INTERNATIONAL MARITIME ORGANIZATION

E

MARITIME SAFETY COMMITTEE
111th session
Agenda item 19

MSC 111/19/1
29 January 2026
Original: ENGLISH
Pre-session public release: ☒

WORK PROGRAMME

Proposal for a new output to amend paragraph 3.5.4 and table 19.1 of SOLAS regulation II-2/19

Submitted by the United Kingdom and IACS

SUMMARY

Executive summary:	This document proposes a new output to amend paragraph 3.5.4 and table 19.1 of SOLAS regulation II-2/19 to clarify the cases where reduced ventilation rates are allowed in container cargo spaces carrying dangerous goods with a view to ensuring consistent implementation.
Strategic direction, if applicable:	7
Output:	None
Action to be taken:	Paragraph 26
Related documents:	SSE 6/12/10, SSE 6/18; SSE 9/14/1, SSE 9/20 and SSE 10/13, annex 6

Introduction

1 This document is submitted in accordance with the relevant provisions of the *Organization and method of work of the Maritime Safety Committee and the Marine Environment Protection Committee and their subsidiary bodies* (MSC-MEPC.1/Circ.5/Rev.6) on the submission of proposals for new outputs, and proposes a new output to revise paragraph 3.5.4 and table 19.1 of SOLAS regulation II-2/19 to clarify cases where reduced ventilation rates are allowed in container cargo spaces carrying dangerous goods, with a view to ensuring consistent implementation of IMO instruments.

Background

2 SOLAS regulation II-2/19.3.4.1 states:

> "3.4.1 Adequate power ventilation shall be provided in enclosed cargo spaces. The arrangement shall be such as to provide for at least six air changes per hour in the cargo space, based on an empty cargo space, and for removal of vapours from the upper or lower parts of the cargo space, as appropriate."

3 SOLAS regulation II-2/19.3.5.4 states:

> "3.5.4 Enclosed spaces outside machinery spaces containing bilge pumps serving cargo spaces intended for carriage of flammable or toxic liquids shall be fitted with separate mechanical ventilation giving at least six air changes per hour. If the space has access from another enclosed space, the door shall be self-closing."

4 Note 1 of table 19.1 of SOLAS regulation II-2/19 (which is currently applicable to SOLAS regulation II-2/19.3.4.1 but not to regulation II-2/19.3.5) states:

> "1 For classes 4 and 5.1 solids not applicable to closed freight containers. For classes 2, 3, 6.1 and 8 when carried in closed freight containers, the ventilation rate may be reduced to not less than two air changes per hour. For classes 4 and 5.1 liquids when carried in closed freight containers, the ventilation rate may be reduced to not less than two air changes per hour. For the purpose of this requirement, a portable tank is a closed freight container."

5 IACS submitted its unified interpretation UI SC 288 to SSE 6 (SSE 6/12/10). The text of the initial interpretation was as follows:

> **"Interpretation**
>
> 1 The reduced air changes per hour as per note 1 of table 19.1 apply equally to the ventilation air change requirements in SOLAS regulation II-2/19.3.4.1 and in SOLAS regulation II-2/19.3.5.4, when the bilge pump is located directly inside a container cargo space.
>
> 2 In such a case, where several container cargo spaces are served by the same bilge pump, the bilge pump is to be installed in the container cargo space with the highest ventilation rate, compared to the other container cargo spaces."

6 During the discussion at SSE 6, concerns were raised with that interpretation (SSE 6/18, paragraphs 12.28 to 12.30), in particular that:

.1 the proposal could change the intent of the regulations, which should be done by a change to the regulation and not through an interpretation; and

.2 SOLAS regulation II-2/19.3.5.4 referred to spaces with dedicated bilge pumps in cargo holds where there could be flammable and toxic liquids, not dangerous goods.

7 Following SSE 6, IACS discussed the outcome of that session with interested parties and prepared a revised draft of the interpretation presented in document SSE 9/14/1:

> **"Interpretation**
>
> 1 The reduced air changes per hour as per note 1 of table 19.1 of SOLAS regulation II-2/19 should apply equally to the ventilation air change requirements in SOLAS regulations II-2/19.3.4.1 and II-2/19.3.5.4, when the bilge pump is located directly inside a container cargo space.
>
> 2 In such a case, where more than one container cargo space is served by the same bilge pump, and some of those cargo spaces comply with the two air changes per hour ventilation rate, while others of those cargo spaces comply with the six air

changes per hour ventilation rate, the bilge pump should be installed in one of those container cargo spaces with the higher ventilation rate."

8 SSE 9 agreed with the proposal in principle, instructing the FP Correspondence Group to further consider document SSE 9/14/1 with a view to finalization. The Correspondence Group agreed that a clarification of the regulation was needed and prepared draft amendments thereof in annex 6 to document SSE 10/13. However, the FP Correspondence Group noted that the consideration of these amendments should be addressed under a new output.

IMO's objectives

9 The main goal of this proposal is to clarify the cases where reduced ventilation rates are allowed in container cargo spaces carrying dangerous goods in order to ensure uniform application. The proposed new output will contribute to strategic direction (SD) 7 "Ensure the regulatory effectiveness of international shipping" as defined in the *Revised Strategic Plan for the Organization for the six-year period 2024-2029*. In the context of SD 7, it will contribute to providing consistency through effective and uniform implementation of IMO instruments.

Need

10 The SSE 9 FP Correspondence Group agreed that a clarification was needed and that amendments to table 19.1 of SOLAS regulation II-2/19 were necessary under a new output.

Analysis of the issue

11 SOLAS regulation II-2/19.3.5.4 requires a minimum of six air changes per hour for enclosed spaces, outside of machinery spaces, containing bilge pumps serving cargo spaces intended for carriage of flammable or toxic liquids.

12 However, where a bilge pump serving cargo spaces intended for carriage of flammable or toxic liquids is fitted in (i) a cargo space or (ii) an enclosed space outside of a machinery space, then the co-sponsors consider that the ventilation rate of six changes per hour for these two types of spaces (as per SOLAS regulations II-2/19.3.4.1 and II-2/19.3.5.4, respectively) can be reduced to not less than two air changes per hour. This is based on the reasoning that the reduced ventilation rate:

.1 for cargo spaces specifically mentioned in note 1 of table 19.1 of SOLAS regulation II-2/19, may equally apply to an enclosed space outside of a machinery space mentioned in SOLAS regulation II-2/19.3.5; and

.2 recognizes the decreased likelihood of leakage of the flammable or toxic liquid cargoes since they are being carried in closed freight containers as so specified in note 1 of table 19.1 of SOLAS regulation II-2/19.

13 It is noted that the location of the bilge pump for the bilge system dedicated to the dangerous goods cargo spaces (as per SOLAS regulation II-2/19.3.5) inside the cargo spaces themselves is common. When dangerous goods carried in closed freight containers are carried in a cargo space also containing the bilge pump dedicated to the dangerous goods cargo space, the following considerations apply:

.1 SOLAS regulation II-2/19.3.4.1 requires six air changes per hour in enclosed cargo spaces. However, as per note 1 in table 19.1 of SOLAS regulation II-2/19, this ventilation rate may be reduced to two air changes per

hour when carrying dangerous goods of classes 2, 3, 4 liquids, 5.1 liquids, 6.1 and 8 in closed freight containers; and on the other hand

.2 SOLAS regulation II-2/19.3.5.4 requires six air changes per hour in the space containing the bilge pump serving cargo spaces intended for carriage of flammable or toxic liquid, i.e. dangerous goods of classes 3, 6.1 or 8.

14 In the case when the bilge pump serves only the cargo space where it is installed, the understanding of the co-sponsors is that only two air changes per hour are needed in the container cargo hold, notwithstanding SOLAS regulation II-2/19.3.5.4. This understanding takes into consideration that note 1 of table 19.1 of SOLAS regulation II-2/19 is applicable (i.e. only dangerous goods of classes 2, 3, 4 liquids, 5.1 liquids, 6.1 and 8 in closed freight containers are carried in the concerned cargo holds) and that the pump is adequate for use in this space (e.g. eductor/ejector). It is believed that the bilge pump will not introduce any additional leakage hazards in the container cargo hold, since the cargo carried in the hold is the actual source of a potential leakage.

15 During discussion in the FP Correspondence Group, it was recognized that the clarification could be achieved through amendments to table 1 by making "note 1" applicable also to the entry for row "regulation 19.3.5" and column ".2 Container cargo spaces" (annex 6 to document SSE 10/13). The Group noted that paragraph 19.3.5.4 is the only paragraph in section 3.5 (Bilge pumping) that addressed air changes; and therefore, the application of the reduced number of air changes was considered to be clear.

16 In addition, the co-sponsors believe that it is essential to also add a clarification in SOLAS regulation II-2/19.3.5.4 to address cases where a bilge pump serves different spaces with different products. In cases where the bilge pump serves several cargo spaces, the same principle may be applied: hazardous cargo leakage in any one cargo space may lead to hazardous cargo in the bilge system, possibly leaking from the pump itself. Therefore, the ventilation rate in the cargo space containing the pump is to be at least the ventilation rate required in any one of the cargo spaces served by the bilge system.

Analysis of implications

17 No costs to the maritime industry are anticipated. The administrative burden to the Organization and to Member States is anticipated to be minimal. A completed administrative checklist, as set out in annex 6 to MSC-MEPC.1/Circ.5/Rev.6, is set out in annex 2.

18 No capacity-building implications are identified. A checklist for the identification of capacity-building implications, as set out in appendix 1 of annex 2 to MSC-MEPC.1/Circ.5/Rev.6, is set out in annex 5.

Benefits

19 This clarification of SOLAS regulation II-2/19 will ensure uniform application of requirements for container cargo spaces carrying dangerous goods by clarifying the cases where reduced ventilation rates are allowed.

Industry standards

20 No industry standards which are directly relevant to the issue exist.

Output

21 The following new output is proposed for the inclusion in the Committee's post biennial agenda:

"Revision of paragraph 3.5.4 and table 19.1 of SOLAS regulation II-2/19".

22 It is anticipated that this task could be completed in one session of the SSE Sub-Committee. Parts I and II of the check/monitoring sheet, as set out in annex 2 to MSC.1/Circ.1500/Rev.3, have been completed and are provided in annex 3 to this document.

23 For illustrative purposes and to assist in the preliminary assessment by the group of chairs, draft amendments of SOLAS regulation II-2/19 are set out in annex 1.

Human element

24 The completed checklist for considering human element issues contained in annex 5 to MSC-MEPC.1/Circ.5/Rev.6 is set out in annex 4 to this document. As the proposal consists in clarifying the cases where reduced ventilation rates are allowed in container cargo spaces carrying dangerous goods in order to ensure uniform application, no impact on the human element is anticipated.

Urgency

25 It is proposed to include the output in the Committee's post-biennial agenda (2028-2029), with one session needed to complete the item, assigning the SSE Sub-Committee as the associated organ.

Action requested of the Committee

26 The Committee is invited to consider the information, in particular the proposals in paragraphs 21 and 25 and take action, as appropriate.

***

ANNEX 1*

DRAFT AMENDMENTS TO SOLAS REGULATION II-2/19

"Regulation 19

Carriage of dangerous goods

3.5 Bilge pumping

3.5.4 Enclosed spaces outside machinery spaces containing bilge pumps serving cargo spaces intended for carriage of flammable or toxic liquids shall be fitted with separate mechanical ventilation giving at least six air changes per hour. If the space has access from another enclosed space, the door shall be self-closing. When the bilge pump is located inside a container cargo space, air changes per hour may be reduced to not less than two air changes per hour as per note 1 of table 19.1. In such a case, where more than one container cargo space is served by the same bilge pump, and some of those cargo spaces comply with the two air changes per hour ventilation rate, while others of those cargo spaces comply with the six air changes per hour ventilation rate, the bilge pump should be installed in one of those container cargo spaces with the higher ventilation rate.

Table 19.1 – Application of the requirements to different modes of carriage of dangerous goods in ships and cargo spaces

Where X appears in table 19.1 it means this requirement is applicable to all classes of dangerous goods as given in the appropriate line of table 19.3, except as indicated by the notes.

Regulation 19.2.2	Weather decks .1 to .5 inclusive	.1	.2	.3		.4	.5
Regulation 19		Not specially designed	Container cargo spaces	Closed ro-ro spaces	Open ro-ro spaces	Solid dangerous goods in bulk	Shipborne barges
3.1.1	X	X	X	X	X	For application of	X
3.1.2	X	X	X	X	X	requirements of	-
3.1.3	-	X	X	X	X	regulation 19 to	X
3.1.4	-	X	X	X	X	different classes	X
3.2	-	X	X	X	X	of dangerous	X[4)]
3.3	-	X	X	X	-	goods, see	X[4)]
3.4.1	-	X	X[1)]	X	-	table 19.2	X[4)]
3.4.2	-	X	X[1)]	X	-		X[4)]
3.5	-	X	X[1)]	X	-		-
3.6.1	X	X	X	X	X		-
3.6.2	X	X	X	X	X		-
3.7	X	X	-	-	X		-
3.8	X	X	X[2)]	X	X		-
3.9	-	-	-	X[3)]	X		-
3.10.1	-	-	-	X	-		-
3.10.2	-	-	-	X	-		-

* The modifications are shown in grey shading.

	Notes 1) For classes 4 and 5.1 solids not applicable to closed freight containers. For classes 2, 3, 6.1 and 8 when carried in closed freight containers, the ventilation rate may be reduced to not less than two air changes per hour. For classes 4 and 5.1 liquids when carried in closed freight containers, the ventilation rate may be reduced to not less than two air changes per hour. For the purpose of this requirement, a portable tank is a closed freight container. 2) Applicable to decks only. 3) Applies only to closed ro-ro spaces, not capable of being sealed. 4) In the special case where the barges are capable of containing flammable vapours or alternatively if they are capable of discharging flammable vapours to a safe space outside the barge carrier compartment by means of ventilation ducts connected to the barges, these requirements may be reduced or waived to the satisfaction of the Administration. 5) Special category spaces shall be treated as closed ro-ro spaces when dangerous goods are carried.

"

***

ANNEX 2

CHECKLIST FOR IDENTIFYING ADMINISTRATIVE REQUIREMENTS

This checklist should be used when preparing the analysis of implications required in submissions of proposals for inclusion of outputs. For the purpose of this analysis, the term "administrative requirement" is defined in accordance with resolution A.1043(27), as an obligation arising from a mandatory IMO instrument to provide or retain information or data.

Instructions:

(A) If the answer to any of the questions below is **YES**, the Member State proposing an output should provide supporting details on whether the requirements are likely to involve start-up and/or ongoing costs. The Member State should also give a brief description of the requirement and, if possible, provide recommendations for further work, e.g. would it be possible to combine the activity with an existing requirement?
(B) If the proposal for the output does not contain such an activity, answer **NR** (Not required).
(C) For any administrative requirement, full consideration should be given to electronic means of fulfilling the requirement in order to alleviate administrative burdens.

1. Notification and reporting? Reporting certain events before or after the event has taken place, e.g. notification of voyage, statistical reporting for IMO Members	**NR**	Yes □ Start-up □ Ongoing
Description of administrative requirement(s) and method of fulfilling it: (if the answer is yes)		
2. Record keeping? Keeping statutory documents up to date, e.g. records of accidents, records of cargo, records of inspections, records of education	**NR**	Yes □ Start-up □ Ongoing
Description of administrative requirement(s) and method of fulfilling it: (if the answer is yes)		
3. Publication and documentation? Producing documents for third parties, e.g. warning signs, registration displays, publication of results of testing	**NR**	Yes □ Start-up □ Ongoing
Description of administrative requirement(s) and method of fulfilling it: (if the answer is yes)		
4. Permits or applications? Applying for and maintaining permission to operate, e.g. certificates, classification society costs	**NR**	Yes □ Start-up □ Ongoing
Description of administrative requirement(s) and method of fulfilling it: (if the answer is yes)		
5. Other identified requirements?	**NR**	Yes □ Start-up □ Ongoing
Description of administrative requirement(s) and method of fulfilling it: (if the answer is yes)		

***

ANNEX 3

CHECK/MONITORING SHEET FOR THE PROCESS OF AMENDING THE CONVENTION AND RELATED MANDATORY INSTRUMENTS (PROPOSAL/DEVELOPMENT)

Part I – Submitter of proposal (refer to section 3.2.1.1)*

1	*Submitted by (Document Number and submitter)* **MSC 111/19/1 – the United Kingdom and IACS**
2	*Meeting session* **MSC 111**
3	*Date (date of submission)* **29 January 2026**

Part II – Details of proposed amendment(s) or new mandatory instrument (refer to sections 3.2.1.1 and 3.2.1.2)*

1	*Strategic Direction* ***7***
2	*Title of the output* ***Revision of paragraph 3.5.4 and table 19.1 of SOLAS regulation II-2/19***
3	*Recommended type of amendments* (MSC.1/Circ.1481) (delete as appropriate)
	• **Four-year cycle of entry into force**
4	*Instruments intended for amendment (SOLAS, LSA Code, etc.) or developed (new code, new version of a code, etc.)* **SOLAS**
5	*Intended application (scope, size, type, tonnage/length restriction, service (International/non-international), activity, etc.)* **All ships having container cargo spaces**
6	*Application to new/existing ships* **New ships**
7	*Proposed coordinating sub-committee* **Sub-Committee on Ship Systems and Equipment (SSE)**
8	*Anticipated supporting sub-committees* **None**
9	*Timescale for completion* **One session**
10	*Expected date(s) for entry into force and implementation/application* **1 January 2032**
11	*Any relevant decision taken or instruction given by the Committee* **None**

***

ANNEX 4

CHECKLIST FOR CONSIDERING HUMAN ELEMENT ISSUES BY IMO BODIES

	1 Question	2 Yes/ No	3 IMO references	4 Considerations	5 Instructions
Workload			*Other relevant references may be added* *Strike out references that are not relevant*	*If answer to question is "yes" identify considerations. If answer is "no" make proper justification*	*Identify how human element considerations should be addressed in the output*
1	**Does the "output" affect workload?**				
1.1	**On board, especially in the already intensive phases of the voyage and port operations to:**		*Revised guidelines for the operational implementation of the International Safety Management (ISM) Code by Companies* (MSC-MEPC.7/Circ.8) *Guidelines on fatigue* (MSC.1/Circ.1598) *Principles of minimum safe manning* (resolution A.1047(27)) *Guidelines for the investigation of accidents where fatigue may have been an issue* (MSC/Circ.621)		
1.1.1	Operations including navigation, cargo and engineering	No			

	1 Question	2 Yes/ No	3 IMO references	4 Considerations	5 Instructions
1.1.2	Maintenance of the ships structure and its equipment	No			
1.1.3	Onboard administration in support of the ships' management systems	No			
1.1.4	Onboard administration related to regulation involving flag States, classification societies, port State and other bodies such as charterers and port authorities	No			
1.1.5	Increased workload or time pressure on personnel if involved in implementation of changes prior to the implementation date	No			
1.2	**Ashore, in a manner that would affect the ships operation to:**				
1.2.1	Companies' administration	No			
1.2.2	Flag State, port State and classification societies administration such that certification and other processes are compromised or delayed	No			

	1 Question	2 Yes/ No	3 IMO references	4 Considerations	5 Instructions
Decision-making			*Other relevant references may be added* *Strike out references that are not relevant*	*If answer to question is "yes" identify considerations. If answer is "no" make proper justification*	*Identify how human element considerations should be addressed in the output*
2	**Does the "output" impact decision-making on board the ship?**				
2.1	By confusion with existing requirements and regulations	No			
2.2	By changing responsibilities as laid out in the ISM Code	No			
2.3	By creating complexity in its implementation and/or in the safety management systems	No			
2.4	By requiring increased mental effort, such as the need to find, transform and analyse data or result in the need to make judgements based on incomplete information	No			
2.5	By limiting the time available to establish situational awareness, decide, communicate (possibly across time zones) or check	No			
2.6	By increasing reliance on judgement and administrative controls to manage major risks such as oil spills and collisions	No			

	1 Question	2 Yes/ No	3 IMO references	4 Considerations	5 Instructions
Living and Working Environment			*Other relevant references may be added* *Strike out references that are not relevant*	*If answer to question is "yes" identify considerations. If answer is "no" make proper justification*	*Identify how human element considerations should be addressed in the output*
3	**Does the "output" affect the living and working environment?**		*Guidelines on the basic elements of a shipboard occupational health and safety programme* (MSC-MEPC.2/Circ.3) *Guidelines on fatigue* (MSC.1/Circ.1598)		
3.1	By interfering with existing arrangements for abandonment, fire fighting and other emergency plans or procedures	No			
3.2	By introducing new materials that could create an explosion, fire, environmental or occupational health risk	No			
3.3	By introducing new high energy sources such as high-voltage, high pressure fluids	No			
3.4	By affecting access or egress and causing lack of ventilation in working spaces	No			
3.5	By affecting the habitability of accommodation spaces due to	No			

	1 Question	2 Yes/ No	3 IMO references	4 Considerations	5 Instructions
	noise, vibration, temperatures, dust and other contaminants				

	1 Question	2 Yes/ No	3 IMO references	4 Considerations	5 Instructions
Operation and Maintenance			*Other relevant references may be added* *Strike out references that are not relevant*	*If answer to question is "yes" identify considerations. If answer is "no" make proper justification*	*Identify how human element considerations should be addressed in the output*
4.	**Does the "output" affect the operation and maintenance of the ship, its structure or systems and equipment?**		*Revised guidelines for the operational implementation of the International Safety Management (ISM) Code by Companies* (MSC-MEPC.7/Circ.8) *Guidelines for bridge equipment and systems, their arrangement and integration (BES)* (SN.1/Circ.288) *Principles of minimum safe manning* (resolution A.1047(27)) *Issues to be considered when introducing new technology on board ships* (MSC/Circ.1091) *Guideline on software quality assurance and human-centred design for e-navigation* (MSC.1/Circ.1512)		

	1 Question	2 Yes/ No	3 IMO references	4 Considerations	5 Instructions
			Guidelines for the standardization of user interface design for navigation equipment (MSC.1/Circ.1609)		
4.1	By introducing equipment that the user may find difficult to operate or maintain or may be unreliable	No			
4.2	By introducing new and/or novel technology, or technology that changes the role of the person	No			
4.3	By introducing requirements for new competencies and roles	No			
4.4	By overloading existing infrastructure such as power generation and ventilation systems	No			
4.5	By poor integration with existing systems and controls	No			
4.6	By introducing new and unfamiliar operations/procedures	No			
4.7	By introducing new and unfamiliar operating interfaces?	No			
4.8	By introducing risks to the ship during any modifications	No			

	1 Question	2 Yes/ No	3 IMO references	4 Considerations	5 Instructions
	required prior to the implementation date of the output				

	1 Question	2 Yes/ No	3 IMO references	4 Considerations	5 Instructions
Measures to address the human element			*Other relevant references may be added* *Strike out references that are not relevant*	*If answer to question is "yes" identify considerations. If answer is "no" make proper justification*	*Identify how human element considerations should be addressed in the output*
5.	**Does the "output" require changes to:**		*Shipboard technical operating and maintenance manuals* (MSC.1/Circ.1253) *Revised guidelines for the operational implementation of the International Safety Management (ISM) Code by Companies* (MSC-MEPC.7/Circ.8)		
5.1	Training	No			
5.2	Practical skill development and competences	No			
5.3	Operating, management and/or maintenance procedures	No			
5.4	Information/manuals for operation and maintenance	No			
5.5	Spares outfit	No			
5.6	Occupational safety requirements including guarding and PPE	No			
5.7	Shore support	No			

***

ANNEX 5

CHECKLIST FOR THE IDENTIFICATION OF CAPACITY-BUILDING IMPLICATIONS

(Appendix 1 of Annex 2 of draft MSC-MEPC.1/Circ.5/Rev.6)

1 For Administrations

□Is new legislation required? *No.*

□Is there a requirement for new equipment and/or systems? *No*
- o Does equipment manufacturing capacity exist internationally? *N/A*
- o Do equipment repair/servicing facilities exist internationally? *N/A*
- o Is there capacity to develop new systems? *N/A*

□Will the implementation require additional financial resources? *No*

□Is there a need for additional human resources or new skills? *No*

□Will there be a need to upgrade current infrastructure? *No*

□Is there enough lead time towards implementation? *Yes*

□Will a rapid implementation procedure be adopted? *No*

□Is there a substantial modification of existing standards? *No*

□Will a guide to implementation be needed? *No*

2 For the industry

□Would the industry require new and/or enhancement of existing systems? *No*
- o Does capacity exist internationally to develop new systems? *N/A*

□Is there a need for additional training of seafarers? *No*
- o Do related and validated training courses exist? *N/A*
- o Are sufficient simulation training courses available internationally? *N/A*

□Will there be a requirement for new equipment? *No*
- o Does manufacturing capacity exist internationally? *N/A*

□Is there repair/servicing and/or retrofitting and does maintenance capacity exist internationally? *N/A*