8	Definitions, Requirements and Compliance Criteria Related to Operational and Safety Performance
Annex 9	Criteria for Testing and Evaluation of Revenue and Crew Seats
Annex 10	Open Reversible Liferafts

Chapter 11	Remote Control, Alarm and Safety Systems
Chapter 12	Electrical Installations
Chapter 13	Shipborne navigational systems and equipment and voyage data recorders
Chapter 14	Radiocommunications
Chapter 15	Operating Compartment Layout
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Annex 1	Form of Safety Certificate for High Speed Craft
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Annex 3	Use of Probability Concept
Annex 4	Procedures for Failure Mode and Effects Analysis
Annex 5	Ice Accretion Applicable to all Types of Craft
Annex 6	Stability of hydrofoil craft
Annex 7	Stability of Multihull Craft
Annex 8	Stability of monohull craft
Annex 9	Definitions, requirements and compliance criteria related to operational and safety performance
Annex 10	Criteria for testing and evaluation of seats
Annex 11	Open reversible liferafts
Annex 12	Factors to be Considered in Determining Craft Operating Limitations