

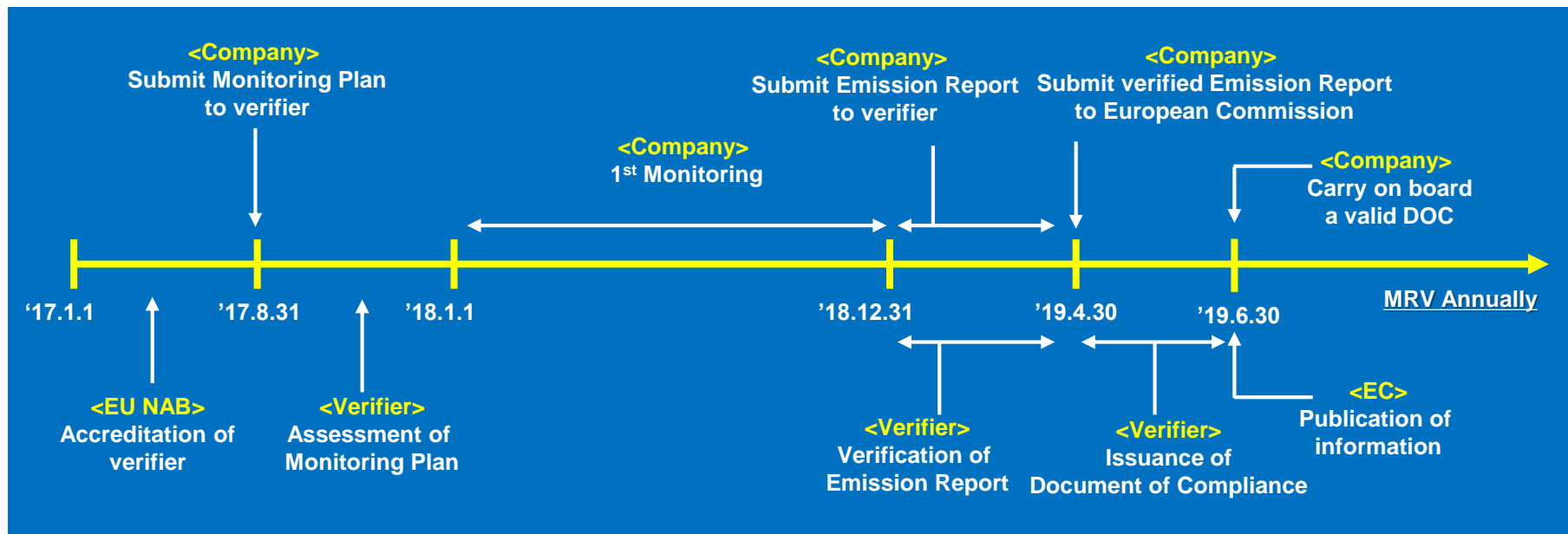
European Union Monitoring Reporting Verification



* 본 자료는 한국선급 및 연구자의 지적 자산으로서 무단 도용을 금합니다 *

EU MRV Regulation

- ❖ Regulation of the European Parliament and of the Council on the Monitoring, Reporting and Verification of Carbon Dioxide Emissions from Maritime Transport and Amending Regulation (EU) No 525/2013
- ❖ **Entry into force** : July 2015 / **1st Monitoring** : from January 2018 to December 2018
- ❖ Company shall submit **Monitoring Plan** to verifier by **31 August 2017**
- ❖ Applies to ships above 5,000 GT regardless of flag





Documentation of EU MRV

- ❖ Regulation (EU) 2015/757 : EU MRV 규정
 - ❖ Implementing Regulation (EU) 2016/1927 : MP, ER, DOC 서식
 - ❖ Implementing Regulation (EU) 2016/1928 : 화물량 산정(여객선, 로로선 및 컨테이너선 제외)
 - ❖ Delegated Regulation (EU) 2016/2071 : Amending Regulation (EU) 2015/757
 - ❖ Delegated Regulation (EU) 2016/2072 : 검증 활동 및 검증 기관 지정
 - ❖ Decision of the EEA joint committee no 215/206 : EEA에 대한 EU MRV 적용
- ✓ 문서 출처 http://ec.europa.eu/clima/policies/transport/shipping_en

➤ Guidance of EU MRV (개발 중) – Monitoring of fuel consumption and emissions

- ❖ **LNG 운반선 연료사용량 산정 지침** - **Fuel consumption for LNG carriers using boil-off gas as fuel** : For those ships the existing Custody Transfer Management System (CTMS) can serve as a very advanced method to determine the fuel consumed on its voyages. LNG consumed at berth can be derived by the flow meters installed on the piping supplying gas to the consumers (engines, boilers, etc) or by level gauges and calibration tables
- ❖ **자동 연료탱크 잔량 측정 지침** - **Method B (fuel tank readings)** : In cases of equipment failure, where electronic equipment is used, fuel tank readings can be carried out with manual tank reading methods
- ❖ **연료 밀도 보정 지침** - **Fuel density** : A number of issues could be addressed including the non-linear relationship between fuel oil density, temperature and pressure (to be taken into account when converting measured volumes into mass at varying temperatures), varying densities due to different measurement methods and the mixture of fuels made on board
- ❖ **바이오/대체연료 배출계수 지침** - **Emission factors** : In case of biofuels and alternative non-fossil fuels are used, emission factors need to be determined. Guidance might be required on the methodology for sampling and methods of analysis
- ❖ **불확도 지침** - **Uncertainty** : As no relevant international and European rules and standards or technological and scientific developments could trigger amendments to Annex I, it is suggested to provide guidance on expected levels of uncertainty for the different monitoring methods including default values which could be applied in the monitoring plans



Guidance of EU MRV (개발 중) – Determination of other parameters

- ❖ **Determination of distance travelled** (e.g. measurement through the water or over ground, consideration of drifting, movements for tank cleaning)
- ❖ **Determination of time spent at sea**
- ❖ **Determination of cargo carried for Ro-Ro (cargo) and Ro-Pax ships** : Based on recommendation of Work Package 3, companies could apply either actual or ship- or company-specific default values for the specific weight of cargo units (per lane-meter or per unit), to be specified in the monitoring plan
- ❖ **Allocation of fuel consumption/emissions to passenger and cargo transport (for Ro-Pax ships)** : Recommendations for the treatment of hanging decks and the area of the freight decks allocated to vehicles belonging to freight paying passengers (concrete proposals provided by Work Package 3)
- ❖ **The determination of cargo carried for container ships is based on actual mass or number of TEUs multiplied by default values for their weight** – The former is linked to applicable instruments pursuant to SOLAS. Guidance could make explicit reference to MSC.1/Circ.1475 (but no change to legal text desired to keep the link to SOLAS flexible in case of any amendments)
- ❖ **WSC proposed default values for container weight and further clarification on the determination for cargo carried for this ship type** – This could be integrated into guidance

➤ Guidance of EU MRV (개발 중) – Verification and Accreditation

- ❖ **Risk assessment to be carried out by verifiers** – how verifiers should use ship tracking data from an external source and how the verifier should interpret the information for the purpose of the verification of the emission report
- ❖ **Recommendations for improvements** – the extent to which verifiers can make recommendations
- ❖ **Materiality & verification of the emission report** – How sampling is relevant for EU MRV verification purposes, determining samples for data auditing and how verifiers apply the materiality principle
- ❖ **Verification of the emission report** – How backward verification should be dealt with when the ship sails to an EU port of call in the reporting period which the company did not foresee and therefore did not submit a monitoring plan to the verifier timely
- ❖ **Verification of the emission report** – To provide examples of how verification activities can be carried out by the verifier for ships reporting for the EU MRV Regulation
- ❖ **Assessment of verifiers by National Accreditation Bodies** in order to issue an accreditation certificate – How accreditation can be received in time during the initial phase (chicken and egg issue)
- ❖ **How verifiers and companies should deal with the situation in which the accreditation is suspended or withdrawn** close to the planned issuing date of the Document of Compliance (DOC) by the verifier
- ❖ **How port state authorities will deal with situations in which a ship calls at an EU port with a DOC issued by a verifier who's accreditation is suspended or withdrawn or without a DOC because the verifier is suspended**

▶ 일반 사항

❖ 모니터링 계획서

- 선박의 배출원 및 배출량 산정 방법론 등을 설명하는 문서
- 2017년 8월 31일까지 검증자에게 제출
- 2017년 8월 31일 이후, 규제 대상 선박은 첫 번째 기항일부터 2개월 이내 제출

❖ 배출량 보고서

- 배출량 및 기타 관련 정보의 모니터링 결과에 대한 보고서
- 2019년부터 매년 4월 30일까지 검증을 완료하여, 회사는 보고서를 EC에 제출
- 검증자는 DOC를 발급

❖ 보고기간

- 2018년부터 매년 1월 1일 - 12월 31일까지
- 항차가 두 개의 년도에 걸쳐있는 경우, 첫 번째 년도의 항차로 포함하여 보고

❖ 재제 조치

- EU 회원국별 규정에 따라 벌금 부과
- 두 번 이상 연속으로 의무 미준수시, 퇴거 명령 조치 (입항 거부)

▶ 모니터링 및 보고 원칙

- ❖ Relevance (적절성)
 - EU MRV Regulation 요구사항에 따른 관련 매개변수의 모니터링 및 보고
- ❖ Completeness (완전성)
 - 모든 배출원에 대한 연료 사용량 및 CO2 배출량을 포함
- ❖ Consistency (일관성) 및 Comparability (비교가능성)
 - 동일한 모니터링 방법론을 적용
- ❖ Transparency (투명성)
 - 제3자에 의해 재계산이 가능하도록 모든 사항을 문서화 및 제공
- ❖ Accuracy (정확성)
 - 데이터 계산 및 보고를 정확하게 하며, 부정확성 최소화 대책 수립

▶ What are we monitoring on a per-voyage basis?

- ❖ 출도착 항만
- ❖ 출도착 일자 및 시간
 - Greenwich Mean Time (GMT/UTC)
 - Departure from Berth and Arrival at Berth
- ❖ 연료 종류별 사용량 합계
 - 주기관, 보조기관, 가스터빈, 보일러 및 불활성가스발생장치
 - 정박 중 연료사량은 별도로 계산
- ❖ 연료 종류별 배출계수
- ❖ CO2 배출량 = 연료사용량 X 배출계수

Type of fuel	Reference	Emission factor (t-CO ₂ /t-fuel)
1 Diesel/Gas oil	ISO 8217 Grades DMX through DMB	3.206
2 Light fuel oil (LFO)	ISO 8217 Grades RMA through RMD	3.151
3 Heavy fuel oil (HFO)	ISO 8217 Grades RME through RMK	3.114
4 Liquefied petroleum gas (LPG)	Propane	3.000
	Butane	3.030
5 Liquefied natural gas (LNG)		2.750
6 Methanol		1.375
7 Ethanol		1.913

➤ What are we monitoring on a per-voyage basis?

- ❖ 운항 거리
 - Real distance travelled or Distance of the most direct route(with correction factor)
 - From Berth of Port of Departure To Berth of Port of Arrival
 - Nautical miles
- ❖ 해상에서의 소요된 시간
 - 항만 출발 및 도착 정보를 토대로 계산
 - Anchoring 제외
- ❖ 운송 화물량
 - 선박 종류별 화물량 산정 단위 사용 필요
- ❖ $\text{Transport Work} = \text{운송 화물량} \times \text{운항 거리}$
- ❖ Voyage Basis 모니터링 면제 기준
 - EU 항만에서만 운항; AND
 - 연간 300 항차 이상 운항



Parameters for Cargo Carried

Unit of Cargo	Ship types
<ul style="list-style-type: none"> • Passengers 	Passenger ships
<ul style="list-style-type: none"> • Tonnes 	Ro-ro ships, Container ships, Oil tankers, Chemical tankers, Gas carriers, Bulk carriers, Refrigerated cargo ships, Combination carriers
<ul style="list-style-type: none"> • Cubic meters 	LNG carriers - <i>Volume of the cargo on discharge</i>
<ul style="list-style-type: none"> • Cubic meters 	Container/Ro-ro cargo ships - <i>the sum of the number of cargo units(car, trailer, truck and other standard units) X Default area X Height of the deck(distance between floor and structural beam) AND</i> - <i>the sum of the number of occupied lane-metres X Height of the deck (for other ro-ro cargo) AND</i> - <i>the sum of the number of TEUs X 38.3m³</i>
<ul style="list-style-type: none"> • Tonnes of Deadweight carried; or • Tonnes of Deadweight carried and Tonnes 	General cargo ships - <i>Deadweight carried for laden voyages and zero for ballast voyages</i> - <i>Deadweight carried means, in metric tonnes, the measured volume displacement of a ship at a load draught condition multiplied by the relative water density at departure reduced by the ship's lightweight and by the weight of the fuel on board determined at the departure of the laden voyage concerned</i>



Parameters for Cargo Carried

Unit of Cargo	Ship types
<ul style="list-style-type: none">• Tonnes; or• Tonnes and Tonnes of Deadweight carried	Vehicle carries <ul style="list-style-type: none">- <i>Actual mass OR</i>- <i>the number of cargo units or occupied lane meters X Default Values for their weight</i>
<ul style="list-style-type: none">• Tonnes; and• Passengers	Ro-Pax ships <ul style="list-style-type: none">- <i>the number of passengers AND</i>- <i>Actual mass OR</i>- <i>the number of cargo units or occupied lane meters X Default Values for their weight</i>
<ul style="list-style-type: none">• Tonnes; or• Tonnes of Deadweight carried and Tonnes	Other ship types

What are we monitoring on an annual basis?

- ★ 연간 기준 모니터링 값은 항차 기준 모니터링 값의 합계
- ❖ 연료 종류별 사용량 총 합계
- ❖ 연료 종류별 배출계수 - IMO 배출계수
- ❖ 총 CO2 배출량 - 연료 사용량 X 배출계수
 - EU 항만 간의(Between) 모든 항차에 대한 총 CO2 배출량
 - EU 항만으로부터 출발한(Departed from) 모든 항차에 대한 총 CO2 배출량
 - EU 항만으로 도착한(Arrived to) 모든 항차에 대한 총 CO2 배출량
 - EU 항만에서 정박 중(Within port at berth) 발생한 총 CO2 배출량
- ❖ 총 운항 거리
- ❖ 총 운항 시간
- ❖ Total Transport Work - (1항차 화물량 X 1항차 거리) + (2항차 화물량 X 2항차 거리) + ... + (n항차 화물량 X n항차 거리)
- ❖ Average Energy Efficiency
 - Fuel Consumption $\frac{\text{Total annual fuel consumption}}{\text{Total distance travelled}}$
 - CO2 emissions $\frac{\text{Total annual CO2 emissions}}{\text{Total distance travelled}}$
 - $\frac{\text{Total annual fuel consumption}}{\text{Total transport work}}$
 - $\frac{\text{Total annual CO2 emissions}}{\text{Total transport work}}$

Monitoring voyages



❖ Case 1

- 부산 : 하역
- 싱가폴 : 하역, 빙커링
- 로테르담 : 하역

👉 **보고대상 : 싱가포르 - 로테르담**

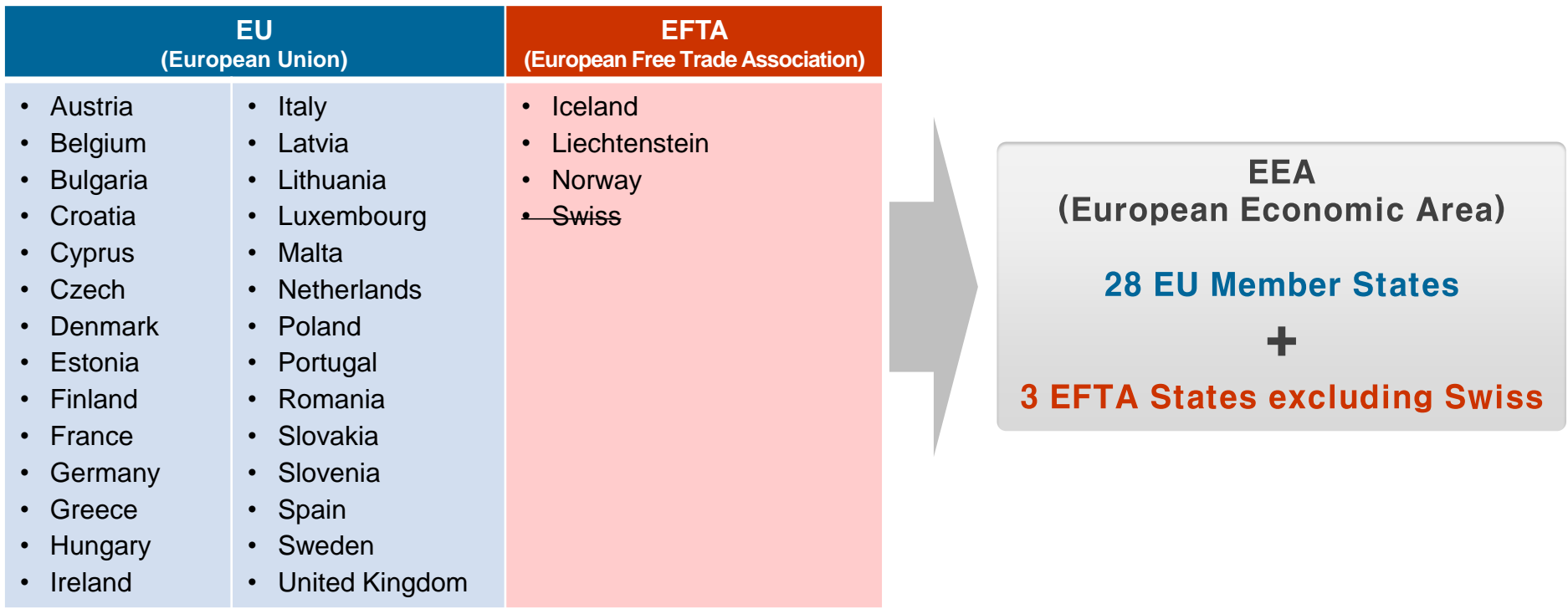
❖ Case 2

- 부산 : 하역
- 싱가폴 : 빙커링
- 로테르담 : 하역

👉 **보고대상 : 부산 - 로테르담**

➤ Extension to EEA(European Economic Area)

Decision of the EEA joint committee no 215/2016 amending Annexes XIII (Transport) and XX (Environment) to the EEA Agreement



👉 아이슬란드 및 노르웨이(Non-EU but EFTA)에 대한 voyage 보고 필요

Monitoring Methods for Fuel Consumption



❖ 선박연료유공급확인서(BDN) + 연료탱크 잔량조사

- 연료사용량 = 측정시작 시점 연료 잔량 + 연료 수급량 - 연료 반출량 - 측정종료 시점 연료 잔량
- 화물을 연료로 사용하는 경우에는 적용 불가(예, LNG 운반선)



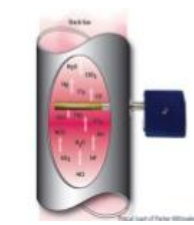
❖ 연료탱크 모니터링

- 연료사용량 = 측정시작 시점 연료 잔량 - 측정종료 시점 연료 잔량
- 매일 연료 잔량 측정 및 연료 수급/반출시 측정



❖ 유량계

- 연료사용량 = 공급라인 측정량 - 회수라인 측정량
- 유종별 계측 필요
- 정확도 관리 필요(검교정/유지보수 등)



❖ CO2 배출량 직접 측정

- 배기가스 스택(굴뚝)에서 측정
- CO2 배출량 = CO2 배출 유량 X CO2 농도
- CO2 배출량에 배출계수 적용하여 연료사용량 산정 필요
- 정확도 관리 필요(검교정/유지보수 등)

* 부피 단위로 측정한 경우, 밀도(Density) 고려하여 질량 단위로 환산 필요

1. On-board systems or
2. Fuel supplier invoice or BDN or
3. Analysis by laboratory

▶ 검증 (Verification)

- ❖ EU 국가인정기구(NAB)에 의해 인정받은 검증기관
 - Independence (독립성) 및 Impartiality (공평성)
- ❖ 모니터링 계획서(MP) 평가
 - 회사는 2017년 8월 31일까지 MP를 검증자에게 제출
 - 검증자는 2017년 12월 31일까지 MP 평가 완료
- ❖ 배출량 보고서(ER) 및 데이터 검증
 - 회사는 매년 ER을 검증자에게 제출
 - 검증자는 ER 및 데이터 검증하고 검증보고서를 회사에 발행 - 만족(satisfactory) or 불만족(unsatisfactory)
 - 회사는 매년 4월 30일까지 검증이 완료된 ER을 유럽집행위원회에 제출
 - ER 제출 완료를 검증기관에 통보
- ❖ 적합 확인서(DOC) 발행
 - 매년 6월 30일까지 DOC를 발행 - 유럽집행위원회와 주관청에 통보
 - 유효기간은 보고 종료 이후부터 18개월 (차년도 6월 30일까지)
 - 선박에 비치 필요 (보고 종료 이후 내년 6월 30일까지) - PSC 및 EU 회원국 비치여부 확인

▶ 검증 관련 사항

❖ Reasonable assurance (합리적 보증)

- 배출량 보고서가 중요한 불일치사항을 포함하지 않음 - 적정 검증 의견 제시 기준

❖ Materiality Level (중요성 수준)

- 불일치사항의 중요성 여부 판단을 위한 양적 기준
- **중요성 기준 5%**: 연료사용량, CO2 배출량, 화물량, 운항거리, 운항시간, Transport Work

(예시) - 선박 X는 HFO 1,000t을 사용하였으며, 배출계수를 2.1144tCO₂/t-fuel을 적용(HFO EF: 3.1144tCO₂/t-fuel)
- 따라서, 선박 X의 배출량을 2,114.4tCO₂로 보고하여 1,000tCO₂를 과소 보고
- 동 불일치사항의 영향은 32% = 1,000tCO₂/3,114tCO₂*100이며, 중요성 기준 5%를 초과함 (반드시 수정 필요)

❖ Risk Assessment (리스크 평가)

- Estimated Data (AIS)도 함께 활용
- 리스크 평가를 토대로 Verification plan 및 Sampling plan 수립

❖ Site visit (현장 검증)

- 회사 및 선박 모니터링/보고 시스템 이해 목적
- 주요 관련 데이터 보관 장소에 따라 Office 또는 Ship 등 현장 검증 장소 결정



THETIS MRV – Information System of EU MRV operated by EMSA

Mandatory Requirements

- electronic templates -

Outside the System

- ✓ Drafts **MP**
- ✓ Monitors CO₂ emissions
- ✓ Produces **ER**



COMPANY

- ✓ Assesses **MP**
- ✓ Verifies **ER**
- ✓ Drafts **VR**



VERIFIER



COMMISSION
MS / FLAG

In the System

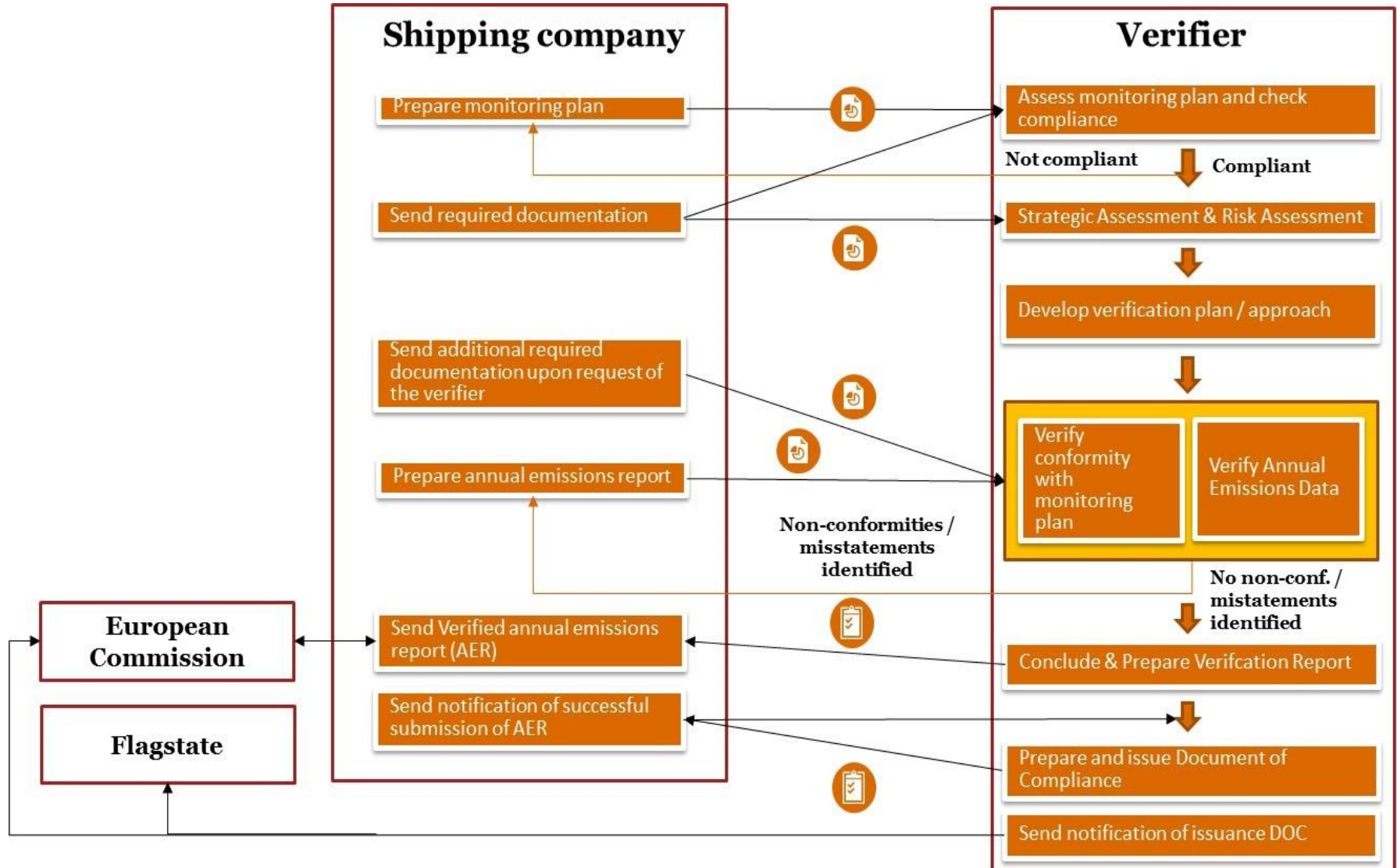


- ✓ Submits **Verified ER**

- ✓ Issues **DoC**

- ✓ Receives the **Verified ER** and **DoC**

Verification Workflow



Part A Revision record sheet

Part C Activity data

- C.1. Conditions of **exemption** related to Article 9(2)
- C.2. Monitoring of **fuel consumption**
- C.3. List of **voyages**
- C.4. **Distance travelled**
- C.5. Amount of **cargo** carried & Number of **passengers**
- C.6. **Time** spent at sea

Part E Management

- E.1. **Regular check** of the adequacy of the monitoring plan
- E.2. Control activities: **Quality assurance** and reliability of information technology
- E.3. Control activities: **Internal reviews** and validation of EU MRV relevant data
- E.4. Control activities: **Corrections** and corrective actions
- E.5. Control activities: **Outsourced** activities (if applicable)
- E.6. Control activities: **Documentation**

Part B Basic data

- B.1. Identification of the **ship**
- B.2. **Company** information
- B.3. **Emission sources** and **fuel types** used
- B.4. **Emission factors**

Part D Data gaps

- D.1. Methods to be used to estimate **fuel consumption**
- D.2. Methods to be used to treat data gaps regarding **distance travelled**
- D.3. Methods to be used to treat data gaps regarding **cargo carried**
- D.4. Methods to be used to treat data gaps regarding **time spent at sea**

Part F Further information

- F.1. List of definitions and abbreviations
- F.2. Additional information

Template is available at
http://ec.europa.eu/clima/policies/transport/shipping_en#tab-0-1
- Implementing Regulation(EU) 2016/1927

★ Emission Report shall be used the electronic version of template available in THESIS MRV ★

Template is available at http://ec.europa.eu/clima/policies/transport/shipping_en#tab-0-1

- Implementing Regulation(EU) 2016/1927

Part A Data identifying the ship and the company

Part B Verification

Part C Information on the monitoring method used and the related level of uncertainty

Part D Results from annual monitoring of the parameters in accordance with Article 10

Fuel consumption and CO2 emitted

Distance travelled, Time spent at sea and Transport Work

Energy Efficiency

Document of Compliance

Document of Compliance

This is to certify that the ship 'NAME' emissions report covering the reporting period 'YEAR N -1' has been considered as satisfactory regarding the requirements of Regulation (EU) 2015/757.

This document of compliance has been issued on 'DAY/MONTH/YEAR N'

This document of compliance is linked to emissions report No. 'Number' and is valid until 30 JUNE 'YEAR N+1'

I) Ship particulars

1. Name of the Ship		
2. IMO identification number		
3. a) Port of registry OR b) Home port		
4. Ship category	<ul style="list-style-type: none"> ▼ Passenger Ship ▼ Container Ship ▼ Chemical tanker ▼ Gas carrier ▼ General cargo ship ▼ Vehicle carrier ▼ Ro-pax ship ▼ Other ship types 	<ul style="list-style-type: none"> ▼ Ro-ro ship ▼ Oil tanker ▼ LNG carrier ▼ Bulk carrier ▼ Refrigerated cargo ship ▼ Combination carrier ▼ Container/ro-ro cargo ship
5. Flag State/Registry		
6. Gross tonnage		

Document of Compliance

II) Ship owner details

1. Name of the Shipowner	
2. Address of the shipowner and its principal place of business	

III) Details of company fulfilling the obligations under Regulation (EU) 2015/757 (voluntary field)

1. Name of the company	
2. Address of the company and its principal place of business	

IV) Verifier

1. Accreditation number	
2. Name of the verifier	
3. Address of the verifier and its principal place of business	

IMO 및 EU MRV 규제 비교



시행일: **2019년** (monitoring)
적용: 5000GT 이상 모든 선박



시행일: **2018년** (monitoring)
적용: 5000GT 초과 EU 입출항 선박

