



Marine Safety Investigation Unit



Transport Malta



## MARINE SAFETY INVESTIGATION REPORT

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Safety investigation into the fatality of a crew member on board the  
Maltese registered bulk carrier

***STARA PLANINA***

in the port of Montoir, France

on 02 August 2014

201408/001

MARINE SAFETY INVESTIGATION REPORT NO. 21/2015

FINAL

Investigations into marine casualties are conducted under the provisions of the Merchant Shipping (Accident and Incident Safety Investigation) Regulations, 2011 and therefore in accordance with Regulation XI-I/6 of the International Convention for the Safety of Life at Sea (SOLAS), and Directive 2009/18/EC of the European Parliament and of the Council of 23 April 2009, establishing the fundamental principles governing the investigation of accidents in the maritime transport sector and amending Council Directive 1999/35/EC and Directive 2002/59/EC of the European Parliament and of the Council.

This safety investigation report is not written, in terms of content and style, with litigation in mind and pursuant to Regulation 13(7) of the Merchant Shipping (Accident and Incident Safety Investigation) Regulations, 2011, shall be inadmissible in any judicial proceedings whose purpose or one of whose purposes is to attribute or apportion liability or blame, unless, under prescribed conditions, a Court determines otherwise.

The objective of this safety investigation report is precautionary and seeks to avoid a repeat occurrence through an understanding of the events of 02 August 2014. Its sole purpose is confined to the promulgation of safety lessons and therefore may be misleading if used for other purposes.

The findings of the safety investigation are not binding on any party and the conclusions reached and recommendations made shall in no case create a presumption of liability (criminal and/or civil) or blame. It should be therefore noted that the content of this safety investigation report does not constitute legal advice in any way and should not be construed as such.

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Standard Cargo October 2011 Carriage of Seedcake: Charles Taylor & Co Limited

## **GLOSSARY OF TERMS AND ABBREVIATIONS**

°C	Degrees Celsius
AB	Able Seaman
BA	Breathing apparatus
BV	Bureau Veritas
Bosun	Boatswain is a senior crewmember of the deck department who supervises the other members of the deck department
CPR	Cardiopulmonary resuscitation
GT	Gross Tonnes
IMBC	International Maritime Solid Bulk Cargoes Code
IMO	International Maritime Organization
kW	Kilowatts
LT	Local time
m	Metres
m <sup>3</sup>	Cubic metres
MSIU	Marine Safety Investigation Unit
PPE	Personal protective equipment
PPM	Parts per million
RPM	Revolutions per minute
SMS	Safety management system
VHF	Very high frequency

## SUMMARY

On 16 July 2014, *Stara Planina*, a Maltese registered bulk carrier, arrived at the anchorage of Montoir, France, with about 32,742 tonnes of soya bean meal that she had loaded in Santos, Brazil.

At about 1030 on 02 August 2014, the vessel arrived alongside her berth in the port of Montoir. After coming alongside, the stevedores and agents requested the vessel to open all hatch covers and hatch accesses, in order to ventilate the spaces before discharging could start on 04 August 2014.

After lunch at about 1300, the chief mate directed the crew to open all the hatch covers and hatch accesses. He also instructed the bosun to mechanically ventilate the hatch accesses as he had recorded high concentrations of carbon monoxide. Shortly after giving these instructions, the chief mate returned to where he had left the bosun, but could not find him. The alarm was raised. Eventually, the bosun was found unconscious at the bottom of an 'Australian ladder' in the forward access to cargo hold no. 4.

The bosun was recovered from the confined space. Attempts by the crew and paramedics to revive him were unsuccessful, and he was pronounced dead at the scene by an attending shore doctor.

As a result of the safety investigation and taking into consideration the safety actions taken by the Company, the Marine Safety Investigation Unit (MSIU) has made one recommendation to Navigation Maritime Bulgare Ltd aimed to address the marking of all cargo hold access hatches and other confined spaces entrances with suitable signage.

# 1 FACTUAL INFORMATION

## 1.1 Vessel, Voyage and Marine Casualty Particulars

Name	<i>Stara Planina</i>
Flag	Malta
Classification Society	DNV GL
IMO Number	9381873
Type	Bulk carrier
Registered Owner	Varna Maritime Ltd
Managers	Navigation Maritime Bulgare Ltd
Construction	Steel (Double bottom)
Length overall	186.45 m
Registered Length	177.0 m
Gross Tonnage	25327
Minimum Safe Manning	16
Authorised Cargo	Solid Bulk
Port of Departure	Santos, Brazil
Port of Arrival	Montoir, France
Type of Voyage	International
Cargo Information	Solvent extracted soya bean meal
Manning	18
Date and Time	02 August 2014 at 1625 (LT)
Type of Marine Casualty	Very Serious Marine Casualty
Place on Board	Ship – Cargo hold
Injuries/Fatalities	One fatality
Damage/Environmental Impact	None
Ship Operation	Normal Service – Discharging
Voyage Segment	Arrival
External & Internal Environment	The wind was Southwest, force 3, and the sea state was calm. Occasional rain showers were reported. Air temperature was 21°C.
Persons on Board	18

## 1.2 Description of Vessel

*Stara Planina*, a 25,327 GT bulk carrier, was built in 2007 at the Bulyard Shipyard in Varna, Bulgaria and registered in Malta. She is owned by Varna Maritime Limited and the technical managers are Navigation Maritime Bulgare Ltd, headquartered in Varna. The vessel is classed with DNV GL.

*Stara Planina* has an overall length of 186.45 m and a beam of 30.0 m. The vessel has five cargo holds with a total trimmed grain capacity of 52,656 m<sup>3</sup>. She is fitted with four cargo deck cranes (Figure 1) and is classed as a handy sized bulk carrier.

*Stara Planina* is operated on the international bulk spot market.

Propulsive power is provided by a 6-cylinder MAN-B&W 6S50MC-C, slow speed direct drive diesel engine producing 8304 kW at 117 rpm. The engine drives a single fixed pitch propeller and is capable of producing a service speed of 14.30 knots.



**Figure 1:** *MV Stara Planina*



### **1.3 Background**

On 24 June 2014, the vessel completed loading 32,742 tonnes of soya bean meal in the port of Santos, Brazil. She then departed on the same day, bound for the port of Montoir in France. On 10 July 2014, the vessel briefly called at the port of Las Palmas, Canary Islands, for hull cleaning and departed on 11 July 2014. The vessel arrived at Montoir anchorage on 16 July 2014 and remained at anchor until 02 August 2014 before finally coming alongside on the same day.

### **1.4 Manning of the Vessel**

The Minimum Safe Manning Certificate issued by Transport Malta's Merchant Shipping Directorate required the vessel to be operated by 16 crew. This included the master, the chief mate, two deck mates and four deck ratings. At the time of the accident, the vessel was manned by 18 crew members and was in compliance with the manning requirements.

The master and crew on board *Stara Planina* were all Bulgarian nationals and Bulgarian was the working language on board.

The bosun who tragically died, was 45 years old and had worked for Navigation Maritime Bulgare Ltd since 1989. He had qualified as a rating in 1993 and was promoted to the rank of bosun in August 2004. He had joined the *Stara Planina* on 15 April 2014 and his medical examination conducted just prior to joining the vessel indicated that he was in good health.

The chief mate was 49 years old at the time of the accident. He had been at sea since 1988 and has sailed as a chief mate for 4.5 years.

### **1.5 Narrative**

At about 1030 on 02 August 2014, the vessel completed her mooring operations alongside. After completion of port formalities, the chief mate along with the cargo surveyor and second mate unsealed the cargo holds. The cargo surveyor advised the chief mate that the Terminal required all cargo holds and hold accesses be ventilated

prior to the commencement of the cargo operations. Cargo operations were planned to start at 0600 on 04 August. This request to ventilate the cargo holds and hatch accesses was repeated by the ship's agent at about 1130.

At 1300, the chief mate ordered the second mate to open the cargo hold hatch covers. The second mate, along with an AB, opened all hatch covers and reported back to the chief mate at about 1330 that the job was completed. The chief mate considered the cargo surveyor's requested for the cargo holds to be ventilated as unusual. He became concerned and proceeded to sample the air in the cargo holds by lowering a personal multigas analyser (Figure 2) on a length of rope.



**Figure 2: Personal multigas analyser**

The cargo holds were first sampled from the port side main deck, then from the starboard side main deck and finally from the aft end access of each cargo hold from the main deck. At about 1600, having completed this sampling process with no indication of alarm, the chief mate then proceeded to sample the air in the forward access of each cargo hold. The forward access hatches are located in the crane housing (Figure 3).

At this point, the chief mate decided he needed assistance and called the second mate on his VHF radio to meet him at the forward entrance to cargo hold no. 1. The bosun,

who also had a VHF radio, responded to the chief mate that since he was in the forecastle store, was available to assist, and that he would meet the chief mate there.



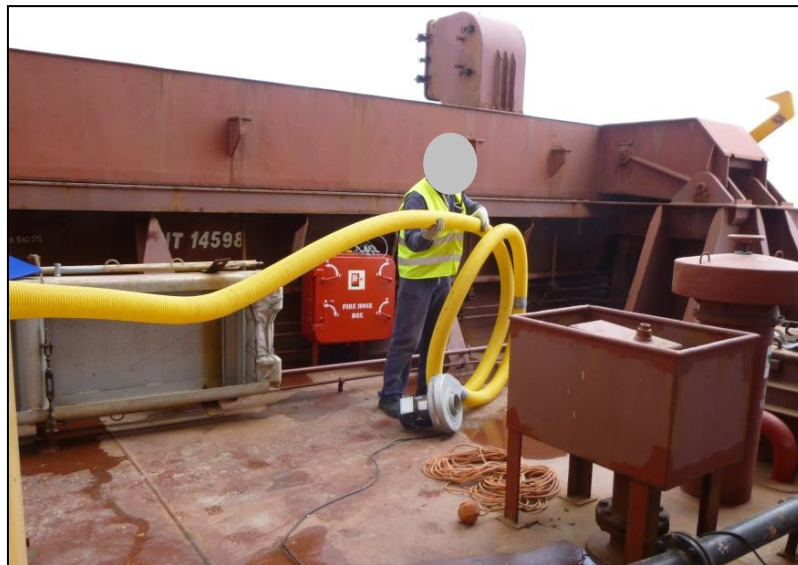
**Figure 3: Cargo hold no. 4 forward access hatches inside the crane housing**

The chief mate and the bosun proceeded to test the atmosphere in the forward entrances to the cargo holds. They found that the gas analyser alarmed at a depth of between 1 m and 1.5 m from the top of the access hatch (Figure 4) on all cargo holds and indicated high concentrations of carbon monoxide. The readings, however, were not documented.



**Figure 4: Forward cargo hold access way viewed from the top void**

The chief mate then instructed the bosun to make preparations to mechanically ventilate the forward cargo hold access ways. Leaving the bosun to collect the necessary equipment, the chief mate went to the bridge and advised the master of his findings. During the briefing, at about 1610, the master and chief mate observed the bosun carrying a portable ventilator and hose on the starboard main deck by cargo hold no. 4 (Figure 5).



**Figure 5: Portable ventilator and hose**

Having reported to the master the necessity to mechanically ventilate the forward cargo hold access ways, the chief mate returned to the main deck to assist the bosun. On his return, however, he was unable to locate the bosun on the main deck and assumed that he had returned to the forecastle store to collect more equipment. The chief mate called him on the VHF radio but when he received no reply, he made a general broadcast to all parties on duty to see if anyone had seen the bosun. The second mate responded that no one knew where the bosun was.

The chief mate continued to search the main deck and then noticed that the portable ventilator hose had been led into the access way of cargo hold no. 4 via cargo deck crane no. 3 housing. Suspecting that the bosun may have entered the cargo hold, the chief mate advised the master to sound the 'General Alarm' and instructed the second mate to bring a breathing apparatus set to cargo deck crane no. 3.

At about 1630, the master proceeded directly to the scene for confirmation on hearing that the bosun may have entered the cargo hold. The second mate collected a breathing apparatus (BA) set and rushed to the scene. He passed the ship's fitter who asked him what was happening and on being informed of the situation, the fitter joined the second mate to assist. On reaching cargo deck crane no. 3, the fitter was instructed to don the BA and enter the cargo hold to search for the bosun. As soon as the fitter descended into the top access space (Figure 6), he reported that he could see the bosun at the bottom of the 'Australian ladder', and proceeded down the ladder.



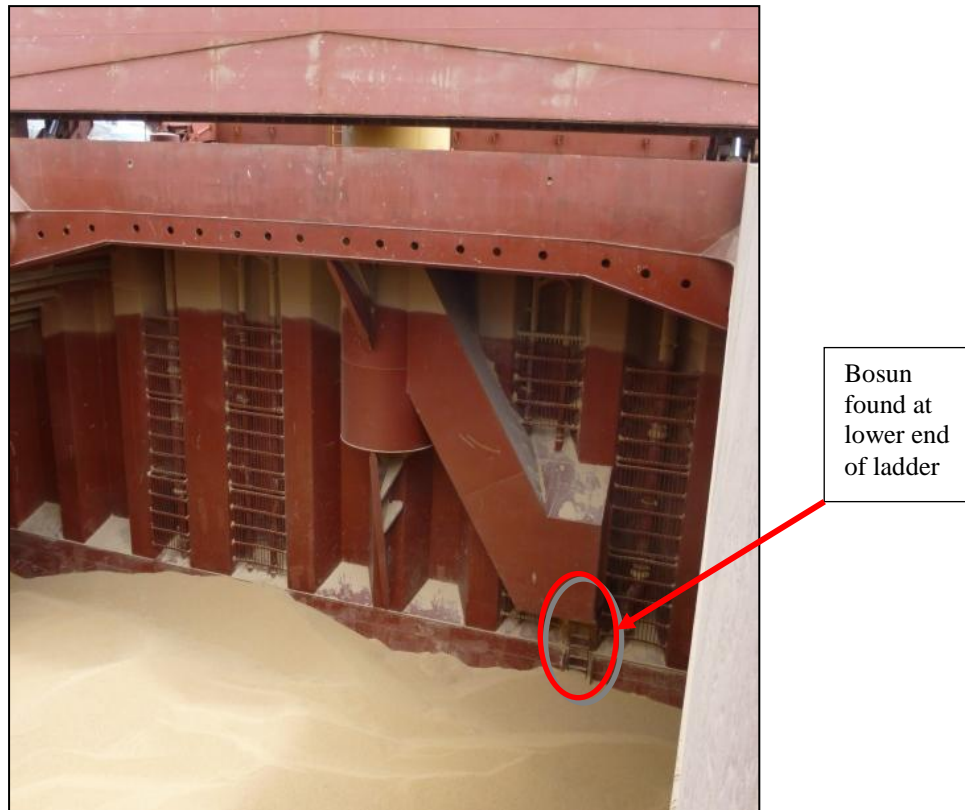
**Figure 6: Internal view of the 'Australian ladder' showing the bottom**

Having confirmed the nature of emergency, the master returned to the bridge to sound the 'General Alarm' and contact the ship's agent to arrange for medical assistance. The master was unable to contact the agent via his mobile phone and instead contacted the port authorities on VHF channel 14 to advise them of the situation. The master then went onto the quayside to request the stevedores to also call for medical assistance.

On finding the bosun at the bottom of the 'Australian ladder' (Figure 7), the fitter tried to wake the bosun but there was no response. The fitter then proceeded to turn



the bosun over and fasten a recovery line around his body. By this time, the second mate had brought another BA set to the scene and donned it. He then entered the cargo hold access to assist the fitter with the recovery of the bosun. The second mate and the fitter attempted to lift the bosun up the 'Australian ladder'. However, both men became exhausted and the second mate withdrew from the cargo hold access.



**Figure 7: External view of cargo hold no. 4's Australian ladder arrangement**

The chief mate then donned a third BA set and entered the cargo hold access to continue with the recovery operation. Between the two of them, they successfully recovered the bosun to the main deck at 1638. At about 1640, the ship's agent called the master, advising him that shore paramedics were en-route to the ship.

After exiting the cargo hold access, the second mate proceeded to administer CPR<sup>1</sup> to the bosun, using oxygen bottles, which he had collected from the ship's infirmary. At about 1652, the shore paramedics arrived on board and took over the resuscitation attempts of the bosun. Shortly afterwards, at 1706, a doctor boarded the vessel. At

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<sup>1</sup> CPR - Cardiopulmonary resuscitation is a first aid technique that can be used if someone is not breathing properly or if their heart has stopped.

1735, the doctor advised the master that all attempts to resuscitate the bosun had failed and pronounced him dead at the scene.

## **1.6 Nature of the Cargo**

The vessel loaded 32,742 tonnes of cargo that was declared as 'Brazilian solvent extracted toasted soya bean meal non GMO in Bulk'.

In accordance with The International Maritime Solid Bulk Cargoes Code (IMSBC), the shippers provided the following information:

- Oil Content Maximum 18.5%;
- Moisture Maximum 14%;
- Group C Cargo.

No special or additional instructions were included with the shipper's declaration, a copy of which can be found in **Annex A**.

The IMSBC Code defines the groups of bulk cargo as:

- Group A: Cargoes which may liquefy, if shipped at moisture content in excess of their transportable moisture limit;
- Group B: cargoes which possess a chemical hazard which could give rise to a dangerous situation on a ship; and
- Group C: cargoes which are neither liable to liquefy (Group A) nor to possess chemical hazards (Group B).

Soya bean meal is regarded and classed as a type of seed cake. The IMSBC Code lists four types of seedcake.

- UN 1386(a): Mechanically expelled seed, containing not more than 20% of oil and moisture combined;
- UN 1386(b): Solvent-extracted and expelled seeds, containing not more than 10% of oil and when the amount of moisture is higher than 10% not more than 20% of oil and moisture combined;
- UN 2217: With not more than 1.5% oil and not more than 11% moisture; and

- Non-Hazardous: Solvent extracted rape and seed meal, pellets, soya bean meal, cotton seed meal and sunflower seed meal, containing not more than 4% oil and 15% oil and moisture combined and being substantially free from flammable solvents.

The main characteristics of the different grades of seedcake are summarised in Table 1 below<sup>2</sup>. The full characteristics on this cargo can be found in **Annex B** of this safety investigation report.

**Table 1: Characteristics of soya bean meal**

	UN 1386 (a)	UN 1386 (b)	UN 2217	Non-hazardous
IMDG Code Hazard Class	4.2	4.2	4.2	N/A
IMSBC Code Hazard Group	B	B	B	C
Size	N/A	N/A	0.1 mm-5 mm	N/A

## 1.7 Hazards of Soya Bean Meal

Seedcake can be described as the residue that remains after the oil from oil-bearing seeds, cereals and associated products is removed. This can be achieved by mechanical crushing or by a process known as ‘solvent extraction’. The IMSBC Code provides guidance on the carriage of soya bean meal, which has been classified as hazardous under the IMDG Class 4.2.

The Code states:

*May self-heat slowly and, if wet or containing an excessive proportion of unoxidised oil, ignite spontaneously. Liable to oxidize, causing subsequent reduction of oxygen in the cargo space. Carbon dioxide may be produced.*

The Code requires that the temperature of this cargo be measured regularly at a number of depths in the cargo spaces and recorded during the voyage.

<sup>2</sup> Standard Cargo Bulletin October 2011 Carriage of Seed Cake: Charles Taylor Consulting.



In addition, a number of Protection and Indemnity Clubs provide guidance on the carriage of seed cake to their members. The “Standard Cargo” Bulletin<sup>3</sup> on the Carriage of Seed Cake (October 2011) is one example and provides further guidance on the carriage of soya bean meal.

The main hazards of seed cake cargo, of which soya bean meal is included in this classification, are the risk of self-heating, spontaneous combustion and oxygen depletion. It is understood that a high moisture content of the cargo can cause self-heating through microbiological activity, producing temperatures in the region of 70°C. At these raised temperatures, the oils in the seed cake oxidise, causing the temperature of the cargo to rise further, and possibly leading to spontaneous combustion. The net effect is that there is a subsequent reduction of the concentration of oxygen in the cargo space and in addition to carbon dioxide, carbon monoxide may also be produced.

In view of these hazards, entry into cargo holds and ladder access trunking should not be permitted until tests have been conducted to establish whether normal oxygen levels have been restored and that there is no carbon monoxide present. These spaces should be treated as ‘enclosed spaces’<sup>4</sup>.

## **1.8 Access to Cargo Hold No. 4**

Forward access to cargo hold no. 4 is gained by an ‘Australian ladder’ that is almost entirely enclosed within a void space. Access is from the main deck via a hatch and a vertical ladder contained within the housing of cargo deck crane no. 3 (Figures 4 and 7). Access to the cargo space is then gained via a vertical ladder (Figure 8), at the base of sloped steps. The access to the lower ladder is covered by a removable lid.

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<sup>3</sup> Standard Cargo is published by the managers of its London agents, Charles Taylor & Co. Limited, downloadable from <http://www.standard-club.com/media/23994/StandardSafetySeedcake-final-2.pdf>.

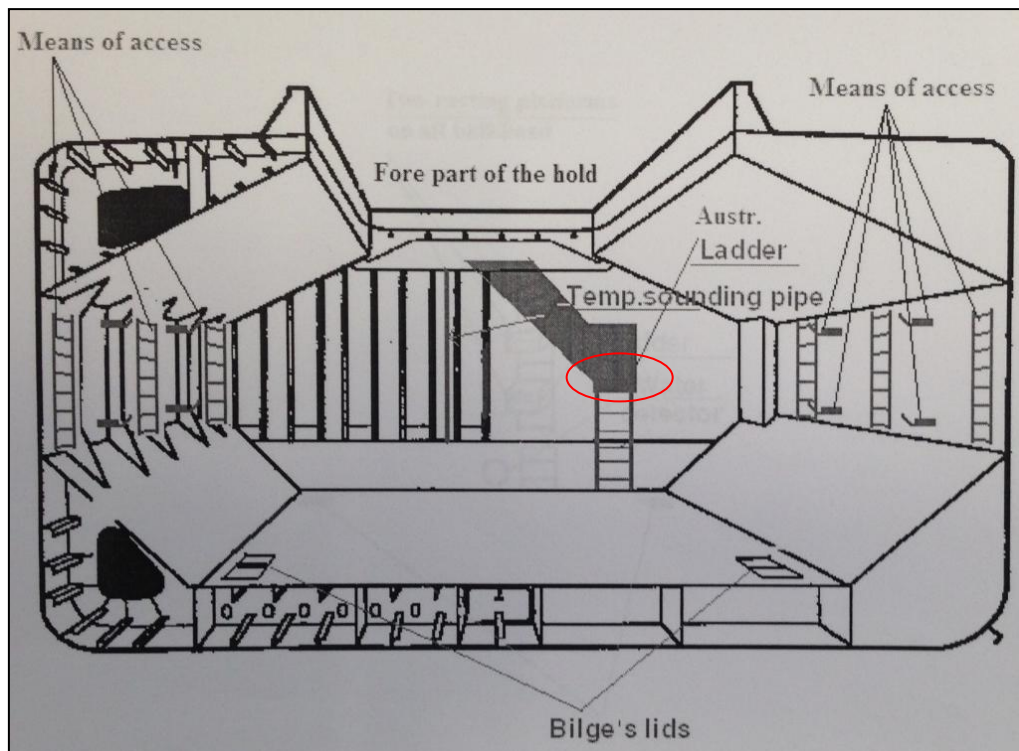
<sup>4</sup> Any space of an enclosed nature where there is a risk of death or serious injury from hazardous substances or dangerous conditions such as lack of oxygen. During the consultation period, managers confirmed that permission had never been granted by the master for entry into the cargo holds. It was also stated that additionally, entry was strictly forbidden by the chief mate. The Company classified cargo holds as ‘enclosed spaces’ and their entry required a special procedure.



**Figure 8: Lower vertical ladder giving access to the cargo space**

The bosun was found at the base of the 'Australian ladder' in the access to cargo hold no. 4 as indicated in Figures 6 and 7.

Figure 9 provides a schematic view of the forward part of cargo hold no. 4.



**Figure 9: Schematic view of the fore part of cargo hold no. 4**

## 1.9 Cargo Sampling

During the safety investigation conducted on board *Stara Planina*, samples of cargo from cargo holds nos. 1 and 4 were obtained by the MSIU and tested at Salamon & Seaber Laboratory in order to establish whether the cargo matched the shipper's declaration. The tested samples were found to have the following oil and moisture contents:

- Cargo hold no. 1: Oil content 1.30% Moisture 12.36%
- Cargo hold no. 4: Oil content 1.88% Moisture 12.43%

The full results of the tests carried out can be found in **Annex C**.

## 1.10 Cargo Hold Atmosphere and Testing

The atmosphere inside the cargo holds and their accesses was tested by a representative from Marine and Cargo Surveyors on 03, 04 and 05 of August 2014. The results are reproduced in **Annex D**. Results from the samples taken on 03 August 2014 indicated high concentrations of carbon monoxide and depleted levels of oxygen in the forward cargo hold access ways. Access was prohibited to these areas. In particular, 24 hours after the accident, the oxygen level in the forward entrance of cargo hold no. 4 was recorded as 13.30%. Successive results indicated a reduction in the level of carbon monoxide and in the depletion of oxygen.

At about 1600 on 05 August, the atmosphere was tested by the MSIU prior to entering the cargo hold access. Despite it being tested earlier in the day and granting 'free access', an increased level of 50 ppm of carbon monoxide was noted and further ventilation was required before the space could be entered for examination of the accident site.

The MSIU representative also took temperature readings of the cargo on 05 and 06 August. The readings (Table 2) did not indicate any cause for concern with respect to self-combustion; outside air temperature was noted to be 22°C.

**Table 2: Cargo temperature samples**

Hold	05 August – 1900 (LT)		06 August – 0800 (LT)	
	F	A	F	A
1	20°C	27.5°C	20°C	23.5°C
2	22°C	23°C	21.5°C	21°C
3	22.5°C	23.5°C	22.5°C	20°C
4	23°C	27°C	24.5°C	25°C
5	23°C	26°C	24°C	22°C

The cargo of soya bean meal in cargo hold no. 4 was sighted towards the end of completion of discharge. No apparent discoloration of the cargo or other indications of the soya bean meal having been subject to overheating was noted.

The ship's bunker reports also indicated that the fuel oil bunker tanks below cargo hold no. 4 were empty during the voyage from Santos and therefore there was no requirement to heat the bunker tanks.

### **1.11 Similar Accidents**

On 16 November 2006, a crew member and a stevedore collapsed as they entered an enclosed stair trunk in cargo hold no. 9 on board a Hong Kong registered vessel. The crew member died and the stevedore was seriously injured in the incident. The investigation revealed that the enclosed stair trunk was not properly ventilated before entry. The seaman and the stevedore were overcome by the high concentration of carbon monoxide in the enclosed stair trunk that had been generated by the wood pellets the vessel was carrying.

On 26 May 2014, three crew members on board the German registered cargo ship *Suntis*, were found unconscious in the main cargo hold forward access compartment, which was sited in the vessel's forecastle. The crew members were recovered from the compartment but despite intensive resuscitation efforts by their rescuers, they did not survive. The vessel was carrying a cargo of sawn timber at the time of the accident. The Fire and Rescue Service analysis of the atmosphere after the accident

showed normal readings (20.9%) of oxygen content at the access hatch. The readings reduced to 10% just below the main deck level inside the hatch opening and to between 5% and 6% at the bottom of the ladder inside the compartment.

### **1.12 Carbon monoxide**

Carbon monoxide (CO) is a poisonous, colourless, odourless and tasteless gas. Carbon monoxide is harmful when breathed because it displaces oxygen in the blood and deprives the body's vital organs of oxygen.

When breathed in, carbon monoxide reacts with the haemoglobin found in the red blood cells and forms carboxyaemoglobin (COHb). The bond between carbon monoxide and haemoglobin is about two hundred times stronger than that of oxygen and haemoglobin. The carbon monoxide is therefore able to displace the oxygen levels in the blood with ease.

Besides tightness across the chest, initial symptoms of carbon monoxide poisoning may include headache, fatigue, dizziness, drowsiness or nausea. However, symptoms vary widely from person to person.

## **2 ANALYSIS**

### **2.1 Purpose**

The purpose of a marine safety investigation is to determine the circumstances and safety factors of the accident as a basis for making recommendations, to prevent further marine casualties or incidents from occurring in the future.

### **2.2 Fatigue**

The vessel was at the anchorage for 17 days prior to berthing at Montoir and during this time the bosun was engaged on day work, working a 10-hour shift. The bosun's hours of rest indicated that he had received adequate rest before attending the mooring stations on the morning of 02 August, and therefore fatigue was *not* considered to be a contributory cause to this accident.

### **2.3 Cause of Death**

The post mortem report confirmed that the bosun had died of asphyxia. It also confirmed that the injuries noted to his head were compatible with a fall similar to that from the top of the lower platform (Figure 6) to the base of the ladder (Figure 7), where he was found. The cause of death was not compatible with carbon monoxide poisoning as initially suspected by the crew.

### **2.4 Effects of Oxygen Starvation**

The atmosphere tested in the forward hatch access of cargo hold no. 4 on 03 August recorded depleted levels of oxygen and high levels of carbon monoxide. The oxygen level was measured at 13.3%, *i.e.* 24 hours after the accident and therefore the concentration of oxygen at the time of the accident would have been lower.

Evidence indicated that the bosun went missing for a short period of time (about 10 to 15 minutes), and because with hindsight it is known that he entered an oxygen depleted environment, the bosun must have been initially overcome by the atmosphere, lost conscious and then fell down the ladder. The effects of depleted

levels of oxygen<sup>5</sup> on a human being are tabulated below (Table 3) and would indicate for the accident to have occurred as surmised above, the oxygen level in the lower part of the hatch access would have been about 10% or less.

**Table 3: The effects of depleted levels of oxygen**

<b>Atmospheric O<sub>2</sub> % Concentration</b>	<b>Effect</b>
16 - 20.9	No symptoms
16	Increased heart and breathing rate, some loss of coordination, increased breathing volume, impaired attention and thinking
14	Abnormal fatigue upon exertion, emotional upset, faulty coordination and impaired judgement
12	Very poor judgement and coordination, impaired respiration that may cause permanent heart damage, nausea and vomiting
< 10	Nausea, vomiting, lethargic movements, perhaps unconsciousness, inability to perform vigorous movements or loss of all movement, unconsciousness followed by death
< 6	Convulsions, shortness of breath, cardiac arrest, spasmodic breathing and death in minutes
< 4	Unconsciousness after one or two breaths

## **2.5 Bosun's Entry into Cargo Hold No. 4**

The bosun was instructed to set up the mechanical ventilation in the forward accesses of the cargo holds. This should not have required him to enter an enclosed space without taking proper precautions and being issued with an entry to enclosed space permit.

The bosun did not inform anybody what he was about to do and neither could the safety investigation establish the events leading up to the discovery of the bosun. Although the bosun may not have had any intention of entering the space, it appears that he did so to either free a trapped ventilator hose or to possibly remove the lid at the base of the ladder, disbelievingly of the atmosphere contained within the space.

<sup>5</sup> North West Occupational Health and Safety Canada. Publication Oxygen: Health Effects and Regulatory Limits Appendix 6.

The bosun was an experienced seaman and should have been aware of the dangers in entering an enclosed space even if it was meant to be for a very short time. Moreover, the very fact that he was required to ventilate a space should have increased his level of alertness that this was not a space to be entered. If he was present at the time when the chief mate tested the atmosphere, he would have also been aware that the multigas detector had alarmed. His entry into cargo hold no. 4 forward access was not in accordance with the Company's confined space entry procedures and unfortunately cost him his life. His actions would therefore require further analysis in order to identify a meaning to the bosun's actions.

It may be stated that there are two main stages in a cognitive process, which happen before a decision is reached:

1. An assessment of the situation – what is the problem?; and
2. An analysis of how to respond to the situation – What shall be done?

The assessment of the situation is actually an attempt to make sense of the prevailing situation – the recognition of the problem, which should then lead to an appropriate response action. Situational awareness is therefore critical for decision-making. The decision-making process is influenced by, *inter alia*, the level of technical expertise and familiarity with the situation. Lack of sinister experiences may eventually lead to a misdiagnosed situation.

Evidence also suggested that the bosun did not inform other crew members of his intention to access the space. In other words, because of this lack of communication, the other crew members would not have been unaware of the decision path being taken by the bosun. This lack of communication prohibited the other crew members from sharing their interpretation and assessment of the situation. The bosun therefore lacked a vital tool. Whilst team decision-making is not necessarily a guarantee of a successful outcome, however, compared with sole individuals, teams would enjoy increased cognitive resources.

In an other similar safety investigation carried out by the MSIU<sup>6</sup>, it was mentioned that unauthorised entry into enclosed spaces can only be achieved if multiple

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<sup>6</sup> Vide [Safety Investigation Report no. 10/2012](#).



preventive safety barriers fail<sup>7</sup>. Given that these barriers were surpassed, there was little which could have been done to minimise the consequences of these hazards within the space.

The perception (of risk) which the bosun had before he went inside the cargo hold did not represent the actual prevailing situation. Therefore, in addition to the absence of local immaterial barriers and the limited effectiveness of ‘remote’ immaterial barriers (SMS procedures) had, the situation would have been compromised even further. In other words, the entry into the cargo hold access shaft may have been decided on subjective factors, irrespective of whether or not he would have witnessed the sampling of the air by the chief mate.

It was to be expected that the intention of the crew member was to access the space (for whatever reason) and come out again. Studies have shown that the crossing of safety barriers is goal driven. Thus, the fact that his safe exit did not materialise, remained a clear indication of an inaccurate assessment of the situation; the benefit of entering the space vs. the potential deficit, and inaccurate perception of the risk involved.

## **2.6 Enclosed Spaces**

The latest Company risk assessment that had been conducted on 16 June 2013 by the ship’s master at the time (**Annex E**), identified the cargo holds as enclosed spaces. One of the existing control measures which was in place required a ‘Permit to Entry’ Form to be completed. Company policy required this Form to be completed by either the chief mate or the chief engineer and signed by the master. According to the risk assessment, the master was also required to provide “*written directions on how to perform the ventilation of cleaning of respective enclosed spaces*” (sic).

Just before the accident, there was no intention to enter the cargo hold or access space, but merely to mechanically ventilate. Therefore, a permit to entry was neither required nor completed. The safety investigation also noted that none of the cargo hold accesses were marked with a sign declaring the space to be dangerous or

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<sup>7</sup> It has been determined that established norms to enter enclosed spaces were not followed. The access is therefore considered to be unauthorised.

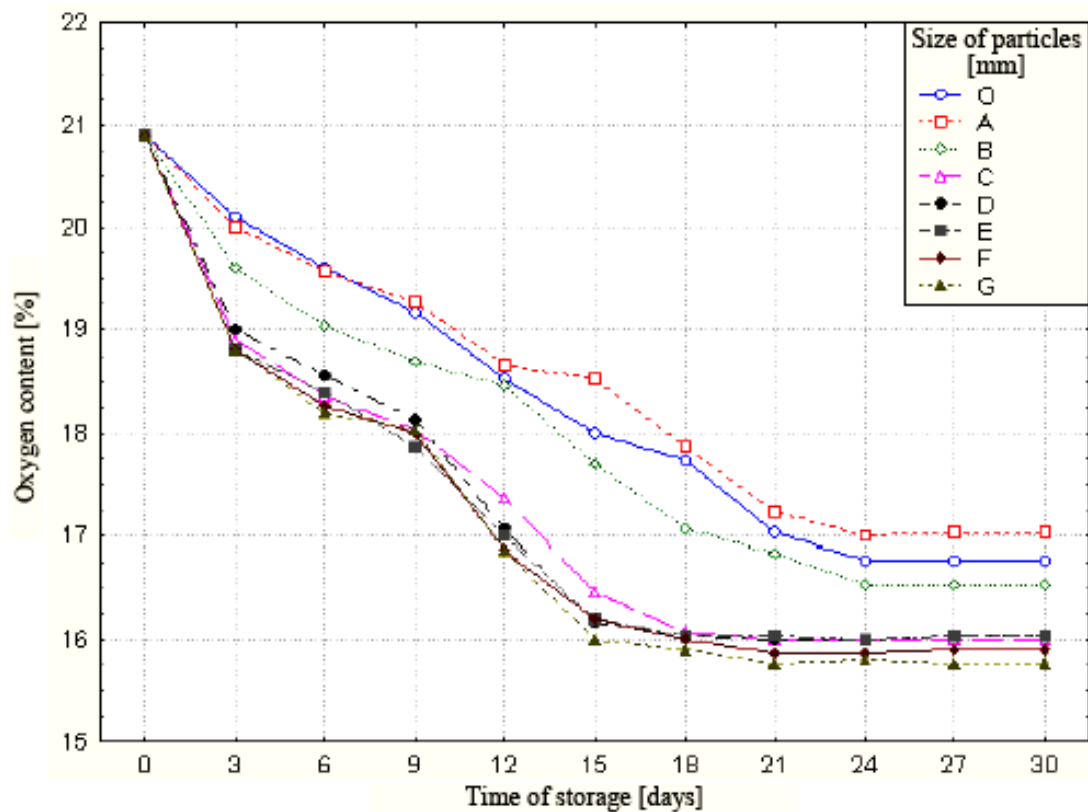
enclosed and neither was there a warning that reminded that a permit to enter was required. The warning may have been the last defence (symbolic) barrier for somebody that was about to enter an enclosed space without permission and without taking appropriate precautions.

The importance of following correct procedures before entering an enclosed space has been the focus of attention in a number of similar accidents in the recent times. Although, the Company's procedures on entry into enclosed spaces were comprehensive and could have prevented this accident, they were not followed on board *Stara Planina*.

## **2.7 Cargo Atmosphere and Risk Perception**

The cargo holds were sealed at the port of Santos and were not opened until 02 August in the port of Montoir, a total of 39 days. Whilst the cargo was identified as non-hazardous, the crew members did not realise that since the cargo holds had been closed for 39 days, its atmosphere may be suspect or deficient to sustain life. Since the crew had carried this type of cargo a number of times in the past, they may have perceived that no particular precautions were required to enter the cargo holds. Nonetheless, since the Company had already identified it as an enclosed space that required a permit to enter.

Soya bean seedcake is susceptible to oxidation. A study by Drzewieniecka (2012) concluded that over a period of 30 days, up to 5% of the oxygen in a space may be depleted (Figure 10).



**Figure 10: Relations of changes in oxygen content of soya bean seed cake over time in storage**

*Adopted from: Drzewieniecka (2012).*

In the absence of detailed technical information such as that presented in Figure 10 and other negative cues, Company procedures were not followed and a dangerous space was entered after it had been closed for 39 days and before it was declared free of all hazards.

Evidence indicated that the cargo hold accesses' atmosphere had not been correctly tested by the crew. As it can be seen by the carbon monoxide exposure limits below (Table 4), the bosun would have had to be exposed to very high levels of carbon monoxide before he would have been overcome.

**Table 4: Carbon monoxide exposure limit**

PPM	Time	Comments
35-50	8 Hours	The maximum allowable concentration for continuous exposure in any 8 hour period, according to OSHA
200	2-3 Hours	Headache (mild)
400	1-2 Hours	Headache (mild)
800	10-15 minutes	Dizziness, nausea
1600	20 minutes	Headache, dizziness, death within one hour
3200	5-10 minutes	Headache, dizziness, death within one hour
6400	1-2 minutes	Headache, dizziness, death within one hour
6000-8000	5 minutes	Incapacitation
12800	2-3 breaths	Unconsciousness
12800	1-3 minutes	Death

*Adopted from: Hutchinson Utilities Commission*

For the level of carbon monoxide (985 ppm) and limited time the bosun remained inside the cargo hold access, he should have been able to extricate himself albeit with some dizziness and nausea<sup>8</sup>. The crew reported that they discovered carbon monoxide during testing of the cargo holds but not lack of oxygen. It was possible that the reading was only taken at the entrance of the cargo hold access and not lowered down to a depth as suggested. It was only by lowering the probe deeper that they would have discovered that the atmosphere was deficient to sustain life.

As already stated, if the bosun had indeed been present at the time when the chief mate was sampling the atmosphere, he would have been aware that the multi-gas meter had alarmed. The fact that he went down the space was suggestive that he either did not consider the alarm as a risk to his life or that the sampling had not taken place and therefore was unaware that the atmosphere was suspect.

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<sup>8</sup> Refer to sub-section 1.12 of this safety investigation report.

## 2.8 Emergency Response

The crew responded to the emergency in good time but the response could have been better planned and executed. On hearing the chief mate's request to sound the general alarm, the master went to the scene rather than raising the alarm. This may have caused an unnecessary delay, with the master himself wanting to confirm the emergency.

The response to the emergency was quick and within minutes the second mate and fitter had donned their BA set and entered the cargo hold access. However, additional equipment such as breathing sets, first aid kits and oxygen arrived in stages. The action of the chief mate in donning a BA set and entering the cargo hold meant that the on-scene command was temporarily lost. The crew used a safety harness (Figure 11) to extract the bosun. This harness, however, was not very effective to extract unconscious bosun from the space.



**Figure 11: Safety harness**

The crew members did not use a Neil Robertson<sup>9</sup> stretcher to lift the bosun out with the aid of suitable rescue equipment such as, for instance, a tripod and block and tackle.

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<sup>9</sup> The Neil Robertson, a widely used rescue stretcher in the merchant navy, which is designed for use where a casualty needs to be lowered or lifted to safety.

## **2.9 Crew Training and Emergency Response**

On 03 July 2014, all the crew members participated in a training session on how to enter an enclosed space. They were made aware of the Company's entry into enclosed space procedures and that the cargo holds and its accesses were designated as enclosed spaces.

While the crew may have received training on the entry procedures, it was obvious that the training regime neither prepared the crew for an accident of this nature nor on how to conduct an enclosed space rescue. An appropriate drill could have highlighted the particular difficulties of recovering an unconscious casualty from a very confined compartment and negotiating an unusually narrow access hatch. The crew would then have been given opportunities to learn effective rescue techniques, identifying the necessary equipment and to practice the use of required equipment for those techniques. Such drills could have also identified the problems of recovering a casualty only using a safety harness.

On board training has two important purposes. It allows the crew to practice procedures put in place so that they can fall back on during emergency situations when there is a great sense of urgency required amidst a developing confusion. Even more, it will also provide an opportunity to test and prove procedures and equipment in realistic settings.

## **2.10 Declaration of Cargo**

Although the samples tested after the accident confirmed that the samples were indeed a 'Group C' non-hazardous cargo, the shipper's declaration had stated the incorrect oil and moisture contents, which identified it as a hazardous cargo.

It is apparent that neither the master nor the chief mate studied the cargo declaration provided by the shippers. If they had, they would have identified that soya bean meal with the declared oil content and moisture level (Section 1.6), should have been declared as IMO Class 4.2 UN No 1386 (a) SEED CAKE because the declaration showed a combined oil and moisture content of 20%, which made it a Group B under the IMSBC Code and therefore a hazardous cargo. Instead, the

declaration was accepted on face value and neither further advice nor clarifications were sought.

Although the inaccuracy in the declaration of the cargo did not in any way contribute to the outcome of the accident, however, it did provide the master and chief mate with the mistaken assumption that the cargo was non-hazardous, and therefore did not require any particular precaution.

**THE FOLLOWING CONCLUSIONS, SAFETY ACTIONS AND RECOMMENDATIONS SHALL IN NO CASE CREATE A PRESUMPTION OF BLAME OR LIABILITY. NEITHER ARE THEY BINDING NOR LISTED IN ANY ORDER OF PRIORITY.**



### **3 CONCLUSIONS**

Findings and safety factors are not listed in any order of priority.

#### **3.1 Immediate Safety Factor**

- 3.1.1 The atmosphere within the forward access of cargo hold no. 4 was depleted of oxygen and contained high levels of carbon monoxide through a combination of oxidation of the oils contained within the cargo of soya bean meal.
- 3.1.2 The bosun entered the cargo hold access without following the correct procedure for entering an enclosed space.

#### **3.2 Latent Conditions and other Safety Factors**

- .1 The enclosed design of the 'Australian ladder' was conducive to the depletion of oxygen and concentration of carbon monoxide. The crew did not recognise this as an enclosed space although the cargo holds had been designated as such.
- .2 The depletion of oxygen and the high concentration of carbon monoxide are likely to have been exasperated due to the bottom lid at the base of the steps giving direct access to the cargo space being either partially or fully open during the voyage from the port of Santos.
- .3 The crew members' rescue efforts highlighted that they were inadequately prepared to deal with a rescue from an enclosed space.

#### **3.3 Other Findings**

- .1 The shipper's cargo declaration gave misleading information but did not in any way contribute to the outcome of the accident. However, it resulted in the master and chief mate mistakenly assuming that the cargo was non-hazardous, and therefore did not require any particular precautions.

## **4 ACTIONS TAKEN**

### **4.1 Safety Actions Taken During the Course of the Safety Investigation**

During the course of the safety investigation, the Company has issued a fleet wide Safety Circular, reminding all crew members of the hazards of confined spaces and the correct entry procedures. Moreover, all serving masters and mates were reminded of the importance to thoroughly check the declaration of cargo and to familiarise themselves with the cargo being carried.

Shipboard training practices / equipment was also reviewed and found satisfactory.

## **5 RECOMMENDATIONS**

In view of the conclusions reached and taking into consideration the safety actions taken during the course of the safety investigation,

**Navigation Maritime Bulgare Ltd are recommended to:**

**21/2015\_R1** Consider permanently marking all cargo hold access hatches and other confined spaces entrances with suitable signage.

## **LIST OF ANNEXES**

Annex A	Cargo Declaration
Annex B	Cargo Characteristics
Annex C	Laboratory Tests on Cargo Samples
Annex D	Cargo Hold Atmosphere Test Results
Annex E	Master's Risk Assessment

## Annex A Cargo Declaration

# SGS

TO  
THE MASTER OF THE  
M/V "STARA PLANINA"  
AT SANTOS PORT

DATE: JUNE 13<sup>th</sup>, 2014

SHIPPER: LOUIS DREYFUS COMMODITIES BRASIL S/A  
PRODUCT: BRAZILIAN SOYABEANMEAL NON GMO IN BULK  
QUANTITY: ABOUT 30.000,000 MT

### CARGO DECLARATION

Dear Sirs,

According to shipper's information product to be loaded on board this vessel is not harmful to the marine environment was commercialized with the following specifications:

OIL:	Basis 18.5%
MOISTURE:	Maximum 14%
FOREIGN MATTER:	Basis 1% maximum 2%
	Basis 8% maximum 8.5% of which maximum 5% heat
Damaged Beans:	Damaged
Broken Beans:	Maximum 30%

Free from Poisonous Seeds / Husks but tolerance maximum 0.005% Castorseed and / on Castorseed Husks.

The issuance of this declaration refers and applies to the regulations contained in the IMO. BC Code – International Maritime Solid Bulk Cargoes (IMSBC) Code, Edition 2012, and does not express any opinion by SGS outside these codes.

This declaration reflects our findings determined at time and place of intervention only and does not relieve the Master and the owner of the M/V "STARA PLANINA" of their obligations and duties in any or all respects.

All SGS services are rendered in accordance with the applicable SGS General Conditions of Service accessible at [http://www.sgs.com/terms\\_and\\_conditions.htm](http://www.sgs.com/terms_and_conditions.htm). Attention is drawn to the limitations of liability and to the clauses on indemnification and jurisdiction. By signing this document, the Client confirms that he/she accepts the applicable SGS General Conditions of Service.

SGS do Brasil Ltda

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Santos Branch / Filial Santos: Av. Vereador Alfredo das Neves, 480 - Alemoa - 11095-510 - Santos-SP - t+ 55 13 2105-9550 - f+ 55 13 3296-2921  
Other Branches / Outras Filiais: [www.br.sgs.com](http://www.br.sgs.com)

Member of the SGS Group (SGS SA)



**Form for cargo information  
For solid bulk cargoes**

Note: this form is not applicable if the cargo to be loaded requires a declaration under the requirements of SOLAS 1974, chapter VII, regulation 5< MARPOL 73/78, Annex III, regulation 4 and the IMDG Code, General Introduction section 9

Shipper: [REDACTED]	Transport document number:
Consignee: <b>TO ORDER</b>	Carrier:
Name/means of transport vessel: <b>MV STARA PLANINA</b>	Instructions or other matters:
Port/place of departure: <b>SANTOS, BRAZIL</b>	<b>N/A</b>
Port/place of destination: <b>FRANCE</b>	
General description of the cargo (Type of material/particle size): <b>BRAZILIAN SOYABEANMEAL NON GMO IN BULK</b>	Gross mass (kg/tonnes): <b>ABOUT 30.000,000 MT</b>
Specification of bulk cargo, if applicable: Stowage factor: <b>1.33 to 1.61 (m3/t)</b> Angle of repose if applicable: <b>&gt;35°</b> Trimming procedures: <b>As per 5.1 General provisions for trimming IMSC BC Code</b> Chemical properties if potential hazard*: <b>N/A</b> * e.g., Class & UN No. Or "MHB": <b>N/A</b>	
Group of the cargo <input type="checkbox"/> Group A and B* <input type="checkbox"/> Group A* <input type="checkbox"/> Group B <input checked="" type="checkbox"/> Group C	Transportable moisture limit <b>OIL CONTENT Max. 18.5%</b> <b>MOISTURE Max. 14%</b> Moisture content at shipment
* For cargoes which may liquefy (Group A and B cargoes) <b>Relevant Special properties of the cargo</b> (e.g., highly soluble in water) <b>Not harmful to the marine environment</b>	Additional certificate(s)* <input checked="" type="checkbox"/> Certificate of moisture content and Transportable moisture limit <input type="checkbox"/> Weathering certificate <input type="checkbox"/> Exemption certificate <input type="checkbox"/> Other (specify) * if required
<b>DECLARATION</b> I hereby declare that the consignment is fully accurately described and that the given test results and other specifications are correct to the best of my knowledge and belief and can be considered as representative for the cargo to be loaded.	
Name/status company/organization of signatory Place and date <b>Santos, JUNE, 13, 2014</b>	
<b>The issuance of this declaration refers and applies to the regulations contained in the IMO. BC Code – International Maritime Solid Bulk Cargoes (IMSBC) Code, Edition 2012, and does not express any opinion by SGS outside these codes.</b>	

SGS do Brasil Ltda.

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## Annex B Cargo Characteristics

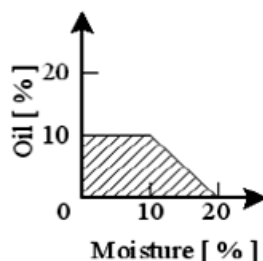
9/4/2014

2013/2011/2008 IMSBC Code, App. 1 Individual Schedules of Solid Bulk Cargoes - Products starting with S

### SEED CAKE, containing vegetable oil UN 1386 (a)

*mechanically expelled seeds, containing more than 10% of oil or more than 20% of oil and moisture combined.*

The range of oil and moisture content is indicated in the figure.



To be carried in bulk only with special permission from the competent authority.

#### DESCRIPTION

Residue remaining after oil has been expelled mechanically from oil-bearing seeds. The cereals and cereal products included in this schedule are those derived from:

<b>Bakery materials</b>	<b>Mill feed pellets</b>
<b>Barley malt pellets</b>	<b>Niger seed, expellers</b>
<b>Beet</b>	<b>Oil cake</b>
<b>Bran pellets</b>	<b>Palm kernel</b>
<b>Brewer's grain pellets</b>	<b>Peanuts</b>
<b>Citrus pulp pellets</b>	<b>Pellets, cereal</b>
<b>Coconut</b>	<b>Pollard pellets</b>
<b>Copra</b>	<b>Rape seed</b>
<b>Corn gluten</b>	<b>Rice broken</b>
<b>Cotton seed</b>	<b>Rice bran</b>
<b>Expellers</b>	<b>Safflower seed</b>
<b>Gluten pellets</b>	<b>Seed expellers, oily</b>
<b>Ground nuts, meal</b>	<b>Soya bean</b>
<b>Hominy chop</b>	<b>Strussa pellets</b>
<b>Linseed</b>	<b>Sunflower seed</b>
<b>Maize</b>	<b>Toasted meals</b>
<b>Meal, oily</b>	

The above may be shipped in the form of pulp, meals, cake, pellets and expellers.

#### **CHARACTERISTICS**

ANGLE OF REPOSE	BULK DENSITY (kg/m <sup>3</sup> )	STOWAGE FACTOR (m <sup>3</sup> /t)
Not applicable	478 to 719	1.39 to 2.09
SIZE	CLASS	GROUP
Not applicable	4.2	B

#### **HAZARD**

May self-heat slowly and, if wet or containing an excessive proportion of unoxidized oil, ignite spontaneously. Liable to oxidize, causing subsequent reduction of oxygen in the cargo space. Carbon dioxide may be produced.

#### **STOWAGE & SEGREGATION**

No special requirements other than prescribed in section 9.3 of this Code.

#### **HOLD CLEANLINESS**

Clean and dry as relevant to the hazards of the cargo.

#### **WEATHER PRECAUTIONS**

This cargo shall be kept as dry as practicable. This cargo shall not be handled during precipitation. During handling of this cargo all non-working hatches of the cargo spaces into which this cargo is loaded or to be loaded shall be closed.

#### **LOADING**

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

#### **PRECAUTIONS**

This cargo shall only be accepted for loading when the temperature of the cargo is not higher than ambient temperature plus 10°C or 55°C, whichever is lower. Before shipment, this cargo shall be properly aged; the duration of ageing required varies with the oil content.

The competent authority may permit seed cakes described in this schedule to be carried under conditions governing SEED CAKE (b), when satisfied, as a result of tests, that such relaxation is justified (see following schedule). Certificates from the competent authority giving such permission shall state the oil content and moisture content. The temperature of this cargo shall be measured regularly at a number of depths in the cargo spaces and recorded during the voyage. If the temperature of the cargo reaches 55°C and continues to increase, ventilation to the cargo shall be stopped. If self-heating continues, then carbon dioxide or inert gas shall be introduced to the cargo space. Entry of personnel into cargo spaces for this cargo shall not be permitted until tests have been carried out and it has been established that the oxygen content has been restored to a normal level.

#### **VENTILATION**

The cargo spaces carrying this cargo shall not be mechanically ventilated during voyage to prevent self-heating of the cargo, except in case of emergency.

#### **CARRIAGE**

Hatches of the cargo spaces carrying this cargo shall be weathertight to prevent the ingress of water.

#### **DISCHARGE**

No special requirements.

**CLEAN-UP**

No special requirements.

**EMERGENCY PROCEDURES**

<p align="center"><b><u>SPECIAL EMERGENCY EQUIPMENT TO BE CARRIED</u></b></p> <p align="center">Self-contained breathing apparatus.</p>
<p align="center"><b><u>EMERGENCY PROCEDURES</u></b></p> <p align="center">Wear self-contained breathing apparatus.</p> <p align="center"><b><u>EMERGENCY ACTION IN THE EVENT OF FIRE</u></b></p> <p align="center">Batten down; use ship's fixed fire-fighting installation, if fitted.</p> <p align="center"><b><u>MEDICAL FIRST AID</u></b></p> <p align="center">Refer to the Medical First Aid Guide (MFAG), as amended.</p>

\* \* \*

**SEED CAKE, containing vegetable oil UN 1386 (b)**

*solvent extractions and expelled seeds, containing not more than 10% of oil and when the amount of moisture is higher than 10%, not more than 20% of oil and moisture combined.*

The provisions of this schedule shall not apply to:

- .1 solvent extracted rape seed meal, soya bean meal, cotton seed meal and sunflower seed meal, containing not more than 4% oil and 15% oil and moisture combined and being substantially free from flammable solvents;
- .2 mechanically expelled citrus pulp pellets containing not more than 2.5% oil and 14% oil and moisture combined;
- .3 mechanically expelled corn gluten meal containing not more than 11.0% oil and 23.6% oil and moisture combined;
- .4 mechanically expelled corn gluten feed pellets containing not more than 5.2% oil and 17.8% oil and moisture combined; and
- .5 mechanically expelled beet pulp pellets containing not more than 2.8% oil and 15.0% oil and moisture combined.

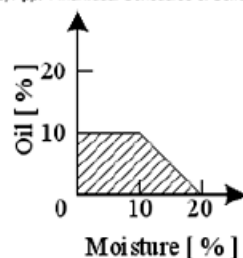
A certificate from a person recognized by the competent authority of the country of shipment shall be provided by the shipper, prior to loading, stating that the provisions of the exemption are met.

**Note:** This entry covers the following:

- .1 all solvent extracted and expelled seed cakes containing not more than 10% oil, and not more than 10% moisture; and
- .2 all solvent extracted and expelled seed cakes containing not more than 10% oil and moisture content higher than 10%, in which case, the oil and moisture combined must not exceed 20%.

The range of oil and moisture content is indicated in the figure.





When in solvent extracted seed cake, the oil or oil and moisture content exceeds the percentages stated above, guidance should be sought from the competent authorities.

#### DESCRIPTION

Residue remaining after oil has been extracted by a solvent process or expelled mechanically from oil bearing seeds. The cereals and cereal products included in this schedule are those derived from:

<b>Bakery materials</b>	<b>Mill feed pellets</b>
<b>Barley malt pellets</b>	<b>Niger seed, expellers</b>
<b>Beet</b>	<b>Oil cake</b>
<b>Bran pellets</b>	<b>Palm kernel</b>
<b>Brewer's grain pellets</b>	<b>Peanuts</b>
<b>Citrus pulp pellets</b>	<b>Pellets, cereal</b>
<b>Coconut</b>	<b>Pollard pellets</b>
<b>Copra</b>	<b>Rape seed</b>
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<b>Gluten pellets</b>	<b>Seed expellers, oily</b>
<b>Ground nuts, meal</b>	<b>Soya bean</b>
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<b>Maize</b>	<b>Toasted meals</b>
<b>Meal, oily</b>	

The above may be shipped in the form of pulp, meals, cake, pellets and expellers.

#### CHARACTERISTICS

ANGLE OF REPOSE	BULK DENSITY (kg/m <sup>3</sup> )	STOWAGE FACTOR (m <sup>3</sup> /t)
Not applicable	478 to 719	1.39 to 2.09
SIZE	CLASS	GROUP

Not applicable	4.2	B
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**HAZARD**

May self-heat slowly and, if wet or containing an excessive proportion of unoxidized oil, ignite spontaneously. Liable to oxidize, causing subsequent reduction of oxygen in the cargo space. Carbon dioxide may also be produced.

**STOWAGE & SEGREGATION**

No special requirements other than prescribed in section 9.3 of this Code.

If the bulkhead between the cargo space and the engine-room is not insulated to class A-60 standard, solvent extraction seed shall be stowed "away from" the bulkhead.

**HOLD CLEANLINESS**

Clean and dry as relevant to the hazards of the cargo.

**WEATHER PRECAUTIONS**

This cargo shall be kept as dry as practicable. This cargo shall not be handled during precipitation. During handling of this cargo all non-working hatches of the cargo spaces into which this cargo is loaded or to be loaded shall be closed.

**LOADING**

This cargo shall only be accepted for loading when the cargo is substantially free from flammable solvent and a certificate from a person recognized by the competent authority of the country of shipment specifying the oil content and moisture content is issued.

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

**PRECAUTIONS**

Before shipment, this cargo shall be properly aged; the duration of ageing required varies with the oil content. The temperature of this cargo shall be measured regularly at a number of depths in the cargo spaces and recorded during the voyage. If the temperature of the cargo reaches 55°C and continues to increase, ventilation to the cargo shall be stopped. If self-heating continues, then carbon dioxide or inert gas shall be introduced to the cargo space. In the case of solvent-extracted seed cakes the use of carbon dioxide or inert gas shall be withheld until fire is apparent. Entry of personnel into cargo spaces for this cargo shall not be permitted until tests have been carried out and it has been established that the oxygen content has been restored to a normal level. When the planned interval between the commencement of loading and the completion of discharge of this cargo exceeds 5 days, the cargo shall not be accepted for loading unless the cargo is to be carried in a cargo space equipped with facilities for introducing carbon dioxide or inert gas into the space. Smoking and the use of naked lights shall be prohibited in the vicinity of the cargo space during loading and unloading and on entry into the cargo spaces at any other time. Electrical circuits for equipment in cargo spaces which is unsuitable for use in an explosive atmosphere shall be isolated by removal of links in the system other than fuses. Spark-arresting screens shall be fitted to ventilators to the cargo spaces containing of this cargo.

**VENTILATION**

Surface ventilation either natural or mechanical should be conducted, as necessary, for removing any residual solvent vapour. To prevent self-heating of the cargo, caution is required when using mechanical ventilation.

**CARRIAGE**

Hatches of the cargo spaces carrying this cargo shall be weathertight to prevent the ingress of water.

**DISCHARGE**

No special requirements.

**CLEAN-UP**

No special requirements.

**EMERGENCY PROCEDURES**

<p align="center"><b><u>SPECIAL EMERGENCY EQUIPMENT TO BE CARRIED</u></b></p> <p align="center">Self-contained breathing apparatus.</p>
<p align="center"><b><u>EMERGENCY PROCEDURES</u></b></p> <p align="center">Wear self-contained breathing apparatus.</p> <p align="center"><b><u>EMERGENCY ACTION IN THE EVENT OF FIRE</u></b></p> <p align="center">Batten down. Use ship's fixed fire-fighting installation, if fitted.</p> <p align="center"><b><u>MEDICAL FIRST AID</u></b></p> <p align="center">Refer to the Medical First Aid Guide (<a href="#">MEAG</a>), as amended.</p>

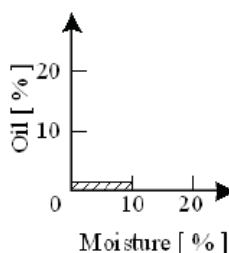
**REMARKS**

The use of CO<sub>2</sub> is limited to controlling the fire and further amounts may need to be injected from time to time during the sea passage to reduce the oxygen content in the hold. On arrival in port, the cargo will need to be dug out to reach the seat of the fire.

\* \* \*

**SEED CAKE UN 2217 with not more than 1.5% oil and not more than 11% moisture.**

The range of oil and moisture content is indicated in the figure.

**DESCRIPTION**

Residue remaining after oil has been extracted by a solvent process from oil-bearing seeds.

The cereals and cereal products included in this schedule are those derived from:

<b>Bakery materials</b>	<b>Meal, oily</b>
<b>Barley malt pellets</b>	<b>Mill feed pellets</b>
<b>Beet</b>	<b>Niger seed, expellers</b>
<b>Bran pellets</b>	<b>Oil cake</b>
<b>Brewer's grain pellets</b>	<b>Palm kernel</b>
<b>Citrus pulp pellets</b>	<b>Peanuts</b>
<b>Coconut</b>	<b>Pellets, cereal</b>
<b>Copra</b>	<b>Pollard pellets</b>

<b>Corn gluten</b>	<b>Rape seed</b>
<b>Cotton seed</b>	<b>Rice broken</b>
<b>Expellers</b>	<b>Rice bran</b>
<b>Gluten pellets</b>	<b>Safflower seed</b>
<b>Ground nuts, meal</b>	<b>Seed expellers, oily</b>
<b>Hominy chop</b>	<b>Soyabean</b>
<b>Linseed</b>	<b>Strussa pellets</b>
<b>Maize</b>	<b>Sunflower seed</b>

The above may be shipped in the form of pulp, meals, cake, pellets, expellers.

The provisions of this entry should not apply to solvent-extracted rape seed meal pellets, soya bean meal, cotton seed meal and sunflower seed meal containing not more than 1.5% oil and not more than 11% moisture and being substantially free from flammable solvent.

A certificate from a person recognized by the competent authority of the country of shipment should be provided by the shipper, prior to loading, stating that the provisions for the exemption are met.

#### **CHARACTERISTICS**

<b>ANGLE OF REPOSE</b>	<b>BULK DENSITY (kg/m<sup>3</sup>)</b>	<b>STOWAGE FACTOR (m<sup>3</sup>/t)</b>
Not applicable	478 to 719	1.39 to 2.09
<b>SIZE</b>	<b>CLASS</b>	<b>GROUP</b>
0.1 mm - 5 mm	4.2	B

#### **HAZARD**

May self-heat slowly and, if wet or containing an excessive proportion of unoxidized oil, ignite spontaneously. Liable to oxidize, causing subsequent reduction of oxygen in the cargo space. Carbon dioxide may also be produced.

#### **STOWAGE & SEGREGATION**

No special requirements other than prescribed in section 9.3 of this Code.

If the bulkhead between the cargo space and the engine-room is not insulated to class A-60 standard, this cargo shall be stowed "away from" the bulkhead.

#### **HOLD CLEANLINESS**

Clean and dry as relevant to the hazards of the cargo.

#### **WEATHER PRECAUTIONS**

This cargo shall be kept as dry as practicable. This cargo shall not be handled during precipitation. During handling of this cargo all non-working hatches of the cargo spaces into which this cargo is loaded or to be loaded shall be closed.

#### **LOADING**

This cargo shall only be accepted for loading when the cargo is substantially free from flammable solvent and a certificate from a person recognized by the competent authority of the country of shipment specifying the oil content and moisture content is issued.

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

### **PRECAUTIONS**

The temperature of this cargo shall be measured regularly at a number of depths in the cargo spaces and recorded during the voyage. If the temperature of the cargo reaches 55°C and continues to increase, ventilation to the cargo shall be stopped. If self-heating continues, then carbon dioxide or inert gas shall be introduced to the cargo space. The use of carbon dioxide or inert gas shall be withheld until fire is apparent. Entry of personnel into cargo spaces for this cargo shall not be permitted until tests have been carried out and it has been established that the oxygen content has been restored to a normal level. When the planned interval between the commencement of loading and the completion of discharge of this cargo exceeds 5 days, the cargo shall not be accepted for loading unless the cargo is to be carried in a cargo space equipped with facilities for introducing carbon dioxide or inert gas into the space. Smoking and the use of naked lights shall be prohibited in the vicinity of the cargo space during loading and unloading and on entry into the cargo spaces at any other time. Electrical circuits for equipment in cargo spaces which is unsuitable for use in an explosive atmosphere, shall be isolated by removal of links in the system other than fuses. Spark-arresting screens shall be fitted to ventilators to the cargo spaces containing of this cargo.

### **VENTILATION**

Surface ventilation either natural or mechanical should be conducted, as necessary, for removing any residual solvent vapour. To prevent self-heating of the cargo caution is required when using mechanical ventilation.

### **CARRIAGE**

Hatches of the cargo spaces carrying this cargo shall be weathertight to prevent the ingress of water.

### **DISCHARGE**

No special requirements.

### **CLEAN-UP**

No special requirements.

### **EMERGENCY PROCEDURES**

<p align="center"><b><u>SPECIAL EMERGENCY EQUIPMENT TO BE CARRIED</u></b></p> <p align="center">Self-contained breathing apparatus.</p>
<p align="center"><b><u>EMERGENCY PROCEDURES</u></b></p> <p align="center">Wear self-contained breathing apparatus.</p> <p align="center"><b><u>EMERGENCY ACTION IN THE EVENT OF FIRE</u></b></p> <p align="center">Batten down. Used ship's fixed fire-fighting installation, if fitted.</p> <p align="center"><b><u>MEDICAL FIRST AID</u></b></p> <p align="center">Refer to the Medical First Aid Guide (MFAG), as amended.</p>

### **REMARKS**

The use of CO<sub>2</sub> is limited to controlling the fire, and further amounts may need to be injected from time to time during passage to reduce the oxygen content in the hold. On arrival in port, the cargo will need to be dug out to reach the seat of the fire.

\* \* \*

### **SEED CAKE (non-hazardous)**

The provisions of this schedule shall only apply to:

- .1 solvent extracted rape seed meal, soya bean meal, cotton seed meal and sunflower seed meal, containing not more than 4% oil and 15% oil and moisture combined and being substantially free from flammable solvents;
- .2 mechanically expelled citrus pulp pellets containing not more than 2.5% oil and 14% oil and moisture combined;
- .3 mechanically expelled corn gluten meal containing not more than 11.0% oil and 23.6% oil and moisture combined;
- .4 mechanically expelled corn gluten feed pellets containing not more than 5.2% oil and 17.8% oil and moisture combined; and
- .5 mechanically expelled beet pulp pellets containing not more than 2.8% oil and 15.0% oil and moisture combined.

**DESCRIPTION****CHARACTERISTICS**

ANGLE OF REPOSE	BULK DENSITY (kg/m <sup>3</sup> )	STOWAGE FACTOR (m <sup>3</sup> /t)
Not applicable	478 to 719	1.39 to 2.09
SIZE	CLASS	GROUP
Not applicable	Not applicable	C

**HAZARD**

No special hazards.

This cargo is non-combustible or has a low fire-risk.

**STOWAGE & SEGREGATION**

No special requirements.

**HOLD CLEANLINESS**

Clean and dry as relevant to the hazards of the cargo.

**WEATHER PRECAUTIONS**

This cargo shall be kept as dry as practicable. This cargo shall not be handled during precipitation. During handling of this cargo all non-working hatches of the cargo spaces into which this cargo is loaded or to be loaded shall be closed.

**LOADING**

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

A certificate from a person recognized by the competent authority of the country of shipment shall be provided by the shipper, prior to loading, stating that the requirements for exemption as set out either in the schedule for seed cake UN 1386 (b) or UN 2217, whichever is applicable, are met.

**PRECAUTIONS**

No special requirements.

**VENTILATION**


No special requirements.

**CARRIAGE**

Hatches of the cargo spaces carrying this cargo shall be weathertight to prevent the ingress of water.

**DISCHARGE**

## Annex C Laboratory Tests on Cargo Samples

<b>S A L A M O N &amp; S E A B E R</b>	
CONSULTING AND ANALYTICAL CHEMISTS ESTABLISHED 1910	
Salamon & Seaber Ltd., First Floor, 2-8 Beaumont Grove, London E1 4NQ Tel: +44 (0)20 7791 2392 Fax: +44 (0)20 7791 3033 E-mail: <a href="mailto:post@salamonandseaber.co.uk">post@salamonandseaber.co.uk</a> Internet: <a href="http://www.salamonandseaber.co.uk">www.salamonandseaber.co.uk</a> VAT Reg.No. GB 245 6074 61	Director: M. P. Blotz, M.Sc., C.Biol., M.S.B., C.Chem., M.R.S.C., M.I.F.S.T.  Consultant: R. A. Bassett, M.Chem. A., C.Chem., F.R.S.C.
Official Analysts to G.A.F.T.A Full Member Analysts to F.O.S.F.A.	
	
<b>TEST CERTIFICATE NO: 14.T3054</b>	<b>DATED 18.08.14</b>
Received (Samples) 11.08.14	Received (Instructions) 11.08.14
Sample Described As: <b>SOYABEAN MEAL</b>	
Ship: "STARA PLANINA"	
Details: Hold 4	
	Sample in plastic bag
Moisture	12.43 %
Oil	1.88 %
Acct. No TM10073 Invoice Enclosed	Page 1 of 1 <b>S A L A M O N &amp; S E A B E R</b> M.P. Blotz
#Sub-contracted analysis	Registered in England No. 1475631

# SALAMON & SEABER

CONSULTING AND ANALYTICAL CHEMISTS

ESTABLISHED 1910

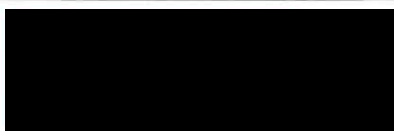
Salamon & Seaber Ltd., First Floor, 2-8 Beaumont Grove, London E1 4NQ  
Tel: +44 (0)20 7791 2392 Fax: +44 (0)20 7791 3033  
E-mail: [post@salamonandseaber.co.uk](mailto:post@salamonandseaber.co.uk)  
Internet: [www.salamonandseaber.co.uk](http://www.salamonandseaber.co.uk)  
VAT Reg.No. GB 245 6074 61

Director:  
M. P. Blotz, M.Sc., C.Biol., M.S.B., C.Chem., M.R.S.C., M.I.F.S.T.

Consultant:  
R. A. Bassett, M.Chem. A., C.Chem., F.R.S.C.

Official Analysts to G.A.F.T.A Full Member Analysts to F.O.S.F.A.

For:



**TEST CERTIFICATE NO: 14.T3053**

Received (Samples) 11.08.14

Sample Described As: **SOYABEAN MEAL**

Ship: "STARA PLANINA"

Details: Hold 1

Sample in plastic bag

DATED 18.08.14

Received (Instructions) 11.08.14

Moisture

12.36 %

Oil

1.30 %

Acct. No TM10073

Invoice Enclosed

#Sub-contracted analysis

Registered in England No. 1475631

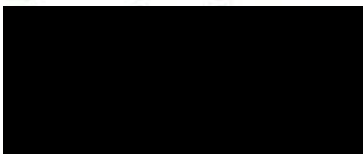
Page 1 of 1

SALAMON & SEABER

M.P. Blotz



## Annex D Cargo Hold Atmosphere Test Results




**RAPPORT INFORMATIF DE CONTRÔLE D'ATMOSPHERE**

Date:	3-Aug-14
Time:	20:00

**M/V STARA PLANINA**

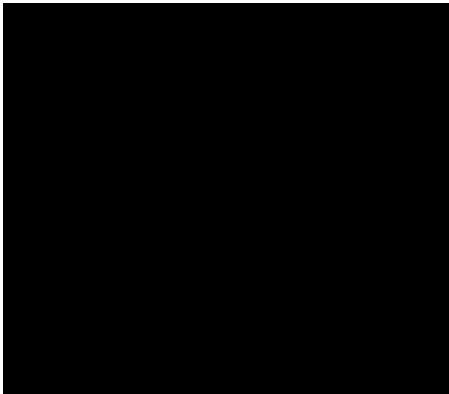
Port: MONTOIR	Agent: AGENA	
Cargo on board	SOYA BEAN MEAL PELLETS	Loading port
Fumigation after loading ? : NO		SANTOS

I, undersigned,  approved surveyor, certify that I have checked atmosphere inside the holds and accesses to holds of the above-mentioned vessel.  
 The results of my findings and my recommendations are reported below :

HOLD N°		O <sub>2</sub>	CO	PH <sub>3</sub>	FLM	H <sub>2</sub> S	RECOMMENDATIONS
<b>Limit values</b>		<b>&gt;19%</b>	<b>&lt;30ppm</b>	<b>&lt;0.1ppm</b>	<b>&lt;10%LEL</b>	<b>&lt;5.0ppm</b>	
<b>1</b>	F	19.5	500	0	0	0	PROHIBITED ACCESS
	H	20.8	0	0	0	0	FREE ACCESS
	A	20.8	0	0	0	0	
<b>2</b>	F	14.4	970	0	0	0	PROHIBITED ACCESS
	H	20.8	0	0	0	0	FREE ACCESS
	A	20.8	0	0	0	0	
<b>3</b>	F	16.3	590	0	0	0	PROHIBITED ACCESS
	H	20.8	0	0	0	0	FREE ACCESS
	A	20.8	0	0	0	0	
<b>4</b>	F	13.3	985	0	0	0	PROHIBITED ACCESS
	H	20.8	0	0	0	0	FREE ACCESS
	A	20.8	15	0	0	0	
<b>5</b>	F	17.3	400	0	0	0	PROHIBITED ACCESS
	H	20.8	0	0	0	0	FREE ACCESS
	A	20.8	0	0	0	0	

Ce rapport montre le résultat des relevés informatifs effectués le 3 Aout de 19h à 20h.  
 Dans les accès avant, les relevés sont faits au niveau du palier situé environ 2,5m en dessous du pont principal. Les teneurs en bas des échelles étaient certainement bien supérieures.  
 Les teneurs non acceptables sont en gras.

This certificate is available for the time at which the measurements have been carried out  
 and is delivered to whom it may concern to serve and avail when required.



## ATMOSPHERE CONTROL SURVEY REPORT.2

Date: 5-Aug-14  
Time: 6:00

### M/V STARA PLANINA

Port: MONTOIR	Agent: AGENA
Cargo on board: SOYA BEAN MEAL PELLETS	Loading port: SANTOS
Fumigation after loading?: NO	

I, undersigned, [REDACTED] approved surveyor, certify that I have checked atmosphere inside the holds and accesses to holds of the above-mentioned vessel. The results of my findings and my recommendations are reported below :

HOLD N°		O <sub>2</sub>	CO	PH <sub>3</sub>	FLM	H <sub>2</sub> S	RECOMMENDATIONS
Limit values		>19%	<30ppm	<0.1ppm	<10%LEL	<5.0ppm	
1	F	20.8	7	0	0	0	FREE ACCESS
	H	20.8	0	0	0	0	
	A	20.8	0	0	0	0	
2	F	19.5	0	0	0	0	FREE ACCESS
	H	20.8	0	0	0	0	
	A	20.8	0	0	0	0	
3	F	20.8	29	0	0	0	FREE ACCESS
	H	20.8	0	0	0	0	
	A	20.8	0	0	0	0	
4	F	20.8	25	0	0	0	FREE ACCESS
	H	20.8	0	0	0	0	
	A	20.8	0	0	0	0	
5	F	20.8	19	0	0	0	FREE ACCESS
	H	20.8	0	0	0	0	
	A	20.8	0	0	0	0	

This certificate is available for the time at which the measurements have been carried out and is delivered to whom it may concern to serve and avail when required.

Master

Surveyor

Port Captain

## Annex E

## Master's Risk Assessment

Дата/Date: 16.06.2013      Стълба 1: Определя опасностите Step 1: Spot the Hazards										Стълба 2: Оценя риска, отчитайки вече предприетите мерки Step 2: Assess the risk considering what is already in place		Стълба 3: Решава проблема Step 3: Fix the problem		Кой и кога ще го направи? Who and when?	Процени риска след допълнителните мерки Reassess the risk after implementation of the additional measures		
Идентифицирай пространствата (съгласно GA plan, Capacity plan или проектната документация) Identify the task (according to GA plan, Capacity plan or Project documentation)	Какви опасни събития крие всяка дейност за хората, околната среда и кораба? / What are the hazardous events to personnel, environment and vessel associated with each activity?				Статус на пространството [затворено / не затворено] Status of the space (enclosed/non-enclosed)	Опасности Hazards				Нивото на риска съгласно таблицата по-долу The risk level - see the guidelines below	Какви мерки вече са предприети за намаляване на риска What is already in place to reduce the risk	Какво още е нужно да се направи? What further action is necessary?					
	затворено пространство – пространство, което притежава поне една от следните характеристики / enclosed space – means a space which has any of the following characteristics	ограничени отвори за влизане и излизане / limited openings for entry and exit	недостатъчна естествена вентилация / inadequate ventilation	не е предназначено за продължително работене / is not designed for continuous worker occupancy		опасна атмосфера / hazardous atmosphere	опасности свързани с формата / конфигурацията на затвореното пространство / configuration hazard	променящи се и опасни условия / changing and hazardous conditions	опасност от затруднено задържане / entrapment hazard								
Wash-room / Умивалня					незатворено / non-enclosed					N.A.							
WC / Toilet					незатворено / non-enclosed					N.A.							
Switch board room / Помещение ел. табла					незатворено / non-enclosed					N.A.							
Компресорно Помещение / Compressor Room																	
Air-cond compressor's room (main deck) / Пом. за климат. компресори (главна палуба)	x	✓	✓	✓	затворено / enclosed					N.A.							
Товарни помещения / Cargo Spaces																	
Hold No. 1 Hold No. 2 Hold No. 3 Hold No. 4 Hold No. 5	✓	✓	✓	✓	затворено / enclosed	✓			✓	N-UBK прозорци HIGH	Однa на атмосферата, в зависимост от конкретния превозан товар и неговите характеристики / Assessment of atmosphere according to particular cargo and its characteristics shall be done NMB 02/3/076 - Вентилиране и влизане в затворени пространства / Ventilation and entering enclosed spaces WI-02-076 - Вентилиране или излизане с инертен газ на пространства от двойния корпус. Влизане в затворени пространства / Ventilation or entering of double hull spaces. Entering enclosed spaces aboard ships Safety poster SAF301 – Enclosed space entry CH-02-002 - Разрешение за влизане в затворено пространство (чек-лист) / Permission for entry in confined space (check-list)	Писмени указания как да се използва вентилация или почистване на съответните затворени пространства Written directions on how to perform the ventilation or cleaning of respective enclosed spaces.	Kapitan / Master				