

SUB-COMMITTEE ON CARRIAGE OF
CARGOES AND CONTAINERS
6th session
Agenda item 5

CCC 6/5/5
10 June 2019
Original: ENGLISH

**AMENDMENTS TO THE IMSBC CODE AND SUPPLEMENTS
SAFE HANDLING OF SOLID BULK CARGOES**

**Guidance for carriage of ammonium nitrate and ammonium nitrate based fertilizer
cargoes**

Submitted by United Kingdom

SUMMARY

Executive summary: This document follows up the recommendations of the report of the incident of the bulk carrier **Cheshire**, as presented in document CCC 5/5/19, and makes additional recommendations for amended guidance for the carriage of ammonium nitrate and ammonium nitrate based fertilizer cargoes

Strategic direction, if applicable: Other work

Output: OW 9

Action to be taken: Paragraph 7

Related documents: CCC 5/5/19 and CCC 6/5/4

Background

1 The Sub-Committee on Carriage of Cargoes and Containers (CCC), at its fifth session, discussed the carriage of ammonium nitrate and ammonium nitrate based fertilizer cargoes (AN and ANBF) after presentation of the preliminary finding of the investigation of an incident involving the Isle of Man-registered bulk carrier **Cheshire**. This incident resulted in an abandoned ship and constructive total loss of the vessel. There was significant support for development of new schedules for these cargoes to address their properties, in particular the possibility of catastrophic cargo decomposition in way of adverse heat sources.

2 A small group of interested Member States has continued to discuss the issues raised at CCC 5. The intent was twofold: to develop new ANBF schedules based upon cargo composition; and to use the investigation into the **Cheshire** casualty to inform this development.

3 This document addresses the development of additional guidance for the carriage of AN and ANBF cargoes.

4 Intersessional development work has resulted in new individual cargo schedules and associated cargo re-categorizations for ANBF cargoes. Following further deliberation by the Group, the United Kingdom believes that the current guidance on carriage of these cargoes, as contained in CCC.1/Circ.4, has largely been superseded by the new individual cargo schedules and now needs to be updated to provide additional guidance for ships carrying AN and ANBF cargoes.

5 The summary of the report into the incident of the bulk carrier **Cheshire** (CCC 5/5/19) identified areas for improvement and the need for a centralized source of information pertinent to these complex chemical cargoes (see paragraphs 5 and 8 to 13 of that document). When transported cool and dry, they present limited health risks, but under certain unfavourable conditions they can become extremely dangerous to life.

6 The United Kingdom proposes a revised CCC circular to provide this guidance and a proposed draft of an appropriate circular is set out in the annex to this document.

Action requested of the Sub-Committee

7 The Sub-Committee is invited to consider replacing the current guidance circular on ANBF (non-hazardous) cargoes (CCC.1/Circ.4) with a new circular, as set out in the annex, to cover existing and proposed classifications.

ANNEX

DRAFT CCC CIRCULAR

CARRIAGE OF AMMONIUM NITRATE AND AMMONIUM NITRATE BASED FERTILIZER CARGOES

1 The Sub-Committee on Carriage of Cargoes and Containers (CCC), at its fifth and sixth sessions (10 to 14 September 2018 and 9 to 13 September 2019, respectively), considered matters related to the carriage of ammonium nitrate and ammonium nitrate based fertilizer cargoes.

2 During these considerations, the Sub-Committee noted the accidents involving the MV **Purple Beach** (2015) and MV **Cheshire** (2017) and the carriage of the cargo at that time identified as AMMONIUM NITRATE BASED FERTILIZER (non-hazardous). The Sub-Committee also noted the need for further examination of the properties of this cargo to ensure its safe carriage and to address awareness of the risks.

3 As a result, new individual cargo schedules for AMMONIUM NITRATE BASED FERTILIZER MHB and AMMONIUM NITRATE BASED FERTILIZER (unclassified) have been developed and will be included in appendix 1 of the International Maritime Solid Bulk Cargoes (IMSBC) Code.

4 According to the Guidance for sea transport of ammonium nitrate based fertilizers by the organization Fertilizers Europe,* the safety principles for this cargo are as follows:

- .1 avoidance of storage of combustible substances near fertilizers;
- .2 avoidance of storage of incompatible substances near fertilizers;
- .3 avoidance of cross contamination with remains of previous cargoes;
- .4 avoidance of cross contamination of next cargo with fertilizer;
- .5 avoidance of sources of heat likely to affect the fertilizer; and
- .6 avoidance of application of heat (e.g. welding) to any section which may have trapped/confined fertilizer.

5 It is recommended that the measures listed in the individual schedules for AMMONIUM NITRATE, AMMONIUM NITRATE BASED FERTILIZER MHB and AMMONIUM NITRATE BASED FERTILIZER (unclassified) as detailed in appendix 1 of the IMSBC Code should be applied carefully in all cases.

6 The gas clouds produced during the incidents mentioned above were large enough to envelop the ship, cover the sea area surrounding the ship and the vapour emitted was highly toxic. These conditions could affect the safe abandonment of the ship and hinder rescue and firefighting efforts. In such events, cargo decomposition may last for multiple days and the temperatures in cargo holds may reach in excess of 500°C.

* Refer to the Guidance available at:
http://fertilizerseurope.com/fileadmin/user_upload/publications/technical_publications/guidance_techn_documentation/Guidance_for_sea_transport_of_ammonium_nitrate_based_fertilizers_01.pdf

7 The best protection for seafarers is awareness of the decomposition process to allow it to be identified at an early stage. Regular monitoring of the cargo and cargo hold space throughout the voyage is crucial to confirm continuing safe transportation of these cargoes both for the crew and the vessel itself.

8 When heated strongly, this cargo may decompose and release toxic gases. Timely opening of cargo hatches can prevent the build-up of pressure and help cool the cargo, impeding the development of cargo decomposition.

9 In case of decomposition of this cargo or fire in an adjacent space to this cargo:

- .1 provide maximum ventilation to remove the gases resulting from decomposition. These gases may include toxic fumes of ammonia and oxides of nitrogen and sulphur;
- .2 wear, as necessary, protective clothing and self-contained breathing apparatus;
- .3 direct application of water is most effective where injection pipes are used to deliver water to hot spots. Water spraying may not be sufficient to control the decomposition;
- .4 flooding of the cargo space may be considered, giving due consideration to the ship's stability and structural strength;
- .5 the ship's gas fire-fighting installation will be ineffective to control decomposition which is a chemical reaction requiring only heat to continue.

10 Further information is set out in the annex.

11 Member States are invited to bring this circular to the attention of shippers, terminal operators, shipowners, ship operators, charterers, shipmasters and all other entities concerned, requesting that extreme care and appropriate action be taken, taking into account the provisions of relevant IMO instruments and the information above when handling and carrying ammonium nitrate and ammonium nitrate based fertilizer cargoes in bulk.

12 This circular revokes CCC.1/Circ.4.

ANNEX

SUMMARY TABLE AND GUIDANCE COMMON TO ALL OF THE LISTED CARGOES

Description	Ammonium nitrate	Ammonium nitrate based fertilizer			
	UN 1942	UN 2067	UN 2071	MHB	Unclassified
Angle of repose	In the range 27° to 42°				
Bulk density (kg/m ³)	In the range 900 to 1,200				
Stowage factor (m ³ /t)	In the range 0.83 to 1.11				
Size (mm)	In the range 1.0 to 5.0				
Class	5.1	5.1	9	MHB (OH)	Group C
Group	Group B	Group B	Group B	Group B	Group C

HAZARDS

Under normal operational conditions

Kept cool and dry, these cargoes present limited hazards during transport.

Fertilizer dust may be irritating to skin and mucous membranes.

All of these cargoes are hygroscopic in nature and will cake if allowed to become wet.

Under abnormal operating conditions

All of these cargoes WILL thermally decompose if subjected to substantial external heat sources; this may initiate a large thermal decomposition which is an emergency situation. Physical composition affects the reaction and how it will behave in the bulk loaded condition.

Thermal decomposition produces significant amounts of heat, toxic ammonia gas and toxic oxides of nitrogen which pose a risk to personnel. SCBA must be worn by any persons exposed to these when attempting to arrest a thermal decomposition.

If constrained, these gases can accelerate decomposition, possibly resulting in an explosion (ANBF cargoes having a UN number) and it is imperative that hold ventilation is maximized wherever possible.

Unlike a fire, thermal decomposition is a chemical reaction that requires no oxygen to continue; indeed oxygen is displaced from the cargo hold by decomposition gases. The **ONLY** way to arrest a large thermal decomposition is by timely and sustained removal of thermal energy.

To arrest large thermal decomposition, the group B cargoes **WILL** require accurate application of water, **or** flooding of the hold space with water to a depth higher than the decomposition front, possibly creating stability concerns. The group C cargoes may self-arrest by removal of the initiating heat source alone.

If thermal decomposition is suspected, contact the cargo manufacturer for composition-specific advice.

STOWAGE AND SEGREGATION

Stow according to the individual cargo schedules.

Segregate from all sources of heat at all times when these cargoes are loaded.

Access to these cargoes must be possible at all times. Stow high if carrying mixed cargo consignments.

HOLD CLEANLINESS

Clean and dry as relevant to the requirements of the individual cargo loaded.

WEATHER PRECAUTIONS

See individual cargo schedules.

LOADING

Trim in accordance with the relevant provisions required under sections 4 and 5 of the IMSBC Code.

See individual cargo schedules for expanded details by cargo type.

Ammonium nitrate and ammonium nitrate based fertilizer cargoes on general cargo ships loaded in bulk or packaged form **must not** be over-stowed – due to access to them being required **at all times**.

Before loading these cargoes, unless they are of the intrinsically safe type, ensure that all electrical circuits are positively isolated.

Before loading these cargoes, ensure that all potential radiant heat sources have been isolated.

Bunkering of fuel is not allowed, pumping of fuel in adjacent tank spaces – other than the engine room – is not allowed.

VENTILATION

These cargoes are hygroscopic; do not ventilate cargo spaces – except in an emergency.

CARRIAGE

These cargoes are hygroscopic – prevent the ingress of water into the hold space – the presence of free water (even in very small quantities) is an indicator of decomposition in its early stages and needs to be investigated.

Record and trend cargo hold atmosphere oxygen levels at least once, preferably twice daily – falling oxygen levels indicate possible decomposition and needs to be investigated.

Record and trend cargo bulk temperature levels at least once, preferably twice daily – rising temperature rates above ambient levels indicate possible decomposition and needs to be investigated.

Foul smells indicate decomposition is actively progressing and needs to be urgently investigated.

Visible "fumes" are another clear indication decomposition is progressing and needs urgent emergency action to be followed.

If decomposition is either suspected or obvious, contact the manufacturers immediately for product-specific advice (which varies according to composition).

DISCHARGE

Bunkering of fuel is not allowed, pumping of fuel in adjacent tank spaces – other than the engine room – is not allowed.

CLEAN-UP

Clean-up according to the individual cargo schedules. Incompatibility and cross contamination need to be taken into account.

EMERGENCY PROCEDURES

Equipment which must be carried

Individual schedules require protective clothing (boots, gloves, coveralls and headgear) and self-contained breathing apparatus.

The IMSBC Code provision 3.2.5 states "When carrying a solid bulk cargo that is liable to emit a toxic or flammable gas, and/or cause oxygen depletion in the cargo space, an appropriate instrument for measuring the concentration of gas and oxygen in the cargo space shall be provided together with detailed instructions for its use. [Early warning of developing unsafe conditions may be achieved by using this equipment to measure the cargo hold atmosphere and trending the readings taken, with respect to time as indicated in the individual schedules]."

Equipment which may also be considered to be carried

Thermal visualisation devices – these can take the form of thermal imaging cameras, radiated infra-red thermometers and reflected infra-red thermometers to assist pinpointing the decomposition front within the bulk pile.

Direct water injection nozzles – these can take the form of Victor nozzles (see diagrams) however it is important to get water close to the decomposition front quickly and a "crushed pipe end" (to produce a spray and assist cargo penetration) will suffice if purpose-made nozzles are not immediately available.

Lance sections – used to extend the nozzle to the required depth in the bulk pile.

Lance/fire hose connection adapters to be able to connect the lance to a water supply.

Additional SCBA – decomposition products are extremely toxic and the provision of breathing apparatus above statutory minimum requirements is recommended when carrying these cargoes.

Decomposition in a cargo space containing this material

Ship's fixed gas fire-extinguishing installation will **NOT** have any effect.

Contact the manufacturer for composition-specific advice.

Try to determine and isolate the source of heat that caused the decomposition initiation.

Prevent pressure build-up (which speeds up the reaction) and provide maximum ventilation (to assist cooling and so slow the reaction) by opening as many hatches as possible and when safe to do so.

Direct injection of water is most effective in the early stages of decomposition but flooding of the cargo space may be considered as a last resort for decomposition that is out of control.

Upon initial application of water, large quantities of steam are driven off – visually worsening the situation. This is entirely normal and water application must not be stopped.

Due consideration should be given to stability in either case. To assist the decision-making process in an emergency, soon after departure, run "as-loaded" test conditions on each loaded hold to determine if it will be safe to flood completely, or to what level **any one hold** can safely be flooded and still retain sufficient margins of stability/hull strength.

Fire in a cargo space not containing this material

Ship's fixed gas fire-extinguishing installation may be effective in the early stages, but heat transferred from a fire in an adjacent space can cause adjacent cargo to thermally decompose with consequent evolution of toxic fumes.

To prevent thermal decomposition initiation in adjacent cargo holds, bulkheads between adjacent spaces should be cooled with copious quantities of water.

Open the boundary openings/hatches of any adjacent spaces containing ammonium nitrate or ammonium nitrate based fertilizers to minimise subsidiary risks.

Contact the manufacturers for composition-specific advice to prevent decomposition initiation of adjacent cargo.

MEDICAL FIRST AID

Fertilizer dust may be irritating to damp skin and mucous membranes – flush with copious amounts of water where possible.

Toxic gases in large quantities are given off in a thermal decomposition (ammonia, oxides of nitrogen, hydrogen chloride and others) – refer to the *Medical First Aid Guide* (MFAG) as amended (tables 1, 6 and 9 in the first instance), contact the cargo manufacturer for additional advice.

FURTHER INFORMATION

Specialist equipment examples

"Victor" nozzle/lance – the lance consists of a drilled nozzle fitted to sections of 1" BSP (approx. 33mm dia.) end threaded steel pipe 1.5 m to 3.0 m in length.

The lance is lengthened by connecting sections together with the aid of screw couplings.

At a water pressure of 8 bars this nozzle has a water capacity of approximately 280 l/min.

Thermal arrest can be achieved with significantly less water compared to a normal fire nozzle or water spray from above (see decomposition arrest figure two).

Depending on overall length, the lance is easy to handle and pierces through the fertilizer very quickly to reach the heart of the decomposition (see decomposition arrest figure two), even if the product is caked.

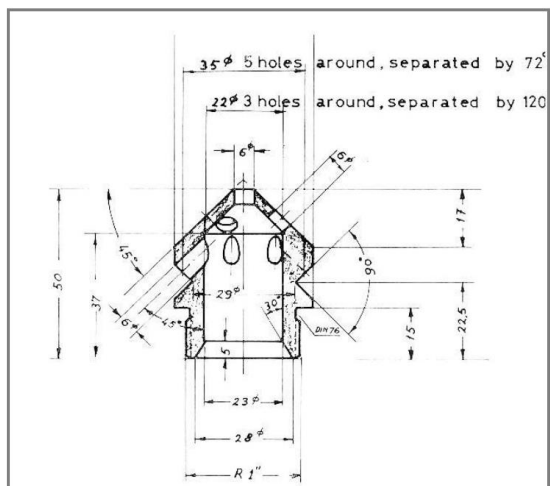


Diagram of Victor Nozzle with dimensions in mm ^[1]



Victor nozzles for fitting to 1" dia. lance. ^[2]

^[1] Fertilizers Europe – guidance for fighting fires and/or decomposition involving solid mineral nitrogen-based fertilizers - 2015 (page 14)

^[2] Agricultural Industries Confederation - AIC Guide - The storage, handling and transportation of Ammonium Nitrate based fertilisers - 2015 (page 56)



Victor nozzle spray pattern (red lance – blue depth marker). ^[2]

Decomposition arrest – must only be undertaken under manufacturer's instructions. Contact the manufacturer for composition-specific advice in all instances.

Figure one - Hose cooling from the cargo surface, time is taken for the water to fall through the bulk pile - large quantities of water are required for cooling effect to be observed (can cause stability issues for the vessel and causes significant cargo water damage!)

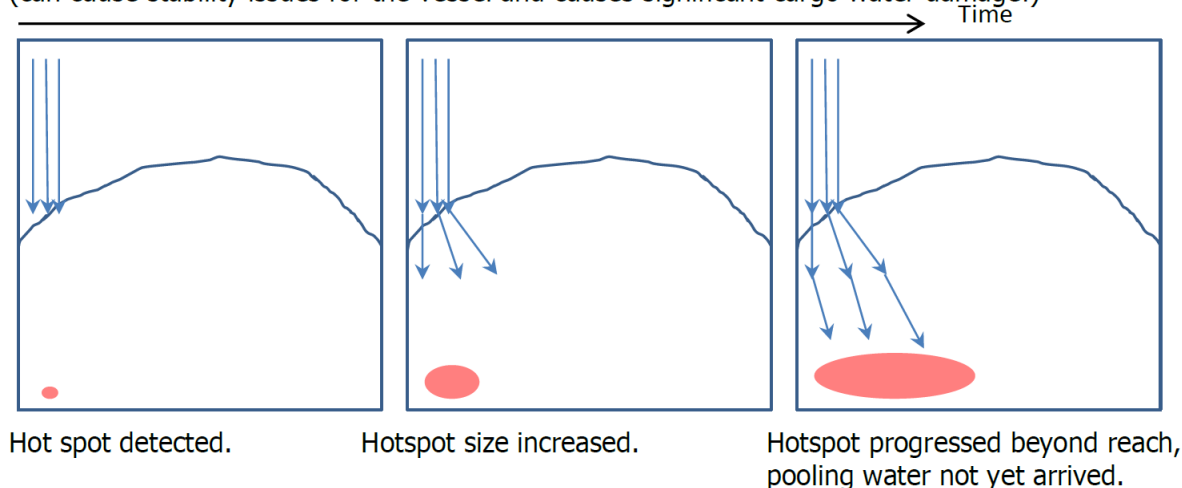
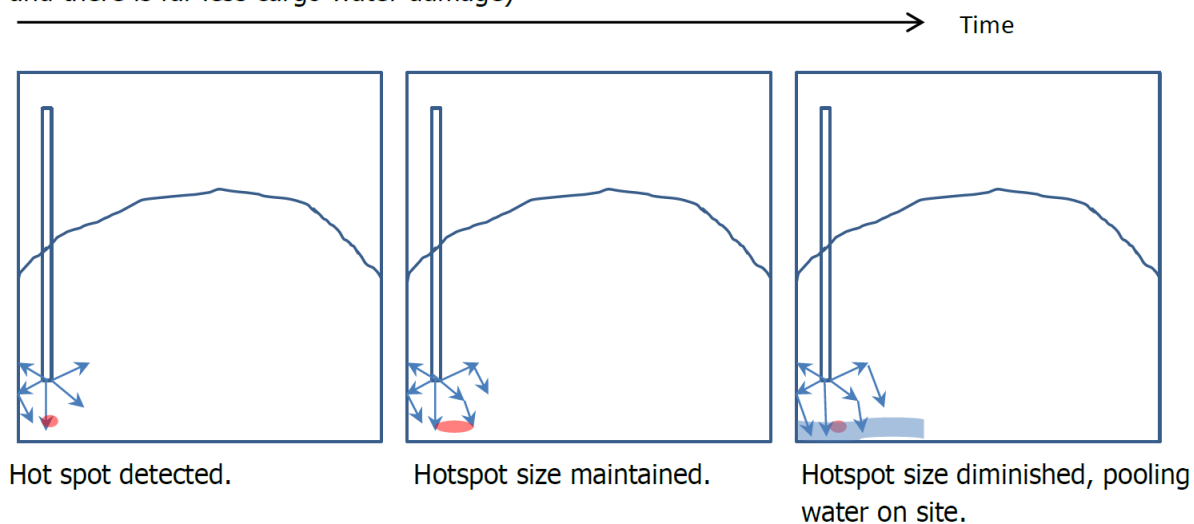


Figure two - Victor Lance application of water directly at the source of the decomposition – much smaller quantities of water are required (very effective use of it, minimal stability impact and there is far less cargo water damage)



Links to thermal devices

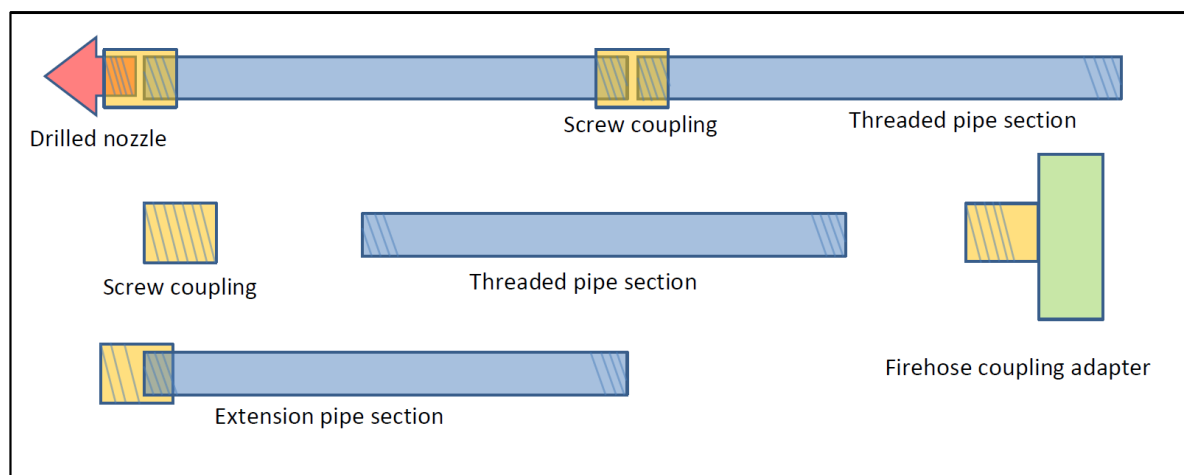
Infrared thermometer –

<https://www.bing.com/search?q=infra+red+thermometer+gif&src=IE-TopResult&FORM=IETR02&conversationid>

Thermal display Camera –

<https://www.bing.com/search?q=thermal+camera&q=n&form=QBRE&sp=-1&pq=thermal+camera&sc=8-14&sk=&cvid=F99147FDE42A467DBDC9A4EE441E05DB>

Water injection lance arrangement



Nozzle manufacture on board by the fitter

Using dia. 40mm x 50mm length bar stock machined in a 3 jaw self-centring chuck.

- With a 90° point angle, bore/drill 23mm diameter to a depth of 37mm, then using a 30° chamfer angle, open out the bore/drill entry to 28mm dia.
- Machine the end to 1" BSP nominal dia. for a length of 15mm, relieve thread ends and provide 90° landing face (for screw coupling).
- Drill 1 x 6mm hole on the centreline axis.
- Perpendicular to the centreline axis, groove circumferentially a 90° chamfer to a depth of 6mm at a distance of 27.5mm from the end face.
- Reverse the bar stock in the chuck, machine the end at 45° to centreline axis for a distance of 17mm.
- Remove from the lathe and place in a pillar drill with the table turned to a 45° angle.
- Drill 5 x 6mm holes equally spaced on 35mm PCD at 45° to centreline axis.
- Reverse and then drill 3 x 6mm holes equally spaced on 22mm PCD and 45° axis to centreline.
- De-burr and polish.

