

Fire Safety Requirements for ships

- **Fundamental Fire safety Requirements in SOLAS and FTP Code**
- **Possible input from TRANAFEU to IMO**

Fire Safety ISO standards in ISOTC92SC1

- Possible input from TRANSFEU to ISOTC92SC1

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Previous-chairman, IMO Fire Protection Sub-Committee
Chairman, ISO/TC92/SC1: Fire safety – Fire initiation and growth

FUNDAMENTAL REQUIREMENTS ON FIRE SAFETY OF SHIPS (SOLAS Convention)

- International Convention of Safety of Life at Sea (**SOLAS**).
- SOLAS chapter II-2 “Construction - Fire protection, fire detection and fire extinction”
- SOLAS chapter II-2 has been developed and revised at IMO (International Maritime Organization) and its Sub-Committee for Fire Protection (**FP**) and Maritime Safety Committee (**MSC**)
- SOLAS chapter II-2 was revised comprehensively in 2000



FUNDAMENTAL REQUIREMENTS ON FIRE SAFETY OF SHIPS (SOLAS Convention)

regulation 2 of chapter II-2 of SOLAS

The **fire safety objectives** of this chapter are to:

- .1 prevent the occurrence of fire and explosion;
- .2 reduce the risk to life caused by fire;
- .3 reduce the risk of damage caused by fire to the ship, its cargo and the environment;
- .4 contain, control and suppress fire and explosion in the compartment of origin; and
- .5 provide adequate and readily accessible means of escape for passengers and crew.

FUNDAMENTAL REQUIREMENTS ON FIRE SAFETY OF SHIPS (SOLAS Convention)

regulation 2 of chapter II-2 of SOLAS

functional requirements

- 1 division of the ship into main vertical and horizontal zones by thermal and structural boundaries;
- 2 separation of accommodation spaces from the remainder of the ship by thermal and structural boundaries;
- 3 restricted use of combustible materials;
- 4 detection of any fire in the zone of origin;
- 5 containment and extinction of any fire in the space of origin;
- 6 protection of means of escape and access for fire fighting;
- 7 ready availability of fire-extinguishing appliances; and
- 8 minimization of possibility of ignition of flammable cargo vapour.



Structure of SOLAS Chapter II-2

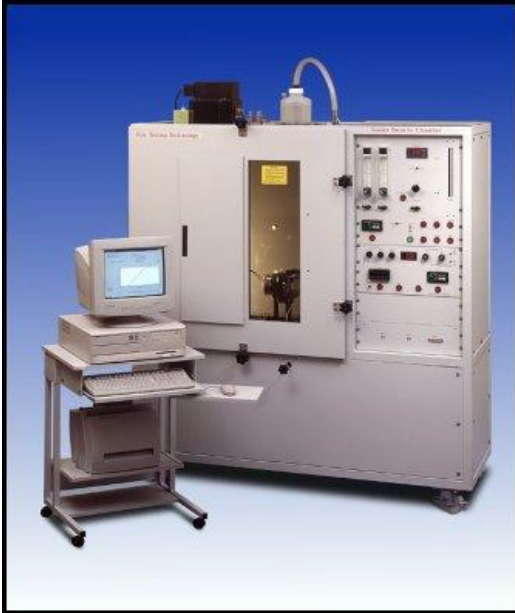
- Part A General**
Regulation 1 Application,
Regulation.2 general principles,
Regulation.3 Definitions
- Part B Prevention of fire and explosion**
Reg.4 Probability of Ignition,
Reg.5 Fire growth potentials,
Reg.6 Smoke and toxicity
- Part C Suppression of Fire**
Reg.7, detection and alarm, Reg.8 Control of smoke spread, Reg.9 Containment of fire,
Reg.10 Fire fighting, Reg.11 Structural integrity
- Part D Escape**
Reg.12 Notification of crew and passengers, Reg.13 Means of escape
- Part E Operational requirements**
Reg.14 Operational readiness and maintenance, Reg.15 Instructions, onboard training
and drills, Reg.16 Operations
- Part F Alternative design and arrangements**
Reg.17 Alternative design and arrangements
- Part G Special requirements**
Reg.18 Helicopter facilities, Reg.19 Carriage of dangerous goods,
Reg.20 Protection of vehicle, special category and ro-ro spaces,
Reg.21 Casualty threshold, safe return to port and safe areas,
Reg.22 Design criteria for systems to remain operational after a fire casualty,
Reg.23 Safety centre on passenger ships

FIRE SAFETY REQUIREMENTS FOR MATERIALS USED ON BOARD SHIPS (regulation 5 and 6)

- 1 **Non-combustibility** for fire protection construction (Decks, Ceilings, Bulkheads, Wall partitions, Doors, Decks, etc.)
- 2 **Low flame-spread characteristics** for surface finishes including paints, floorings, plastics pipes, cables to be added near future)
- 3 **Limitation of smoke and toxic gas production** for surface finishes, floorings, plastics pipes, (cables to be added near future)
- 4 **Ignitability** of curtains, hanging textiles, upholstered furniture and bedding components and films; and

Detailed requirements are specified in International Code of Application of Fire Test Procedures (FTP Code)

Part 2 Smoke and toxicity test



Criteria for smoke,

$D_m < 200$ for surface of wall and ceiling

$D_m < 400$ for primary deck covering, , plastic pipes and electric cables

$D_m < 500$ for floor covering

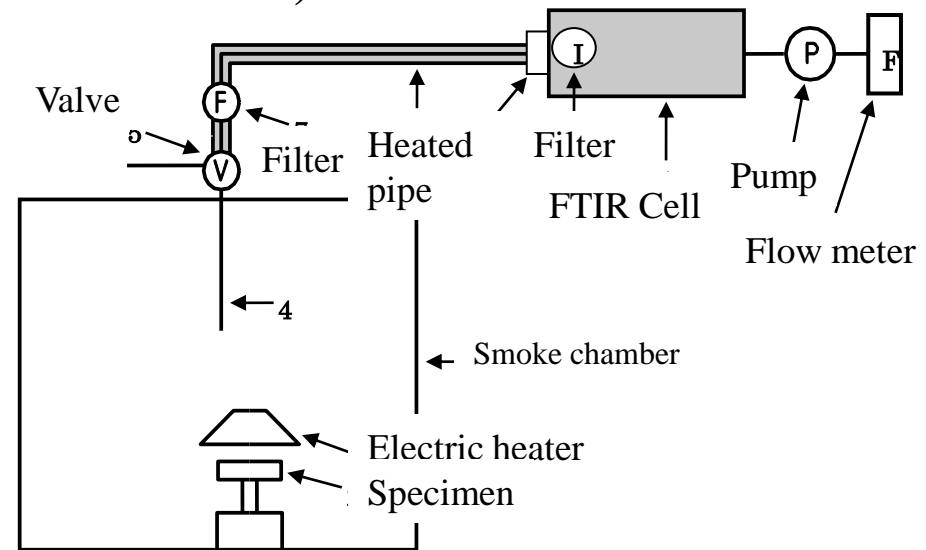
Criteria for toxic gases

$CO < 1450$ ppm, $HCl < 600$ ppm, $HF < 600$ ppm,

$HBr < 600$ ppm, $NO_2 < 350$ ppm, $HCN < 140$ ppm,

$SO_2 < 120$ ppm (200 ppm for floor coverings) .

reference: ISO 5659-2 gas measurement using FTIR (ISO/DIS 21489)

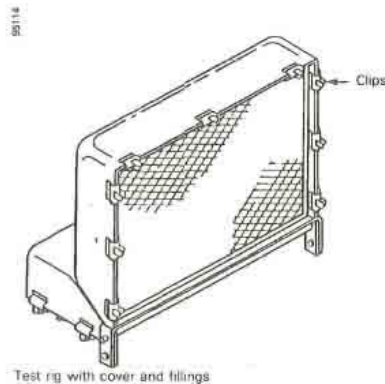
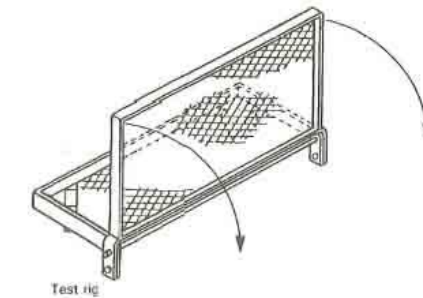


IMO needs to further improve FTP Code Part 2 for smoke and Toxicity, and is waiting for any Proposal from TRANSFEU.

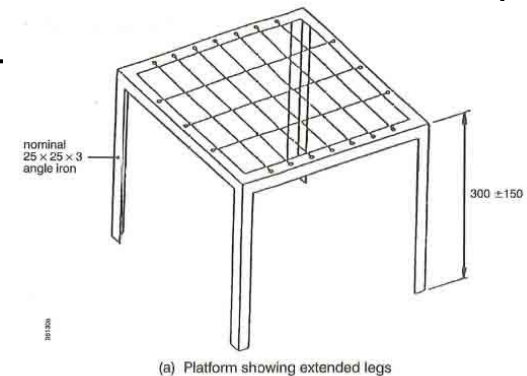
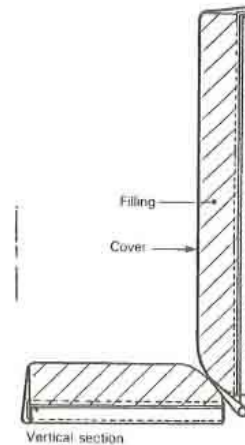
Part 6	Primary deck coverings test reference: ISO 5658-2	Criteria: same as floor materials Revision: to be merged into Part 5
Part 7	Test for vertically supported textiles and films reference: IMO A.652(16)	Criteria: not to ignite by a small flame source (DIN small burner) Revision: no change
Part 8	Test for upholstered furniture reference: IMO A.687(17)	Criteria: not to ignite by a specified cigarette and small flame source Revision: Specification of cigarette ignition source will be harmonized with Part 9.
Part 9	Test for bedding components reference: IMO A.688(17)	Criteria: not to ignite by a specified cigarette and small flame source Revision: no significant change



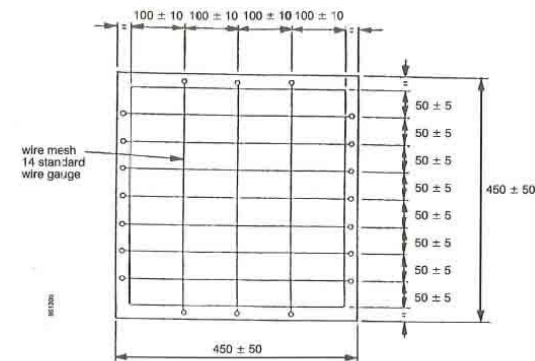
Part 7



Part 8



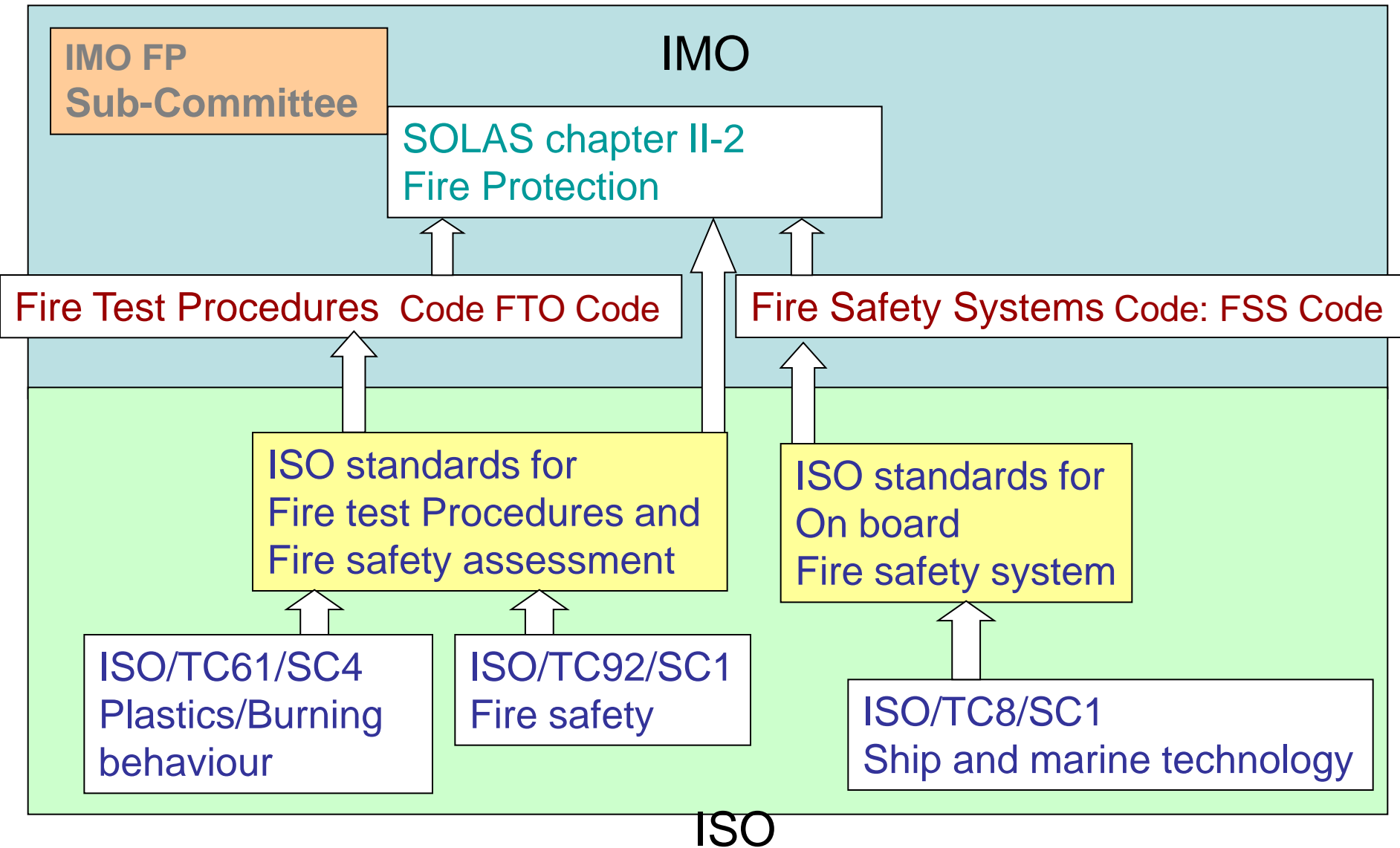
(a) Platform showing extended legs



(b) Spacing of wire mesh platform

Part 9

IMO and ISO on Fire Protection



Possible input from TRANSFEU to IMO

Target products of evaluation

Common products for surface transportation vehicles

- Seating
- Curtain
- Ceiling, Wall and partition surface (floor covering?)
- Table
- Other interior components (e.g., lighting system, luggage shelf)

This does not cover fire safety in sleeping compartment.



Application to surface transportation vehicles

- Data base of fire performance of each component can be developed and used in any application.
- Actual design of vehicles may differ significantly by **volume and dimensions**. No uniform application of fire performance (either ranking or classification) can be applicable to all vehicles.
- **Ships and high-speed water craft** shall have **sprinkler system and fire detection and alarm system**.
- Performance of **emergency air/gas exhaust system, if fitted**, can be taken into account.

Fire scenario for consideration

- No possibility of self-ignition?
- If power source is accommodated, possibility of initiation by the power source should be considered.
- Smoking is prohibited in enclosure of vehicle
- Ignition by arsonist
 - Size of ignition source
 - Cigarette lighters
 - Papers ignited by lighters and/or alcohol

Need to specify the ignition source for evaluation;
possibly

Seating and table: 75kW burner on the seat and
alcohol fire underneath

Curtain: cigarette lighter

Wall and ceiling surface (and possibly curtain):
40 kW/m² in 250mm diameter

Other product: to be decided

Performance criteria

- Product shall not ignite by the ignition source;
 - by the power source accommodated in the product,
 - by arsonist ignition source
- or
- Product shall not spread the fire to the neighbor products
 - Limited flame spread within the component
 - Heat release and total heat release rate shall not exceed criteria to be developed
- and
- Product shall not give off smoke and gases which result in serious danger in the vehicle



Data necessary for evaluation

- Full scale product fire test would be required.
 - Ignitability test by the ignition source
- If ignited, then;
 - Flame spread, heat release, smoke generation and gas generation by FTIR at
 - For surface finish;
 - ISO 5658-4 or ISO 21367;
 - For seating, table and other components
 - ISO 9705, ISO 24473 or
 - Furniture calorimeter or smaller scale compartment fire test method may be developed to measure heat release up to 500 kW or 1MW for smaller products such as tables and lighting systems.
 - Measurement resolution should be in order of 1kW.

Evaluation on hazard of smoke and gases

- Evaluation on each design of vehicle shall be done using the test data and designed volume of the vehicle and its compartment;
 - On the assumption of
 - All the smoke and gases are accumulated in the compartment,
 - If emergency exhaust system is installed, the performance of emergency air/gas exhaust system can be taken into account
 - Against FED, FEC, immovability of people in smoke

Possible input from TRANSFEU to IMO

- Bench scale test protocol using ISO5659-2 and continuous FTIR gas measurement for improvement of IMO FTP Code Part 2 (Smoke and gas)
- Fire scenario and design fire for seating and related components as a new approach of fire safety of ships and water-crafts

EC representative to IMO

- EMSA (European Maritime Safety Agency) is the EC representative to IMO.

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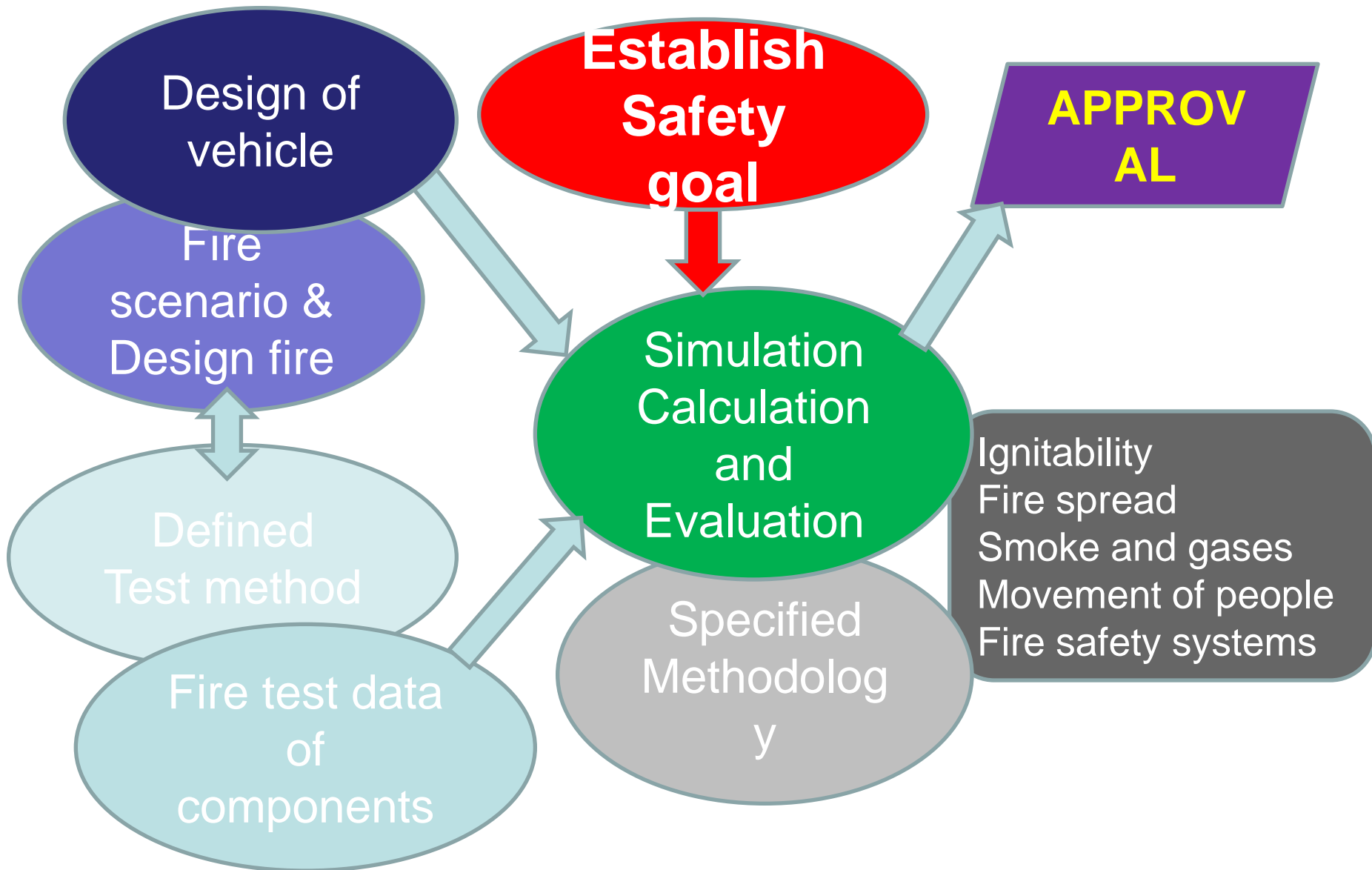
Lisboa, Portugal



TRANSFEU results and proposals can be inputted to IMO through EMSA.

Fire safety Engineering ISO/TC92 (SC1)

Fire Safety Evaluation System



Possible input from TRANSFEU to ISO/TC92(Fire safety) and its SC1 (Fire initiation and growth)

- NWIP on continuous gas measurement using FTIR during fire tests (e.g., single smoke chamber test, room fire test, open calorimetry, cable fire test)
- NWIP on Fire scenario and design fire for seating and related components in surface vehicles;
- NWIP on smaller furniture calorimeter or smaller scale compartment fire test method to measure heat release up to 500 kW or 1MW with measurement resolution of 1kW

Thank you



Chaired IMO FP from 1994 to 2003

Chairing ISO TC92 SC1 (Fire Safety/Fire Initiation and Growth)

Chairing ISO TC8 SC2 (Marine Environment protection)